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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

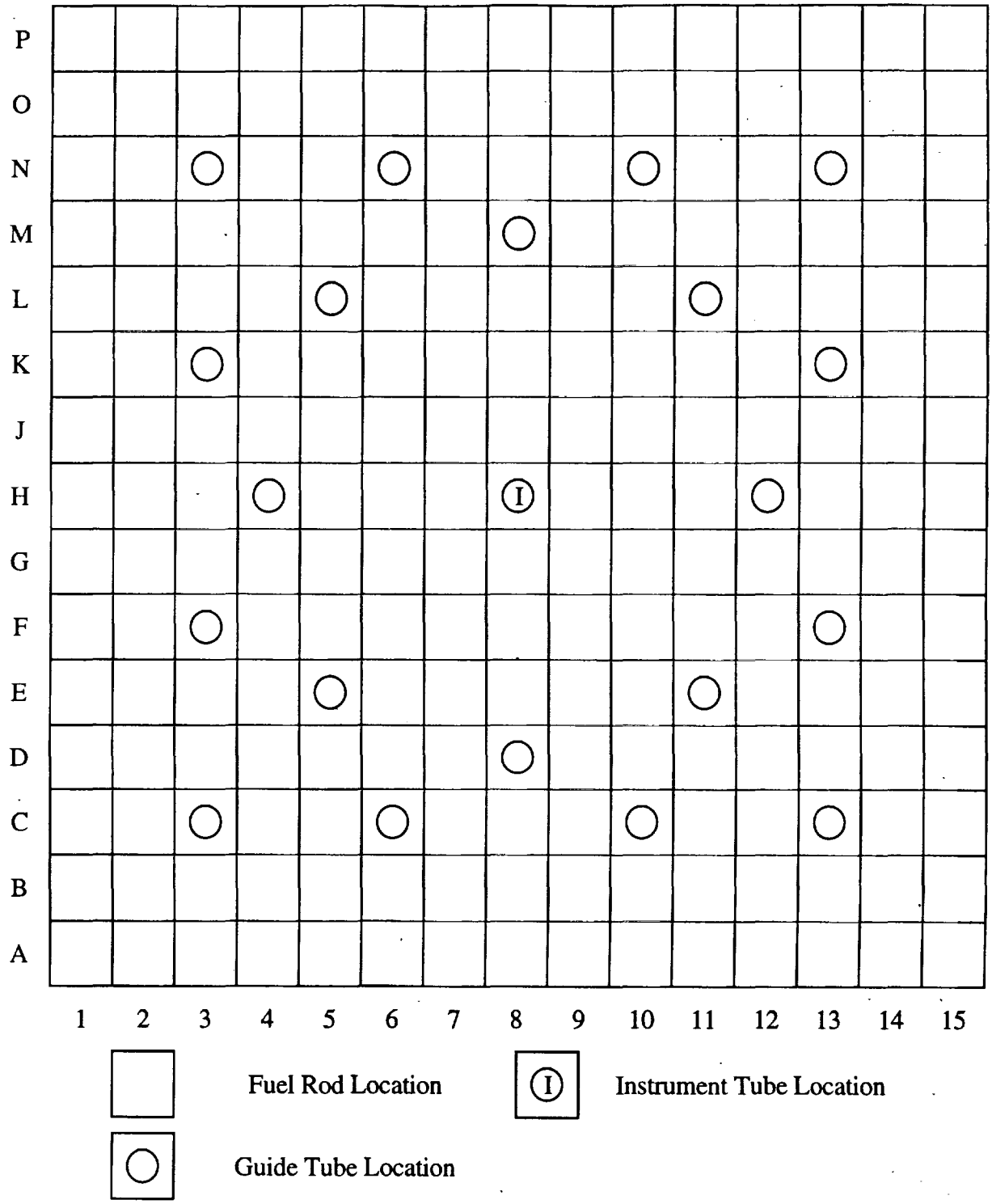
Reference 5.5

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:

$$StackDensity = \frac{ULoad}{(NFR)(\frac{\pi}{4})(PDia.)^2(FuelLength)}(\frac{1000gU}{1kgU})(\frac{270gUO_2}{238gU}) \qquad \text{Equation 7-1}$$

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:

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

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:

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

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, cm^2	FV, cm^2	MV, cm^2	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-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=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-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
```

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 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
      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
      '
      ' - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      '
1   ssssssssssss      aaaaaaaaa      ssssssssssss     22222222222    hh          hh
   ssssssssssssss    aaaaaaaaaaa    ssssssssssssss   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
```

```
   ssssssssssss   aa        aa   ssssssssssss   2222222222222   hh        hh
    sssssssssss   aa        aa    sssssssssss   2222222222222   hh        hh
0

   nn         nn  iiiiiiiiiiii    cccccccccc    hh        hh    oooooooooo    ll
   nnn        nn  iiiiiiiiiiii   cccccccccccc   hh        hh   oooooooooooo   ll
   nnnn       nn      ii        cc         cc   hh        hh   oo        oo   ll
   nn nn      nn      ii        cc              hh        hh   oo        oo   ll
   nn  nn     nn      ii        cc              hh        hh   oo        oo   ll
   nn   nn    nn      ii        cc              hhhhhhhhhhhh   oo        oo   ll
   nn    nn   nn      ii        cc              hhhhhhhhhhhh   oo        oo   ll
   nn     nn  nn      ii        cc              hh        hh   oo        oo   ll
   nn      nn nn      ii        cc              hh        hh   oo        oo   ll
   nn       nnnn      ii        cc         cc   hh        hh   oo        oo   ll
   nn         nnn  iiiiiiiiiiii   cccccccccccc   hh        hh   oooooooooooo   llllllllllll
   nn          nn  iiiiiiiiiiii    cccccccccc    hh        hh    oooooooooo    llllllllllll
0

     0000000      88888888888              //     0000000      88888888888              //   99999999999   7777777777777
    000000000    8888888888888            //     000000000    8888888888888            //   9999999999999 7777777777777
   00       00   88        88            //     00       00   88        88            //   99        99  77         77
  00         00  88        88           //     00         00 88        88           //    99        99            77
  00         00  88        88          //      00         00 88        88          //     99        99           77
  00         00   88888888888         //       00         00  88888888888         //      9999999999999         77
  00         00   88888888888        //        00         00  88888888888        //       999999999999         77
  00         00  88        88       //         00         00 88        88       //                99         77
  00         00  88        88      //          00         00 88        88      //                 99         77
   00       00   88        88     //           00       00   88        88     //                  99         77
    000000000    8888888888888   //             000000000    8888888888888   //                  9999999999999         77
     0000000      88888888888  //                0000000      88888888888  //                    999999999999         77
0

        11        33333333333                    22222222222    99999999999                    33333333333         11
       111        3333333333333                2222222222222   9999999999999                  3333333333333        111
      1111        33        33        :::      22        22   99        99        :::         33        33       1111
        11                  33        :::                22   99        99        :::                  33         11
        11                  33        :::                22   99        99        :::                  33         11
        11                333                           22    9999999999999                      333         11
        11                333                        22       999999999999                       333         11
        11                  33        :::           22                99        :::                  33         11
        11                  33        :::        22                   99        :::                  33         11
        11        33        33        :::     22                      99        :::         33        33         11
    11111111      3333333333333                2222222222222   9999999999999                  3333333333333     11111111
    11111111       33333333333                 2222222222222   999999999999                   33333333333      11111111
1
0                                 sssssssssss    cccccccccc     aaaaaaaaa     ll              eeeeeeeeeeeeee
                                 sssssssssssss  cccccccccccc   aaaaaaaaaaa   ll              eeeeeeeeeeeeee
                                 ss        ss   cc         cc  aa        aa   ll              ee
                                 ss             cc             aa        aa   ll              ee
                                 ss             cc             aa        aa   ll              ee
                                 sssssssssssss  cc             aaaaaaaaaaaaa ll              eeeeeeeee
                                  sssssssssssss cc             aaaaaaaaaaaaa ll              eeeeeeeee
                                           ss   cc             aa        aa   ll              ee
                                           ss   cc             aa        aa   ll              ee
                                 ss        ss   cc         cc  aa        aa   ll              ee
                                 sssssssssssss  cccccccccccc   aa        aa   lllllllllllll   eeeeeeeeeeeeee
                                  sssssssssss    cccccccccc    aa        aa   lllllllllllll   eeeeeeeeeeeee
```

```
*****************************************************************************
*****************************************************************************
*****************************************************************************
*****                                                                   *****
*****                 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                                   *****
*****                                                                   *****
*****                                                                   *****
*****************************************************************************
*****************************************************************************
*****************************************************************************
```

```
1
0'
0'
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  3.21E+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
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   1.64E+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
      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
      '
      '
1   ssssssssssss      aaaaaaaaa      ssssssssssss     22222222222    hh         hh
   sssssssssssss    aaaaaaaaaaa    sssssssssssss   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
   sssssssssssss    aaaaaaaaaaaaa   sssssssssssss              22    hhhhhhhhhhhhh
    sssssssssssss   aaaaaaaaaaaaa    sssssssssssss           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
   sssssssssssss   aa          aa   sssssssssssss   2222222222222   hh         hh
    ssssssssssss   aa          aa    ssssssssssss   2222222222222   hh         hh
0

   nn          nn  iiiiiiiiiiii     cccccccccc    hh         hh    ooooooooooo    11
   nnn         nn  iiiiiiiiiiii    cccccccccccc   hh         hh   ooooooooooooo   11
   nnnn        nn       ii         cc          cc  hh         hh   oo         oo   11
   nn nn       nn       ii         cc              hh         hh   oo         oo   11
   nn   nn     nn       ii         cc              hh         hh   oo         oo   11
```

```
   nn    nn    nn       ii        cc              hhhhhhhhhhhhh   oo         oo   ll
   nn     nn   nn       ii        cc              hhhhhhhhhhhhh   oo         oo   ll
   nn      nn  nn       ii        cc              hh         hh   oo         oo   ll
   nn       nn nn       ii        cc              hh         hh   oo         oo   ll
   nn        nnnn       ii        cc         cc   hh         hh   oo         oo   ll
   nn         nnn  iiiiiiiiiiii   cccccccccccc   hh         hh   ooooooooooooo   lllllllllllll
   nn          nn  iiiiiiiiiiii    cccccccccccc   hh         hh    ooooooooooo    lllllllllllll
0

     0000000       88888888888                //     0000000       88888888888                //   99999999999    7777777777777
    000000000     8888888888888               //    000000000     8888888888888               //   9999999999999   777777777777
   00       00    88         88              //    00       00    88         88              //   99         99   77         77
   00        00   88         88             //     00        00   88         88             //    99         99             77
   00        00   88         88            //      00        00   88         88            //     99         99            77
   00        00    88888888888            //       00        00    88888888888            //      9999999999999          77
   00        00    88888888888           //        00        00    88888888888           //       999999999999          77
   00        00   88         88         //          00        00   88         88         //                   99         77
   00        00   88         88        //           00        00   88         88        //                    99         77
    00       00   88         88       //             00       00   88         88       //                     99         77
     000000000    8888888888888      //               000000000    8888888888888      //          9999999999999         77
      0000000      88888888888      //                 0000000      88888888888      //          999999999999          77
0

        11        33333333333                    33333333333    99999999999                    5555555555555    33333333333
       111       3333333333333                  3333333333333   9999999999999                  5555555555555   3333333333333
      1111       33         33        :::       33         33   99         99        :::       55               33         33
        11                   33        :::                  33   99         99        :::       55                          33
        11                   33        :::                  33   99         99        :::       55                          33
        11                 333                            333    9999999999999                  555555555555             333
        11                 333                            333     999999999999                  5555555555555            333
        11                   33        :::                  33             99        :::                   55              33
        11                   33        :::                  33             99        :::                   55              33
        11       33         33        :::       33         33             99        :::       55         55   33         33
    11111111     3333333333333                  3333333333333   9999999999999                  5555555555555   3333333333333
    11111111      33333333333                    33333333333    999999999999                   55555555555     33333333333
1
0                                 ssssssssssss     cccccccccccc      aaaaaaaaa     ll              eeeeeeeeeeeee
                                 ssssssssssssss   cccccccccccccc    aaaaaaaaaaa    ll              eeeeeeeeeeeee
                                 ss         ss   cc         cc   aa         aa   ll              ee
                                 ss              cc              aa         aa   ll              ee
                                 ss              cc              aa         aa   ll              ee
                                 ssssssssssss    cc              aaaaaaaaaaaaa   ll              eeeeeeeee
                                  ssssssssssss   cc              aaaaaaaaaaaaa   ll              eeeeeeeee
                                            ss   cc              aa         aa   ll              ee
                                            ss   cc              aa         aa   ll              ee
                                 ss         ss   cc         cc   aa         aa   ll              ee
                                 ssssssssssssss   cccccccccccccc   aa         aa   lllllllllllll   eeeeeeeeeeeee
                                  ssssssssssss     cccccccccccc    aa         aa   lllllllllllll   eeeeeeeeeeeee


                        ******************************************************************************
                        ******************************************************************************
                        ******************************************************************************
                        *****                                                                      *****
                        *****                 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                                      *****
                        *****                                                                      *****
                        *****                                                                      *****
                        ******************************************************************************
                        ******************************************************************************
                        ******************************************************************************
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    3.21E+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
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    1.46E+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
```

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	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
pu238	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

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	7.79E+01	1.77E+02	1.82E+02	1.82E+02	1.82E+02	1.82E+02	1.82E+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	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

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	2.14E+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

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	1.21E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+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-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
      '
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   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
   ssssssssssssss   aa          aa   ssssssssssssss   2222222222222   hh          hh
    ssssssssssss    aa          aa    ssssssssssss    2222222222222   hh          hh
0

   nn          nn  iiiiiiiiiiii    cccccccccccc   hh          hh    ooooooooooo    11
   nnn         nn  iiiiiiiiiiii    cccccccccccccc  hh          hh   ooooooooooooo   11
   nnnn        nn        ii        cc          cc  hh          hh   oo          oo   11
```

```
   nn nn       nn       ii         cc              hh         hh   oo         oo   ll
   nn   nn     nn       ii         cc              hh         hh   oo         oo   ll
   nn    nn    nn       ii         cc              hhhhhhhhhhhhh   oo         oo   ll
   nn     nn   nn       ii         cc              hhhhhhhhhhhhh   oo         oo   ll
   nn      nn  nn       ii         cc              hh         hh   oo         oo   ll
   nn       nn nn       ii         cc              hh         hh   oo         oo   ll
   nn        nnnn       ii         cc          cc  hh         hh   oo         oo   ll
   nn         nnn  iiiiiiiiiiii    cccccccccccc    hh         hh   ooooooooooooo   lllllllllllll
   nn          nn  iiiiiiiiiiii     cccccccccccc   hh         hh    ooooooooooo    lllllllllllll
0

     0000000       88888888888                //     0000000       88888888888                //   99999999999    7777777777777
    000000000     8888888888888              //    000000000     8888888888888              //   9999999999999   777777777777
   00       00    88         88             //    00       00    88         88             //   99         99   77         77
  00         00   88         88            //    00         00   88         88            //    99         99            77
  00         00   88         88           //     00         00   88         88           //     99         99           77
  00         00    88888888888          //      00         00    88888888888          //      9999999999999         77
  00         00    88888888888         //       00         00    88888888888         //       999999999999         77
  00         00   88         88       //        00         00   88         88       //                   99         77
  00         00   88         88      //         00         00   88         88      //                    99         77
   00       00    88         88     //           00       00    88         88     //                     99         77
    000000000     8888888888888    //             000000000     8888888888888    //           9999999999999         77
     0000000       88888888888   //               0000000       88888888888   //             999999999999         77
0

        11        33333333333                          44     666666666666                          44       0000000
       111        3333333333333                       444     6666666666666                        444      000000000
      1111        33         33        :::           4444     66                  :::             4444     00        00
        11                   33        :::          44 44     66                  :::            44 44     00         00
        11                   33        :::         44  44     66                  :::           44  44     00         00
        11                 333                     44   44     666666666666                     44   44     00         00
        11                 333                    44    44     6666666666666                   44    44     00         00
        11                   33        :::      444444444444   66         66       :::      444444444444   00         00
        11                   33        :::      4444444444444  66         66       :::      4444444444444  00         00
        11        33         33        :::                44   66         66       :::                44     00        00
    11111111     3333333333333                          44     6666666666666                          44      000000000
    11111111      33333333333                          44      66666666666                           44       0000000
1
0                                 sssssssssss    cccccccccccc     aaaaaaaaa     ll              eeeeeeeeeeeee
                                 sssssssssssss  cccccccccccccc   aaaaaaaaaaa   ll              eeeeeeeeeeeee
                                 ss         ss  cc         cc   aa         aa   ll              ee
                                 ss             cc              aa         aa   ll              ee
                                 ss             cc              aa         aa   ll              ee
                                 sssssssssssss  cc              aaaaaaaaaaaaa   ll              eeeeeeeee
                                  sssssssssssss cc              aaaaaaaaaaaaa   ll              eeeeeeeee
                                            ss  cc              aa         aa   ll              ee
                                            ss  cc              aa         aa   ll              ee
                                 ss         ss  cc         cc   aa         aa   ll              ee
                                 sssssssssssss  cccccccccccccc   aa         aa   lllllllllllll   eeeeeeeeeeeee
                                  sssssssssss    cccccccccccc    aa         aa   lllllllllllll   eeeeeeeeeeeee
```

```
                    ******************************************************************************
                    ******************************************************************************
                    ******************************************************************************
                    *****                                                                      *****
                    *****                 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:  13:46:40                                      *****
                    *****                                                                      *****
                    *****                                                                      *****
                    ******************************************************************************
                    ******************************************************************************
                    ******************************************************************************
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

```
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, 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
      '
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
   ssssssssssss    aa         aa  ssssssssssss    2222222222222 hh         hh
    ssssssssss     aa         aa   ssssssssss     2222222222222 hh         hh
0

   nn          nn  iiiiiiiiiiii    cccccccccc    hh         hh   oooooooooo    ll
   nnn         nn  iiiiiiiiiiii   cccccccccccc   hh         hh  oooooooooooo   ll
```

```
   nnnn        nn       ii        cc        cc   hh        hh   oo        oo   ll
   nn nn       nn       ii        cc             hh        hh   oo        oo   ll
   nn   nn     nn       ii        cc             hh        hh   oo        oo   ll
   nn    nn    nn       ii        cc             hhhhhhhhhhhhh  oo        oo   ll
   nn     nn   nn       ii        cc             hhhhhhhhhhhhh  oo        oo   ll
   nn      nn  nn       ii        cc             hh        hh   oo        oo   ll
   nn       nn nn       ii        cc             hh        hh   oo        oo   ll
   nn        nnnn       ii        cc        cc   hh        hh   oo        oo   ll
   nn         nnn  iiiiiiiiiiii   cccccccccccc   hh        hh   ooooooooooooo   lllllllllllll
   nn          nn  iiiiiiiiiiii    cccccccccccc   hh        hh    ooooooooooo    lllllllllllll
0

     0000000       88888888888              //     0000000       88888888888              //   99999999999    7777777777777
    000000000     8888888888888            //     000000000     8888888888888            //   9999999999999   777777777777
   00       00    88         88            //     00       00    88         88            //   99         99   77         77
   00        00   88         88           //      00        00   88         88           //    99         99            77
   00        00   88         88          //       00        00   88         88          //     99         99           77
   00        00    88888888888          //        00        00    88888888888          //      9999999999999          77
   00        00    88888888888         //         00        00    88888888888         //       999999999999          77
   00        00   88         88        //          00        00   88         88        //                  99         77
   00        00   88         88       //           00        00   88         88       //                  99         77
   00       00    88         88      //             00       00    88         88      //                  99         77
    000000000     8888888888888     //               000000000     8888888888888     //          9999999999999         77
     0000000       88888888888     //                 0000000       88888888888     //           999999999999         77
0

        11                44                          11        666666666666                   5555555555555   5555555555555
       111               444                         111        6666666666666                  5555555555555   5555555555555
      1111              4444          :::           1111        66                   :::       55              55
        11             44 44          :::             11        66                   :::       55              55
        11            44  44          :::             11        66                   :::       55              55
        11           44   44                          11        666666666666                   555555555555    555555555555
        11          44    44                          11        6666666666666                  5555555555555   5555555555555
        11        444444444444        :::             11        66         66        :::                  55              55
        11        4444444444444       :::             11        66         66        :::                  55              55
        11                44          :::             11        66         66        :::       55         55   55         55
     11111111             44                       11111111     6666666666666                  5555555555555   5555555555555
     11111111             44                       11111111      66666666666                    55555555555     55555555555
1
0                                 sssssssssss     cccccccccccc     aaaaaaaaa     ll              eeeeeeeeeeeee
                                 sssssssssssss   cccccccccccccc   aaaaaaaaaaa   ll              eeeeeeeeeeeee
                                 ss         ss   cc         cc   aa         aa   ll              ee
                                 ss              cc              aa         aa   ll              ee
                                 ss              cc              aa         aa   ll              ee
                                 sssssssssssss   cc              aaaaaaaaaaaaa   ll              eeeeeeeee
                                  sssssssssssss  cc              aaaaaaaaaaaaa   ll              eeeeeeeee
                                            ss   cc              aa         aa   ll              ee
                                            ss   cc              aa         aa   ll              ee
                                 ss         ss   cc         cc   aa         aa   ll              ee
                                 sssssssssssss   cccccccccccccc   aa         aa   lllllllllllll   eeeeeeeeeeeee
                                  sssssssssss     cccccccccccc    aa         aa   lllllllllllll   eeeeeeeeeeeee


                        ******************************************************************************
                        ******************************************************************************
                        ******************************************************************************
                        *****                                                                      *****
                        *****                 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
      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=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
   ssssssssssssss    aaaaaaaaaaaa    ssssssssssssss   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  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     cccccccccccc    hh          hh    oooooooooooo    ll
   nnn         nn  iiiiiiiiiiii    cccccccccccccc   hh          hh   oooooooooooooo   ll
```

```
nnnn        nn      ii        cc        cc  hh        hh  oo        oo  ll
nn nn       nn      ii        cc            hh        hh  oo        oo  ll
nn   nn     nn      ii        cc            hh        hh  oo        oo  ll
nn    nn    nn      ii        cc            hhhhhhhhhhhhh oo        oo  ll
nn     nn   nn      ii        cc            hhhhhhhhhhhhh oo        oo  ll
nn      nn  nn      ii        cc            hh        hh  oo        oo  ll
nn       nn nn      ii        cc            hh        hh  oo        oo  ll
nn        nnnn      ii        cc        cc  hh        hh  oo        oo  ll
nn         nnn iiiiiiiiiiii  cccccccccccc  hh        hh  ooooooooooooo  lllllllllllll
nn          nn iiiiiiiiiiii   cccccccccccc  hh        hh   ooooooooooo   lllllllllllll
0

   0000000      88888888888              //    0000000      99999999999              //  99999999999   7777777777777
  000000000    8888888888888             //   000000000    9999999999999             //  9999999999999  777777777777
 00       00   88        88             //   00       00   99        99             //  99        99  77        77
00         00  88        88            //   00         00  99        99            //  99        99          77
00         00  88        88           //    00         00  99        99           //  99        99         77
00         00   88888888888           //    00         00  9999999999999          //   9999999999999        77
00         00   88888888888          //     00         00   999999999999         //    999999999999        77
00         00  88        88         //      00         00            99        //                 99        77
00         00  88        88        //       00         00            99       //                  99        77
 00       00   88        88       //         00       00             99      //                   99       77
  000000000    8888888888888     //           000000000    9999999999999     //          9999999999999       77
   0000000      88888888888     //             0000000     999999999999     //           999999999999       77
0

      ll              44                          44            44                      ll        0000000
     111             444                         444           444                     111       000000000
    1111            4444          :::           4444          4444          :::       1111      00       00
      ll           44 44          :::          44 44         44 44          :::         ll      00        00
      ll          44  44          :::         44  44        44  44          :::         ll      00        00
      ll         44   44                     44   44       44   44                      ll      00        00
      ll        44    44                    44    44      44    44                      ll      00        00
      ll       444444444444       :::     444444444444  444444444444       :::         ll      00        00
      ll       4444444444444      :::     4444444444444 4444444444444      :::         ll      00        00
      ll              44          :::             44            44          :::         ll       00       00
   11111111           44                          44            44                   11111111     000000000
   11111111           44                          44            44                   11111111      0000000
1
0                                 sssssssssss    cccccccccccc     aaaaaaaaa     ll            eeeeeeeeeeeee
                                 ssssssssssss  cccccccccccccc   aaaaaaaaaaa    ll            eeeeeeeeeeeee
                                 ss        ss  cc        cc  aa        aa    ll            ee
                                 ss            cc            aa        aa    ll            ee
                                 ss            cc            aa        aa    ll            ee
                                 sssssssssss   cc            aaaaaaaaaaaaa   ll            eeeeeeeee
                                  sssssssssss  cc            aaaaaaaaaaaaa   ll            eeeeeeeee
                                           ss  cc            aa        aa    ll            ee
                                           ss  cc            aa        aa    ll            ee
                                 ss        ss  cc        cc  aa        aa    ll            ee
                                 ssssssssssss  cccccccccccccc  aa        aa  lllllllllllll  eeeeeeeeeeeee
                                  sssssssssss    cccccccccccc   aa        aa  lllllllllllll  eeeeeeeeeeeee
```

```
                    ******************************************************************************
                    ******************************************************************************
                    ******************************************************************************
                    *****                                                                    *****
                    *****                 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

```
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, 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
      '
1   ssssssssssss      aaaaaaaaa      ssssssssssss     22222222222    hh          hh
   ssssssssssssss    aaaaaaaaaaa    ssssssssssssss   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
   ssssssssssssss     aa         aa  ssssssssssssss   2222222222222  hh          hh
    ssssssssssss      aa         aa   ssssssssssss    2222222222222  hh          hh
```

```
0

nn          nn  iiiiiiiiiiii    cccccccccccc    hh          hh    oooooooooooo    ll
nnn         nn  iiiiiiiiiiii    cccccccccccc    hh          hh    oooooooooooo    ll
nnnn        nn      ii          cc          cc  hh          hh    oo          oo  ll
nn nn       nn      ii          cc              hh          hh    oo          oo  ll
nn   nn     nn      ii          cc              hh          hh    oo          oo  ll
nn    nn    nn      ii          cc              hhhhhhhhhhhhhh    oo          oo  ll
nn     nn   nn      ii          cc              hhhhhhhhhhhhhh    oo          oo  ll
nn      nn  nn      ii          cc              hh          hh    oo          oo  ll
nn       nn nn      ii          cc              hh          hh    oo          oo  ll
nn        nnnn      ii          cc          cc  hh          hh    oo          oo  ll
nn         nnn  iiiiiiiiiiii    cccccccccccc    hh          hh    oooooooooooo    llllllllllll
nn          nn  iiiiiiiiiiii    cccccccccccc    hh          hh    oooooooooooo    llllllllllll
0

    0000000       88888888888              //     0000000       88888888888              //   99999999999    7777777777777
   000000000     8888888888888            //     000000000     8888888888888            //   9999999999999  777777777777
  00       00    88         88           //     00       00    88         88           //   99         99  77         77
 00         00   88         88          //      00         00  88         88          //    99         99           77
 00         00   88         88         //       00         00  88         88         //     99         99          77
 00         00    88888888888        //        00         00   88888888888        //      9999999999999         77
 00         00    88888888888       //         00         00   88888888888       //        999999999999         77
 00         00   88         88     //           00         00  88         88     //                  99        77
 00         00   88         88    //            00         00  88         88    //                   99       77
  00       00    88         88   //             00       00    88         88   //                    99      77
   000000000     8888888888888  //               000000000     8888888888888  //                9999999999999     77
    0000000       88888888888  //                 0000000       88888888888  //                 999999999999     77
0

     11                44                                44     33333333333                                44     666666666666
    111               444                               444     3333333333333                             444     6666666666666
   1111              4444          :::               4444     33         33          :::               4444     66
     11             44 44          :::              44 44                 33          :::              44 44     66
     11            44  44          :::             44  44                 33          :::             44  44     66
     11           44   44                          44   44              333                         44   44     666666666666
     11          44    44                         44    44              333                        44    44     6666666666666
     11         444444444444        :::         444444444444               33          :::         444444444444     66         66
     11        4444444444444        :::        4444444444444               33          :::        4444444444444     66         66
     11                44            :::                44     33         33          :::                44     66         66
   11111111            44                           44     3333333333333                             44     6666666666666
   11111111            44                           44      33333333333                              44      66666666666
1
0                          sssssssssss     cccccccccccc      aaaaaaaaa     ll              eeeeeeeeeeeee
                          sssssssssssss   cccccccccccccc    aaaaaaaaaaa   ll              eeeeeeeeeeeee
                          ss         ss   cc          cc    aa         aa ll              ee
                          ss              cc              aa         aa ll              ee
                          ss              cc              aa         aa ll              ee
                          sssssssssssss   cc              aaaaaaaaaaaaa ll              eeeeeeeee
                           sssssssssssss  cc              aaaaaaaaaaaaa ll              eeeeeeeee
                                     ss   cc              aa         aa ll              ee
                                     ss   cc              aa         aa ll              ee
                          ss         ss   cc          cc  aa         aa ll              ee
                          sssssssssssss   cccccccccccccc  aa         aa llllllllllll    eeeeeeeeeeeee
                           sssssssssss     cccccccccccc   aa         aa llllllllllll    eeeeeeeeeeeee


                    ******************************************************************
                    ******************************************************************
                    ******************************************************************
                    *****                                                          *****
                    *****                 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                           *****
                    *****                                                          *****
                    *****                                                          *****
                    ******************************************************************
                    ******************************************************************
                    ******************************************************************
1
0
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  2.95E+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
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	1.25E+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	1.43E+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
      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
      '
1   ssssssssss      aaaaaaaaa      ssssssssss     22222222222    hh         hh
   sssssssssssss    aaaaaaaaaaa   sssssssssssss  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
   sssssssssss      aaaaaaaaaaaaa  sssssssssss            22     hhhhhhhhhhhhh
    sssssssssss     aaaaaaaaaaaaa   sssssssssss         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
   sssssssssssss    aa         aa  sssssssssssss  2222222222222   hh         hh
    ssssssssssss    aa         aa   ssssssssssss   2222222222222   hh         hh
0

   nn          nn  iiiiiiiiiii     cccccccccc    hh         hh    oooooooooo    ll
```

```
   nnn          nn  iiiiiiiiiiii   cccccccccccc   hh         hh   oooooooooooo   ll
   nnnn         nn      ii         cc         cc   hh         hh   oo         oo   ll
   nn nn        nn      ii         cc              hh         hh   oo         oo   ll
   nn   nn      nn      ii         cc              hh         hh   oo         oo   ll
   nn    nn     nn      ii         cc              hhhhhhhhhhhhh   oo         oo   ll
   nn     nn    nn      ii         cc              hhhhhhhhhhhhh   oo         oo   ll
   nn      nn   nn      ii         cc              hh         hh   oo         oo   ll
   nn       nn nn       ii         cc              hh         hh   oo         oo   ll
   nn        nnnn       ii         cc         cc   hh         hh   oo         oo   ll
   nn         nnn  iiiiiiiiiiii   cccccccccccc   hh         hh   oooooooooooo   llllllllllll
   nn          nn  iiiiiiiiiiii    cccccccccccc   hh         hh    oooooooooooo   llllllllllll
0

     0000000       88888888888              //     0000000       99999999999              //   99999999999    7777777777777
    000000000     8888888888888             //    000000000     9999999999999             //   9999999999999  777777777777
   00       00    88         88            //   00       00    99         99            //   99         99  77         77
  00         00   88         88           //   00         00  99         99           //   99         99           77
  00         00   88         88          //   00         00  99         99          //   99         99          77
  00         00    88888888888           //   00         00  9999999999999         //   9999999999999         77
  00         00    88888888888          //   00         00   999999999999        //    999999999999         77
  00         00   88         88         //   00         00              99       //                 99        77
  00         00   88         88        //   00         00              99      //                 99        77
   00       00    88         88       //    00       00               99     //                 99       77
    000000000     8888888888888      //      000000000     9999999999999    //             9999999999999  77
     0000000       88888888888     //         0000000     999999999999    //              999999999999  77
0

       11         5555555555555                    11          0000000                    22222222222          44
      111         5555555555555                   111         000000000                  2222222222222         444
     1111         55                   :::       1111        00       00        :::      22          22       4444
       11         55                   :::         11       00         00       :::                 22      44 44
       11         55                   :::         11       00         00       :::                 22     44   44
       11         555555555555                     11       00         00                      22    44    44
       11         5555555555555                    11       00         00                   22      44    44
       11                   55         :::         11       00         00       :::         22        444444444444
       11                   55         :::         11       00         00       :::       22          444444444444
       11         55        55         :::         11        00       00        :::     22                   44
    11111111      5555555555555                  11111111      000000000                2222222222222          44
    11111111       55555555555                   11111111       0000000                 2222222222222          44
1
0                                  sssssssssss    ccccccccccc     aaaaaaaaa     ll          eeeeeeeeeeeee
                                  sssssssssssss  ccccccccccccc   aaaaaaaaaaa   ll          eeeeeeeeeeeee
                                  ss         ss  cc         cc   aa         aa  ll          ee
                                  ss             cc              aa         aa  ll          ee
                                  ss             cc              aa         aa  ll          ee
                                  sssssssssss    cc              aaaaaaaaaaaaa  ll          eeeeeeeee
                                   sssssssssss   cc              aaaaaaaaaaaaa  ll          eeeeeeeee
                                            ss   cc              aa         aa  ll          ee
                                            ss   cc              aa         aa  ll          ee
                                  ss         ss  cc         cc   aa         aa  ll          ee
                                  sssssssssssss  ccccccccccccc   aa         aa  llllllllllll eeeeeeeeeeeee
                                   sssssssssss    ccccccccccc    aa         aa  llllllllllll eeeeeeeeeeeee
```

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

```
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   2.95E+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
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	1.40E+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	5.14E+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-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
      '
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          22  hh          hh
   ss              aa         aa  ss              22          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
   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   ooooooooooooo   11
   nnnn        nn       ii         cc         cc   hh         hh   oo         oo   11
   nn nn       nn       ii         cc              hh         hh   oo         oo   11
   nn   nn     nn       ii         cc              hh         hh   oo         oo   11
   nn    nn    nn       ii         cc              hhhhhhhhhhhhh   oo         oo   11
   nn     nn   nn       ii         cc              hhhhhhhhhhhhh   oo         oo   11
   nn      nn  nn       ii         cc              hh         hh   oo         oo   11
   nn       nn nn       ii         cc              hh         hh   oo         oo   11
   nn        nnnn       ii         cc         cc   hh         hh   oo         oo   11
   nn         nnn  iiiiiiiiiiii    cccccccccccc   hh         hh   ooooooooooooo   1111111111111
   nn          nn  iiiiiiiiiiii     cccccccccc    hh         hh    ooooooooooo    1111111111111
0

     0000000       88888888888              //     0000000       88888888888              //   99999999999    7777777777777
    000000000     8888888888888             //    000000000     8888888888888             //   9999999999999   777777777777
   00       00    88         88            //    00       00    88         88            //   99         99   77         77
   00        00   88         88           //     00        00   88         88           //    99         99            77
   00        00   88         88          //      00        00   88         88          //     99         99           77
   00        00    88888888888          //       00        00    88888888888          //      9999999999999         77
   00        00    88888888888         //        00        00    88888888888         //       999999999999         77
   00        00   88         88        //         00        00   88         88        //                  99        77
   00        00   88         88       //          00        00   88         88       //                  99        77
    00       00   88         88      //            00       00   88         88      //                  99       77
    000000000     8888888888888    //              000000000     8888888888888    //           9999999999999       77
     0000000       88888888888   //                0000000       88888888888   //             999999999999        77
0

        11        5555555555555                    33333333333    22222222222                   5555555555555    88888888888
       111        5555555555555                   3333333333333  2222222222222                 5555555555555   8888888888888
      1111        55                  :::         33         33  22         22        :::       55             88         88
        11        55                  :::                     33             22        :::       55             88         88
        11        55                  :::                     33             22        :::       55             88         88
        11        555555555555                            333            22                    555555555555     88888888888
        11        5555555555555                           333          22                     5555555555555    88888888888
        11                  55        :::                     33       22              :::                  55   88         88
        11                  55        :::                     33     22                :::                  55   88         88
        11        55        55        :::         33         33   22                  :::       55        55   88         88
     11111111     5555555555555                   3333333333333  2222222222222                 5555555555555   8888888888888
     11111111      55555555555                     33333333333   2222222222222                  55555555555     88888888888
1
0                                 ssssssssssss     cccccccccccc      aaaaaaaaa     11             eeeeeeeeeeeee
                                 ssssssssssssss   cccccccccccccc    aaaaaaaaaaa    11             eeeeeeeeeeeee
                                 ss         ss   cc         cc   aa         aa   11             ee
                                 ss              cc              aa         aa   11             ee
                                 ss              cc              aa         aa   11             ee
                                 ssssssssssssss   cc              aaaaaaaaaaaaa   11             eeeeeeeee
                                  ssssssssssssss   cc              aaaaaaaaaaaaa   11             eeeeeeeee
                                            ss   cc              aa         aa   11             ee
                                            ss   cc              aa         aa   11             ee
                                 ss         ss   cc         cc   aa         aa   11             ee
                                 ssssssssssssss   cccccccccccccc   aa         aa   1111111111111   eeeeeeeeeeeee
                                  ssssssssssss     cccccccccccc    aa         aa   1111111111111   eeeeeeeeeeeee
```

```
                    ******************************************************************************
                    ******************************************************************************
                    ******************************************************************************
                    *****                                                                      *****
                    *****                 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                                      *****
                    *****                                                                      *****
                    *****                                                                      *****
                    ******************************************************************************
                    ******************************************************************************
                    ******************************************************************************
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    2.95E+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
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	1.46E+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 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
      '
1   ssssssssssss      aaaaaaaaa      sssssssssss     22222222222    hh         hh
   sssssssssssss    aaaaaaaaaaa    sssssssssssss   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
   sssssssssssss    aaaaaaaaaaaaa   sssssssssssss             22    hhhhhhhhhhhhh
    sssssssssssss   aaaaaaaaaaaaa    sssssssssssss          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
   sssssssssssss   aa         aa   sssssssssssss   2222222222222   hh         hh
    sssssssssssss   aa         aa    sssssssssssss   2222222222222   hh         hh
0

   nn          nn  iiiiiiiiiiii     cccccccccc    hh         hh    oooooooooooo    11
```

```
   nnn         nn  iiiiiiiiiiii    cccccccccccc   hh         hh   ooooooooooooo   ll
   nnnn        nn       ii         cc         cc   hh         hh   oo         oo   ll
   nn nn       nn       ii         cc              hh         hh   oo         oo   ll
   nn   nn     nn       ii         cc              hh         hh   oo         oo   ll
   nn    nn    nn       ii         cc              hhhhhhhhhhhhh   oo         oo   ll
   nn     nn   nn       ii         cc              hhhhhhhhhhhhh   oo         oo   ll
   nn      nn  nn       ii         cc              hh         hh   oo         oo   ll
   nn       nn nn       ii         cc              hh         hh   oo         oo   ll
   nn        nnnn       ii         cc         cc   hh         hh   oo         oo   ll
   nn         nnn  iiiiiiiiiiii    cccccccccccc   hh         hh   ooooooooooooo   llllllllllll
   nn          nn  iiiiiiiiiiii     cccccccccc    hh         hh    ooooooooooo    llllllllllll
0

     0000000       88888888888                //     0000000       88888888888                //   99999999999    7777777777777
    000000000     8888888888888               //    000000000     8888888888888               //   9999999999999   777777777777
   00       00    88         88              //    00       00    88         88              //   99         99   77         77
   00        00   88         88             //     00        00   88         88             //    99         99            77
   00        00   88         88            //      00        00   88         88            //     99         99           77
   00        00    88888888888             //      00        00    88888888888             //      9999999999999         77
   00        00    88888888888            //       00        00    88888888888            //       999999999999         77
   00        00   88         88           //        00        00   88         88           //                  99        77
   00        00   88         88          //         00        00   88         88          //                  99        77
    00       00   88         88         //           00       00   88         88         //                  99        77
    000000000     8888888888888        //             000000000     8888888888888        //          9999999999999        77
     0000000       88888888888       //                0000000       88888888888       //          999999999999         77
0

        11         666666666666                    22222222222    22222222222                    33333333333      0000000
       111        6666666666666                   2222222222222  2222222222222                  3333333333333    000000000
      1111        66                   :::        22         22  22         22          :::      33         33   00        00
        11        66                   :::                   22             22          :::                  33   00         00
        11        66                   :::                   22             22          :::                  33   00         00
        11        666666666666                             22             22                              333   00         00
        11        6666666666666                          22             22                              333   00         00
        11        66         66        :::            22             22                :::                  33   00         00
        11        66         66        :::          22             22                  :::                  33   00         00
        11        66         66        :::        22             22                    :::      33         33   00        00
    11111111      6666666666666                   2222222222222  2222222222222                  3333333333333    000000000
    11111111       66666666666                    2222222222222  2222222222222                   33333333333      0000000
1
0                                 ssssssssssss    cccccccccccc     aaaaaaaaa     ll              eeeeeeeeeeeee
                                 ssssssssssssss  cccccccccccccc   aaaaaaaaaaa   ll              eeeeeeeeeeeee
                                 ss         ss   cc         cc   aa         aa   ll              ee
                                 ss              cc              aa         aa   ll              ee
                                 ss              cc              aa         aa   ll              ee
                                 ssssssssssss    cc              aaaaaaaaaaaaa   ll              eeeeeeeee
                                  ssssssssssss   cc              aaaaaaaaaaaaa   ll              eeeeeeeee
                                            ss   cc              aa         aa   ll              ee
                                            ss   cc              aa         aa   ll              ee
                                 ss         ss   cc         cc   aa         aa   ll              ee
                                 ssssssssssssss  cccccccccccccc   aa         aa   llllllllllll   eeeeeeeeeeeee
                                  ssssssssssss    cccccccccccc    aa         aa   llllllllllll   eeeeeeeeeeeee
```

```
                    ******************************************************************************
                    ******************************************************************************
                    ******************************************************************************
                    *****                                                                      *****
                    *****                 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    2.95E+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
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+04	3.51E+04	3.51E+04	3.51E+04	3.51E+04	3.51E+04	3.51E+04

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-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
      '
      ' - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      '
1   ssssssssssss      aaaaaaaaa      ssssssssssss     22222222222    hh         hh
   ssssssssssssss    aaaaaaaaaaa    ssssssssssssss   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
```

```
   sssssssssssss   aa        aa   sssssssssssss   2222222222222   hh        hh
    sssssssssss    aa        aa    sssssssssss    2222222222222   hh        hh
0

   nn         nn   iiiiiiiiiiii    cccccccccc    hh        hh    oooooooooo    11
   nnn        nn   iiiiiiiiiiii   cccccccccccc   hh        hh   oooooooooooo   11
   nnnn       nn       ii        cc        cc    hh        hh   oo        oo    11
   nn nn      nn       ii        cc              hh        hh   oo        oo    11
   nn   nn    nn       ii        cc              hh        hh   oo        oo    11
   nn     nn  nn       ii        cc              hhhhhhhhhhhhhh   oo        oo    11
   nn      nn nn       ii        cc              hhhhhhhhhhhhhh   oo        oo    11
   nn       nn nn      ii        cc              hh        hh   oo        oo    11
   nn        nn nn     ii        cc              hh        hh   oo        oo    11
   nn         nnnn     ii        cc        cc    hh        hh   oo        oo    11
   nn          nnn  iiiiiiiiiiii   cccccccccccc   hh        hh   oooooooooooo   1111111111111
   nn           nn  iiiiiiiiiiii    cccccccccc    hh        hh    oooooooooo    1111111111111
0

     0000000       88888888888              //     0000000       88888888888              //   99999999999   7777777777777
    000000000     8888888888888             //    000000000     8888888888888             //   9999999999999 7777777777777
   00       00    88        88             //    00       00    88        88             //   99        99  77        77
  00         00   88        88            //    00         00   88        88            //    99        99  77        77
  00         00   88        88           //     00         00   88        88           //     99        99            77
  00         00    88888888888          //      00         00    88888888888          //      9999999999999          77
  00         00    88888888888         //       00         00    88888888888         //       9999999999999          77
  00         00   88        88        //        00         00   88        88        //                99          77
  00         00   88        88       //         00         00   88        88       //                 99          77
   00       00    88        88      //           00       00    88        88      //                  99         77
    000000000     8888888888888    //             000000000     8888888888888    //             9999999999999         77
     0000000       88888888888   //               0000000       88888888888   //               999999999999         77
0

       11        7777777777777                      11        33333333333                    33333333333      0000000
      111        777777777777                      111       3333333333333                  3333333333333    000000000
     1111        77        77        :::           1111       33        33        :::       33        33   00        00
       11                77        :::             11                  33        :::                 33   00         00
       11               77         :::             11                  33        :::                 33   00         00
       11              77                          11                333                          333   00         00
       11              77                          11                333                          333   00         00
       11             77          :::              11                  33        :::                 33   00         00
       11             77          :::              11                  33        :::                 33   00         00
       11            77           :::              11       33        33        :::       33        33   00        00
    11111111         77                           11111111  3333333333333                  3333333333333    000000000
    11111111         77                           11111111   33333333333                    33333333333      0000000
1
.0                          sssssssssss    cccccccccc     aaaaaaaaa    11            eeeeeeeeeeeee
                           sssssssssssss  cccccccccccc   aaaaaaaaaaa   11            eeeeeeeeeeeee
                           ss        ss   cc        cc   aa        aa   11            ee
                           ss             cc             aa        aa   11            ee
                           ss             cc             aa        aa   11            ee
                           sssssssssss    cc             aaaaaaaaaaaaa 11            eeeeeeeee
                            sssssssssss   cc             aaaaaaaaaaaaa 11            eeeeeeeee
                                     ss   cc             aa        aa   11            ee
                                     ss   cc             aa        aa   11            ee
                           ss        ss   cc        cc   aa        aa   11            ee
                           sssssssssssss  cccccccccccc   aa        aa   1111111111111 eeeeeeeeeeeee
                            sssssssssss    cccccccccc    aa        aa   1111111111111 eeeeeeeeeeeee


                    ************************************************************************
                    ************************************************************************
                    ************************************************************************
                    *****                                                              *****
                    *****                 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                              *****
                    *****                                                              *****
                    *****                                                              *****
                    ************************************************************************
                    ************************************************************************
                    ************************************************************************

1
0'
0'
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   3.21E+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
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    1.64E+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    8.04E-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    4.46E+00  4.66E+00  4.65E+00  4.62E+00  4.59E+00  4.56E+00  4.53E+00
     pu238    4.46E+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    4.14E-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 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
      '
      '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      '
1   ssssssssss      aaaaaaaaa      ssssssssss     22222222222    hh          hh
   sssssssssss    aaaaaaaaaaa    sssssssssss   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
   sssssssssss    aaaaaaaaaaaaa   sssssssssss             22     hhhhhhhhhhhhh
    sssssssssss   aaaaaaaaaaaaa    sssssssssss          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
```

```
   ssssssssssssss   aa         aa   ssssssssssssss   2222222222222   hh         hh
    sssssssssssss   aa         aa    sssssssssssss   2222222222222   hh         hh
0

   nn          nn  iiiiiiiiiiiii     ccccccccccc    hh         hh    ooooooooooo    ll
   nnn         nn  iiiiiiiiiiiii    cccccccccccccc  hh         hh   ooooooooooooo   ll
   nnnn        nn        ii         cc          cc   hh         hh   oo         oo   ll
   nn nn       nn        ii         cc               hh         hh   oo         oo   ll
   nn   nn     nn        ii         cc               hh         hh   oo         oo   ll
   nn     nn   nn        ii         cc               hhhhhhhhhhhhh   oo         oo   ll
   nn       nn nn        ii         cc               hhhhhhhhhhhhh   oo         oo   ll
   nn         nnnn       ii         cc          cc   hh         hh   oo         oo   ll
   nn          nnn  iiiiiiiiiiiii    cccccccccccccc  hh         hh   ooooooooooooo   lllllllllllll
   nn          nn  iiiiiiiiiiiii     ccccccccccc    hh         hh    ooooooooooo    lllllllllllll
0

     0000000       88888888888                //     0000000       88888888888                //   99999999999    7777777777777
    000000000     8888888888888              //    000000000     8888888888888              //   9999999999999  7777777777777
   00       00    88         88             //    00       00    88         88             //   99         99  77         77
  00         00   88         88            //    00         00   88         88            //    99         99            77
  00         00   88         88           //     00         00   88         88           //     99         99           77
  00         00    88888888888          //      00         00    88888888888          //      9999999999999         77
  00         00    88888888888         //       00         00    88888888888         //       9999999999999         77
  00         00   88         88        //        00         00   88         88        //                  99        77
  00         00   88         88       //         00         00   88         88       //                   99        77
   00       00    88         88      //          00       00    88         88      //                    99       77
    000000000     8888888888888     //            000000000     8888888888888     //            9999999999999       77
     0000000       88888888888    //               0000000       88888888888    //             999999999999        77
0

       11        7777777777777                    333333333333    22222222222                          44          11
      111        777777777777                    3333333333333   2222222222222                        444         111
     1111        77        77          :::       33         33   22         22          :::          4444        1111
       11                77          :::                  33                22          :::         44 44          11
       11               77           :::                  33                22          :::        44  44          11
       11              77                                333              22                        44   44          11
       11              77                                333            22                         44   44          11
       11             77            :::                  33          22                :::       444444444444      11
       11             77            :::                  33        22                  :::       444444444444      11
       11            77             :::       33         33     22                    :::                44          11
    11111111         77                      3333333333333    2222222222222                          44       11111111
    11111111         77                       33333333333     2222222222222                          44       11111111
1
0                                 ssssssssssss    cccccccccccc     aaaaaaaaa    ll          eeeeeeeeeeeeee
                                 sssssssssssss   ccccccccccccc    aaaaaaaaaa   ll          eeeeeeeeeeeeee
                                 ss         ss   cc          cc   aa         aa ll          ee
                                 ss              cc               aa         aa ll          ee
                                 ss              cc               aa         aa ll          ee
                                 sssssssssssss   cc               aaaaaaaaaaaaa ll          eeeeeeeee
                                  sssssssssssss  cc               aaaaaaaaaaaaa ll          eeeeeeeee
                                           ss    cc               aa         aa ll          ee
                                           ss    cc               aa         aa ll          ee
                                 ss         ss   cc          cc   aa         aa ll          ee
                                 sssssssssssss   cccccccccccccc   aa         aa 1111111111111 eeeeeeeeeeeeee
                                  sssssssssss     cccccccccccc    aa         aa 1111111111111 eeeeeeeeeeeeee


                        ******************************************************************
                        ******************************************************************
                        ******************************************************************
                        *****                                                          *****
                        *****                 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                          *****
                        *****                                                          *****
                        *****                                                          *****
                        ******************************************************************
                        ******************************************************************
                        ******************************************************************
1
0'
0'
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   3.21E+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
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   1.66E+00  3.80E+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  2.64E+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-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
      '
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         22   hh         hh
   ss              aa         aa  ss              22         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
   ssssssssssss    aa         aa  ssssssssssss   2222222222222    hh         hh
    ssssssssss     aa         aa   ssssssssss    2222222222222    hh         hh
0

   nn          nn  iiiiiiiiiii     cccccccccc    hh         hh    oooooooooo    ll
```

```
   nnn          nn  iiiiiiiiiiii    cccccccccccc   hh          hh   oooooooooooo   ll
   nnnn         nn      ii          cc         cc  hh          hh   oo          oo   ll
   nn nn        nn      ii          cc             hh          hh   oo          oo   ll
   nn   nn      nn      ii          cc             hh          hh   oo          oo   ll
   nn     nn    nn      ii          cc             hhhhhhhhhhhhh    oo          oo   ll
   nn       nn  nn      ii          cc             hhhhhhhhhhhhh    oo          oo   ll
   nn         nn nn     ii          cc             hh          hh   oo          oo   ll
   nn          nnnn     ii          cc         cc  hh          hh   oo          oo   ll
   nn           nnn  iiiiiiiiiiii    cccccccccccc   hh          hh   oooooooooooo   llllllllllll
   nn            nn  iiiiiiiiiiii     cccccccccccc  hh          hh    oooooooooooo   llllllllllll
0

     0000000       88888888888                //     0000000       88888888888                //   99999999999    7777777777777
    000000000     8888888888888              //    000000000     8888888888888              //   9999999999999  777777777777
   00        00   88          88            //   00        00   88          88            //   99         99  77          77
  00          00  88          88           //   00          00  88          88           //   99         99            77
  00          00  88          88          //   00          00  88          88          //   99         99           77
  00          00   88888888888           //   00          00   88888888888           //   9999999999999          77
  00          00   88888888888          //   00          00   88888888888          //    999999999999          77
  00          00  88          88       //   00          00  88          88       //                  99         77
  00          00  88          88      //   00          00  88          88      //                   99         77
   00        00   88          88     //    00        00   88          88     //                    99        77
    000000000     8888888888888   //       000000000     8888888888888   //   9999999999999         77
     0000000       88888888888  //          0000000       88888888888  //    999999999999         77
0

        11        7777777777777                  5555555555555          44                        11          0000000
       111        777777777777                   5555555555555         444                       111         000000000
      1111        77        77        :::        55                   4444          :::        1111        00        00
        11                77          :::        55                  44 44          :::          11        00         00
        11               77           :::        55                 44  44          :::          11        00         00
        11              77                      555555555555       44   44                      11        00         00
        11              77                      5555555555555     44    44                      11        00         00
        11             77           :::                   55   444444444444        :::          11        00         00
        11             77           :::                   55   4444444444444       :::          11        00         00
        11            77            :::        55         55          44           :::          11        00        00
    11111111          77                        5555555555555         44                    11111111     000000000
    11111111          77                         55555555555          44                    11111111      0000000
1
0                                 sssssssssss    ccccccccccc     aaaaaaaaa     ll            eeeeeeeeeeeeee
                                 sssssssssssss  ccccccccccccc   aaaaaaaaaaa   ll            eeeeeeeeeeeeee
                                 ss         ss  cc         cc   aa         aa  ll            ee
                                 ss             cc              aa         aa  ll            ee
                                 ss             cc              aa         aa  ll            ee
                                 sssssssssssss  cc              aaaaaaaaaaaaa  ll            eeeeeeeee
                                  sssssssssssss cc              aaaaaaaaaaaaa  ll            eeeeeeeee
                                           ss   cc              aa         aa  ll            ee
                                           ss   cc              aa         aa  ll            ee
                                 ss         ss  cc         cc   aa         aa  ll            ee
                                 sssssssssssss  ccccccccccccc   aa         aa  llllllllllll  eeeeeeeeeeeeee
                                  sssssssssss    ccccccccccc    aa         aa  llllllllllll  eeeeeeeeeeeeee
```

```
*****************************************************************************
*****************************************************************************
*****************************************************************************
*****                                                                   *****
*****                 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:  17:54:10                                   *****
*****                                                                   *****
*****                                                                   *****
*****************************************************************************
*****************************************************************************
*****************************************************************************
```

```
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   2.95E+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
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	1.46E+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 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-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
      '
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  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
   ssssssssssssss   aa          aa   ssssssssssssss   2222222222222  hh          hh
    ssssssssssss    aa          aa    ssssssssssss    2222222222222  hh          hh
0

   nn          nn  iiiiiiiiiiii     cccccccccccc    hh          hh    oooooooooooo    ll
```

```
nnn        nn  iiiiiiiiiiii   cccccccccccc   hh        hh   ooooooooooooo   ll
nnnn       nn       ii        cc        cc   hh        hh   oo         oo   ll
nn nn      nn       ii        cc             hh        hh   oo         oo   ll
nn   nn    nn       ii        cc             hh        hh   oo         oo   ll
nn    nn   nn       ii        cc             hhhhhhhhhhhhh   oo         oo   ll
nn     nn  nn       ii        cc             hhhhhhhhhhhhh   oo         oo   ll
nn      nn nn       ii        cc             hh        hh   oo         oo   ll
nn       nn nn      ii        cc             hh        hh   oo         oo   ll
nn        nnnn      ii        cc        cc   hh        hh   oo         oo   ll
nn         nnn  iiiiiiiiiiii   cccccccccccc   hh        hh   ooooooooooooo   llllllllllll
nn          nn  iiiiiiiiiiii    cccccccccccc   hh        hh    ooooooooooo    llllllllllll
0

   0000000      88888888888              //    0000000      88888888888              //   99999999999   7777777777777
  000000000    8888888888888             //   000000000    8888888888888             //   9999999999999  777777777777
 00       00   88         88            //   00       00   88         88            //   99         99  77        77
00         00  88         88           //   00         00  88         88           //   99         99          77
00         00  88         88          //    00         00  88         88          //    99         99         77
00         00   88888888888          //     00         00   88888888888          //     9999999999999        77
00         00   88888888888         //      00         00   88888888888         //      999999999999        77
00         00  88         88       //       00         00  88         88       //                 99        77
00         00  88         88      //        00         00  88         88      //                  99        77
 00       00   88         88     //          00       00   88         88     //                   99       77
  000000000    8888888888888   //            000000000    8888888888888   //          9999999999999       77
   0000000      88888888888  //               0000000      88888888888  //            999999999999        77
0

      11        99999999999                  22222222222   5555555555555                        44     666666666666
     111       9999999999999                2222222222222  5555555555555                       444    6666666666666
    1111       99         99        :::     22         22  55                  :::            4444    66
      11       99         99        :::                 22  55                  :::           44 44    66
      11       99         99        :::                 22  55                  :::          44  44    66
      11       9999999999999                         22    555555555555                     44   44    666666666666
      11        999999999999                       22      5555555555555                   44    44    6666666666666
      11                  99        :::           22                  55        :::      444444444444  66         66
      11                  99        :::         22                    55        :::      4444444444444  66         66
      11                  99        :::       22            55        55        :::              44    66         66
  11111111     9999999999999                2222222222222  5555555555555                        44    6666666666666
  11111111     999999999999                 2222222222222   55555555555                        44     66666666666
1
0                                 ssssssssssss    cccccccccccc     aaaaaaaaa    ll            eeeeeeeeeeeee
                                 ssssssssssssss  cccccccccccccc   aaaaaaaaaaa   ll            eeeeeeeeeeeee
                                 ss         ss   cc         cc   aa         aa   ll            ee
                                 ss              cc              aa         aa   ll            ee
                                 ss              cc              aa         aa   ll            ee
                                 ssssssssssss    cc              aaaaaaaaaaaaa   ll            eeeeeeeee
                                  ssssssssssss   cc              aaaaaaaaaaaaa   ll            eeeeeeeee
                                            ss   cc              aa         aa   ll            ee
                                            ss   cc              aa         aa   ll            ee
                                 ss         ss   cc         cc   aa         aa   ll            ee
                                 ssssssssssssss  cccccccccccccc   aa         aa   llllllllllll  eeeeeeeeeeeee
                                  ssssssssssss    cccccccccccc    aa         aa   llllllllllll  eeeeeeeeeeeee
```

```
                    ******************************************************************************
                    ******************************************************************************
                    ******************************************************************************
                    *****                                                                      *****
                    *****                 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                                      *****
                    *****                                                                      *****
                    *****                                                                      *****
                    ******************************************************************************
                    ******************************************************************************
                    ******************************************************************************
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   2.95E+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
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	1.47E+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-04	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	3.64E+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