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1. Purpose

This analysis is prepared by the Mined Geologic Disposal System (MGDS) Waste Package Development (WPD) department with the objective of providing a comprehensive, conservative estimate of the consequences of the criticality which could possibly occur as the result of commercial spent nuclear fuel emplaced in the underground repository at Yucca Mountain. The consequences of criticality are measured principally in terms of the resulting changes in radionuclide inventory as a function of the power level and duration of the criticality. The purpose of this analysis is to extend the prior estimates of increased radionuclide inventory (Refs. 5.52 and 5.54), for both internal and external criticality. This analysis, and similar estimates and refinements to be completed before the end of fiscal year 1997, will be provided as input to Total System Performance Assessment - Viability Assessment (TSPA-VA) to demonstrate compliance with the repository performance objectives.

2. Quality Assurance

The Quality Assurance (QA) program applies to this analysis. The work reported in this document is part of the preliminary probabilistic evaluation of the waste package (WP). This activity can affect the proper functioning of the MGDS waste package; the waste package has been identified as an MGDS Q-List item important to safety and waste isolation (Ref. 5.1, pp. 5, 16). The waste package is on the Q-List by direct inclusion by the Department of Energy (DOE) as are the natural barriers of the Topopah Spring Welded (TSw) Hydrogeologic Unit, the Calico Hills Nonwelded (CHn) Hydrogeologic Unit, and the Saturated Zone (SZ) barrier; a QAP-2-3 evaluation has yet to be conducted. The work performed for this analysis is covered by a WPD QAP-2-0 work control Activity Evaluation entitled *Perform Probabilistic Waste Package Design Analyses* (Ref. 5.2). This QAP-2-0 evaluation determined that such activities are subject to *Quality Assurance Requirements and Description* (QARD) (Ref. 5.3) requirements. Applicable procedural controls are listed in the evaluation.

All design inputs which are identified in this document are for preliminary design and shall be treated as unqualified data; these design inputs will require subsequent qualification (or superseding inputs) as the waste package design proceeds. 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). In addition, the inputs associated with this analysis are not required to be procedurally controlled as TBV. However, use of any data from this analysis for input into documents supporting procurement, fabrication, or construction is required to be controlled as TBV in accordance with the appropriate procedures.

3. Method

The following methods are used for evaluating the consequences of WP internal criticality:

- The waste package temperature is determined as that at which the evaporation from the water surface (assumed to be just covering the top most assemblies; see Assumption 4.3.16) will just balance the infiltration which is assumed to be the maximum credible, 10 mm/yr (Ref. 5.18, Sect. 7).

- The drift wall temperature is determined by repository scale and drift scale hydrothermal calculations summarized in TSPA-95 (Ref. 5.18).
- The power level of the internal criticality is that necessary to support the rate of heat dissipation to the environment: (1) by radiation to the drift wall and conduction through the rock invert which is driven by the temperature gradient between the waste package and the drift wall; (2) by heating the infiltrating water from the general repository temperature to the waste package temperature; and (3) by evaporation of the water (heat of vaporization) from the surface of the pond within the waste package.
- The duration of the internal criticality is limited by the duration of the peak inflow (to the waste package) of water moderator necessary to maintain the power level.
- The sustainability of this criticality with respect to the balance between fissile species, which are generally consumed by the criticality, and neutron absorbers, which are generally produced by the criticality is verified by using SAS2H (Ref. 5.39) to calculate the species amounts at several times during the criticality, and using these amounts as input to MCNP (Ref. 5.40) to calculate the k_{eff} at each of the times.
- The radionuclide inventory found by using SAS2H is decayed after criticality shutdown for several times up to 999,999 years, using ORIGEN-S (Ref. 5.39).

The following methods are used for evaluating the consequences of criticality external to the WP:

- The average temperature of the critical mass is estimated as the boiling temperature of water at 50 atm. The reason for this estimate is that the most probable place where a reducing zone may occur is in organic material at the base of the tuff (Ref. 5.52), which is typically 500 meters below the water table (Ref. 5.25, Figure 1-6), giving rise to a hydrostatic pressure of 50 atm.
- The maximum power is determined as that required to maintain the average temperature of the critical spherical configuration against heat conduction out from the sphere.
- The maximum <u>sustainable</u> power is determined by assuming that all fissile material transported to the critical mass by the fissile material bearing water from one or more degraded waste packages in the repository is burned (Assumption 4.3.8).
- The duration of the external criticality is determined by the duration of flow of fissile material bearing water from the repository.
- The sustainability of the criticality and the increase in radionuclide inventory are determined by the same methods as were used for the internal criticality, using the computer codes, MCNP (Ref. 5.40), SAS2H, and ORIGEN-S (both Ref. 5.39).

Further detail on the specific analytical methods employed for each step is available in Section 7 of this analysis.

4. Design Inputs

The design inputs identified in this document are for preliminary design and shall be treated as unqualified data; these design input will require subsequent qualification (or superseding inputs) as the waste package design proceeds. This document will not directly support any construction, fabrication, or procurement activity and therefore is not required to be procedurally controlled as TBV.

4.1 Design Parameters

4.1.1 Spent Fuel Assembly Parameters

The fuel assembly upon which this calculation is based is the B&W 15 x 15 fuel assembly. The mechanical parameters for this assembly type are shown in Table 4.1-1. Note that inches are converted to centimeters exactly (2.54 cm/in.); this is not an indication of tolerance (accuracy), but is done for consistency between calculations using English or metric units. The theoretical density of UO_2 is 10.96 g/cm^3 (Ref. 5.39, Table M8.2.1). Non-fuel material compositions of Alloy 825, water, Zircaloy-4, A 516 carbon steel, and 316B6A stainless steel-boron alloy are taken from a QAP-3-9 analysis on material compositions (Ref. 5.5) and used in Attachment VII.

Table 4.1-1. Mechanical Parameters of B&W 15x15 Fuel Assembly

Parameter	Value	Units	Metric	Units	Radius (cm)	Ref.
Fuel Rods	208	/assbly	208	/assbly		5.41
Fuel Rods on a Lattice Side	15	/side	15	/side		5.41
Guide Tubes	16	/assbly	16	/assbly		5.41
Instrumentation Tubes	1	/assbly	1	/assbly		5.41
Total Guide + Instrument Tubes	17	/assbly	17	/assbly		-
Clad/Tube Material	ZIRC-4		ZIRC-4			5.41
Fuel Pellet OD	0.3686	inches	0.936244	cm	0.468122	5.41
Fuel Stack Height	141.8	inches	360.172	cm		5.41
Mass of U	1023	lb	464	kg		5.7
Mass of UO_2	1160.64	lb	526.46	kg		5.41
Percent of Theoretical Density	95	%	95	%		5.41
Fuel Clad OD	0.430	inches	1.0922	cm	0.5461	5.41
Clad Thickness	0.0265	inches	0.06731	cm		5.41
Fuel Clad ID*	0.377	inches	0.95758	cm	0.47879	-
Fuel Rod Pitch	0.568	inches	1.44272	cm		5.41
Guide Tube OD	0.530	inches	1.3462	cm	0.6731	5.41
Guide Tube Thickness	0.016	inches	0.04064	cm		5.41
Guide Tube ID*	0.498	inches	1.26492	cm	0.63246	-
Instrumentation Tube OD	0.493	inches	1.25222	cm	0.62611	5.41
Fuel Assembly Envelope	8.536	inches	21.68144	cm		5.41

* The inner diameters (IDs) above are calculated by subtracting 2 X thickness from the outer diameter (OD).

4.1.2 Intact Waste Package Geometry Parameters

The intact waste package geometry parameters used in this analysis are taken from Reference 5.54. The dimensions are listed in Table 4.1-2 below. Figure 4.1-1 depicts the 21 Pressurized Water Reactor (PWR) Advanced Uncanistered Fuel (AUCF) WP, its internals, and the material specifications (Ref. 5.34).

Table 4.1-2. Intact WP Dimensions

Component	Dimension (cm)
Outer barrier length (skirt edge to skirt edge)	533.5
Outer barrier skirt length (both ends)	22.5
Outer barrier inner radii	73.1
Outer barrier outer radii	83.1
Inner barrier length (overall)	466.5
Inner barrier inner radii	71.095
Inner barrier outer radii	73.095
Fuel cell tube opening	22.9
Fuel cell tube thickness	0.5
Fuel cell tube height	457.5
Criticality control panel/plate thickness	0.7
Criticality control panel/plate width	113.4
Criticality control long panel/plate (16 total) length	122.1
Criticality control short panel/plate (16 total) length	73.0
Criticality control panel/plate cutout length (4 per long panel/2 per short panel)	56.7
Criticality control panel/plate cutout width	0.7
Side and corner guide thickness	1.0

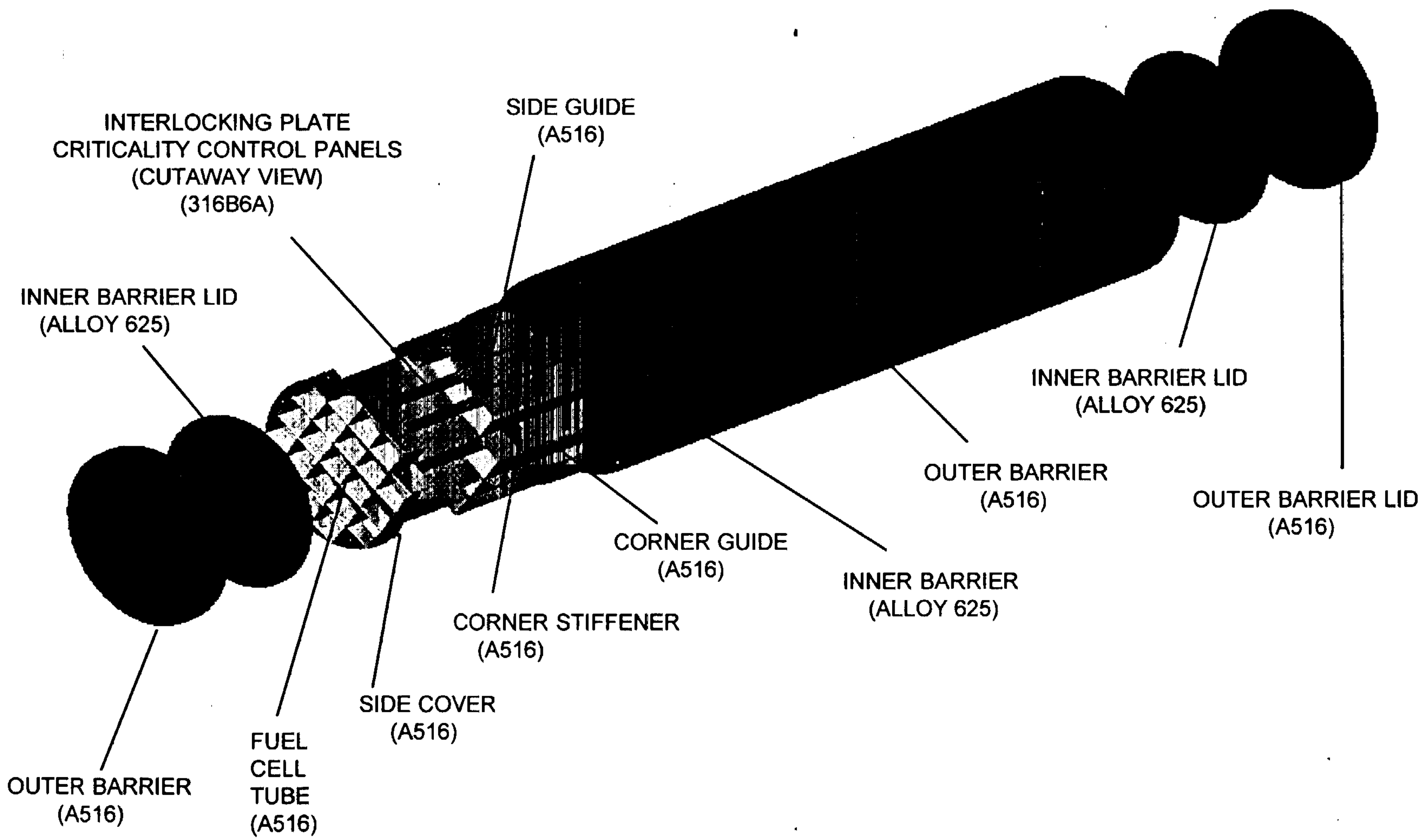

Figure 4.1-1. Advanced Uncanistered Fuel Waste Package with Internals Shown

4.1.3 Isotope Atomic Weights

The atomic weights of isotopes are listed in Table 4.1-3 below (Ref. 5.43 unless otherwise noted) and are used in the number density calculations discussed in Sections 7.2.1 and 7.4.4.

Table 4.1-3. Atomic Weights in g/mole (Ref. 5.43)

Isotope	MCNP ID	Atomic Weight
O-16	8016.50C	15.994915
nat. Mo	42000.50C	95.94
Mo-95	42095.50C	94.905839
Tc-99	43099.50C	98.90627501*
Ru-101	44101.50C	100.905576
Rh-103	45103.50C	102.905511
Ag-109	47109.50C	108.904756
nat. Cd	48000.50C	112.4
Xe-131	54131.50C	130.905069**
Xe-135	54135.50C	134.9063***
Cs-133	55133.50C	132.905355
Cs-135	55135.50C	134.90577
Nd-143	60143.50C	142.909779
Nd-145	60145.50C	144.912538
Sm-147	62147.50C	146.914867
Sm-149	62149.50C	148.91718
Sm-150	62150.50C	149.917276
Sm-151	62151.50C	150.919919
Sm-152	62152.50C	151.919756
Eu-151	63151.55C	150.919838
Eu-153	63153.55C	152.921242
Eu-154	63154.50C	153.923053
Gd-155	64155.50C	154.922664
Gd-157	64157.50C	156.924025
U-233	92233.50C	233.039522
U-234	92234.50C	234.040904
U-235	92235.50C	235.043915
U-236	92236.50C	236.045637
U-238	92238.50C	238.05077
Np-237	93237.55C	237.048056
Pu-238	94238.50C	238.049511
Pu-239	94239.55C	239.052146
Pu-240	94240.50C	240.053882
Pu-241	94241.50C	241.056737
Pu-242	94242.50C	242.058725
Pu-243	94243.35C	243.061972
Am-241	95241.50C	241.056714
Am-242m	95242.50C	242.059502
Am-243	95243.50C	243.061367
Cm-243	96243.35C	243.06137
Cm-245	96245.35C	245.065371

* From Reference 5.5
** From Reference 5.33
***Linearly interpolated from Atomic Weights of Xe-134 and Xe-136 in Reference 5.33.

Avogadro's Number $[N_A] = 0.602252\ (\text{g-mol})^{-1} \times 10^{24}$ (Ref. 5.43, p. 933).

4.1.4 Far-Field Tuff Composition and Characteristics

The composition and characteristics of the far field tuff are shown in Table 4.1-1 (Ref. 5.48, p. 16 unless noted otherwise).

Table 4.1-4. Calico Hills/Prow Pass Nonwelded-Zeolitic Tuff

Parameter	Value
Mean Density 198 samples	1.746 g/cm^3 *
Mean Porosity 127 samples (Max = 0.470**)	0.306*
Estimated Average Thermal Conductivity	1.38 W/m·K***
SiO_2 Wt%	69.1
TiO_2 Wt%	0.11
Al_2O_3 Wt%	13.4
Fe_2O_3 Wt%	1.13
MnO Wt%	0.05
MgO Wt%	0.94
CaO Wt%	3.22
Na_2O Wt%	1.23
K_2O Wt%	2.64
P_2O_5 Wt%	0.01
LOI (volatile) Wt%	8.90
Total Wt%	100.7

* Average values obtained form the data in Reference 5.47, p. 7-11.

** Previous evaluation of the porosity data for this tuff indicated that the 47% porosity data point was a statistical outlier (Ref. 5.47, p. 7-10) which was probably anomalous, so that the maximum of the sample should have been the maximum of the remaining 126 elements, 40% porosity.

*** Estimate is from Reference 5.31, p. 6 and is based on the average of two values from the Calico Hills tuff unit.

In addition to the above major-element concentrations, 25 trace-element concentrations were identified by parts per million (ppm) by weight (Ref. 5.48, Appendix C). Some of these trace elements have high absorption cross sections, for example, Eu, Hf, Sm, etc. Previous evaluation (Ref. 5.55, p. 5) indicated that none of these elements is contained in sufficient concentrations in the tuff, with an adequate confidence in the nominal value, to be included.

4.1.5 Properties of Saturated Liquid Water

Table 4.1-5. Properties of Saturated Water (Ref. 5.20, p. 656)

Temperature (°F)	Pressure (psia)	Specific Volume (ft^3/lb)
500	680.0	0.02043
510	743.5	0.02067

4.2 Criteria

This design analysis provides preliminary input for criticality analyses which evaluate whether waste package designs meet the repository criticality control design criteria from requirement documents. The *Mined Geological Disposal System Requirements Document* (Ref. 5.11) and the *Engineered Barrier Design Requirements Document* (EBDRD, Ref. 5.12) have criteria which pertain to criticality analyses. Reference 5.12 is the lower level document and contains all of the criteria listed in Reference 5.11. These requirements also apply to accumulations of fissile material in the far-field because far-field consequences can have an impact on the WP design. The WP is the source for material in the far-field and mitigation of significant consequences in the far-field may require some modification of the WP (Engeneered Barrier) design. The criteria cited in Reference 5.12 that have bearing on this analysis include the following:

4.2.1 From the EBDRD (Ref. 5.12);
"**3.2.2.6 CRITICALITY PROTECTION**

A. The Engineered Barrier Segment shall be designed to ensure that a nuclear criticality accident is not possible unless at least two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to nuclear criticality safety. Each system shall be designed for criticality safety under normal and accident conditions. The calculated effective multiplication factor must be sufficiently below unity to show at least a five percent margin, after allowance for the bias in the method of calculation and the uncertainty in the experiments used to validate the methods of calculation.
[MGDS-RD 3.2.2.6.A][10CFR60.131(b)(7)]

B. To mitigate the potential for nuclear criticality, the Engineering Barrier Segment shall be designed and constructed to comply with the nuclear criticality requirements specified by DOE order 6430.1A, 1300-4.
[MGDS-RD 3.2.2.6.B] [DOE Order 6430.1A, 1300-4]"

4.2.2 From the EBDRD (Ref. 5.12);
"**3.7.1.3 INTERNAL STRUCTURE REQUIREMENTS**

A. The internal structure shall provide separation of the waste forms such that

nuclear criticality shall not be possible unless at least two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to nuclear criticality safety. The calculated effective multiplication factor (k_{eff}) must be sufficiently below unity to show at least a five percent margin after allowance for the bias in the method of calculation and the uncertainty in the experiments used to validate the methods of calculation (TBD).
[MGDS-RD 3.2.2.6.A] [10CFR60.131(b)(7)]"

The present DOE Office of Civilian Radioactive Waste Management (OCWRM) and Civilian Radioactive Waste Management System (CRWMS) Management and Operating Contractor (M&O) position is that the requirement cited in the above criteria based on 10CFR60.131(b)7, being primarily of a deterministic nature, is not appropriate for postclosure disposal criticality. Instead, the probability or risk based approach has been recommended to the U.S. Nuclear Regulatory Commission (NRC) in the following two letters:

4.2.3 From Ronald A. Milner, Director, Office of Program Management and Integration, OCRWM, to the NRC, Docketing and Service Branch, dated June 16, 1995, which included the specific recommendation to apply the above requirements only to preclosure, and create the following new requirement for postclosure criticality:

"Postclosure criticality safety. The engineered barrier system shall be designed such that the probability and consequences of nuclear criticality provide reasonable assurance that the performance objective of §60.112 is met." (Ref. 5.4)

4.2.4 From Stephan J. Brocoum, Assistant Manager for Suitability and Licensing, OCRWM, to Michael J. Bell, Chief, Engineering and Geosciences Branch, Division of Waste Management, Office of Nuclear Material Safety and Safeguards, NRC, which referred to the above referenced letter, and specifically commented as follows:

"The DOE, therefore, requests that consideration be given to the DOE's proposed revision to 10CFR60.131(b)7 that would allow disposal criticality to be evaluated with risk-based methods." (Ref. 5.6)

The analyses in this document are intended to provide values of, and justification for, consequence parameters (specifically increased radionuclide inventory) plus probability information which will be used as part of TSPA-License Application (LA) to demonstrate compliance with the performance objective of §60.112 (or, as appropriate, other applicable performance objectives in effect or proposed by the NRC at the time the TSPA-LA analysis is performed). The "TBD" items identified in the above criteria will not be carried to the conclusions of this analysis based on the rationale that the conclusions are for preliminary design, and will not be used as input in design documents supporting construction, fabrication, or procurement.

4.3 Assumptions

All assumptions identified in this section will require verification (or superseding assumptions) as the waste package design proceeds and should be treated as unconfirmed items for preliminary design. For this preliminary design, that will not be used to support procurement, fabrication, or construction, the assumptions are clearly identified and traceable to a source, but are not procedurally controlled as TBV.

4.3.1 Principal Isotope (PI) burnup credit is assumed to be an acceptable method to account for reduced reactivity of SNF in criticality evaluations. The basis for this assumption is CDA Key 009 (Ref. 5.44). This assumption is used throughout Section 7.

4.3.2 The reference PWR fuel physical assembly selected for conceptual development is the B&W 15 x 15 fuel type, which has been established as one of the more reactive PWR fuel designs under intact fuel assembly and fixed basket geometry conditions (Ref. 5.16, p. II.A.3-35). This assumption is used throughout Section 7.

4.3.3 The design basis spent nuclear fuel (SNF) characteristics within the physical assembly are 3.0% U-235 enrichment, 20 GWd/MTU burnup, as established by the M&O (Ref. 5.10, Section 5). This SNF composition is assumed to be more stressing with respect to criticality than 96-97% of the SNF inventory. This SNF composition is representative only. It does not necessarily match any composition for a B&W assembly type specified in the previous assumption. This assumption is used throughout Section 7.

4.3.4 For SNF, the list of "Principal Isotopes" previously established (Ref. 5.46, p. 4-4) for long-term criticality control was used. The 29 principal isotopes are shown in Table 4.3-1. This assumption is used in Sections 7.3.2 and 7.4.

Table 4.3-1. Principal Long-Term Burnup Credit Isotopes

-	Mo-95	Tc-99	Ru-101	Rh-103
Ag-109	Nd-143	Nd-145	Sm-147	Sm-149
Sm-150	Sm-151	Sm-152	Eu-151	Eu-153
Gd-155	U-233	U-234	U-235	U-236
U-238	Np-237	Pu-238	Pu-239	Pu-240
Pu-241	Pu-242	Am-241	Am-242m	Am-243

4.3.5 It is assumed that the cooling of the external criticality in the saturated zone will be primarily by conduction. The basis for this assumption is that the maximum cooling possible from the next largest physical mechanism, advective flow through the criticality zone, is much smaller than the rock conduction, as is seen from the following calculation:

The maximum advective heat transfer is approximated by the mean advective flow

(Darcy velocity) in the saturated zone (2 meters/yr, Ref. 5.18, p. 7-21) multiplied by the cross-section area of the critical zone (1.4 m radius, which is 6.16 m^2 cross-section), multiplied by the heat capacity of water (aproximated by 4200 Joules/kg·K, Ref 5.14, which is also $4.2x10^6$ Joules/m^3·K), multiplied by maximum temperature change between the critical mass and the far-field heat sink, and divided by the number of seconds in a year ($31.5x10^6$). The maximum change in temperature between the critical sphere and the far field is given in Attachment I, and in Section 7.3.2, as $P/(4\pi kR)$, where k is the thermal conductivity (1.38 W/m·K, Ref. 5.31, p. 6), P is the power generated by the critical sphere, and R is the radius, 1.4 m, given above. The resulting conservative estimate of advective heat transfer is 0.07P, which means that it can be no more than 7% of the conductive heat transfer. This assumption is used in Section 7.3.2.

4.3.6 It is assumed that the maximum power from the worst case external criticality will occur in the saturated zone, at the base of the tuff and will be at a pressure of 50 atmospheres. The basis for this assumption is that the reducing material from original organic deposits could not have been emplaced while the tuff was being deposited, and can, therefore, be found only at the base of the tuff, which is approximately 500 meters below the water table (Ref. 5.25, Figure 1-6), at which the hydrostatic pressure is approximately 50 atmospheres. A rapid onset of criticality could, of course, result in a temporary overpressure, but that possibility is not considered according to the steady state assumption (Assumption 4.3.7, below). This assumption is used in Section 7.3.3.

4.3.7 It is assumed that the criticality is in a steady state so that the time independent heat conduction equation can be used to establish the relation between criticality power and temperature. The basis for this assumption is that over the thousands of years (conservative estimate of reactor duration) the short period fluctuations will average out. This assumption is used in Section 7.3.2 and in Attachment I.

4.3.8 First, it is assumed that the sustainable criticality power for the external criticality is limited by the fuel replenishment rate from the infiltration of fissile material bearing water from the repository. (This is lower than the maximum power identified in Assumption 4.3.6, above and described in Section 7.3.3.) Secondly, it is further assumed that the incoming fissile material can only provide that portion of the fissile material which is above 1.37%, as is explained in Section 7.3.4 of this analysis and Section 7.7 of Reference 5.52, where the argument was initially presented. The basis for the first part of this assumption is that the criticality will begin when k_{eff} just reaches 1, so that any amount of fissile material consumed must be replaced by fresh fissile material in order to sustain the criticality. The basis for the second part of this assumption is given in Section 7.3.4 of this analysis and Section 7.7 of Reference 5.52. This assumption is used in Section 7.3.4.

4.3.9 The SAS2H module in SCALE4.3 (Ref. 5.39) is assumed to be applicable to analysis of accumulations of fissile material in tuff. The basis of this assumption is that the 44 group cross section library used in these calculations likely provides enough detail to cover the more thermal spectrum (compared to PWRs) of the external accumulations adequately.

This assumption will require future verification. This assumption was used in a previous analysis (Ref. 5.53) to generate the data used in Section 7.2.2, and is also used in Section 6.1.

4.3.10 The SAS2H and ORIGEN-S modules in SCALE4.3 are assumed to provide reasonable predictions of isotopic compositions for a low power criticality event over several thousand years. The basis of this assumption is the demonstration in Section 7.4.2 that no nonconservative trends exist by comparing the results of 100 year and 1000 year time steps. This assumptions will require future verification. This assumption is used in Sections 6.1, 7.2.1, 7.2.2, 7.4.3, and 7.4.4.

4.3.11 For external criticality, water infiltration has provided the mechanism for waste package and SNF degradation, as well as the mechanism for actinide transport to the far field environment. This assumption is used throughout Sections 7.3 and 7.4.

4.3.12 The material compositions for tuff in the far field is assumed to be represented by the major constituents of Calico Hills/Prow Pass nonwelded-zeolitic tuff taken from References 5.47 and 5.48. Portions of these formations fall within the saturated zone. This assumption is used throughout Sections 7.3 and 7.4.

4.3.13 The accumulation of UO_2 in saturated tuff is assumed to be represented by a spherical homogeneous mixture of UO_2/tuff/water. Fracture distributions and densities in the tuff, size and density of potential uranium deposits, and presence and composition of reducing zones within the tuff are unknown. This assumption is used throughout Sections 7.3 and 7.4.

4.3.14 The power level of the internal criticality is that necessary to support the rate of heat dissipation to the environment: (1) from the lower half of the waste package, by conduction through the rock invert which is driven by the temperature gradient between the waste package and the drift wall; (2) from the upper half of the waste package, which is assumed to be uncovered, by radiation from the package surface to the drift wall; (3) by evaporation of the water from the surface of the pond within the waste package. This assumption was used in Reference 5.54, which is the basis for information provided in Sections 7.1 and 7.2.

4.3.15 In determining the temperature gradient for Assumption 4.3.14, the drift wall temperature is determined by repository scale and drift scale hydrothermal calculations summarized in TSPA-95 (Ref. 5.18). This assumption is used throughout Sections 7.1 and 7.2.

4.3.16 In determining the temperature gradient for Assumption 4.3.14, the waste package temperature is assumed to be just large enough that the evaporation from the water surface (assumed to just cover the top most assemblies) will just balance the water inflow to the package which is assumed to be at the maximum high infiltration rate 10 mm/yr (Ref. 5.18, TSPA-95). The basis for this assumption is that the internal criticality is moderator limited, so that it is necessary to maintain the water level in order to maintain the criticality. It turns out that even for this maximum possible infiltration rate, this waste package temperature is significantly less than the boiling temperature. This assumption is stated in Section 3.0, and is used throughout Sections 7.1, 7.2, and 7.3.4.

4.3.17 The duration of the internal criticality is limited by the peak inflow of water necessary to maintain the power level estimated according to Assumption 4.3.14. The basis for this assumption is the same as the basis for Assumption 4.3.16 to which it is closely related. This assumption is used throughout Sections 7.1 and 7.2.

4.3.18 The fresh fuel bias and uncertainty for MCNP is approximately 0.015 (Ref. 5.45, p. 6-221). The preliminary SNF bias and uncertainty is approximately 0.06 (Ref. 5.45, p. 6-221). These uncertainties were used in a prior unverified analysis. This assumption is used throughout Section 7.

4.3.19 The deterministic based requirements in the EBDRD (Ref. 5.12) are assumed not to apply to postclosure disposal criticality. The basis is the ongoing interaction between DOE and NRC to change the requirements to allow a probabilistic approach to postclosure disposal criticality as indicated in Section 4.2. This assumption is used throughout Section 7.

4.3.20 It is assumed that the mobilization (removal from the waste package) of the fissile material is much slower than the dissolution of the SNF. The consequence of this assumption is that the removal of the fissile material from the waste package is limited by the water flux through the waste package, or incident on the waste package. The basis of this assumption is the analysis given in Reference 5.52, Section 7.2. This assumption is used in Section 7.3.4.

4.4 Codes and Standards

American National Standard on "Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors", ANSI/ANS-8.17, 1984.

5. References -

5.1 *Q-List*, YMP/90-55Q, REV 3, Yucca Mountain Site Characterization Project

5.2 Activity Evaluation, *Perform Probabilistic Waste Package Design Analyses*, Document Identifier Number (DI#) BB0000000-01717-2200-00030 REV 02, CRWMS M&O

5.3 *Quality Assurance Requirements and Description*, DOE/RW-0333P, REV 5, Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM)

5.4 Letter, R.A. Milner to Secretary, U.S. NRC Docketing and Service Branch, Transmitting DOE comments regarding NRC-proposed revisions to 10 CFR Part 60 Regulations for Design Basis Events, June 16, 1995

5.5 *Material Compositions and Number Densities for Neutronics Calculations*, DI# BBA000000-01717-0200-00002 REV 00, CRWMS M&O

5.6 Letter, S.J. Brocoum to M.J. Bell, Providing DOE acknowledgment of receipt of NRC comments on the Annotated Outline for the Disposal Criticality Analysis Topical Report, April 12, 1996

5.7 *Characteristics of Potential Repository Wastes*, DOE/RW-0184-R1, Volume 1, p. 2A-8, July 1992, DOE OCRWM

5.8 *Initial Waste Package Probabilistic Criticality Analysis: Uncanistered Fuel*, DI# B00000000-01717-2200-00079 REV 01, CRWMS M&O

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5.10 *Mined Geologic Disposal System Advanced Conceptual Design Report, Volume III of IV, Engineered Barrier Segment/Waste Package*, DI#: B00000000-01717-5705-00027 REV 00, CRWMS M&O.

5.11 *Mined Geologic Disposal System Requirements Document*, DOE/RW-0404P REV 02/ICN 01, DOE OCRWM

5.12 *Engineered Barrier Design Requirements Document*, YMP/CM-0024, REV 0, ICN 1, Yucca Mountain Site Characterization Project

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5.14 Holman, J.P., *Heat Transfer*, 7th Edition, McGraw-Hill Publishing Company, 1990

5.15 *User Manual for the CDB_R*, DI#: A00000000-01717-2002-20002 REV 01, CRWMS M&O

5.16 *Multi-Purpose Canister (MPC) Implementation Program Conceptual Design Phase Report, Volume II.A - MPC Conceptual Design Report*, DI# A20000000-00811-5705-00002 REV 00, CRWMS M&O

5.17 *CRC Handbook of Chemistry and Physics*, 66th Edition, CRC Press, 1985

5.18 *Total System Performance Assessment - 1995: An Evaluation of the Potential Yucca Mountain Repository*, DI# B00000000-01717-2200-00136 REV 01, CRWMS M&O

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5.25 *Performance Assessment of the Direct Disposal in Unsaturated Tuff of Spent Nuclear Fuel and High-Level Waste Owned by U.S. Department of Energy*, Sandia National Laboratory, SAND94-2563/2, March 1995

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5.31 *Emplacement Scale Thermal Evaluations of Large and Small WP Designs*, DI# BB0000000-01717-0200-00009 REV 00, CRWMS M&O

5.32 Reserved

5.33 *Nuclides and Isotopes*, Fourteenth Edition, General Electric Company, 1989

5.34 *Material of 21 PWR AUCF Waste Container*, Interoffice Correspondence LV.WP.HW.03/96.059, Helen Wang, March 13, 1996, CRWMS M&O

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5.38 Reserved

5.39 *SCALE 4.3, RSIC Computer Code Collection*, CCC-545, Oak Ridge National Laboratory, October 1995

5.40 *MCNP 4A - Monte Carlo N-Particle Transport Code System*, CSCI# 30006 v4A, RSIC Computer Code Collection, CCC-200, Oak Ridge National Laboratory, February 1994

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5.44 *Controlled Design Assumptions (CDA) Document*, DI# B00000000-01717-4600-00032 REV 03, CRWMS M&O (TBV-221-DD)

5.45 *Initial Summary Report for Repository/Waste Package Advanced Conceptual Design*, DI# B00000000-01717-5705-00015 REV 00, CRWMS M&O

5.46 *Disposal Criticality Analysis Technical Report*, DI# B00000000-01717-5705-00020 REV 00, CRWMS M&O

5.47 *Total-System Performance Assessment for Yucca Mountain - SNL Second Iteration (TSPA-1993), Volume 1*, SAND93-2675, April, 1994

5.48 *Chemistry of Diagenetically Altered Tuffs at a Potential Nuclear Waste Repository, Yucca Mountain, Nye County, Nevada*, LA-10802-MS, Los Alamos National Laboratory, October, 1986

5.49 *SCALE4.3 and MCNP4A Installation*, Interoffice Correspondence LV.WP.JWD.06/96.135, J. Wesley Davis, June 11, 1996, CRWMS M&O

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5.54 *Second Waste Package Probabilistic Criticality Analysis: Generation and Evaluation of Internal Criticality Configurations*, DI# BBA000000-01717-2200-00005 REV 00, CRWMS M&O

5.55 *Preliminary Criticality Analysis of Degraded SNF Accumulations External to a Waste Package*, DI# BBA000000-01717-0200-00016 REV 00, CRWMS M&O

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

6. Use of Computer Software -

6.1 Scientific and Engineering Software

SCALE 4.3 (Ref. 5.39), which includes the SAS2H and ORIGEN-S modules used in this report, has not been qualified according to QA procedures. The SAS2H and ORIGEN-S results for external criticalities of this analysis, therefore, shall be treated as unqualified data. SCALE 4.3 was run on HP Series 735 Workstations. SCALE 4.3 is an appropriate tool to be utilized to determine the composition and characteristics of PWR spent fuel and has been demonstrated to run correctly on the HP 735 workstations (Ref. 5.49). This code has been validated for this application by ORNL (Ref. 5.56). The application of SAS2H to accumulations of fissile material in tuff and to long term low power depletion due to a criticality event does not fall within the ORNL range of validation and must be validated in the future. The 44 group cross section library used in these calculations likely provides enough detail to cover the more thermal spectrum of the external accumulations adequately (Assumption 4.3.9). In addition, the ability to cover the long term low power depletion calculations is checked in this report (Section 7.4.2) by comparing the results from two different time step sizes (100 and 1000 years; Assumption 4.3.10).

MCNP4A (Ref. 5.40; CSCI# 30006 v4A) was run on HP 735 Workstations. MCNP4A is qualified according to QA procedures and was obtained from the SCM in accordance with appropriate procedures. MCNP4A is utilized to determine the criticality potential SNF and of fissile material accumulations in the far field environment external to the repository and is an appropriate tool for these purposes, and was used within the range of validation.

The results from MCNP cases are reported as $k_{eff} \pm 2\sigma$. k_{eff} is the final estimated combined collision/absorption/track-length k_{eff} reported in MCNP. 2σ is twice the standard deviation of the calculated value and $k_{eff} \pm 2\sigma$ approximately represents the 95% confidence interval of the result.

There are biases and uncertainties associated with a criticality calculation. How these biases and uncertainties are treated in criticality calculations is covered in the American National Standard on "Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors" (see Section 4.4). The fresh fuel bias and uncertainty for MCNP is approximately 0.015 (Ref. 5.16, p. II.A.3-35). The fresh fuel bias and uncertainty is appropriate for application to the external accumulations of fissile material investigated in this analysis.

The CDB LWR Radiological PC Database (CDB-R, Ref. 5.13), CSCI: A00000000-02268-1200-20002 v1.1, was used to obtain the radiological characteristics of the thermal/shielding DBF. The CDB has been qualified by the Office of Civilian Radioactive Waste Management for use in work subject to the requirements of the QARD (Ref. 5.3). The CDB was installed on an IBM-compatible PC in accordance with the User Manual for the CDB-R (p. 1, Ref. 5.15) and was obtained in accordance with the QAP-SI series procedures. Use of the SNF radionuclide inventories from the CDB is appropriate for this design analysis and is within the range of validation performed for the CDB.

6.2 Computational Support Software

LOTUS 1-2-3, Release 4.01 for Windows was used to calculate the isotopic number densities for the spent nuclear fuel and tuff/water/UO_2 mixtures investigated. Details of the equations and used of the spreadsheet are provided in Section 7.

7. Design Analysis -

This design analysis is presented in five sections. Sections 7.1 and 7.2 deal with internal criticality. The first gives the basic parameters of the criticality, and the second gives the results of the neutronics evaluation; increase in radionuclide inventory and change in k_{eff}. Sections 7.3 and 7.4 deal with external criticality in the same way as the internal criticality sections. Section 7.5 summarizes the previous estimates of probability associated with the critical configurations and lists the data items expected to be obtained within the next year to improve these estimates.

7.1 Internal Criticality, Basic Parameters

7.1.1 Waste Package Nominal Criticality Configuration

The purpose of this section is to summarize the 21 PWR AUCF WP internal degraded configuration for which the consequences of criticality have been modeled, and provide a brief summary of the progression of WP degradation from the initial configuration to the configuration for which criticality may be of concern. Further detail on the information presented here can be found in the *Second Waste Package Probabilistic Criticality Analysis: Generation and Evaluation of Internal Criticality Configurations* (Ref. 5.54) and the *Emplaced Waste Package Structural Capability Through Time Report* (Ref. 5.50).

7.1.1.1 Basket Collapse

This section discusses the four primary basket components responsible for maintaining the initial configuration of the WP, and the anticipated changes in the WP configuration which will occur as a result of their degradation following WP breach. These are the side and corner guides, the neutron absorber plates, fuel cell tubes, and the fuel assemblies themselves. Prior to WP breach, the interior of the WP is filled with an inert gas, and no degradation of the internal components would be expected. The inert environment is lost on first pit penetration of both WP barriers, which TSPA-95 (Ref. 5.18, Sect. 5) predicted would occur for a majority of WPs (typically 80% or more) within 2000 to 10,000 years after emplacement under most of the 83 MTU/acre scenarios. However, those scenarios which considered that the remaining carbon steel could provide cathodic protection for the inner barrier showed much longer times to first pit penetration (in the 10,000 to 100,000 year time frame)

The AUCF WP side and corner guides are fabricated from 10 mm thick carbon steel plates. Reference 5.50 indicates that the side guide will fail by bending at a thickness of 2.9 mm if there is no backfill loading the basket. Reference 5.50 estimated that this failure would occur within 60 to 340 years following WP breach for the 83 MTU/acre case without backfill using the TSPA-95 carbon steel corrosion model. Failure of the side guides will cause the bottom row of fuel assemblies to shift downward to touch the inside of the inner barrier. As the criticality control plate assemblies also rest on the top of the side guides, the entire basket structure should also shift downward. Since the corner guides are under less loading, their failure should occur shortly after failure of the side guides. Failure of the corner guides will result in the assemblies on the end of the second row from the bottom to shift downward to touch the inside of the inner barrier.

The assemblies above them should remain in place until sufficient degradation of the neutron absorber plates which support them has occurred.

The fuel cell tubes are also fabricated from carbon steel and have a wall thickness of 5 mm. The tubes will fully degrade before the failure of the side guides or the criticality control plates. In analyzing the criticality control plates, it was determined that the plates could maintain the basket and SNF assembly configuration without structural support from the tubes. Failure of the tubes will, therefore, not cause collapse of the basket, so no specific analysis was performed for the tubes. However, the remaining corrosion products occupy a greater volume than the original tubes and are fairly insoluble. Thus their presence may have some impact on WP internal criticality.

The AUCF WP neutron absorber plates are fabricated from 7 mm thick borated Type 316L stainless steel plates. Reference 5.50 found that the horizontal absorber plates will bend once 2.5 mm of thinning has occured, and the vertical plates will buckle after 5.36 mm of material is removed. Reference 5.50 made a preliminary estimate that it will take 2000 to 8500 years following breach of the WP for general corrosion of both sides of the neutron absorber plates to remove the 2.5 mm of material that would be required for bending to occur. It was estimated to take 4300 to 18,000 years to remove the 5.36 mm of material that would be required for buckling of the vertical plates. Bending will occur first at the ends of horizontal long criticality plates, causing the assemblies in the two side columns to drop down. Final collapse of the basket will occur due to bending of the horizontal plates supporting the assemblies (which would be expected to occur at a time later than the bending of the ends because the plates are supported on two sides) or buckling of the vertical plates. Final collapse will leave the center three columns of fuel assemblies resting on the bottom of the inner barrier.

Finally, Reference 5.50 also evaluated possible mechanisms for denting or crushing the fuel assemblies such that they no longer provide an optimum geometry for criticality. It was concluded that denting of the fuel rods would not occur because there is sufficient void space for expansion of the corroding basket materials, thus preventing them from causing any load on the fuel assemblies. Preliminary structural analyses were also performed which determined that the bottom-most fuel assemblies would be capable of supporting the entire degraded basket structure, and all fuel assemblies above them, without being crushed. Based on this information, the assumption of intact fuel assemblies for criticality analyses is appropriate and conservative until significant corrosion of the fuel rods and spacer grids has occured. Efforts to estimate the amount of corrosion required for such failures are currently under way.

Figure 7.1.1-1 shows the initial and degraded waste package internal configurations. As will be discussed in the following sections the final stage, where complete degradation of the basket components has occured, will be the primary configuration of concern for postclosure internal AUCF WP criticality.

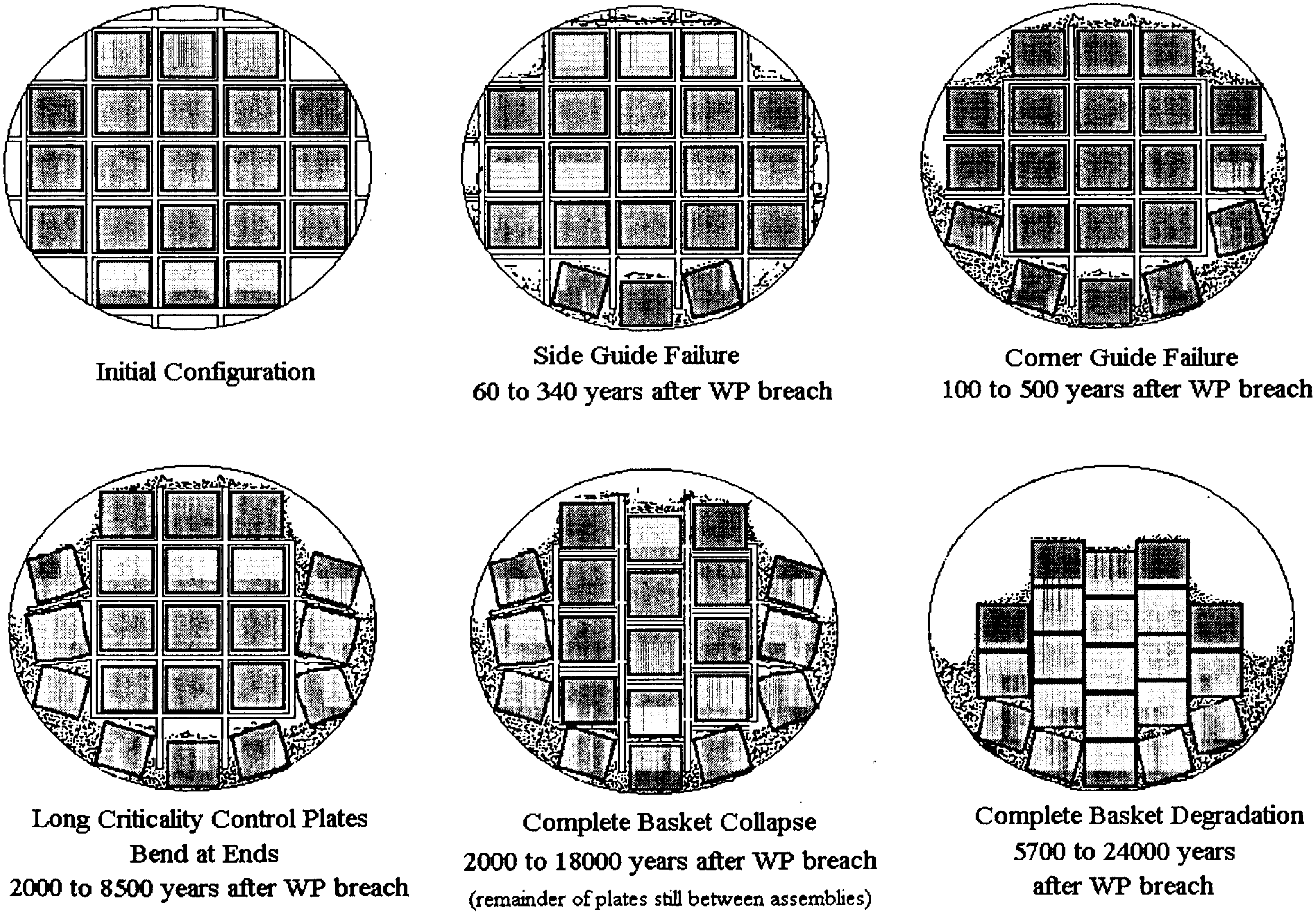

Figure 7.1.1-1. Initial and Degraded Waste Package Internal Configurations

7.1.1.2 Neutron Absorber Loss

As discussed above in Section 7.1.1.1, the degradation and collapse of the basket will leave behind a significant amount of iron, nickel, and chromium oxide corrosion products. In addition, the boron in borated stainless steel is in the form of a boride of iron (or one of the other metal components of stainless steel). Since such borides are generally found to be very stable (as described in Reference 5.25), the borides can be assumed to oxidize much more slowly than the iron, and some fraction will be trapped in the solid iron/chromium/nickel oxide matrix of the corroding stainless steel. Oxide corrosion products from the carbon steel components will also contribute to this trapping process.

Reference 5.54 performed an evaluation of the times required to remove specific amounts of the oxide corrosion products and the trapped boron from a WP which is assumed to be penetrated only on top and filled with water. A scenario which could lead to this configuration is based on the assumption that there will be very little probability of penetration of the lower portion of the waste package barriers before penetration of the upper portion, because such an "outside-in" process would require pit growth to a depth of 12 centimeters against gravity. The scenario begins with penetration of the upper portion of the barrier in 3000 to 5000 years; during much of the time before 3000 years the barrier temperature is above 90°C, and the aqueous corrosion rate of corrosion resistant inner barrier is modeled as being relatively high (Ref. 5.18), which is the reason why the penetration time is so short. After penetration of the upper portion of the barrier, penetration of the lower portion can begin from the inside out. By this time, however, the temperature is likely to have dropped below 50°C, where the TSPA-95 inner barrier corrosion models predict very small corrosion rates (Ref. 5.18). Because of the present uncertainty in the corrosion model, the probability for achieving a water-filled configuration as a result of this scenario has not yet been estimated. It is expected to be small.

Under such a flooded "bath tub" scenario (which is a required precondition for any internal WP criticality), removal of the oxides is accomplished by dissolution and removal via flushing through the upper portion of the WP. Reference 5.54 assumed that by the time oxides are dissolved, the trapped boride will have oxidized and will also dissolve, in which case it will be quickly flushed out of the package. The alternative is that the boron would still be solid boride, in which case it could remain in place (clinging to the remaining solid iron oxide, or fuel rods) or it could fall to the bottom of the package. The preliminary analysis in Reference 5.54 found that a flooded WP did not exceed a k_{eff} of 0.91 (used as the delimiter for criticality in that reference) until only 90% of the iron, nickel, and chromium oxides (uniformly occupying approximately 26% of the interior void space), and 5% of the initial boron remained. By this time, all internal plates, guides, and tubes had completely degraded. Thus, the first four degraded configurations identified in Figure 7.1.1-1 are of no concern from a postclosure criticality standpoint. Flushing times required to remove this material ranged from 12,000 years to greater than 100,000 years, depending on a number of assumptions such as the fraction of trapped boron, the inflow rate, the solubility of the oxides, the efficiency of the flushing process, and the drip rate of water onto the package.

7.1.2 Determination of Power, Temperature, and Duration

The internal criticality scenarios evaluated thus far simulate a flooded waste package that is gradually approaching a critical condition (k_{eff}=1) as a result of positive reactivity insertions caused by a slow loss of boron and iron from the package interior. Once a waste package reaches a k_{eff} of 1, continued small positive reactivity insertions will cause the power output of the waste package to begin to slowly rise (i.e., a long reactor period). If the power exceeds a certain limit, the rate at which water is consequentially removed from the waste package will exceed the rate of input, and the resulting water level drop will provide a negative reactivity insertion driving the waste package back towards a subcritical condition. Conversely, if insufficient power is produced, the water level will be maintained and the exchange process discussed previously will continue to remove dissolved boron, thus providing a continued source of positive reactivity insertions until the point of equilibrium is achieved. The maximum steady state power can then be estimated by determining the power required to maintain the bulk waste package water temperature at the point where water is removed at the same rate that it drips into the waste package. The waste package must produce sufficient power to raise the temperature of the incoming water to this equilibrium value, as well as account for the heat of vaporization and heat losses to the environment by radiation and/or conduction. Preliminary calculations, which are provided in detail in Reference 5.54, have shown that at a water temperature of 57.4°C, the evaporation rate will match the maximum TSPA-95 rate at which water drips into a WP located beneath a flowing fracture (191 liters/yr, Ref. 5.18, Sect. 7). The thermal power required to raise the water temperature to 57.4°C, while at the same time compensating for heat losses to the environment is 2.18 kW.

7.2 Internal Criticality, Neutronic Evaluation

The neutronic evaluation procedure for the far-field criticality involves three tasks as indicated below:

1) SAS2H burn calculations for intact fuel assemblies were run in a separate analysis (Ref. 5.53) and the results are displayed and utilized in this analysis,
2) Spreadsheet calculations of compositions from various duration criticality events using information from step 1, and
3) MCNP calculations of k_{eff} based on compositions from a 15,000 year decay case and the various duration criticality events.

7.2.1 Radionuclide Increase Resulting From an Internal Criticality

To evaluate the effects of a criticality on the radionuclide inventory of a waste package, the computer code ORIGEN-S was run using the PWR criticality design basis fuel, and the steady state power of 2.18 kW discussed above. The criticality was assumed in References 5.53 and 5.54 to occur after the fuel had aged/decayed for 15,000 years and was maintained at the above mentioned power for three durations: 1000, 5000 and 10,000 years. The maximum duration of 10,000 years is based on the assumption that it is the upper bound for the conditions supporting criticality (high infiltration, integrity of the lower part of the barrier, sufficient fissile material and void space remaining). The output of these runs was the radionuclide inventory, in curies, at the times corresponding to the end of each criticality, and at fuel ages (time since reactor discharge) of 45,000 and 65,000 years (Ref. 5.53, Atts. VII-XI). In addition a fourth, decay-only case was run to determine the radionuclide inventories at the above times for fuel which did not experience a criticality event (Ref. 5.53, Att. VI). The percentage increase in the inventories of 36 of the isotopes examined in TSPA-95 is provided in Reference 5.54. The overall effect of the criticality on the radionuclide inventory can be summarized by the percentage increase in the total curies, over that of the decay-only case, for the 36 TSPA-95 isotopes. Table 7.2.1-1 shows this comparison. The explicitly stated times are measured from emplacement. Figure 7.2.1-1 graphically shows that even the 10,000 year duration criticality does not increase the inventory of the 36 isotopes above that at the time the criticality began. In addition, the criticality appears to have no significant long-term effect on the inventory of these isotopes. Within 25,000 years the total inventory of these 36 isotopes in fuel assemblies which experienced a criticality can barely be distinguished (<10%) from the inventory in fuel assemblies which did not experience a criticality. Furthermore, Table 7.2.1-2 indicates that the increase in the total inventory of the 36 TSPA-95 isotopes in a fuel assembly which experiences a criticality at 15,000 years does not exceed that of the worst decay only fuel, which is represented by the PWR thermal/shielding DBF.

Table 7.2.1-3 shows that the total increase in the inventory of the 36 TSPA-95 isotopes per unit burnup for the PWR criticality DBF is comparible to the in-reactor burn with ≈400 years of decay. Note that Table 7.2.1-3 gives the increment in Curies due to the specified burn, while Table 7.2.1-2 gives the toal Curies after the specified burn. These results are consistent based on the fact that the short lived isotopes present from the in-reactor burn have decayed by 400 years. It is just these short lived isotopes which are not present after the long post-closure criticality burns. It should be noted that the comparison of the 10,000 year burn increment in totoal Curies with the meaningful 400 year initial decay shows only a 2% increase. All calculations are performed in Attachment VIII. Tables 7.2.1-4 through 7.2.1-6 provide detailed inventories of the 36 isotopes, and the percentage change from the decay-only case, for the 1000, 5000, and 10,000 year criticalities.

Table 7.2.1-1. Percentage Increase in Total Curies of the 36 TSPA-95 Isotopes

Duration of Criticality (years)	Percent Increase at End of Criticality	Percent Increase at 45,000 years	Percent Increase at 65,000 years
1000	8.5% (16k years)	0.73%	0.73%
5000	15% (20k years)	4.2%	3.7%
10,000	24% (25k years)	9.9%	8.5%

Table 7.2.1-2. Total Curies of 36 TSPA-95 Isotopes Per Assembly

Fuel Age (years since)	16,000	20,000	25,000	45,000	65,000
PWR Thermal/Shielding DBF, Decay Only*	-	1.7e+02	-	-	-
PWR Criticality DBF, Decay Only	1.4e+02	1.2e+02	9.8e+01	5.3e+01	3.2e+01
PWR Criticality DBF, 1000 yr Criticality	1.5e+02	-	-	5.4e+01	3.3e+01
PWR Criticality DBF, 5000 yr Criticality	-	1.4e+02	-	5.5e+01	3.3e+01
PWR Criticality DBF, 10,000 yr Criticality	-	-	1.2e+02	5.8e+01	3.5e+01

* - Information for this fuel obtained from the CDB-R (Ref. 5.13).

Table 7.2.1-3. Total Curies of 36 TSPA-95 Isotopes Per Unit Burnup (Ci/GWd) Per Assembly

	Incremental Burnup (GWd)	Fuel Age (years since discharge)							
		30	400	15,000	16,000	20,000	25,000	45,000	65,000
PWR Criticality DBF, Decay Only	9.3e+00	1.3e+03	1.2e+02	1.6e+01	1.5e+01	1.3e+01	1.1e+01	5.7e+00	3.5e+00
PWR Criticality DBF, 1000 yr Criticality	3.8e-02	-	-	-	3.0e+02	-	-	2.6e+01	2.6e+01
PWR Criticality DBF, 5000 yr Criticality	1.9e-01	-	-	-	-	1.1e+02	-	1.1e+01	5.3e+00
PWR Criticality DBF, 10,000 yr Criticality	3.8e-01	-	-	-	-	-	5.8e+01	1.3e+01	7.9e+00

Inventory of 36 TSPA 95 Nuclides as a Function of Time for a PWR SNF Assembly After A 10,000 Year Criticality Starting at 15,000 Years

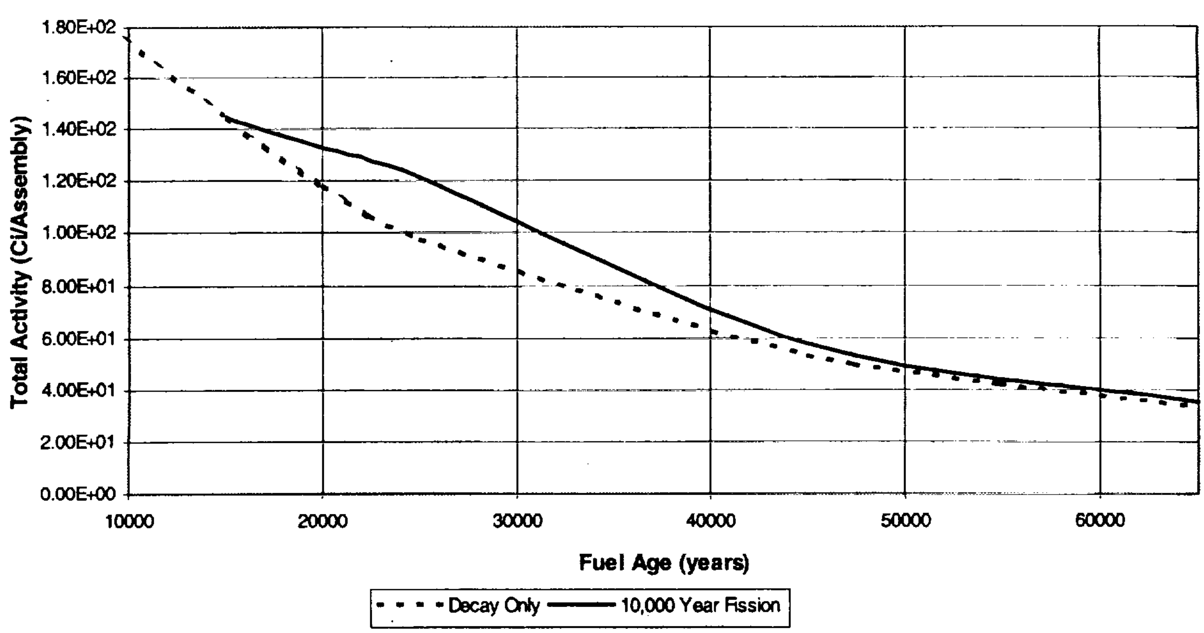

Figure 7.2.1-1

Table 7.2.1-4. Effects of 1000 Year Criticality on the Radionuclide Inventory of a PWR Fuel Assembly (Ref. 5.54)

	16,000 yr Act. (Ci) Critical	Act. (Ci) Decay Only	% Diff. Isotope	% Diff. Total	45,000 yr Act. (Ci) Critical	Act. (Ci) Decay Only	% Diff. Isotope	% Diff. Total	65,000 yr Act. (Ci) Critical	Act. (Ci) Decay Only	% Diff. Isotope	% Diff. Total
ac227	4.9e-003	4.3e-003	1.6e+001	4.9e-004	1.0e-002	1.0e-002	3.0e+000	5.6e-004	1.3e-002	1.3e-002	2.3e+000	9.3e-004
am241	2.6e+000	2.2e-003	1.2e+005	1.9e+000	2.0e-004	2.0e-004	-1.5e+000	-5.6e-006	3.9e-005	3.9e-005	-1.5e+000	-1.9e-006
am242m	2.0e-003	0.0e+000	N/A	1.4e-003	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
am243	4.8e-001	4.5e-001	7.2e+000	2.3e-002	3.1e-002	2.9e-002	7.2e+000	3.9e-003	4.8e-003	4.5e-003	7.2e+000	9.9e-004
c 14	4.9e-006	4.8e-006	2.5e+000	8.7e-008	1.5e-007	1.4e-007	2.8e+000	7.5e-009	1.3e-008	1.3e-008	2.3e+000	9.3e-010
cm244	1.7e-002	0.0e+000	N/A	1.2e-002	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
cm245	2.1e-003	2.1e-003	-1.4e+000	-2.2e-005	2.0e-004	2.0e-004	-1.5e+000	-5.6e-006	3.9e-005	3.9e-005	-1.5e+000	-1.9e-006
cm246	9.6e-005	8.8e-005	9.2e+000	5.8e-006	1.4e-006	1.3e-006	9.5e+000	2.3e-007	7.3e-008	6.7e-008	9.2e+000	1.9e-008
cs135	2.0e-001	2.0e-001	9.9e-001	1.4e-003	2.0e-001	2.0e-001	1.0e+000	3.8e-003	2.0e-001	2.0e-001	1.0e+000	6.2e-003
i129	8.8e-003	8.8e-003	4.5e-001	2.9e-005	8.8e-003	8.8e-003	4.5e-001	7.5e-005	8.8e-003	8.8e-003	3.4e-001	9.3e-005
nb 93m	3.5e-001	3.5e-001	5.8e-001	1.4e-003	3.4e-001	3.4e-001	2.9e-001	1.9e-003	3.4e-001	3.4e-001	2.9e-001	3.1e-003
nb 94	1.9e-005	1.4e-005	4.0e+001	4.0e-006	7.1e-006	5.0e-006	4.1e+001	3.9e-006	3.6e-006	2.5e-006	4.1e+001	3.2e-006
np237	3.8e-001	3.8e-001	2.6e-001	7.2e-004	3.8e-001	3.8e-001	2.6e-001	1.9e-003	3.8e-001	3.8e-001	2.7e-001	3.1e-003
pa231	4.9e-003	4.3e-003	1.6e+001	4.9e-004	1.0e-002	1.0e-002	3.0e+000	5.6e-004	1.3e-002	1.3e-002	1.6e+000	6.2e-004
pb210	8.0e-002	8.0e-002	0.0e+000	0.0e+000	2.1e-001	2.1e-001	4.7e-001	1.9e-003	2.8e-001	2.8e-001	7.1e-001	6.2e-003
pd107	2.6e-002	2.6e-002	3.8e-001	7.2e-005	2.6e-002	2.6e-002	3.8e-001	1.9e-004	2.6e-002	2.6e-002	7.7e-001	6.2e-004
pu238	2.9e+000	0.0e+000	N/A	2.1e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
pu239	1.0e+002	1.0e+002	9.7e-001	7.2e-001	4.5e+001	4.5e+001	6.7e-001	5.6e-001	2.6e+001	2.5e+001	7.9e-001	6.2e-001
pu240	2.9e+001	2.8e+001	4.3e+000	8.7e-001	1.4e+000	1.3e+000	3.8e+000	9.4e-002	1.7e-001	1.6e-001	4.4e+000	2.2e-002
pu241	3.2e+000	2.1e-003	1.5e+005	2.3e+000	2.0e-004	2.0e-004	-1.5e+000	-5.6e-006	3.9e-005	3.9e-005	-1.5e+000	-1.9e-006
pu242	2.7e-001	2.7e-001	-3.7e-001	-7.2e-004	2.6e-001	2.6e-001	-3.9e-001	-1.9e-003	2.5e-001	2.5e-001	-4.0e-001	-3.1e-003
ra226	8.0e-002	8.0e-002	-1.3e-001	-7.2e-005	2.1e-001	2.1e-001	4.7e-001	1.9e-003	2.8e-001	2.8e-001	7.1e-001	6.2e-003
ra228	9.0e-008	9.0e-008	0.0e+000	0.0e+000	2.8e-007	2.8e-007	3.6e-001	1.9e-009	4.1e-007	4.1e-007	4.9e-001	6.2e-009
se 79	1.4e-001	1.4e-001	7.3e-001	7.2e-004	7.5e-002	7.5e-002	6.7e-001	9.4e-004	4.9e-002	4.9e-002	6.1e-001	9.3e-004
sm151	7.9e-001	0.0e+000	N/A	5.7e-001	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
sn126	1.3e-001	1.2e-001	8.1e-001	7.2e-004	1.0e-001	1.0e-001	0.0e+000	0.0e+000	8.9e-002	8.8e-002	4.5e-001	1.2e-003
tc 99	3.8e+000	3.7e+000	5.3e-001	1.4e-002	3.4e+000	3.4e+000	5.9e-001	3.8e-002	3.2e+000	3.2e+000	3.1e-001	3.1e-002
th229	1.1e-002	1.2e-002	-8.7e-001	-7.2e-005	5.1e-002	5.1e-002	0.0e+000	0.0e+000	7.8e-002	7.8e-002	0.0e+000	0.0e+000
th230	9.2e-002	9.2e-002	-2.2e-001	-1.4e-004	2.2e-001	2.2e-001	4.5e-001	1.9e-003	2.9e-001	2.9e-001	7.0e-001	6.2e-003
th232	9.0e-008	9.0e-008	0.0e+000	0.0e+000	2.8e-007	2.8e-007	3.6e-001	1.9e-009	4.1e-007	4.1e-007	4.9e-001	6.2e-009
u233	2.5e-002	2.5e-002	-8.0e-001	-1.4e-004	6.7e-002	6.7e-002	0.0e+000	0.0e+000	9.3e-002	9.3e-002	1.1e-001	3.1e-004
u234	6.7e-001	6.7e-001	9.0e-001	4.3e-003	6.3e-001	6.3e-001	9.6e-001	1.1e-002	6.1e-001	6.0e-001	1.0e+000	1.9e-002
u235	1.6e-002	1.6e-002	-6.4e-001	-7.2e-005	1.8e-002	1.8e-002	-5.6e-001	-1.9e-004	1.8e-002	1.8e-002	-5.4e-001	-3.1e-004
u236	1.3e-001	1.3e-001	7.9e-001	7.2e-004	1.3e-001	1.3e-001	0.0e+000	0.0e+000	1.4e-001	1.3e-001	7.5e-001	3.1e-003
u238	1.5e-001	1.5e-001	0.0e+000	0.0e+000	1.5e-001	1.5e-001	0.0e+000	0.0e+000	1.5e-001	1.5e-001	0.0e+000	0.0e+000
zr 93	3.5e-001	3.5e-001	5.8e-001	1.4e-003	3.4e-001	3.4e-001	2.9e-001	1.9e-003	3.4e-001	3.4e-001	2.9e-001	3.1e-003
36 Iso. Totals	1.5e+002	1.4e+002	8.5e+000	0.0e+000	5.4e+001	5.3e+001	7.3e-001	0.0e+000	3.3e+001	3.2e+001	7.3e-001	0.0e+000

Table 7.2.1-5. Effects of 5000 Year Criticality on the Radionuclide Inventory of a PWR Fuel Assembly (Ref. 5.54)

	20,000 yr Act. (Ci) Critical	Act. (Ci) Decay Only	% Diff. Isotope	% Diff. Total	45,000 yr Act. (Ci) Critical	Act. (Ci) Decay Only	% Diff. Isotope	% Diff. Total	65,000 yr Act. (Ci) Critical	Act. (Ci) Decay Only	% Diff. Isotope	% Diff. Total
Ac227	8.8e-003	5.2e-003	7.0e+001	3.1e-003	1.2e-002	1.0e-002	2.0e+001	3.8e-003	1.4e-002	1.3e-002	1.0e+001	4.0e-003
Am241	2.7e+000	1.6e-003	1.7e+005	2.3e+000	1.9e-004	2.0e-004	-7.5e+000	-2.8e-005	3.6e-005	3.9e-005	-7.4e+000	-9.0e-006
Am242m	2.4e-003	0.0e+000	N/A	2.0e-003	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
Am243	4.4e-001	3.1e-001	4.4e+001	1.1e-001	4.2e-002	2.9e-002	4.4e+001	2.4e-002	6.4e-003	4.5e-003	4.3e+001	6.0e-003
C 14	3.5e-006	3.0e-006	1.7e+001	4.3e-007	1.7e-007	1.4e-007	1.7e+001	4.5e-008	1.5e-008	1.3e-008	1.7e+001	6.8e-009
Cm244	1.6e-002	0.0e+000	N/A	1.3e-002	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
Cm245	1.4e-003	1.5e-003	-7.1e+000	-9.3e-005	1.9e-004	2.0e-004	-7.0e+000	-2.6e-005	3.6e-005	3.9e-005	-7.4e+000	-9.0e-006
Cm246	7.4e-005	4.9e-005	5.1e+001	2.1e-005	1.9e-006	1.3e-006	5.2e+001	1.2e-006	1.0e-007	6.7e-008	5.2e+001	1.1e-007
Cs135	2.1e-001	2.0e-001	4.4e+000	7.6e-003	2.1e-001	2.0e-001	4.5e+000	1.7e-002	2.1e-001	2.0e-001	4.5e+000	2.8e-002
I129	9.0e-003	8.8e-003	2.0e+000	1.5e-004	9.0e-003	8.8e-003	2.0e+000	3.4e-004	9.0e-003	8.8e-003	2.0e+000	5.6e-004
Nb 93m	3.5e-001	3.5e-001	2.0e+000	5.9e-003	3.5e-001	3.4e-001	2.0e+000	1.3e-002	3.5e-001	3.4e-001	2.1e+000	2.2e-002
Nb 94	4.1e-005	1.2e-005	2.5e+002	2.5e-005	1.8e-005	5.0e-006	2.5e+002	2.4e-005	8.9e-006	2.5e-006	2.5e+002	2.0e-005
Np237	3.8e-001	3.8e-001	1.0e+000	3.4e-003	3.8e-001	3.8e-001	1.1e+000	7.5e-003	3.8e-001	3.8e-001	1.3e+000	1.5e-002
Pa231	8.8e-003	5.2e-003	7.0e+001	3.1e-003	1.2e-002	1.0e-002	2.0e+001	3.8e-003	1.4e-002	1.3e-002	1.0e+001	4.0e-003
Pb210	1.0e-001	1.0e-001	-9.9e-001	-8.5e-004	2.2e-001	2.1e-001	2.3e+000	9.4e-003	2.9e-001	2.8e-001	3.6e+000	3.1e-002
Pd107	2.7e-002	2.6e-002	1.9e+000	4.2e-004	2.7e-002	2.6e-002	1.9e+000	9.4e-004	2.7e-002	2.6e-002	2.3e+000	1.9e-003
Pu238	3.0e+000	0.0e+000	N/A	2.5e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
Pu239	9.6e+001	9.2e+001	3.6e+000	2.8e+000	4.7e+001	4.5e+001	3.8e+000	3.2e+000	2.6e+001	2.5e+001	4.0e+000	3.1e+000
Pu240	2.3e+001	1.9e+001	2.6e+001	4.1e+000	1.7e+000	1.3e+000	2.6e+001	6.4e-001	2.0e-001	1.6e-001	2.6e+001	1.3e-001
Pu241	2.6e+000	1.5e-003	1.7e+005	2.2e+000	1.9e-004	2.0e-004	-7.5e+000	-2.8e-005	3.6e-005	3.9e-005	-7.4e+000	-9.0e-006
Pu242	2.7e-001	2.7e-001	-1.1e+000	-2.5e-003	2.5e-001	2.6e-001	-1.2e+000	-5.6e-003	2.5e-001	2.5e-001	-1.6e+000	-1.2e-002
Ra226	1.0e-001	1.0e-001	-9.9e-001	-8.5e-004	2.2e-001	2.1e-001	2.8e+000	1.1e-002	2.9e-001	2.8e-001	3.9e+000	3.4e-002
Ra228	1.1e-007	1.1e-007	0.0e+000	0.0e+000	2.8e-007	2.8e-007	1.4e+000	7.5e-009	4.2e-007	4.1e-007	1.7e+000	2.2e-008
Se 79	1.3e-001	1.3e-001	3.2e+000	3.4e-003	7.7e-002	7.5e-002	3.1e+000	4.3e-003	5.1e-002	4.9e-002	3.1e+000	4.6e-003
Sm151	8.0e-001	0.0e+000	N/A	6.8e-001	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
Sn126	1.2e-001	1.2e-001	2.5e+000	2.5e-003	1.0e-001	1.0e-001	2.0e+000	3.8e-003	9.1e-002	8.8e-002	2.5e+000	6.8e-003
Tc 99	3.8e+000	3.7e+000	2.2e+000	6.8e-002	3.5e+000	3.4e+000	2.1e+000	1.3e-001	3.3e+000	3.2e+000	1.9e+000	1.9e-001
Th229	1.6e-002	1.6e-002	-6.1e-001	-8.5e-005	5.1e-002	5.1e-002	-3.9e-001	-3.8e-004	7.8e-002	7.8e-002	1.3e-001	3.1e-004
Th230	1.1e-001	1.1e-001	-8.8e-001	-8.5e-004	2.3e-001	2.2e-001	2.7e+000	1.1e-002	3.0e-001	2.9e-001	3.8e+000	3.4e-002
Th232	1.1e-007	1.1e-007	0.0e+000	0.0e+000	2.8e-007	2.8e-007	1.4e+000	7.5e-009	4.2e-007	4.1e-007	1.7e+000	2.2e-008
U233	3.1e-002	3.1e-002	-1.9e+000	-5.1e-004	6.7e-002	6.7e-002	-1.5e-001	-1.9e-004	9.3e-002	9.3e-002	3.2e-001	9.3e-004
U234	6.9e-001	6.6e-001	5.3e+000	3.0e-002	6.6e-001	6.3e-001	5.3e+000	6.2e-002	6.3e-001	6.0e-001	5.2e+000	9.6e-002
U235	1.6e-002	1.6e-002	-1.9e+000	-2.5e-004	1.8e-002	1.8e-002	-1.1e+000	-3.8e-004	1.8e-002	1.8e-002	-1.6e+000	-9.3e-004
U236	1.3e-001	1.3e-001	1.6e+000	1.7e-003	1.4e-001	1.3e-001	2.2e+000	5.6e-003	1.4e-001	1.3e-001	2.2e+000	9.3e-003
U238	1.5e-001	1.5e-001	0.0e+000	0.0e+000	1.5e-001	1.5e-001	0.0e+000	0.0e+000	1.5e-001	1.5e-001	0.0e+000	0.0e+000
Zr 93	3.5e-001	3.5e-001	2.0e+000	5.9e-003	3.5e-001	3.4e-001	2.0e+000	1.3e-002	3.5e-001	3.4e-001	2.1e+000	2.2e-002
36 Iso. Totals	1.4e+002	1.2e+002	1.5e+001	0.0e+000	5.5e+001	5.3e+001	4.2e+000	0.0e+000	3.3e+001	3.2e+001	3.7e+000	0.0e+000

Table 7.2.1-6. Effects of 10,000 Year Criticality on the Radionuclide Inventory of a PWR Fuel Assembly (Ref. 5.54)

	25,000 yr Act. (Ci) Critical	Act. (Ci) Decay Only	% Diff. Isotope	% Diff. Total	45,000 yr Act. (Ci) Critical	Act. (Ci) Decay Only	% Diff. Isotope	% Diff. Total	65,000 yr Act. (Ci) Critical	Act. (Ci) Decay Only	% Diff. Isotope	% Diff. Total
Ac227	1.4e-002	6.3e-003	1.2e+002	8.0e-003	1.5e-002	1.0e-002	4.9e+001	9.2e-003	1.6e-002	1.3e-002	2.4e+001	9.6e-003
Am241	2.1e+000	1.1e-003	2.0e+005	2.2e+000	1.7e-004	2.0e-004	-1.4e+001	-5.5e-005	3.4e-005	3.9e-005	-1.5e+001	-1.8e-005
Am242m	1.9e-003	0.0e+000	N/A	2.0e-003	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
Am243	4.1e-001	1.9e-001	1.1e+002	2.2e-001	6.3e-002	2.9e-002	1.1e+002	6.3e-002	9.5e-003	4.5e-003	1.1e+002	1.6e-002
C14	2.4e-006	1.6e-006	4.8e+001	8.0e-007	2.1e-007	1.4e-007	4.9e+001	1.3e-007	1.9e-008	1.3e-008	4.8e+001	1.9e-008
Cm244	1.5e-002	0.0e+000	N/A	1.6e-002	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
Cm245	8.8e-004	1.0e-003	-1.4e+001	-1.5e-004	1.7e-004	2.0e-004	-1.4e+001	-5.5e-005	3.4e-005	3.9e-005	-1.5e+001	-1.8e-005
Cm246	5.2e-005	2.4e-005	1.2e+002	2.9e-005	2.8e-006	1.3e-006	1.2e+002	2.8e-006	1.5e-007	6.7e-008	1.2e+002	2.5e-007
Cs135	2.2e-001	2.0e-001	8.4e+000	1.7e-002	2.2e-001	2.0e-001	9.0e+000	3.4e-002	2.2e-001	2.0e-001	8.5e+000	5.3e-002
I129	9.2e-003	8.8e-003	4.1e+000	3.7e-004	9.2e-003	8.8e-003	4.1e+000	6.8e-004	9.2e-003	8.8e-003	4.0e+000	1.1e-003
Nb 93m	3.6e-001	3.4e-001	4.1e+000	1.4e-002	3.6e-001	3.4e-001	4.1e+000	2.6e-002	3.5e-001	3.4e-001	3.8e+000	4.0e-002
Nb 94	7.4e-005	1.0e-005	6.4e+002	6.5e-005	3.7e-005	5.0e-006	6.4e+002	6.1e-005	1.9e-005	2.5e-006	6.4e+002	5.0e-005
Np237	3.9e-001	3.8e-001	2.1e+000	8.2e-003	3.9e-001	3.8e-001	2.1e+000	1.5e-002	3.8e-001	3.8e-001	2.4e+000	2.8e-002
Pa231	1.4e-002	6.3e-003	1.2e+002	8.0e-003	1.5e-002	1.0e-002	4.9e+001	9.2e-003	1.6e-002	1.3e-002	2.4e+001	9.6e-003
Pb210	1.3e-001	1.3e-001	-7.9e-001	-1.0e-003	2.2e-001	2.1e-001	4.7e+000	1.9e-002	3.1e-001	2.8e-001	1.1e+001	9.9e-002
Pd107	2.7e-002	2.6e-002	3.8e+000	1.0e-003	2.7e-002	2.6e-002	3.8e+000	1.9e-003	2.7e-002	2.6e-002	4.2e+000	3.4e-003
Pu238	3.1e+000	0.0e+000	N/A	3.1e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
Pu239	8.7e+001	8.0e+001	8.6e+000	7.0e+000	4.9e+001	4.5e+001	8.9e+000	7.5e+000	2.8e+001	2.5e+001	9.1e+000	7.1e+000
Pu240	1.8e+001	1.1e+001	6.9e+001	7.7e+000	2.2e+000	1.3e+000	6.8e+001	1.7e+000	2.7e-001	1.6e-001	6.9e+001	3.4e-001
Pu241	2.1e+000	1.0e-003	2.1e+005	2.2e+000	1.7e-004	2.0e-004	-1.4e+001	-5.5e-005	3.4e-005	3.9e-005	-1.5e+001	-1.8e-005
Pu242	2.6e-001	2.7e-001	-2.6e+000	-7.1e-003	2.5e-001	2.6e-001	-2.7e+000	-1.3e-002	2.4e-001	2.5e-001	-2.8e+000	-2.2e-002
Ra226	1.3e-001	1.3e-001	-7.9e-001	-1.0e-003	2.2e-001	2.1e-001	4.7e+000	1.9e-002	3.1e-001	2.8e-001	1.1e+001	9.9e-002
Ra228	1.5e-007	1.5e-007	6.8e-001	1.0e-009	2.8e-007	2.8e-007	2.2e+000	1.1e-008	4.2e-007	4.1e-007	2.9e+000	3.7e-008
Se 79	1.2e-001	1.1e-001	6.1e+000	7.1e-003	7.9e-002	7.5e-002	6.3e+000	8.8e-003	5.2e-002	4.9e-002	6.3e+000	9.6e-003
Sm151	8.1e-001	0.0e+000	N/A	8.2e-001	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000	0.0e+000
Sn126	1.2e-001	1.2e-001	5.1e+000	6.1e-003	1.1e-001	1.0e-001	4.9e+000	9.4e-003	9.3e-002	8.8e-002	5.0e+000	1.4e-002
Tc 99	3.8e+000	3.6e+000	4.1e+000	1.5e-001	3.5e+000	3.4e+000	4.1e+000	2.6e-001	3.3e+000	3.2e+000	3.8e+000	3.7e-001
Th229	2.3e-002	2.3e-002	-1.7e+000	-4.1e-004	5.1e-002	5.1e-002	-1.2e+000	-1.1e-003	7.8e-002	7.8e-002	-1.3e-001	-3.1e-004
Th230	1.4e-001	1.4e-001	0.0e+000	0.0e+000	2.3e-001	2.2e-001	5.0e+000	2.1e-002	3.1e-001	2.9e-001	7.3e+000	6.5e-002
Th232	1.5e-007	1.5e-007	6.8e-001	1.0e-009	2.8e-007	2.8e-007	2.2e+000	1.1e-008	4.2e-007	4.1e-007	2.9e+000	3.7e-008
U233	3.7e-002	3.9e-002	-3.1e+000	-1.2e-003	6.7e-002	6.7e-002	-6.0e-001	-7.5e-004	9.3e-002	9.3e-002	3.2e-001	9.3e-004
U234	7.2e-001	6.5e-001	1.1e+001	7.4e-002	6.9e-001	6.3e-001	1.1e+001	1.3e-001	6.6e-001	6.0e-001	1.1e+001	2.0e-001
U235	1.6e-002	1.6e-002	-3.6e+000	-6.1e-004	1.7e-002	1.8e-002	-2.8e+000	-9.4e-004	1.8e-002	1.8e-002	-2.7e+000	-1.5e-003
U236	1.4e-001	1.3e-001	3.1e+000	4.1e-003	1.4e-001	1.3e-001	4.5e+000	1.1e-002	1.4e-001	1.3e-001	4.5e+000	1.9e-002
U238	1.5e-001	1.5e-001	0.0e+000	0.0e+000	1.5e-001	1.5e-001	0.0e+000	0.0e+000	1.5e-001	1.5e-001	0.0e+000	0.0e+000
Zr 93	3.6e-001	3.4e-001	4.1e+000	1.4e-002	3.6e-001	3.4e-001	4.1e+000	2.6e-002	3.5e-001	3.4e-001	3.8e+000	4.0e-002
36 Iso. Total	1.2e+002	9.8e+001	2.4e+001	0.0e+000	5.8e+001	5.3e+001	9.9e+000	0.0e+000	3.5e+001	3.2e+001	8.5e+000	0.0e+000

7.2.2 Compositions as a Function of Duration for Internal Criticality

Number densities for the fuel accounting for burnup and production of isotopes were calculated for a base case with decay out to 15,000 years and for the criticalities lasting 1000, 5000 and 10,000 years. The SAS2H and ORIGEN-S case descriptions which support these number density calculations are provided in Sections 7.5.1 and 7.5.2 of Reference 5.53. The grams/assembly compositions are taken from Attachments XI and XII of Reference 5.53. The grams/assembly output per appropriate time step ("initial" decay column for criticality cases) in conjunction with the assembly volume was used to calculate the number density of each of the required isotopes using a LOTUS 1-2-3 spreadsheet. The equation for number density is shown below (Ref. 5.20, p. 34):

$$N = \rho N_A / M$$

where,
- ρ is the physical density in g/cm^3, calculated as grams/assembly ÷ assembly volume (51575.24 cm^3, Ref. 5.54 Att. VIII),
- N_A is Avagadro's Number - 0.602252E+24 atoms/mole (Ref. 5.43), and
- M is the gram atomic weight.

The units of the resulting number density is in atoms/cm^3. The required units for subsequent use are atoms/barn-cm where 1 barn equals 10^{-24} cm^2. The calculations in the spreadsheet drops the E+24 from Avagadro's Number to account for the conversion. As a conservatism in the criticality calculations which will use these number densities, the values are adjusted up to a 96% theoretical density.

The Principal Isotopes previously established (Ref. 5.46, p. 4-4) were used with the addition of Cd, Gd-157, Xe-131, and Cs-133. These four additional isotopes were identified in the top 15 fission product absorber list for 1000 and 5000 year criticalities as described in Section 7.4.4. These four isotopes were added to provide a indication of realistic reactivity changes due to burnup in the long term low power criticality being analyzed.

The grams/assembly (Ref. 5.53, Attachments XI and XII) for each isotope and the results of the number density calculations are shown in Attachment II which is the LOTUS 1-2-3 spreadsheet used to generate the values.

The burnup associated with each of the criticality durations is shown in the Table 7.2.2-1 along with the masses of the major fissile isotopes (U-235 and Pu-239), Pu-240 (actinide absorber) and fission products absorbers. Note that while the mass of Pu-239 decreased by 19% (partially offset by U-235 mass increase), the mass of major absorbers such as Pu-240, Sm-149, and Eu-151 decreased by 41%, 51%, and 10%, respectively. The mass of the Pu isotopes decreased due to absorption and decay, while the mass of these two fission products decreased by absorption.

Table 7.2.2-1. Burnup and Composition Changes Associated with Criticality Duration

Duration of Criticality (years)	0	1000	5000	10,000
Burnup (MWd)	0	37.95	189.76	379.52
Mass of U-235 (g)	7.21E+3	7.23E+3	7.29E+3	7.35E+3
Mass of Pu-239 (g)	1.72E+3	1.68E+3	1.54E+3	1.40E+3
Mass of Pu-240 (g)	1.38E+2	1.30E+2	1.03E+2	8.09E+1
Mass of Sm-149 (g)	1.42E+0	1.18E+0	7.88E-1	6.96E-1
Mass of Nd-143 (g)	2.69E+2	2.70E+2	2.73E+2	2.77E+2
Mass of Eu-151 (g)	6.22E+0	6.12E+0	5.87E+0	5.60E+0
Mass of Rh-103 (g)	1.44E+2	1.44E+2	1.45E+2	1.47E+2
Mass of Xe-131 (g)	1.38E+2	1.38E+2	1.40E+2	1.42E+2

7.2.3 Check of Reactivity Changes With Time Due to Internal Criticality

The AUCF waste package design model in MCNP consists of ½ of the package with a reflective plane along the axis to represent the entire package. The AUCF waste package containment barriers are modeled as separate units in the MCNP model. The composition, thicknesses, radii, and lengths of the containment barriers are modeled explicitly as listed in Table 4.1-2. The outer containment barrier's skirt was not modeled in detail, since the skirt would not effect the criticality results. For this degraded model, no basket structure remains and a uniform mixture of iron oxide, water, and boron surrounds the fuel assemblies. The fuel assemblies are uniformly stacked together, with no separation, at the bottom of the waste package. The fuel assemblies in the AUCF waste package are modeled in a lattice. Each fuel assembly is treated as a heterogeneous system with the fuel pins, control rod guide tubes, and instrument guide tube modeled explicitly. The properties of the design basis B&W 15×15 Mark B5 assembly are used in the analyses as listed in Table 4.1-1. A cross-sectional view from the MCNP model is shown in Figure 7.2.3-1. The non-fuel material compositions were taken from a previous QAP-3-9 analysis on material compositions (Ref. 5.5).

A degraded configuration with 5371.1 kg of Fe and 1.6 kg of B was identified as appropriate for determination of the reactivity effect of burnup because it represented the Fe, B combination at the earliest possible time of criticality (the last case in Table 7.4-2 of Reference 5.54, with the specific Fe, B amounts given in Attachment II, p. II-3 of that document). To be consistent with previous calculations (Ref. 5.54, p. 10), the masses were rounded to whole percentages. The moderator was modeled as 26% Fe_2O_3 (based on the mass conversion equation in Reference 5.54, p. VIII-6: Fe mass=20.94 x void %) displacing water in the void space within the waste package with 5% of the original B-10 (based on total mass of B in Reference 5.54, p. VIII-5: 30.474 kg) also incorporated into the moderator. The calculation for the number densities for the moderator composition is shown in Attachment II.

The fuel compositions described in Section 7.2.2 were inserted into the MCNP model and the cases were run to generate values of k_{eff} as a function of criticality duration. The results of the cases are shown in Table 7.2.3-1. The corresponding attachments containing the input and relevant output for each case are shown in parentheses.

Table 7.2.3-1. MCNP Case Results to Demonstrate Reactivity Changes Due to an Internal Criticality

Criticality Duration (years)	0	1000	5000	10,000
k_{eff}	0.8967 ± 0.0020 (III)	0.8989 ± 0.0019 (IV)	0.9006 ± 0.0021 (V)	0.9002 ± 0.0022 (VI)

The slight increase in k_{eff} with burnup comparing 0 and 10,000 years can be attributed to the higher relative burnup/decay of absorbers compared to fissile isotopes as discussed in Section 7.2.1.

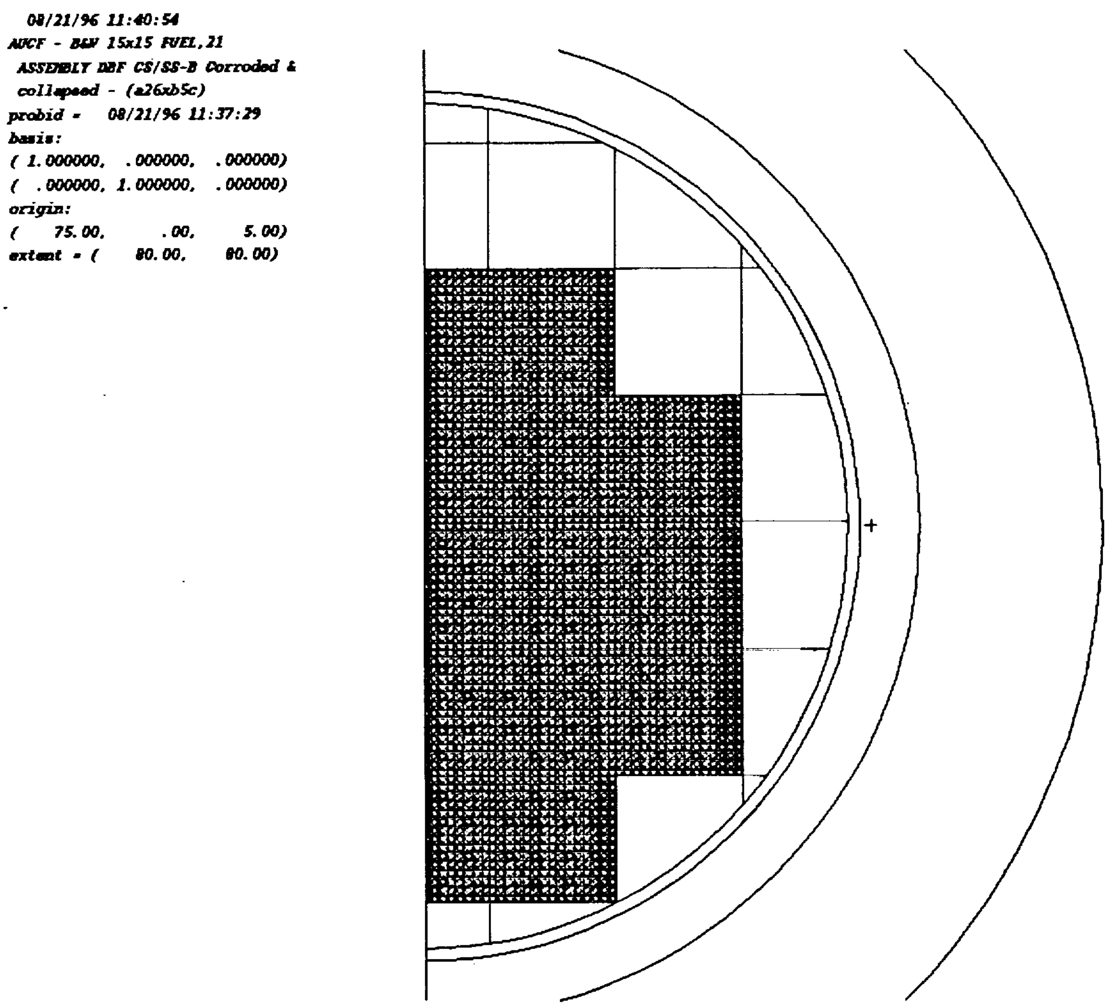

Figure 7.2.3-1. MCNP Model of 21 PWR AUCF WP with Fully Degraded Basket

7.3 External Criticality, Basic Parameters

7.3.1 Geometry and Material Composition

The concentrations of water and UO_2 used for this analysis are chosen with the following considerations:

- The maximum porosity of the rock beneath the repository site, in the saturated zone, is taken to be the sample maximum, 40%, explained in the footnote to Table 4.1-4. Since the sample size was over 100, the probability of some random location exceeding this value is taken to be less than 0.01. (This is conservative, since the probability that 1% of the true population exceed a porosity of 40% is $0.99^{126} = 0.28$. Restated in probability terms, the probability that the 99 percentile of the true population is greater than 40% porosity is 0.28. It should be noted, however, that the sample comes from a limited number of boreholes, so there could be a greater variation than is estimated here.) If a value of porosity larger than 40% were selected, the probability would have to be reduced by a factor smaller than 0.01. Since there are no new probability calculations in this analysis to which to apply such a factor, it is reasonably conservative to take 40% as the porosity.
- The water volume percent plus UO_2 volume percent should equal the porosity.
- The very conservative value of 8% UO_2 by volume with 32% water by volume is equivalent to 32% UO_2 by weight according to the formula in the third footnote to Table 7.5-1 of Reference 5.52; this weight percent is higher than any known natural uranium deposit of 1m radius. There are smaller size regions of well known uranium deposits (e.g., Oklo, Cigar Lake, Pena Blanca) which have higher concentrations (Ref. 5.52, p. 26, and references cited therein).

Of the alternative concentrations evaluated in Reference 5.52 (Table 7.5-1), the parameter set falls between the 4th and 7th cases, indicating a critical mass above 10.1 metric tons of U, but less than 18 tons. Such a large mass implies a very small probability of accumulation, according to the methodology of Reference 5.52; in fact, several of the cases in Reference 5.52, Table 7.5-1, have a higher probability, according to the probabilities given in Table 7.6-1 of Reference 5.52. This apparent contradiction, of taking a case which the methodology estimates to have a significantly lower probability, results from the principal inadequacy of the methodology of Reference 5.52, which is the lack of correlation between size of reducing zone and the maximum amount of UO_2 it can extract or concentrate. The cases in Reference 5.52 which appear to have higher probabilities than the one selected here, actually require a porosity higher than is consistent with physical reality; with additional data on the joint distribution of concentration of UO_2 (or grade) and areal extent (or deposit size) these cases with apparently higher probability may be seen to be impossible and not considered any further.

The compositions in the form of number densities for UO_2, 30.6% porosity tuff, and water were taken from Attachment VIII of Reference 5.55 and entered into a LOTUS 1-2-3 spreadsheet which is included as Attachment VII. The 30.6% porosity tuff number densities were converted to those representative of 40% porosity tuff by the ratio (1-0.4)/(1-0.306). The corresponding weight percents of the components in the UO_2 feed were calculated by multiplying the component atom density by the component atomic weight and dividing by the sum of this product for all the components. The homogeneous mixture number densities for the combination of 40% porosity tuff with 8 volume percent UO_2 and 32 volume percent H_2O occupying the pore/fracture space (porosity) were calculated as shown in the spreadsheet by multiplying the UO_2 number densities by 0.08 and the water number densities by 0.32.

The critical radius for a similar composition in a spherical geometry was found to be 140 cm (Ref. 5.55, p. 35).

7.3.2 Relation Between Power and Temperature

For this analysis the relation between the steady state power output of an external criticality and the resulting temperature is determined primarily by heat conduction from the spherical mass to the distant environment. Since there are no free surfaces in the external far-field, there can be no cooling by radiation. It is further assumed that cooling by convection is small by comparison with conduction, for the reasons given in Assumption 4.3.5. The temperature is then determined by solving the steady state heat conduction equation; the details of this process are given in Attachment I. The results are as follows.

Within a sphere generating total power P, uniformly throughout its volume, at a power density of $3P/(4\pi R^3)$, where R is the radius of the sphere, the solution for temperature given in Attachment I is:

$$T = T_s + P(1-r^2/R^2)/(8k\pi R),$$

where k is the thermal conductivity in W/m·K, r is the distance from the center of the sphere, and T_s is the temperature of the surface of the sphere, assumed to be constant (Assumption 4.3.7). The consequence of this general result is that the temperature at the center of the sphere is:

$$T_c = T_s + P/(8k\pi R),$$

and the average temperature (computed in Attachment I) is:

$$T_{av} = T_s + P/(20k\pi R).$$

If the power, P, is parabolically distributed throughout the sphere, with peak power at the center, the power density will be, $15P(1-r^2/R^2)/(8\pi R^3)$, which is normalized so that multiplying the power density by $4\pi r^2$ and integrating over r from 0 to R gives P. The general solution for temperature within the sphere is derived in Attachment I as:

$$T = T_s + 7P/(32k\pi R) - 15P[r^2/(6R^2) - r^4/(20R^4)]/(8k\pi R),$$

which leads to the center temperature:

$$T_c = T_s + 7P/(32k\pi R),$$

and the average temperature:

$$T_{av} = T_s + P/(14k\pi R).$$

For any spherically symmetric power density inside the sphere, the solution for the temperature outside the sphere can be used to determine the surface temperature in terms of the temperature of the rock far from the sphere, T_∞:

$$T_s = T_\infty + P/(4k\pi R).$$

7.3.3 Maximum Possible Power and Temperature

The maximum possible temperature under isobaric conditions is the boiling temperature of water, at 50 atmospheres (735 psia, 5.07 MPa) pressure (hydrostatic pressure at approximately 500 meters below the water table, Assumption 4.3.6) because bulk boiling will drive the power down based on previous results (Ref. 5.55, p. 40). The saturated temperature and density of liquid water at 50 atm pressure were linearly interpolated from the values in Table 4.1-5 to be 265 °C (508.7 °F) and 0.776 g/cm^3 (48.45 lb/ft^3). The depth from the surface to the saturated zone is taken to be 611 m (approximate, from Ref 5.18, Fig 2.3-7). The temperature of the rock can be determined from the following relation (Ref. 5.44, p. 6-168) assuming that the last thermal gradient extends 500 m below the saturated zone level (total of 1111 m; see Assumption 4.3.6):

$$T_\infty = 18.7\ ^\circ\text{C} + 0.019\ ^\circ\text{C/m (0 to 150 m)} + 0.018\ ^\circ\text{C/m (150 to 400 m)} + 0.030\ ^\circ\text{C/m (400 to 541 m)},$$

$$T_\infty = 47.4\ ^\circ\text{C}.$$

The average thermal conductivity, k, of the rock at a depth of 535.2 m has been estimated to be 1.38 W/m·K (Ref. 5.31, p. 6). This value will be used for the tuff in this analysis.

Based on the temperature equations for a parabolic power density in a sphere in Section 7.3.2, the average temperature can be determined from the following equation:

$$T_{av} = T_\infty + P/(4k\pi R) + P/(14k\pi R).$$

Power corresponding to a given average temperature can be determined by manipulating this equation to the following form:

$$P = (T_{av} - T_\infty) \cdot (1/(4k\pi R) + 1/(14k\pi R))^{-1}.$$

Using the values described above and limiting the power based on an average temperature of 265 °C, a value of 4.1 kW is calculated for the maximum power.

7.3.4 Maximum Sustainable Power, Temperature, and Duration

Maximum mobilization rate of uranium and plutonium in SNF:

It is assumed that mobilization is much slower than dissolution so that removal is solubility limited (Assumption 4.3.20).

WP area (horizontal cross section through the axis) = 6.62 m^2.

Infiltration rate = 10 mm/yr (or 1 mm/yr with 10x concentration) (Ref. 5.18 and Assumption 4.3.16).

Solubility of U and Pu = 2000 ppm (g UO_2/ton water) (conservatively taken to be approximately the maximum of solubility for both U and Pu, Ref. 5.18, p. 6-29).

Mass mobilized/yr = (2000 g UO_2/ton water) x (6.62x0.01 tons/yr) = 132 g/yr, for a single waste package.

For reference: Time to remove 10 tons of U plus Pu: $10^7/132$ = 75,800 years (note: more than 1 waste package of SNF).

Maximum sustainable power:

Approximately 1.23 g/day of U-235 is consumed per megawatt of power if the fissions are induced primarily by thermal neutrons (Ref. 5.20, p. 78) and the production of other fissile isotopes is ignored. The maximum infiltration rate of UO_2 was calculated to be 132 g/year per WP above and the weight fraction of U-235 in the UO_2 was calculated to be 0.017 as shown in the spreadsheet included in Attachment VII. Multiplying these two numbers together provides a U-235 infiltration rate of 2.244 g/year which would support a burnup of 1.824 MWd. Dividing the burnup possible for the maximum infiltration rate by the number of days in the year (365.25) provides a maximum steady state power of 0.004995 MW (4.995 kW) which can be maintained by the criticality. This result indicates that 22% more fissile material could enter the critical volume than could be consumed based on the temperature limited power calculated above.

However, the Oklo experience suggests that a natural reactor can only be burned down to an effective enrichment $^{235}U/(^{238}U+^{235}U)$ of 1.37% (see Assumption 4.3.8) so the sustainable power is limited to:

$$4995*(1.94-1.37)/1.94 = 1468 \text{ W},$$

where 1.94 is the % fissile content in the design basis fuel after discharge (Ref. 5.52, p. 40).

The criticality duration is determined by the 100,000 year hydrologic cycle divided into four subcycles having power levels determined by the cycle average for that 25,000 year time period.

25,000 years at 132 g/yr UO_2 infiltration rate and power of 1468 W (125 °C)
25,000 years at 2/3*(132 g/yr) UO_2 infiltration rate and power of 979 W (99.0 °C)
25,000 years at 1/3*(132 g/yr) UO_2 infiltration rate and power of 489 W (73.0 °C)
25,000 years at 0 g/yr UO_2 infiltration rate and power of 0 W (47.4 °C)

The temperatures indicated above are the average temperatures of the critical spheres as calculated from the equations listed in Section 7.3.2. This cycle requires 6.6 metric tons of UO_2 from a second waste package to sustain the criticality under this scenario.

7.4 External Criticality, Neutronics Evaluation

The neutronic evaluation procedure for the far-field criticality involves five tasks as indicated below:

1) MCNP model and k_{eff} calculation based on initial composition.

2) SAS2H model and burn calculation for 1, 10, 100, 1000, 5000, and 10,000 year events.

3) ORIGEN-S decay calculations for the 1000, 5000, and 10,000 year events.

4) Spreadsheet calculations of compositions from various duration criticality events.

5) MCNP calculations (recomputation of k_{eff}) based on compositions from the various duration criticality events.

The details of each task, along with the results, are provided in the following five subsections.

7.4.1 Reference MCNP Calculation for Initial Composition

A reference MCNP case using the initial homogeneous composition was set up based on a previously developed MCNP model (Ref. 5.55, Sections 7.4.2, 7.4.3). The model is composed of an inner spherical region 140 cm in radius containing the tuff/water/UO_2 mixture and an outer reflector region 60 cm thick containing a 40% porosity tuff/water mixture. This initial case was run based on compositions representative of a temperature of 300 K. A second case was run based on the ambient conditions described in Section 7.3.1 in which water densities were adjusted to a density of 0.990 g/cm^3 corresponding to a temperature of 50 °C (323 K) and a pressure of 5.07 MPa (50 atm). A third case was run based on the average temperature of 538 K (265 °C) in the fuel region which corresponds to the 4 kW power level. Cross sections are not available for exactly the 4 kW power conditions so the closest available were used. Hydrogen thermal cross section data representative of 400 K (lwtr.02t) was used for the reflector and of 500 K (lwtr.03t) for the inner region. Cross sections for H, O, U-235, and U-238 representative of 600 K were used in the inner region. The k_{eff} results are shown in Table 7.4.1-1. The input and pertinent output are included in Attachments IX, X, and XI. These results indicate that the temperature calculated for a 4 kW power level would drive the criticality on a negative transient (reduce power). Determination of actual powers would require dynamic analysis which is beyond the scope of the present report and the capability of MCNP with the limited temperature dependance of the current library. These results do indicate that operation at this temperature (power) will provide conservative overestimates of any radioisotopes which may be produced.

Table 7.4.1-1. Variation of k_{eff} with Temperature for an External Criticality

Temperature (K)	300	323	538
$k_{eff} \pm 2\sigma$	0.9776 ± 0.0016	0.9772 ± 0.0015	0.9424 ± 0.0020

The previous external criticality analysis (Ref. 5.55) used a fresh fuel bias and uncertainty of -0.015 in k_{eff}, because power level and duration of criticalities were not considered. The burnup of fuel and the production of fission products will introduce additional bias and uncertainty. For this analysis, an additional bias and uncertainty of -0.005 in k_{eff} is applied to account for burnup effects. This bias and uncertainty is applied uniformly to all results, fresh and burned, in order to provide a consistent comparison base between results. As will be shown in Section 7.4.5, the additional bias and uncertainty of -0.005 in k_{eff} bounds the worth of fission products at 1000 years. With the application of a total bias and uncertainty of -0.020 in k_{eff}, the 300 K and the 323 K cases would be slightly supercritical.

7.4.2 SAS2H Burnup Calculations

SAS2H cases were set up for critical events lasting 1, 10, 100, 1000, 5000 and 10,000 years at a power level which was rounded to 4 kW corresponding to the scenario described in Section 7.3.4 where power is limited by the boiling point of water. The material descriptions in weight fractions and densities were taken directly from print table 40 in the MCNP case output included in Attachment XI. The isotopes and corresponding weight fractions from Attachment XI are listed in Table 7.4.2-1. The density of the tuff/water/UO_2 region is 2.6344 g/cm^3 and the density of the reflector region is 1.9053 g/cm^3. The temperatures for materials are entered in Kelvin and are 538 K (265 °C) for the fuel region and 323 K (50 °C) for the reflector region. SAS2H does not have a spherical geometry option. The most suitable cell geometry option available in SAS2H for the burnup calculation is an infinite slab (symmslabcell option). The fuel region is modeled as a 280 cm thick slab and a 60 cm thick reflector region is added on each side. Because three regions are required in the model, the reflector is broken into two regions. The volume of the fuel region is calculated as $4/3\pi(140\ \text{cm})^3$ and is entered as "volfueltot=1.1494E7." All grams and curies tables for the isotopes in the output are normalized to this volume.

Table 7.4.2-1. Isotopic/Elemental Weight Fractions for External Criticality SAS2H Cases

Material ID	Weight Fraction	Material ID	Weight Fraction	Material ID	Weight Fraction	Material ID	Weight Fraction
Tuff/Water/UO_2 Region							
1001	0.01055	8016	0.40755	11023	0.00570	12000	0.00354
13027	0.04434	14000	0.20193	19000	0.01370	20000	0.01439
26000	0.00494	92234	0.00007	92235	0.00567	92236	0.00136
92238	0.28593	93237	0.00033	-	-	-	-
Tuff/Water Reflector Region							
1001	0.02326	8016	0.57779	11023	0.00789	12000	0.00490
13027	0.06130	14000	0.27919	19000	0.01894	20000	0.01989
26000	0.00683	-	-	-	-	-	-

The operating time was adjusted for each of the burn cases. A five year (1826.25 day) down time was added to the end of each case to provide decay compositions for comparison with those from the follow-on ORIGEN-S cases described in Section 7.4.3. Note that the infiltration of UO_2 during the criticality cannot be modeled in SAS2H and is accounted for in the number density calculations described in Section 7.4.4.

The input and relevant output from each of the six SAS2H cases are listed in Attachments XIII through XVIII.

As a check of the effect of burn step size, the 1000 year case with a step size of 100 years was compared with the 1000 year print of the 10,000 year case with a step size of 1000 years. The order of ranking per absorption rate of the top 15 fission products listed in the "fraction of total absorption rate" tables in the outputs for the 1000 year time print included in Attachments XVI and XVIII are the same and the absorption rates vary between cases less than 3%. The actinides "nuclide concentrations" in gram atoms for the same times also indicate that the major nuclides U-233, U-234, U-235, U-236, U-238, and Np-237 match. The Pu isotopes are overpredicted by 4% or less in the 10,000 year case (1000 year timesteps). These results are acceptable and conservative.

The burnup associated with each of the criticality durations is shown in the Table 7.4.2-2 along with the masses of the major fissile isotopes (U-235 and Pu-239).

Table 7.4.2-2. Burnup and Fissile Composition Changes Associated with Criticality Duration

Duration of Criticality (Years)	1	10	100	1000	5000	10,000
Burnup (MWd)	1.461E00	1.461E01	1.461E02	1.461E03	7.305E03	1.461E04
Mass of U-235 (kg)	1.72E02	1.72E02	1.71E02	1.70E02	1.63E02	1.56E02
Mass of Pu-239 (kg)	1.18E-3	1.21E-2	1.19E-1	1.15E00	5.18E00	9.03E00

A SAS2H case was set up for critical event corresponding to the 100,000 year hydrologic cycle described in Section 7.3.4 where power is limited by a time dependent UO_2 infiltration rate. The case models three 25,000 year periods of decreasing power as described in Section 7.3.4 followed by a 25,000 year decay period. The base material description was the same as described above. The average temperature for each period was set with the temkcyc variable for the corresponding power level. The total burnup for this case is 2.681E4 MWd. At the end of the 75,000 years at power the U-235 and Pu-239 masses are 154 and 5.81 kg, respectively. The input and summarized output for this case is included in Attachment XIX.

7.4.3 ORIGEN-S Decay Calculations

Simple, decay only, ORIGEN-S cases were set up with decay times out to 999,999 years for the 1000, 5000, and 10,000 year duration criticality cases. The input was the same for each case except for titles which include the criticality duration for the 1000 and 5000 year cases. The entire output (including echo of input) is included in Attachments XX through XXII for the 1000, 5000, and 10,000 year duration criticalities, respectively. The ORIGEN-S case was run immediately after the corresponding SAS2H case and utilized the final binary cross section file on unit 21 from the SAS2H case. The case correspondence by attachment number is XVI/XX, XVII/XXI, and XVIII/XXII. The fact that the correct library is used (unit 21) is verified by comparing the final downtime print of concentrations in the SAS2H output with the concentrations in the corresponding decay times in the ORIGEN-S output (compositions will match). The library contains only the final cycle step (1 position in library). The library unit number and data position are entered in the input (3$$ card).

The decay times are grouped in 10 steps with the units changing from days to years as appropriate. The activity of isotopes of concern are shown in Tables 7.4.3-1, -2, and -3. The activities are listed for 0, 10,000, 20,000, 50,000, 100,000, and 250,000 year decay times. Data for additional decay times and isotopes can be found in the outputs included in Attachments XX through XXII. Because the SAS2H case was set up on the appropriate volume, the activities and masses listed in the output are per critical volume.

The same ORIGEN decay case was run in conjunction with the 100,000 year geologic cycle and the activity of isotopes of concern are shown in Table 7.4.3-4. Data for additional decay times and isotopes can be found in the output included in Attachment XXIII. The input and output for the case is included in Attachment XXIII and was run in conjunction with the SAS2H case included in Attachment XIX.

7.4.4 Burnup Compositions

Number densities for the homogeneous mixtures accounting for burnup and production of isotopes were calculated for each criticality from 1 to 10,000 years duration as well as the 100,000 year geologic cycle criticality. The tuff composition portion of the mixture remained constant. The component densities for UO_2 with burnup and fission products were calculated from the grams/assembly output for the "initial" decay column of data from the SAS2H outputs included in Attachments XIII through XIX by dividing by the volume of the criticality. The component density was incorporated into the equation for number density as shown below (Ref. 5.20, p. 34):

$$N = \rho N_A / M$$

where, ρ is the physical density in g/cm^3, N_A is Avagadro's Number - 0.602252E+24 atoms/mole (Ref. 5.43), and M is the gram atomic weight.

The units of the resulting number density is in atoms/cm^3. The required units for subsequent use are atoms/barn-cm where 1 barn equals 10^{-24} cm^2. The calculations in the spreadsheet (Attachment VII) drop the E+24 from Avagadro's Number to account for the conversion.

The top 15 fission products from the standpoint of absorption were identified from the "fraction of total absorption rate" tables for the last burn step of each case which can be found in the SAS2H outputs included in Attachments XIII through XIX. Two exceptions to this were made in the 1 and 10 year duration criticality cases. Pm-147 and Eu-155 show up in the top 15 absorbers for these cases but no cross sections exist in the MCNP library. Sm-147 and Gd-155, which are the daughter products of Pm-147 and Eu-155, respectively, were substituted. An isotopic cross section for Cd-113 is not available in the MCNP cross sections, so the Cd isotopes from 110 to 116 were summed and the Cd elemental cross section was used in all cases. In addition, the mass of Xe-135 was not printed in the SAS2H outputs because it falls below a threshold for listing, even though its absorption rate is significant and it shows up in the absorption rate tables. The Xe-135 mass used in the 1 year and 10 year compositions was taken from the first "nuclide concentrations, grams" for fission products in the charge column in the 1000 year duration criticality ORIGEN-S case (Attachment XX), which has a significantly lower print threshold. Because of its short half-life (~ 9 hours) the mass of Xe-135 will remain relatively constant through all the cases. The value was rounded to 8.7E-5 grams of X-135.

Two variations of the number density calculations were run to account for the extreme UO_2 infiltration cases of 132 g/year and 0 g/year after initiation of the criticality. In the maximum infiltration rate case, the number densities for the UO_2 feed isotopes U-234, U-235, U-236, U-238, and Np-237 were multiplied by the quantity (132 g/fuel region volume (cm^3)/10.96 g/cm^3)

Table 7.4.3-1. Additional TSPA-95 Radionuclide Inventory (in Ci) Generated by a 1000 Year External Criticality (initial inventory at the end of criticality with subsequent decay)

Isotope	Initial	10,000yr	20,000yr	50,000yr	100,000yr	250,000yr
ac227	7.62E-03	7.65E-02	1.32E-01	2.44E-01	3.26E-01	3.68E-01
am241	8.40E-02	1.01E-08	1.14E-15	3.53E-18	5.97E-20	2.90E-25
am242m	7.96E-05	3.56E-26	0.00E+00	0.00E+00	0.00E+00	0.00E+00
am243	1.19E-08	4.66E-09	1.82E-09	1.08E-10	9.83E-13	7.34E-19
c 14	5.01E-06	1.49E-06	4.46E-07	1.18E-08	2.79E-11	3.66E-19
cm244	5.20E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
cm245	2.08E-16	9.20E-17	4.07E-17	3.52E-18	5.96E-20	2.90E-25
cm246	3.19E-19	7.37E-20	1.70E-20	2.10E-22	1.38E-25	0.00E+00
cs135	6.67E-02	6.65E-02	6.63E-02	6.57E-02	6.48E-02	6.19E-02
i129	1.14E-03	1.14E-03	1.14E-03	1.14E-03	1.14E-03	1.13E-03
nb 93m	6.26E-02	6.38E-02	6.35E-02	6.27E-02	6.13E-02	5.72E-02
nb 94	1.92E-06	1.36E-06	9.68E-07	3.47E-07	6.30E-08	3.76E-10
np237	7.03E+00	7.01E+00	6.99E+00	6.92E+00	6.81E+00	6.48E+00
pa231	7.87E-03	7.65E-02	1.32E-01	2.43E-01	3.26E-01	3.68E-01
pb210	2.15E-02	1.02E+00	2.07E+00	4.57E+00	7.27E+00	8.69E+00
pd107	7.17E-04	7.16E-04	7.16E-04	7.13E-04	7.10E-04	6.98E-04
pu238	9.54E+01	7.82E-26	0.00E+00	0.00E+00	0.00E+00	0.00E+00
pu239	7.15E+01	5.36E+01	4.02E+01	1.70E+01	4.03E+00	5.40E-02
pu240	1.25E+00	4.33E-01	1.51E-01	6.34E-03	3.22E-05	4.24E-12
pu241	2.25E-01	9.21E-17	4.07E-17	3.53E-18	5.97E-20	2.90E-25
pu242	8.70E-08	9.05E-08	8.88E-08	8.40E-08	7.66E-08	5.80E-08
ra226	2.28E-02	1.02E+00	2.07E+00	4.57E+00	7.27E+00	8.70E+00
ra228	1.31E-07	1.45E-06	2.78E-06	6.74E-06	1.33E-05	3.31E-05
se 79	3.12E-03	3.06E-03	2.99E-03	2.81E-03	2.53E-03	1.85E-03
sm151	1.44E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
sn126	1.03E-02	9.66E-03	9.01E-03	7.32E-03	5.17E-03	1.83E-03
tc 99	6.76E-01	6.54E-01	6.33E-01	5.74E-01	4.87E-01	2.98E-01
th229	1.30E-03	1.19E-01	3.37E-01	1.10E+00	2.23E+00	4.35E+00
th230	1.21E-01	1.27E+00	2.30E+00	4.73E+00	7.17E+00	8.58E+00
th232	1.32E-07	1.45E-06	2.78E-06	6.74E-06	1.33E-05	3.31E-05
u233	3.04E-02	3.28E-01	6.12E-01	1.39E+00	2.46E+00	4.46E+00
u234	1.34E+01	1.31E+01	1.28E+01	1.20E+01	1.08E+01	8.09E+00
u235	3.67E-01	3.68E-01	3.68E-01	3.69E-01	3.70E-01	3.70E-01
u236	2.68E+00	2.68E+00	2.68E+00	2.68E+00	2.67E+00	2.66E+00
u238	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00
zr 93	6.41E-02	6.38E-02	6.35E-02	6.27E-02	6.13E-02	5.72E-02
Total	2.10E+02	8.50E+01	7.50E+01	6.00E+01	5.50E+01	5.70E+01

Table 7.4.3-2. Additional TSPA-95 Radionuclide Inventory (in Ci) Generated By a 5000 Year External Criticality (initial inventory at the end of criticality with subsequent decay)

Isotope	Initial	10,000yr	20,000yr	50,000yr	100,000yr	250,000yr
ac227	3.97E-02	9.99E-02	1.49E-01	2.48E-01	3.23E-01	3.63E-01
am241	3.62E+00	4.14E-07	1.94E-13	1.24E-14	2.09E-16	1.02E-21
am242m	5.17E-03	2.31E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00
am243	6.76E-06	2.64E-06	1.03E-06	6.13E-08	5.56E-10	4.16E-16
c 14	1.99E-05	5.94E-06	1.77E-06	4.70E-08	1.11E-10	1.45E-18
cm244	3.28E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
cm245	7.28E-13	3.22E-13	1.43E-13	1.23E-14	2.09E-16	1.02E-21
cm246	6.12E-15	1.41E-15	3.27E-16	4.03E-18	2.65E-21	7.53E-31
cs135	3.34E-01	3.33E-01	3.32E-01	3.29E-01	3.24E-01	3.10E-01
i129	5.83E-03	5.83E-03	5.83E-03	5.82E-03	5.81E-03	5.77E-03
nb 93m	3.17E-01	3.15E-01	3.14E-01	3.09E-01	3.03E-01	2.83E-01
nb 94	1.08E-05	7.70E-06	5.47E-06	1.96E-06	3.56E-07	2.12E-09
np237	6.98E+00	6.96E+00	6.94E+00	6.87E+00	6.76E+00	6.44E+00
pa231	3.97E-02	9.98E-02	1.49E-01	2.48E-01	3.23E-01	3.63E-01
pb210	3.61E-01	1.53E+00	2.61E+00	5.15E+00	7.89E+00	9.21E+00
pd107	5.05E-03	5.04E-03	5.04E-03	5.02E-03	4.99E-03	4.91E-03
pu238	9.40E+01	5.08E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00
pu239	3.22E+02	2.41E+02	1.81E+02	7.64E+01	1.81E+01	2.43E-01
pu240	2.45E+01	8.53E+00	2.97E+00	1.25E-01	6.34E-04	8.34E-11
pu241	4.61E+00	3.23E-13	1.43E-13	1.24E-14	2.09E-16	1.02E-21
pu242	2.07E-05	2.06E-05	2.02E-05	1.91E-05	1.74E-05	1.32E-05
ra226	3.61E-01	1.53E+00	2.61E+00	5.16E+00	7.89E+00	9.21E+00
ra228	6.67E-07	2.02E-06	3.38E-06	7.45E-06	1.42E-05	3.45E-05
se 79	1.55E-02	1.52E-02	1.49E-02	1.40E-02	1.26E-02	9.19E-03
sm151	1.53E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
sn126	5.69E-02	5.31E-02	4.95E-02	4.02E-02	2.84E-02	1.01E-02
tc 99	3.35E+00	3.24E+00	3.14E+00	2.84E+00	2.41E+00	1.47E+00
th229	2.85E-02	1.96E-01	4.31E-01	1.19E+00	2.30E+00	4.36E+00
th230	6.12E-01	1.79E+00	2.84E+00	5.32E+00	7.78E+00	9.09E+00
th232	6.67E-07	2.02E-06	3.38E-06	7.45E-06	1.42E-05	3.45E-05
u233	1.48E-01	4.38E-01	7.16E-01	1.47E+00	2.52E+00	4.47E+00
u234	1.42E+01	1.39E+01	1.36E+01	1.27E+01	1.14E+01	8.48E+00
u235	3.53E-01	3.56E-01	3.58E-01	3.62E-01	3.64E-01	3.64E-01
u236	2.75E+00	2.75E+00	2.75E+00	2.75E+00	2.75E+00	2.73E+00
u238	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00
zr 93	3.17E-01	3.15E-01	3.14E-01	3.09E-01	3.03E-01	2.83E-01
Total	5.00E+02	2.90E+02	2.20E+02	1.20E+02	7.50E+01	6.10E+01

Table 7.4.3-3. Additional TSPA-95 Radionuclide Inventory (in Ci) Generated By a 10,000 Year External Criticality (initial inventory at the end of criticality with subsequent decay)

Isotope	Initial	10,000yr	20,000yr	50,000yr	100,000yr	250,000yr
ac227	8.05E-02	1.30E-01	1.71E-01	2.55E-01	3.21E-01	3.56E-01
am241	1.21E+01	1.38E-06	3.08E-12	2.43E-13	4.11E-15	2.00E-20
am242m	1.79E-02	8.02E-24	0.00E+00	0.00E+00	0.00E+00	0.00E+00
am243	6.91E-05	2.70E-05	1.05E-05	6.27E-07	5.69E-09	4.25E-15
c 14	3.08E-05	9.18E-06	2.74E-06	7.26E-08	1.71E-10	2.25E-18
cm244	3.35E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
cm245	1.43E-11	6.33E-12	2.80E-12	2.42E-13	4.11E-15	1.99E-20
cm246	2.26E-13	5.22E-14	1.21E-14	1.49E-16	9.79E-20	2.79E-29
cs135	6.70E-01	6.68E-01	6.66E-01	6.60E-01	6.50E-01	6.21E-01
i129	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.18E-02
nb 93m	6.25E-01	6.22E-01	6.20E-01	6.11E-01	5.98E-01	5.58E-01
nb 94	2.74E-05	1.95E-05	1.38E-05	4.97E-06	9.01E-07	5.37E-09
np237	6.93E+00	6.91E+00	6.89E+00	6.82E+00	6.71E+00	6.39E+00
pa231	8.04E-02	1.30E-01	1.71E-01	2.55E-01	3.21E-01	3.56E-01
pb210	9.53E-01	2.18E+00	3.28E+00	5.88E+00	8.64E+00	9.83E+00
pd107	1.31E-02	1.30E-02	1.30E-02	1.30E-02	1.29E-02	1.27E-02
pu238	9.30E+01	1.76E-23	0.00E+00	0.00E+00	0.00E+00	0.00E+00
pu239	5.61E+02	4.21E+02	3.16E+02	1.33E+02	3.16E+01	4.24E-01
pu240	7.28E+01	2.53E+01	8.81E+00	3.70E-01	1.88E-03	2.48E-10
pu241	1.36E+01	6.34E-12	2.81E-12	2.43E-13	4.11E-15	2.00E-20
pu242	1.51E-04	1.49E-04	1.47E-04	1.39E-04	1.26E-04	9.57E-05
ra226	9.53E-01	2.18E+00	3.28E+00	5.88E+00	8.65E+00	9.83E+00
ra228	1.35E-06	2.75E-06	4.16E-06	8.37E-06	1.54E-05	3.64E-05
se 79	3.09E-02	3.03E-02	2.97E-02	2.78E-02	2.51E-02	1.83E-02
sm151	1.61E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
sn126	1.24E-01	1.15E-01	1.08E-01	8.75E-02	6.18E-02	2.19E-02
tc 99	6.62E+00	6.41E+00	6.20E+00	5.62E+00	4.77E+00	2.91E+00
th229	9.73E-02	3.02E-01	5.49E-01	1.30E+00	2.37E+00	4.38E+00
th230	1.24E+00	2.45E+00	3.52E+00	6.04E+00	8.53E+00	9.70E+00
th232	1.35E-06	2.75E-06	4.16E-06	8.37E-06	1.54E-05	3.64E-05
u233	2.85E-01	5.68E-01	8.37E-01	1.57E+00	2.59E+00	4.48E+00
u234	1.51E+01	1.48E+01	1.45E+01	1.35E+01	1.21E+01	8.96E+00
u235	3.38E-01	3.43E-01	3.47E-01	3.53E-01	3.56E-01	3.57E-01
u236	2.83E+00	2.84E+00	2.85E+00	2.85E+00	2.84E+00	2.83E+00
u238	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00
zr 93	6.25E-01	6.22E-01	6.20E-01	6.11E-01	5.98E-01	5.58E-01
Total	8.10E+02	4.90E+02	3.70E+02	1.90E+02	9.50E+01	6.60E+01

Table 7.4.3-4. Additional TSPA-95 Radionuclide Inventory (in Ci) Generated By a 100,000 Year External Criticality (initial inventory at the end of criticality with subsequent decay)

Isotope	Initial	10,000yr	20,000yr	50,000yr	100,000yr	250,000yr
ac227	3.40E-01	3.39E-01	3.38E-01	3.39E-01	3.42E-01	3.44E-01
am241	3.03E-01	3.44E-08	5.18E-14	3.99E-15	6.75E-17	3.28E-22
am242m	5.40E-05	2.41E-26	0.00E+00	0.00E+00	0.00E+00	0.00E+00
am243	8.31E-06	3.24E-06	1.27E-06	7.54E-08	6.84E-10	5.11E-16
c 14	5.62E-06	1.68E-06	5.00E-07	1.33E-08	3.13E-11	4.10E-19
cm244	4.94E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
cm245	2.35E-13	1.04E-13	4.60E-14	3.98E-15	6.74E-17	3.27E-22
cm246	2.84E-15	6.56E-16	1.52E-16	1.87E-18	1.23E-21	3.42E-31
cs135	1.21E+00	1.21E+00	1.21E+00	1.20E+00	1.18E+00	1.13E+00
i129	2.18E-02	2.18E-02	2.18E-02	2.17E-02	2.17E-02	2.15E-02
nb 93m	1.13E+00	1.12E+00	1.12E+00	1.10E+00	1.08E+00	1.01E+00
nb 94	1.03E-04	7.31E-05	5.19E-05	1.86E-05	3.38E-06	2.02E-08
np237	6.72E+00	6.70E+00	6.67E+00	6.61E+00	6.50E+00	6.20E+00
pa231	3.40E-01	3.39E-01	3.38E-01	3.39E-01	3.42E-01	3.44E-01
pb210	7.06E+00	7.73E+00	8.32E+00	9.63E+00	1.09E+01	1.02E+01
pd107	2.33E-02	2.33E-02	2.33E-02	2.32E-02	2.31E-02	2.27E-02
pu238	1.12E+01	5.30E-26	0.00E+00	0.00E+00	0.00E+00	0.00E+00
pu239	3.60E+02	2.70E+02	2.03E+02	8.56E+01	2.03E+01	2.72E-01
pu240	1.33E+01	4.64E+00	1.61E+00	6.78E-02	3.45E-04	4.53E-11
pu241	3.05E-01	1.04E-13	4.60E-14	3.99E-15	6.75E-17	3.28E-22
pu242	4.65E-05	4.56E-05	4.48E-05	4.24E-05	3.86E-05	2.92E-05
ra226	7.06E+00	7.73E+00	8.32E+00	9.63E+00	1.09E+01	1.03E+01
ra228	1.06E-05	1.21E-05	1.35E-05	1.80E-05	2.53E-05	4.74E-05
se 79	5.22E-02	5.11E-02	5.01E-02	4.70E-02	4.23E-02	3.09E-02
sm151	2.02E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
sn126	1.73E-01	1.61E-01	1.50E-01	1.22E-01	8.63E-02	3.05E-02
tc 99	1.06E+01	1.03E+01	9.94E+00	9.01E+00	7.65E+00	4.67E+00
th229	1.57E+00	1.77E+00	1.98E+00	2.55E+00	3.34E+00	4.79E+00
th230	7.23E+00	7.88E+00	8.44E+00	9.71E+00	1.07E+01	1.01E+01
th232	1.06E-05	1.21E-05	1.35E-05	1.80E-05	2.53E-05	4.74E-05
u233	1.80E+00	2.01E+00	2.21E+00	2.75E+00	3.50E+00	4.86E+00
u234	1.48E+01	1.45E+01	1.42E+01	1.33E+01	1.19E+01	8.79E+00
u235	3.32E-01	3.35E-01	3.37E-01	3.41E-01	3.44E-01	3.44E-01
u236	2.99E+00	2.99E+00	2.99E+00	2.99E+00	2.98E+00	2.97E+00
u238	2.90E+00	2.90E+00	2.90E+00	2.90E+00	2.90E+00	2.90E+00
zr 93	1.13E+00	1.12E+00	1.12E+00	1.10E+00	1.08E+00	1.01E+00
Total	4.50E+02	3.40E+02	2.80E+02	1.60E+02	9.60E+01	7.00E+01

and the resulting product was added to the number density calculated from the mass entered from the SAS2H output shown in the spreadsheet. Oxygen was adjusted for the additional material while also being adjusted down for the displaced water. Hydrogen was adjusted down to account for the displaced water by the volume fraction of UO_2 added (quantity described above). In the 0 g/yr infiltration rate case, number densities were calculated directly from the SAS2H masses for actinides and fission products and the water number densities were maintained constant.

The calculations and results are shown in the LOTUS 1-2-3 spreadsheet included in Attachment VII.

7.4.5 Check of Reactivity Changes With Time Due to Criticality

The MCNP base case for 538 K described in Section 7.4.1 was used with the number densities calculated in the previous section for the 3 criticality durations from 1000 to 10,000 years. The results of the MCNP cases are shown in Table 7.4.5-1 (Attachment numbers shown in parentheses). These cases demonstrate that the system reactivity is not significantly affected by the continued infiltration of material or by the burnup of fissile material and generation of fission products. The burnup is only 1.45 GWd/MTU (1.461E4 GWd/ 10.1 MTU) even after 10,000 years and at the maximum infiltration rate only adds 1.3 metric tons of UO_2. As indicated by the results in Reference 5.55, very large changes in the characteristics of these very large thermal systems are required to significantly change the k_{eff} value.

Table 7.4.5-1. MCNP Case Results to Demonstrate Reactivity Changes with Time

Time (years)	132 g/yr UO_2 Infiltration	0 g/yr UO_2 Infiltration
0.00	0.9424 ± 0.0020 (XI)	-
1000	0.9395 ± 0.0019 (XXV)	0.9373 ± 0.0018 (XXVIII)
5000	0.9417 ± 0.0016 (XXVI)	0.9348 ± 0.0016 (XXIX)
10,000	0.9453 ± 0.0019 (XXVII)	0.9336 ± 0.0016 (XXX)

Two additional cases were run for the 1000 year duration criticality with high UO_2 infiltration. In one case the fission products were removed providing a k_{eff} of 0.9440 ± 0.0018 (XXXI). In the other case Pu-238, Pu-239, and U-233 were removed providing a k_{eff} of 0.9349 ± 0.0016 (XXXII). This represents a nominal worth compared to the reference case above (XXV) of -0.48% and 0.49% for fission products and Pu, respectively at 1000 years. These same two cases were also run for the 10,000 year duration criticality with high UO_2 infiltration. For the case with fission products removed, a k_{eff} of 0.9556 ± 0.0019 (XXXIII) was calculated and for the case with Pu-238, Pu-239, and U-233 removed, a k_{eff} of 0.9090 ± 0.0018 (XXXIV) was calculated. This represents a nominal worth compared to the reference case above (XXVII) of -1.09% and +3.84% for fission products and Pu, respectively at 10,000 years.

In order to demonstrate that the top 15 fission product absorbers were sufficient to cover fission product effects, the next 16 highest fission product absorbers were reviewed for inclusion in an additional case based on the 10,000 year duration criticality with high UO_2 infiltration. The "fraction of total absorption rate" table for the last burn step of the 10,000 year duration case which can be found in the SAS2H output included in Attachments XVIII provides the absorption data. Five of these next highest fission product absorbers do not have cross sections available for MCNP and were discarded. The other eleven of these absorbers were added to the 10,000 year composition in the MCNP case providing a k_{eff} of 0.9448 ± 0.0018 (XXXV). Comparison of this result with that which included only 15 fission products demonstrates that the 15 fission products are sufficient.

The MCNP base case for 323 K (50 °C) described in Section 7.4.1 was used with the number densities calculated in the previous section for the 100,000 year hydrologic cycle. The results of the MCNP cases are a k_{eff} of 0.9994 ± 0.0019 (XXXVI) for the UO_2 infiltration case and 0.9477 ± 0.0017 (XXXVII) for no UO_2 infiltration. Note that these calculations are performed at 323 K while those reported above were performed at 538 K, representative of the respective power levels. At the variable infiltration rate, 6.6 metric tons of UO_2 are added displacing water over the 75,000 years of operation.

7.5 Probability Estimates

7.5.1 Summary of Prior Probability Estimates

The principal contribution to the probability of internal criticality (Refs. 5.8 and 5.9) came from a combination of the following events or processes:

- A given waste package has sufficiently reactive fuel.
- Hydraulically conductive fracture, or focusing, over the waste package.
- Increased infiltration rate (at least 10 times present value) within some time, T_1.
- Given the increased flow, the waste package barriers are breached within some time, T_2, after T_1.
- Given the barrier breach, a sufficient quantity of neutron absorber is removed from the waste package within some time, T_3, after $T_1 + T_2$.
- Water which has filled the waste package does not corrode through the inner barrier at the bottom of the waste package lying on its side.

The result, for the uncanistered fuel waste package was an expectation of less than 1 criticality in 80,000 years (Ref. 5.8, p. 55).

The principal contribution to the probability of external criticality (Ref. 5.52) came from a combination of the following events or processes:

- The number of waste packages having sufficient fissile content to provide a critical mass for a reducing zone in the repository far-field.
- The probability that a fissile bearing stream from a waste package having sufficient fissile content will encounter a single reducing zone, based on the distribution of

organic/carbonaceous deposits on the Colorado Plateau.
- The probability of the reducing zone being of sufficient size (based on the random juxtaposition of individual organic/carbonaceous deposits) to trap a critical mass.

The result is that the expected number of external criticalities from commercial SNF, over an arbitrarily long time period, is less than 2×10^{-7} (Ref. 5.52, p. 41, which was the highest value found in that analysis, although it was for a configuration different from the principal case in this analysis).

7.5.2 Data Needs for Future Probability Estimates

The following paragraphs identify the items of information which are expected to become available within the next year and will enable improvement of the accuracy of the probability estimates.

Internal criticality:

- Actual fracture density data from the Yucca Mountain tunnel at the repository horizon to more realistically estimate the probability of dripping on a given waste package and the associated concentration factor.
- Improved model of aqueous corrosion rate of the corrosion resistant inner barrier of the waste package, particularly as a function of temperature. This will facilitate the calculation of a probability density function for the criticality duration which is based on the length of time water can be contained in the WP to a depth sufficient to provide moderator for a critical mass of assemblies, including consideration of the increased temperature caused by the criticality (e.g., a peak temperature of 57°C versus the drift wall temperature of less than 50 °C beyond 10,000 years given in the TSPA-95 data (Ref 5.18).
- Improved model for corrosion of borated stainless steel and the metal borides contained in the stainless steel matrix.

External criticality:

- Fissile mobilization rate, which consists of the waste form dissolution rate and the solubility of the fissile species (since the solution is the medium for the removal of the fissile material from the waste package).
- Systematic identification of organic (carbonaceous) deposits and other reducing zones in tuff, characterizing their size and density. These parameters could replace the hypothetical log combination methodology used in Reference 5.52, particularly at the base of tuff layers.
- Identification of exceptionally high permeability formations below the water table which could focus the fissile bearing water from more than one waste package at a time (assuming that it could reach the water table without any lateral spreading).
- More data on the areal extent of highest grade ores at Oklo, to be used to generate a joint probability distribution for the occurrence of possible values of concentration and size, which will, in turn be used for an alternative estimate of the maximum possible size and concentration of any individual reducing zone. This may also serve to eliminate the

possibility of the high uranium, high water cases which were considered in Reference 5.52, but were rejected for the nominal case in this analysis for the reasons given in Section 7.3.1, above.

8. Conclusions

In compliance with the M&O Quality Administrative Procedures, the design results presented in this document should not be used for procurement, fabrication, or construction unless properly identified, tracked as TBV, and controlled by the appropriate procedures.

The purpose of this probabilistic evaluation was to estimate the consequences of a criticality event, both internal and external to a waste package. As a result of the calculations performed in this analysis, it can be concluded that:

- Maximum power determined by the boiling temperature of water is less than 5 kW.
- Duration is nominally less than 10,000 years, but can be cycled up to 100,000 years.
- Maximum sustainable power, as determined by the inflow of the worst case high concentration of fissile bearing water, is less than 1.5 kW.
- Change in k_{eff} over the duration of the criticality is small, for nominal 10,000 year duration and even for 100,000 year cycling due to temperature and UO_2 infiltration limited power.
- Increase in radionuclide inventory is small (both for a single package and for the number of packages which are likely to go critical).

9. Attachments -

List of Attachments

Attachment	Description	Date	Number of Pages
I	Derivation of Power-Temperature Relationship	8/28/96	2
II	LOTUS 1-2-3 Spreadsheet - Number Densities for Internal Criticality (ucfcalcs.wk4 sheet F)	8/30/96	4
III	MCNP Case - Internal Criticality 0 Year Duration (a26xb5cO.sum)	8/22/96	10
IV	MCNP Case - Internal Criticality 1000 Year Duration (a26xb5dO.sum)	8/23/96	10
V	MCNP Case - Internal Criticality 5000 Year Duration (a26xb5eO.sum)	8/22/96	10
VI	MCNP Case - Internal Criticality 10,000 Year Duration (a26xb5fO.sum)	8/22/96	10
VII	LOTUS 1-2-3 Spreadsheet - Tuff/Water/UO2 Mixture Number Densities (leshpher2.wk4 Sheet C)	8/29/96	10
VIII	LOTUS 1-2-3 Spreadsheet - Internal Criticality Radionuclide Inventory Comparisons	9/4/96	3
IX	MCNP Case - External Criticality 0 Year Duration, 300K (sp40aO.sum)	8/22/96	4
X	MCNP Case - External Criticality 0 Year Duration, 323K (sp40a2O.sum)	8/23/96	4
XI	MCNP Case - External Criticality 0 Year Duration, 538K (sp40a1O.sum)	8/22/96	4
XII	Not Used	n/a	n/a
XIII	SAS2H Case - External Criticality 1 Year Duration (tuff7.sum)	8/29/96	54
XIV	SAS2H Case - External Criticality 10 Year Duration (tuff6.sum)	8/29/96	56
XV	SAS2H Case - External Criticality 100 Year Duration (tuff5.sum)	8/29/96	59
XVI	SAS2H Case - External Criticality 1000 Year Duration (tuff3.sum)	8/29/96	100

Attachment	Description	Date	Number of Pages
XVII	SAS2H Case - External Criticality 5000 Year Duration (tuff2.sum)	8/29/96	64
XVIII	SAS2H Case - External Criticality 10,000 Year Duration (tuff1.sum)	8/29/96	102
XIX	SAS2H Case - External Criticality 100,000 Year Hydrologic Cycle (tuff9.sum)	9/3/96	231
XX	ORIGEN-S Case - Decay of 1000 Year Criticality (origen3.output)	8/28/96	231
XXI	ORIGEN-S Case - Decay of 5000 Year Criticality (origen2.output)	8/28/96	231
XXII	ORIGEN-S Case - Decay of 10,000 Year Criticality (origen1.output)	8/28/96	231
XXIII	ORIGEN-S Case - Decay of 100,000 Year Hydrologic Cycle Criticality (origen9.output)	8/29/96	231
XXIV	Not Used	n/a	n/a
XXV	MCNP Case - External Criticality 1000 Year Duration, 538K, UO_2 infiltration (sp40e1O.sum)	8/30/96	4
XXVI	MCNP Case - External Criticality 5000 Year Duration, 538K, UO_2 infiltration (sp40f1P.sum)	8/22/96	4
XXVII	MCNP Case - External Criticality 10,000 Year Duration, 538K, UO_2 infiltration (sp40g1O.sum)	8/30/96	4
XXVIII	MCNP Case - External Criticality 1000 Year Duration, 538K, No UO_2 infiltration (sp40e1nO.sum)	8/30/96	4
XXIX	MCNP Case - External Criticality 5000 Year Duration, 538K, No UO_2 infiltration (sp40f1nP.sum)	8/22/96	4
XXX	MCNP Case - External Criticality 10,000 Year Duration, 538K, No UO_2 infiltration (sp40g1nO.sum)	8/30/96	4
XXXI	MCNP Case - External Criticality 1000 Year Duration, 538K, UO_2 infiltration, No FP (sp40e1yO.sum)	8/30/96	4
XXXII	MCNP Case - External Criticality 1000 Year Duration, 538K, UO_2 infiltration, No U-233, Pu-238, Pu-239 (sp40e1zO.sum)	8/30/96	4
XXXIII	MCNP Case - External Criticality 10,000 Year Duration, 538K, UO_2 infiltration, No FP (sp40g1yO.sum)	8/30/96	4

Attachment	Description	Date	Number of Pages
XXXIV	MCNP Case - External Criticality 10,000 Year Duration, 538K, UO_2 infiltration, No U-233, Pu-238, Pu-239 (sp40g1zO.sum)	8/30/96	4
XXXV	MCNP Case - External Criticality 10,000 Year Duration, 538K, UO_2 infiltration, Extended FP (sp40g1xO.sum)	8/30/96	4
XXXVI	MCNP Case - External Criticality 100,000 Year Duration, 323K, UO_2 infiltration (sp40lO.sum)	8/30/96	4
XXXVII	MCNP Case - External Criticality 100,000 Year Duration, 323K, No UO_2 infiltration (sp40lnO.sum)	8/30/96	4

Derivation of Power-Temperature Relationship for External Criticality

The following formulas are valid in any consistent set of units. However SI (or MKS) is recommended, for which the units of distance is meters, temperature is Kelvin or Centigrade, and thermal conductivity is W/m·C.

The heat conduction equation in spherical coordinates, assuming spherical symmetry so that the derivatives with respect to angle are zero, and the system is in a steady state, is given in Reference 5.14, p. 6, Eq. 1-3(c):

$$\frac{1}{r}\frac{d^2}{dr^2}(rT) = -\frac{\dot{q}}{k},$$

where $\dot{q}$ is the power (heat generation rate) per unit volume and k is the thermal conductivity. Three forms of the solution are of interest:

Outside a sphere

There are no heat sources outside the sphere, so the right side of the heat conduction equation is zero. The solution is of the form:

$$T = c_1 + c_2/r.$$

This assumes a fixed temperature at large distances from the sphere, $c_1 = T_\infty$.

At the surface of the sphere, the temperature gradient is determined by the heat outflow per unit area. If the power generated inside the sphere is P, the boundary condition at the surface of the sphere (r=R) becomes:

$$\frac{dT}{dr}\Big|_{r=R} = -\frac{P}{4\pi k R^2},$$

which is satisfied if $c_2 = P/(4\pi k)$, so that the solution outside the sphere becomes:

$$T = T_\infty + P/(4k\pi r),$$

so that the temperature at the surface is determined by the temperature at infinity and the total power generated within the sphere as:

$$T_s = T_\infty + P/(4k\pi R).$$

Inside a sphere which is homogeneously heated

If the total power generated is P, homogeneously distributed in a sphere of radius R, the power per unit volume is $3P/(4\pi R^3)$. Integrating the heat conduction equation gives the solution:

$$T = T_s + P(1-r^2/R^2)/(8k\pi R),$$

where the two integration constants have been determined by the conditions that the temperature be finite at the center of the sphere (r=0) and that the temperature at the surface (r=R) be T_s.

The average temperature is computed by multiplying by $4\pi r^2$ and integrating from r=0 to r=R, and dividing the result by the volume of the sphere, $4\pi R^3/3$, to get:

$$T_{av} = T_s + P/(20k\pi R).$$

Inside a sphere with parabolic power density

The parabolic power density normalized to integrate to the total power P through the volume of a sphere of radius R is:

$$15P(1-r^2/R^2)/(8\pi R^3).$$

Using this power density on the right side of the heat conduction equation leads to the solution:

$$T = T_s + 7P/(32k\pi R) - 15P[r^2/(6R^2) - r^4/(20R^4)]/(8k\pi R),$$

where the two integration constants have been determined in the same manner as for the homogeneously heated case described above. Averaging this form over the sphere gives:

$$T_{av} = T_s + P/(14k\pi R).$$

SAS2H Number Density Worksheet: Consequence Analysis - Internal Criticality

Number Density = (mass/assembly) / (volume) * (Na) / (Aw) * correction to 96% density for fresh fu
Avogadro's Number [Na 0.602252
Atomic Weight [Aw]

Volume= Pi X .468122 X .468122 X 360.172 X 208
= 51575.24

SAS2H UO2 density=10.206
Correction to 96% density
1.0309278
(REF. 5.43)

Isotope List:

U mass=.464kg
UO2 mass= 526.38 kg

	Element	Symbol	Isotope	MCNP ID	Atomic Wei	ORIGINS ID
8	Oxygen	O	O-16	8016.50C	15.99492	
42	Molybdenu	Mo	nat.	42000.50C	95.94	
		Mo	Mo-95	42095.50C	94.90584	mo 95
43	Technetium	Tc	Tc-99*	43099.50C	98.90628	tc 99
44	Ruthenium	Ru	Ru-101	44101.50C	100.9056	ru101
45	Rhodium	Rh	Rh-103	45103.50C	102.9055	rh103
47	Silver	Ag	Ag-109	47109.50C	108.9048	ag109
48	Cadmium	Cd	nat.	48000.50C	112.4	
55	Cesium	Cs	Cs-133	55133.50C	132.9054	cs133
		Cs	Cs-135	55135.50C	134.9058	cs135
60	Neodymiu	Nd	Nd-143	60143.50C	142.9098	nd143
		Nd	Nd-145	60145.50C	144.9125	nd145
62	Samarium	Sm	Sm-147	62147.50C	146.9149	sm147
		Sm	Sm-149	62149.50C	148.9172	sm149
		Sm	Sm-150	62150.50C	149.9173	sm150
		Sm	Sm-151	62151.50C	150.9199	sm151
		Sm	Sm-152	62152.50C	151.9198	sm152
63	Europium	Eu	Eu-151	63151.55C	150.9198	eu151
		Eu	Eu-153	63153.55C	152.9212	eu153
		Eu	Eu-154	63154.50C	153.9231	eu154
64	Gadolinium	Gd	nat.	64000.35C	157.25	
		Gd	Gd-155	64155.50C	154.9227	gd155
		Gd	Gd-157	64157.50C	156.924	gd157
72	Hafnium	Hf	nat.	72000.50C	178.49	
92	Uranium	U	U-233	92233.50C	233.0395	u233
		U	U-234	92234.50C	234.0409	u234
		U	U-235	92235.50C	235.0439	u235
		U	U-236	92236.50C	236.0456	u236
		U	U-238	92238.50C	238.0508	u238
93	Neptunium	Np	Np-237	93237.55C	237.0481	np237
94	Plutonium	Pu	Pu-238	94238.50C	238.0495	pu238
		Pu	Pu-239	94239.55C	239.0521	pu239
		Pu	Pu-240	94240.50C	240.0539	pu240
		Pu	Pu-241	94241.50C	241.0567	pu241
		Pu	Pu-242	94242.50C	242.0587	pu242
		Pu	Pu-243	94243.35C	243.062	pu243
95	Americium	Am	Am-241	95241.50C	241.0567	am241
		Am	Am-242m	95242.50C	242.0595	am242m
		Am	Am-243	95243.50C	243.0614	am243
96	Curium	Cm	Cm-243	96243.35C	243.0614	cm243
		Cm	Cm-245	96245.35C	245.0654	cm245
		Cm	Cm-248	96248.35C	248.0722	cm248
	Xenon	Xe	Xe-131 *	54131.50c	130.9051	* AW from Chart of the Nuclides
		Xe	Xe-135 *	54135.50c	134.9063	

Number Density = grams/assembly / Assembly Volume * Avagadro's Number / Atomic Weight
* (Density Correction to 96% TD) * (Isotopic Correction Factor)

Time Effects Curve
BURNUP: PWR 20 GWd/MT PWR B&W 15x15, 3.00% , Burnup 20 GWd/MTHM
ENRICHMENT: 3.00% DECAY TIME: 15,000 YEARS
DECAY TIME: 15,000 YEARS Volume 51575.24 pwr 3.0% 20 G

ISOTOPE	GRAMS/	fraction		Aw	MCNP ID	Number Density
O 16	62377.29	0.120501	1	15.99492	8016.50C	4.6947E-02
mo 95	224	0.000433	1	94.90584	42095.50C	2.8413E-05
tc 99	219	0.000423	1	98.90628	43099.50C	2.6655E-05
ru101	218	0.000421	1	100.9056	44101.50C	2.6008E-05
rh103	144	0.000278	1	102.9055	45103.50C	1.6846E-05
ag109	21.9	0.000042	1	108.9048	47109.50C	2.4208E-06
nd143	269	0.00052	1	142.9098	60143.50C	2.2660E-05
nd145	203	0.000392	1	144.9125	60145.50C	1.6864E-05
sm147	89.7	0.000173	1	146.9149	62147.50C	7.3501E-06
sm149	1.42	2.7E-06	1	148.9172	62149.50C	1.1479E-07
sm150	80.4	0.000155	1	149.9173	62150.50C	6.4561E-06
sm151	0	0	1	150.9199	62151.50C	0.0000E+00
eu151	6.22	0.000012	1	150.9198	63151.55C	4.9615E-07
sm152	37.4	0.000072	1	151.9198	62152.50C	2.9636E-06
eu153	27	0.000052	1	152.9212	63153.55C	2.1255E-06
gd155	3.18	6.1E-06	1	154.9227	64155.50C	2.4710E-07
u233	2.43	4.7E-06	1	233.0395	92233.50C	1.2553E-07
u234	107	0.000207	1	234.0409	92234.50C	5.5037E-06
u235	7210	0.013928	1	235.0439	92235.50C	3.6928E-04
u236	1940	0.003748	1	236.0456	92236.50C	9.8940E-05
u238	442000	0.853857	1	238.0508	92238.50C	2.2352E-02
np237	541	0.001045	1	237.0481	93237.55C	2.7474E-05
pu238	0	0	1	238.0495	94238.50C	0.0000E+00
pu239	1720	0.003323	1	239.0521	94239.55C	8.6617E-05
pu240	138	0.000267	1	240.0539	94240.50C	6.9205E-06
pu241	2.24E-05	4.3E-11	1	241.0567	94241.50C	1.1186E-12
pu242	68.9	0.000133	1	242.0587	94242.50C	3.4266E-06
am241	7.04E-04	1.4E-09	1	241.0567	95241.50C	3.5158E-11
am242m	0	0	1	242.0595	95242.50C	0.0000E+00
am243	2.46	4.8E-06	1	243.0614	95243.50C	1.2184E-07
total	517651.3	1			Total	7.0057E-02

oxygen mass/assembly = 464000 g UO / (1-11.8503E-2) * 11.8503E-2 fraction of O in UO2
62377.29
Effective density = 10.03682

Time Effects Curve
BURNUP: PWR 20 GWd/MT PWR B&W 15x15, 3.00% , Burnup 20 GWd/MTHM
ENRICHMENT: 3.00% DECAY TIME: 15000 YEARS
DECAY TIME: 15000 YEARS Volume 51575.24 pwr 3.0% 20 GWd/MT
CRITICALITY DURATION 0 Years 0 yr crit

ISOTOPE	GRAMS/	%		Aw	MCNP ID	Number Density
O 16	62377.29	0.120385	1	15.99492	8016.50C	4.6947E-02
mo 95	224	0.000432	1	94.90584	42095.50C	2.8413E-05
tc 99	219	0.000423	1	98.90628	43099.50C	2.6655E-05
ru101	218	0.000421	1	100.9056	44101.50C	2.6008E-05
rh103	144	0.000278	1	102.9055	45103.50C	1.6846E-05
ag109	21.9	0.000042	1	108.9048	47109.50C	2.4208E-06
nd143	269	0.000519	1	142.9098	60143.50C	2.2660E-05
nd145	2.03E+02	0.039%	1	144.9125	60145.50C	1.6864E-05
sm147	8.97E+01	0.017%	1	146.9149	62147.50C	7.3501E-06
sm149	1.42E+00	0.000%	1	148.9172	62149.50C	1.1479E-07
sm150	8.04E+01	0.016%	1	149.9173	62150.50C	6.4561E-06

For Time Effects Cases, the Isotopic Correction Factor is set to 1.0.

Number Density Calculation for 26 volume% Fe_2O_3 in Water
density of Fe_2O_3 is 5.24 g/cc from Handbook of Chemistry and Physics (Ref. 5.17)
Note: O is O-16 66 Edition, page B-104
AW of Fe= 55.847 AW of O= 15.99492 from Nuclear Chemical Engineering (Ref. 5.43)

Molecular Density = 5.24 X .602252 / (2x55.847 + 3x15.9949)
= 0.019763 ND for 26%
ND of Fe=2x.019762= 0.039527 0.010277
ND of O=3x.019762= 0.05929 0.0154155

Water Number Density
ND of H= 0.066878 from Material Compositions and Number Densities...
ND of O= 0.033439 BBA000000-01717-0200-00002 Rev 00

ND for 74%
H 0.0494897
O 0.0247449

Total ND for O = .024745+.015414= 0.040160

B-10 Number Density (Assume no volume offset)
mass of B= 30.474 kg from Second WP Probabilistic Criticality Analysis...
void space 5.714E6 cc BBA000000-01717-2200-00005 REV 00 (Ref. 5.54)

AW of B-10 10.0129 from page I-10 of Material Compositions and Number Densities...
WT Fractio .288/1.6= 0.18 BBA000000-01717-0200-00002 Rev 00 (Ref. 5.5)

ND of B-10=30.474E3*.18/5.714E6*.602252/10.0129= 5.7740E-05
ND for 5%
2.8870E-06
TOTAL ND =sum of O, Fe, H, B-10 0.09993

mass density=1.00x.74 + 5.24x.26= 2.1024

sm151	0.00E+00	0.000%	1	150.9199	62151.50C	0.0000E+00
eu151	6.22E+00	0.001%	1	150.9198	63151.55C	4.9615E-07
sm152	3.74E+01	0.007%	1	151.9198	62152.50C	2.9636E-06
eu153	2.70E+01	0.005%	1	152.9212	63153.55C	2.1255E-06
gd155	3.18E+00	0.001%	1	154.9227	64155.50C	2.4710E-07
gd157	3.11E-02	0.000%	1	156.924	64157.50C	2.3858E-09
cd(113)	1.77E+01	0.003%	1	112.4	48000.50C	1.8989E-06
xe131	1.38E+02	0.027%	1	130.9051	54131.50C	1.2691E-05
cs133	3.41E+02	0.066%	1	132.9054	55133.50C	3.0887E-05
u233	2.43E+00	0.000%	1	233.0395	92233.50C	1.2553E-07
u234	1.07E+02	0.021%	1	234.0409	92234.50C	5.5037E-06
u235	7.21E+03	1.391%	1	235.0439	92235.50C	3.6928E-04
u236	1.94E+03	0.374%	1	236.0456	92236.50C	9.8940E-05
u238	4.42E+05	85.304%	1	238.0508	92238.50C	2.2352E-02
np237	5.41E+02	0.104%	1	237.0481	93237.55C	2.7474E-05
pu238	0.00E+00	0.000%	1	238.0495	94238.50C	0.0000E+00
pu239	1.72E+03	0.332%	1	239.0521	94239.55C	8.6617E-05
pu240	1.38E+02	0.027%	1	240.0539	94240.50C	6.9205E-06
pu241	2.24E-05	0.000%	1	241.0567	94241.50C	1.1186E-12
pu242	6.89E+01	0.013%	1	242.0587	94242.50C	3.4266E-06
am241	7.04E-04	0.000%	1	241.0567	95241.50C	3.5158E-11
am242m	0.00E+00	0.000%	1	242.0595	95242.50C	0.0000E+00
am243	2.46E+00	0.000%	1	243.0614	95243.50C	1.2184E-07
total	518148.1	100.00%			Total	7.010280E-02

oxygen mass/assembly = 464000 g UO / (1-11.8503E-2) * 11.8503E-2 fraction of O in UO2
62377.29
Effective density = 10.04645

Time Effects Curve
BURNUP: PWR 20 GWd/MT PWR B&W 15x15, 3.00% , Burnup 20 GWd/MTHM
ENRICHMENT: 3.00% DECAY TIME: 15000 YEARS
DECAY TIME: 15000 YEARS Volume 51575.24 pwr 3.0% 20 GWd/MT
CRITICALITY| DURATION 1000 Years 1000 yr crit

ISOTOPE	GRAMS/	%		Aw	MCNP ID	Number Density
O 16	62377.29	0.120385	1	15.99492	8016.50C	4.6947E-02
mo 95	225	0.000434	1	94.90584	42095.50C	2.8540E-05
tc 99	220	0.000425	1	98.90628	43099.50C	2.6777E-05
ru101	219	0.000423	1	100.9056	44101.50C	2.6127E-05
rh103	144	0.000278	1	102.9055	45103.50C	1.6846E-05
ag109	21.9	0.000042	1	108.9048	47109.50C	2.4208E-06
nd143	270	0.000521	1	142.9098	60143.50C	2.2744E-05
nd145	2.04E+02	0.039%	1	144.9125	60145.50C	1.6947E-05
sm147	9.01E+01	0.017%	1	146.9149	62147.50C	7.3829E-06
sm149	1.18E+00	0.000%	1	148.9172	62149.50C	9.5390E-08
sm150	8.08E+01	0.016%	1	149.9173	62150.50C	6.4882E-06
sm151	3.01E-02	0.000%	1	150.9199	62151.50C	2.4010E-09
eu151	6.12E+00	0.001%	1	150.9198	63151.55C	4.8817E-07
sm152	3.75E+01	0.007%	1	151.9198	62152.50C	2.9715E-06
eu153	2.71E+01	0.005%	1	152.9212	63153.55C	2.1334E-06
gd155	2.73E+00	0.001%	1	154.9227	64155.50C	2.1214E-07
gd157	2.36E-02	0.000%	1	156.924	64157.50C	1.8105E-09
cd(113)	1.78E+01	0.003%	1	112.4	48000.50C	1.9107E-06
xe131	1.38E+02	0.027%	1	130.9051	54131.50C	1.2691E-05
cs133	3.42E+02	0.066%	1	132.9054	55133.50C	3.0978E-05
u233	2.58E+00	0.000%	1	233.0395	92233.50C	1.3328E-07
u234	1.08E+02	0.021%	1	234.0409	92234.50C	5.5552E-06
u235	7.23E+03	1.395%	1	235.0439	92235.50C	3.7030E-04
u236	1.96E+03	0.378%	1	236.0456	92236.50C	9.9960E-05

u238	4.42E+05	85.304%	1	238.0508	92238.50C	2.2352E-02
np237	5.41E+02	0.104%	1	237.0481	93237.55C	2.7474E-05
pu238	1.69E-01	0.000%	1	238.0495	94238.50C	8.5464E-09
pu239	1.68E+03	0.324%	1	239.0521	94239.55C	8.4602E-05
pu240	1.30E+02	0.025%	1	240.0539	94240.50C	6.5193E-06
pu241	3.14E-02	0.000%	1	241.0567	94241.50C	1.5681E-09
pu242	6.86E+01	0.013%	1	242.0587	94242.50C	3.4117E-06
am241	7.54E-01	0.000%	1	241.0567	95241.50C	3.7655E-08
am242m	1.90E-04	0.000%	1	242.0595	95242.50C	9.4492E-12
am243	2.40E+00	0.000%	1	243.0614	95243.50C	1.1887E-07
total	518148.1	100.00%			Total	7.010317E-02

oxygen mass/assembly = 464000 g UO / (1-11.8503E-2) * 11.8503E-2 fraction of O in UO2
62377.29

Effective density = 10.04645

Time Effects Curve

BURNUP: PWR 20 GWd/MT PWR B&W 15x15, 3.00% , Burnup 20 GWd/MTHM

ENRICHMENT: 3.00% DECAY TIME: 15000 YEARS

DECAY TIME: 15000 YEARS Volume 51575.24 pwr 3.0% 20 GWd/MT

CRITICALITY| DURATION 5000 Years 5000 yr crit

ISOTOPE	GRAMS/	%		Aw	MCNP ID	Number Density
O 16	62377.29	0.120385	1	15.99492	8016.50C	4.6947E-02
mo 95	229	0.000442	1	94.90584	42095.50C	2.9047E-05
tc 99	220	0.000425	1	98.90628	43099.50C	2.6777E-05
ru101	223	0.00043	1	100.9056	44101.50C	2.6604E-05
rh103	145	0.00028	1	102.9055	45103.50C	1.6963E-05
ag109	22.2	0.000043	1	108.9048	47109.50C	2.4540E-06
nd143	273	0.000527	1	142.9098	60143.50C	2.2997E-05
nd145	2.07E+02	0.040%	1	144.9125	60145.50C	1.7196E-05
sm147	9.16E+01	0.018%	1	146.9149	62147.50C	7.5058E-06
sm149	7.88E-01	0.000%	1	148.9172	62149.50C	6.3701E-08
sm150	8.21E+01	0.016%	1	149.9173	62150.50C	6.5926E-06
sm151	3.04E-02	0.000%	1	150.9199	62151.50C	2.4249E-09
eu151	5.87E+00	0.001%	1	150.9198	63151.55C	4.6823E-07
sm152	3.77E+01	0.007%	1	151.9198	62152.50C	2.9874E-06
eu153	2.77E+01	0.005%	1	152.9212	63153.55C	2.1806E-06
gd155	1.51E+00	0.000%	1	154.9227	64155.50C	1.1733E-07
gd157	1.63E-02	0.000%	1	156.924	64157.50C	1.2504E-09
cd(113)	1.83E+01	0.004%	1	112.4	48000.50C	1.9600E-06
xe131	1.40E+02	0.027%	1	130.9051	54131.50C	1.2875E-05
cs133	3.47E+02	0.067%	1	132.9054	55133.50C	3.1431E-05
u233	3.16E+00	0.001%	1	233.0395	92233.50C	1.6324E-07
u234	1.12E+02	0.022%	1	234.0409	92234.50C	5.7609E-06
u235	7.29E+03	1.407%	1	235.0439	92235.50C	3.7337E-04
u236	2.02E+03	0.390%	1	236.0456	92236.50C	1.0302E-04
u238	4.42E+05	85.304%	1	238.0508	92238.50C	2.2352E-02
np237	5.46E+02	0.105%	1	237.0481	93237.55C	2.7728E-05
pu238	1.74E-01	0.000%	1	238.0495	94238.50C	8.7993E-09
pu239	1.54E+03	0.297%	1	239.0521	94239.55C	7.7552E-05
pu240	1.03E+02	0.020%	1	240.0539	94240.50C	5.1653E-06
pu241	2.54E-02	0.000%	1	241.0567	94241.50C	1.2685E-09
pu242	6.74E+01	0.013%	1	242.0587	94242.50C	3.3520E-06
am241	7.77E-01	0.000%	1	241.0567	95241.50C	3.8803E-08
am242m	2.27E-04	0.000%	1	242.0595	95242.50C	1.1289E-11
am243	2.21E+00	0.000%	1	243.0614	95243.50C	1.0946E-07
total	518133.9	100.00%			Total	7.010379E-02

oxygen mass/assembly = 464000 g UO / (1-11.8503E-2) * 11.8503E-2 fraction of O in UO2
62377.29

Effective density = 10.04617

Time Effects Curve

BURNUP: PWR 20 GWd/MT PWR B&W 15x15, 3.00% , Burnup 20 GWd/MTHM

ENRICHMENT: 3.00% DECAY TIME: 15000 YEARS

DECAY TIME: 15000 YEARS Volume 51575.24 pwr 3.0% 20 GWd/MT

CRITICALITY DURATION 10,000 Years 10,000 yr crit

ISOTOPE	GRAMS/	%		Aw	MCNP ID	Number Density
O 16	62377.29	0.120385	1	15.99492	8016.50C	4.6947E-02
mo 95	233	0.00045	1	94.90584	42095.50C	2.9555E-05
tc 99	221	0.000427	1	98.90628	43099.50C	2.6899E-05
ru101	227	0.000438	1	100.9056	44101.50C	2.7082E-05
rh103	147	0.000284	1	102.9055	45103.50C	1.7197E-05
ag109	22.5	0.000043	1	108.9048	47109.50C	2.4871E-06
nd143	277	0.000535	1	142.9098	60143.50C	2.3334E-05
nd145	2.11E+02	0.041%	1	144.9125	60145.50C	1.7528E-05
sm147	9.34E+01	0.018%	1	146.9149	62147.50C	7.6533E-06
sm149	6.96E-01	0.000%	1	148.9172	62149.50C	5.6264E-08
sm150	8.32E+01	0.016%	1	149.9173	62150.50C	6.6809E-06
sm151	3.06E-02	0.000%	1	150.9199	62151.50C	2.4408E-09
eu151	5.60E+00	0.001%	1	150.9198	63151.55C	4.4669E-07
sm152	3.79E+01	0.007%	1	151.9198	62152.50C	3.0032E-06
eu153	2.84E+01	0.005%	1	152.9212	63153.55C	2.2357E-06
gd155	7.60E-01	0.000%	1	154.9227	64155.50C	5.9056E-08
gd157	1.55E-02	0.000%	1	156.924	64157.50C	1.1891E-09
cd(113)	1.89E+01	0.004%	1	112.4	48000.50C	2.0221E-06
xe131	1.42E+02	0.027%	1	130.9051	54131.50C	1.3059E-05
cs133	3.53E+02	0.068%	1	132.9054	55133.50C	3.1974E-05
u233	3.88E+00	0.001%	1	233.0395	92233.50C	2.0043E-07
u234	1.16E+02	0.022%	1	234.0409	92234.50C	5.9667E-06
u235	7.35E+03	1.419%	1	235.0439	92235.50C	3.7645E-04
u236	2.09E+03	0.403%	1	236.0456	92236.50C	1.0659E-04
u238	4.42E+05	85.304%	1	238.0508	92238.50C	2.2352E-02
np237	5.50E+02	0.106%	1	237.0481	93237.55C	2.7931E-05
pu238	1.80E-01	0.000%	1	238.0495	94238.50C	9.1027E-09
pu239	1.40E+03	0.270%	1	239.0521	94239.55C	7.0502E-05
pu240	8.09E+01	0.016%	1	240.0539	94240.50C	4.0570E-06
pu241	2.05E-02	0.000%	1	241.0567	94241.50C	1.0238E-09
pu242	6.59E+01	0.013%	1	242.0587	94242.50C	3.2774E-06
am241	6.23E-01	0.000%	1	241.0567	95241.50C	3.1112E-08
am242m	1.86E-04	0.000%	1	242.0595	95242.50C	9.2503E-12
am243	2.05E+00	0.000%	1	243.0614	95243.50C	1.0153E-07
total	518139.2	100.00%			Total	7.010568E-02

oxygen mass/assembly = 464000 g UO / (1-11.8503E-2) * 11.8503E-2 fraction of O in UO2

62377.29

Effective density = 10.04628

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1mcnp     version 4a    ld=10/01/93                           08/20/96 17:19:50
************************************************************************     probid =   08/20/96 17:19:50
 inp=a26xb5c outp=a26xb5c0

        AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5c)
        C      Advanced Uncanistered Fuel Waste Package, collapsed basket 10k 26%/5%B
        C      15000 year decay  0 yr criticality
        C      CELL SPECIFICATIONS
        C        Assembly Sub-lattices - 1/2 Model
        1      0       1  3 -13 -20   FILL=1 (0 -74 0) IMP:N=1
        C      1      0        1  3  -4 -13 -20   FILL=1 (0 -73.8 0) IMP:N=1
        C      2      0        3  4  -5 -13 -20   FILL=1 (0 -73.8 0) IMP:N=1
        C      3      0        3  5 -13 -20       FILL=1 (0 -73.8 0) IMP:N=1
        C        Assembly Sub-lattices - 1/4 Model
        C      1      0        1   2   3  -4 -13 -20   FILL=1 (0 -12.3 0) IMP:N=1
        C      2      0        2   3   4  -5 -13 -20   FILL=1 (0 -12.3 0) IMP:N=1
        C      3      0        2   3   5 -13 -20       FILL=1 (0 -12.3 0) IMP:N=1
        C      ASSEMBLY LATTICE DESCRIPTION
        5      1  -2.1024  -61  60 -63  62  IMP:N=1 LAT=1 U=1
               FILL=0:3 0:7 0:0  1 1  1  1  56 56 1  1  56 56 56 1
                                 56 56 56 1  56 56 56 1  56 56 1  1
                                 1 1  1  1   1 1 1 1      $ 1/2 model
        C      5      1  -2.1024   60 -61  62 -63  IMP:N=1 LAT=1 U=1
        C             FILL=0:3 0:3 0:0  58 58 64 70  58 58 62 70
        C                               60 62 70  1  70 70  1  1 $ 1/4 model
        C      BARRIER CELLS
        C      Basket Material-Lid Gap
        76     3  -1.0000    1 -20  13  -14     IMP:N=1 $ 1/2 model
        C      76    1  -2.1024    1   2 -20  13  -14     IMP:N=1 $ 1/4 model
        C      Inner Barrier
        77     5  -8.1400    1   3  20 -21 -14  IMP:N=1 $ 1/2 model
        C      77    5  -8.1400    1   2   3  20 -21 -14  IMP:N=1 $ 1/4 model
        C      Inner Lid
        78     5  -8.1400    1  14 -15 -21      IMP:N=1 $ 1/2 model
        C      78    5  -8.1400    1   2  14 -15 -21      IMP:N=1 $ 1/4 model
        C       Gap between Inner and Outer Barrier Lids
        79     3  -1.0000    1  15 -16 -21      IMP:N=1 $ 1/2 model
        C      79    1  -2.1024    1   2  15 -16 -21      IMP:N=1 $ 1/4 model
        C       Gap between Inner and Outer Barriers
        80     3  -1.0000   21 -22   1   3 -16  IMP:N=1 $ 1/2 model
        C      80    1  -2.1024   21 -22   1   2   3 -16  IMP:N=1 $ 1/4 model
        C      Outer Barrier
        81     7  -7.8320   22 -24   1   3 -16  IMP:N=1 $ 1/2 model
        C      81    7  -7.8320   22 -24   1   2   3 -16  IMP:N=1 $ 1/4 model
        C      Outer Barrier Lid
        82     7  -7.8320    1 -24  16 -17      IMP:N=1 $ 1/2 model
        C      82    7  -7.8320    1   2 -24  16 -17      IMP:N=1 $ 1/4 model
        C      12" of Water around Container
        83     3  -1.0000   24 -25   1   3 -17  IMP:N=1 $ 1/2 model
        C      83    1  -2.1024   24 -25   1   2   3 -17  IMP:N=1 $ 1/4 model
        C      12" of Water above Container
        84     3  -1.0000   17 -19   1 -25      IMP:N=1 $ 1/2 model
        C      84    1  -2.1024   17 -58   1   2 -59      IMP:N=1 $ 1/4 model
        C      OUTSIDE WORLD
        85     0  -1:-3:19:25  IMP:N=0  $ 1/2 model
        C      85    0  -1:-2:-3:19:25  IMP:N=0  $ 1/4 model
        C      WET PIN LATTICE DESCRIPTION
        86     1  -2.1024  -26 27 -28  29  IMP:N=1 LAT=1  U=56
               FILL -8:8 -8:8 0:0  56 16R  56 2 14R 56  56 2 14R 56
                                   56 2 4R 4 2 2R 4 2 4R 56
```

```
                                56 2 2R 4 2 6R 4 2 2R 56  56 2 14R 56
                                56 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 56
                                56 2 14R 56
                                56 2 6R 6 2 6R 56
                                56 2 14R 56
                                56 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 56
                                56 2 14R 56  56 2 2R 4 2 6R 4 2 2R 56
                                56 2 4R 4 2 2R 4 2 4R 56
                                56 2 14R 56  56 2 14R 56  56 16R
c      MIXED PIN LATTICE DESCRIPTION
c      87    3  -0.001225  -26 27 -28  29  IMP:N=1 LAT=1  U=72
c       FILL -8:8 -8:8 0:0  57 16R  57 3 14R 57  57 3 14R 57
c                            57 3 4R 5 3 2R 5 3 4R 57
c                            57 3 2R 5 3 6R 5 3 2R 57  57 3 14R 57
c                            57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
c                            57 3 14R 57
c                            57 3 6R 7 3 6R 57
c                            57 2 14R 57
c                            57 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 57
c                            57 2 14R 57  57 2 2R 4 2 6R 4 2 2R 57
c                            57 2 4R 4 2 2R 4 2 4R 57
c                            57 2 14R 57  57 2 14R 57  57 16R
c      DRY PIN LATTICE DESCRIPTION
88     3  -0.001225  -26 27 -28  29  IMP:N=1 LAT=1  U=57
       FILL -8:8 -8:8 0:0  57 16R  57 3 14R 57  57 3 14R 57
                           57 3 4R 5 3 2R 5 3 4R 57
                           57 3 2R 5 3 6R 5 3 2R 57  57 3 14R 57
                           57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
                           57 3 14R 57
                           57 3 6R 7 3 6R 57
                           57 3 14R 57
                           57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
                           57 3 14R 57  57 3 2R 5 3 6R 5 3 2R 57
                           57 3 4R 5 3 2R 5 3 4R 57
                           57 3 14R 57  57 3 14R 57  57 16R
c      WET FUEL ROD
89     2   7.0103E-02   -30 -10      IMP:N=1 U=2
90     4  -6.5600    -30  10 -11 IMP:N=1 U=2
91     1  -2.1024    -30  11     IMP:N=1 U=2
92     1  -2.1024     30 -31 -11 IMP:N=1 U=2
93     1  -2.1024     30 -31  11 IMP:N=1 U=2
94     4  -6.5600     31 -32 -11 IMP:N=1 U=2
95     1  -2.1024     31 -32  11 IMP:N=1 U=2
96     1  -2.1024     32         IMP:N=1 U=2
c      DRY FUEL ROD
97     2   7.0103E-02   -30 -10      IMP:N=1 U=3
98     4  -6.5600    -30  10 -11 IMP:N=1 U=3
99     3  -0.001225    -30  11      IMP:N=1 U=3
100    3  -0.001225     30 -31 -11 IMP:N=1 U=3
101    3  -0.001225     30 -31  11 IMP:N=1 U=3
102    4  -6.5600     31 -32 -11 IMP:N=1 U=3
103    3  -0.001225     31 -32  11 IMP:N=1 U=3
104    3  -0.001225     32         IMP:N=1 U=3
c      WET CONTROL ROD/GUIDE TUBE
105    1  -2.1024   -33        IMP:N=1 U=4  $ No DCRA Rod
c      105   9  -7.8300  -33         IMP:N=1 U=4  $ DCRA Rod
106    1  -2.1024   33  -34  IMP:N=1 U=4
107    1  -2.1024   34  -35  IMP:N=1 U=4  $ No DCRA Cladding
c      107   4  -6.5600   34  -35  IMP:N=1 U=4  $ DCRA Cladding
108    1  -2.1024   35  -36  IMP:N=1 U=4
```

```
109   4  -6.5600   36  -37  IMP:N=1 U=4
110   1  -2.1024   37       IMP:N=1 U=4
c     DRY CONTROL ROD/GUIDE TUBE
111   3  -0.001225  -33          IMP:N=1 U=5  $ No DCRA Rod
c     111   9  -7.8300  -33          IMP:N=1 U=5  $ DCRA Rod
112   3  -0.001225   33  -34  IMP:N=1 U=5
113   3  -0.001225   34  -35  IMP:N=1 U=5  $ No DCRA Cladding
c     113   4  -6.5600   34  -35  IMP:N=1 U=5  $ DCRA Cladding
114   3  -0.001225   35  -36  IMP:N=1 U=5
115   4  -6.5600   36  -37  IMP:N=1 U=5
116   3  -0.001225   37       IMP:N=1 U=5
c     WET INSTRUMENTATION TUBE
117   1  -2.1024  -38         IMP:N=1 U=6
118   4  -6.5600   38 -39     IMP:N=1 U=6
119   1  -2.1024   39         IMP:N=1 U=6
c     DRY INSTRUMENTATION TUBE
120   3  -0.001225  -38         IMP:N=1 U=7
121   4  -6.5600   38 -39     IMP:N=1 U=7
122   3  -0.001225   39         IMP:N=1 U=7
c     FUEL CELL BASKET STRUCTURE
c     Code: boron in [B=] all panels [all], left [l], bottom, [b], right [r], to
c     FUEL CELL BASKET STRUCTURE -         WET - Borated panels
c        WATER GAP      - ASSEMBLY LEFT
123   1  -2.1024   52            IMP:N=1 U=8
c     123   1  -2.1024   48            IMP:N=1 U=8
c        OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c     124   6  -7.8320  -48  52      IMP:N=1 U=8
c        CS TUBE - ASSEMBLY LEFT
c     125   7  -7.8320  -52  56      IMP:N=1 U=8
c        SS PANEL - ASSEMBLY LEFT
126   8  -7.7700  -52          IMP:N=1 U=8
c        WATER GAP      - ASSEMBLY BOTTOM
127   1  -2.1024   53            IMP:N=1 U=9
c     127   1  -2.1024   49            IMP:N=1 U=9
c        OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c     128   6  -7.8320  -49  53      IMP:N=1 U=9
c        CS TUBE - ASSEMBLY BOTTOM
c     129   7  -7.8320  -53  57      IMP:N=1 U=9
c        SS PANEL - ASSEMBLY BOTTOM
130   8  -7.7700  -53          IMP:N=1 U=9
c        WATER GAP      - ASSEMBLY RIGHT
131   1  -2.1024  -54            IMP:N=1 U=10
c     131   1  -2.1024  -50            IMP:N=1 U=10
c        OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c     132   6  -7.8320   50 -54      IMP:N=1 U=10
c        CS TUBE - ASSEMBLY RIGHT
c     133   7  -7.8320   54 -58      IMP:N=1 U=10
c        SS PANEL - ASSEMBLY RIGHT
134   8  -7.7700   54          IMP:N=1 U=10
c        WATER GAP      - ASSEMBLY TOP
135   1  -2.1024  -55            IMP:N=1 U=11
c     135   1  -2.1024  -51            IMP:N=1 U=11
c        OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c     136   6  -7.8320   51 -55      IMP:N=1 U=11
c        CS TUBE - ASSEMBLY TOP
c     137   7  -7.8320   55 -59      IMP:N=1 U=11
c        SS PANEL - ASSEMBLY TOP
138   8  -7.7700   55          IMP:N=1 U=11
c     FUEL CELL BASKET STRUCTURE -         DRY - Borated panels
c        GAP      - ASSEMBLY LEFT
```

```
        139   3  -0.001225   52             IMP:N=1 U=12
        c        139   3  -0.001225   48           IMP:N=1 U=12
        c           OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
        c        140   6  -7.8320  -48  52       IMP:N=1 U=12
        c           CS TUBE - ASSEMBLY LEFT
        c        141   7  -7.8320  -52  56       IMP:N=1 U=12
        c           SS PANEL - ASSEMBLY LEFT
        142   8  -7.7700   -52          IMP:N=1 U=12
        c           GAP      - ASSEMBLY BOTTOM
        143  3  -0.001225   53            IMP:N=1 U=13
        c        143   3  -0.001225   49           IMP:N=1 U=13
        c           OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
        c        144   6  -7.8320  -49  53       IMP:N=1 U=13
        c           CS TUBE - ASSEMBLY BOTTOM
        c        145   7  -7.8320  -53  57       IMP:N=1 U=13
        c           SS PANEL - ASSEMBLY BOTTOM
        146   8  -7.7700   -53          IMP:N=1 U=13
        c           GAP      - ASSEMBLY RIGHT
        147   3  -0.001225  -54             IMP:N=1 U=14
        c        147   3  -0.001225  -50           IMP:N=1 U=14
        c           OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
        c        148   6  -7.8320   50 -54       IMP:N=1 U=14
        c           CS TUBE - ASSEMBLY RIGHT
        c        149   7  -7.8320   54 -58       IMP:N=1 U=14
        c           SS PANEL - ASSEMBLY RIGHT
        150   8  -7.7700   54           IMP:N=1 U=14
        c           GAP      - ASSEMBLY TOP
        151   3  -0.001225  -55             IMP:N=1 U=15
        c        151   3  -0.001225  -51           IMP:N=1 U=15
        c           OXIDATION LAYER CS TUBE - ASSEMBLY TOP
        c        152   6  -7.8320   51 -55       IMP:N=1 U=15
        c           CS TUBE - ASSEMBLY TOP
        c        153   7  -7.8320   55 -59       IMP:N=1 U=15
        c           SS PANEL - ASSEMBLY TOP
        154   8  -7.7700   55           IMP:N=1 U=15
        c        FUEL CELL BASKET STRUCTURE -        WET - Unborated panels
        c           WATER GAP       - ASSEMBLY LEFT
        155   1  -2.1024    52            IMP:N=1 U=16
        c        155   1  -2.1024    48          IMP:N=1 U=16
        c           OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
        c        156   6  -7.8320  -48  52       IMP:N=1 U=16
        c           CS TUBE - ASSEMBLY LEFT
        c        157   7  -7.8320  -52  56       IMP:N=1 U=16
        c           PANEL - ASSEMBLY LEFT
        158   1  -2.1024  -52          IMP:N=1 U=16
        c           WATER GAP       - ASSEMBLY BOTTOM
        159   1  -2.1024    53            IMP:N=1 U=17
        c        159   1  -2.1024    49          IMP:N=1 U=17
        c           OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
        c        160   6  -7.8320  -49  53       IMP:N=1 U=17
        c           CS TUBE - ASSEMBLY BOTTOM
        c        161   7  -7.8320  -53  57       IMP:N=1 U=17
        c           PANEL - ASSEMBLY BOTTOM
        162   1  -2.1024  -53          IMP:N=1 U=17
        c           WATER GAP       - ASSEMBLY RIGHT
        163   1  -2.1024  -54             IMP:N=1 U=18
        c        163   1  -2.1024  -50           IMP:N=1 U=18
        c           OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
        c        164   6  -7.8320   50 -54       IMP:N=1 U=18
        c           CS TUBE - ASSEMBLY RIGHT
```

```
c      165   7  -7.8320    54 -58        IMP:N=1 U=18
c         PANEL - ASSEMBLY RIGHT
166    1  -2.1024    54           IMP:N=1 U=18
c         WATER GAP      - ASSEMBLY TOP
167    1  -2.1024  -55                IMP:N=1 U=19
c      167   1  -2.1024  -51                 IMP:N=1 U=19
c         OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c      168   6  -7.8320    51 -55       IMP:N=1 U=19
c         CS TUBE - ASSEMBLY TOP
c      169   7  -7.8320    55 -59       IMP:N=1 U=19
c         PANEL - ASSEMBLY TOP
170    1  -2.1024    55           IMP:N=1 U=19
c      FUEL CELL BASKET STRUCTURE -          DRY - Unborated panels
c         GAP        - ASSEMBLY LEFT
171    3  -0.001225    52              IMP:N=1 U=20
c      171   3  -0.001225    48               IMP:N=1 U=20
c         OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c      172   6  -7.8320   -48  52       IMP:N=1 U=20
c         CS TUBE - ASSEMBLY LEFT
c      173   7  -7.8320   -52  56       IMP:N=1 U=20
c         PANEL - ASSEMBLY LEFT
174    3  -0.001225   -52          IMP:N=1 U=20
c         GAP        - ASSEMBLY BOTTOM
175    3  -0.001225    53              IMP:N=1 U=21
c      175   3  -0.001225    49               IMP:N=1 U=21
c         OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c      176   6  -7.8320   -49  53       IMP:N=1 U=21
c         CS TUBE - ASSEMBLY BOTTOM
c      177   7  -7.8320   -53  57       IMP:N=1 U=21
c         PANEL - ASSEMBLY BOTTOM
178    3  -0.001225   -53          IMP:N=1 U=21
c         GAP        - ASSEMBLY RIGHT
179    3  -0.001225   -54              IMP:N=1 U=22
c      179   3  -0.001225   -50               IMP:N=1 U=22
c         OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c      180   6  -7.8320    50 -54        IMP:N=1 U=22
c         CS TUBE - ASSEMBLY RIGHT
c      181   7  -7.8320    54 -58        IMP:N=1 U=22
c         PANEL - ASSEMBLY RIGHT
182    3  -0.001225    54          IMP:N=1 U=22
c         GAP        - ASSEMBLY TOP
183    3  -0.001225   -55              IMP:N=1 U=23
c      183   3  -0.001225   -51               IMP:N=1 U=23
c         OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c      184   6  -7.8320    51 -55       IMP:N=1 U=23
c         CS TUBE - ASSEMBLY TOP
c      185   7  -7.8320    55 -59       IMP:N=1 U=23
c         PANEL - ASSEMBLY TOP
186    3  -0.001225    55          IMP:N=1 U=23

c      SURFACE SPECIFICATIONS
1*     PX     0.0
c      2*     PY     0.00       $ For 1/4 Model
3*     PZ     0.00
c      4      PX    12.30       $ For Collapsed Model
c      5      PX    36.90       $ For Collapsed Model
c      6      PY    12.30       $ Water Level Surface
c      7      PY    36.90       $ Water Level Surface
c      8      PY   -12.30       $ Water Level Surface
c      9      PY   -36.90       $ Water Level Surface
```

```
10   PZ  180.0860     $ TOP ACTIVE FUEL
11   PZ  201.2360     $ TOP FUEL HARDWARE
c    12   PZ  226.75       $ TOP TUBE - (Shielding Model)
13   PZ  228.75       $ TOP OF BASKET MATERIAL
14   PZ  229.25       $ TOP RING/WATER GAP
15   PZ  231.75       $ TOP INNER LID
16   PZ  234.75       $ TOP LID GAP
17   PZ  245.75       $ TOP OUTER LID
c    18   PZ  268.25       $ TOP SKIRT - (Shielding Model)
19   PZ  298.75       $ TOP REFLECTOR REGION
20   CZ   71.095      $ ID OF INNER BARRIER
21   CZ   73.095      $ OD OF INNER BARRIER
22   CZ   73.10       $ ID OF OUTER BARRIER
c    23   CZ    76.45      $ ID OF SKIRT LIP - (Shielding Model)
24   CZ   83.10       $ OD OF OUTER BARRIER
25   CZ  113.60       $ OD OF REFLECTOR REGION
c    PIN LATTICE BOUNDS
26   PX  0.72136
27   PX -0.72136
28   PY  0.72136
29   PY -0.72136
c     FUEL ROD
30   CZ  0.468122
31   CZ  0.478790
32   CZ  0.546100
c     CONTROL ROD/GUIDE TUBE
33   CZ  0.45340  $ 0.49022
34   CZ  0.46990  $ 0.50292
35   CZ  0.54610  $ 0.56007
36   CZ  0.62230  $ 0.63246
37   CZ  0.67310
c     INSTRUMENTATION TUBE
38   CZ  0.56007
39   CZ  0.62611
c    ASSEMBLY LATTICE BOUNDS Actual
44   PX  -10.65  $ ACTUAL 10.82025
45   PY  -10.65
46   PX   10.65
47   PY   10.65
c    48   PX  -11.0  $ Corrosion Expansion Cards
c    49   PY  -11.0
c    50   PX   11.0
c    51   PY   11.0
52   PX  -10.650001  $ UCF Intact Inside Tube ID
53   PY  -10.650001
54   PX   10.650001
55   PY   10.650001
56   PX  -11.95   $ UCF Intact Outside Tube ID
57   PY  -11.95
58   PX   11.95
59   PY   11.95
c    FUEL CELL LATTICE BOUNDS
60   PX  -10.65     $ ACTUAL 12.30
61   PX   10.65
62   PY  -10.65
63   PY   10.65
c    45 degree planes
64   P    1. -1.  0. 0.
65   P    1.  1.  0. 0.
c    EXTRA CARDS
```

```
MODE   N
C      VOL    88J
KCODE    4000 1. 7 97
C        KSRC    -4.3   -5.7 1.   -2.8   -5.7 5.   -1.4   -5.7 10.   0.    -5.7  5.
C         1.44 -5.7 3.    2.88 -5.7 8.    4.32 -5.7   9.
C        -5.7  -4.3 2.  -4.3   -4.3 1.  -2.8   -4.3   5.  -1.4   -4.3 10.
C         0.   -4.3 5.   1.44  -4.3 3.   2.88  -4.3   8.   4.32  -4.3  9.
C        -5.7  -2.9 2.  -4.3   -2.9 1.                    -1.4   -2.9 10.
C         0.   -2.9 5.                   2.88  -2.9   8.   4.32  -2.0  9.
C        -5.7  -1.4 2.  -4.3   -1.4 1.  -2.8   -1.4   5.  -1.4   -1.4 10.
C         0.   -1.4 5.   1.44  -1.4 3.   2.88  -1.4   8.   4.32  -1.4  9.
C        -5.7   0.0 2.  -4.3    0.0 1.  -2.8    0.0   5.  -1.4    0.0 10.
C                        1.44   0.0 3.   2.88   0.0   8.   4.32   0.0  9.
C        -5.7   1.4 2.                  -2.8    1.4   5.  -1.4    1.4 10.
C         0.    1.4 5.   1.44   1.4 3.   2.88   1.4   8.   4.32   1.4  9.
C        -5.7   2.9 2.  -4.3    2.9 1.  -2.8    2.9   5.  -1.4    2.9 10.
C         0.    2.9 5.   1.44   2.9 3.   2.88   2.9   8.   4.32   2.9  9.
C        -5.7   4.3 2.  -4.3    4.3 1.  -2.8    4.3   5.  -1.4    4.3 10.
C         0.    4.3 5.   1.44   4.3 3.   2.88   4.3   8.   4.32   4.3  9.
C       MATERIAL SPECIFICATIONS
C           WATER AT 300 K d=1.0000 g/cc w/ 26% Fe2O3 w/ 5% B10
M1     1001.50C  4.9490-2     8016.50C  4.0160-2  26000.55C 1.0277-2
       5010.50C  2.8870-6
MT1    LWTR.01T
C           3.00%/20 GWD  15000 yr decay  0 yr crit
M2          8016.50C       4.6947E-02
      42095.50C   2.8413E-05
      43099.50C   2.6655E-05
      44101.50C   2.6008E-05
      45103.50C   1.6846E-05
      47109.50C   2.4208E-06
      60143.50C   2.2660E-05
      60145.50C   1.6864E-05
      62147.50C   7.3501E-06
      62149.50C   1.1479E-07
      62150.50C   6.4561E-06
      63151.55C   4.9615E-07
      62152.50C   2.9636E-06
      63153.55C   2.1255E-06
      64155.50C   2.4710E-07
      64157.50C   2.3858E-09
      48000.50C   1.8989E-06
      54131.50C   1.2691E-05
      55133.50C   3.0887E-05
      92233.50C   1.2553E-07
      92234.50C   5.5037E-06
      92235.50C   3.6928E-04
      92236.50C   9.8940E-05
      92238.50C   2.2352E-02
      93237.55C   2.7474E-05
      94239.55C   8.6617E-05
      94240.50C   6.9205E-06
      94241.50C   1.1186E-12
      94242.50C   3.4266E-06
      95241.50C   3.5158E-11
      95243.50C   1.2184E-07
C           WATER AT 300 K d=1.0000 g/cc
M3     1001.50C  6.6878-2     8016.50C  3.3439-2
MT3    LWTR.01T
```

```
        C          Air d=0.001225 g/cc
        C     M3     7014.50C  -0.80   8016.50C  -0.20
        C          ZIRCALOY-4 d=6.56 g/cc
        M4     8016.50C -0.0012  24000.50C -0.0010  26000.55C -0.0020
              40000.50C -0.9818  50000.35C -0.0140
        C         ALLOY 825 d=8.14 g/cc
        M5     6000.50C -0.0005  13027.50C -0.0020  14000.50C -0.0050
              16032.50C -0.0003  22000.50C -0.0090  24000.50C -0.2150
              25055.50C -0.0100  26000.55C -0.2857  28000.50C -0.4200
              29000.50C -0.0225  42000.50C -0.0300
        C         Oxidized A516 CARBON STEEL and Water Mixture d=7.832 g/cc
        C     M6     6000.50C -0.00220  14000.50C -0.002750  15031.50C -0.00035
        C           16032.50C -0.00035  25055.50C -0.0090
        C           26000.55C -0.98535
        C         A516 CARBON STEEL d=7.832 g/cc
        M7     6000.50C -0.00220  14000.50C -0.002750  15031.50C -0.00035
              16032.50C -0.00035  25055.50C -0.0090
              26000.55C -0.98535
        C         SS316B6A  1.6%  d=7.77 g/cc
        M8     5010.50C -0.00288  5011.50C -0.013120
               6000.50C -0.00030  7014.50C -0.00100 14000.50C -0.0075
              15031.50C -0.00045 16032.50C -0.00030 24000.50C -0.19000
              25055.50C -0.02000 26000.55C -0.60445 28000.50C -0.13500
              42000.50C -0.02500
        C         SS316B3A 0.87wt% B d=7.83 g/cc
        C     M9     5010.50C -0.001566 5011.50C -0.007134
        C            6000.50C -0.00030  7014.50C -0.00100 14000.50C -0.00750
        C           15031.50C -0.00045 16032.50C -0.00030 24000.50C -0.19000
        C           25055.50C -0.02000 26000.55C -0.60445 28000.50C -0.13500
        C           42000.50C -0.02500
        C         Al 6063 d=2.69 g/cc
        C     M10  12000.50C -0.00675  13027.50C -0.98125  14000.50C -0.00400
        C           22000.50C -0.00150  24000.50C -0.00100  25055.50C -0.00100
        C           26000.55C -0.00350  29000.50C -0.00100
        C     TALLIES
        PRINT

1     initial source from file   srctp
```

1problem summary

run terminated when 97 kcode cycles were done.

\+ AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5c)   probid = 08/20/96 17:19:50   08/20/96 19:10:37

0

neutron creation	tracks	weight (per source particle)	energy	neutron loss	tracks	weight (per source particle)	energy
source	387087	1.0024E+00	2.0572E+00	escape	5	7.0869E-06	1.8240E-05
				energy cutoff	0	0.	0.
				time cutoff	0	0.	0.
weight window	0	0.	0.	weight window	0	0.	0.
cell importance	0	0.	0.	cell importance	0	0.	0.
weight cutoff	0	4.9996E-02	6.1536E-06	weight cutoff	387745	4.9806E-02	8.3240E-06
energy importance	0	0.	0.	energy importance	0	0.	0.
dxtran	0	0.	0.	dxtran	0	0.	0.
forced collisions	0	0.	0.	forced collisions	0	0.	0.
exp. transform	0	0.	0.	exp. transform	0	0.	0.

```
upscattering              0     0.            7.3602E-08        downscattering          0    0.             1.9223E+00
                                                                capture                 0    6.5791E-01     3.5810E-02
(n,xn)                 1324     2.7042E-03    2.1498E-03        loss to (n,xn)        661    1.3507E-03     1.1386E-02
fission                   0     0.            0.                loss to fission         0    3.4598E-01     8.9877E-02
    total            388411     1.0551E+00    2.0594E+00            total          388411    1.0551E+00     2.0594E+00

  number of neutrons banked                         663       average lifetime, shakes           cutoffs
  neutron tracks per source particle     1.0034E+00            escape           1.9585E+04         tco   1.0000E+34
  neutron collisions per source particle 4.6254E+01            capture          2.3100E+03         eco    .0000E+00
  total neutron collisions                     17904367        capture or escape 2.3101E+03        wc1  -5.0000E-01
  net multiplication               1.0014E+00  .0001           any termination  2.4720E+03         wc2  -2.5000E-01

computer time so far in this run   110.41 minutes              maximum number ever in bank         2
computer time in mcrun             110.31 minutes              bank overflows to backup file       0
source particles per minute            3.5090E+03              field length                        0
random numbers generated                251075470              most random numbers used was     8243 in history   186679

range of sampled source weights = 9.5648E-01 to 1.1034E+00
1keff results for: AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5c)        probid =   08/20/96 17:19:50

the initial fission neutron source distribution was read from the srctp file named srctp   .
the criticality problem was scheduled to skip   7 cycles and run a total of   97 cycles with nominally     4000 neutrons per cycle.
this problem has run   7 inactive cycles with    27818 neutron histories and   90 active cycles with      359269 neutron histories.

this calculation has completed the requested number of keff cycles using a total of      387087 fission neutron source histories.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

the following cells with fissionable material had no neutron tracks entering:
    97

the following cells with fissionable material had no neutron collisions:
    97

the following cells with fissionable material had no fission source points:
    97

warning.     1 fissionable cells had no tracks entering,    1 cells had no collisions, and    1 cells had no fission source points.
               the keff results could be too small because these cells with fissionable material were not sampled.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

          the k( collision) cycle values appear normally distributed at the 95 percent confidence level
          the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
          the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

----------------------------------------------------------------------------------------------------------------------------------
| the final estimated combined collision/absorption/track-length keff =  .89668 with an estimated standard deviation of  .00102 |
| the estimated 68, 95, & 99 percent keff confidence intervals are  .89565 to  .89770,  .89464 to  .89871, and  .89398 to  .89938 |
| the estimated collision/absorption neutron removal lifetime = 2.31E-05 seconds with an estimated standard deviation of 4.98E-08 |
----------------------------------------------------------------------------------------------------------------------------------
```

the estimated average keffs, one standard deviations, and 68, 95, and 99 percent confidence intervals are:

keff estimator	keff	standard deviation	68% confidence	95% confidence	99% confidence	corr
collision	.89604	.00130	.89474 to .89734	.89346 to .89862	.89262 to .89946	
absorption	.89705	.00120	.89584 to .89825	.89464 to .89945	.89386 to .90023	
track length	.89634	.00139	.89495 to .89773	.89357 to .89910	.89267 to .90000	
col/absorp	.89661	.00107	.89554 to .89768	.89448 to .89874	.89378 to .89943	.4478
abs/trk len	.89676	.00102	.89573 to .89778	.89472 to .89879	.89406 to .89945	.2475
col/trk len	.89615	.00124	.89492 to .89739	.89369 to .89862	.89289 to .89942	.6950
col/abs/trk len	.89668	.00102	.89565 to .89770	.89464 to .89871	.89398 to .89938	

```
1mcnp     version 4a    ld=10/01/93                              08/22/96 17:36:25
*****************************************************************************          probid =    08/22/96 17:36:25
 inp=a26xb5d outp=a26xb5d0

        AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5d)
        C      Advanced Uncanistered Fuel Waste Package, collapsed basket 10k 26%/5%B
        C      15000 year decay  1000 yr criticality
        C      CELL SPECIFICATIONS
        C        Assembly Sub-lattices - 1/2 Model
        1      0       1  3 -13 -20   FILL=1 (0 -74 0) IMP:N=1
        C      1     0          1  3  -4 -13 -20   FILL=1 (0 -73.8 0) IMP:N=1
        C      2     0          3  4  -5 -13 -20   FILL=1 (0 -73.8 0) IMP:N=1
        C      3     0          3  5 -13 -20       FILL=1 (0 -73.8 0) IMP:N=1
        C        Assembly Sub-lattices - 1/4 Model
        C      1     0          1   2   3  -4 -13 -20   FILL=1 (0 -12.3 0) IMP:N=1
        C      2     0          2   3   4  -5 -13 -20   FILL=1 (0 -12.3 0) IMP:N=1
        C      3     0          2   3   5 -13 -20       FILL=1 (0 -12.3 0) IMP:N=1
        C      ASSEMBLY LATTICE DESCRIPTION
        5      1  -2.1024  -61  60 -63  62   IMP:N=1 LAT=1 U=1
               FILL=0:3 0:7 0:0  1 1  1  1  56 56 1  1  56 56 56 1
                                 56 56 56 1  56 56 56 1  56 56 1  1
                                 1 1  1  1   1 1 1 1     $ 1/2 model
        C      5     1  -2.1024   60 -61  62 -63  IMP:N=1 LAT=1 U=1
        C             FILL=0:3 0:3 0:0  58 58 64 70  58 58 62 70
        C                               60 62 70  1  70 70  1  1 $ 1/4 model
        C      BARRIER CELLS
        C      Basket Material-Lid Gap
        76     3  -1.0000    1 -20  13  -14      IMP:N=1 $ 1/2 model
        C      76    1  -2.1024    1   2 -20  13  -14      IMP:N=1 $ 1/4 model
        C      Inner Barrier
        77     5  -8.1400    1   3  20 -21 -14  IMP:N=1 $ 1/2 model
        C      77    5  -8.1400    1   2   3  20 -21 -14  IMP:N=1 $ 1/4 model
        C      Inner Lid
        78     5  -8.1400    1  14 -15 -21       IMP:N=1 $ 1/2 model
        C      78    5  -8.1400    1   2  14 -15 -21       IMP:N=1 $ 1/4 model
        C       Gap between Inner and Outer Barrier Lids
        79     3  -1.0000    1  15 -16 -21       IMP:N=1 $ 1/2 model
        C      79    1  -2.1024    1   2  15 -16 -21       IMP:N=1 $ 1/4 model
        C       Gap between Inner and Outer Barriers
        80     3  -1.0000   21 -22   1   3 -16  IMP:N=1 $ 1/2 model
        C      80    1  -2.1024   21 -22   1   2   3 -16  IMP:N=1 $ 1/4 model
        C      Outer Barrier
        81     7  -7.8320   22 -24   1   3 -16  IMP:N=1 $ 1/2 model
        C      81    7  -7.8320   22 -24   1   2   3 -16  IMP:N=1 $ 1/4 model
        C      Outer Barrier Lid
        82     7  -7.8320    1 -24  16 -17       IMP:N=1 $ 1/2 model
        C      82    7  -7.8320    1   2 -24  16 -17       IMP:N=1 $ 1/4 model
        C      12" of Water around Container
        83     3  -1.0000   24 -25   1   3 -17  IMP:N=1 $ 1/2 model
        C      83    1  -2.1024   24 -25   1   2   3 -17  IMP:N=1 $ 1/4 model
        C      12" of Water above Container
        84     3  -1.0000   17 -19   1 -25       IMP:N=1 $ 1/2 model
        C      84    1  -2.1024   17 -58   1   2 -59       IMP:N=1 $ 1/4 model
        C      OUTSIDE WORLD
        85     0  -1:-3:19:25  IMP:N=0  $ 1/2 model
        C      85    0  -1:-2:-3:19:25  IMP:N=0  $ 1/4 model
        C      WET PIN LATTICE DESCRIPTION
        86     1  -2.1024  -26 27 -28  29  IMP:N=1 LAT=1  U=56
               FILL -8:8 -8:8 0:0  56 16R  56 2 14R 56  56 2 14R 56
                                   56 2 4R 4 2 2R 4 2 4R 56
```

```
                          56 2 2R 4 2 6R 4 2 2R 56  56 2 14R 56
                          56 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 56
                          56 2 14R 56
                          56 2 6R 6 2 6R 56
                          56 2 14R 56
                          56 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 56
                          56 2 14R 56  56 2 2R 4 2 6R 4 2 2R 56
                          56 2 4R 4 2 2R 4 2 4R 56
                          56 2 14R 56  56 2 14R 56  56 16R
c     MIXED PIN LATTICE DESCRIPTION
c     87    3  -0.001225  -26 27 -28  29  IMP:N=1 LAT=1  U=72
c      FILL -8:8 -8:8 0:0  57 16R  57 3 14R 57  57 3 14R 57
c                          57 3 4R 5 3 2R 5 3 4R 57
c                          57 3 2R 5 3 6R 5 3 2R 57  57 3 14R 57
c                          57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
c                          57 3 14R 57
c                          57 3 6R 7 3 6R 57
c                          57 2 14R 57
c                          57 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 57
c                          57 2 14R 57  57 2 2R 4 2 6R 4 2 2R 57
c                          57 2 4R 4 2 2R 4 2 4R 57
c                          57 2 14R 57  57 2 14R 57  57 16R
c     DRY PIN LATTICE DESCRIPTION
88    3  -0.001225  -26 27 -28  29  IMP:N=1 LAT=1  U=57
      FILL -8:8 -8:8 0:0  57 16R  57 3 14R 57  57 3 14R 57
                          57 3 4R 5 3 2R 5 3 4R 57
                          57 3 2R 5 3 6R 5 3 2R 57  57 3 14R 57
                          57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
                          57 3 14R 57
                          57 3 6R 7 3 6R 57
                          57 3 14R 57
                          57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
                          57 3 14R 57  57 3 2R 5 3 6R 5 3 2R 57
                          57 3 4R 5 3 2R 5 3 4R 57
                          57 3 14R 57  57 3 14R 57  57 16R
c     WET FUEL ROD
89    2   7.0103E-02   -30 -10     IMP:N=1 U=2
90    4  -6.5600   -30  10 -11 IMP:N=1 U=2
91    1  -2.1024   -30  11     IMP:N=1 U=2
92    1  -2.1024    30 -31 -11 IMP:N=1 U=2
93    1  -2.1024    30 -31  11 IMP:N=1 U=2
94    4  -6.5600    31 -32 -11 IMP:N=1 U=2
95    1  -2.1024    31 -32  11 IMP:N=1 U=2
96    1  -2.1024    32         IMP:N=1 U=2
c     DRY FUEL ROD
97    2   7.0103E-02   -30 -10     IMP:N=1 U=3
98    4  -6.5600   -30  10 -11 IMP:N=1 U=3
99    3  -0.001225   -30  11     IMP:N=1 U=3
100   3  -0.001225    30 -31 -11 IMP:N=1 U=3
101   3  -0.001225    30 -31  11 IMP:N=1 U=3
102   4  -6.5600    31 -32 -11 IMP:N=1 U=3
103   3  -0.001225    31 -32  11 IMP:N=1 U=3
104   3  -0.001225    32         IMP:N=1 U=3
c     WET CONTROL ROD/GUIDE TUBE
105   1  -2.1024  -33        IMP:N=1 U=4  $ No DCRA Rod
c     105   9  -7.8300  -33       IMP:N=1 U=4  $ DCRA Rod
106   1  -2.1024   33  -34  IMP:N=1 U=4
107   1  -2.1024   34  -35  IMP:N=1 U=4  $ No DCRA Cladding
c     107   4  -6.5600   34  -35  IMP:N=1 U=4  $ DCRA Cladding
108   1  -2.1024   35  -36  IMP:N=1 U=4
```

```
109  4  -6.5600   36  -37  IMP:N=1 U=4
110  1  -2.1024   37       IMP:N=1 U=4
c    DRY CONTROL ROD/GUIDE TUBE
111  3  -0.001225  -33      IMP:N=1 U=5  $ No DCRA Rod
c    111   9  -7.8300   -33       IMP:N=1 U=5  $ DCRA Rod
112  3  -0.001225   33  -34  IMP:N=1 U=5
113  3  -0.001225   34  -35  IMP:N=1 U=5  $ No DCRA Cladding
c    113   4  -6.5600   34  -35  IMP:N=1 U=5  $ DCRA Cladding
114  3  -0.001225   35  -36  IMP:N=1 U=5
115  4  -6.5600   36  -37  IMP:N=1 U=5
116  3  -0.001225   37      IMP:N=1 U=5
c    WET INSTRUMENTATION TUBE
117  1  -2.1024  -38        IMP:N=1 U=6
118  4  -6.5600   38 -39    IMP:N=1 U=6
119  1  -2.1024   39        IMP:N=1 U=6
c    DRY INSTRUMENTATION TUBE
120  3  -0.001225  -38        IMP:N=1 U=7
121  4  -6.5600   38 -39    IMP:N=1 U=7
122  3  -0.001225   39        IMP:N=1 U=7
c    FUEL CELL BASKET STRUCTURE
c    Code: boron in [B=] all panels [all], left [l], bottom, [b], right [r], to
c    FUEL CELL BASKET STRUCTURE -         WET - Borated panels
c       WATER GAP       - ASSEMBLY LEFT
123  1  -2.1024   52              IMP:N=1 U=8
c    123   1  -2.1024   48              IMP:N=1 U=8
c       OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c    124   6  -7.8320  -48  52       IMP:N=1 U=8
c       CS TUBE - ASSEMBLY LEFT
c    125   7  -7.8320  -52  56       IMP:N=1 U=8
c       SS PANEL - ASSEMBLY LEFT
126  8  -7.7700  -52         IMP:N=1 U=8
c       WATER GAP       - ASSEMBLY BOTTOM
127  1  -2.1024   53              IMP:N=1 U=9
c    127   1  -2.1024   49              IMP:N=1 U=9
c       OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c    128   6  -7.8320  -49  53       IMP:N=1 U=9
c       CS TUBE - ASSEMBLY BOTTOM
c    129   7  -7.8320  -53  57       IMP:N=1 U=9
c       SS PANEL - ASSEMBLY BOTTOM
130  8  -7.7700  -53         IMP:N=1 U=9
c       WATER GAP       - ASSEMBLY RIGHT
131  1  -2.1024  -54              IMP:N=1 U=10
c    131   1  -2.1024  -50              IMP:N=1 U=10
c       OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c    132   6  -7.8320   50 -54       IMP:N=1 U=10
c       CS TUBE - ASSEMBLY RIGHT
c    133   7  -7.8320   54 -58       IMP:N=1 U=10
c       SS PANEL - ASSEMBLY RIGHT
134  8  -7.7700   54          IMP:N=1 U=10
c       WATER GAP       - ASSEMBLY TOP
135  1  -2.1024  -55              IMP:N=1 U=11
c    135   1  -2.1024  -51              IMP:N=1 U=11
c       OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c    136   6  -7.8320   51 -55       IMP:N=1 U=11
c       CS TUBE - ASSEMBLY TOP
c    137   7  -7.8320   55 -59       IMP:N=1 U=11
c       SS PANEL - ASSEMBLY TOP
138  8  -7.7700   55          IMP:N=1 U=11
c    FUEL CELL BASKET STRUCTURE -         DRY - Borated panels
c       GAP      - ASSEMBLY LEFT
```

```
139   3  -0.001225   52              IMP:N=1 U=12
c        139   3  -0.001225   48              IMP:N=1 U=12
c           OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c        140   6  -7.8320  -48  52       IMP:N=1 U=12
c           CS TUBE - ASSEMBLY LEFT
c        141   7  -7.8320  -52  56       IMP:N=1 U=12
c           SS PANEL - ASSEMBLY LEFT
142   8  -7.7700  -52             IMP:N=1 U=12
c           GAP      - ASSEMBLY BOTTOM
143  3  -0.001225   53              IMP:N=1 U=13
c        143   3  -0.001225   49              IMP:N=1 U=13
c           OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c        144   6  -7.8320  -49  53       IMP:N=1 U=13
c           CS TUBE - ASSEMBLY BOTTOM
c        145   7  -7.8320  -53  57       IMP:N=1 U=13
c           SS PANEL - ASSEMBLY BOTTOM
146   8  -7.7700  -53             IMP:N=1 U=13
c           GAP      - ASSEMBLY RIGHT
147   3  -0.001225  -54             IMP:N=1 U=14
c        147   3  -0.001225  -50              IMP:N=1 U=14
c           OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c        148   6  -7.8320   50 -54       IMP:N=1 U=14
c           CS TUBE - ASSEMBLY RIGHT
c        149   7  -7.8320   54 -58       IMP:N=1 U=14
c           SS PANEL - ASSEMBLY RIGHT
150   8  -7.7700   54             IMP:N=1 U=14
c           GAP      - ASSEMBLY TOP
151   3  -0.001225  -55             IMP:N=1 U=15
c        151   3  -0.001225  -51              IMP:N=1 U=15
c           OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c        152   6  -7.8320   51 -55       IMP:N=1 U=15
c           CS TUBE - ASSEMBLY TOP
c        153   7  -7.8320   55 -59       IMP:N=1 U=15
c           SS PANEL - ASSEMBLY TOP
154   8  -7.7700   55             IMP:N=1 U=15
c        FUEL CELL BASKET STRUCTURE -        WET - Unborated panels
c           WATER GAP      - ASSEMBLY LEFT
155   1  -2.1024   52             IMP:N=1 U=16
c        155   1  -2.1024   48             IMP:N=1 U=16
c           OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c        156   6  -7.8320  -48  52       IMP:N=1 U=16
c           CS TUBE - ASSEMBLY LEFT
c        157   7  -7.8320  -52  56       IMP:N=1 U=16
c           PANEL - ASSEMBLY LEFT
158   1  -2.1024  -52             IMP:N=1 U=16
c           WATER GAP      - ASSEMBLY BOTTOM
159   1  -2.1024   53             IMP:N=1 U=17
c        159   1  -2.1024   49             IMP:N=1 U=17
c           OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c        160   6  -7.8320  -49  53       IMP:N=1 U=17
c           CS TUBE - ASSEMBLY BOTTOM
c        161   7  -7.8320  -53  57       IMP:N=1 U=17
c           PANEL - ASSEMBLY BOTTOM
162   1  -2.1024  -53             IMP:N=1 U=17
c           WATER GAP      - ASSEMBLY RIGHT
163   1  -2.1024  -54             IMP:N=1 U=18
c        163   1  -2.1024  -50             IMP:N=1 U=18
c           OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c        164   6  -7.8320   50 -54       IMP:N=1 U=18
c           CS TUBE - ASSEMBLY RIGHT
```

```
c      165   7  -7.8320   54 -58         IMP:N=1 U=18
c         PANEL - ASSEMBLY RIGHT
166    1  -2.1024   54          IMP:N=1 U=18
c         WATER GAP      - ASSEMBLY TOP
167    1  -2.1024  -55              IMP:N=1 U=19
c      167   1  -2.1024  -51                IMP:N=1 U=19
c         OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c      168   6  -7.8320   51 -55       IMP:N=1 U=19
c         CS TUBE - ASSEMBLY TOP
c      169   7  -7.8320   55 -59       IMP:N=1 U=19
c         PANEL - ASSEMBLY TOP
170    1  -2.1024   55          IMP:N=1 U=19
c      FUEL CELL BASKET STRUCTURE -          DRY - Unborated panels
c         GAP      - ASSEMBLY LEFT
171    3  -0.001225   52              IMP:N=1 U=20
c      171   3  -0.001225   48                IMP:N=1 U=20
c         OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c      172   6  -7.8320  -48  52       IMP:N=1 U=20
c         CS TUBE - ASSEMBLY LEFT
c      173   7  -7.8320  -52  56       IMP:N=1 U=20
c         PANEL - ASSEMBLY LEFT
174    3  -0.001225  -52          IMP:N=1 U=20
c         GAP      - ASSEMBLY BOTTOM
175    3  -0.001225   53              IMP:N=1 U=21
c      175   3  -0.001225   49                IMP:N=1 U=21
c         OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c      176   6  -7.8320  -49  53       IMP:N=1 U=21
c         CS TUBE - ASSEMBLY BOTTOM
c      177   7  -7.8320  -53  57       IMP:N=1 U=21
c         PANEL - ASSEMBLY BOTTOM
178    3  -0.001225  -53          IMP:N=1 U=21
c         GAP      - ASSEMBLY RIGHT
179    3  -0.001225  -54              IMP:N=1 U=22
c      179   3  -0.001225  -50                IMP:N=1 U=22
c         OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c      180   6  -7.8320   50 -54        IMP:N=1 U=22
c         CS TUBE - ASSEMBLY RIGHT
c      181   7  -7.8320   54 -58        IMP:N=1 U=22
c         PANEL - ASSEMBLY RIGHT
182    3  -0.001225   54          IMP:N=1 U=22
c         GAP      - ASSEMBLY TOP
183    3  -0.001225  -55              IMP:N=1 U=23
c      183   3  -0.001225  -51                IMP:N=1 U=23
c         OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c      184   6  -7.8320   51 -55       IMP:N=1 U=23
c         CS TUBE - ASSEMBLY TOP
c      185   7  -7.8320   55 -59       IMP:N=1 U=23
c         PANEL - ASSEMBLY TOP
186    3  -0.001225   55          IMP:N=1 U=23

c      SURFACE SPECIFICATIONS
1*     PX    0.0
c      2*   PY    0.00      $ For 1/4 Model
3*     PZ    0.00
c      4    PX   12.30      $ For Collapsed Model
c      5    PX   36.90      $ For Collapsed Model
c      6    PY   12.30      $ Water Level Surface
c      7    PY   36.90      $ Water Level Surface
c      8    PY  -12.30      $ Water Level Surface
c      9    PY  -36.90      $ Water Level Surface
```

```
10    PZ  180.0860     $ TOP ACTIVE FUEL
11    PZ  201.2360     $ TOP FUEL HARDWARE
c     12   PZ  226.75       $ TOP TUBE - (Shielding Model)
13    PZ  228.75       $ TOP OF BASKET MATERIAL
14    PZ  229.25       $ TOP RING/WATER GAP
15    PZ  231.75       $ TOP INNER LID
16    PZ  234.75       $ TOP LID GAP
17    PZ  245.75       $ TOP OUTER LID
c     18   PZ  268.25       $ TOP SKIRT - (Shielding Model)
19    PZ  298.75       $ TOP REFLECTOR REGION
20    CZ   71.095      $ ID OF INNER BARRIER
21    CZ   73.095      $ OD OF INNER BARRIER
22    CZ   73.10       $ ID OF OUTER BARRIER
c     23   CZ   76.45       $ ID OF SKIRT LIP - (Shielding Model)
24    CZ   83.10       $ OD OF OUTER BARRIER
25    CZ  113.60       $ OD OF REFLECTOR REGION
c     PIN LATTICE BOUNDS
26    PX  0.72136
27    PX -0.72136
28    PY  0.72136
29    PY -0.72136
c      FUEL ROD
30    CZ  0.468122
31    CZ  0.478790
32    CZ  0.546100
c      CONTROL ROD/GUIDE TUBE
33    CZ  0.45340  $ 0.49022
34    CZ  0.46990  $ 0.50292
35    CZ  0.54610  $ 0.56007
36    CZ  0.62230  $ 0.63246
37    CZ  0.67310
c      INSTRUMENTATION TUBE
38    CZ  0.56007
39    CZ  0.62611
c     ASSEMBLY LATTICE BOUNDS Actual
44    PX  -10.65  $ ACTUAL 10.82025
45    PY  -10.65
46    PX   10.65
47    PY   10.65
c     48   PX  -11.0  $ Corrosion Expansion Cards
c     49   PY  -11.0
c     50   PX   11.0
c     51   PY   11.0
52    PX  -10.650001  $ UCF Intact Inside Tube ID
53    PY  -10.650001
54    PX   10.650001
55    PY   10.650001
56    PX  -11.95   $ UCF Intact Outside Tube ID
57    PY  -11.95
58    PX   11.95
59    PY   11.95
c     FUEL CELL LATTICE BOUNDS
60    PX  -10.65     $ ACTUAL 12.30
61    PX   10.65
62    PY  -10.65
63    PY   10.65
c     45 degree planes
64    P    1. -1.  0. 0.
65    P    1.  1.  0. 0.
c     EXTRA CARDS
```

```
MODE   N
C      VOL    88J
KCODE    4000 1. 7 97
C        KSRC    -4.3  -5.7 1.  -2.8   -5.7 5.  -1.4   -5.7 10.   0.    -5.7  5.
C         1.44 -5.7 3.   2.88 -5.7 8.   4.32 -5.7  9.
C        -5.7  -4.3 2.  -4.3  -4.3 1.  -2.8  -4.3  5.  -1.4  -4.3 10.
C         0.   -4.3 5.   1.44 -4.3 3.   2.88 -4.3  8.   4.32 -4.3  9.
C        -5.7  -2.9 2.  -4.3  -2.9 1.                   -1.4  -2.9 10.
C         0.   -2.9 5.                  2.88 -2.9  8.   4.32 -2.0  9.
C        -5.7  -1.4 2.  -4.3  -1.4 1.  -2.8  -1.4  5.  -1.4  -1.4 10.
C         0.   -1.4 5.   1.44 -1.4 3.   2.88 -1.4  8.   4.32 -1.4  9.
C        -5.7   0.0 2.  -4.3   0.0 1.  -2.8   0.0  5.  -1.4   0.0 10.
C                        1.44  0.0 3.   2.88  0.0  8.   4.32  0.0  9.
C        -5.7   1.4 2.                 -2.8   1.4  5.  -1.4   1.4 10.
C         0.    1.4 5.   1.44  1.4 3.   2.88  1.4  8.   4.32  1.4  9.
C        -5.7   2.9 2.  -4.3   2.9 1.  -2.8   2.9  5.  -1.4   2.9 10.
C         0.    2.9 5.   1.44  2.9 3.   2.88  2.9  8.   4.32  2.9  9.
C        -5.7   4.3 2.  -4.3   4.3 1.  -2.8   4.3  5.  -1.4   4.3 10.
C         0.    4.3 5.   1.44  4.3 3.   2.88  4.3  8.   4.32  4.3  9.
C       MATERIAL SPECIFICATIONS
C           WATER AT 300 K d=1.0000 g/cc w/ 26% Fe2O3 w/ 5% B10
M1     1001.50C  4.9490-2    8016.50C  4.0160-2  26000.55C 1.0277-2
       5010.50C  2.8870-6
MT1    LWTR.01T
C           3.00%/20 GWD  15000 yr decay  1000 yr crit
M2          8016.50C       4.6947E-02
      42095.50C   2.8540E-05
      43099.50C   2.6777E-05
      44101.50C   2.6127E-05
      45103.50C   1.6846E-05
      47109.50C   2.4208E-06
      60143.50C   2.2744E-05
      60145.50C   1.6947E-05
      62147.50C   7.3829E-06
      62149.50C   9.5390E-08
      62150.50C   6.4882E-06
      62151.50C   2.4010E-09
      63151.55C   4.8817E-07
      62152.50C   2.9715E-06
      63153.55C   2.1334E-06
      64155.50C   2.1214E-07
      64157.50C   1.8105E-09
      48000.50C   1.9107E-06
      54131.50C   1.2691E-05
      55133.50C   3.0978E-05
      92233.50C   1.3328E-07
      92234.50C   5.5552E-06
      92235.50C   3.7030E-04
      92236.50C   9.9960E-05
      92238.50C   2.2352E-02
      93237.55C   2.7474E-05
      94238.50C   8.5464E-09
      94239.55C   8.4602E-05
      94240.50C   6.5193E-06
      94241.50C   1.5681E-09
      94242.50C   3.4117E-06
      95241.50C   3.7655E-08
      95242.50C   9.4492E-12
      95243.50C   1.1887E-07
```

```
        C        WATER AT 300 K d=1.0000 g/cc
        M3    1001.50C  6.6878-2    8016.50C  3.3439-2
        MT3   LWTR.01T
        C        Air d=0.001225 g/cc
        C   M3    7014.50C  -0.80    8016.50C  -0.20
        C        ZIRCALOY-4 d=6.56 g/cc
        M4    8016.50C -0.0012  24000.50C -0.0010  26000.55C -0.0020
             40000.50C -0.9818  50000.35C -0.0140
        C        ALLOY 825 d=8.14 g/cc
        M5    6000.50C -0.0005  13027.50C -0.0020  14000.50C -0.0050
             16032.50C -0.0003  22000.50C -0.0090  24000.50C -0.2150
             25055.50C -0.0100  26000.55C -0.2857  28000.50C -0.4200
             29000.50C -0.0225  42000.50C -0.0300
        C       Oxidized A516 CARBON STEEL and Water Mixture d=7.832 g/cc
        C   M6    6000.50C -0.00220  14000.50C -0.002750  15031.50C -0.00035
        C        16032.50C -0.00035  25055.50C -0.0090
        C        26000.55C -0.98535
        C       A516 CARBON STEEL d=7.832 g/cc
        M7    6000.50C -0.00220  14000.50C -0.002750  15031.50C -0.00035
             16032.50C -0.00035  25055.50C -0.0090
             26000.55C -0.98535
        C       SS316B6A  1.6%  d=7.77 g/cc
        M8    5010.50C -0.00288  5011.50C -0.013120
              6000.50C -0.00030  7014.50C -0.00100 14000.50C -0.0075
             15031.50C -0.00045 16032.50C -0.00030 24000.50C -0.19000
             25055.50C -0.02000 26000.55C -0.60445 28000.50C -0.13500
             42000.50C -0.02500
        C       SS316B3A 0.87wt% B d=7.83 g/cc
        C   M9    5010.50C -0.001566 5011.50C -0.007134
        C          6000.50C -0.00030  7014.50C -0.00100 14000.50C -0.00750
        C         15031.50C -0.00045 16032.50C -0.00030 24000.50C -0.19000
        C         25055.50C -0.02000 26000.55C -0.60445 28000.50C -0.13500
        C         42000.50C -0.02500
        C       Al 6063 d=2.69 g/cc
        C   M10  12000.50C -0.00675  13027.50C -0.98125  14000.50C -0.00400
        C        22000.50C -0.00150  24000.50C -0.00100  25055.50C -0.00100
        C        26000.55C -0.00350  29000.50C -0.00100
        C   TALLIES
        PRINT

1     initial source from file   srctp
1problem summary

      run terminated when    97 kcode cycles were done.
+                                                                          08/22/96 21:47:49
      AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5d)     probid =   08/22/96 17:36:25
0
```

neutron creation	tracks	weight (per source particle)	energy (per source particle)	neutron loss	tracks	weight (per source particle)	energy (per source particle)
source	387082	1.0024E+00	2.0569E+00	escape	3	4.2712E-06	2.1235E-05
				energy cutoff	0	0.	0.
				time cutoff	0	0.	0.
weight window	0	0.	0.	weight window	0	0.	0.
cell importance	0	0.	0.	cell importance	0	0.	0.
weight cutoff	0	5.0178E-02	2.3040E-06	weight cutoff	387754	5.0286E-02	6.6705E-06
energy importance	0	0.	0.	energy importance	0	0.	0.
dxtran	0	0.	0.	dxtran	0	0.	0.
forced collisions	0	0.	0.	forced collisions	0	0.	0.
exp. transform	0	0.	0.	exp. transform	0	0.	0.

```
upscattering            0     0.            7.4166E-08        downscattering          0    0.           1.9217E+00
                                                              capture                 0    6.5703E-01   3.6044E-02
(n,xn)               1349     2.7469E-03    2.0453E-03        loss to (n,xn)        674    1.3724E-03   1.1617E-02
fission                 0     0.            0.                loss to fission         0    3.4660E-01   8.9473E-02
   total           388431     1.0553E+00    2.0589E+00           total           388431    1.0553E+00   2.0589E+00

  number of neutrons banked                         675     average lifetime, shakes            cutoffs
  neutron tracks per source particle         1.0035E+00       escape          9.9733E+03         tco   1.0000E+34
  neutron collisions per source particle     4.6435E+01       capture         2.3235E+03         eco    .0000E+00
  total neutron collisions                     17974161       capture or escape 2.3235E+03       wc1  -5.0000E-01
  net multiplication                 1.0014E+00   .0001       any termination 2.4866E+03         wc2  -2.5000E-01

computer time so far in this run   115.30 minutes           maximum number ever in bank        2
computer time in mcrun             115.19 minutes           bank overflows to backup file      0
source particles per minute          3.3603E+03             field length                       0
random numbers generated              251752202             most random numbers used was   11029 in history   177534

range of sampled source weights = 9.4496E-01 to 1.1287E+00
1keff results for: AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5d)      probid =   08/22/96 17:36:25


the initial fission neutron source distribution was read from the srctp file named srctp   .
the criticality problem was scheduled to skip   7 cycles and run a total of   97 cycles with nominally     4000 neutrons per cycle.
this problem has run   7 inactive cycles with    27659 neutron histories and   90 active cycles with     359423 neutron histories.


this calculation has completed the requested number of keff cycles using a total of     387082 fission neutron source histories.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

the following cells with fissionable material had no neutron tracks entering:
    97

the following cells with fissionable material had no neutron collisions:
    97

the following cells with fissionable material had no fission source points:
    97

warning.     1 fissionable cells had no tracks entering,    1 cells had no collisions, and    1 cells had no fission source points.
               the keff results could be too small because these cells with fissionable material were not sampled.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

          the k( collision) cycle values appear normally distributed at the 95 percent confidence level
          the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
          the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

 -----------------------------------------------------------------------------------------------------------------------------
|                                                                                                                             |
| the final estimated combined collision/absorption/track-length keff =  .89888 with an estimated standard deviation of  .00096 |
|                                                                                                                             |
| the estimated 68, 95, & 99 percent keff confidence intervals are  .89792 to  .89984,  .89696 to  .90080, and  .89634 to  .90142 |
|                                                                                                                             |
| the estimated collision/absorption neutron removal lifetime = 2.33E-05 seconds with an estimated standard deviation of 5.63E-08 |
|                                                                                                                             |
 -----------------------------------------------------------------------------------------------------------------------------
```

the estimated average keffs, one standard deviations, and 68, 95, and 99 percent confidence intervals are:

keff estimator	keff	standard deviation	68% confidence	95% confidence	99% confidence	corr
collision	.89997	.00113	.89884 to .90110	.89772 to .90222	.89698 to .90296	
absorption	.89758	.00111	.89647 to .89870	.89537 to .89980	.89464 to .90052	
track length	.90063	.00134	.89928 to .90197	.89795 to .90330	.89708 to .90418	
col/absorp	.89874	.00097	.89778 to .89971	.89682 to .90067	.89619 to .90130	.4106
abs/trk len	.89872	.00099	.89773 to .89971	.89675 to .90069	.89611 to .90134	.2656
col/trk len	.90011	.00112	.89899 to .90123	.89788 to .90235	.89715 to .90307	.7102
col/abs/trk len	.89888	.00096	.89792 to .89984	.89696 to .90080	.89634 to .90142	

```
1mcnp     version 4a    ld=10/01/93                          08/20/96 21:00:04
 ***************************************************************************   probid =   08/20/96 21:00:04
 inp=a26xb5e outp=a26xb5e0

          AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5e)
          C      Advanced Uncanistered Fuel Waste Package, collapsed basket 10k 26%/5%B
          C      15000 year decay  1000 yr criticality
          C      CELL SPECIFICATIONS
          C        Assembly Sub-lattices - 1/2 Model
          1      0       1  3 -13 -20   FILL=1 (0 -74 0) IMP:N=1
          C      1      0       1  3  -4 -13 -20   FILL=1 (0 -73.8 0) IMP:N=1
          C      2      0       3  4  -5 -13 -20   FILL=1 (0 -73.8 0) IMP:N=1
          C      3      0       3  5 -13 -20       FILL=1 (0 -73.8 0) IMP:N=1
          C        Assembly Sub-lattices - 1/4 Model
          C      1      0       1   2   3  -4 -13 -20   FILL=1 (0 -12.3 0) IMP:N=1
          C      2      0       2   3   4  -5 -13 -20   FILL=1 (0 -12.3 0) IMP:N=1
          C      3      0       2   3   5 -13 -20       FILL=1 (0 -12.3 0) IMP:N=1
          C      ASSEMBLY LATTICE DESCRIPTION
          5      1  -2.1024  -61  60 -63  62  IMP:N=1 LAT=1 U=1
                 FILL=0:3 0:7 0:0  1 1  1  1  56 56 1  1  56 56 56 1
                                   56 56 56 1  56 56 56 1  56 56 1  1
                                   1 1  1  1   1 1 1 1       $ 1/2 model
          C      5      1  -2.1024   60 -61  62 -63  IMP:N=1 LAT=1 U=1
          C             FILL=0:3 0:3 0:0  58 58 64 70  58 58 62 70
          C                               60 62 70  1  70 70  1  1 $ 1/4 model
          C      BARRIER CELLS
          C      Basket Material-Lid Gap
          76     3  -1.0000    1 -20  13  -14     IMP:N=1 $ 1/2 model
          C      76    1  -2.1024    1   2 -20  13  -14    IMP:N=1 $ 1/4 model
          C      Inner Barrier
          77     5  -8.1400    1   3  20 -21 -14  IMP:N=1 $ 1/2 model
          C      77    5  -8.1400    1   2   3  20 -21 -14  IMP:N=1 $ 1/4 model
          C      Inner Lid
          78     5  -8.1400    1  14 -15 -21       IMP:N=1 $ 1/2 model
          C      78    5  -8.1400    1   2  14 -15 -21      IMP:N=1 $ 1/4 model
          C       Gap between Inner and Outer Barrier Lids
          79     3  -1.0000    1  15 -16 -21       IMP:N=1 $ 1/2 model
          C      79    1  -2.1024    1   2  15 -16 -21      IMP:N=1 $ 1/4 model
          C       Gap between Inner and Outer Barriers
          80     3  -1.0000   21 -22   1   3 -16  IMP:N=1 $ 1/2 model
          C      80    1  -2.1024   21 -22   1   2   3 -16  IMP:N=1 $ 1/4 model
          C      Outer Barrier
          81     7  -7.8320   22 -24   1   3 -16  IMP:N=1 $ 1/2 model
          C      81    7  -7.8320   22 -24   1   2   3 -16  IMP:N=1 $ 1/4 model
          C      Outer Barrier Lid
          82     7  -7.8320    1 -24  16 -17       IMP:N=1 $ 1/2 model
          C      82    7  -7.8320    1   2 -24  16 -17      IMP:N=1 $ 1/4 model
          C      12" of Water around Container
          83     3  -1.0000   24 -25   1   3 -17  IMP:N=1 $ 1/2 model
          C      83    1  -2.1024   24 -25   1   2   3 -17  IMP:N=1 $ 1/4 model
          C      12" of Water above Container
          84     3  -1.0000   17 -19   1 -25       IMP:N=1 $ 1/2 model
          C      84    1  -2.1024   17 -58   1   2 -59      IMP:N=1 $ 1/4 model
          C      OUTSIDE WORLD
          85     0  -1:-3:19:25  IMP:N=0  $ 1/2 model
          C      85    0  -1:-2:-3:19:25  IMP:N=0  $ 1/4 model
          C      WET PIN LATTICE DESCRIPTION
          86     1  -2.1024  -26 27 -28  29  IMP:N=1 LAT=1  U=56
                 FILL -8:8 -8:8 0:0  56 16R  56 2 14R 56  56 2 14R 56
                                     56 2 4R 4 2 2R 4 2 4R 56
```

```
                                56 2 2R 4 2 6R 4 2 2R 56  56 2 14R 56
                                56 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 56
                                56 2 14R 56
                                56 2 6R 6 2 6R 56
                                56 2 14R 56
                                56 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 56
                                56 2 14R 56  56 2 2R 4 2 6R 4 2 2R 56
                                56 2 4R 4 2 2R 4 2 4R 56
                                56 2 14R 56  56 2 14R 56  56 16R
c      MIXED PIN LATTICE DESCRIPTION
c      87    3  -0.001225  -26 27 -28  29  IMP:N=1 LAT=1  U=72
c       FILL -8:8 -8:8 0:0  57 16R  57 3 14R 57  57 3 14R 57
c                           57 3 4R 5 3 2R 5 3 4R 57
c                           57 3 2R 5 3 6R 5 3 2R 57  57 3 14R 57
c                           57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
c                           57 3 14R 57
c                           57 3 6R 7 3 6R 57
c                           57 2 14R 57
c                           57 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 57
c                           57 2 14R 57  57 2 2R 4 2 6R 4 2 2R 57
c                           57 2 4R 4 2 2R 4 2 4R 57
c                           57 2 14R 57  57 2 14R 57  57 16R
c      DRY PIN LATTICE DESCRIPTION
88     3  -0.001225  -26 27 -28  29  IMP:N=1 LAT=1  U=57
       FILL -8:8 -8:8 0:0  57 16R  57 3 14R 57  57 3 14R 57
                           57 3 4R 5 3 2R 5 3 4R 57
                           57 3 2R 5 3 6R 5 3 2R 57  57 3 14R 57
                           57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
                           57 3 14R 57
                           57 3 6R 7 3 6R 57
                           57 3 14R 57
                           57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
                           57 3 14R 57  57 3 2R 5 3 6R 5 3 2R 57
                           57 3 4R 5 3 2R 5 3 4R 57
                           57 3 14R 57  57 3 14R 57  57 16R
c      WET FUEL ROD
89     2   7.0104E-02   -30 -10      IMP:N=1 U=2
90     4  -6.5600    -30  10 -11  IMP:N=1 U=2
91     1  -2.1024    -30  11       IMP:N=1 U=2
92     1  -2.1024     30 -31 -11  IMP:N=1 U=2
93     1  -2.1024     30 -31  11  IMP:N=1 U=2
94     4  -6.5600     31 -32 -11  IMP:N=1 U=2
95     1  -2.1024     31 -32  11  IMP:N=1 U=2
96     1  -2.1024     32          IMP:N=1 U=2
c      DRY FUEL ROD
97     2   7.0104E-02   -30 -10      IMP:N=1 U=3
98     4  -6.5600    -30  10 -11  IMP:N=1 U=3
99     3  -0.001225    -30  11       IMP:N=1 U=3
100    3  -0.001225     30 -31 -11  IMP:N=1 U=3
101    3  -0.001225     30 -31  11  IMP:N=1 U=3
102    4  -6.5600    31 -32 -11  IMP:N=1 U=3
103    3  -0.001225     31 -32  11  IMP:N=1 U=3
104    3  -0.001225     32          IMP:N=1 U=3
c      WET CONTROL ROD/GUIDE TUBE
105    1  -2.1024  -33         IMP:N=1 U=4  $ No DCRA Rod
c      105   9  -7.8300   33         IMP:N=1 U=4  $ DCRA Rod
106    1  -2.1024   33  -34  IMP:N=1 U=4
107    1  -2.1024   34  -35  IMP:N=1 U=4  $ No DCRA Cladding
c      107   4  -6.5600   34  -35  IMP:N=1 U=4  $ DCRA Cladding
108    1  -2.1024   35  -36  IMP:N=1 U=4
```

```
109   4  -6.5600   36  -37  IMP:N=1 U=4
110   1  -2.1024   37       IMP:N=1 U=4
c     DRY CONTROL ROD/GUIDE TUBE
111   3  -0.001225  -33        IMP:N=1 U=5  $ No DCRA Rod
c     111   9  -7.8300  -33        IMP:N=1 U=5  $ DCRA Rod
112   3  -0.001225   33  -34  IMP:N=1 U=5
113   3  -0.001225   34  -35  IMP:N=1 U=5  $ No DCRA Cladding
c     113   4  -6.5600   34  -35  IMP:N=1 U=5  $ DCRA Cladding
114   3  -0.001225   35  -36  IMP:N=1 U=5
115   4  -6.5600   36  -37  IMP:N=1 U=5
116   3  -0.001225   37        IMP:N=1 U=5
c     WET INSTRUMENTATION TUBE
117   1  -2.1024  -38          IMP:N=1 U=6
118   4  -6.5600   38 -39      IMP:N=1 U=6
119   1  -2.1024   39          IMP:N=1 U=6
c     DRY INSTRUMENTATION TUBE
120   3  -0.001225  -38          IMP:N=1 U=7
121   4  -6.5600   38 -39      IMP:N=1 U=7
122   3  -0.001225   39          IMP:N=1 U=7
c     FUEL CELL BASKET STRUCTURE
c     Code: boron in [B=] all panels [all], left [l], bottom, [b], right [r], to
c     FUEL CELL BASKET STRUCTURE -        WET - Borated panels
c        WATER GAP      - ASSEMBLY LEFT
123   1  -2.1024   52              IMP:N=1 U=8
c     123   1  -2.1024   48              IMP:N=1 U=8
c        OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c     124   6  -7.8320  -48  52      IMP:N=1 U=8
c        CS TUBE - ASSEMBLY LEFT
c     125   7  -7.8320  -52  56      IMP:N=1 U=8
c        SS PANEL - ASSEMBLY LEFT
126   8  -7.7700  -52          IMP:N=1 U=8
c        WATER GAP      - ASSEMBLY BOTTOM
127   1  -2.1024   53              IMP:N=1 U=9
c     127   1  -2.1024   49              IMP:N=1 U=9
c        OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c     128   6  -7.8320  -49  53      IMP:N=1 U=9
c        CS TUBE - ASSEMBLY BOTTOM
c     129   7  -7.8320  -53  57      IMP:N=1 U=9
c        SS PANEL - ASSEMBLY BOTTOM
130   8  -7.7700  -53          IMP:N=1 U=9
c        WATER GAP      - ASSEMBLY RIGHT
131   1  -2.1024  -54              IMP:N=1 U=10
c     131   1  -2.1024  -50              IMP:N=1 U=10
c        OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c     132   6  -7.8320   50 -54      IMP:N=1 U=10
c        CS TUBE - ASSEMBLY RIGHT
c     133   7  -7.8320   54 -58      IMP:N=1 U=10
c        SS PANEL - ASSEMBLY RIGHT
134   8  -7.7700   54          IMP:N=1 U=10
c        WATER GAP      - ASSEMBLY TOP
135   1  -2.1024  -55              IMP:N=1 U=11
c     135   1  -2.1024  -51              IMP:N=1 U=11
c        OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c     136   6  -7.8320   51 -55      IMP:N=1 U=11
c        CS TUBE - ASSEMBLY TOP
c     137   7  -7.8320   55 -59      IMP:N=1 U=11
c        SS PANEL - ASSEMBLY TOP
138   8  -7.7700   55          IMP:N=1 U=11
c     FUEL CELL BASKET STRUCTURE -           DRY - Borated panels
c        GAP      - ASSEMBLY LEFT
```

```
139   3  -0.001225   52              IMP:N=1 U=12
c     139   3  -0.001225   48              IMP:N=1 U=12
c        OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c     140   6  -7.8320  -48  52      IMP:N=1 U=12
c        CS TUBE - ASSEMBLY LEFT
c     141   7  -7.8320  -52  56      IMP:N=1 U=12
c        SS PANEL - ASSEMBLY LEFT
142   8  -7.7700  -52          IMP:N=1 U=12
c        GAP      - ASSEMBLY BOTTOM
143 3  -0.001225   53             IMP:N=1 U=13
c     143   3  -0.001225   49              IMP:N=1 U=13
c        OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c     144   6  -7.8320  -49  53      IMP:N=1 U=13
c        CS TUBE - ASSEMBLY BOTTOM
c     145   7  -7.8320  -53  57      IMP:N=1 U=13
c        SS PANEL - ASSEMBLY BOTTOM
146   8  -7.7700  -53          IMP:N=1 U=13
c        GAP      - ASSEMBLY RIGHT
147   3  -0.001225  -54             IMP:N=1 U=14
c     147   3  -0.001225  -50              IMP:N=1 U=14
c        OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c     148   6  -7.8320   50 -54      IMP:N=1 U=14
c        CS TUBE - ASSEMBLY RIGHT
c     149   7  -7.8320   54 -58      IMP:N=1 U=14
c        SS PANEL - ASSEMBLY RIGHT
150   8  -7.7700   54          IMP:N=1 U=14
c        GAP      - ASSEMBLY TOP
151   3  -0.001225  -55             IMP:N=1 U=15
c     151   3  -0.001225  -51              IMP:N=1 U=15
c        OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c     152   6  -7.8320   51 -55      IMP:N=1 U=15
c        CS TUBE - ASSEMBLY TOP
c     153   7  -7.8320   55 -59      IMP:N=1 U=15
c        SS PANEL - ASSEMBLY TOP
154   8  -7.7700   55          IMP:N=1 U=15
c     FUEL CELL BASKET STRUCTURE -        WET - Unborated panels
c        WATER GAP      - ASSEMBLY LEFT
155   1  -2.1024   52             IMP:N=1 U=16
c     155   1  -2.1024   48             IMP:N=1 U=16
c        OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c     156   6  -7.8320  -48  52      IMP:N=1 U=16
c        CS TUBE - ASSEMBLY LEFT
c     157   7  -7.8320  -52  56      IMP:N=1 U=16
c        PANEL - ASSEMBLY LEFT
158   1  -2.1024  -52          IMP:N=1 U=16
c        WATER GAP      - ASSEMBLY BOTTOM
159   1  -2.1024   53             IMP:N=1 U=17
c     159   1  -2.1024   49             IMP:N=1 U=17
c        OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c     160   6  -7.8320  -49  53      IMP:N=1 U=17
c        CS TUBE - ASSEMBLY BOTTOM
c     161   7  -7.8320  -53  57      IMP:N=1 U=17
c        PANEL - ASSEMBLY BOTTOM
162   1  -2.1024  -53          IMP:N=1 U=17
c        WATER GAP      - ASSEMBLY RIGHT
163   1  -2.1024  -54             IMP:N=1 U=18
c     163   1  -2.1024  -50             IMP:N=1 U=18
c        OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c     164   6  -7.8320   50 -54      IMP:N=1 U=18
c        CS TUBE - ASSEMBLY RIGHT
```

```
c      165  7 -7.8320   54 -58      IMP:N=1 U=18
c         PANEL - ASSEMBLY RIGHT
166    1  -2.1024   54          IMP:N=1 U=18
c         WATER GAP      - ASSEMBLY TOP
167    1  -2.1024  -55              IMP:N=1 U=19
c      167   1  -2.1024  -51              IMP:N=1 U=19
c         OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c      168   6 -7.8320   51 -55      IMP:N=1 U=19
c         CS TUBE - ASSEMBLY TOP
c      169   7 -7.8320   55 -59      IMP:N=1 U=19
c         PANEL - ASSEMBLY TOP
170    1  -2.1024   55          IMP:N=1 U=19
c      FUEL CELL BASKET STRUCTURE -          DRY - Unborated panels
c         GAP       - ASSEMBLY LEFT
171    3  -0.001225   52              IMP:N=1 U=20
c      171   3  -0.001225   48              IMP:N=1 U=20
c         OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c      172   6 -7.8320  -48  52      IMP:N=1 U=20
c         CS TUBE - ASSEMBLY LEFT
c      173   7 -7.8320  -52  56      IMP:N=1 U=20
c         PANEL - ASSEMBLY LEFT
174    3  -0.001225  -52          IMP:N=1 U=20
c         GAP       - ASSEMBLY BOTTOM
175    3  -0.001225   53              IMP:N=1 U=21
c      175   3  -0.001225   49              IMP:N=1 U=21
c         OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c      176   6 -7.8320  -49  53      IMP:N=1 U=21
c         CS TUBE - ASSEMBLY BOTTOM
c      177   7 -7.8320  -53  57      IMP:N=1 U=21
c         PANEL - ASSEMBLY BOTTOM
178    3  -0.001225  -53          IMP:N=1 U=21
c         GAP       - ASSEMBLY RIGHT
179    3  -0.001225  -54              IMP:N=1 U=22
c      179   3  -0.001225  -50              IMP:N=1 U=22
c         OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c      180   6 -7.8320   50 -54      IMP:N=1 U=22
c         CS TUBE - ASSEMBLY RIGHT
c      181   7 -7.8320   54 -58      IMP:N=1 U=22
c         PANEL - ASSEMBLY RIGHT
182    3  -0.001225   54          IMP:N=1 U=22
c         GAP       - ASSEMBLY TOP
183    3  -0.001225  -55              IMP:N=1 U=23
c      183   3  -0.001225  -51              IMP:N=1 U=23
c         OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c      184   6 -7.8320   51 -55      IMP:N=1 U=23
c         CS TUBE - ASSEMBLY TOP
c      185   7 -7.8320   55 -59      IMP:N=1 U=23
c         PANEL - ASSEMBLY TOP
186    3  -0.001225   55          IMP:N=1 U=23

c      SURFACE SPECIFICATIONS
1*    PX    0.0
c     2*    PY    0.00       $ For 1/4 Model
3*    PZ    0.00
c     4     PX   12.30       $ For Collapsed Model
c     5     PX   36.90       $ For Collapsed Model
c     6     PY   12.30       $ Water Level Surface
c     7     PY   36.90       $ Water Level Surface
c     8     PY  -12.30       $ Water Level Surface
c     9     PY  -36.90       $ Water Level Surface
```

```
10   PZ  180.0860    $ TOP ACTIVE FUEL
11   PZ  201.2360    $ TOP FUEL HARDWARE
C    12   PZ  226.75      $ TOP TUBE - (Shielding Model)
13   PZ  228.75      $ TOP OF BASKET MATERIAL
14   PZ  229.25      $ TOP RING/WATER GAP
15   PZ  231.75      $ TOP INNER LID
16   PZ  234.75      $ TOP LID GAP
17   PZ  245.75      $ TOP OUTER LID
C    18   PZ  268.25      $ TOP SKIRT - (Shielding Model)
19   PZ  298.75      $ TOP REFLECTOR REGION
20   CZ   71.095     $ ID OF INNER BARRIER
21   CZ   73.095     $ OD OF INNER BARRIER
22   CZ   73.10      $ ID OF OUTER BARRIER
C    23   CZ   76.45      $ ID OF SKIRT LIP - (Shielding Model)
24   CZ   83.10      $ OD OF OUTER BARRIER
25   CZ  113.60      $ OD OF REFLECTOR REGION
C    PIN LATTICE BOUNDS
26   PX  0.72136
27   PX -0.72136
28   PY  0.72136
29   PY -0.72136
C     FUEL ROD
30   CZ  0.468122
31   CZ  0.478790
32   CZ  0.546100
C     CONTROL ROD/GUIDE TUBE
33   CZ  0.45340  $ 0.49022
34   CZ  0.46990  $ 0.50292
35   CZ  0.54610  $ 0.56007
36   CZ  0.62230  $ 0.63246
37   CZ  0.67310
C     INSTRUMENTATION TUBE
38   CZ  0.56007
39   CZ  0.62611
C    ASSEMBLY LATTICE BOUNDS Actual
44   PX  -10.65  $ ACTUAL 10.82025
45   PY  -10.65
46   PX   10.65
47   PY   10.65
C    48   PX  -11.0  $ Corrosion Expansion Cards
C    49   PY  -11.0
C    50   PX   11.0
C    51   PY   11.0
52   PX  -10.650001   $ UCF Intact Inside Tube ID
53   PY  -10.650001
54   PX   10.650001
55   PY   10.650001
56   PX  -11.95    $ UCF Intact Outside Tube ID
57   PY  -11.95
58   PX   11.95
59   PY   11.95
C    FUEL CELL LATTICE BOUNDS
60   PX  -10.65     $ ACTUAL 12.30
61   PX   10.65
62   PY  -10.65
63   PY   10.65
C    45 degree planes
64   P    1. -1.  0. 0.
65   P    1.  1.  0. 0.
C    EXTRA CARDS
```

```

MODE  N
C      VOL   88J
KCODE   4000 1. 7 97
C         KSRC   -4.3  -5.7 1.  -2.8  -5.7 5.  -1.4  -5.7 10.   0.   -5.7  5.
C          1.44 -5.7 3.   2.88 -5.7 8.   4.32 -5.7  9.
C         -5.7  -4.3 2.  -4.3  -4.3 1.  -2.8  -4.3  5.  -1.4  -4.3 10.
C          0.   -4.3 5.   1.44 -4.3 3.   2.88 -4.3  8.   4.32 -4.3  9.
C         -5.7  -2.9 2.  -4.3  -2.9 1.                   -1.4  -2.9 10.
C          0.   -2.9 5.                  2.88 -2.9  8.   4.32 -2.0  9.
C         -5.7  -1.4 2.  -4.3  -1.4 1.  -2.8  -1.4  5.  -1.4  -1.4 10.
C          0.   -1.4 5.   1.44 -1.4 3.   2.88 -1.4  8.   4.32 -1.4  9.
C         -5.7   0.0 2.  -4.3   0.0 1.  -2.8   0.0  5.  -1.4   0.0 10.
C                         1.44  0.0 3.   2.88  0.0  8.   4.32  0.0  9.
C         -5.7   1.4 2.                 -2.8   1.4  5.  -1.4   1.4 10.
C          0.    1.4 5.   1.44  1.4 3.   2.88  1.4  8.   4.32  1.4  9.
C         -5.7   2.9 2.  -4.3   2.9 1.  -2.8   2.9  5.  -1.4   2.9 10.
C          0.    2.9 5.   1.44  2.9 3.   2.88  2.9  8.   4.32  2.9  9.
C         -5.7   4.3 2.  -4.3   4.3 1.  -2.8   4.3  5.  -1.4   4.3 10.
C          0.    4.3 5.   1.44  4.3 3.   2.88  4.3  8.   4.32  4.3  9.
C        MATERIAL SPECIFICATIONS
C           WATER AT 300 K d=1.0000 g/cc w/ 26% Fe2O3 w/ 5% B10
M1     1001.50C  4.9490-2     8016.50C  4.0160-2  26000.55C 1.0277-2
       5010.50C  2.8870-6
MT1    LWTR.01T
C           3.00%/20 GWD  15000 yr decay  5000 yr crit
M2          8016.50C     4.6947E-02
     42095.50C   2.9047E-05
     43099.50C   2.6777E-05
     44101.50C   2.6604E-05
     45103.50C   1.6963E-05
     47109.50C   2.4540E-06
     60143.50C   2.2997E-05
     60145.50C   1.7196E-05
     62147.50C   7.5058E-06
     62149.50C   6.3701E-08
     62150.50C   6.5926E-06
     62151.50C   2.4249E-09
     63151.55C   4.6823E-07
     62152.50C   2.9874E-06
     63153.55C   2.1806E-06
     64155.50C   1.1733E-07
     64157.50C   1.2504E-09
     48000.50C   1.9600E-06
     54131.50C   1.2875E-05
     55133.50C   3.1431E-05
     92233.50C   1.6324E-07
     92234.50C   5.7609E-06
     92235.50C   3.7337E-04
     92236.50C   1.0302E-04
     92238.50C   2.2352E-02
     93237.55C   2.7728E-05
     94238.50C   8.7993E-09
     94239.55C   7.7552E-05
     94240.50C   5.1653E-06
     94241.50C   1.2685E-09
     94242.50C   3.3520E-06
     95241.50C   3.8803E-08
     95242.50C   1.1289E-11
     95243.50C   1.0946E-07
```

```
        c         WATER AT 300 K d=1.0000 g/cc
        m3    1001.50c  6.6878-2    8016.50c  3.3439-2
        mt3   lwtr.01t
        c         Air d=0.001225 g/cc
        c    m3    7014.50c  -0.80   8016.50c  -0.20
        c         ZIRCALOY-4 d=6.56 g/cc
        m4    8016.50c -0.0012  24000.50c -0.0010  26000.55c -0.0020
             40000.50c -0.9818  50000.35c -0.0140
        c        ALLOY 825 d=8.14 g/cc
        m5    6000.50c -0.0005  13027.50c -0.0020  14000.50c -0.0050
             16032.50c -0.0003  22000.50c -0.0090  24000.50c -0.2150
             25055.50c -0.0100  26000.55c -0.2857  28000.50c -0.4200
             29000.50c -0.0225  42000.50c -0.0300
        c        Oxidized A516 CARBON STEEL and Water Mixture d=7.832 g/cc
        c    m6     6000.50c -0.00220  14000.50c -0.002750  15031.50c -0.00035
        c          16032.50c -0.00035  25055.50c -0.0090
        c          26000.55c -0.98535
        c        A516 CARBON STEEL d=7.832 g/cc
        m7     6000.50c -0.00220  14000.50c -0.002750  15031.50c -0.00035
             16032.50c -0.00035  25055.50c -0.0090
             26000.55c -0.98535
        c         SS316B6A  1.6%  d=7.77 g/cc
        m8      5010.50c -0.00288  5011.50c -0.013120
               6000.50c -0.00030  7014.50c -0.00100 14000.50c -0.0075
             15031.50c -0.00045 16032.50c -0.00030 24000.50c -0.19000
             25055.50c -0.02000 26000.55c -0.60445 28000.50c -0.13500
             42000.50c -0.02500
        c         SS316B3A 0.87wt% B d=7.83 g/cc
        c    m9     5010.50c -0.001566 5011.50c -0.007134
        c           6000.50c -0.00030  7014.50c -0.00100 14000.50c -0.00750
        c          15031.50c -0.00045 16032.50c -0.00030 24000.50c -0.19000
        c          25055.50c -0.02000 26000.55c -0.60445 28000.50c -0.13500
        c          42000.50c -0.02500
        c         Al 6063 d=2.69 g/cc
        c    m10  12000.50c -0.00675  13027.50c -0.98125  14000.50c -0.00400
        c         22000.50c -0.00150  24000.50c -0.00100  25055.50c -0.00100
        c         26000.55c -0.00350  29000.50c -0.00100
        c    TALLIES
        PRINT

1     initial source from file   srctp

1problem summary

      run terminated when     97 kcode cycles were done.
                                                                                   08/20/96 22:55:23
+     AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5e)      probid =   08/20/96 21:00:04
0
```

neutron creation	tracks	weight (per source particle)	energy	neutron loss	tracks	weight (per source particle)	energy
source	388004	9.9999E-01	2.0600E+00	escape	10	1.7170E-05	3.6994E-05
				energy cutoff	0	0.	0.
				time cutoff	0	0.	0.
weight window	0	0.	0.	weight window	0	0.	0.
cell importance	0	0.	0.	cell importance	0	0.	0.
weight cutoff	0	5.1088E-02	7.4122E-06	weight cutoff	388630	5.1257E-02	5.9796E-06
energy importance	0	0.	0.	energy importance	0	0.	0.
dxtran	0	0.	0.	dxtran	0	0.	0.

forced collisions	0	0.	0.
exp. transform	0	0.	0.
upscattering	0	0.	7.5977E-08
(n,xn)	1269	2.5713E-03	2.0152E-03
fission	0	0.	0.
total	389273	1.0536E+00	2.0620E+00

forced collisions	0	0.	0.
exp. transform	0	0.	0.
downscattering	0	0.	1.9258E+00
capture	0	6.5312E-01	3.5701E-02
loss to (n,xn)	633	1.2827E-03	1.0840E-02
loss to fission	0	3.4797E-01	8.9545E-02
total	389273	1.0536E+00	2.0620E+00

```
number of neutrons banked                          636
neutron tracks per source particle          1.0033E+00
neutron collisions per source particle      4.6989E+01
total neutron collisions                      18231800
net multiplication                   1.0013E+00  .0001

average lifetime, shakes
  escape                 9.2675E+03
  capture                2.3781E+03
  capture or escape      2.3782E+03
  any termination        2.5508E+03

cutoffs
  tco    1.0000E+34
  eco     .0000E+00
  wc1   -5.0000E-01
  wc2   -2.5000E-01

computer time so far in this run   115.20 minutes
computer time in mcrun             115.10 minutes
source particles per minute            3.3711E+03
random numbers generated                254604968

maximum number ever in bank            2
bank overflows to backup file          0
field length                           0
most random numbers used was       10424 in history   346341
```

1keff results for: AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5e) probid = 08/20/96 21:00:04

the initial fission neutron source distribution was read from the srctp file named srctp .
the criticality problem was scheduled to skip 7 cycles and run a total of 97 cycles with nominally 4000 neutrons per cycle.
this problem has run 7 inactive cycles with 27651 neutron histories and 90 active cycles with 360353 neutron histories.

this calculation has completed the requested number of keff cycles using a total of 388004 fission neutron source histories.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

the following cells with fissionable material had no neutron tracks entering:
97

the following cells with fissionable material had no neutron collisions:
97

the following cells with fissionable material had no fission source points:
97

warning. 1 fissionable cells had no tracks entering, 1 cells had no collisions, and 1 cells had no fission source points.
the keff results could be too small because these cells with fissionable material were not sampled.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the k(collision) cycle values appear normally distributed at the 95 percent confidence level
the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

---

the final estimated combined collision/absorption/track-length keff = .90061 with an estimated standard deviation of .00107

the estimated 68, 95, & 99 percent keff confidence intervals are .89955 to .90168, .89849 to .90274, and .89780 to .90343

the estimated collision/absorption neutron removal lifetime = 2.38E-05 seconds with an estimated standard deviation of 5.97E-08

---

the estimated average keffs, one standard deviations, and 68, 95, and 99 percent confidence intervals are:

keff estimator	keff	standard deviation	68% confidence	95% confidence	99% confidence	corr
collision	.90078	.00131	.89946 to .90209	.89816 to .90340	.89731 to .90425	
absorption	.90042	.00118	.89924 to .90159	.89808 to .90276	.89731 to .90352	
track length	.90126	.00162	.89964 to .90288	.89803 to .90449	.89698 to .90554	
col/absorp	.90056	.00106	.89950 to .90163	.89844 to .90268	.89775 to .90337	.4650
abs/trk len	.90066	.00108	.89958 to .90174	.89851 to .90280	.89781 to .90351	.2902
col/trk len	.90079	.00132	.89947 to .90212	.89816 to .90343	.89730 to .90429	.7969
col/abs/trk len	.90061	.00107	.89955 to .90168	.89849 to .90274	.89780 to .90343	

```
1mcnp     version 4a    ld=10/01/93                          08/20/96 22:55:24
*****************************************************************************     probid =   08/20/96 22:55:24
 inp=a26xb5f outp=a26xb5f0

         AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5f)
         C      Advanced Uncanistered Fuel Waste Package, collapsed basket 10k 26%/5%B
         C      15000 year decay  10000 yr criticality
         C      CELL SPECIFICATIONS
         C        Assembly Sub-lattices - 1/2 Model
         1      0       1  3 -13 -20   FILL=1 (0 -74 0) IMP:N=1
         C      1     0       1  3   -4 -13 -20   FILL=1 (0 -73.8 0) IMP:N=1
         C      2     0       3  4   -5 -13 -20   FILL=1 (0 -73.8 0) IMP:N=1
         C      3     0       3  5 -13 -20        FILL=1 (0 -73.8 0) IMP:N=1
         C        Assembly Sub-lattices - 1/4 Model
         C      1     0       1   2   3  -4 -13 -20   FILL=1 (0 -12.3 0) IMP:N=1
         C      2     0       2   3   4  -5 -13 -20   FILL=1 (0 -12.3 0) IMP:N=1
         C      3     0       2   3   5 -13 -20       FILL=1 (0 -12.3 0) IMP:N=1
         C      ASSEMBLY LATTICE DESCRIPTION
         5      1  -2.1024  -61  60 -63  62  IMP:N=1 LAT=1 U=1
                FILL=0:3 0:7 0:0  1 1  1  1  56 56 1  1  56 56 56 1
                                  56 56 56 1  56 56 56 1  56 56 1  1
                                  1 1  1  1   1 1 1 1       $ 1/2 model
         C      5      1  -2.1024   60 -61  62 -63  IMP:N=1 LAT=1 U=1
         C            FILL=0:3 0:3 0:0  58 58 64 70  58 58 62 70
         C                              60 62 70  1  70 70  1  1 $ 1/4 model
         C      BARRIER CELLS
         C      Basket Material-Lid Gap
         76     3  -1.0000     1 -20  13  -14     IMP:N=1 $ 1/2 model
         C      76     1  -2.1024     1   2 -20  13  -14     IMP:N=1 $ 1/4 model
         C      Inner Barrier
         77     5  -8.1400   1   3  20 -21 -14  IMP:N=1 $ 1/2 model
         C      77     5   -8.1400     1   2   3  20 -21 -14  IMP:N=1 $ 1/4 model
         C      Inner Lid
         78     5  -8.1400   1  14 -15 -21       IMP:N=1 $ 1/2 model
         C      78     5   -8.1400     1   2  14 -15 -21       IMP:N=1 $ 1/4 model
         C       Gap between Inner and Outer Barrier Lids
         79     3  -1.0000   1  15 -16 -21       IMP:N=1 $ 1/2 model
         C      79     1  -2.1024     1   2  15 -16 -21      IMP:N=1 $ 1/4 model
         C       Gap between Inner and Outer Barriers
         80     3  -1.0000   21 -22   1   3 -16  IMP:N=1 $ 1/2 model
         C      80     1  -2.1024   21 -22   1   2   3 -16  IMP:N=1 $ 1/4 model
         C      Outer Barrier
         81     7  -7.8320   22 -24   1   3 -16  IMP:N=1 $ 1/2 model
         C      81     7  -7.8320   22 -24   1   2   3 -16  IMP:N=1 $ 1/4 model
         C      Outer Barrier Lid
         82     7  -7.8320     1 -24  16 -17      IMP:N=1 $ 1/2 model
         C      82     7  -7.8320     1   2 -24  16 -17      IMP:N=1 $ 1/4 model
         C      12" of Water around Container
         83     3  -1.0000   24 -25   1   3 -17  IMP:N=1 $ 1/2 model
         C      83     1  -2.1024   24 -25   1   2   3 -17  IMP:N=1 $ 1/4 model
         C      12" of Water above Container
         84     3  -1.0000   17 -19   1 -25       IMP:N=1 $ 1/2 model
         C      84     1  -2.1024   17 -58   1   2 -59      IMP:N=1 $ 1/4 model
         C      OUTSIDE WORLD
         85     0  -1:-3:19:25  IMP:N=0  $ 1/2 model
         C      85     0  -1:-2:-3:19:25  IMP:N=0  $ 1/4 model
         C      WET PIN LATTICE DESCRIPTION
         86     1  -2.1024  -26 27 -28  29  IMP:N=1 LAT=1  U=56
                FILL -8:8 -8:8 0:0  56 16R  56 2 14R 56  56 2 14R 56
                                      56 2 4R 4 2 2R 4 2 4R 56
```

```
                                56 2 2R 4 2 6R 4 2 2R 56  56 2 14R 56
                                56 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 56
                                56 2 14R 56
                                56 2 6R 6 2 6R 56
                                56 2 14R 56
                                56 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 56
                                56 2 14R 56  56 2 2R 4 2 6R 4 2 2R 56
                                56 2 4R 4 2 2R 4 2 4R 56
                                56 2 14R 56  56 2 14R 56  56 16R
       c    MIXED PIN LATTICE DESCRIPTION
       c    87   3  -0.001225  -26 27 -28  29  IMP:N=1 LAT=1  U=72
       c     FILL -8:8 -8:8 0:0  57 16R  57 3 14R 57  57 3 14R 57
       c                          57 3 4R 5 3 2R 5 3 4R 57
       c                          57 3 2R 5 3 6R 5 3 2R 57  57 3 14R 57
       c                          57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
       c                          57 3 14R 57
       c                          57 3 6R 7 3 6R 57
       c                          57 2 14R 57
       c                          57 2 2 4 2 2 4 2 2R 4 2 2 4 2 2 57
       c                          57 2 14R 57  57 2 2R 4 2 6R 4 2 2R 57
       c                          57 2 4R 4 2 2R 4 2 4R 57
       c                          57 2 14R 57  57 2 14R 57  57 16R
       c    DRY PIN LATTICE DESCRIPTION
       88   3  -0.001225  -26 27 -28  29  IMP:N=1 LAT=1  U=57
            FILL -8:8 -8:8 0:0  57 16R  57 3 14R 57  57 3 14R 57
                                57 3 4R 5 3 2R 5 3 4R 57
                                57 3 2R 5 3 6R 5 3 2R 57  57 3 14R 57
                                57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
                                57 3 14R 57
                                57 3 6R 7 3 6R 57
                                57 3 14R 57
                                57 3 3 5 3 3 5 3 2R 5 3 3 5 3 3 57
                                57 3 14R 57  57 3 2R 5 3 6R 5 3 2R 57
                                57 3 4R 5 3 2R 5 3 4R 57
                                57 3 14R 57  57 3 14R 57  57 16R
       c    WET FUEL ROD
       89   2   7.0106E-02   -30 -10      IMP:N=1 U=2
       90   4  -6.5600   -30  10 -11 IMP:N=1 U=2
       91   1  -2.1024   -30  11     IMP:N=1 U=2
       92   1  -2.1024    30 -31 -11 IMP:N=1 U=2
       93   1  -2.1024    30 -31  11 IMP:N=1 U=2
       94   4  -6.5600    31 -32 -11 IMP:N=1 U=2
       95   1  -2.1024    31 -32  11 IMP:N=1 U=2
       96   1  -2.1024    32         IMP:N=1 U=2
       c    DRY FUEL ROD
       97   2   7.0106E-02   -30 -10      IMP:N=1 U=3
       98   4  -6.5600   -30  10 -11 IMP:N=1 U=3
       99   3  -0.001225    -30  11      IMP:N=1 U=3
       100  3  -0.001225     30 -31 -11 IMP:N=1 U=3
       101  3  -0.001225     30 -31  11 IMP:N=1 U=3
       102  4  -6.5600    31 -32 -11 IMP:N=1 U=3
       103  3  -0.001225     31 -32  11 IMP:N=1 U=3
       104  3  -0.001225     32          IMP:N=1 U=3
       c    WET CONTROL ROD/GUIDE TUBE
       105  1  -2.1024  -33        IMP:N=1 U=4  $ No DCRA Rod
       c    105   9  -7.8300  -33         IMP:N=1 U=4  $ DCRA Rod
       106  1  -2.1024   33  -34  IMP:N=1 U=4
       107  1  -2.1024   34  -35  IMP:N=1 U=4  $ No DCRA Cladding
       c    107   4  -6.5600   34  -35  IMP:N=1 U=4  $ DCRA Cladding
       108  1  -2.1024   35  -36  IMP:N=1 U=4
```

```
109    4  -6.5600    36  -37  IMP:N=1 U=4
110    1  -2.1024    37       IMP:N=1 U=4
c      DRY CONTROL ROD/GUIDE TUBE
111    3  -0.001225  -33        IMP:N=1 U=5  $ No DCRA Rod
c      111   9  -7.8300  -33        IMP:N=1 U=5  $ DCRA Rod
112    3  -0.001225   33  -34  IMP:N=1 U=5
113    3  -0.001225   34  -35  IMP:N=1 U=5  $ No DCRA Cladding
c      113   4  -6.5600   34  -35  IMP:N=1 U=5  $ DCRA Cladding
114    3  -0.001225   35  -36  IMP:N=1 U=5
115    4  -6.5600   36  -37  IMP:N=1 U=5
116    3  -0.001225   37       IMP:N=1 U=5
c      WET INSTRUMENTATION TUBE
117    1  -2.1024  -38         IMP:N=1 U=6
118    4  -6.5600   38 -39     IMP:N=1 U=6
119    1  -2.1024   39         IMP:N=1 U=6
c      DRY INSTRUMENTATION TUBE
120    3  -0.001225  -38         IMP:N=1 U=7
121    4  -6.5600   38 -39     IMP:N=1 U=7
122    3  -0.001225  39         IMP:N=1 U=7
c      FUEL CELL BASKET STRUCTURE
c      Code: boron in [B=] all panels [all], left [l], bottom, [b], right [r], to
c      FUEL CELL BASKET STRUCTURE -        WET - Borated panels
c         WATER GAP       - ASSEMBLY LEFT
123    1  -2.1024   52               IMP:N=1 U=8
c      123   1  -2.1024   48               IMP:N=1 U=8
c         OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c      124   6  -7.8320  -48  52       IMP:N=1 U=8
c         CS TUBE - ASSEMBLY LEFT
c      125   7  -7.8320  -52  56       IMP:N=1 U=8
c         SS PANEL - ASSEMBLY LEFT
126    8  -7.7700  -52          IMP:N=1 U=8
c         WATER GAP       - ASSEMBLY BOTTOM
127    1  -2.1024   53               IMP:N=1 U=9
c      127   1  -2.1024   49               IMP:N=1 U=9
c         OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c      128   6  -7.8320  -49  53       IMP:N=1 U=9
c         CS TUBE - ASSEMBLY BOTTOM
c      129   7  -7.8320  -53  57       IMP:N=1 U=9
c         SS PANEL - ASSEMBLY BOTTOM
130    8  -7.7700  -53          IMP:N=1 U=9
c         WATER GAP       - ASSEMBLY RIGHT
131    1  -2.1024  -54               IMP:N=1 U=10
c      131   1  -2.1024  -50               IMP:N=1 U=10
c         OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c      132   6  -7.8320   50 -54       IMP:N=1 U=10
c         CS TUBE - ASSEMBLY RIGHT
c      133   7  -7.8320   54 -58       IMP:N=1 U=10
c         SS PANEL - ASSEMBLY RIGHT
134    8  -7.7700   54          IMP:N=1 U=10
c         WATER GAP       - ASSEMBLY TOP
135    1  -2.1024  -55               IMP:N=1 U=11
c      135   1  -2.1024  -51               IMP:N=1 U=11
c         OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c      136   6  -7.8320   51 -55       IMP:N=1 U=11
c         CS TUBE - ASSEMBLY TOP
c      137   7  -7.8320   55 -59       IMP:N=1 U=11
c         SS PANEL - ASSEMBLY TOP
138    8  -7.7700   55          IMP:N=1 U=11
c      FUEL CELL BASKET STRUCTURE -        DRY - Borated panels
c         GAP      - ASSEMBLY LEFT
```

```
139   3  -0.001225   52               IMP:N=1 U=12
c       139   3  -0.001225   48             IMP:N=1 U=12
c           OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c       140   6  -7.8320  -48  52       IMP:N=1 U=12
c           CS TUBE - ASSEMBLY LEFT
c       141   7  -7.8320  -52  56       IMP:N=1 U=12
c           SS PANEL - ASSEMBLY LEFT
142     8  -7.7700  -52           IMP:N=1 U=12
c           GAP       - ASSEMBLY BOTTOM
143  3  -0.001225   53                IMP:N=1 U=13
c       143   3  -0.001225   49             IMP:N=1 U=13
c           OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c       144   6  -7.8320  -49  53       IMP:N=1 U=13
c           CS TUBE - ASSEMBLY BOTTOM
c       145   7  -7.8320  -53  57       IMP:N=1 U=13
c           SS PANEL - ASSEMBLY BOTTOM
146     8  -7.7700  -53           IMP:N=1 U=13
c           GAP       - ASSEMBLY RIGHT
147     3  -0.001225  -54             IMP:N=1 U=14
c       147   3  -0.001225  -50             IMP:N=1 U=14
c           OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c       148   6  -7.8320   50 -54       IMP:N=1 U=14
c           CS TUBE - ASSEMBLY RIGHT
c       149   7  -7.8320   54 -58       IMP:N=1 U=14
c           SS PANEL - ASSEMBLY RIGHT
150     8  -7.7700   54           IMP:N=1 U=14
c           GAP       - ASSEMBLY TOP
151     3  -0.001225  -55             IMP:N=1 U=15
c       151   3  -0.001225  -51             IMP:N=1 U=15
c           OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c       152   6  -7.8320   51 -55       IMP:N=1 U=15
c           CS TUBE - ASSEMBLY TOP
c       153   7  -7.8320   55 -59       IMP:N=1 U=15
c           SS PANEL - ASSEMBLY TOP
154     8  -7.7700   55           IMP:N=1 U=15
c       FUEL CELL BASKET STRUCTURE -        WET - Unborated panels
c           WATER GAP      - ASSEMBLY LEFT
155     1  -2.1024    52              IMP:N=1 U=16
c       155   1  -2.1024    48              IMP:N=1 U=16
c           OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c       156   6  -7.8320  -48  52       IMP:N=1 U=16
c           CS TUBE - ASSEMBLY LEFT
c       157   7  -7.8320  -52  56       IMP:N=1 U=16
c           PANEL - ASSEMBLY LEFT
158     1  -2.1024  -52           IMP:N=1 U=16
c           WATER GAP      - ASSEMBLY BOTTOM
159     1  -2.1024    53              IMP:N=1 U=17
c       159   1  -2.1024    49              IMP:N=1 U=17
c           OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c       160   6  -7.8320  -49  53       IMP:N=1 U=17
c           CS TUBE - ASSEMBLY BOTTOM
c       161   7  -7.8320  -53  57       IMP:N=1 U=17
c           PANEL - ASSEMBLY BOTTOM
162     1  -2.1024  -53           IMP:N=1 U=17
c           WATER GAP      - ASSEMBLY RIGHT
163     1  -2.1024  -54               IMP:N=1 U=18
c       163   1  -2.1024  -50               IMP:N=1 U=18
c           OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c       164   6  -7.8320   50 -54       IMP:N=1 U=18
c           CS TUBE - ASSEMBLY RIGHT
```

```
c       165  7 -7.8320   54 -58       IMP:N=1 U=18
c          PANEL - ASSEMBLY RIGHT
166     1  -2.1024   54            IMP:N=1 U=18
c          WATER GAP      - ASSEMBLY TOP
167     1  -2.1024  -55                 IMP:N=1 U=19
c       167  1  -2.1024  -51                     IMP:N=1 U=19
c          OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c       168  6  -7.8320   51 -55      IMP:N=1 U=19
c          CS TUBE - ASSEMBLY TOP
c       169  7  -7.8320   55 -59      IMP:N=1 U=19
c          PANEL - ASSEMBLY TOP
170     1  -2.1024   55            IMP:N=1 U=19
c       FUEL CELL BASKET STRUCTURE -          DRY - Unborated panels
c          GAP     - ASSEMBLY LEFT
171     3  -0.001225   52              IMP:N=1 U=20
c       171  3  -0.001225   48                 IMP:N=1 U=20
c          OXIDATION LAYER CS TUBE - ASSEMBLY LEFT
c       172  6  -7.8320  -48  52       IMP:N=1 U=20
c          CS TUBE - ASSEMBLY LEFT
c       173  7  -7.8320  -52  56       IMP:N=1 U=20
c          PANEL - ASSEMBLY LEFT
174     3  -0.001225  -52           IMP:N=1 U=20
c          GAP     - ASSEMBLY BOTTOM
175     3  -0.001225   53              IMP:N=1 U=21
c       175  3  -0.001225   49                 IMP:N=1 U=21
c          OXIDATION LAYER CS TUBE - ASSEMBLY BOTTOM
c       176  6  -7.8320  -49  53       IMP:N=1 U=21
c          CS TUBE - ASSEMBLY BOTTOM
c       177  7  -7.8320  -53  57       IMP:N=1 U=21
c          PANEL - ASSEMBLY BOTTOM
178     3  -0.001225  -53           IMP:N=1 U=21
c          GAP     - ASSEMBLY RIGHT
179     3  -0.001225  -54              IMP:N=1 U=22
c       179  3  -0.001225  -50                 IMP:N=1 U=22
c          OXIDATION LAYER CS TUBE - ASSEMBLY RIGHT
c       180  6  -7.8320   50 -54       IMP:N=1 U=22
c          CS TUBE - ASSEMBLY RIGHT
c       181  7  -7.8320   54 -58       IMP:N=1 U=22
c          PANEL - ASSEMBLY RIGHT
182     3  -0.001225   54           IMP:N=1 U=22
c          GAP     - ASSEMBLY TOP
183     3  -0.001225  -55              IMP:N=1 U=23
c       183  3  -0.001225  -51                 IMP:N=1 U=23
c          OXIDATION LAYER CS TUBE - ASSEMBLY TOP
c       184  6  -7.8320   51 -55       IMP:N=1 U=23
c          CS TUBE - ASSEMBLY TOP
c       185  7  -7.8320   55 -59       IMP:N=1 U=23
c          PANEL - ASSEMBLY TOP
186     3  -0.001225   55           IMP:N=1 U=23

c       SURFACE SPECIFICATIONS
1*      PX     0.0
c       2*   PY     0.00       $ For 1/4 Model
3*      PZ     0.00
c       4    PX    12.30       $ For Collapsed Model
c       5    PX    36.90       $ For Collapsed Model
c       6    PY    12.30       $ Water Level Surface
c       7    PY    36.90       $ Water Level Surface
c       8    PY   -12.30       $ Water Level Surface
c       9    PY   -36.90       $ Water Level Surface
```

```
10    PZ  180.0860     $ TOP ACTIVE FUEL
11    PZ  201.2360     $ TOP FUEL HARDWARE
c     12   PZ  226.75      $ TOP TUBE - (Shielding Model)
13    PZ  228.75       $ TOP OF BASKET MATERIAL
14    PZ  229.25       $ TOP RING/WATER GAP
15    PZ  231.75       $ TOP INNER LID
16    PZ  234.75       $ TOP LID GAP
17    PZ  245.75       $ TOP OUTER LID
c     18   PZ  268.25      $ TOP SKIRT - (Shielding Model)
19    PZ  298.75       $ TOP REFLECTOR REGION
20    CZ   71.095      $ ID OF INNER BARRIER
21    CZ   73.095      $ OD OF INNER BARRIER
22    CZ   73.10       $ ID OF OUTER BARRIER
c     23   CZ    76.45      $ ID OF SKIRT LIP - (Shielding Model)
24    CZ   83.10       $ OD OF OUTER BARRIER
25    CZ  113.60       $ OD OF REFLECTOR REGION
c     PIN LATTICE BOUNDS
26    PX  0.72136
27    PX -0.72136
28    PY  0.72136
29    PY -0.72136
c      FUEL ROD
30    CZ  0.468122
31    CZ  0.478790
32    CZ  0.546100
c      CONTROL ROD/GUIDE TUBE
33    CZ  0.45340  $ 0.49022
34    CZ  0.46990  $ 0.50292
35    CZ  0.54610  $ 0.56007
36    CZ  0.62230  $ 0.63246
37    CZ  0.67310
c      INSTRUMENTATION TUBE
38    CZ  0.56007
39    CZ  0.62611
c     ASSEMBLY LATTICE BOUNDS Actual
44    PX  -10.65  $ ACTUAL 10.82025
45    PY  -10.65
46    PX   10.65
47    PY   10.65
c     48    PX  -11.0  $ Corrosion Expansion Cards
c     49    PY  -11.0
c     50    PX   11.0
c     51    PY   11.0
52    PX  -10.650001  $ UCF Intact Inside Tube ID
53    PY  -10.650001
54    PX   10.650001
55    PY   10.650001
56    PX  -11.95    $ UCF Intact Outside Tube ID
57    PY  -11.95
58    PX   11.95
59    PY   11.95
c     FUEL CELL LATTICE BOUNDS
60    PX  -10.65     $ ACTUAL 12.30
61    PX   10.65
62    PY  -10.65
63    PY   10.65
c     45 degree planes
64    P    1. -1.  0. 0.
65    P    1.  1.  0. 0.
c     EXTRA CARDS
```

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MODE   N
C      VOL    88J
KCODE    4000 1. 7 97
C         KSRC   -4.3   -5.7 1.   -2.8   -5.7 5.   -1.4   -5.7 10.    0.    -5.7  5.
C          1.44 -5.7 3.    2.88 -5.7 8.    4.32 -5.7  9.
C         -5.7  -4.3 2.   -4.3  -4.3 1.   -2.8  -4.3  5.   -1.4  -4.3 10.
C          0.   -4.3 5.    1.44 -4.3 3.    2.88 -4.3  8.    4.32 -4.3  9.
C         -5.7  -2.9 2.   -4.3  -2.9 1.                    -1.4  -2.9 10.
C          0.   -2.9 5.                    2.88 -2.9  8.    4.32 -2.0  9.
C         -5.7  -1.4 2.   -4.3  -1.4 1.   -2.8  -1.4  5.   -1.4  -1.4 10.
C          0.   -1.4 5.    1.44 -1.4 3.    2.88 -1.4  8.    4.32 -1.4  9.
C         -5.7   0.0 2.   -4.3   0.0 1.   -2.8   0.0  5.   -1.4   0.0 10.
C                          1.44  0.0 3.    2.88  0.0  8.    4.32  0.0  9.
C         -5.7   1.4 2.                   -2.8   1.4  5.   -1.4   1.4 10.
C          0.    1.4 5.    1.44  1.4 3.    2.88  1.4  8.    4.32  1.4  9.
C         -5.7   2.9 2.   -4.3   2.9 1.   -2.8   2.9  5.   -1.4   2.9 10.
C          0.    2.9 5.    1.44  2.9 3.    2.88  2.9  8.    4.32  2.9  9.
C         -5.7   4.3 2.   -4.3   4.3 1.   -2.8   4.3  5.   -1.4   4.3 10.
C          0.    4.3 5.    1.44  4.3 3.    2.88  4.3  8.    4.32  4.3  9.
C        MATERIAL SPECIFICATIONS
C           WATER AT 300 K d=1.0000 g/cc w/ 26% Fe2O3 w/ 5% B10
M1     1001.50C  4.9490-2    8016.50C  4.0160-2  26000.55C 1.0277-2
       5010.50C  2.8870-6
MT1    LWTR.01T
C           3.00%/20 GWD  15000 yr decay  10000 yr crit
M2          8016.50C      4.6947E-02
      42095.50C   2.9555E-05
      43099.50C   2.6899E-05
      44101.50C   2.7082E-05
      45103.50C   1.7197E-05
      47109.50C   2.4871E-06
      60143.50C   2.3334E-05
      60145.50C   1.7528E-05
      62147.50C   7.6533E-06
      62149.50C   5.6264E-08
      62150.50C   6.6809E-06
      62151.50C   2.4408E-09
      63151.55C   4.4669E-07
      62152.50C   3.0032E-06
      63153.55C   2.2357E-06
      64155.50C   5.9056E-08
      64157.50C   1.1891E-09
      48000.50C   2.0221E-06
      54131.50C   1.3059E-05
      55133.50C   3.1974E-05
      92233.50C   2.0043E-07
      92234.50C   5.9667E-06
      92235.50C   3.7645E-04
      92236.50C   1.0659E-04
      92238.50C   2.2352E-02
      93237.55C   2.7931E-05
      94238.50C   9.1027E-09
      94239.55C   7.0502E-05
      94240.50C   4.0570E-06
      94241.50C   1.0238E-09
      94242.50C   3.2774E-06
      95241.50C   3.1112E-08
      95242.50C   9.2503E-12
      95243.50C   1.0153E-07
```

```
        C         WATER AT 300 K d=1.0000 g/cc
        M3    1001.50C  6.6878-2    8016.50C  3.3439-2
        MT3   LWTR.01T
        C         Air d=0.001225 g/cc
        C    M3    7014.50C  -0.80   8016.50C  -0.20
        C         ZIRCALOY-4 d=6.56 g/cc
        M4    8016.50C -0.0012  24000.50C -0.0010  26000.55C -0.0020
             40000.50C -0.9818  50000.35C -0.0140
        C        ALLOY 825 d=8.14 g/cc
        M5    6000.50C -0.0005  13027.50C -0.0020  14000.50C -0.0050
             16032.50C -0.0003  22000.50C -0.0090  24000.50C -0.2150
             25055.50C -0.0100  26000.55C -0.2857  28000.50C -0.4200
             29000.50C -0.0225  42000.50C -0.0300
        C        Oxidized A516 CARBON STEEL and Water Mixture d=7.832 g/cc
        C    M6    6000.50C -0.00220  14000.50C -0.002750  15031.50C -0.00035
        C         16032.50C -0.00035  25055.50C -0.0090
        C         26000.55C -0.98535
        C        A516 CARBON STEEL d=7.832 g/cc
        M7    6000.50C -0.00220  14000.50C -0.002750  15031.50C -0.00035
             16032.50C -0.00035  25055.50C -0.0090
             26000.55C -0.98535
        C        SS316B6A  1.6%  d=7.77 g/cc
        M8    5010.50C -0.00288  5011.50C -0.013120
              6000.50C -0.00030  7014.50C -0.00100 14000.50C -0.0075
             15031.50C -0.00045 16032.50C -0.00030 24000.50C -0.19000
             25055.50C -0.02000 26000.55C -0.60445 28000.50C -0.13500
             42000.50C -0.02500
        C        SS316B3A 0.87wt% B d=7.83 g/cc
        C    M9    5010.50C -0.001566 5011.50C -0.007134
        C          6000.50C -0.00030  7014.50C -0.00100 14000.50C -0.00750
        C         15031.50C -0.00045 16032.50C -0.00030 24000.50C -0.19000
        C         25055.50C -0.02000 26000.55C -0.60445 28000.50C -0.13500
        C         42000.50C -0.02500
        C        Al 6063 d=2.69 g/cc
        C    M10  12000.50C -0.00675  13027.50C -0.98125  14000.50C -0.00400
        C         22000.50C -0.00150  24000.50C -0.00100  25055.50C -0.00100
        C         26000.55C -0.00350  29000.50C -0.00100
        C    TALLIES
        PRINT

1     initial source from file   srctp
1problem summary

      run terminated when     97 kcode cycles were done.
+                                                                              08/21/96 00:50:24
      AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5f)    probid =   08/20/96 22:55:24
0
```

neutron creation	tracks	weight (per source particle)	energy (per source particle)	neutron loss	tracks	weight (per source particle)	energy (per source particle)
source	388354	9.9909E-01	2.0536E+00	escape	7	9.1811E-06	2.6297E-05
				energy cutoff	0	0.	0.
				time cutoff	0	0.	0.
weight window	0	0.	0.	weight window	0	0.	0.
cell importance	0	0.	0.	cell importance	0	0.	0.
weight cutoff	0	5.1206E-02	5.3136E-06	weight cutoff	389025	5.1889E-02	1.0547E-05
energy importance	0	0.	0.	energy importance	0	0.	0.
dxtran	0	0.	0.	dxtran	0	0.	0.
forced collisions	0	0.	0.	forced collisions	0	0.	0.
exp. transform	0	0.	0.	exp. transform	0	0.	0.

```
upscattering            0    0.            7.6094E-08        downscattering           0   0.            1.9191E+00
                                                             capture                  0   6.5097E-01    3.5891E-02
(n,xn)               1352    2.7427E-03    2.2046E-03        loss to (n,xn)         674   1.3673E-03    1.1601E-02
fission                 0    0.            0.                loss to fission          0   3.4880E-01    8.9234E-02
    total          389706    1.0530E+00    2.0559E+00            total           389706   1.0530E+00    2.0559E+00

  number of neutrons banked                        678      average lifetime, shakes               cutoffs
  neutron tracks per source particle     1.0035E+00          escape             2.1281E+04          tco    1.0000E+34
  neutron collisions per source particle 4.7025E+01          capture            2.3934E+03          eco     .0000E+00
  total neutron collisions                 18262445          capture or escape  2.3936E+03          wc1   -5.0000E-01
  net multiplication              1.0014E+00  .0001          any termination    2.5626E+03          wc2   -2.5000E-01

computer time so far in this run   114.87 minutes           maximum number ever in bank        2
computer time in mcrun             114.77 minutes           bank overflows to backup file      0
source particles per minute        3.3838E+03               field length                       0
random numbers generated            255297822               most random numbers used was     9706 in history   186745

range of sampled source weights = 9.5034E-01 to 1.1019E+00
1keff results for: AUCF - B&W 15x15 FUEL,21 ASSEMBLY DBF CS/SS-B Corroded & collapsed - (a26xb5f)       probid =   08/20/96 22:55:24

the initial fission neutron source distribution was read from the srctp file named srctp   .
the criticality problem was scheduled to skip   7 cycles and run a total of   97 cycles with nominally    4000 neutrons per cycle.
this problem has run   7 inactive cycles with    27794 neutron histories and   90 active cycles with     360560 neutron histories.

this calculation has completed the requested number of keff cycles using a total of     388354 fission neutron source histories.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

the following cells with fissionable material had no neutron tracks entering:
    97

the following cells with fissionable material had no neutron collisions:
    97

the following cells with fissionable material had no fission source points:
    97

warning.     1 fissionable cells had no tracks entering,    1 cells had no collisions, and    1 cells had no fission source points.
               the keff results could be too small because these cells with fissionable material were not sampled.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

          the k( collision) cycle values appear normally distributed at the 95 percent confidence level
          the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
          the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

.................................................................................................................................
| the final estimated combined collision/absorption/track-length keff =  .90019 with an estimated standard deviation of  .00108 |
| the estimated 68, 95, & 99 percent keff confidence intervals are  .89910 to  .90127,  .89803 to  .90235, and  .89732 to  .90305 |
| the estimated collision/absorption neutron removal lifetime = 2.39E-05 seconds with an estimated standard deviation of 5.71E-08 |
.................................................................................................................................
```

the estimated average keffs, one standard deviations, and 68, 95, and 99 percent confidence intervals are:

keff estimator	keff	standard deviation	68% confidence	95% confidence	99% confidence	corr
collision	.90068	.00127	.89941 to .90196	.89815 to .90322	.89732 to .90405	
absorption	.90008	.00132	.89876 to .90140	.89746 to .90270	.89660 to .90356	
track length	.89966	.00142	.89824 to .90108	.89683 to .90249	.89591 to .90342	
col/absorp	.90040	.00109	.89931 to .90149	.89822 to .90258	.89751 to .90329	.4081
abs/trk len	.89989	.00111	.89879 to .90100	.89769 to .90210	.89697 to .90282	.2980
col/trk len	.90039	.00126	.89913 to .90165	.89789 to .90290	.89707 to .90371	.7472
col/abs/trk len	.90019	.00108	.89910 to .90127	.89803 to .90235	.89732 to .90305	

C	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1											******* Base	Case at 300 K	*****	case sp40a	
2		Number Density Worksheet:			Isotope List					Far Field Criticality - 8%		UO2 in beginning - 40% Porosity Tuff w/ water			
3											Tuff Porosit	40%		Years Critical	0
4											Volume	11494000.00		UO2 added	0
5		Element	Symbol	Isotope	MCNP ID	Atomic Weight					UO2%	8%			Number
6	1	Hydrogen	H	H-1	1001.50C	1.007825				ISOTOPE	Gm/Critic	Aw	Wt%	MCNP ID	Density
7			D	H-2	1002.55C	2.014102				SM149	0	148.91718		62149.50c	0.0000E+00
8			T	H-3	1003.50C	3.01605				SM151	0	150.919919		62151.50c	0.0000E+00
9	2	Helium	He	nat.	2000.01C	4.0026				ND143	0	142.909779		60143.50c	0.0000E+00
10			He	He-4	2004.50C	4.002631				RH103	0	102.905511		45103.50c	0.0000E+00
11	3	Lithium	Li	Li-6	3006.50C	6.015125				EU151	0	150.919838		63151.55c	0.0000E+00
12			Li	Li-7	3007.55C	7.016004				GD157	0	156.924025		64157.50c	0.0000E+00
13	4	Beryllium	Be	Be-9	4009.50C	9.012186				GD155	0	154.922664		64155.50c	0.0000E+00
14	5	Boron	B	B-10	5010.50C	10.01294				CD(113)	0	112.4		48000.50c	0.0000E+00
15			B	B-11	5011.56C	11.00931				XE131	0	130.905069		54131.50c	0.0000E+00
16	6	Carbon	C	nat.	6000.50C	12.01115				CS133	0	132.905355		55133.50c	0.0000E+00
17			C	C-12	6012.50C	12				TC99	0	98.90628		43099.50c	0.0000E+00
18	7	Nitrogen	N	N-14	7014.50C	14.00307				SM147	0	146.914867		62147.50c	0.0000E+00
19	8	Oxygen	O	O-16	8016.50C	15.99492				XE135	0	134.9063		54135.50c	0.0000E+00
20	9	Fluorine	F	F-19	9019.50C	18.9984				ND145	0	144.912538		60145.50c	0.0000E+00
21	11	Sodium	Na	Na-23	11023.50C	22.98977				MO95	0	94.905839		42095.50c	0.0000E+00
22	12	Magnesium	Mg	nat.	12000.50C	24.312				U233	0	233.039522		92233.50c	0.0000E+00
23	13	Aluminum	Al	Al-27	13027.50C	26.98154				U234	0	234.040904		92234.50c	4.6944E-07
24	14	Silicon	Si	nat.	14000.50C	28.086				U235	0	235.043915		92235.50c	3.8253E-05
25	15	Phosphoru	P	P-31	15031.50C	30.97376				U236	0	236.045637		92236.50c	9.1532E-06
26	16	Sulfur	S	S-32	16032.50C	31.97207				U238	0	238.05077		92238.50c	1.9055E-03
27	17	Chlorine	Cl	nat.	17000.50C	35.452				NP237	0	237.048056		92237.55c	2.1829E-06
28	19	Potasium	K	nat.	19000.50C	39.102				PU238	0	238.049511		94238.50c	0.0000E+00
29	20	Calcium	Ca	nat.	20000.50C	40.08				PU239	0	239.052146		94239.55c	0.0000E+00
30	22	Titanium	Ti	nat.	22000.50C	47.9				PU240	0	240.053882		94240.50c	0.0000E+00
31	23	Vanadium	V	nat.	23000.50C	50.942				O	0	15.994915		8016.50c	4.2818E-02
32	24	Chromium	Cr	nat.	24000.50C	51.996			water	H		1.00782519		1001.50c	2.1396E-02
33	25	Manganese	Mn	Mn-55	25055.50C	54.93805				O		15.994915			
34	26	Iron	Fe	nat.	26000.55C	55.847			Tuff	O		15.994915			
35	27	Cobalt	Co	Co-59	27059.50C	58.93319				Na		22.9897707		11023.50c	3.9366E-04
36	28	Nickel	Ni	nat.	28000.50C	58.71				Mg		24.312		12000.50c	2.3128E-04
37	29	Copper	Cu	nat.	29000.50C	63.54				Al		26.9815389		13027.50c	2.6070E-03
38	30	Zinc	Zn	nat.		65.37				Si		28.086		14000.50c	1.1406E-02
39	33	Arsenic	As	As-75	33075.35C	74.9216				K		39.102		19000.50c	5.5591E-04
40	38	Strontium	Sr	nat.		87.62				Ca		40.08		20000.50c	5.6949E-04
41	40	Zirconium	Zr	nat.	40000.50C	91.22				Fe		55.847		26000.55c	1.4037E-04
42	41	Niobium	Nb	Nb-93	41093.50C	92.90638				TOTAL	0				8.20735E-02
43	42	Molybdenu	Mo	nat.	42000.50C	95.94									
44			Mo	Mo-95	42095.50c	94.90584					***** Base Case at 50 C (323 K) Case sp40a2				
45	43	Technetium	Tc	Tc-99*	43099.50c	98.90628									
46	44	Ruthenium	Ru	Ru-101	44101.50c	100.9056				Far Field Criticality - 8%		UO2 in beginning - 40% Porosity Tuff w/ water			
47	45	Rhodium	Rh	Rh-103	45103.50C	102.9055					Tuff Porosit	40%		Years Critical	0
48	47	Silver	Ag	Ag-109	47109.50C	108.9048					Volume	11494000.00		UO2 added	0
49	48	Cadmium	Cd	nat.	48000.50C	112.4					UO2%	8%	T=50 C de	0.99	Number
50	49	Indium	In	nat.		114.82				ISOTOPE	Gm/Critic	Aw	Wt%	MCNP ID	Density
51	50	Tin	Sn	nat.	50000.35C	118.69				SM149	0	148.91718		62149.50c	0.0000E+00
52	54	Xenon	Xe	Xe-131 *	54131.50c	130.9051	* AW from Chart of the Nuclides			SM151	0	150.919919		62151.50c	0.0000E+00
53			Xe	Xe-135 *	54135.50c	134.9063				ND143	0	142.909779		60143.50c	0.0000E+00
54	55	Cesium	Cs	Cs-133	55133.50c	132.9054				RH103	0	102.905511		45103.50c	0.0000E+00
55			Cs	Cs-135	55135.50c	134.9058				EU151	0	150.919838		63151.55c	0.0000E+00

C	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
56	56	Barium	Ba	nat.		137.34				GD157	0	156.924025		64157.50c	0.0000E+00
57	57	Lanthanum	La	nat.		138.91				GD155	0	154.922664		64155.50c	0.0000E+00
58	58	Cerium	Ce	nat.		140.12				CD(113)	0	112.4		48000.50c	0.0000E+00
59	60	Neodymiu	Nd	Nd-143	60143.50c	142.9098				XE131	0	130.905069		54131.50c	0.0000E+00
60			Nd	Nd-145	60145.50c	144.9125				CS133	0	132.905355		55133.50c	0.0000E+00
61										TC99	0	98.90628		43099.50c	0.0000E+00
62										SM147	0	146.914867		62147.50c	0.0000E+00
63										XE135	0	134.9063		54135.50c	0.0000E+00
64										ND145	0	144.912538		60145.50c	0.0000E+00
65		Number Density Worksheet:			Isotope List	(Continued)				MO95	0	94.905839		42095.50c	0.0000E+00
66										U233	0	233.039522		92233.50c	0.0000E+00
67										U234	0	234.040904		92234.50c	4.6944E-07
68		Element	Symbol	Isotope	MCNP ID	Atomic Weight				U235	0	235.043915		92235.53c	3.8253E-05
69	62	Samarium	Sm	Sm-147		146.9149				U236	0	236.045637		92236.50c	9.1532E-06
70			Sm	Sm-149	62149.50C	148.9172				U238	0	238.05077		92238.53c	1.9055E-03
71			Sm	Sm-150		149.9173				NP237	0	237.048056		93237.50c	2.1829E-06
72			Sm	Sm-151		150.9199				PU238	0	238.049511		94238.50c	0.0000E+00
73			Sm	Sm-152		151.9198				PU239	0	239.052146		94239.55c	0.0000E+00
74	63	Europium	Eu	Eu-151	63151.55C	150.9198				PU240	0	240.053882		94240.50c	0.0000E+00
75			Eu	Eu-153	63153.55C	152.9212				O	0	15.994915		8016.53c	4.2711E-02
76			Eu	Eu-154	63154.50C	153.9231				H		1.00782519		1001.53c	2.1182E-02
77	64	Gadolinium	Gd	nat.	64000.35C	157.25				O		15.994915			
78			Gd	Gd-155	64155.50C	154.9227				O		15.994915			
79			Gd	Gd-157	64157.50C	156.924				Na		22.9897707		11023.50c	3.9366E-04
80	72	Hafnium	Hf	nat.	72000.50C	178.49				Mg		24.312		12000.50c	2.3128E-04
81	73	Tantalum	Ta	Ta-181	73181.50C	180.948				Al		26.9815389		13027.50c	2.6070E-03
82	74	Tungsten	W	nat.	74000.55C	183.85				Si		28.086		14000.50c	1.1406E-02
83	82	Lead	Pb	nat.	82000.50C	207.19				K		39.102		19000.50c	5.5591E-04
84	92	Uranium	U	U-233	92233.50C	233.0395				Ca		40.08		20000.50c	5.6949E-04
85			U	U-234	92234.50C	234.0409				Fe		55.847		26000.55c	1.4037E-04
86			U	U-235	92235.50C	235.0439				TOTAL	0				8.17526E-02
87			U	U-236	92236.50C	236.0456			****** 100,000 year hydrologic cycle cases - years critical indicated below is full power equivalent c						
88			U	U-238	92238.50C	238.0508				Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water					w/ UO2 additio
89	93	Neptunium	Np	Np-237	93237.55C	237.0481					Tuff Porosit	40%		Years Critical	50000
90	94	Plutonium	Pu	Pu-238	94238.50C	238.0495					Volume	11494000.00		UO2 added	0.052391664
91			Pu	Pu-239	94239.55C	239.0521					UO2%	8%	T=50 C de	0.99	Number
92			Pu	Pu-240	94240.50C	240.0539				ISOTOPE	Gm/Critic	Aw	Wt%	MCNP ID	Density
93			Pu	Pu-241	94241.50C	241.0567				SM149	8.79E+00	148.91718		62149.50c	3.0928E-09
94			Pu	Pu-242	94242.50C	242.0587				SM150	1.85E+02	149.917276		62150.50c	6.4659E-08
95			Pu	Pu-243	94243.35C	243.062				ND143	9.53E+02	142.909779		60143.50c	3.4941E-07
96	95	Americium	Am	Am-241	95241.50C	241.0567				RH103	3.99E+02	102.905511		45103.50c	2.0316E-07
97			Am	Am-242m	95242.50C	242.0595				EU151	3.76E+01	150.919838		63151.55c	1.3054E-08
98			Am	Am-243	95243.50C	243.0614				KR83	5.03E+01	82.914137		36083.50c	3.1787E-08
99	96	Curium	Cm	Cm-243	96243.35C	243.0614				GD155	6.66E-01	154.922664		64155.50c	2.2525E-10
100			Cm	Cm-245	96245.35C	245.0654				CS135	1.05E+03	134.90577		55135.50c	4.0782E-07
101			Cm	Cm-248	96248.35C	248.0722				XE131	4.50E+02	130.905069		54131.50c	1.8012E-07
102	36	Krypton	Kr	Kr-83	36083.50C	82.91414				CS133	1.06E+03	132.905355		55133.50c	4.1790E-07
103										TC99	6.21E+02	98.90628		43099.50c	3.2898E-07
104		Number Density Worksheet:								SM147	3.89E+02	146.914867		62147.50c	1.3874E-07
105										SM152	7.57E+01	151.919756		62152.50c	2.6109E-08
106		Number Density = (Weight %) * (Density) * (Na) / (Aw)								ND145	6.66E+02	144.912538		60145.50c	2.4081E-07
107		Avogadro's Number [Na]		0.602252						MO95	7.23E+02	94.905839		42095.50c	3.9916E-07
108		Atomic Weight [Aw]								U233	1.87E+02	233.039522		92233.50c	4.2045E-08
109										U234	2.38E+03	234.040904		92234.50c	8.4027E-07
110										U235	1.54E+05	235.043915		92235.50c	5.9382E-05

C	A	B	C	D	E	F	G	H	I
111	TUFF & Water Number Densities								
112									
113		H2O	H	6.6861260E-02					
114			O	3.3430630E-02					
115	40% Porosi	Tuff	O	2.8209363E-02					
116			Na	3.9366415E-04					
117	Multiply 30.6%		Mg	2.3127847E-04					
118	Porosity Tuff by		Al	2.6069628E-03					
119	(1-0.4)/(1-0.306)		Si	1.1406406E-02					
120			K	5.5590692E-04					
121			Ca	5.6949182E-04					
122			Fe	1.4036533E-04					
123									
124									
125		Feed	3.0% / 20 GWD/mt						
126				Full Density	wt fraction				
127		UO2	O	4.8888950E-02	0.118494				
128			U-234	5.8680620E-06	0.000208				
129			U-235	4.7816080E-04	0.01703				
130			U-236	1.1441480E-04	0.004092				
131			U-238	2.3818750E-02	0.859195				
132			Np-237	2.7286570E-05	0.00098				
133					1				

C	J	K	L	M	N	O
111	U236	4.62E+04	236.045637		92236.50c	1.6250E-05
112	U238	8.63E+06	238.05077		92238.50c	3.1474E-03
113	NP237	9.53E+03	237.048056		93237.50c	3.5361E-06
114	PU238	0.00E+00	238.049511		94238.50c	0.0000E+00
115	PU239	5.81E+03	239.052146		94239.55c	1.2735E-06
116	PU240	5.87E+01	240.053882		94240.50c	1.2813E-08
117	O	0	15.994915		SUM 8016.50c	4.3539E-02
118	H		1.00782519		1001.50c	1.7714E-02
119	O		15.994915			
120	O		15.994915			
121	Na		22.9897707		11023.50c	3.9366E-04
122	Mg		24.312		12000.50c	2.3128E-04
123	Al		26.9815389		13027.50c	2.6070E-03
124	Si		28.086		14000.50c	1.1406E-02
125	K		39.102		19000.50c	5.5591E-04
126	Ca		40.08		20000.50c	5.6949E-04
127	Fe		55.847		26000.55c	1.4037E-04
128	TOTAL	8854835				8.03881E-02
129						
130						
131	Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water					
132		Tuff Porosit	40%		Years Critical	50000
133		Volume	11494000.00		UO2 added	0.052391664
134		UO2%	8%	T=265 C d	0.776	Number
135	ISOTOPE	Gm/Critic	Aw	Wt%	MCNP ID	Density
136	SM149	8.79E+00	148.91718		62149.50c	3.0928E-09
137	SM150	1.85E+02	149.917276		62150.50c	6.4659E-08
138	ND143	9.53E+02	142.909779		60143.50c	3.4941E-07
139	RH103	3.99E+02	102.905511		45103.50c	2.0316E-07
140	EU151	3.76E+01	150.919838		63151.55c	1.3054E-08
141	KR83	5.03E+01	82.914137		36083.50c	3.1787E-08
142	GD155	6.66E-01	154.922664		64155.50c	2.2525E-10
143	CS135	1.05E+03	134.90577		55135.50c	4.0782E-07
144	XE131	4.50E+02	130.905069		54131.50c	1.8012E-07
145	CS133	1.06E+03	132.905355		55133.50c	4.1790E-07
146	TC99	6.21E+02	98.90628		43099.50c	3.2898E-07
147	SM147	3.89E+02	146.914867		62147.50c	1.3874E-07
148	SM152	7.6E+01	151.919756		62152.50c	2.6109E-08
149	ND145	6.66E+02	144.912538		60145.50c	2.4081E-07
150	MO95	7.23E+02	94.905839		42095.50c	3.9916E-07
151	U233	1.87E+02	233.039522		92233.50c	4.2045E-08
152	U234	2.38E+03	234.040904		92234.50c	8.4027E-07
153	U235	1.54E+05	235.043915		92235.53c	5.9382E-05
154	U236	4.62E+04	236.045637		92236.50c	1.6250E-05
155	U238	8.63E+06	238.05077		92238.53c	3.1474E-03
156	NP237	9.53E+03	237.048056		93237.50c	3.5361E-06
157	PU238	0.00E+00	238.049511		94238.50c	0.0000E+00
158	PU239	5.81E+03	239.052146		94239.55c	1.2735E-06
159	PU240	5.87E+01	240.053882		94240.50c	1.2813E-08
160	O	0	15.994915		SUM 8016.50c	4.1624E-02
161	H		1.00782519		1001.50c	1.3885E-02
162	O		15.994915			
163	O		15.994915			
164	Na		22.9897707		11023.50c	3.9366E-04
165	Mg		24.312		12000.50c	2.3128E-04

C	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
166										Al		26.9815389		13027.50c	2.6070E-03
167										Si		28.086		14000.50c	1.1406E-02
168										K		39.102		19000.50c	5.5591E-04
169										Ca		40.08		20000.50c	5.6949E-04
170										Fe		55.847		26000.55c	1.4037E-04
171										TOTAL	8854835				7.46445E-02
172														*** case sp40ln	
173										Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water					no additional U
174											Tuff Porosit	40%		Years Critical	50000
175											Volume	11494000.00		UO2 added	0.052391664
176											UO2%	8%	T=50 C de	0.99	Number
177										ISOTOPE	Gm/Critic	Aw	Wt%	MCNP ID	Density
178										SM149	8.79E+00	148.91718		62149.50c	3.0928E-09
179										SM150	1.85E+02	149.917276		62150.50c	6.4659E-08
180										ND143	9.53E+02	142.909779		60143.50c	3.4941E-07
181										RH103	3.99E+02	102.905511		45103.50c	2.0316E-07
182										EU151	3.76E+01	150.919838		63151.55c	1.3054E-08
183										KR83	5.03E+01	82.914137		36083.50c	3.1787E-08
184										GD155	6.66E-01	154.922664		64155.50c	2.2525E-10
185										CS135	1.05E+03	134.90577		55135.50c	4.0782E-07
186										XE131	4.50E+02	130.905069		54131.50c	1.8012E-07
187										CS133	1.06E+03	132.905355		55133.50c	4.1790E-07
188										TC99	6.21E+02	98.90628		43099.50c	3.2898E-07
189										SM147	3.89E+02	146.914867		62147.50c	1.3874E-07
190										SM152	7.6E+01	151.919756		62152.50c	2.6109E-08
191										ND145	6.66E+02	144.912538		60145.50c	2.4081E-07
192										MO95	7.23E+02	94.905839		42095.50c	3.9916E-07
193										U233	1.87E+02	233.039522		92233.50c	4.2045E-08
194										U234	2.38E+03	234.040904		92234.50c	5.3283E-07
195										U235	1.54E+05	235.043915		92235.50c	3.4330E-05
196										U236	4.62E+04	236.045637		92236.50c	1.0255E-05
197										U238	8.63E+06	238.05077		92238.50c	1.8995E-03
198										NP237	9.53E+03	237.048056		93237.50c	2.1065E-06
199										PU238	0.00E+00	238.049511		94238.50c	0.0000E+00
200										PU239	5.81E+03	239.052146		94239.55c	1.2735E-06
201										PU240	5.87E+01	240.053882		94240.50c	1.2813E-08
202										O	0	15.994915		SUM 8016.50c	4.2711E-02
203										H		1.00782519		1001.50c	2.1182E-02
204										O		15.994915			
205										O		15.994915			
206										Na		22.9897707		11023.50c	3.9366E-04
207										Mg		24.312		12000.50c	2.3128E-04
208										Al		26.9815389		13027.50c	2.6070E-03
209										Si		28.086		14000.50c	1.1406E-02
210										K		39.102		19000.50c	5.5591E-04
211										Ca		40.08		20000.50c	5.6949E-04
212										Fe		55.847		26000.55c	1.4037E-04
213										TOTAL	8854835				8.17479E-02
214															
215															
216															
217															
218															
219															
220															

C	P	Q	R	S	T	U	V	W
1			**** Base case at	Power T=265 C	case sp40a1			
2		Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
3			Tuff Porosity=	40%		Years Critical	0	
4			Volume	11494000.00		UO2 added	0	
5			UO2%	8%	T=265 C den=	0.776	Number	
6		ISOTOPE	Gm/Critical %	Aw	Wt%	MCNP ID	Density	
7		SM149	0	148.91718		62149.50c	0.0000E+00	
8		SM151	0	150.919919		62151.50c	0.0000E+00	
9		ND143	0	142.909779		60143.50c	0.0000E+00	
10		RH103	0	102.905511		45103.50c	0.0000E+00	
11		EU151	0	150.919838		63151.55c	0.0000E+00	
12		GD157	0	156.924025		64157.50c	0.0000E+00	
13		GD155	0	154.922664		64155.50c	0.0000E+00	
14		CD(113)	0	112.4		48000.50c	0.0000E+00	
15		XE131	0	130.905069		54131.50c	0.0000E+00	
16		CS133	0	132.905355		55133.50c	0.0000E+00	
17		TC99	0	98.90628		43099.50c	0.0000E+00	
18		SM147	0	146.914867		62147.50c	0.0000E+00	
19		XE135	0	134.9063		54135.50c	0.0000E+00	
20		ND145	0	144.912538		60145.50c	0.0000E+00	
21		MO95	0	94.905839		42095.50c	0.0000E+00	
22		U233	0	233.039522		92233.50c	0.0000E+00	
23		U234	0	234.040904		92234.50c	4.6944E-07	
24		U235	0	235.043915		92235.53c	3.8253E-05	
25		U236	0	236.045637		92236.50c	9.1532E-06	
26		U238	0	238.05077		92238.53c	1.9055E-03	
27		NP237	0	237.048056		93237.50c	2.1829E-06	
28		PU238	0	238.049511		94238.50c	0.0000E+00	
29		PU239	0	239.052146		94239.55c	0.0000E+00	
30		PU240	0	240.053882		94240.50c	0.0000E+00	
31		O	0	15.994915		8016.53c	4.0422E-02	
32	water	H		1.00782519		1001.53c	1.6603E-02	
33		O		15.994915				
34	Tuff	O		15.994915				
35		Na		22.9897707		11023.50c	3.9366E-04	
36		Mg		24.312		12000.50c	2.3128E-04	
37		Al		26.9815389		13027.50c	2.6070E-03	
38		Si		28.086		14000.50c	1.1406E-02	
39		K		39.102		19000.50c	5.5591E-04	
40		Ca		40.08		20000.50c	5.6949E-04	
41		Fe		55.847		26000.55c	1.4037E-04	
42		TOTAL	0				7.48846E-02	
43								
44			***** Cases w/ UO2 addition at 132 g/year ******					*******
45				case names sp40(alpha)1				
46		Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
47			Tuff Porosity=	40%		Years Critical	1	
48			Volume	11494000.00		UO2 added	1.04783E-06	
49			UO2%	8%	T=265 C den=	0.776	Number	
50		ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
51		SM149	1.05E-02	148.91718		62149.50c	3.6945E-12	
52		SM151	4.62E-03	150.919919		62150.50c	1.6040E-12	
53		ND143	5.84E-02	142.909779		60143.50c	2.1412E-11	
54		RH103	1.79E-02	102.905511		45103.50c	9.1143E-12	
55		SM152	2.75E-03	151.919756		62152.50c	9.4847E-13	
56		GD157	7.73E-05	156.924025		64157.50c	2.5811E-14	
57		GD155	3.58E-04	154.922664		64155.50c	1.2118E-13	
58		CD(113)	6.62E-04	112.4		48000.50c	3.0860E-13	
59		XE131	2.44E-02	130.905069		54131.50c	9.7665E-12	
60		CS133	6.18E-02	132.905355		55133.50c	2.4364E-11	
61		TC99	3.98E-02	98.90628		43099.50c	2.1085E-11	
62		SM147	2.08E-02	146.914867		62147.50c	7.4290E-12	
63		XE135	8.7E-05	134.9063		54135.50c	3.3790E-14	

C	X	Y	Z	AA	AB	AC	AD
1		Backcheck of initial composition from SAS2H which was based on MCNP wt. fractions					
2	Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water					*** These # densities were not	
3		Tuff Porosity=	40%		Years Critical	0	
4		Volume	11494000.00		UO2 added	0	
5		UO2%	8%	T=265 C d	0.776	Number	
6	ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
7	SM149	0	148.91718		62149.50c	0.0000E+00	
8	SM151	0	150.919919		62151.50c	0.0000E+00	
9	ND143	0	142.909779		60143.50c	0.0000E+00	
10	RH103	0	102.905511		45103.50c	0.0000E+00	
11	EU151	0	150.919838		63151.55c	0.0000E+00	
12	GD157	0	156.924025		64157.50c	0.0000E+00	
13	GD155	0	154.922664		64155.50c	0.0000E+00	
14	CD(113)	0	112.4		48000.50c	0.0000E+00	
15	XE131	0	130.905069		54131.50c	0.0000E+00	
16	CS133	0	132.905355		55133.50c	0.0000E+00	
17	TC99	0	98.90628		43099.50c	0.0000E+00	
18	SM147	0	146.914867		62147.50c	0.0000E+00	
19	XE135	0	134.9063		54135.50c	0.0000E+00	
20	ND145	0	144.912538		60145.50c	0.0000E+00	
21	MO95	0	94.905839		42095.50c	0.0000E+00	
22	U233	0	233.039522		92233.50c	0.0000E+00	
23	U234	2119.55337	234.040904		92234.50c	4.7453E-07	
24	U235	171683.823	235.043915		92235.53c	3.8273E-05	
25	U236	41179.894	236.045637		92236.50c	9.1411E-06	
26	U238	8657769.92	238.05077		92238.53c	1.9057E-03	
27	NP237	9992.18017	237.048056		93237.50c	2.2087E-06	
28	PU238	0	238.049511		94238.50c	0.0000E+00	
29	PU239	0	239.052146		94239.55c	0.0000E+00	
30	PU240	0	240.053882		94240.50c	0.0000E+00	
31	O	0	15.994915		8016.53c	4.0422E-02	
32	H		1.00782519		1001.53c	1.6603E-02	
33	O		15.994915				
34	O		15.994915				
35	Na		22.9897707		11023.50c	3.9366E-04	
36	Mg		24.312		12000.50c	2.3128E-04	
37	Al		26.9815389		13027.50c	2.6070E-03	
38	Si		28.086		14000.50c	1.1406E-02	
39	K		39.102		19000.50c	5.5591E-04	
40	Ca		40.08		20000.50c	5.6949E-04	
41	Fe		55.847		26000.55c	1.4037E-04	
42	TOTAL	8882745.38				7.48848E-02	
43							
44	Assume no additional UO2 infiltration after criticality initiation.*****						
45			MCNP case names sp40(alpha)1n				
46	Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
47		Tuff Porosity=	40%		Years Critical	1	
48		Volume	11494000.00		UO2 added	0	
49		UO2%	8%	T=265 C d	0.776	Number	
50	ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
51	SM149	1.05E-02	148.91718		62149.50c	3.6945E-12	
52	SM151	4.62E-03	150.919919		62150.50c	1.6040E-12	
53	ND143	5.84E-02	142.909779		60143.50c	2.1412E-11	
54	RH103	1.79E-02	102.905511		45103.50c	9.1143E-12	
55	SM152	2.75E-03	151.919756		62152.50c	9.4847E-13	
56	GD157	7.73E-05	156.924025		64157.50c	2.5811E-14	
57	GD155	3.58E-04	154.922664		64155.50c	1.2118E-13	
58	CD(113)	6.62E-04	112.4		48000.50c	3.0860E-13	
59	XE131	2.44E-02	130.905069		54131.50c	9.7665E-12	
60	CS133	6.18E-02	132.905355		55133.50c	2.4364E-11	
61	TC99	3.98E-02	98.90628		43099.50c	2.1085E-11	
62	SM147	2.08E-02	146.914867		62147.50c	7.4290E-12	
63	XE135	8.7E-05	134.9063		54135.50c	3.3790E-14	

C	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
64		ND145	3.79E-02	144.912538		60145.50c	1.3704E-11		ND145	3.79E-02	144.912538		60145.50c	1.3704E-11	
65		KR83	2.92E-03	82.914137		36083.50c	1.8453E-12		KR83	2.92E-03	82.914137		36083.50c	1.8453E-12	
66		U233	2.84E-03	233.039522		92233.50c	6.3855E-13		U233	2.84E-03	233.039522		92233.50c	6.3855E-13	
67		U234	2.12E+03	234.040904		92234.50c	4.7463E-07		U234	2.12E+03	234.040904		92234.50c	4.7463E-07	
68		U235	1.72E+05	235.043915		92235.53c	3.8344E-05		U235	1.72E+05	235.043915		92235.53c	3.8343E-05	
69		U236	4.12E+04	236.045637		92236.50c	9.1456E-06		U236	4.12E+04	236.045637		92236.50c	9.1455E-06	
70		U238	8.66E+06	238.05077		92238.53c	1.9062E-03		U238	8.66E+06	238.05077		92238.53c	1.9061E-03	
71		NP237	9.99E+03	237.048056		93237.50c	2.2082E-06		NP237	9.99E+03	237.048056		93237.50c	2.2082E-06	
72		PU238	4.39E-02	238.049511		94238.50c	9.6628E-12		PU238	4.39E-02	238.049511		94238.50c	9.6628E-12	
73		PU239	1.18E+00	239.052146		94239.55c	2.5864E-10		PU239	1.18E+00	239.052146		94239.55c	2.5864E-10	
74		PU240	5.81E-06	240.053882		94240.50c	1.2682E-15		PU240	5.81E-06	240.053882		94240.50c	1.2682E-15	
75		O	0	15.994915		SUM 8016.53c	4.0422E-02		O	0	15.994915		8016.53c	4.0422E-02	
76		H		1.00782519		1001.53c	1.6603E-02		H		1.00782519		1001.53c	1.6603E-02	
77		O		15.994915					O		15.994915				
78		O		15.994915					O		15.994915				
79		Na		22.9897707		11023.50c	3.9366E-04		Na		22.9897707		11023.50c	3.9366E-04	
80		Mg		24.312		12000.50c	2.3128E-04		Mg		24.312		12000.50c	2.3128E-04	
81		Al		26.9815389		13027.50c	2.6070E-03		Al		26.9815389		13027.50c	2.6070E-03	
82		Si		28.086		14000.50c	1.1406E-02		Si		28.086		14000.50c	1.1406E-02	
83		K		39.102		19000.50c	5.5591E-04		K		39.102		19000.50c	5.5591E-04	
84		Ca		40.08		20000.50c	5.6949E-04		Ca		40.08		20000.50c	5.6949E-04	
85		Fe		55.847		26000.55c	1.4037E-04		Fe		55.847		26000.55c	1.4037E-04	
86		TOTAL	8885311.5098				7.48853E-02		TOTAL	8885311.51				7.48854E-02	
87	se sp40l														
88		Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water							Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
89			Tuff Porosity=	40%		Years Critical	10			Tuff Porosity=	40%		Years Critical	10	
90			Volume	11494000.00		UO2 added	0.0000104783			Volume	11494000.00		UO2 added	0	
91			UO2%	8%	T=265 C den=	0.776	Number			UO2%	8%	T=265 C d	0.776	Number	
92		ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density		ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
93		SM149	1.05E-01	148.91718		62149.50c	3.6945E-11		SM149	1.05E-01	148.91718		62149.50c	3.6945E-11	
94		SM151	4.10E-02	150.919919		62151.50c	1.4235E-11		SM151	4.10E-02	150.919919		62151.50c	1.4235E-11	
95		ND143	5.51E-01	142.909779		60143.50c	2.0202E-10		ND143	5.51E-01	142.909779		60143.50c	2.0202E-10	
96		RH103	2.09E-01	102.905511		45103.50c	1.0642E-10		RH103	2.09E-01	102.905511		45103.50c	1.0642E-10	
97		SM152	2.75E-02	151.919756		62152.50c	9.4847E-12		SM152	2.75E-02	151.919756		62152.50c	9.4847E-12	
98		GD157	7.32E-04	156.924025		64157.50c	2.4442E-13		GD157	7.32E-04	156.924025		64157.50c	2.4442E-13	
99		GD155	3.58E-03	154.922664		64155.50c	1.2108E-12		GD155	3.58E-03	154.922664		64155.50c	1.2108E-12	
100		CD(113)	6.65E-03	112.4		48000.50c	3.1000E-12		CD(113)	6.65E-03	112.4		48000.50c	3.1000E-12	
101		XE131	2.48E-01	130.905069		54131.50c	9.9266E-11		XE131	2.48E-01	130.905069		54131.50c	9.9266E-11	
102		CS133	5.83E-01	132.905355		55133.50c	2.2984E-10		CS133	5.83E-01	132.905355		55133.50c	2.2984E-10	
103		TC99	3.96E-01	98.90628		43099.50c	2.0979E-10		TC99	3.96E-01	98.90628		43099.50c	2.0979E-10	
104		SM147	2.19E-01	146.914867		62147.50c	7.7928E-11		SM147	2.19E-01	146.914867		62147.50c	7.7928E-11	
105		XE135	8.7E-05	134.9063		54135.50c	3.3790E-14		XE135	8.7E-05	134.9063		54135.50c	3.3790E-14	
106		ND145	3.72E-01	144.912538		60145.50c	1.3451E-10		ND145	3.72E-01	144.912538		60145.50c	1.3451E-10	
107		MO95	3.86E-01	94.905839		42095.50c	2.1311E-10		MO95	3.86E-01	94.905839		42095.50c	2.1311E-10	
108		U233	3.15E-02	233.039522		92233.50c	7.0825E-12		U233	3.15E-02	233.039522		92233.50c	7.0825E-12	
109		U234	2.12E+03	234.040904		92234.50c	4.7469E-07		U234	2.12E+03	234.040904		92234.50c	4.7463E-07	
110		U235	1.72E+05	235.043915		92235.53c	3.8348E-05		U235	1.72E+05	235.043915		92235.53c	3.8343E-05	
111		U236	4.12E+04	236.045637		92236.50c	9.1467E-06		U236	4.12E+04	236.045637		92236.50c	9.1455E-06	
112		U238	8.66E+06	238.05077		92238.53c	1.9064E-03		U238	8.66E+06	238.05077		92238.53c	1.9061E-03	
113		NP237	9.99E+03	237.048056		93237.50c	2.2085E-06		NP237	9.99E+03	237.048056		93237.50c	2.2082E-06	
114		PU238	4.27E-01	238.049511		94238.50c	9.3987E-11		PU238	4.27E-01	238.049511		94238.50c	9.3987E-11	
115		PU239	1.21E+01	239.052146		94239.55c	2.6522E-09		PU239	1.21E+01	239.052146		94239.55c	2.6522E-09	
116		PU240	6.00E-04	240.053882		94240.50c	1.3096E-13		PU240	6.00E-04	240.053882		94240.50c	1.3096E-13	
117		O	0	15.994915		SUM 8016.53c	4.0422E-02		O	0	15.994915		8016.53c	4.0422E-02	
118		H		1.00782519		1001.53c	1.6602E-02		H		1.00782519		1001.53c	1.6603E-02	
119		O		15.994915					O		15.994915				
120		O		15.994915					O		15.994915				
121		Na		22.9897707		11023.50c	3.9366E-04		Na		22.9897707		11023.50c	3.9366E-04	
122		Mg		24.312		12000.50c	2.3128E-04		Mg		24.312		12000.50c	2.3128E-04	
123		Al		26.9815389		13027.50c	2.6070E-03		Al		26.9815389		13027.50c	2.6070E-03	
124		Si		28.086		14000.50c	1.1406E-02		Si		28.086		14000.50c	1.1406E-02	
125		K		39.102		19000.50c	5.5591E-04		K		39.102		19000.50c	5.5591E-04	
126		Ca		40.08		20000.50c	5.6949E-04		Ca		40.08		20000.50c	5.6949E-04	

C	P	Q	R	S	T	U	V	W
127		Fe		55.847		26000.55c	1.4037E-04	
128		TOTAL	8885325.7071				7.48853E-02	
129								
130		Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
131			Tuff Porosity=	40%		Years Critical	100	
132			Volume	11494000.00		UO2 added	0.0001047833	
133			UO2%	8%	T=265 C den=	0.776	Number	
134		ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
135		SM149	9.89E-01	148.91718		62149.50c	3.4798E-10	
136		SM151	2.95E-01	150.919919		62151.50c	1.0242E-10	
137		ND143	5.52E+00	142.909779		60143.50c	2.0239E-09	
138		RH103	2.12E+00	102.905511		45103.50c	1.0795E-09	
139		EU151	1.28E-01	150.919838		63151.55c	4.4440E-11	
140		GD157	6.71E-03	156.924025		64157.50c	2.2405E-12	
141		GD155	3.26E-02	154.922664		64155.50c	1.1026E-11	
142		CD(113)	6.65E-02	112.4		48000.50c	3.1000E-11	
143		XE131	2.49E+00	130.905069		54131.50c	9.9667E-10	
144		CS133	5.84E+00	132.905355		55133.50c	2.3024E-09	
145		TC99	3.96E+00	98.90628		43099.50c	2.0979E-09	
146		SM147	2.10E+00	146.914867		62147.50c	7.4896E-10	
147		XE135	8.7E-05	134.9063		54135.50c	3.3790E-14	
148		ND145	3.72E+00	144.912538		60145.50c	1.3451E-09	
149		MO95	4.00E+00	94.905839		42095.50c	2.2084E-09	
150		U233	3.18E-01	233.039522		92233.50c	7.1500E-11	
151		U234	2.12E+03	234.040904		92234.50c	4.7524E-07	
152		U235	1.71E+05	235.043915		92235.53c	3.8170E-05	
153		U236	4.12E+04	236.045637		92236.50c	9.1575E-06	
154		U238	8.66E+06	238.05077		92238.53c	1.9086E-03	
155		NP237	9.99E+03	237.048056		93237.50c	2.2110E-06	
156		PU238	3.07E+00	238.049511		94238.50c	6.7574E-10	
157		PU239	1.19E+02	239.052146		94239.55c	2.6083E-08	
158		PU240	5.87E-02	240.053882		94240.50c	1.2813E-11	
159		O	0	15.994915		SUM 8016.53c	4.0424E-02	
160		H		1.00782519		1001.53c	1.6598E-02	
161		O		15.994915				
162		O		15.994915				
163		Na		22.9897707		11023.50c	3.9366E-04	
164		Mg		24.312		12000.50c	2.3128E-04	
165		Al		26.9815389		13027.50c	2.6070E-03	
166		Si		28.086		14000.50c	1.1406E-02	
167		K		39.102		19000.50c	5.5591E-04	
168		Ca		40.08		20000.50c	5.6949E-04	
169		Fe		55.847		26000.55c	1.4037E-04	
170		TOTAL	8884463.7146				7.48847E-02	
171								
172		Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
173	2		Tuff Porosity=	40%		Years Critical	1000	
174			Volume	11494000.00		UO2 added	0.0010478333	
175			UO2%	8%	T=265 C den=	0.776	Number	
176		ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
177		SM149	5.77E+00	148.91718		62149.50c	2.0302E-09	
178		SM151	5.49E-01	150.919919		62151.50c	1.9060E-10	
179		ND143	5.50E+01	142.909779		60143.50c	2.0165E-08	
180		RH103	2.13E+01	102.905511		45103.50c	1.0845E-08	
181		EU151	3.50E+00	150.919838		63151.55c	1.2151E-09	
182		GD157	3.34E-02	156.924025		64157.50c	1.1152E-11	
183		GD155	2.79E-01	154.922664		64155.50c	9.4362E-11	
184		CD(113)	6.89E-01	112.4		48000.50c	3.2119E-10	
185		XE131	2.49E+01	130.905069		54131.50c	9.9667E-09	
186		CS133	5.84E+01	132.905355		55133.50c	2.3024E-08	
187		TC99	3.95E+01	98.90628		43099.50c	2.0926E-08	
188		SM147	2.17E+01	146.914867		62147.50c	7.7393E-09	
189		SM152	2.92E+00	151.919756		62152.50c	1.0071E-09	

C	X	Y	Z	AA	AB	AC	AD
127	Fe		55.847		26000.55c	1.4037E-04	
128	TOTAL	8885325.71				7.48854E-02	
129							
130	Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
131		Tuff Porosity=	40%		Years Critical	100	
132		Volume	11494000.00		UO2 added	0	
133		UO2%	8%	T=265 C d	0.776	Number	
134	ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
135	SM149	9.89E-01	148.91718		62149.50c	3.4798E-10	
136	SM151	2.95E-01	150.919919		62151.50c	1.0242E-10	
137	ND143	5.52E+00	142.909779		60143.50c	2.0239E-09	
138	RH103	2.12E+00	102.905511		45103.50c	1.0795E-09	
139	EU151	1.28E-01	150.919838		63151.55c	4.4440E-11	
140	GD157	6.71E-03	156.924025		64157.50c	2.2405E-12	
141	GD155	3.26E-02	154.922664		64155.50c	1.1026E-11	
142	CD(113)	6.65E-02	112.4		48000.50c	3.1000E-11	
143	XE131	2.49E+00	130.905069		54131.50c	9.9667E-10	
144	CS133	5.84E+00	132.905355		55133.50c	2.3024E-09	
145	TC99	3.96E+00	98.90628		43099.50c	2.0979E-09	
146	SM147	2.10E+00	146.914867		62147.50c	7.4896E-10	
147	XE135	8.7E-05	134.9063		54135.50c	3.3790E-14	
148	ND145	3.72E+00	144.912538		60145.50c	1.3451E-09	
149	MO95	4.00E+00	94.905839		42095.50c	2.2084E-09	
150	U233	3.18E-01	233.039522		92233.50c	7.1500E-11	
151	U234	2.12E+03	234.040904		92234.50c	4.7463E-07	
152	U235	1.71E+05	235.043915		92235.53c	3.8120E-05	
153	U236	4.12E+04	236.045637		92236.50c	9.1455E-06	
154	U238	8.66E+06	238.05077		92238.53c	1.9061E-03	
155	NP237	9.99E+03	237.048056		93237.50c	2.2082E-06	
156	PU238	3.07E+00	238.049511		94238.50c	6.7574E-10	
157	PU239	1.19E+02	239.052146		94239.55c	2.6083E-08	
158	PU240	5.87E-02	240.053882		94240.50c	1.2813E-11	
159	O	0	15.994915		8016.53c	4.0422E-02	
160	H		1.00782519		1001.53c	1.6603E-02	
161	O		15.994915				
162	O		15.994915				
163	Na		22.9897707		11023.50c	3.9366E-04	
164	Mg		24.312		12000.50c	2.3128E-04	
165	Al		26.9815389		13027.50c	2.6070E-03	
166	Si		28.086		14000.50c	1.1406E-02	
167	K		39.102		19000.50c	5.5591E-04	
168	Ca		40.08		20000.50c	5.6949E-04	
169	Fe		55.847		26000.55c	1.4037E-04	
170	TOTAL	8884463.71				7.48852E-02	
171							
172	Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
173		Tuff Porosity=	40%		Years Critical	1000	
174		Volume	11494000.00		UO2 added	0	
175		UO2%	8%	T=265 C d	0.776	Number	
176	ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
177	SM149	5.77E+00	148.91718		62149.50c	2.0302E-09	
178	SM151	5.49E-01	150.919919		62151.50c	1.9060E-10	
179	ND143	5.50E+01	142.909779		60143.50c	2.0165E-08	
180	RH103	2.13E+01	102.905511		45103.50c	1.0845E-08	
181	EU151	3.50E+00	150.919838		63151.55c	1.2151E-09	
182	GD157	3.34E-02	156.924025		64157.50c	1.1152E-11	
183	GD155	2.79E-01	154.922664		64155.50c	9.4362E-11	
184	CD(113)	6.89E-01	112.4		48000.50c	3.2119E-10	
185	XE131	2.49E+01	130.905069		54131.50c	9.9667E-09	
186	CS133	5.84E+01	132.905355		55133.50c	2.3024E-08	
187	TC99	3.95E+01	98.90628		43099.50c	2.0926E-08	
188	SM147	2.17E+01	146.914867		62147.50c	7.7393E-09	
189	SM152	2.9E+00	151.919756		62152.50c	1.0071E-09	

C	P	Q	R	S	T	U	V	W
190		ND145	3.71E+01	144.912538		60145.50c	1.3415E-08	SUM FP
191		MO95	4.01E+01	94.905839		42095.50c	2.2139E-08	1.331E-07
192		U233	3.16E+00	233.039522		92233.50c	7.1050E-10	
193		U234	2.15E+03	234.040904		92234.50c	4.8749E-07	
194		U235	1.70E+05	235.043915		92235.53c	3.8398E-05	
195		U236	4.14E+04	236.045637		92236.50c	9.3098E-06	
196		U238	8.65E+06	238.05077		92238.53c	1.9289E-03	
197		NP237	9.97E+03	237.048056		93237.50c	2.2324E-06	
198		PU238	5.57E+00	238.049511		94238.50c	1.2260E-09	
199		PU239	1.15E+03	239.052146		94239.55c	2.5206E-07	
200		PU240	5.49E+00	240.053882		94240.50c	1.1983E-09	
201		O	0	15.994915		SUM 8016.53c	4.0446E-02	
202		H		1.00782519		1001.53c	1.6549E-02	
203		O		15.994915				
204		O		15.994915				
205		Na		22.9897707		11023.50c	3.9366E-04	
206		Mg		24.312		12000.50c	2.3128E-04	
207		Al		26.9815389		13027.50c	2.6070E-03	
208		Si		28.086		14000.50c	1.1406E-02	
209		K		39.102		19000.50c	5.5591E-04	
210		Ca		40.08		20000.50c	5.6949E-04	
211		Fe		55.847		26000.55c	1.4037E-04	
212		TOTAL	8874995.9604				7.48784E-02	
213								
214		Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
215			Tuff Porosity=	40%		Years Critical	5000	
216			Volume	11494000.00		UO2 added	0.0052391664	
217			UO2%	8%	T=265 C den=	0.776	Number	
218		ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
219		SM149	7.89E+00	148.91718		62149.50c	2.7761E-09	
220		SM150	4.54E+01	149.917276		62150.50c	1.5868E-08	
221		ND143	2.70E+02	142.909779		60143.50c	9.8994E-08	
222		RH103	1.09E+02	102.905511		45103.50c	5.5500E-08	
223		EU151	1.65E+01	150.919838		63151.55c	5.7285E-09	
224		GD157	5.42E-02	156.924025		64157.50c	1.8097E-11	
225		GD155	6.99E-01	154.922664		64155.50c	2.3641E-10	
226		CD(113)	3.96E+00	112.4		48000.50c	1.8479E-09	
227		XE131	1.24E+02	130.905069		54131.50c	4.9633E-08	
228		CS133	2.91E+02	132.905355		55133.50c	1.1472E-07	
229		TC99	1.96E+02	98.90628		43099.50c	1.0383E-07	
230		SM147	1.08E+02	146.914867		62147.50c	3.8518E-08	
231		SM152	1.69E+01	151.919756		62152.50c	5.8288E-09	
232		ND145	1.84E+02	144.912538		60145.50c	6.6530E-08	
233		MO95	1.99E+02	94.905839		42095.50c	1.0987E-07	
234		U233	1.53E+01	233.039522		92233.50c	3.4401E-09	
235		U234	2.28E+03	234.040904		92234.50c	5.4119E-07	
236		U235	1.63E+05	235.043915		92235.53c	3.8842E-05	
237		U236	4.25E+04	236.045637		92236.50c	1.0034E-05	
238		U238	8.65E+06	238.05077		92238.53c	2.0287E-03	
239		NP237	9.90E+03	237.048056		93237.50c	2.3313E-06	
240		PU238	5.49E+00	238.049511		94238.50c	1.2084E-09	
241		PU239	5.18E+03	239.052146		94239.55c	1.1354E-06	
242		PU240	1.08E+02	240.053882		94240.50c	2.3573E-08	
243		O	0	15.994915		SUM 8016.53c	4.0542E-02	
244		H		1.00782519		1001.53c	1.6331E-02	
245		O		15.994915				
246		O		15.994915				
247		Na		22.9897707		11023.50c	3.9366E-04	
248		Mg		24.312		12000.50c	2.3128E-04	
249		Al		26.9815389		13027.50c	2.6070E-03	
250		Si		28.086		14000.50c	1.1406E-02	
251		K		39.102		19000.50c	5.5591E-04	
252		Ca		40.08		20000.50c	5.6949E-04	

C	X	Y	Z	AA	AB	AC	AD
190	ND145	3.71E+01	144.912538		60145.50c	1.3415E-08	
191	MO95	4.01E+01	94.905839		42095.50c	2.2139E-08	
192	U233	3.16E+00	233.039522		92233.50c	7.1050E-10	
193	U234	2.15E+03	234.040904		92234.50c	4.8134E-07	
194	U235	1.70E+05	235.043915		92235.53c	3.7897E-05	
195	U236	4.14E+04	236.045637		92236.50c	9.1899E-06	
196	U238	8.65E+06	238.05077		92238.53c	1.9039E-03	
197	NP237	9.97E+03	237.048056		93237.50c	2.2038E-06	
198	PU238	5.57E+00	238.049511		94238.50c	1.2260E-09	
199	PU239	1.15E+03	239.052146		94239.55c	2.5206E-07	
200	PU240	5.49E+00	240.053882		94240.50c	1.1983E-09	
201	O	0	15.994915		8016.53c	4.0422E-02	
202	H		1.00782519		1001.53c	1.6603E-02	
203	O		15.994915				
204	O		15.994915				
205	Na		22.9897707		11023.50c	3.9366E-04	
206	Mg		24.312		12000.50c	2.3128E-04	
207	Al		26.9815389		13027.50c	2.6070E-03	
208	Si		28.086		14000.50c	1.1406E-02	
209	K		39.102		19000.50c	5.5591E-04	
210	Ca		40.08		20000.50c	5.6949E-04	
211	Fe		55.847		26000.55c	1.4037E-04	
212	TOTAL	8874995.96				7.48831E-02	
213							
214	Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
215		Tuff Porosity=	40%		Years Critical	5000	
216		Volume	11494000.00		UO2 added	0	
217		UO2%	8%	T=265 C d	0.776	Number	
218	ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
219	SM149	7.89E+00	148.91718		62149.50c	2.7761E-09	
220	SM150	4.54E+01	149.917276		62150.50c	1.5868E-08	
221	ND143	2.70E+02	142.909779		60143.50c	9.8994E-08	
222	RH103	1.09E+02	102.905511		45103.50c	5.5500E-08	
223	EU151	1.65E+01	150.919838		63151.55c	5.7285E-09	
224	GD157	5.42E-02	156.924025		64157.50c	1.8097E-11	
225	GD155	6.99E-01	154.922664		64155.50c	2.3641E-10	
226	CD(113)	3.96E+00	112.4		48000.50c	1.8479E-09	
227	XE131	1.24E+02	130.905069		54131.50c	4.9633E-08	
228	CS133	2.91E+02	132.905355		55133.50c	1.1472E-07	
229	TC99	1.96E+02	98.90628		43099.50c	1.0383E-07	
230	SM147	1.08E+02	146.914867		62147.50c	3.8518E-08	
231	SM152	1.69E+01	151.919756		62152.50c	5.8288E-09	
232	ND145	1.84E+02	144.912538		60145.50c	6.6530E-08	
233	MO95	1.99E+02	94.905839		42095.50c	1.0987E-07	
234	U233	1.53E+01	233.039522		92233.50c	3.4401E-09	
235	U234	2.28E+03	234.040904		92234.50c	5.1045E-07	
236	U235	1.63E+05	235.043915		92235.53c	3.6337E-05	
237	U236	4.25E+04	236.045637		92236.50c	9.4341E-06	
238	U238	8.65E+06	238.05077		92238.53c	1.9039E-03	
239	NP237	9.90E+03	237.048056		93237.50c	2.1883E-06	
240	PU238	5.49E+00	238.049511		94238.50c	1.2084E-09	
241	PU239	5.18E+03	239.052146		94239.55c	1.1354E-06	
242	PU240	1.08E+02	240.053882		94240.50c	2.3573E-08	
243	O	0	15.994915		8016.53c	4.0422E-02	
244	H		1.00782519		1001.53c	1.6603E-02	
245	O		15.994915				
246	O		15.994915				
247	Na		22.9897707		11023.50c	3.9366E-04	
248	Mg		24.312		12000.50c	2.3128E-04	
249	Al		26.9815389		13027.50c	2.6070E-03	
250	Si		28.086		14000.50c	1.1406E-02	
251	K		39.102		19000.50c	5.5591E-04	
252	Ca		40.08		20000.50c	5.6949E-04	

C	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
253		Fe		55.847		26000.55c	1.4037E-04		Fe		55.847		26000.55c	1.4037E-04	
254		TOTAL	8874561.1972				7.48597E-02		TOTAL	8874561.2				7.48833E-02	
255															
256		Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water							Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water						
257			Tuff Porosity=	40%		Years Critical	10000			Tuff Porosity=	40%		Years Critical	10000	
258			Volume	11494000.00		UO2 added	0.0104783327			Volume	11494000.00		UO2 added	0	
259			UO2%	8%	T=265 C den=	0.776	Number			UO2%	8%	T=265 C d	0.776	Number	
260		ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density		ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density	
261		SM149	8.02E+00	148.91718		62149.50c	2.8219E-09		SM149	8.02E+00	148.91718		62149.50c	2.8219E-09	
262		EU151	2.77E+01	150.919838		63151.55c	9.6170E-09		EU151	2.77E+01	150.919838		63151.55c	9.6170E-09	
263		ND143	5.30E+02	142.909779		60143.50c	1.9432E-07		ND143	5.30E+02	142.909779		60143.50c	1.9432E-07	
264		RH103	2.22E+02	102.905511		45103.50c	1.1304E-07		RH103	2.22E+02	102.905511		45103.50c	1.1304E-07	
265		XE131	2.49E+02	130.905069		54131.50c	9.9667E-08		XE131	2.49E+02	130.905069		54131.50c	9.9667E-08	
266		CS133	5.81E+02	132.905355		55133.50c	2.2906E-07		CS133	5.81E+02	132.905355		55133.50c	2.2906E-07	
267		SM147	2.14E+02	146.914867		62147.50c	7.6323E-08		SM147	2.14E+02	146.914867		62147.50c	7.6323E-08	
268		TC99	3.87E+02	98.90628		43099.50c	2.0502E-07		TC99	3.87E+02	98.90628		43099.50c	2.0502E-07	
269		GD155	8.59E-01	154.922664		64155.50c	2.9053E-10		GD155	8.59E-01	154.922664		64155.50c	2.9053E-10	
270		ND145	3.64E+02	144.912538		60145.50c	1.3161E-07		ND145	3.64E+02	144.912538		60145.50c	1.3161E-07	
271		SM152	3.80E+01	151.919756		62152.50c	1.3106E-08		SM152	3.8E+01	151.919756		62152.50c	1.3106E-08	
272		MO95	3.94E+02	94.905839		42095.50c	2.1753E-07		MO95	3.94E+02	94.905839		42095.50c	2.1753E-07	
273		CD(113)	9.01E+00	112.4		48000.50c	4.2020E-09		CD(113)	9.01E+00	112.4		48000.50c	4.2020E-09	
274		SM150	9.83E+01	149.917276		62150.50c	3.4356E-08	SUM FP	SM150	9.83E+01	149.917276		62150.50c	3.4356E-08	
275		KR83	2.78E+01	82.914137		36083.50c	1.7568E-08	1.349E-06	KR83	2.78E+01	82.914137		36083.50c	1.7568E-08	
276		U233	2.95E+01	233.039522		92233.50c	6.6328E-09		U233	2.95E+01	233.039522		92233.50c	6.6328E-09	
277		U234	2.43E+03	234.040904		92234.50c	6.0552E-07		U234	2.43E+03	234.040904		92234.50c	5.4403E-07	
278		U235	1.56E+05	235.043915		92235.53c	3.9787E-05		U235	1.56E+05	235.043915		92235.53c	3.4776E-05	
279		U236	4.37E+04	236.045637		92236.50c	1.0899E-05		U236	4.37E+04	236.045637		92236.50c	9.7005E-06	
280		U238	8.64E+06	238.05077		92238.53c	2.1513E-03		U238	8.64E+06	238.05077		92238.53c	1.9017E-03	
281		NP237	9.83E+03	237.048056		93237.50c	2.4587E-06		NP237	9.83E+03	237.048056		93237.50c	2.1728E-06	
282		PU238	5.43E+00	238.049511		94238.50c	1.1952E-09		PU238	5.43E+00	238.049511		94238.50c	1.1952E-09	
283		PU239	9.03E+03	239.052146		94239.55c	1.9793E-06		PU239	9.03E+03	239.052146		94239.55c	1.9793E-06	
284		PU240	3.21E+02	240.053882		94240.50c	7.0065E-08		PU240	3.21E+02	240.053882		94240.50c	7.0065E-08	
285		O	0	15.994915		SUM 8016.53c	4.0662E-02		O	0	15.994915		8016.53c	4.0422E-02	
286		H		1.00782519		1001.53c	1.6059E-02		H		1.00782519		1001.53c	1.6603E-02	
287		O		15.994915					O		15.994915				
288		O		15.994915					O		15.994915				
289		Na		22.9897707		11023.50c	3.9366E-04		Na		22.9897707		11023.50c	3.9366E-04	
290		Mg		24.312		12000.50c	2.3128E-04		Mg		24.312		12000.50c	2.3128E-04	
291		Al		26.9815389		13027.50c	2.6070E-03		Al		26.9815389		13027.50c	2.6070E-03	
292		Si		28.086		14000.50c	1.1406E-02		Si		28.086		14000.50c	1.1406E-02	
293		K		39.102		19000.50c	5.5591E-04		K		39.102		19000.50c	5.5591E-04	
294		Ca		40.08		20000.50c	5.6949E-04		Ca		40.08		20000.50c	5.6949E-04	
295		Fe		55.847		26000.55c	1.4037E-04		Fe		55.847		26000.55c	1.4037E-04	
296		TOTAL	8864496.623				7.48343E-02		TOTAL	8864496.62				7.48814E-02	
297															
298		Far Field Criticality - 8% UO2 in beginning - 40% Porosity Tuff w/ water - Extended													
299			Tuff Porosity=	40%		Years Critical	10000								
300			Volume	11494000.00		UO2 added	0.0104783327								
301			UO2%	8%	T=265 C den=	0.776	Number								
302		ISOTOPE	Gm/Critical	Aw	Wt%	MCNP ID	Density								
303		SM149	8.02E+00	148.91718		62149.50c	2.8219E-09								
304		EU151	2.77E+01	150.919838		63151.55c	9.6170E-09								
305		ND143	5.30E+02	142.909779		60143.50c	1.9432E-07								
306		RH103	2.22E+02	102.905511		45103.50c	1.1304E-07								
307		XE131	2.49E+02	130.905069		54131.50c	9.9667E-08								
308		CS133	5.81E+02	132.905355		55133.50c	2.2906E-07								
309		SM147	2.14E+02	146.914867		62147.50c	7.6323E-08								
310		TC99	3.87E+02	98.90628		43099.50c	2.0502E-07								
311		GD155	8.59E-01	154.922664		64155.50c	2.9053E-10								
312		ND145	3.64E+02	144.912538		60145.50c	1.3161E-07								
313		SM152	3.8E+01	151.919756		62152.50c	1.3106E-08								
314		MO95	3.94E+02	94.905839		42095.50c	2.1753E-07								
315		CD(113)	9.01E+00	112.4		48000.50c	4.2020E-09								

C	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
316		SM150	9.83E+01	149.917276		62150.50c	3.4356E-08								
317		KR83	2.78E+01	82.914137		36083.50c	1.7568E-08								
318		CS135	5.81E+02	134.90577		55135.50c	2.2566E-07								
319		GD157	7.02E-02	156.924025		64157.50c	2.3440E-11								
320		RU101	3.40E+02	100.905576		44101.50c	1.7655E-07								
321		EU153	1.90E+01	152.921242		63153.55c	6.5102E-09								
322		PR141	5.30E+02	140.907648	*	59141.50c	1.9708E-07								
323		SM151	6.13E-01	150.919919		62151.50c	2.1282E-10								
324		AG109	1.05E+01	108.904756		47109.50c	5.0518E-09								
325		PD105	9.04E+01	104.90508	*	46105.50c	4.5152E-08								
326		ZR93	2.49E+02	92.905676	*	40093.50c	1.4043E-07								
327		GD152	7.10E+00	151.919788		64152.50c	2.4488E-09								
328		PD108	1.45E+01	107.903894	*	46108.50c	7.0411E-09								
329		U233	2.95E+01	233.039522		92233.50c	6.6328E-09								
330		U234	2.43E+03	234.040904		92234.50c	6.0552E-07								
331		U235	1.56E+05	235.043915		92235.53c	3.9787E-05								
332		U236	4.37E+04	236.045637		92236.50c	1.0899E-05								
333		U238	8.64E+06	238.05077		92238.53c	2.1513E-03								
334		NP237	9.83E+03	237.048056		93237.50c	2.4587E-06								
335		PU238	5.43E+00	238.049511		94238.50c	1.1952E-09								
336		PU239	9.03E+03	239.052146		94239.55c	1.9793E-06								
337		PU240	3.21E+02	240.053882		94240.50c	7.0065E-08								
338		O	0	15.994915		SUM 8016.53c	4.0662E-02								
339		H		1.00782519		1001.53c	1.6059E-02								
340		O		15.994915											
341		O		15.994915											
342		Na		22.9897707		11023.50c	3.9366E-04								
343		Mg		24.312		12000.50c	2.3128E-04								
344		Al		26.9815389		13027.50c	2.6070E-03								
345		Si		28.086		14000.50c	1.1406E-02								
346		K		39.102		19000.50c	5.5591E-04								
347		Ca		40.08		20000.50c	5.6949E-04								
348		Fe		55.847		26000.55c	1.4037E-04								
349		TOTAL	8866338.8062				7.48351E-02								

Internal Criticality Radionuclide Inventory Comparisons

	Total Ci of 36 Isotopes per assembly							
	30	400	15000	16000	20000	25000	45000	65000
PWR Thermal/Shielding DBF, Decay Only					1.73E+02			
PWR Criticality DBF, Decay Only	1.18E+04	1.14E+03	1.45E+02	1.40E+02	1.20E+02	9.80E+01	5.30E+01	3.20E+01
PWR Criticality DBF, 1000 yr Criticality				1.50E+02			5.40E+01	3.30E+01
PWR Criticality DBF, 5000 yr Criticality					1.40E+02		5.50E+01	3.30E+01
PWR Criticality DBF, 10000 yr Criticality						1.20E+02	5.80E+01	3.50E+01

		Total Ci of 36 TSPA 95 Isotopes Per Unit Burnup Age of Fuel (years)							
PWR Thermal/Shielding DBF, Decay Only	Incremental Burnup (GWd)	30	400	15000	16000	20000	25000	45000	65000
PWR Criticality DBF, Decay Only	9.280	1274.58	122.40	15.60	15.09	12.93	10.56	5.71	3.45
PWR Criticality DBF, 1000 yr Criticality	0.038				263.16			26.32	26.32
PWR Criticality DBF, 5000 yr Criticality	0.190					105.40		10.54	5.27
PWR Criticality DBF, 10000 yr Criticality	0.380						57.97	13.17	7.90

PWR DBF ISOTOPE	Imported Data from CDB-R Therm/Shld decay only 20000 yrs CURIES/MTIHM	(Ci/MTHM*.464) CURIES/ASSY	PWR Crit. DBF Isotopes	16000 yr 1k crit	20000 yr 5k crit	From Ref. 5.53 25000 yr 10k crit	45000 yr 1k crit	5k crit
========	==================							
AC227	6.77E-03	3.14E-03	ac227	4.9E-03	8.8E-03	1.4E-02	1.0E-02	1.2E-02
AM241	1.45E-01	6.74E-02	am241	2.6E+00	2.7E+00	2.1E+00	2.0E-04	1.9E-04
AM242M	7.23E-39	3.35E-39	am242m	2.0E-03	2.4E-03	1.9E-03	0.0E+00	0.0E+00
AM243	5.67E+00	2.63E+00	am243	4.8E-01	4.4E-01	4.1E-01	3.1E-02	4.2E-02
C 14	1.45E-01	6.71E-02	c 14	4.9E-06	3.5E-06	2.4E-06	1.5E-07	1.7E-07
CM244	1.19E-10	5.51E-11	cm244	1.7E-02	1.6E-02	1.5E-02	0.0E+00	0.0E+00
CM245	1.45E-01	6.73E-02	cm245	2.1E-03	1.4E-03	8.8E-04	2.0E-04	1.9E-04
CM246	1.04E-02	4.80E-03	cm246	9.6E-05	7.4E-05	5.2E-05	1.4E-06	1.9E-06
CS135	6.90E-01	3.20E-01	cs135	2.0E-01	2.1E-01	2.2E-01	2.0E-01	2.1E-01
I129	4.50E-02	2.09E-02	i129	8.8E-03	9.0E-03	9.2E-03	8.8E-03	9.0E-03
NB 93M	2.83E+00	1.31E+00	nb 93m	3.5E-01	3.5E-01	3.6E-01	3.4E-01	3.5E-01
NB 94	7.40E-01	3.43E-01	nb 94	1.9E-05	4.1E-05	7.4E-05	7.1E-06	1.8E-05
NP237	1.75E+00	8.10E-01	np237	3.8E-01	3.8E-01	3.9E-01	3.8E-01	3.8E-01
PA231	6.77E-03	3.14E-03	pa231	4.9E-03	8.8E-03	1.4E-02	1.0E-02	1.2E-02
PB210	5.10E-01	2.37E-01	pb210	8.0E-02	1.0E-01	1.3E-01	2.1E-01	2.2E-01
PD107	1.66E-01	7.68E-02	pd107	2.6E-02	2.7E-02	2.7E-02	2.6E-02	2.7E-02
PU238	1.42E-38	6.59E-39	pu238	2.9E+00	3.0E+00	3.1E+00	0.0E+00	0.0E+00
PU239	2.44E+02	1.13E+02	pu239	1.0E+02	9.6E+01	8.7E+01	4.5E+01	4.7E+01
PU240	8.62E+01	4.00E+01	pu240	2.9E+01	2.3E+01	1.8E+01	1.4E+00	1.7E+00
PU241	1.45E-01	6.74E-02	pu241	3.2E+00	2.6E+00	2.1E+00	2.0E-04	1.9E-04
PU242	2.45E+00	1.14E+00	pu242	2.7E-01	2.7E-01	2.6E-01	2.6E-01	2.5E-01
RA226	5.10E-01	2.37E-01	ra226	8.0E-02	1.0E-01	1.3E-01	2.1E-01	2.2E-01
RA228	4.65E-07	2.16E-07	ra228	9.0E-08	1.1E-07	1.5E-07	2.8E-07	2.8E-07
SE 79	4.77E-01	2.21E-01	se 79	1.4E-01	1.3E-01	1.2E-01	7.5E-02	7.7E-02
SM151	0.00E+00	0.00E+00	sm151	7.9E-01	8.0E-01	8.1E-01	0.0E+00	0.0E+00
SN126	9.83E-01	4.56E-01	sn126	1.3E-01	1.2E-01	1.2E-01	1.0E-01	1.0E-01
TC 99	1.70E+01	7.90E+00	tc 99	3.8E+00	3.8E+00	3.8E+00	3.4E+00	3.5E+00
TH229	7.91E-02	3.67E-02	th229	1.1E-02	1.6E-02	2.3E-02	5.1E-02	5.1E-02
TH230	5.71E-01	2.65E-01	th230	9.2E-02	1.1E-01	1.4E-01	2.2E-01	2.3E-01
TH232	4.64E-07	2.15E-07	th232	9.0E-08	1.1E-07	1.5E-07	2.8E-07	2.8E-07
U233	1.44E-01	6.66E-02	u233	2.5E-02	3.1E-02	3.7E-02	6.7E-02	6.7E-02
U234	3.39E+00	1.57E+00	u234	6.7E-01	6.9E-01	7.2E-01	6.3E-01	6.6E-01
U235	2.23E-02	1.03E-02	u235	1.6E-02	1.6E-02	1.6E-02	1.8E-02	1.8E-02
U236	5.30E-01	2.46E-01	u236	1.3E-01	1.3E-01	1.4E-01	1.3E-01	1.4E-01
U238	3.11E-01	1.44E-01	u238	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
ZR 93	2.97E+00	1.38E+00	zr 93	3.5E-01	3.5E-01	3.6E-01	3.4E-01	3.5E-01
36 TSPA Total	3.73E+02	1.73E+02		1.5E+02	1.4E+02	1.2E+02	5.4E+01	5.5E+01

								decay only				
	65000 yr				Ref. 5.53	Ref. 5.53	Ref. 5.53	Ref. 5.54	Ref. 5.54	Ref. 5.54	Ref. 5.54	Ref. 5.54
10k crit	1k crit	5k crit	10k crit		30 yr	400 yr	15000 yr	16000 yr	20000 yr	25000 yr	45000 yr	65000 yr
1.5E-02	1.3E-02	1.4E-02	1.6E-02		1.1E-05	1.2E-04	4.0E-03	4.3E-03	5.2E-03	6.3E-03	1.0E-02	1.3E-02
1.7E-04	3.9E-05	3.6E-05	3.4E-05		1.1E+03	7.9E+02	2.4E-03	2.2E-03	1.6E-03	1.1E-03	2.0E-04	3.9E-05
0.0E+00	0.0E+00	0.0E+00	0.0E+00		3.9E+00	6.3E-01	4.6E-32	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
6.3E-02	4.8E-03	6.4E-03	9.5E-03		2.0E+00	1.9E+00	4.9E-01	4.5E-01	3.1E-01	1.9E-01	2.9E-02	4.5E-03
2.1E-07	1.3E-08	1.5E-08	1.9E-08		3.3E-05	3.2E-05	5.4E-06	4.8E-06	3.0E-06	1.6E-06	1.4E-07	1.3E-08
0.0E+00	0.0E+00	0.0E+00	0.0E+00		3.9E+01	2.7E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.7E-04	3.9E-05	3.6E-05	3.4E-05		7.9E-03	7.6E-03	2.3E-03	2.1E-03	1.5E-03	1.0E-03	2.0E-04	3.9E-05
2.8E-06	7.3E-08	1.0E-07	1.5E-07		9.2E-04	8.7E-04	1.0E-04	8.8E-05	4.9E-05	2.4E-05	1.3E-06	6.7E-08
2.2E-01	2.0E-01	2.1E-01	2.2E-01		2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01
9.2E-03	8.8E-03	9.0E-03	9.2E-03		8.8E-03	8.8E-03	8.8E-03	8.8E-03	8.8E-03	8.8E-03	8.8E-03	8.8E-03
3.6E-01	3.4E-01	3.5E-01	3.5E-01		2.6E-01	3.5E-01	3.5E-01	3.5E-01	3.5E-01	3.4E-01	3.4E-01	3.4E-01
3.7E-05	3.6E-06	8.9E-06	1.9E-05		2.3E-05	2.3E-05	1.4E-05	1.4E-05	1.2E-05	1.0E-05	5.0E-06	2.5E-06
3.9E-01	3.8E-01	3.8E-01	3.8E-01		9.7E-02	2.2E-01	3.8E-01	3.8E-01	3.8E-01	3.8E-01	3.8E-01	3.8E-01
1.5E-02	1.3E-02	1.4E-02	1.6E-02		2.2E-05	1.3E-04	4.0E-03	4.3E-03	5.2E-03	6.3E-03	1.0E-02	1.3E-02
2.2E-01	2.8E-01	2.9E-01	3.1E-01		2.9E-07	1.6E-04	7.5E-02	8.0E-02	1.0E-01	1.3E-01	2.1E-01	2.8E-01
2.7E-02	2.6E-02	2.7E-02	2.7E-02		2.6E-02	2.6E-02	2.6E-02	2.6E-02	2.6E-02	2.6E-02	2.6E-02	2.6E-02
0.0E+00	0.0E+00	0.0E+00	0.0E+00		4.1E+02	2.3E+01	4.6E-32	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4.9E+01	2.6E+01	2.6E+01	2.8E+01		1.6E+02	1.6E+02	1.1E+02	1.0E+02	9.2E+01	8.0E+01	4.5E+01	2.5E+01
2.2E+00	1.7E-01	2.0E-01	2.7E-01		1.5E+02	1.5E+02	3.1E+01	2.8E+01	1.9E+01	1.1E+01	1.3E+00	1.6E-01
1.7E-04	3.9E-05	3.6E-05	3.4E-05		9.8E+03	7.8E-03	2.3E-03	2.1E-03	1.5E-03	1.0E-03	2.0E-04	3.9E-05
2.5E-01	2.5E-01	2.5E-01	2.4E-01		2.8E-01	2.8E-01	2.7E-01	2.7E-01	2.7E-01	2.7E-01	2.6E-01	2.5E-01
2.2E-01	2.8E-01	2.9E-01	3.1E-01		1.1E-06	1.8E-04	7.5E-02	8.0E-02	1.0E-01	1.3E-01	2.1E-01	2.8E-01
2.8E-07	4.1E-07	4.2E-07	4.2E-07		1.1E-10	1.8E-09	8.4E-08	9.0E-08	1.1E-07	1.5E-07	2.8E-07	4.1E-07
7.9E-02	4.9E-02	5.1E-02	5.2E-02		1.9E-01	1.9E-01	1.4E-01	1.4E-01	1.3E-01	1.1E-01	7.5E-02	4.9E-02
0.0E+00	0.0E+00	0.0E+00	0.0E+00		1.3E+02	7.5E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.1E-01	8.9E-02	9.1E-02	9.3E-02		1.4E-01	1.4E-01	1.3E-01	1.2E-01	1.2E-01	1.2E-01	1.0E-01	8.8E-02
3.5E+00	3.2E+00	3.3E+00	3.3E+00		3.9E+00	3.9E+00	3.8E+00	3.7E+00	3.7E+00	3.6E+00	3.4E+00	3.2E+00
5.1E-02	7.8E-02	7.8E-02	7.8E-02		4.8E-08	4.5E-06	1.0E-02	1.2E-02	1.6E-02	2.3E-02	5.1E-02	7.8E-02
2.3E-01	2.9E-01	3.0E-01	3.1E-01		1.6E-04	2.3E-03	8.7E-02	9.2E-02	1.1E-01	1.4E-01	2.2E-01	2.9E-01
2.8E-07	4.1E-07	4.2E-07	4.2E-07		1.5E-10	1.8E-09	8.4E-08	9.0E-08	1.1E-07	1.5E-07	2.8E-07	4.1E-07
6.7E-02	9.3E-02	9.3E-02	9.3E-02		2.2E-05	2.9E-04	2.3E-02	2.5E-02	3.1E-02	3.9E-02	6.7E-02	9.3E-02
6.9E-01	6.1E-01	6.3E-01	6.6E-01		5.4E-01	6.8E-01	6.7E-01	6.7E-01	6.6E-01	6.5E-01	6.3E-01	6.0E-01
1.7E-02	1.8E-02	1.8E-02	1.8E-02		1.4E-02	1.4E-02	1.6E-02	1.6E-02	1.6E-02	1.6E-02	1.8E-02	1.8E-02
1.4E-01	1.4E-01	1.4E-01	1.4E-01		9.2E-02	9.3E-02	1.3E-01	1.3E-01	1.3E-01	1.3E-01	1.3E-01	1.3E-01
1.5E-01	1.5E-01	1.5E-01	1.5E-01		1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
3.6E-01	3.4E-01	3.5E-01	3.5E-01		3.5E-01	3.5E-01	3.5E-01	3.5E-01	3.5E-01	3.4E-01	3.4E-01	3.4E-01
5.8E+01	3.3E+01	3.3E+01	3.5E+01		1.2E+04	1.1E+03	1.4E+02	1.4E+02	1.2E+02	9.8E+01	5.3E+01	3.2E+01

```
1mcnp     version 4a    ld=10/01/93                          07/26/96 08:40:39
****************************************************************************         probid =   07/26/96 08:40:39
 inp=sp40a outp=sp40a.0

         Far-Field Consequence Study - 32% H2O/ 8% UO2 (sp40a) 0 Years  300K
         C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
         C    Water and UO2 offset each other in porous space
         C     CELL SPECIFICATIONS
         C     INNER WATER REGION
         1     1  8.20735-2   -1    IMP:N=1
         2     2  8.42302-2  1 -2   IMP:N=1
         C     OUTSIDE WORLD
         3     0  2   IMP:N=0

         C     SURFACE SPECIFICATIONS
         1     SO  140         $ INNER FUEL ZONE
         2     SO  200         $ TUFF REFLECTOR

         MODE  N
         KCODE  4000 1. 30 130
         C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
         C       0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5  -16 5 5 0 10 10 17
         C      MATERIAL SPECIFICATIONS
         c        32 vol% water in calico Hills tuff - 8 vol% UO2
         c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
         m1       1001.50c 2.1396-2   8016.50c 4.2818-2  11023.50c 3.9366-4
                 12000.50c 2.3128-4  13027.50c 2.6070-3  14000.50c 1.1406-2
                 19000.50c 5.5591-4  20000.50c 5.6949-4  26000.55c 1.4037-4
                 92234.50c 4.6944-7  92235.50c 3.8253-5  92236.50c 9.1532-6
                 92238.50c 1.9055-3  93237.50c 2.1829-6
         mt1     lwtr.01t
         c        40 vol% water in calico Hills tuff
         m2       1001.50c 2.6744-2   8016.50c 4.1582-2  11023.50c 3.9366-4
                 12000.50c 2.3128-4  13027.50c 2.6070-3  14000.50c 1.1406-2
                 19000.50c 5.5591-4  20000.50c 5.6949-4  26000.55c 1.4037-4
         mt2     lwtr.01t
         PRINT
1    initial source from file   srctp

 original number of points                     4015
    points not in any cell                 0
    points in cells of zero importance     0
    points in void cells                   0
    points in ambiguous cells              0
 total points rejected                            0
 points remaining                              4015
 points after expansion or contraction         4001
 nominal source size                           4000

 initial guess for k(eff.)                 1.000000

 cycles to skip before tallying                  30

 number of keff cycles that can be stored       260

 total fission nubar data are being used.
1material composition                                                          print table 40

 material
  number     component nuclide, atom fraction
```

```
    1          1001,   .26069      8016,   .52170      11023,   .00480      12000,   .00282
              13027,   .03176     14000,   .13897      19000,   .00677      20000,   .00694
              26000,   .00171     92234,   .00001      92235,   .00047      92236,   .00011
              92238,   .02322     93237,   .00003
 associated thermal s(a,b) data sets:    lwtr.01t
    2          1001,   .31751      8016,   .49367      11023,   .00467      12000,   .00275
              13027,   .03095     14000,   .13542      19000,   .00660      20000,   .00676
              26000,   .00167
 associated thermal s(a,b) data sets:    lwtr.01t



 material
  number     component nuclide, mass fraction

    1          1001,   .01323      8016,   .42028      11023,   .00555      12000,   .00345
              13027,   .04317     14000,   .19658      19000,   .01334      20000,   .01401
              26000,   .00481     92234,   .00007      92235,   .00552      92236,   .00133
              92238,   .27836     93237,   .00032
    2          1001,   .02344      8016,   .57845      11023,   .00787      12000,   .00489
              13027,   .06118     14000,   .27861      19000,   .01890      20000,   .01985
              26000,   .00682
1cell volumes and masses                                                          print table 50

       cell     atom          gram          input        calculated                            reason volume
              density       density        volume         volume         mass       pieces   not calculated

    1    1  8.20735E-02   2.70602E+00   .00000E+00   1.14940E+07   3.11031E+07       1
    2    2  8.42302E-02   1.90934E+00   .00000E+00   2.20163E+07   4.20366E+07       1
    3    3   .00000E+00    .00000E+00   .00000E+00    .00000E+00    .00000E+00       0      infinite
1problem summary

     run terminated when   130 kcode cycles were done.
+                                                                                      07/26/96 11:15:45
     Far-Field Consequence Study - 32% H2O/ 8% UO2 (sp40a) 0 Years  300K     probid =  07/26/96 08:40:39
0
 neutron creation      tracks      weight        energy         neutron loss        tracks      weight         energy
                                   (per source particle)                                        (per source particle)

 source                519712    1.0006E+00    2.0304E+00       escape                  71    7.8193E-05    4.8272E-05
                                                                energy cutoff            0    0.            0.
                                                                time cutoff              0    0.            0.
 weight window              0    0.            0.               weight window            0    0.            0.
 cell importance            0    0.            0.               cell importance          0    0.            0.
 weight cutoff              0    5.8391E-02    2.5613E-05       weight cutoff       519894    5.8323E-02    2.4633E-05
 energy importance          0    0.            0.               energy importance        0    0.            0.
 dxtran                     0    0.            0.               dxtran                   0    0.            0.
 forced collisions          0    0.            0.               forced collisions        0    0.            0.
 exp. transform             0    0.            0.               exp. transform           0    0.            0.
 upscattering               0    0.            1.9735E-07       downscattering           0    0.            1.9368E+00
                                                                capture                  0    6.0074E-01    5.8408E-02
 (n,xn)                   505    7.4376E-04    5.4034E-04       loss to (n,xn)         252    3.7112E-04    3.1107E-03
 fission                    0    0.            0.               loss to fission          0    4.0018E-01    3.2580E-02
     total             520217    1.0597E+00    2.0310E+00           total           520217    1.0597E+00    2.0310E+00

   number of neutrons banked                 253         average lifetime, shakes          cutoffs
   neutron tracks per source particle   1.0010E+00         escape            2.0960E+04      tco   1.0000E+34
```

```
 neutron collisions per source particle 7.7830E+01        capture             9.3384E+03          eco    .0000E+00
 total neutron collisions                  40449082        capture or escape  9.3393E+03          wc1  -5.0000E-01
 net multiplication                 1.0004E+00  .0000      any termination     1.0085E+04          wc2  -2.5000E-01

computer time so far in this run     89.99 minutes         maximum number ever in bank        2
computer time in mcrun               89.95 minutes         bank overflows to backup file      0
source particles per minute          5.7777E+03            field length                       0
random numbers generated              466116603            most random numbers used was    12366 in history   242791

range of sampled source weights = 9.5102E-01 to 1.0692E+00
1neutron  activity in each cell                                                                        print table 126

             tracks     population   collisions   collisions     number       flux       average      average
      cell   entering                              * weight      weighted     weighted   track weight   track mfp
                                                 (per history)    energy       energy    (relative)      (cm)

    1    1    577532      519965      35423477    4.9823E+01   2.5818E-04   5.2493E-01   8.1462E-01   2.1899E+00
    2    2     75241       36493       5025605    5.1939E+00   4.7126E-05   2.2736E-01   5.9409E-01   1.3345E+00
1keff results for: Far-Field Consequence Study - 32% H2O/ 8% UO2 (sp40a) 0 Years  300K               probid =   07/26/96 08:40:39
```

the initial fission neutron source distribution was read from the srctp file named srctp .
the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally 4000 neutrons per cycle.
this problem has run 30 inactive cycles with 120293 neutron histories and 100 active cycles with 399419 neutron histories.

this calculation has completed the requested number of keff cycles using a total of 519712 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the k(collision) cycle values appear normally distributed at the 95 percent confidence level
the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

---

the final estimated combined collision/absorption/track-length keff = .97755 with an estimated standard deviation of .00081

the estimated 68, 95, & 99 percent keff confidence intervals are .97674 to .97835, .97593 to .97916, and .97541 to .97968

the estimated collision/absorption neutron removal lifetime = 9.36E-05 seconds with an estimated standard deviation of 1.75E-07

---

the estimated average keffs, one standard deviations, and 68, 95, and 99 percent confidence intervals are:

keff estimator	keff	standard deviation	68% confidence	95% confidence	99% confidence	corr
collision	.97699	.00138	.97561 to .97838	.97424 to .97974	.97334 to .98064	
absorption	.97847	.00110	.97736 to .97957	.97627 to .98066	.97556 to .98138	
track length	.97663	.00134	.97529 to .97797	.97397 to .97929	.97310 to .98016	
col/absorp	.97788	.00082	.97706 to .97870	.97624 to .97952	.97571 to .98005	-.1060
abs/trk len	.97770	.00080	.97690 to .97851	.97610 to .97930	.97558 to .97983	-.1259
col/trk len	.97645	.00135	.97510 to .97780	.97376 to .97914	.97288 to .98002	.9838
col/abs/trk len	.97755	.00081	.97674 to .97835	.97593 to .97916	.97541 to .97968	

```
1mcnp     version 4a    ld=10/01/93                        08/23/96 10:15:41
 *************************************************************************          probid =   08/23/96 10:15:41
 inp=sp40a2 outp=sp40a20

    1-       Far-Field Consequence Study - 32% H2O/ 8% UO2 (sp40a2) 0 Years  300K
    2-       C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
    3-       C    Water and UO2 offset each other in porous space  50 C uniform
    4-       C     CELL SPECIFICATIONS
    5-       C     INNER WATER REGION
    6-       1     1  8.17526-2   -1    IMP:N=1
    7-       2     2  8.38290-2  1 -2   IMP:N=1
    8-       C     OUTSIDE WORLD
    9-       3     0  2   IMP:N=0
   10-
   11-       C     SURFACE SPECIFICATIONS
   12-       1     SO  140       $ INNER FUEL ZONE
   13-       2     SO  200       $ TUFF REFLECTOR
   14-
   15-       MODE  N
   16-       KCODE  4000 1. 30 130
   17-       C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
   18-       C       0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5  -16 5 5 0 10 10 17
   19-       C      MATERIAL SPECIFICATIONS
   20-       c        32 (x .99 at 50 C) vol% water in calico Hills tuff - 8 vol% UO2
   21-       c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
   22-       m1        1001.50c 2.1182-2   8016.50c 4.2711-2  11023.50c 3.9366-4
   23-                12000.50c 2.3128-4  13027.50c 2.6070-3  14000.50c 1.1406-2
   24-                19000.50c 5.5591-4  20000.50c 5.6949-4  26000.55c 1.4037-4
   25-                92234.50c 4.6944-7  92235.50c 3.8253-5  92236.50c 9.1532-6
   26-                92238.50c 1.9055-3  93237.50c 2.1829-6
   27-       mt1      lwtr.01t
   28-       c         40 (x .99 at 50 C) vol% water in calico Hills tuff
   29-       m2        1001.50c 2.6477-2   8016.50c 4.1448-2  11023.50c 3.9366-4
   30-                12000.50c 2.3128-4  13027.50c 2.6070-3  14000.50c 1.1406-2
   31-                19000.50c 5.5591-4  20000.50c 5.6949-4  26000.55c 1.4037-4
   32-       mt2      lwtr.01t
   33-       PRINT
1     initial source from file   srctp

 original number of points                         4048
    points not in any cell                      0
    points in cells of zero importance          0
    points in void cells                        0
    points in ambiguous cells                   0
 total points rejected                                0
 points remaining                                  4048
 points after expansion or contraction             3997
 nominal source size                               4000

 initial guess for k(eff.)                     1.000000

 cycles to skip before tallying                      30

 number of keff cycles that can be stored           260

 total fission nubar data are being used.
1material composition                                                                      print table 40

 material
  number     component nuclide, atom fraction
```

```
    1        1001,   .25910      8016,   .52244     11023,   .00482     12000,   .00283
            13027,   .03189     14000,   .13952     19000,   .00680     20000,   .00697
            26000,   .00172     92234,   .00001     92235,   .00047     92236,   .00011
            92238,   .02331     93237,   .00003
 associated thermal s(a,b) data sets:    lwtr.01t
    2        1001,   .31585      8016,   .49444     11023,   .00470     12000,   .00276
            13027,   .03110     14000,   .13606     19000,   .00663     20000,   .00679
            26000,   .00167
 associated thermal s(a,b) data sets:    lwtr.01t



 material
  number    component nuclide, mass fraction

    1        1001,   .01312      8016,   .41972     11023,   .00556     12000,   .00345
            13027,   .04322     14000,   .19681     19000,   .01335     20000,   .01402
            26000,   .00482     92234,   .00007     92235,   .00552     92236,   .00133
            92238,   .27869     93237,   .00032
    2        1001,   .02326      8016,   .57779     11023,   .00789     12000,   .00490
            13027,   .06130     14000,   .27919     19000,   .01894     20000,   .01989
            26000,   .00683
1cell volumes and masses                                                       print table 50

        cell     atom         gram         input       calculated                            reason volume
                density      density       volume        volume        mass        pieces    not calculated

    1     1  8.17526E-02  2.70282E+00  .00000E+00  1.14940E+07  3.10664E+07     1
    2     2  8.38290E-02  1.90533E+00  .00000E+00  2.20163E+07  4.19483E+07     1
    3     3   .00000E+00   .00000E+00  .00000E+00   .00000E+00   .00000E+00     0       infinite
1problem summary

     run terminated when   130 kcode cycles were done.
                                                                                       08/23/96 13:47:25
+    Far-Field Consequence Study - 32% H2O/ 8% UO2 (sp40a2) 0 Years  300K     probid =  08/23/96 10:15:41
0
 neutron creation     tracks      weight      energy           neutron loss       tracks      weight      energy
                                  (per source particle)                                       (per source particle)

 source               518810    1.0023E+00  2.0305E+00         escape                113    1.2903E-04  1.2917E-04
                                                               energy cutoff           0    0.          0.
                                                               time cutoff             0    0.          0.
 weight window             0    0.          0.                 weight window           0    0.          0.
 cell importance           0    0.          0.                 cell importance         0    0.          0.
 weight cutoff             0    5.8402E-02  3.2972E-05         weight cutoff      518942    5.8636E-02  3.3741E-05
 energy importance         0    0.          0.                 energy importance       0    0.          0.
 dxtran                    0    0.          0.                 dxtran                  0    0.          0.
 forced collisions         0    0.          0.                 forced collisions       0    0.          0.
 exp. transform            0    0.          0.                 exp. transform          0    0.          0.
 upscattering              0    0.          1.9681E-07         downscattering          0    0.          1.9372E+00
                                                               capture                 0    6.0199E-01  5.8119E-02
 (n,xn)                  488    7.1361E-04  4.8042E-04         loss to (n,xn)        243    3.5546E-04  2.9646E-03
 fission                   0    0.          0.                 loss to fission         0    4.0030E-01  3.2620E-02
     total            519298    1.0614E+00  2.0310E+00             total          519298    1.0614E+00  2.0310E+00

   number of neutrons banked                     245     average lifetime, shakes          cutoffs
   neutron tracks per source particle     1.0009E+00       escape            2.1238E+04      tco   1.0000E+34
```

neutron collisions per source particle	7.7862E+01	capture	9.3706E+03	eco	.0000E+00
total neutron collisions	40395375	capture or escape	9.3722E+03	wc1	-5.0000E-01
net multiplication	1.0004E+00 .0000	any termination	1.0137E+04	wc2	-2.5000E-01

computer time so far in this run	89.65 minutes	maximum number ever in bank	2
computer time in mcrun	89.61 minutes	bank overflows to backup file	0
source particles per minute	5.7894E+03	field length	0
random numbers generated	465318405	most random numbers used was	12040 in history 376270

range of sampled source weights = 9.2915E-01 to 1.0650E+00

1neutron activity in each cell print table 126

	cell	tracks entering	population	collisions	collisions * weight (per history)	number weighted energy	flux weighted energy	average track weight (relative)	average track mfp (cm)
1	1	578169	519055	35184913	4.9712E+01	2.6018E-04	5.2471E-01	8.1658E-01	2.2038E+00
2	2	77612	37548	5210462	5.3914E+00	4.6338E-05	2.2143E-01	5.9394E-01	1.3362E+00
total		655781	556603	40395375	5.5103E+01				

1keff results for: Far-Field Consequence Study - 32% H2O/ 8% UO2 (sp40a2) 0 Years 300K probid = 08/23/96 10:15:41

the initial fission neutron source distribution was read from the srctp file named srctp .
the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally 4000 neutrons per cycle.
this problem has run 30 inactive cycles with 119746 neutron histories and 100 active cycles with 399064 neutron histories.

this calculation has completed the requested number of keff cycles using a total of 518810 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the k(collision) cycle values appear normally distributed at the 95 percent confidence level
the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

the final estimated combined collision/absorption/track-length keff = .97716 with an estimated standard deviation of .00073

the estimated 68, 95, & 99 percent keff confidence intervals are .97643 to .97789, .97571 to .97861, and .97524 to .97909

the estimated collision/absorption neutron removal lifetime = 9.37E-05 seconds with an estimated standard deviation of 1.80E-07

the estimated average keffs, one standard deviations, and 68, 95, and 99 percent confidence intervals are:

keff estimator	keff	standard deviation	68% confidence	95% confidence	99% confidence	corr
collision	.97733	.00132	.97600 to .97866	.97469 to .97997	.97383 to .98083	
absorption	.97701	.00099	.97602 to .97800	.97504 to .97897	.97440 to .97961	
track length	.97708	.00134	.97573 to .97842	.97440 to .97975	.97353 to .98062	
col/absorp	.97713	.00072	.97641 to .97785	.97569 to .97857	.97522 to .97904	-.1824
abs/trk len	.97703	.00073	.97630 to .97776	.97558 to .97849	.97510 to .97896	-.1692
col/trk len	.97731	.00134	.97597 to .97865	.97464 to .97998	.97377 to .98085	.9845

col/abs/trk len	.97716	.00073	.97643 to .97789	.97571 to .97861	.97524 to .97909

```
1mcnp     version 4a    ld=10/01/93                          07/26/96 12:01:33
 **************************************************************************      probid =   07/26/96 12:01:33
 inp=sp40a1 outp=sp40a1.0

          Far-Field Consequence Study - 32% H2O/ 8% UO2 (sp40a1) 0 Years  600K
          C    Calico Hills Tuff 1.5095 g/cc  .40 porosity -  sphere surrounded by tuff
          C    Water and UO2 offset each other in porous space / H2O @ 500k
          C     CELL SPECIFICATIONS
          C     INNER WATER REGION
          1     1  7.48846-2   -1   IMP:N=1
          2     2  8.38290-2  1 -2  IMP:N=1
          C     OUTSIDE WORLD
          3     0  2   IMP:N=0

          C     SURFACE SPECIFICATIONS
          1     SO  140       $ INNER FUEL ZONE
          2     SO  200       $ TUFF REFLECTOR

          MODE  N
          KCODE  4000 1. 30 130
          C     KSRC   0 0 1  0 0 10  0 0 -20  0 0 29  0 20 5  0 0 -5  -10 0 -10
          C       0 -5 -20 -10 0 -13 0 -10 14 0 0 -15 -10 -5  -16 5 5 0 10 10 17
          C      MATERIAL SPECIFICATIONS
          c        32 (x .776 at 265 C) vol% water in calico Hills tuff - 8 vol% UO2
          c        3.0% Original Enrichment/ 20 GWD/MT decayed to Uranium isotopes
          m1       1001.53c 1.6603-2   8016.53c 4.0422-2  11023.50c 3.9366-4
                  12000.50c 2.3128-4  13027.50c 2.6070-3  14000.50c 1.1406-2
                  19000.50c 5.5591-4  20000.50c 5.6949-4  26000.55c 1.4037-4
                  92234.50c 4.6944-7  92235.53c 3.8253-5  92236.50c 9.1532-6
                  92238.53c 1.9055-3  93237.50c 2.1829-6
          mt1     lwtr.03t
          c        40 (x .99 at 50 C) vol% water in calico Hills tuff
          m2       1001.53c 2.6477-2   8016.53c 4.1448-2  11023.50c 3.9366-4
                  12000.50c 2.3128-4  13027.50c 2.6070-3  14000.50c 1.1406-2
                  19000.50c 5.5591-4  20000.50c 5.6949-4  26000.55c 1.4037-4
          mt2     lwtr.02t
          PRINT
1    initial source from file   srctp

 original number of points                          4001
    points not in any cell                        0
    points in cells of zero importance            0
    points in void cells                          0
    points in ambiguous cells                     0
 total points rejected                                 0
 points remaining                                   4001
 points after expansion or contraction              4000
 nominal source size                                4000

 initial guess for k(eff.)                      1.000000

 cycles to skip before tallying                       30

 number of keff cycles that can be stored            260

 total fission nubar data are being used.

 warning.   lwtr.02t and   lwtr.03t are both called for.                                       print table 40
1material composition
```

```
material
 number     component nuclide, atom fraction

    1           1001,   .22172        8016,   .53979        11023,   .00526        12000,   .00309
               13027,   .03481       14000,   .15232        19000,   .00742        20000,   .00760
               26000,   .00187       92234,   .00001        92235,   .00051        92236,   .00012
               92238,   .02545       93237,   .00003
associated thermal s(a,b) data sets:     lwtr.03t
    2           1001,   .31585        8016,   .49444        11023,   .00470        12000,   .00276
               13027,   .03110       14000,   .13606        19000,   .00663        20000,   .00679
               26000,   .00167
associated thermal s(a,b) data sets:     lwtr.02t



material
 number     component nuclide, mass fraction

    1           1001,   .01055        8016,   .40755        11023,   .00570        12000,   .00354
               13027,   .04434       14000,   .20193        19000,   .01370        20000,   .01439
               26000,   .00494       92234,   .00007        92235,   .00567        92236,   .00136
               92238,   .28593       93237,   .00033
    2           1001,   .02326        8016,   .57779        11023,   .00789        12000,   .00490
               13027,   .06130       14000,   .27919        19000,   .01894        20000,   .01989
               26000,   .00683
1cell volumes and masses                                                                          print table 50

        cell      atom          gram          input        calculated                          reason volume
                density       density        volume         volume         mass       pieces   not calculated

     1     1  7.48846E-02   2.63436E+00   .00000E+00   1.14940E+07   3.02795E+07      1
     2     2  8.38290E-02   1.90533E+00   .00000E+00   2.20163E+07   4.19483E+07      1
     3     3   .00000E+00    .00000E+00   .00000E+00    .00000E+00    .00000E+00      0      infinite
1problem summary

     run terminated when   130 kcode cycles were done.
                                                                                       07/26/96 14:46:59
+    Far-Field Consequence Study - 32% H2O/ 8% UO2 (sp40a1) 0 Years  600K       probid =   07/26/96 12:01:33
0
 neutron creation      tracks      weight       energy            neutron loss        tracks      weight       energy
                                   (per source particle)                                          (per source particle)

 source                519688    1.0006E+00   2.0277E+00          escape                 112    1.1480E-04   1.1651E-04
                                                                  energy cutoff            0    0.           0.
                                                                  time cutoff              0    0.           0.
 weight window              0    0.           0.                  weight window            0    0.           0.
 cell importance            0    0.           0.                  cell importance          0    0.           0.
 weight cutoff              0    6.4155E-02   1.7917E-05          weight cutoff       519846    6.4103E-02   3.9674E-05
 energy importance          0    0.           0.                  energy importance        0    0.           0.
 dxtran                     0    0.           0.                  dxtran                   0    0.           0.
 forced collisions          0    0.           0.                  forced collisions        0    0.           0.
 exp. transform             0    0.           0.                  exp. transform           0    0.           0.
 upscattering               0    0.           3.4039E-07          downscattering           0    0.           1.9255E+00
                                                                  capture                  0    6.1590E-01   6.2459E-02
 (n,xn)                   538    7.8906E-04   5.5245E-04          loss to (n,xn)         268    3.9334E-04   3.2773E-03
 fission                    0    0.           0.                  loss to fission          0    3.8503E-01   3.6840E-02
     total             520226    1.0655E+00   2.0283E+00              total           520226    1.0655E+00   2.0283E+00
```

number of neutrons banked	270	average lifetime, shakes		cutoffs		
neutron tracks per source particle	1.0010E+00	escape	3.0559E+04	tco	1.0000E+34	
neutron collisions per source particle	7.9711E+01	capture	9.5684E+03	eco	.0000E+00	
total neutron collisions	41424645	capture or escape	9.5708E+03	wc1	-5.0000E-01	
net multiplication	1.0004E+00 .0000	any termination	1.0408E+04	wc2	-2.5000E-01	

computer time so far in this run	95.66 minutes	maximum number ever in bank	2
computer time in mcrun	95.62 minutes	bank overflows to backup file	0
source particles per minute	5.4349E+03	field length	0
random numbers generated	480822729	most random numbers used was	12386 in history 367999

range of sampled source weights = 9.0744E-01 to 1.0579E+00

1neutron activity in each cell print table 126

	cell	tracks entering	population	collisions	collisions * weight (per history)	number weighted energy	flux weighted energy	average track weight (relative)	average track mfp (cm)
1	1	599158	519957	34357801	4.8313E+01	3.0916E-04	5.0477E-01	8.0256E-01	2.5043E+00
2	2	102454	48279	7066844	7.2108E+00	4.6390E-05	1.9975E-01	5.7956E-01	1.3152E+00
total		701612	568236	41424645	5.5524E+01				

1keff results for: Far-Field Consequence Study - 32% H2O/ 8% UO2 (sp40a1) 0 Years 600K probid = 07/26/96 12:01:33

the initial fission neutron source distribution was read from the srctp file named srctp .
the criticality problem was scheduled to skip 30 cycles and run a total of 130 cycles with nominally 4000 neutrons per cycle.
this problem has run 30 inactive cycles with 119927 neutron histories and 100 active cycles with 399761 neutron histories.

this calculation has completed the requested number of keff cycles using a total of 519688 fission neutron source histories.
all cells with fissionable material were sampled and had fission neutron source points.

the results of the w test for normality applied to the individual collision, absorption, and track-length keff cycle values are:

the k(collision) cycle values appear normally distributed at the 95 percent confidence level
the k(absorption) cycle values appear normally distributed at the 95 percent confidence level
the k(trk length) cycle values appear normally distributed at the 95 percent confidence level

---

the final estimated combined collision/absorption/track-length keff = .94240 with an estimated standard deviation of .00099

the estimated 68, 95, & 99 percent keff confidence intervals are .94141 to .94339, .94042 to .94437, and .93978 to .94502

the estimated collision/absorption neutron removal lifetime = 9.56E-05 seconds with an estimated standard deviation of 2.03E-07

---

the estimated average keffs, one standard deviations, and 68, 95, and 99 percent confidence intervals are:

keff estimator	keff	standard deviation	68% confidence	95% confidence	99% confidence	corr
collision	.94224	.00151	.94073 to .94375	.93924 to .94524	.93826 to .94622	
absorption	.94255	.00119	.94136 to .94375	.94017 to .94493	.93940 to .94571	
track length	.94207	.00153	.94054 to .94361	.93902 to .94513	.93802 to .94613	
col/absorp	.94244	.00099	.94145 to .94342	.94047 to .94440	.93983 to .94504	.1015

abs/trk len	.94238	.00099	.94139 to .94336	.94042 to .94434	.93978 to .94498	.0842
col/trk len	.94227	.00152	.94075 to .94379	.93924 to .94529	.93826 to .94628	.9876
col/abs/trk len	.94240	.00099	.94141 to .94339	.94042 to .94437	.93978 to .94502	

```
1          primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-   module sas2h     will be called
     SAS2H: Far-Field Crit based on B&W 15x15, 3.00wt%, 20gwd/mtu 40% H2O/ 8% UO2
     44group     latticecell
     '
     '  mixtures of tuff infinite slabs:
     arbm-ftuff  2.6344 14 0 0 0 1001 1.055 8016 40.755 11023 0.570 12000 0.354
                             13027 4.434 14000 20.193 19000 1.370 20000 1.439
                             26000 0.494 92235 0.567 92234 0.007 92236 0.136
                             92238 28.593 93237 0.033 1 1.0 538   end
     kr-83      1 0 1-20 538 end
     kr-85      1 0 1-20 538 end
     sr-90      1 0 1-20 538 end
      y-89      1 0 1-20 538 end
     mo-95      1 0 1-20 538 end
     zr-93      1 0 1-20 538 end
     zr-94      1 0 1-20 538 end
     zr-95      1 0 1-20 538 end
     nb-94      1 0 1-20 538 end
     tc-99      1 0 1-20 538 end
     rh-103     1 0 1-20 538 end
     rh-105     1 0 1-20 538 end
     ru-101     1 0 1-20 538 end
     ru-106     1 0 1-20 538 end
     pd-105     1 0 1-20 538 end
     pd-108     1 0 1-20 538 end
     ag-109     1 0 1-20 538 end
     sb-124     1 0 1-20 538 end
     xe-131     1 0 1-20 538 end
     xe-132     1 0 1-20 538 end
     xe-135     1 0 1-20 538 end
     xe-136     1 0 1-20 538 end
     cs-134     1 0 1-20 538 end
     cs-135     1 0 1-20 538 end
     cs-137     1 0 1-20 538 end
     ba-136     1 0 1-20 538 end
     la-139     1 0 1-20 538 end
     pr-141     1 0 1-20 538 end
     pr-143     1 0 1-20 538 end
     ce-144     1 0 1-20 538 end
     nd-143     1 0 1-20 538 end
     nd-145     1 0 1-20 538 end
     pm-147     1 0 1-20 538 end
     pm-148     1 0 1-20 538 end
     nd-147     1 0 1-20 538 end
     sm-147     1 0 1-20 538 end
     sm-149     1 0 1-20 538 end
     sm-150     1 0 1-20 538 end
     sm-151     1 0 1-20 538 end
     sm-152     1 0 1-20 538 end
     gd-155     1 0 1-20 538 end
     eu-153     1 0 1-20 538 end
     eu-154     1 0 1-20 538 end
     eu-155     1 0 1-20 538 end
     arbm-tuff1  1.90533 9 0 0 0 1001 2.326 8016 57.779 11023 0.789 12000 0.490
                             13027 6.130 14000 27.919 19000 1.894 20000 1.989
                             26000 0.683 2 1.0 323.   end
     arbm-tuff2  1.90533 9 0 0 0 1001 2.326 8016 57.779 11023 0.789 12000 0.490
                             13027 6.130 14000 27.919 19000 1.894 20000 1.989
                             26000 0.683 3 1.0 323.   end
```

```
      '
      ' - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      end comp
      '
      ' - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      '
      '  fuel-pin-cell geometry:
      '
      symmslabcell  340.  280. 1 3 281. 2 end
      '
      ' - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      '
      '
      '  assembly and cycle parameters:
      '
      npin/assm=1 fuelngth=280. ncycles=1 nlib/cyc=5 volfueltot=1.1494E7
      printlevel=6 inplevel=0 end
      power=0.004 burn=3.6525e2 down=1.82625e3
         end
0 * normal termination *
1   ooooooooooo    rrrrrrrrrrr    iiiiiiiiiiii    ggggggggggg    eeeeeeeeeeeee   nn          nn   sssssssssss
   ooooooooooooo   rrrrrrrrrrrr   iiiiiiiiiiii   ggggggggggggg   eeeeeeeeeeeee   nnn         nn  sssssssssssss
   oo         oo   rr         rr       ii        gg         gg   ee              nnnn        nn  ss         ss
   oo         oo   rr         rr       ii        gg              ee              nn nn       nn  ss
   oo         oo   rr         rr       ii        gg              ee              nn  nn      nn  ss
   oo         oo   rrrrrrrrrrrr        ii        gg    ggggggg   eeeeeeeee       nn   nn     nn  ssssssssssss
   oo         oo   rrrrrrrrrrr         ii        gg    ggggggg   eeeeeeeee       nn    nn    nn   ssssssssssss
   oo         oo   rr      rr          ii        gg         gg   ee              nn     nn   nn             ss
   oo         oo   rr       rr         ii        gg         gg   ee              nn      nn nn             ss
   oo         oo   rr        rr        ii        gg         gg   ee              nn       nnnn  ss         ss
   ooooooooooooo   rr         rr  iiiiiiiiiiii   ggggggggggggg   eeeeeeeeeeeee   nn        nnn  sssssssssssss
    ooooooooooo    rr         rr  iiiiiiiiiiii    ggggggggggg    eeeeeeeeeeeee   nn         nn   sssssssssss
0

   dddddddddddd      aaaaaaaaa     vv          vv  iiiiiiiiiiii    sssssssssss
   ddddddddddddd    aaaaaaaaaaa    vv          vv  iiiiiiiiiiii   sssssssssssss
   dd         dd   aa         aa   vv          vv       ii        ss         ss
   dd         dd   aa         aa   vv          vv       ii        ss
   dd         dd   aa         aa   vv          vv       ii        ss
   dd         dd   aaaaaaaaaaaaa   vv          vv       ii        ssssssssssss
   dd         dd   aaaaaaaaaaaaa    vv        vv        ii         ssssssssssss
   dd         dd   aa         aa     vv      vv         ii                    ss
   dd         dd   aa         aa      vv    vv          ii                    ss
   dd         dd   aa         aa       vv  vv           ii        ss          ss
   ddddddddddddd   aa         aa        vvv        iiiiiiiiiiii   sssssssssssss
   dddddddddddd    aa         aa         v         iiiiiiiiiiii    sssssssssss
0

      0000000       88888888888             //   22222222222    88888888888             //   99999999999    666666666666
     000000000     8888888888888           //   2222222222222  8888888888888           //   9999999999999  6666666666666
    00       00    88         88          //    22         22  88         88          //    99         99  66
   00         00   88         88         //                22  88         88         //     99         99  66
   00         00   88         88        //                 22  88         88        //      99         99  66
   00         00    88888888888        //                22     88888888888        //       9999999999999  666666666666
   00         00    88888888888       //               22       88888888888       //         999999999999  6666666666666
   00         00   88         88     //              22        88         88     //                    99  66         66
   00         00   88         88    //             22          88         88    //                     99  66         66
    00       00    88         88   //            22            88         88   //                      99  66         66
     000000000     8888888888888  //            2222222222222  8888888888888  //            999999999999  6666666666666
      0000000       88888888888  //             2222222222222   88888888888  //             99999999999    66666666666
```

```
0
                                                      5555555555555  5555555555555              5555555555555  88888888888
      11     7777777777777                            5555555555555  5555555555555              5555555555555  8888888888888
     111     777777777777                             5555555555555  5555555555555        :::   55             88         88
    1111     77         77          :::               55             55                   :::   55             88         88
      11               77           :::               55             55                   :::   55             88         88
      11              77            :::               55             55                         555555555555    88888888888
      11             77                               555555555555   555555555555               5555555555555   88888888888
      11             77                               5555555555555  5555555555555                         55  88         88
      11            77              :::                          55             55        :::              55  88         88
      11            77              :::                          55             55        :::              55  88         88
      11           77               :::               55         55  55         55        :::   55         55  8888888888888
  11111111         77                                 5555555555555  5555555555555              5555555555555   88888888888
  11111111         77                                  55555555555    55555555555                55555555555
1
0                         sssssssssss    cccccccccc     aaaaaaaaa    ll             eeeeeeeeeeee
                         sssssssssssss  cccccccccccc   aaaaaaaaaaa   ll             eeeeeeeeeeee
                         ss         ss  cc         cc  aa        aa  ll             ee
                         ss             cc             aa        aa  ll             ee
                         ss             cc             aa        aa  ll             ee
                         ssssssssssss   cc             aaaaaaaaaaaa  ll             eeeeeeeee
                          ssssssssssss  cc             aaaaaaaaaaaa  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  llllllllllll   eeeeeeeeeeee
                          sssssssssss    cccccccccc    aa        aa  llllllllllll   eeeeeeeeeeee
```

```
*****************************************************************************************
*****************************************************************************************
*****************************************************************************************
*****                                                                               *****
*****                        program verification information                       *****
*****                                                                               *****
*****                     code system:    scale  version:    4.3                    *****
*****                                                                               *****
*****************************************************************************************
*****************************************************************************************
*****                                                                               *****
*****                                                                               *****
*****                 program:  o0o004                                              *****
*****                                                                               *****
*****           creation date:  03/13/96                                            *****
*****                                                                               *****
*****                 library:  /usr1/ornl/Scale/bin                                *****
*****                                                                               *****
*****                                                                               *****
*****               test code:  origens                                             *****
*****                                                                               *****
*****                 version:  3.0                                                 *****
*****                                                                               *****
*****                 jobname:  davis                                               *****
*****                                                                               *****
*****       date of execution:  08/28/96                                            *****
*****                                                                               *****
*****       time of execution:  17:55:58                                            *****
```

```
                    *****                                                                               *****
                    *****                                                                               *****
                    ****************************************************************************************
                    ****************************************************************************************
                    ****************************************************************************************
1
0       -1q array has      1 entries.
0        0q array has      1 entries.
0        0q array has      1 entries.
0        0q array has      1 entries.
0        0q array has      1 entries.
0         dbl. prec. machine word applied has, at least, a 16 significant figure accuracy.
0             short-lived split test fraction, qxn =    9.1188E-04
0             half-norm of matrix used, axn =    7.0000E+00
0             4-place-accuracy-retention ratio, ratio4 =    6.4516E-13
0        1q array has     20 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        4q array has      1 entries.
0       54q array has     12 entries.
1library information...

          cross-section data taken from position number  1 of library on unit 33.

          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          ********************************************************************************
          *                                                                              *
          *             prelim lwr origen-s binary working library--id = 1143           *
          *          made from modified card-image origen-s libraries of scale 4.2      *
          *       data from the light element, actinide, and fission product libraries  *
          *         decay data, including gamma and total energy, are from endf/b-vi    *
          *                                                                              *
          *       neutron flux spectrum factors and cross sections were produced from   *
          *      the "presas2" case updating all nuclides on the scale "burnup" library *
          *                                                                              *
          *                   fission product yields are from endf/b-v                  *
          *                                                                              *
          *               photon libraries use an 18-energy-group structure             *
          *              the photon data are from the master photon data base,          *
          *               produced to include bremsstrahlung from uo2 matrix            *
          *                                                                              *
          *         see information above this box (if present) for later updates      *
          *                                                                              *
          ********************************************************************************
          *                                                                              *
```

```
0        *******************************************************************************
0                   .other identification and sizes of library.
0                    data set name:  ft33f001
0                8/28/1996    date library was produced
0                     1697    total number of nuclides in library
                       689    number of light-element nuclides
                       129    number of actinide nuclides
                       879    number of fission product nuclides
0                     7993    number of nonzero off-diagonal matrix elements
0        *******************************************************************************
1
     sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                    light elements         page    1
0                                                     nuclide concentrations, grams
                                                      basis =single reactor assembly
              initial   1E-18 d
     na 23   1.73E+05  1.73E+05
     al 27   1.35E+06  1.35E+06
   total     1.52E+06  1.52E+06
1
     sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                         actinides         page    2
0                                                     nuclide concentrations, grams
                                                      basis =single reactor assembly
              initial   1E-18 d
      u234   2.12E+03  2.12E+03
      u235   1.72E+05  1.72E+05
      u236   4.12E+04  4.12E+04
      u238   8.66E+06  8.66E+06
     np237   9.99E+03  9.99E+03
   total     8.88E+06  8.88E+06
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                                            page    3
         power=     .00mw, burnup=      0.mwd, flux= 3.00E+08n/cm**2-sec
0                                                   basis =
0    (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                    initial         18.3 d         36.5 d         54.8 d         73.1 d         73.1 d
     productions   1.023182E+06   1.023182E+06   1.023183E+06   1.023183E+06   1.023183E+06   1.023183E+06
     absorptions   8.460824E+05   8.460847E+05   8.460852E+05   8.460858E+05   8.460863E+05   8.460863E+05
     k infinity    1.209317E+00   1.209314E+00   1.209314E+00   1.209314E+00   1.209313E+00   1.209313E+00
0                    initial         18.3 d         36.5 d         54.8 d         73.1 d         73.1 d
     actinide
     absorptions   8.423173E+05   8.423174E+05   8.423176E+05   8.423178E+05   8.423180E+05   8.423180E+05
     non-actinide
     abs. fracs.   4.450083E-03   4.452646E-03   4.453003E-03   4.453421E-03   4.453838E-03   4.453838E-03
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                  fission products         page    4
0                                              fraction of total absorption rate
         power=     .00mw, burnup=      0.mwd, flux= 3.00E+08n/cm**2-sec
0                initial    18.3 d    36.5 d    54.8 d    73.1 d    73.1 d

     xe135      .00E+00  2.28E-06  2.28E-06  2.28E-06  2.28E-06  2.28E-06
     sm149      .00E+00  3.01E-07  6.68E-07  1.04E-06  1.40E-06  1.40E-06
     sm151      .00E+00  1.54E-08  3.22E-08  4.91E-08  6.59E-08  6.59E-08
     nd143      .00E+00  2.56E-09  8.54E-09  1.59E-08  2.37E-08  2.37E-08
     gd157      .00E+00  3.74E-09  7.67E-09  1.16E-08  1.55E-08  1.55E-08
     cd113      .00E+00  3.18E-09  6.42E-09  9.65E-09  1.29E-08  1.29E-08
     pm147      .00E+00  1.47E-09  4.39E-09  7.73E-09  1.12E-08  1.12E-08
     rh105      .00E+00  8.28E-09  8.28E-09  8.28E-09  8.28E-09  8.28E-09
     xe131      .00E+00  1.16E-09  3.30E-09  5.64E-09  8.03E-09  8.03E-09
     cs133      .00E+00  1.14E-09  3.05E-09  5.04E-09  7.03E-09  7.03E-09
     rh103      .00E+00  5.01E-10  1.82E-09  3.73E-09  6.06E-09  6.07E-09
     tc 99      .00E+00  1.07E-09  2.44E-09  3.82E-09  5.21E-09  5.21E-09
     eu155      .00E+00  1.18E-09  2.34E-09  3.50E-09  4.65E-09  4.65E-09
```

nd145	.00E+00	1.04E-09	2.10E-09	3.17E-09	4.23E-09	4.23E-09
pr143	.00E+00	1.61E-09	2.36E-09	2.66E-09	2.78E-09	2.78E-09
sm152	.00E+00	5.54E-10	1.11E-09	1.66E-09	2.22E-09	2.22E-09
xe133	.00E+00	1.81E-09	2.01E-09	2.03E-09	2.03E-09	2.03E-09
kr 83	.00E+00	4.42E-10	8.90E-10	1.34E-09	1.79E-09	1.79E-09
cs135	.00E+00	4.04E-10	8.29E-10	1.25E-09	1.68E-09	1.68E-09
ru101	.00E+00	3.25E-10	6.50E-10	9.75E-10	1.30E-09	1.30E-09
ce141	.00E+00	5.08E-10	8.58E-10	1.10E-09	1.26E-09	1.26E-09
eu153	.00E+00	2.36E-10	5.15E-10	7.93E-10	1.07E-09	1.07E-09
la139	.00E+00	2.48E-10	4.98E-10	7.47E-10	9.96E-10	9.96E-10
pm149	.00E+00	9.59E-10	9.62E-10	9.62E-10	9.62E-10	9.62E-10
nd147	.00E+00	6.46E-10	8.50E-10	9.15E-10	9.35E-10	9.35E-10
pr141	.00E+00	5.22E-11	1.87E-10	3.78E-10	6.06E-10	6.06E-10
pd105	.00E+00	1.05E-10	2.24E-10	3.43E-10	4.62E-10	4.62E-10
zr 93	.00E+00	1.03E-10	2.09E-10	3.15E-10	4.22E-10	4.22E-10
mo 95	.00E+00	7.52E-12	5.27E-11	1.57E-10	3.28E-10	3.28E-10
gd155	.00E+00	1.81E-11	7.23E-11	1.62E-10	2.88E-10	2.88E-10
i129	.00E+00	6.40E-11	1.33E-10	2.04E-10	2.78E-10	2.78E-10
ru103	.00E+00	9.82E-11	1.69E-10	2.21E-10	2.58E-10	2.58E-10
mo 97	.00E+00	5.33E-11	1.10E-10	1.67E-10	2.23E-10	2.23E-10
ag109	.00E+00	3.84E-11	7.86E-11	1.19E-10	1.59E-10	1.59E-10
pm151	.00E+00	1.09E-10	1.09E-10	1.09E-10	1.09E-10	1.09E-10
ce144	.00E+00	2.61E-11	5.10E-11	7.48E-11	9.77E-11	9.77E-11
sm147	.00E+00	2.65E-12	1.69E-11	4.69E-11	9.39E-11	9.39E-11
zr 95	.00E+00	3.01E-11	5.48E-11	7.51E-11	9.18E-11	9.18E-11
ru102	.00E+00	2.29E-11	4.58E-11	6.87E-11	9.16E-11	9.16E-11
sr 90	.00E+00	2.09E-11	4.18E-11	6.26E-11	8.34E-11	8.34E-11
y 91	.00E+00	2.71E-11	4.97E-11	6.80E-11	8.27E-11	8.27E-11
ce142	.00E+00	2.05E-11	4.12E-11	6.18E-11	8.25E-11	8.25E-11
nd148	.00E+00	1.99E-11	3.99E-11	5.98E-11	7.98E-11	7.98E-11
nd146	.00E+00	1.66E-11	3.32E-11	4.99E-11	6.65E-11	6.65E-11
ba138	.00E+00	1.41E-11	2.83E-11	4.25E-11	5.67E-11	5.67E-11
pd108	.00E+00	1.37E-11	2.75E-11	4.12E-11	5.50E-11	5.50E-11
in115	.00E+00	1.10E-11	2.46E-11	3.84E-11	5.22E-11	5.22E-11
ba140	.00E+00	2.97E-11	4.07E-11	4.48E-11	4.63E-11	4.63E-11
xe132	.00E+00	9.05E-12	2.12E-11	3.33E-11	4.55E-11	4.55E-11

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 5

0 fraction of total absorption rate

power= .00mw, burnup= 0.mwd, flux= 3.00E+08n/cm**2-sec

0

	initial	18.3 d	36.5 d	54.8 d	73.1 d	73.1 d
nb 95	.00E+00	4.55E-12	1.53E-11	2.89E-11	4.35E-11	4.35E-11
ce140	.00E+00	4.43E-12	1.48E-11	2.74E-11	4.08E-11	4.08E-11
sm153	.00E+00	3.79E-11	3.79E-11	3.79E-11	3.79E-11	3.79E-11
eu151	.00E+00	2.20E-12	9.19E-12	2.10E-11	3.76E-11	3.76E-11
y 89	.00E+00	2.93E-12	1.08E-11	2.26E-11	3.75E-11	3.75E-11
zr 91	.00E+00	2.63E-12	1.00E-11	2.12E-11	3.54E-11	3.54E-11
mo 98	.00E+00	8.46E-12	1.69E-11	2.54E-11	3.38E-11	3.38E-11
eu156	.00E+00	1.91E-11	2.78E-11	3.16E-11	3.32E-11	3.32E-11
mo100	.00E+00	8.09E-12	1.62E-11	2.43E-11	3.24E-11	3.24E-11
pd107	.00E+00	7.96E-12	1.59E-11	2.39E-11	3.19E-11	3.19E-11
xe134	.00E+00	7.83E-12	1.57E-11	2.36E-11	3.14E-11	3.14E-11
zr 92	.00E+00	6.33E-12	1.28E-11	1.92E-11	2.57E-11	2.57E-11
nd144	.00E+00	1.62E-12	6.40E-12	1.42E-11	2.49E-11	2.49E-11
kr 87	.00E+00	2.26E-11	2.26E-11	2.26E-11	2.26E-11	2.20E-11
zr 96	.00E+00	5.21E-12	1.04E-11	1.56E-11	2.08E-11	2.08E-11
ru104	.00E+00	4.96E-12	9.93E-12	1.49E-11	1.99E-11	1.99E-11
sr 89	.00E+00	6.73E-12	1.20E-11	1.61E-11	1.92E-11	1.92E-11
nd150	.00E+00	4.44E-12	8.88E-12	1.33E-11	1.78E-11	1.78E-11
cs137	.00E+00	4.37E-12	8.74E-12	1.31E-11	1.75E-11	1.75E-11

ce143	.00E+00	1.74E-11	1.74E-11	1.74E-11	1.74E-11	1.74E-11
xe136	.00E+00	4.25E-12	8.49E-12	1.27E-11	1.70E-11	1.70E-11
i127	.00E+00	3.07E-12	7.59E-12	1.22E-11	1.70E-11	1.70E-11
la140	.00E+00	9.71E-12	1.39E-11	1.54E-11	1.60E-11	1.60E-11
mo 99	.00E+00	1.30E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11
br 81	.00E+00	3.23E-12	6.46E-12	9.69E-12	1.29E-11	1.29E-11
zr 94	.00E+00	2.76E-12	5.51E-12	8.27E-12	1.10E-11	1.10E-11
rb 85	.00E+00	2.47E-12	4.98E-12	7.50E-12	1.00E-11	1.00E-11
te130	.00E+00	1.92E-12	3.85E-12	5.77E-12	7.69E-12	7.69E-12
sm154	.00E+00	1.88E-12	3.75E-12	5.63E-12	7.50E-12	7.50E-12
kr 85	.00E+00	1.84E-12	3.69E-12	5.55E-12	7.39E-12	7.39E-12
rb 87	.00E+00	1.82E-12	3.66E-12	5.49E-12	7.32E-12	7.32E-12
cd111	.00E+00	1.07E-12	2.95E-12	4.97E-12	7.02E-12	7.02E-12
i131	.00E+00	5.34E-12	6.49E-12	6.73E-12	6.78E-12	6.78E-12
se 77	.00E+00	1.26E-12	2.69E-12	4.13E-12	5.56E-12	5.56E-12
kr 84	.00E+00	8.70E-13	1.74E-12	2.61E-12	3.48E-12	3.48E-12
ru106	.00E+00	8.64E-13	1.70E-12	2.51E-12	3.29E-12	3.29E-12
sb121	.00E+00	6.31E-13	1.32E-12	2.01E-12	2.69E-12	2.69E-12
se 79	.00E+00	6.52E-13	1.30E-12	1.96E-12	2.61E-12	2.61E-12
te127m	.00E+00	5.77E-13	1.31E-12	1.98E-12	2.57E-12	2.57E-12
kr 86	.00E+00	4.73E-13	9.47E-13	1.42E-12	1.89E-12	1.89E-12
sb123	.00E+00	4.65E-13	9.36E-13	1.41E-12	1.89E-12	1.89E-12
te128	.00E+00	4.25E-13	8.53E-13	1.28E-12	1.71E-12	1.71E-12
te129m	.00E+00	5.59E-13	9.49E-13	1.22E-12	1.40E-12	1.40E-12
se 80	.00E+00	3.05E-13	6.10E-13	9.15E-13	1.22E-12	1.22E-12
ba137	.00E+00	8.52E-14	3.07E-13	6.64E-13	1.16E-12	1.16E-12
gd156	.00E+00	1.07E-13	3.46E-13	6.43E-13	9.66E-13	9.66E-13
dy161	.00E+00	1.44E-13	3.89E-13	6.51E-13	9.15E-13	9.15E-13
tb159	.00E+00	1.82E-13	3.76E-13	5.69E-13	7.63E-13	7.63E-13
sb125	.00E+00	1.57E-13	3.36E-13	5.19E-13	7.01E-13	7.01E-13

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 6

0 fraction of total absorption rate

power= .00mw, burnup= 0.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	18.3 d	36.5 d	54.8 d	73.1 d	73.1 d
li 6	.00E+00	1.73E-13	3.46E-13	5.19E-13	6.92E-13	6.92E-13
cd112	.00E+00	1.62E-13	3.37E-13	5.13E-13	6.89E-13	6.89E-13
sn117	.00E+00	1.36E-13	2.75E-13	4.13E-13	5.51E-13	5.51E-13
sn119	.00E+00	1.12E-13	2.25E-13	3.37E-13	4.50E-13	4.50E-13
sn115	.00E+00	8.49E-14	1.89E-13	2.94E-13	3.99E-13	3.99E-13
sr 88	.00E+00	8.64E-14	1.74E-13	2.61E-13	3.48E-13	3.48E-13
sm150	.00E+00	2.92E-14	9.62E-14	2.02E-13	3.46E-13	3.46E-13
ag111	.00E+00	2.61E-13	3.09E-13	3.18E-13	3.19E-13	3.19E-13
eu157	.00E+00	2.95E-13	2.95E-13	2.95E-13	2.95E-13	2.95E-13
pd110	.00E+00	6.31E-14	1.26E-13	1.89E-13	2.53E-13	2.53E-13
cd114	.00E+00	6.16E-14	1.23E-13	1.85E-13	2.46E-13	2.46E-13
pd106	.00E+00	1.57E-14	6.19E-14	1.38E-13	2.42E-13	2.42E-13
se 82	.00E+00	5.91E-14	1.18E-13	1.77E-13	2.36E-13	2.36E-13
gd158	.00E+00	5.69E-14	1.14E-13	1.71E-13	2.28E-13	2.28E-13
sn126	.00E+00	4.71E-14	9.42E-14	1.41E-13	1.88E-13	1.88E-13
se 78	.00E+00	4.50E-14	9.03E-14	1.36E-13	1.81E-13	1.81E-13
cd115m	.00E+00	5.82E-14	1.02E-13	1.35E-13	1.60E-13	1.60E-13
pm148m	.00E+00	6.01E-15	3.23E-14	8.12E-14	1.49E-13	1.49E-13
sn124	.00E+00	3.68E-14	7.37E-14	1.11E-13	1.47E-13	1.47E-13
dy162	.00E+00	3.48E-14	6.97E-14	1.05E-13	1.39E-13	1.39E-13
dy164	.00E+00	3.11E-14	6.23E-14	9.34E-14	1.25E-13	1.25E-13
eu154	.00E+00	2.67E-14	5.38E-14	8.14E-14	1.09E-13	1.09E-13
as 75	.00E+00	2.69E-14	5.40E-14	8.11E-14	1.08E-13	1.08E-13
y 90	.00E+00	1.58E-14	3.56E-14	5.54E-14	7.51E-14	7.51E-14
sn118	.00E+00	1.51E-14	3.02E-14	4.54E-14	6.05E-14	6.05E-14

cs136	.00E+00	3.45E-14	4.77E-14	5.27E-14	5.47E-14	5.47E-14
cd116	.00E+00	1.28E-14	2.55E-14	3.83E-14	5.10E-14	5.10E-14
sn122	.00E+00	1.25E-14	2.49E-14	3.74E-14	4.98E-14	4.98E-14
ba136	.00E+00	5.16E-15	1.60E-14	2.91E-14	4.29E-14	4.29E-14
sn120	.00E+00	9.38E-15	1.88E-14	2.81E-14	3.75E-14	3.75E-14
kr 82	.00E+00	7.80E-15	1.65E-14	2.52E-14	3.39E-14	3.39E-14
cs134	.00E+00	7.60E-15	1.53E-14	2.31E-14	3.10E-14	3.10E-14
dy163	.00E+00	7.67E-15	1.53E-14	2.30E-14	3.07E-14	3.07E-14
ru105	.00E+00	3.00E-14	3.00E-14	3.00E-14	3.00E-14	3.00E-14
sn125	.00E+00	2.15E-14	2.73E-14	2.88E-14	2.93E-14	2.92E-14
ge 73	.00E+00	7.17E-15	1.45E-14	2.17E-14	2.90E-14	2.90E-14
ru 99	.00E+00	5.42E-15	1.25E-14	1.96E-14	2.67E-14	2.67E-14
zr 90	.00E+00	1.04E-15	5.05E-15	1.21E-14	2.23E-14	2.23E-14
te125	.00E+00	1.06E-15	4.62E-15	1.09E-14	2.01E-14	2.01E-14
xe130	.00E+00	4.76E-15	9.70E-15	1.46E-14	1.96E-14	1.96E-14
mo 96	.00E+00	3.41E-15	7.09E-15	1.08E-14	1.44E-14	1.44E-14
pm148	.00E+00	1.05E-15	4.31E-15	8.63E-15	1.33E-14	1.33E-14
rb 88	.00E+00	1.27E-14	1.27E-14	1.27E-14	1.27E-14	1.27E-14
ge 76	.00E+00	2.66E-15	5.33E-15	7.99E-15	1.07E-14	1.07E-14
i135	.00E+00	1.00E-14	1.00E-14	1.00E-14	1.00E-14	9.95E-15
te132	.00E+00	9.30E-15	9.49E-15	9.49E-15	9.49E-15	9.49E-15
gd160	.00E+00	1.69E-15	3.37E-15	5.06E-15	6.75E-15	6.75E-15
te134	.00E+00	5.77E-15	5.77E-15	5.77E-15	5.77E-15	5.39E-15
te126	.00E+00	9.22E-16	2.08E-15	3.33E-15	4.60E-15	4.60E-15

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 7

0 fraction of total absorption rate

power= .00mw, burnup= 0.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	18.3 d	36.5 d	54.8 d	73.1 d	73.1 d
sn123	.00E+00	9.65E-16	1.84E-15	2.63E-15	3.35E-15	3.35E-15
sb126	.00E+00	1.91E-15	2.60E-15	2.85E-15	2.94E-15	2.94E-15
ru100	.00E+00	6.49E-16	1.30E-15	1.96E-15	2.63E-15	2.63E-15
ho165	.00E+00	5.26E-16	1.06E-15	1.59E-15	2.12E-15	2.12E-15
in117m	.00E+00	2.07E-15	2.07E-15	2.07E-15	2.07E-15	2.07E-15
sr 87	.00E+00	3.04E-16	6.09E-16	9.13E-16	1.22E-15	1.22E-15
sb124	.00E+00	3.98E-16	7.21E-16	9.83E-16	1.20E-15	1.20E-15
i130	.00E+00	7.10E-16	7.11E-16	7.11E-16	7.11E-16	7.08E-16
nb 94	.00E+00	1.75E-16	3.51E-16	5.26E-16	7.01E-16	7.01E-16
in117	.00E+00	6.07E-16	6.07E-16	6.07E-16	6.07E-16	6.07E-16
ge 74	.00E+00	1.47E-16	2.93E-16	4.40E-16	5.86E-16	5.86E-16
te124	.00E+00	4.65E-17	1.42E-16	2.78E-16	4.47E-16	4.47E-16
in113	.00E+00	2.49E-17	1.00E-16	2.26E-16	4.02E-16	4.02E-16
ge 72	.00E+00	8.33E-17	1.86E-16	2.89E-16	3.92E-16	3.92E-16
eu152	.00E+00	8.17E-17	1.66E-16	2.57E-16	3.57E-16	3.57E-16
se 76	.00E+00	5.68E-17	1.19E-16	1.80E-16	2.42E-16	2.42E-16
sr 86	.00E+00	2.40E-17	7.85E-17	1.48E-16	2.26E-16	2.26E-16
rb 86	.00E+00	1.18E-16	1.78E-16	2.08E-16	2.23E-16	2.23E-16
dy165	.00E+00	2.08E-16	2.08E-16	2.08E-16	2.08E-16	2.07E-16
ba135	.00E+00	3.50E-17	7.35E-17	1.15E-16	1.61E-16	1.61E-16
tb160	.00E+00	4.73E-17	8.72E-17	1.21E-16	1.49E-16	1.49E-16
cd118	.00E+00	1.19E-16	1.19E-16	1.19E-16	1.19E-16	1.12E-16
ge 75	.00E+00	8.51E-17	8.51E-17	8.51E-17	8.51E-17	8.39E-17
xe128	.00E+00	1.36E-17	2.73E-17	4.09E-17	5.46E-17	5.46E-17
er166	.00E+00	9.94E-18	2.45E-17	3.92E-17	5.39E-17	5.39E-17
nd142	.00E+00	7.24E-18	1.63E-17	2.77E-17	4.22E-17	4.22E-17
gd152	.00E+00	7.41E-18	1.52E-17	2.33E-17	3.20E-17	3.20E-17
gd154	.00E+00	1.97E-18	7.50E-18	1.66E-17	2.95E-17	2.95E-17
sm148	.00E+00	4.19E-19	3.84E-18	1.29E-17	2.91E-17	2.91E-17
in119m	.00E+00	2.97E-17	2.97E-17	2.97E-17	2.97E-17	2.80E-17
cd110	.00E+00	3.68E-18	8.09E-18	1.32E-17	1.90E-17	1.90E-17

ba134	.00E+00	1.22E-18	4.73E-18	1.06E-17	1.88E-17	1.88E-17
kr 80	.00E+00	4.07E-18	8.19E-18	1.23E-17	1.64E-17	1.64E-17
dy160	.00E+00	9.41E-19	3.55E-18	7.55E-18	1.27E-17	1.27E-17
pd104	.00E+00	4.32E-19	1.64E-18	4.18E-18	8.50E-18	8.50E-18
br 79	.00E+00	3.76E-19	1.02E-18	1.94E-18	3.13E-18	3.13E-18
te122	.00E+00	4.26E-19	9.68E-19	1.52E-18	2.07E-18	2.07E-18
in119	.00E+00	2.32E-18	2.32E-18	2.32E-18	2.32E-18	1.54E-18
be 9	.00E+00	3.43E-19	6.85E-19	1.02E-18	1.37E-18	1.37E-18
pr142	.00E+00	6.42E-19	7.95E-19	1.01E-18	1.27E-18	1.27E-18
xe129	.00E+00	1.03E-19	3.39E-19	7.15E-19	1.24E-18	1.24E-18
ag107	.00E+00	6.99E-20	2.83E-19	6.39E-19	1.13E-18	1.13E-18
nb 93	.00E+00	1.76E-19	3.56E-19	5.36E-19	7.22E-19	7.22E-19
sn116	.00E+00	1.53E-19	3.16E-19	4.82E-19	6.55E-19	6.55E-19
li 7	.00E+00	1.33E-19	2.66E-19	3.99E-19	5.32E-19	5.32E-19
te123	.00E+00	7.98E-20	1.80E-19	3.03E-19	4.42E-19	4.42E-19
er167	.00E+00	5.32E-20	1.06E-19	1.60E-19	2.13E-19	2.13E-19
cd109	.00E+00	3.33E-21	9.98E-21	1.33E-20	2.00E-20	2.00E-20
cs134m	.00E+00	.00E+00	3.33E-21	6.65E-21	9.98E-21	9.98E-21

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 8

0 fraction of total absorption rate

power= .00mw, burnup= 0.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	18.3 d	36.5 d	54.8 d	73.1 d	73.1 d
cd108	.00E+00	3.33E-21	6.65E-21	6.65E-21	9.98E-21	9.98E-21

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 9

power= 4.000E-03mw, burnup=2.9220E-01mwd, flux= 3.00E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	18.3 d	36.5 d	54.8 d	73.1 d	73.1 d
h 1	.00E+00	4.40E-09	8.81E-09	1.32E-08	1.76E-08	1.76E-08
h 2	.00E+00	1.31E-11	2.61E-11	3.92E-11	5.22E-11	5.22E-11
h 3	.00E+00	9.56E-14	1.91E-13	2.86E-13	3.81E-13	3.81E-13
h 4	.00E+00	3.87E-37	7.72E-37	1.16E-36	1.54E-36	.00E+00
he 3	.00E+00	1.34E-16	5.37E-16	1.21E-15	2.15E-15	2.15E-15
he 4	.00E+00	7.28E-10	1.46E-09	2.18E-09	2.91E-09	2.91E-09
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
na 22	.00E+00	5.68E-13	1.13E-12	1.68E-12	2.23E-12	2.23E-12
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	.00E+00	3.64E-08	3.64E-08	3.64E-08	3.64E-08	3.63E-08
na 24m	.00E+00	5.99E-15	5.99E-15	5.99E-15	5.99E-15	5.99E-30
na 25	.00E+00	2.88E-30	5.76E-30	8.64E-30	1.15E-29	6.08E-31
mg 24	.00E+00	7.55E-07	1.55E-06	2.34E-06	3.13E-06	3.13E-06
mg 25	.00E+00	9.58E-14	1.92E-13	2.87E-13	3.83E-13	3.83E-13
mg 26	.00E+00	1.31E-11	2.61E-11	3.92E-11	5.22E-11	5.22E-11
mg 27	.00E+00	2.18E-12	2.18E-12	2.18E-12	2.18E-12	1.60E-12
mg 28	.00E+00	4.41E-24	4.41E-24	4.41E-24	4.41E-24	4.40E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	.00E+00	2.70E-10	2.70E-10	2.70E-10	2.70E-10	7.33E-11
al 29	.00E+00	3.80E-32	1.52E-31	3.42E-31	6.08E-31	3.89E-31
al 30	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
si 28	.00E+00	2.20E-06	4.40E-06	6.60E-06	8.79E-06	8.79E-06
si 29	.00E+00	1.41E-16	5.64E-16	1.27E-15	2.26E-15	2.26E-15
si 30	.00E+00	9.70E-27	7.76E-26	2.62E-25	6.21E-25	6.21E-25
si 31	.00E+00	6.95E-39	5.56E-38	1.88E-37	4.45E-37	4.37E-37
si 32	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		3.00E+08	3.00E+08	3.00E+08	3.00E+08	3.00E-07

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 10

power= 4.000E-03mw, burnup=2.9220E-01mwd, flux= 3.00E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	18.3 d	36.5 d	54.8 d	73.1 d	73.1 d
he 4	.00E+00	2.54E-06	5.08E-06	7.63E-06	1.02E-05	1.02E-05
th226	.00E+00	5.65E-31	2.72E-30	6.90E-30	1.34E-29	1.34E-29
th227	.00E+00	8.47E-18	6.06E-17	1.82E-16	3.85E-16	3.85E-16
th228	.00E+00	3.89E-17	2.14E-16	6.13E-16	1.32E-15	1.32E-15
th229	.00E+00	1.04E-14	7.46E-14	2.28E-13	4.93E-13	4.93E-13
th230	.00E+00	1.28E-06	2.55E-06	3.83E-06	5.11E-06	5.11E-06
th231	.00E+00	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	.00E+00	2.58E-07	5.16E-07	7.74E-07	1.03E-06	1.03E-06
th233	.00E+00	2.39E-18	4.78E-18	7.17E-18	9.57E-18	8.39E-18
th234	.00E+00	2.19E-07	3.49E-07	4.26E-07	4.71E-07	4.71E-07
pa231	.00E+00	3.60E-08	7.50E-08	1.14E-07	1.53E-07	1.53E-07
pa232	.00E+00	6.18E-16	1.29E-15	1.96E-15	2.63E-15	2.63E-15
pa233	.00E+00	5.45E-07	8.86E-07	1.10E-06	1.23E-06	1.23E-06
pa234m	.00E+00	7.40E-12	1.18E-11	1.44E-11	1.59E-11	1.59E-11
pa234	.00E+00	3.31E-12	5.26E-12	6.42E-12	7.10E-12	7.10E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	.00E+00	5.48E-28	2.63E-27	6.69E-27	1.29E-26	1.29E-26
u231	.00E+00	6.12E-23	2.84E-22	6.26E-22	1.04E-21	1.04E-21
u232	.00E+00	1.86E-13	5.56E-13	1.11E-12	1.84E-12	1.84E-12
u233	.00E+00	1.38E-07	4.79E-07	9.49E-07	1.50E-06	1.50E-06
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	.00E+00	2.74E-06	3.16E-06	3.22E-06	3.23E-06	3.23E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	.00E+00	3.29E-07	3.29E-07	3.29E-07	3.29E-07	2.90E-07
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	.00E+00	2.85E-13	5.62E-13	8.30E-13	1.09E-12	1.09E-12
np236m	.00E+00	2.16E-12	2.16E-12	2.16E-12	2.16E-12	2.15E-12
np236	.00E+00	1.02E-11	2.05E-11	3.07E-11	4.10E-11	4.10E-11
np237	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01
np238	.00E+00	1.57E-06	1.58E-06	1.58E-06	1.58E-06	1.58E-06
np239	.00E+00	4.73E-05	4.75E-05	4.75E-05	4.75E-05	4.75E-05
np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np240	.00E+00	9.69E-15	9.74E-15	9.74E-15	9.74E-15	9.29E-15
np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu236	.00E+00	1.39E-11	2.87E-11	4.33E-11	5.77E-11	5.77E-11
pu237	.00E+00	9.13E-18	3.94E-17	8.62E-17	1.46E-16	1.46E-16
pu238	.00E+00	7.86E-06	1.73E-05	2.67E-05	3.62E-05	3.62E-05
pu239	.00E+00	2.08E-04	4.63E-04	7.19E-04	9.74E-04	9.74E-04
pu240	.00E+00	4.61E-11	2.14E-10	5.08E-10	9.28E-10	9.28E-10
pu241	.00E+00	1.42E-17	1.37E-16	4.97E-16	1.22E-15	1.22E-15
pu242	.00E+00	1.26E-24	2.52E-23	1.39E-22	4.61E-22	4.61E-22
pu243	.00E+00	2.77E-33	5.52E-32	3.05E-31	1.01E-30	1.00E-30
pu244	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu245	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu246	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
totals	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04
0 flux		3.00E+08	3.00E+08	3.00E+08	3.00E+08	3.00E-07

0 1q array has 20 entries.
0 3q array has 1 entries.
0 3q array has 1 entries.
0 3q array has 1 entries.
0 4q array has 1 entries.
0 54q array has 12 entries.

```
1library information...
          cross-section data taken from position number  2 of library on unit 33.

          pass    1
          pass    0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          pass    1
          pass    0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          ********************************************************************************
          *                                                                              *
          *             prelim lwr origen-s binary working library--id = 1143           *
          *          made from modified card-image origen-s libraries of scale 4.2      *
          *       data from the light element, actinide, and fission product libraries  *
          *         decay data, including gamma and total energy, are from endf/b-vi    *
          *                                                                              *
          *       neutron flux spectrum factors and cross sections were produced from   *
          *      the "presas2" case updating all nuclides on the scale "burnup" library *
          *                                                                              *
          *                    fission product yields are from endf/b-v                 *
          *                                                                              *
          *                photon libraries use an 18-energy-group structure            *
          *               the photon data are from the master photon data base,         *
          *                produced to include bremsstrahlung from uo2 matrix           *
          *                                                                              *
          *         see information above this box (if present) for later updates      *
          *                                                                              *
          ********************************************************************************
          *                                                                              *
0         ********************************************************************************
0                    .other identification and sizes of library.
0                     data set name:  ft33f001
0                8/28/1996    date library was produced
0                     1697    total number of nuclides in library
                       689    number of light-element nuclides
                       129    number of actinide nuclides
                       879    number of fission product nuclides
0                     7993    number of nonzero off-diagonal matrix elements
0         ********************************************************************************
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                  page   11
         power=    .00mw, burnup=      1.mwd, flux= 2.82E+08n/cm**2-sec
0                                               basis =
0    (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                   initial          91.3 d          109.6 d          127.8 d          146.1 d          146.1 d
     productions    1.090702E+06    1.090702E+06    1.090703E+06    1.090703E+06    1.090703E+06    1.090703E+06
     absorptions    8.934394E+05    8.934399E+05    8.934406E+05    8.934413E+05    8.934419E+05    8.934419E+05
     k infinity     1.220790E+00    1.220790E+00    1.220789E+00    1.220789E+00    1.220788E+00    1.220788E+00
0                   initial          91.3 d          109.6 d          127.8 d          146.1 d          146.1 d
     actinide
     absorptions    8.900519E+05    8.900521E+05    8.900524E+05    8.900527E+05    8.900529E+05    8.900529E+05
     non-actinide
```

abs. fracs. 3.791451E-03 3.791869E-03 3.792226E-03 3.792703E-03 3.793120E-03 3.793120E-03

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 12

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.82E+08n/cm**2-sec

0

	initial	91.3 d	109.6 d	127.8 d	146.1 d	146.1 d
sm149	1.42E-06	1.79E-06	2.17E-06	2.54E-06	2.91E-06	2.91E-06
xe135	2.31E-06	2.31E-06	2.31E-06	2.31E-06	2.31E-06	2.31E-06
sm151	6.68E-08	8.38E-08	1.01E-07	1.18E-07	1.35E-07	1.35E-07
nd143	2.40E-08	3.21E-08	4.04E-08	4.87E-08	5.69E-08	5.69E-08
gd157	1.57E-08	1.97E-08	2.37E-08	2.76E-08	3.16E-08	3.16E-08
cd113	1.31E-08	1.63E-08	1.96E-08	2.29E-08	2.61E-08	2.61E-08
pm147	1.11E-08	1.45E-08	1.79E-08	2.13E-08	2.46E-08	2.46E-08
rh103	6.05E-09	8.69E-09	1.16E-08	1.46E-08	1.77E-08	1.77E-08
xe131	7.97E-09	1.04E-08	1.27E-08	1.51E-08	1.75E-08	1.75E-08
cs133	6.97E-09	8.95E-09	1.09E-08	1.29E-08	1.49E-08	1.49E-08
tc 99	5.15E-09	6.52E-09	7.88E-09	9.25E-09	1.06E-08	1.06E-08
eu155	4.64E-09	5.78E-09	6.91E-09	8.03E-09	9.14E-09	9.14E-09
nd145	4.22E-09	5.28E-09	6.34E-09	7.40E-09	8.46E-09	8.46E-09
rh105	8.35E-09	8.33E-09	8.33E-09	8.33E-09	8.33E-09	8.33E-09
sm152	2.20E-09	2.75E-09	3.30E-09	3.85E-09	4.40E-09	4.40E-09
kr 83	1.80E-09	2.26E-09	2.71E-09	3.16E-09	3.61E-09	3.61E-09
cs135	1.67E-09	2.09E-09	2.52E-09	2.94E-09	3.36E-09	3.36E-09
pr143	2.79E-09	2.84E-09	2.86E-09	2.86E-09	2.87E-09	2.87E-09
ru101	1.28E-09	1.60E-09	1.92E-09	2.24E-09	2.56E-09	2.56E-09
eu153	1.07E-09	1.35E-09	1.63E-09	1.91E-09	2.18E-09	2.18E-09
xe133	2.05E-09	2.05E-09	2.05E-09	2.05E-09	2.05E-09	2.05E-09
la139	1.00E-09	1.26E-09	1.51E-09	1.76E-09	2.01E-09	2.01E-09
pr141	6.10E-10	8.66E-10	1.14E-09	1.42E-09	1.72E-09	1.72E-09
mo 95	3.26E-10	5.65E-10	8.69E-10	1.23E-09	1.65E-09	1.65E-09
ce141	1.27E-09	1.38E-09	1.46E-09	1.51E-09	1.54E-09	1.54E-09
gd155	2.93E-10	4.56E-10	6.55E-10	8.89E-10	1.16E-09	1.16E-09
pm149	9.75E-10	9.75E-10	9.75E-10	9.75E-10	9.75E-10	9.75E-10
nd147	9.27E-10	9.33E-10	9.36E-10	9.36E-10	9.36E-10	9.36E-10
pd105	4.60E-10	5.78E-10	6.96E-10	8.15E-10	9.33E-10	9.33E-10
zr 93	4.18E-10	5.23E-10	6.28E-10	7.34E-10	8.39E-10	8.39E-10
i129	2.81E-10	3.56E-10	4.32E-10	5.09E-10	5.86E-10	5.86E-10
mo 97	2.25E-10	2.82E-10	3.39E-10	3.96E-10	4.53E-10	4.53E-10
sm147	9.31E-11	1.57E-10	2.37E-10	3.34E-10	4.48E-10	4.48E-10
ru103	2.59E-10	2.86E-10	3.06E-10	3.20E-10	3.30E-10	3.30E-10
ag109	1.58E-10	1.97E-10	2.37E-10	2.76E-10	3.16E-10	3.16E-10
ru102	9.24E-11	1.15E-10	1.39E-10	1.62E-10	1.85E-10	1.85E-10
ce144	9.81E-11	1.20E-10	1.41E-10	1.61E-10	1.80E-10	1.80E-10
sr 90	8.43E-11	1.05E-10	1.26E-10	1.47E-10	1.68E-10	1.68E-10
ce142	8.34E-11	1.04E-10	1.25E-10	1.46E-10	1.67E-10	1.67E-10
nd148	8.01E-11	1.00E-10	1.20E-10	1.40E-10	1.60E-10	1.60E-10
eu151	3.80E-11	5.97E-11	8.62E-11	1.18E-10	1.54E-10	1.54E-10
nd146	6.72E-11	8.40E-11	1.01E-10	1.18E-10	1.34E-10	1.34E-10
zr 95	9.09E-11	1.04E-10	1.16E-10	1.25E-10	1.32E-10	1.32E-10
y 91	8.36E-11	9.56E-11	1.05E-10	1.13E-10	1.19E-10	1.19E-10
y 89	3.78E-11	5.51E-11	7.43E-11	9.49E-11	1.17E-10	1.17E-10
ba138	5.74E-11	7.17E-11	8.61E-11	1.00E-10	1.15E-10	1.15E-10
zr 91	3.57E-11	5.25E-11	7.14E-11	9.18E-11	1.14E-10	1.14E-10
pm151	1.10E-10	1.10E-10	1.10E-10	1.10E-10	1.10E-10	1.10E-10
pd108	5.43E-11	6.78E-11	8.12E-11	9.47E-11	1.08E-10	1.08E-10

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 13

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.82E+08n/cm**2-sec

0 initial 91.3 d 109.6 d 127.8 d 146.1 d 146.1 d

in115	5.22E-11	6.61E-11	8.00E-11	9.39E-11	1.08E-10	1.08E-10
ce140	4.13E-11	5.52E-11	6.93E-11	8.34E-11	9.75E-11	9.75E-11
nd144	2.52E-11	3.88E-11	5.50E-11	7.38E-11	9.51E-11	9.51E-11
xe132	4.54E-11	5.76E-11	6.98E-11	8.19E-11	9.41E-11	9.41E-11
nb 95	4.35E-11	5.78E-11	7.12E-11	8.33E-11	9.41E-11	9.41E-11
mo 98	3.34E-11	4.18E-11	5.02E-11	5.85E-11	6.69E-11	6.69E-11
mo100	3.23E-11	4.03E-11	4.84E-11	5.65E-11	6.45E-11	6.45E-11
pd107	3.21E-11	4.00E-11	4.80E-11	5.60E-11	6.39E-11	6.39E-11
xe134	3.17E-11	3.97E-11	4.76E-11	5.56E-11	6.35E-11	6.35E-11
zr 92	2.59E-11	3.24E-11	3.90E-11	4.55E-11	5.20E-11	5.20E-11
ba140	4.65E-11	4.71E-11	4.73E-11	4.74E-11	4.74E-11	4.74E-11
zr 96	2.04E-11	2.55E-11	3.06E-11	3.57E-11	4.08E-11	4.08E-11
ru104	1.98E-11	2.48E-11	2.98E-11	3.47E-11	3.97E-11	3.97E-11
sm153	3.82E-11	3.81E-11	3.81E-11	3.81E-11	3.81E-11	3.81E-11
i127	1.69E-11	2.17E-11	2.65E-11	3.14E-11	3.64E-11	3.64E-11
nd150	1.78E-11	2.22E-11	2.66E-11	3.11E-11	3.55E-11	3.55E-11
cs137	1.74E-11	2.18E-11	2.61E-11	3.05E-11	3.48E-11	3.48E-11
eu156	3.35E-11	3.42E-11	3.45E-11	3.46E-11	3.46E-11	3.46E-11
xe136	1.71E-11	2.14E-11	2.57E-11	3.00E-11	3.43E-11	3.43E-11
sr 89	1.95E-11	2.20E-11	2.39E-11	2.54E-11	2.66E-11	2.66E-11
br 81	1.29E-11	1.61E-11	1.94E-11	2.26E-11	2.58E-11	2.58E-11
zr 94	1.09E-11	1.37E-11	1.64E-11	1.92E-11	2.19E-11	2.19E-11
kr 87	2.23E-11	2.30E-11	2.30E-11	2.30E-11	2.30E-11	2.15E-11
rb 85	1.00E-11	1.25E-11	1.51E-11	1.76E-11	2.01E-11	2.01E-11
ce143	1.75E-11	1.75E-11	1.75E-11	1.75E-11	1.75E-11	1.75E-11
la140	1.59E-11	1.61E-11	1.62E-11	1.62E-11	1.62E-11	1.62E-11
te130	7.78E-12	9.73E-12	1.17E-11	1.36E-11	1.56E-11	1.56E-11
cd111	7.09E-12	9.16E-12	1.12E-11	1.33E-11	1.54E-11	1.54E-11
sm154	7.55E-12	9.44E-12	1.13E-11	1.32E-11	1.51E-11	1.51E-11
kr 85	7.45E-12	9.31E-12	1.12E-11	1.30E-11	1.48E-11	1.48E-11
rb 87	7.31E-12	9.14E-12	1.10E-11	1.28E-11	1.46E-11	1.46E-11
mo 99	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11
se 77	5.63E-12	7.08E-12	8.54E-12	9.99E-12	1.14E-11	1.14E-11
kr 84	3.45E-12	4.31E-12	5.17E-12	6.04E-12	6.90E-12	6.90E-12
i131	6.79E-12	6.80E-12	6.80E-12	6.80E-12	6.80E-12	6.80E-12
ru106	3.25E-12	3.99E-12	4.70E-12	5.40E-12	6.07E-12	6.07E-12
sb121	2.68E-12	3.36E-12	4.04E-12	4.73E-12	5.41E-12	5.41E-12
se 79	2.64E-12	3.30E-12	3.96E-12	4.62E-12	5.29E-12	5.29E-12
ba137	1.17E-12	1.81E-12	2.58E-12	3.49E-12	4.54E-12	4.54E-12
te127m	2.59E-12	3.12E-12	3.60E-12	4.02E-12	4.39E-12	4.39E-12
kr 86	1.91E-12	2.39E-12	2.87E-12	3.35E-12	3.83E-12	3.83E-12
sb123	1.88E-12	2.36E-12	2.84E-12	3.33E-12	3.82E-12	3.82E-12
te128	1.71E-12	2.14E-12	2.56E-12	2.99E-12	3.42E-12	3.42E-12
se 80	1.23E-12	1.54E-12	1.85E-12	2.16E-12	2.47E-12	2.47E-12
gd156	9.52E-13	1.28E-12	1.61E-12	1.95E-12	2.28E-12	2.28E-12
dy161	9.25E-13	1.19E-12	1.46E-12	1.72E-12	1.99E-12	1.99E-12
te129m	1.41E-12	1.54E-12	1.62E-12	1.68E-12	1.72E-12	1.72E-12
tb159	7.62E-13	9.55E-13	1.15E-12	1.34E-12	1.53E-12	1.53E-12
sb125	6.99E-13	8.79E-13	1.06E-12	1.23E-12	1.40E-12	1.40E-12

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 14

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.82E+08n/cm**2-sec

0	initial	91.3 d	109.6 d	127.8 d	146.1 d	146.1 d
li 6	7.01E-13	8.76E-13	1.05E-12	1.23E-12	1.40E-12	1.40E-12
cd112	6.93E-13	8.69E-13	1.05E-12	1.22E-12	1.40E-12	1.40E-12
sm150	3.47E-13	5.32E-13	7.55E-13	1.02E-12	1.32E-12	1.32E-12
sn117	5.54E-13	6.93E-13	8.32E-13	9.71E-13	1.11E-12	1.11E-12
pd106	2.40E-13	3.71E-13	5.29E-13	7.11E-13	9.19E-13	9.19E-13
sn119	4.55E-13	5.68E-13	6.82E-13	7.96E-13	9.09E-13	9.09E-13

sn115	4.04E-13	5.10E-13	6.15E-13	7.21E-13	8.27E-13	8.27E-13
sr 88	3.51E-13	4.39E-13	5.27E-13	6.15E-13	7.03E-13	7.03E-13
pm148m	1.50E-13	2.31E-13	3.21E-13	4.19E-13	5.22E-13	5.22E-13
pd110	2.51E-13	3.13E-13	3.75E-13	4.38E-13	5.00E-13	5.00E-13
cd114	2.43E-13	3.04E-13	3.65E-13	4.26E-13	4.86E-13	4.86E-13
se 82	2.38E-13	2.98E-13	3.58E-13	4.17E-13	4.77E-13	4.77E-13
gd158	2.27E-13	2.84E-13	3.41E-13	3.98E-13	4.54E-13	4.54E-13
sn126	1.91E-13	2.38E-13	2.86E-13	3.34E-13	3.81E-13	3.81E-13
se 78	1.81E-13	2.27E-13	2.72E-13	3.18E-13	3.63E-13	3.63E-13
ag111	3.17E-13	3.17E-13	3.17E-13	3.17E-13	3.17E-13	3.17E-13
eu157	2.97E-13	2.96E-13	2.96E-13	2.96E-13	2.96E-13	2.96E-13
sn124	1.46E-13	1.82E-13	2.19E-13	2.55E-13	2.91E-13	2.91E-13
dy162	1.40E-13	1.74E-13	2.09E-13	2.43E-13	2.78E-13	2.78E-13
dy164	1.26E-13	1.57E-13	1.89E-13	2.20E-13	2.51E-13	2.51E-13
eu154	1.10E-13	1.39E-13	1.69E-13	1.98E-13	2.28E-13	2.28E-13
as 75	1.08E-13	1.35E-13	1.62E-13	1.90E-13	2.17E-13	2.17E-13
cd115m	1.61E-13	1.80E-13	1.94E-13	2.04E-13	2.12E-13	2.12E-13
y 90	7.60E-14	9.60E-14	1.16E-13	1.36E-13	1.56E-13	1.56E-13
sn118	5.96E-14	7.45E-14	8.93E-14	1.04E-13	1.19E-13	1.19E-13
cd116	5.05E-14	6.32E-14	7.58E-14	8.84E-14	1.01E-13	1.01E-13
sn122	5.02E-14	6.27E-14	7.52E-14	8.77E-14	1.00E-13	1.00E-13
ba136	4.28E-14	5.70E-14	7.13E-14	8.56E-14	9.99E-14	1.00E-13
zr 90	2.25E-14	3.58E-14	5.23E-14	7.18E-14	9.44E-14	9.44E-14
te125	2.01E-14	3.22E-14	4.73E-14	6.53E-14	8.64E-14	8.64E-14
sn120	3.76E-14	4.70E-14	5.63E-14	6.57E-14	7.51E-14	7.51E-14
kr 82	3.41E-14	4.29E-14	5.17E-14	6.04E-14	6.92E-14	6.92E-14
cs134	3.12E-14	3.93E-14	4.75E-14	5.58E-14	6.42E-14	6.42E-14
dy163	3.08E-14	3.84E-14	4.61E-14	5.37E-14	6.13E-14	6.13E-14
ge 73	2.92E-14	3.66E-14	4.39E-14	5.13E-14	5.86E-14	5.86E-14
cs136	5.43E-14	5.51E-14	5.54E-14	5.55E-14	5.56E-14	5.55E-14
ru 99	2.66E-14	3.38E-14	4.10E-14	4.82E-14	5.54E-14	5.54E-14
xe130	1.98E-14	2.48E-14	2.99E-14	3.49E-14	3.99E-14	3.99E-14
pm148	1.31E-14	1.76E-14	2.22E-14	2.67E-14	3.13E-14	3.12E-14
ru105	2.97E-14	2.96E-14	2.96E-14	2.96E-14	2.96E-14	2.95E-14
sn125	2.91E-14	2.92E-14	2.92E-14	2.93E-14	2.93E-14	2.92E-14
mo 96	1.44E-14	1.81E-14	2.17E-14	2.54E-14	2.91E-14	2.91E-14
ge 76	1.07E-14	1.34E-14	1.60E-14	1.87E-14	2.14E-14	2.14E-14
gd160	6.76E-15	8.44E-15	1.01E-14	1.18E-14	1.35E-14	1.35E-14
rb 88	1.28E-14	1.29E-14	1.29E-14	1.29E-14	1.29E-14	1.28E-14
i135	1.01E-14	1.01E-14	1.01E-14	1.01E-14	1.01E-14	1.00E-14
te126	4.62E-15	5.91E-15	7.21E-15	8.50E-15	9.80E-15	9.80E-15
te132	9.56E-15	9.56E-15	9.56E-15	9.56E-15	9.56E-15	9.56E-15
sn123	3.30E-15	3.94E-15	4.52E-15	5.05E-15	5.53E-15	5.53E-15

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 15

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.82E+08n/cm**2-sec

0	initial	91.3 d	109.6 d	127.8 d	146.1 d	146.1 d
ru100	2.66E-15	3.34E-15	4.03E-15	4.72E-15	5.42E-15	5.42E-15
te134	5.46E-15	5.85E-15	5.85E-15	5.85E-15	5.85E-15	5.09E-15
ho165	2.12E-15	2.65E-15	3.18E-15	3.71E-15	4.24E-15	4.24E-15
sb126	2.95E-15	2.98E-15	3.00E-15	3.00E-15	3.00E-15	3.00E-15
sr 87	1.23E-15	1.53E-15	1.84E-15	2.15E-15	2.45E-15	2.45E-15
in117m	2.09E-15	2.09E-15	2.09E-15	2.09E-15	2.09E-15	2.09E-15
sb124	1.19E-15	1.37E-15	1.51E-15	1.62E-15	1.71E-15	1.71E-15
in113	4.02E-16	6.28E-16	9.04E-16	1.23E-15	1.61E-15	1.61E-15
nb 94	6.97E-16	8.72E-16	1.05E-15	1.22E-15	1.40E-15	1.40E-15
te124	4.52E-16	6.49E-16	8.67E-16	1.10E-15	1.35E-15	1.35E-15
ge 74	5.93E-16	7.41E-16	8.89E-16	1.04E-15	1.19E-15	1.19E-15
eu152	3.61E-16	4.74E-16	6.03E-16	7.51E-16	9.22E-16	9.22E-16

ge 72	3.96E-16	5.00E-16	6.04E-16	7.09E-16	8.13E-16	8.13E-16
i130	7.11E-16	7.14E-16	7.14E-16	7.15E-16	7.15E-16	7.10E-16
in117	6.15E-16	6.14E-16	6.14E-16	6.14E-16	6.14E-16	6.14E-16
sr 86	2.28E-16	3.11E-16	3.96E-16	4.81E-16	5.68E-16	5.68E-16
se 76	2.45E-16	3.08E-16	3.71E-16	4.33E-16	4.96E-16	4.96E-16
ba135	1.61E-16	2.09E-16	2.61E-16	3.17E-16	3.76E-16	3.76E-16
rb 86	2.25E-16	2.33E-16	2.37E-16	2.39E-16	2.40E-16	2.40E-16
tb160	1.51E-16	1.75E-16	1.95E-16	2.12E-16	2.27E-16	2.27E-16
dy165	2.10E-16	2.09E-16	2.09E-16	2.09E-16	2.09E-16	2.06E-16
sm148	2.92E-17	5.32E-17	8.55E-17	1.26E-16	1.76E-16	1.76E-16
nd142	4.27E-17	6.09E-17	8.30E-17	1.09E-16	1.40E-16	1.40E-16
gd154	2.98E-17	4.65E-17	6.71E-17	9.16E-17	1.20E-16	1.20E-16
er166	5.43E-17	6.91E-17	8.40E-17	9.88E-17	1.14E-16	1.14E-16
xe128	5.51E-17	6.90E-17	8.28E-17	9.67E-17	1.11E-16	1.11E-16
cd118	1.14E-16	1.20E-16	1.20E-16	1.20E-16	1.20E-16	1.07E-16
ge 75	8.50E-17	8.64E-17	8.64E-17	8.64E-17	8.64E-17	8.26E-17
ba134	1.88E-17	2.95E-17	4.25E-17	5.80E-17	7.61E-17	7.61E-17
gd152	3.24E-17	4.16E-17	5.17E-17	6.27E-17	7.49E-17	7.49E-17
cd110	1.92E-17	2.57E-17	3.29E-17	4.07E-17	4.92E-17	4.92E-17
pd104	8.40E-18	1.46E-17	2.31E-17	3.40E-17	4.73E-17	4.73E-17
dy160	1.27E-17	1.88E-17	2.58E-17	3.35E-17	4.18E-17	4.18E-17
kr 80	1.66E-17	2.07E-17	2.49E-17	2.91E-17	3.32E-17	3.32E-17
in119m	2.83E-17	3.01E-17	3.01E-17	3.01E-17	3.01E-17	2.50E-17
br 79	3.13E-18	4.59E-18	6.32E-18	8.32E-18	1.06E-17	1.06E-17
xe129	1.24E-18	1.91E-18	2.73E-18	3.70E-18	4.82E-18	4.82E-18
ag107	1.14E-18	1.79E-18	2.57E-18	3.50E-18	4.57E-18	4.57E-18
te122	2.05E-18	2.60E-18	3.16E-18	3.71E-18	4.27E-18	4.27E-18
be 9	1.34E-18	1.68E-18	2.01E-18	2.35E-18	2.69E-18	2.69E-18
pr142	1.28E-18	1.57E-18	1.88E-18	2.21E-18	2.54E-18	2.52E-18
nb 93	7.25E-19	9.13E-19	1.11E-18	1.31E-18	1.52E-18	1.52E-18
sn116	6.45E-19	8.19E-19	1.00E-18	1.19E-18	1.38E-18	1.38E-18
te123	4.43E-19	5.98E-19	7.65E-19	9.47E-19	1.14E-18	1.14E-18
li 7	5.40E-19	6.75E-19	8.09E-19	9.43E-19	1.08E-18	1.08E-18
in119	1.56E-18	2.35E-18	2.35E-18	2.35E-18	2.35E-18	7.42E-19
er167	2.15E-19	2.69E-19	3.26E-19	3.79E-19	4.33E-19	4.33E-19
cd109	2.01E-20	2.35E-20	2.69E-20	3.36E-20	3.69E-20	3.69E-20
cd108	1.01E-20	1.34E-20	1.68E-20	2.01E-20	2.35E-20	2.35E-20

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 16

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.82E+08n/cm**2-sec

0	initial	91.3 d	109.6 d	127.8 d	146.1 d	146.1 d
cs134m	1.01E-20	1.34E-20	1.68E-20	1.68E-20	2.01E-20	2.01E-20

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 17

power= 4.000E-03mw, burnup=5.8440E-01mwd, flux= 2.82E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	91.3 d	109.6 d	127.8 d	146.1 d	146.1 d
h 1	1.76E-08	2.19E-08	2.62E-08	3.05E-08	3.48E-08	3.48E-08
h 2	5.22E-11	6.50E-11	7.77E-11	9.04E-11	1.03E-10	1.03E-10
h 3	3.81E-13	4.73E-13	5.65E-13	6.57E-13	7.48E-13	7.48E-13
h 4	.00E+00	1.92E-36	2.29E-36	2.67E-36	3.04E-36	.00E+00
he 3	2.15E-15	3.35E-15	4.81E-15	6.52E-15	8.50E-15	8.50E-15
he 4	2.91E-09	3.62E-09	4.33E-09	5.04E-09	5.75E-09	5.75E-09
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	3.50E-10	4.35E-10	5.20E-10	6.05E-10	6.91E-10	6.91E-10
ne 21	2.62E-18	4.03E-18	5.71E-18	7.66E-18	9.88E-18	9.88E-18
ne 22	5.99E-14	9.31E-14	1.33E-13	1.80E-13	2.34E-13	2.34E-13
ne 23	6.56E-17	7.10E-15	7.10E-15	7.10E-15	7.10E-15	5.66E-19

na 22	2.23E-12	2.75E-12	3.27E-12	3.78E-12	4.28E-12	4.28E-12
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	3.63E-08	3.07E-08	3.07E-08	3.07E-08	3.07E-08	3.05E-08
na 24m	5.99E-30	5.05E-15	5.05E-15	5.05E-15	5.05E-15	5.05E-30
na 25	6.08E-31	1.39E-29	1.66E-29	1.93E-29	2.20E-29	6.06E-32
mg 24	3.13E-06	3.80E-06	4.47E-06	5.14E-06	5.81E-06	5.81E-06
mg 25	3.83E-13	4.77E-13	5.70E-13	6.64E-13	7.58E-13	7.58E-13
mg 26	5.22E-11	6.50E-11	7.77E-11	9.04E-11	1.03E-10	1.03E-10
mg 27	1.60E-12	2.12E-12	2.12E-12	2.12E-12	2.12E-12	1.14E-12
mg 28	4.40E-24	4.32E-24	4.32E-24	4.32E-24	4.32E-24	4.30E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	7.33E-11	2.28E-10	2.28E-10	2.28E-10	2.28E-10	1.67E-11
al 29	3.89E-31	9.14E-31	1.30E-30	1.75E-30	2.27E-30	9.29E-31
al 30	.00E+00	7.01E-45	7.01E-45	1.40E-44	1.40E-44	.00E+00
si 28	8.79E-06	1.06E-05	1.25E-05	1.44E-05	1.62E-05	1.62E-05
si 29	2.26E-15	3.51E-15	5.00E-15	6.73E-15	8.70E-15	8.70E-15
si 30	6.21E-25	1.21E-24	2.09E-24	3.30E-24	4.90E-24	4.90E-24
si 31	4.37E-37	8.72E-37	1.50E-36	2.37E-36	3.51E-36	3.39E-36
si 32	.00E+00	.00E+00	.00E+00	.00E+00	1.40E-45	1.40E-45
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		2.82E+08	2.82E+08	2.82E+08	2.82E+08	2.82E-07

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 18

power= 4.000E-03mw, burnup=5.8440E-01mwd, flux= 2.82E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	91.3 d	109.6 d	127.8 d	146.1 d	146.1 d
he 4	1.02E-05	1.27E-05	1.53E-05	1.78E-05	2.04E-05	2.04E-05
th226	1.34E-29	2.17E-29	3.24E-29	4.55E-29	6.08E-29	6.08E-29
th227	3.85E-16	6.77E-16	1.06E-15	1.54E-15	2.11E-15	2.11E-15
th228	1.32E-15	2.42E-15	3.98E-15	6.09E-15	8.81E-15	8.81E-15
th229	4.93E-13	8.84E-13	1.41E-12	2.07E-12	2.88E-12	2.88E-12
th230	5.11E-06	6.39E-06	7.66E-06	8.94E-06	1.02E-05	1.02E-05
th231	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	1.03E-06	1.29E-06	1.55E-06	1.81E-06	2.07E-06	2.07E-06
th233	8.39E-18	1.19E-17	1.43E-17	1.66E-17	1.90E-17	1.46E-17
th234	4.71E-07	4.98E-07	5.14E-07	5.23E-07	5.29E-07	5.29E-07
pa231	1.53E-07	1.92E-07	2.31E-07	2.70E-07	3.09E-07	3.09E-07
pa232	2.63E-15	3.30E-15	3.97E-15	4.64E-15	5.31E-15	5.29E-15
pa233	1.23E-06	1.32E-06	1.37E-06	1.40E-06	1.42E-06	1.42E-06
pa234m	1.59E-11	1.68E-11	1.73E-11	1.76E-11	1.78E-11	1.78E-11
pa234	7.10E-12	7.50E-12	7.74E-12	7.88E-12	7.97E-12	7.97E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	1.29E-26	2.10E-26	3.14E-26	4.40E-26	5.89E-26	5.89E-26
u231	1.04E-21	1.46E-21	1.94E-21	2.43E-21	2.94E-21	2.94E-21
u232	1.84E-12	2.74E-12	3.81E-12	5.05E-12	6.46E-12	6.46E-12
u233	1.50E-06	2.10E-06	2.73E-06	3.38E-06	4.04E-06	4.04E-06
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	3.23E-06	3.16E-06	3.15E-06	3.15E-06	3.15E-06	3.15E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	2.90E-07	3.22E-07	3.22E-07	3.22E-07	3.22E-07	2.51E-07
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	1.09E-12	1.33E-12	1.57E-12	1.79E-12	2.01E-12	2.01E-12
np236m	2.15E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.08E-12
np236	4.10E-11	5.09E-11	6.08E-11	7.07E-11	8.06E-11	8.06E-11
np237	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01
np238	1.58E-06	1.56E-06	1.56E-06	1.56E-06	1.56E-06	1.56E-06

	np239	4.75E-05	4.65E-05	4.65E-05	4.65E-05	4.65E-05	4.65E-05
	np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	np240	9.29E-15	9.48E-15	9.48E-15	9.48E-15	9.48E-15	8.63E-15
	np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	pu236	5.77E-11	7.15E-11	8.51E-11	9.85E-11	1.12E-10	1.12E-10
	pu237	1.46E-16	2.11E-16	2.83E-16	3.61E-16	4.42E-16	4.42E-16
	pu238	3.62E-05	4.55E-05	5.48E-05	6.42E-05	7.35E-05	7.35E-05
	pu239	9.74E-04	1.23E-03	1.48E-03	1.73E-03	1.98E-03	1.98E-03
	pu240	9.28E-10	1.47E-09	2.14E-09	2.92E-09	3.83E-09	3.83E-09
	pu241	1.22E-15	2.42E-15	4.21E-15	6.73E-15	1.01E-14	1.01E-14
	pu242	4.61E-22	1.15E-21	2.42E-21	4.53E-21	7.79E-21	7.79E-21
	pu243	1.00E-30	2.46E-30	5.18E-30	9.69E-30	1.67E-29	1.63E-29
	pu244	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	pu245	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	pu246	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	totals	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04
0	flux		2.82E+08	2.82E+08	2.82E+08	2.82E+08	2.82E-07

```
0        1q array has      20 entries.
0        3q array has       1 entries.
0        3q array has       1 entries.
0        3q array has       1 entries.
0        4q array has       1 entries.
0       54q array has      12 entries.
1library information...

         cross-section data taken from position number  3 of library on unit 33.

         pass   1
         pass   0
         *scale-system control module sas2 library*
         used a time-dependent neutron spectrum, for each of the above passes
           pass 0 applies start-up fuel densiities
           pass n applies mid time densities of nth library interval
         first library updated was...
         pass   1
         pass   0
         *scale-system control module sas2 library*
         used a time-dependent neutron spectrum, for each of the above passes
           pass 0 applies start-up fuel densiities
           pass n applies mid time densities of nth library interval
         first library updated was...
         ********************************************************************************
         *                                                                              *
         *             prelim lwr origen-s binary working library--id = 1143            *
         *          made from modified card-image origen-s libraries of scale 4.2       *
         *       data from the light element, actinide, and fission product libraries   *
         *         decay data, including gamma and total energy, are from endf/b-vi     *
         *                                                                              *
         *       neutron flux spectrum factors and cross sections were produced from    *
         *      the "presas2" case updating all nuclides on the scale "burnup" library  *
         *                                                                              *
         *                   fission product yields are from endf/b-v                   *
         *                                                                              *
         *                 photon libraries use an 18-energy-group structure            *
         *                the photon data are from the master photon data base,         *
         *                 produced to include bremsstrahlung from uo2 matrix           *
         *                                                                              *
         *         see information above this box (if present) for later updates        *
         *                                                                              *
         ********************************************************************************
```

```
         *                                                                           *
0        *****************************************************************************
0                  .other identification and sizes of library.
0                   data set name:  ft33f001
0               8/28/1996    date library was produced
0                    1697    total number of nuclides in library
                      689    number of light-element nuclides
                      129    number of actinide nuclides
                      879    number of fission product nuclides
0                    7993    number of nonzero off-diagonal matrix elements
0        *****************************************************************************
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                            page   19
         power=     .00mw, burnup=       1.mwd, flux= 2.74E+08n/cm**2-sec
0                                                   basis =
0    (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                    initial        164.4 d        182.6 d        200.9 d        219.2 d        219.2 d
     productions  1.122439E+06   1.122440E+06   1.122440E+06   1.122440E+06   1.122441E+06   1.122441E+06
     absorptions  9.157813E+05   9.157819E+05   9.157824E+05   9.157831E+05   9.157836E+05   9.157836E+05
     k infinity   1.225663E+00   1.225662E+00   1.225662E+00   1.225662E+00   1.225661E+00   1.225661E+00
0                    initial        164.4 d        182.6 d        200.9 d        219.2 d        219.2 d
     actinide
     absorptions  9.125454E+05   9.125456E+05   9.125458E+05   9.125460E+05   9.125463E+05   9.125463E+05
     non-actinide
     abs. fracs.  3.533483E-03   3.533840E-03   3.534257E-03   3.534734E-03   3.535092E-03   3.535092E-03
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2           fission products        page   20
0                                         fraction of total absorption rate
         power=     .00mw, burnup=       1.mwd, flux= 2.74E+08n/cm**2-sec
0                initial   164.4 d   182.6 d   200.9 d   219.2 d   219.2 d
```

	initial	164.4 d	182.6 d	200.9 d	219.2 d	219.2 d
sm149	2.93E-06	3.30E-06	3.67E-06	4.05E-06	4.42E-06	4.42E-06
xe135	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06
sm151	1.36E-07	1.53E-07	1.70E-07	1.87E-07	2.04E-07	2.04E-07
nd143	5.72E-08	6.55E-08	7.39E-08	8.22E-08	9.06E-08	9.06E-08
gd157	3.18E-08	3.58E-08	3.97E-08	4.37E-08	4.77E-08	4.77E-08
cd113	2.63E-08	2.96E-08	3.29E-08	3.62E-08	3.94E-08	3.94E-08
pm147	2.45E-08	2.77E-08	3.09E-08	3.41E-08	3.72E-08	3.72E-08
rh103	1.77E-08	2.09E-08	2.42E-08	2.75E-08	3.09E-08	3.09E-08
xe131	1.74E-08	1.98E-08	2.22E-08	2.46E-08	2.69E-08	2.69E-08
cs133	1.48E-08	1.68E-08	1.88E-08	2.07E-08	2.27E-08	2.27E-08
tc 99	1.06E-08	1.19E-08	1.33E-08	1.47E-08	1.60E-08	1.60E-08
eu155	9.13E-09	1.02E-08	1.13E-08	1.24E-08	1.35E-08	1.35E-08
nd145	8.46E-09	9.52E-09	1.06E-08	1.16E-08	1.27E-08	1.27E-08
rh105	8.36E-09	8.36E-09	8.36E-09	8.36E-09	8.36E-09	8.36E-09
sm152	4.38E-09	4.93E-09	5.48E-09	6.02E-09	6.57E-09	6.57E-09
kr 83	3.63E-09	4.08E-09	4.54E-09	4.99E-09	5.45E-09	5.45E-09
cs135	3.36E-09	3.78E-09	4.20E-09	4.62E-09	5.05E-09	5.05E-09
ru101	2.54E-09	2.86E-09	3.18E-09	3.49E-09	3.81E-09	3.81E-09
mo 95	1.65E-09	2.11E-09	2.62E-09	3.16E-09	3.73E-09	3.73E-09
eu153	2.18E-09	2.46E-09	2.74E-09	3.02E-09	3.29E-09	3.29E-09
la139	2.02E-09	2.27E-09	2.52E-09	2.77E-09	3.03E-09	3.03E-09
pr141	1.72E-09	2.02E-09	2.33E-09	2.63E-09	2.94E-09	2.94E-09
pr143	2.87E-09	2.87E-09	2.87E-09	2.87E-09	2.87E-09	2.87E-09
gd155	1.17E-09	1.47E-09	1.81E-09	2.19E-09	2.60E-09	2.60E-09
xe133	2.06E-09	2.06E-09	2.06E-09	2.06E-09	2.06E-09	2.06E-09
ce141	1.55E-09	1.57E-09	1.59E-09	1.60E-09	1.61E-09	1.61E-09
pd105	9.31E-10	1.05E-09	1.17E-09	1.28E-09	1.40E-09	1.40E-09
zr 93	8.36E-10	9.41E-10	1.05E-09	1.15E-09	1.26E-09	1.26E-09
sm147	4.46E-10	5.76E-10	7.22E-10	8.83E-10	1.06E-09	1.06E-09
pm149	9.80E-10	9.80E-10	9.80E-10	9.80E-10	9.80E-10	9.80E-10
nd147	9.33E-10	9.33E-10	9.33E-10	9.33E-10	9.33E-10	9.33E-10

i129	5.89E-10	6.67E-10	7.45E-10	8.23E-10	9.01E-10	9.01E-10
mo 97	4.53E-10	5.11E-10	5.68E-10	6.25E-10	6.82E-10	6.82E-10
ag109	3.15E-10	3.54E-10	3.93E-10	4.33E-10	4.72E-10	4.72E-10
ru103	3.31E-10	3.38E-10	3.44E-10	3.48E-10	3.50E-10	3.50E-10
eu151	1.55E-10	1.96E-10	2.42E-10	2.93E-10	3.49E-10	3.49E-10
ru102	1.85E-10	2.09E-10	2.32E-10	2.55E-10	2.78E-10	2.78E-10
sr 90	1.69E-10	1.90E-10	2.11E-10	2.32E-10	2.53E-10	2.53E-10
ce142	1.68E-10	1.89E-10	2.10E-10	2.31E-10	2.52E-10	2.52E-10
ce144	1.81E-10	1.99E-10	2.17E-10	2.33E-10	2.50E-10	2.49E-10
nd148	1.61E-10	1.81E-10	2.01E-10	2.21E-10	2.41E-10	2.41E-10
y 89	1.17E-10	1.40E-10	1.63E-10	1.87E-10	2.11E-10	2.11E-10
zr 91	1.14E-10	1.37E-10	1.61E-10	1.85E-10	2.10E-10	2.10E-10
nd144	9.56E-11	1.19E-10	1.45E-10	1.73E-10	2.04E-10	2.04E-10
nd146	1.35E-10	1.52E-10	1.69E-10	1.86E-10	2.02E-10	2.02E-10
ba138	1.15E-10	1.30E-10	1.44E-10	1.59E-10	1.73E-10	1.73E-10
in115	1.08E-10	1.22E-10	1.36E-10	1.50E-10	1.64E-10	1.64E-10
pd108	1.08E-10	1.21E-10	1.34E-10	1.48E-10	1.61E-10	1.61E-10
ce140	9.79E-11	1.12E-10	1.26E-10	1.40E-10	1.55E-10	1.55E-10

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 21

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.74E+08n/cm**2-sec

0	initial	164.4 d	182.6 d	200.9 d	219.2 d	219.2 d
zr 95	1.32E-10	1.38E-10	1.43E-10	1.47E-10	1.50E-10	1.50E-10
xe132	9.40E-11	1.06E-10	1.18E-10	1.30E-10	1.43E-10	1.43E-10
y 91	1.20E-10	1.25E-10	1.29E-10	1.32E-10	1.35E-10	1.35E-10
nb 95	9.40E-11	1.03E-10	1.12E-10	1.18E-10	1.24E-10	1.24E-10
pm151	1.10E-10	1.10E-10	1.10E-10	1.10E-10	1.10E-10	1.10E-10
mo 98	6.65E-11	7.49E-11	8.32E-11	9.15E-11	9.98E-11	9.98E-11
mo100	6.44E-11	7.25E-11	8.05E-11	8.86E-11	9.67E-11	9.67E-11
pd107	6.41E-11	7.21E-11	8.00E-11	8.80E-11	9.60E-11	9.60E-11
xe134	6.38E-11	7.17E-11	7.97E-11	8.77E-11	9.57E-11	9.57E-11
zr 92	5.22E-11	5.87E-11	6.52E-11	7.18E-11	7.83E-11	7.83E-11
zr 96	4.04E-11	4.55E-11	5.05E-11	5.56E-11	6.07E-11	6.07E-11
ru104	3.97E-11	4.46E-11	4.96E-11	5.45E-11	5.95E-11	5.95E-11
i127	3.63E-11	4.13E-11	4.63E-11	5.14E-11	5.65E-11	5.65E-11
nd150	3.55E-11	4.00E-11	4.44E-11	4.88E-11	5.33E-11	5.33E-11
cs137	3.48E-11	3.91E-11	4.34E-11	4.77E-11	5.20E-11	5.20E-11
xe136	3.44E-11	3.87E-11	4.30E-11	4.73E-11	5.16E-11	5.16E-11
ba140	4.75E-11	4.75E-11	4.75E-11	4.75E-11	4.75E-11	4.75E-11
br 81	2.58E-11	2.90E-11	3.22E-11	3.55E-11	3.87E-11	3.87E-11
sm153	3.82E-11	3.82E-11	3.82E-11	3.82E-11	3.82E-11	3.82E-11
eu156	3.48E-11	3.48E-11	3.48E-11	3.48E-11	3.48E-11	3.48E-11
zr 94	2.18E-11	2.46E-11	2.73E-11	3.00E-11	3.28E-11	3.28E-11
rb 85	2.01E-11	2.26E-11	2.52E-11	2.77E-11	3.02E-11	3.02E-11
sr 89	2.67E-11	2.77E-11	2.84E-11	2.90E-11	2.94E-11	2.94E-11
cd111	1.54E-11	1.75E-11	1.96E-11	2.17E-11	2.38E-11	2.38E-11
te130	1.56E-11	1.76E-11	1.96E-11	2.15E-11	2.35E-11	2.35E-11
sm154	1.51E-11	1.70E-11	1.89E-11	2.08E-11	2.27E-11	2.27E-11
kr 85	1.49E-11	1.67E-11	1.86E-11	2.04E-11	2.22E-11	2.22E-11
rb 87	1.46E-11	1.64E-11	1.83E-11	2.01E-11	2.19E-11	2.19E-11
kr 87	2.16E-11	2.31E-11	2.31E-11	2.31E-11	2.31E-11	2.08E-11
ce143	1.76E-11	1.76E-11	1.76E-11	1.76E-11	1.76E-11	1.75E-11
se 77	1.15E-11	1.30E-11	1.44E-11	1.59E-11	1.74E-11	1.74E-11
la140	1.62E-11	1.62E-11	1.62E-11	1.62E-11	1.62E-11	1.62E-11
mo 99	1.31E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.31E-11
kr 84	6.87E-12	7.73E-12	8.59E-12	9.45E-12	1.03E-11	1.03E-11
ba137	4.56E-12	5.76E-12	7.08E-12	8.55E-12	1.02E-11	1.02E-11
ru106	6.03E-12	6.68E-12	7.30E-12	7.90E-12	8.48E-12	8.48E-12
sb121	5.40E-12	6.08E-12	6.76E-12	7.44E-12	8.12E-12	8.12E-12

se 79	5.31E-12	5.98E-12	6.64E-12	7.31E-12	7.97E-12	7.97E-12
i131	6.81E-12	6.81E-12	6.81E-12	6.81E-12	6.81E-12	6.81E-12
sb123	3.81E-12	4.30E-12	4.79E-12	5.28E-12	5.78E-12	5.78E-12
kr 86	3.84E-12	4.32E-12	4.80E-12	5.28E-12	5.76E-12	5.76E-12
te127m	4.41E-12	4.74E-12	5.04E-12	5.31E-12	5.54E-12	5.54E-12
te128	3.42E-12	3.85E-12	4.27E-12	4.70E-12	5.13E-12	5.13E-12
se 80	2.48E-12	2.79E-12	3.10E-12	3.41E-12	3.72E-12	3.72E-12
gd156	2.27E-12	2.60E-12	2.93E-12	3.27E-12	3.60E-12	3.60E-12
dy161	2.00E-12	2.26E-12	2.53E-12	2.79E-12	3.06E-12	3.06E-12
sm150	1.32E-12	1.66E-12	2.04E-12	2.46E-12	2.92E-12	2.92E-12
tb159	1.53E-12	1.72E-12	1.91E-12	2.11E-12	2.30E-12	2.30E-12
li 6	1.41E-12	1.59E-12	1.76E-12	1.94E-12	2.11E-12	2.11E-12

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 22

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.74E+08n/cm**2-sec

0	initial	164.4 d	182.6 d	200.9 d	219.2 d	219.2 d
cd112	1.40E-12	1.58E-12	1.75E-12	1.93E-12	2.11E-12	2.11E-12
sb125	1.40E-12	1.57E-12	1.74E-12	1.91E-12	2.07E-12	2.07E-12
pd106	9.16E-13	1.15E-12	1.40E-12	1.67E-12	1.97E-12	1.97E-12
te129m	1.73E-12	1.76E-12	1.78E-12	1.79E-12	1.80E-12	1.80E-12
sn117	1.11E-12	1.25E-12	1.39E-12	1.53E-12	1.67E-12	1.67E-12
sn119	9.14E-13	1.03E-12	1.14E-12	1.26E-12	1.37E-12	1.37E-12
sn115	8.31E-13	9.38E-13	1.04E-12	1.15E-12	1.26E-12	1.26E-12
sr 88	7.05E-13	7.94E-13	8.82E-13	9.70E-13	1.06E-12	1.06E-12
pm148m	5.25E-13	6.30E-13	7.37E-13	8.45E-13	9.54E-13	9.54E-13
pd110	4.99E-13	5.61E-13	6.23E-13	6.85E-13	7.47E-13	7.47E-13
cd114	4.84E-13	5.44E-13	6.05E-13	6.65E-13	7.25E-13	7.25E-13
se 82	4.79E-13	5.39E-13	5.99E-13	6.58E-13	7.18E-13	7.18E-13
gd158	4.53E-13	5.10E-13	5.67E-13	6.23E-13	6.80E-13	6.80E-13
sn126	3.83E-13	4.31E-13	4.79E-13	5.27E-13	5.75E-13	5.75E-13
se 78	3.64E-13	4.09E-13	4.55E-13	5.00E-13	5.46E-13	5.46E-13
sn124	2.90E-13	3.26E-13	3.63E-13	3.99E-13	4.35E-13	4.35E-13
dy162	2.78E-13	3.13E-13	3.47E-13	3.81E-13	4.16E-13	4.16E-13
dy164	2.53E-13	2.84E-13	3.15E-13	3.47E-13	3.78E-13	3.78E-13
eu154	2.29E-13	2.60E-13	2.91E-13	3.23E-13	3.55E-13	3.55E-13
as 75	2.17E-13	2.44E-13	2.71E-13	2.98E-13	3.25E-13	3.25E-13
ag111	3.16E-13	3.15E-13	3.15E-13	3.15E-13	3.15E-13	3.15E-13
eu157	2.96E-13	2.96E-13	2.96E-13	2.96E-13	2.96E-13	2.95E-13
y 90	1.57E-13	1.77E-13	1.96E-13	2.16E-13	2.36E-13	2.36E-13
cd115m	2.13E-13	2.19E-13	2.23E-13	2.27E-13	2.29E-13	2.29E-13
zr 90	9.47E-14	1.20E-13	1.49E-13	1.81E-13	2.16E-13	2.16E-13
te125	8.63E-14	1.10E-13	1.37E-13	1.67E-13	2.00E-13	2.00E-13
sn118	1.18E-13	1.33E-13	1.48E-13	1.63E-13	1.77E-13	1.77E-13
ba136	9.98E-14	1.14E-13	1.29E-13	1.43E-13	1.57E-13	1.57E-13
cd116	1.01E-13	1.13E-13	1.26E-13	1.38E-13	1.51E-13	1.51E-13
sn122	1.01E-13	1.13E-13	1.26E-13	1.38E-13	1.51E-13	1.51E-13
sn120	7.52E-14	8.45E-14	9.39E-14	1.03E-13	1.13E-13	1.13E-13
kr 82	6.94E-14	7.82E-14	8.70E-14	9.58E-14	1.05E-13	1.05E-13
cs134	6.44E-14	7.30E-14	8.16E-14	9.03E-14	9.92E-14	9.92E-14
dy163	6.14E-14	6.90E-14	7.66E-14	8.42E-14	9.18E-14	9.18E-14
ge 73	5.88E-14	6.62E-14	7.36E-14	8.09E-14	8.83E-14	8.83E-14
ru 99	5.53E-14	6.26E-14	6.99E-14	7.73E-14	8.47E-14	8.47E-14
xe130	4.01E-14	4.51E-14	5.02E-14	5.52E-14	6.03E-14	6.03E-14
cs136	5.54E-14	5.54E-14	5.55E-14	5.55E-14	5.55E-14	5.54E-14
pm148	3.11E-14	3.53E-14	3.97E-14	4.40E-14	4.83E-14	4.82E-14
mo 96	2.90E-14	3.27E-14	3.64E-14	4.01E-14	4.37E-14	4.37E-14
ge 76	2.14E-14	2.41E-14	2.68E-14	2.94E-14	3.21E-14	3.21E-14
sn125	2.92E-14	2.92E-14	2.92E-14	2.92E-14	2.92E-14	2.92E-14
ru105	2.94E-14	2.95E-14	2.95E-14	2.95E-14	2.95E-14	2.91E-14

gd160	1.35E-14	1.51E-14	1.68E-14	1.85E-14	2.02E-14	2.02E-14
te126	9.81E-15	1.11E-14	1.24E-14	1.37E-14	1.50E-14	1.50E-14
rb 88	1.29E-14	1.30E-14	1.30E-14	1.30E-14	1.30E-14	1.28E-14
i135	1.00E-14	1.02E-14	1.02E-14	1.02E-14	1.02E-14	9.98E-15
te132	9.58E-15	9.59E-15	9.59E-15	9.59E-15	9.59E-15	9.58E-15
ru100	5.45E-15	6.16E-15	6.87E-15	7.59E-15	8.32E-15	8.32E-15

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 23

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.74E+08n/cm**2-sec

0	initial	164.4 d	182.6 d	200.9 d	219.2 d	219.2 d
sn123	5.49E-15	5.92E-15	6.31E-15	6.67E-15	6.99E-15	6.99E-15
ho165	4.24E-15	4.77E-15	5.30E-15	5.82E-15	6.35E-15	6.35E-15
te134	5.12E-15	5.89E-15	5.89E-15	5.89E-15	5.89E-15	4.78E-15
sr 87	2.46E-15	2.77E-15	3.08E-15	3.39E-15	3.70E-15	3.70E-15
in113	1.60E-15	2.03E-15	2.50E-15	3.03E-15	3.60E-15	3.60E-15
sb126	3.01E-15	3.01E-15	3.01E-15	3.01E-15	3.01E-15	3.01E-15
te124	1.36E-15	1.62E-15	1.89E-15	2.17E-15	2.46E-15	2.46E-15
in117m	2.10E-15	2.10E-15	2.10E-15	2.10E-15	2.10E-15	2.10E-15
nb 94	1.39E-15	1.57E-15	1.74E-15	1.92E-15	2.09E-15	2.09E-15
sb124	1.71E-15	1.79E-15	1.85E-15	1.89E-15	1.93E-15	1.93E-15
eu152	9.26E-16	1.12E-15	1.35E-15	1.61E-15	1.90E-15	1.90E-15
ge 74	1.19E-15	1.34E-15	1.49E-15	1.64E-15	1.79E-15	1.79E-15
ge 72	8.17E-16	9.21E-16	1.03E-15	1.13E-15	1.24E-15	1.24E-15
sr 86	5.70E-16	6.57E-16	7.44E-16	8.31E-16	9.19E-16	9.19E-16
se 76	4.98E-16	5.62E-16	6.25E-16	6.88E-16	7.51E-16	7.51E-16
i130	7.11E-16	7.16E-16	7.16E-16	7.16E-16	7.16E-16	7.09E-16
ba135	3.76E-16	4.38E-16	5.04E-16	5.73E-16	6.45E-16	6.45E-16
in117	6.17E-16	6.17E-16	6.17E-16	6.17E-16	6.17E-16	6.16E-16
sm148	1.76E-16	2.35E-16	3.03E-16	3.80E-16	4.66E-16	4.66E-16
nd142	1.40E-16	1.75E-16	2.15E-16	2.58E-16	3.07E-16	3.07E-16
gd154	1.21E-16	1.53E-16	1.90E-16	2.31E-16	2.76E-16	2.76E-16
tb160	2.28E-16	2.40E-16	2.50E-16	2.59E-16	2.67E-16	2.67E-16
rb 86	2.41E-16	2.42E-16	2.42E-16	2.42E-16	2.42E-16	2.42E-16
dy165	2.07E-16	2.10E-16	2.10E-16	2.10E-16	2.10E-16	2.03E-16
ba134	7.61E-17	9.67E-17	1.20E-16	1.46E-16	1.74E-16	1.74E-16
er166	1.14E-16	1.29E-16	1.44E-16	1.59E-16	1.74E-16	1.74E-16
xe128	1.11E-16	1.25E-16	1.39E-16	1.53E-16	1.67E-16	1.67E-16
gd152	7.54E-17	8.89E-17	1.04E-16	1.21E-16	1.39E-16	1.39E-16
pd104	4.71E-17	6.29E-17	8.13E-17	1.02E-16	1.26E-16	1.26E-16
cd118	1.08E-16	1.21E-16	1.21E-16	1.21E-16	1.21E-16	1.02E-16
cd110	4.94E-17	5.85E-17	6.81E-17	7.84E-17	8.93E-17	8.93E-17
ge 75	8.31E-17	8.69E-17	8.69E-17	8.69E-17	8.69E-17	8.04E-17
dy160	4.17E-17	5.05E-17	5.97E-17	6.93E-17	7.91E-17	7.91E-17
kr 80	3.33E-17	3.75E-17	4.17E-17	4.59E-17	5.00E-17	5.00E-17
br 79	1.06E-17	1.31E-17	1.60E-17	1.90E-17	2.24E-17	2.24E-17
in119m	2.51E-17	3.02E-17	3.02E-17	3.02E-17	3.02E-17	2.17E-17
xe129	4.82E-18	6.10E-18	7.52E-18	9.10E-18	1.08E-17	1.08E-17
ag107	4.59E-18	5.81E-18	7.16E-18	8.66E-18	1.03E-17	1.03E-17
te122	4.26E-18	4.82E-18	5.38E-18	5.95E-18	6.51E-18	6.51E-18
be 9	2.67E-18	3.00E-18	3.33E-18	3.67E-18	4.00E-18	4.00E-18
pr142	2.53E-18	2.88E-18	3.22E-18	3.57E-18	3.92E-18	3.89E-18
nb 93	1.53E-18	1.75E-18	1.98E-18	2.23E-18	2.48E-18	2.48E-18
sn116	1.37E-18	1.57E-18	1.78E-18	1.98E-18	2.20E-18	2.20E-18
te123	1.14E-18	1.35E-18	1.56E-18	1.78E-18	2.01E-18	2.01E-18
li 7	1.09E-18	1.22E-18	1.36E-18	1.49E-18	1.63E-18	1.63E-18
er167	4.35E-19	4.89E-19	5.43E-19	6.00E-19	6.54E-19	6.54E-19
in119	7.45E-19	2.36E-18	2.36E-18	2.36E-18	2.36E-18	3.40E-19
cd109	3.71E-20	4.04E-20	4.38E-20	4.72E-20	5.05E-20	5.05E-20
cd108	2.36E-20	2.36E-20	2.70E-20	3.03E-20	3.37E-20	3.37E-20

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 24
0 fraction of total absorption rate
power= .00mw, burnup= 1.mwd, flux= 2.74E+08n/cm**2-sec
0

	initial	164.4 d	182.6 d	200.9 d	219.2 d	219.2 d
cs134m	2.02E-20	2.36E-20	2.70E-20	3.03E-20	3.03E-20	3.03E-20

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 25
power= 4.000E-03mw, burnup=8.7659E-01mwd, flux= 2.74E+08n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	164.4 d	182.6 d	200.9 d	219.2 d	219.2 d
h 1	3.48E-08	3.91E-08	4.33E-08	4.76E-08	5.18E-08	5.18E-08
h 2	1.03E-10	1.16E-10	1.28E-10	1.41E-10	1.54E-10	1.54E-10
h 3	7.48E-13	8.39E-13	9.29E-13	1.02E-12	1.11E-12	1.11E-12
h 4	.00E+00	3.41E-36	3.78E-36	4.14E-36	4.51E-36	.00E+00
he 3	8.50E-15	1.07E-14	1.32E-14	1.59E-14	1.89E-14	1.89E-14
he 4	5.75E-09	6.45E-09	7.16E-09	7.86E-09	8.57E-09	8.57E-09
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	6.91E-10	7.75E-10	8.60E-10	9.44E-10	1.03E-09	1.03E-09
ne 21	9.88E-18	1.23E-17	1.50E-17	1.80E-17	2.12E-17	2.12E-17
ne 22	2.34E-13	2.94E-13	3.61E-13	4.34E-13	5.14E-13	5.14E-13
ne 23	5.66E-19	7.04E-15	7.04E-15	7.04E-15	7.04E-15	5.25E-21
na 22	4.28E-12	4.78E-12	5.26E-12	5.74E-12	6.22E-12	6.22E-12
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	3.05E-08	2.85E-08	2.85E-08	2.85E-08	2.85E-08	2.82E-08
na 24m	5.05E-30	4.68E-15	4.68E-15	4.68E-15	4.68E-15	4.68E-30
na 25	6.06E-32	2.44E-29	2.71E-29	2.97E-29	3.24E-29	4.81E-33
mg 24	5.81E-06	6.43E-06	7.05E-06	7.67E-06	8.29E-06	8.29E-06
mg 25	7.58E-13	8.51E-13	9.43E-13	1.04E-12	1.13E-12	1.13E-12
mg 26	1.03E-10	1.16E-10	1.28E-10	1.41E-10	1.54E-10	1.54E-10
mg 27	1.14E-12	2.10E-12	2.10E-12	2.10E-12	2.10E-12	8.34E-13
mg 28	4.30E-24	4.29E-24	4.29E-24	4.29E-24	4.29E-24	4.26E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	1.67E-11	2.11E-10	2.11E-10	2.11E-10	2.11E-10	4.24E-12
al 29	9.29E-31	2.80E-30	3.42E-30	4.10E-30	4.84E-30	1.27E-30
al 30	.00E+00	2.24E-44	2.94E-44	4.34E-44	5.89E-44	.00E+00
si 28	1.62E-05	1.79E-05	1.96E-05	2.14E-05	2.31E-05	2.31E-05
si 29	8.70E-15	1.09E-14	1.33E-14	1.60E-14	1.88E-14	1.88E-14
si 30	4.90E-24	6.93E-24	9.43E-24	1.25E-23	1.61E-23	1.61E-23
si 31	3.39E-36	4.98E-36	6.78E-36	8.96E-36	1.16E-35	1.09E-35
si 32	1.40E-45	2.80E-45	4.20E-45	7.01E-45	1.12E-44	1.12E-44
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		2.74E+08	2.74E+08	2.74E+08	2.74E+08	2.74E-07

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 26
power= 4.000E-03mw, burnup=8.7659E-01mwd, flux= 2.74E+08n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	164.4 d	182.6 d	200.9 d	219.2 d	219.2 d
he 4	2.04E-05	2.30E-05	2.56E-05	2.81E-05	3.07E-05	3.07E-05
th226	6.08E-29	7.78E-29	9.72E-29	1.19E-28	1.43E-28	1.43E-28
th227	2.11E-15	2.77E-15	3.53E-15	4.39E-15	5.33E-15	5.34E-15
th228	8.81E-15	1.22E-14	1.64E-14	2.13E-14	2.72E-14	2.72E-14
th229	2.88E-12	3.83E-12	4.93E-12	6.18E-12	7.57E-12	7.57E-12
th230	1.02E-05	1.15E-05	1.28E-05	1.41E-05	1.53E-05	1.53E-05
th231	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	2.07E-06	2.32E-06	2.58E-06	2.84E-06	3.10E-06	3.10E-06
th233	1.46E-17	2.13E-17	2.37E-17	2.61E-17	2.84E-17	1.92E-17
th234	5.29E-07	5.32E-07	5.34E-07	5.35E-07	5.36E-07	5.36E-07

pa231	3.09E-07	3.48E-07	3.87E-07	4.26E-07	4.65E-07	4.65E-07
pa232	5.29E-15	5.98E-15	6.65E-15	7.32E-15	7.99E-15	7.96E-15
pa233	1.42E-06	1.43E-06	1.44E-06	1.45E-06	1.45E-06	1.45E-06
pa234m	1.78E-11	1.79E-11	1.80E-11	1.81E-11	1.81E-11	1.81E-11
pa234	7.97E-12	8.02E-12	8.05E-12	8.06E-12	8.07E-12	8.07E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	5.89E-26	7.54E-26	9.42E-26	1.15E-25	1.38E-25	1.38E-25
u231	2.94E-21	3.41E-21	3.91E-21	4.43E-21	4.94E-21	4.94E-21
u232	6.46E-12	8.02E-12	9.75E-12	1.16E-11	1.37E-11	1.37E-11
u233	4.04E-06	4.71E-06	5.38E-06	6.06E-06	6.74E-06	6.74E-06
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	3.15E-06	3.12E-06	3.11E-06	3.11E-06	3.11E-06	3.11E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	2.51E-07	3.19E-07	3.19E-07	3.19E-07	3.19E-07	2.19E-07
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	2.01E-12	2.22E-12	2.42E-12	2.62E-12	2.81E-12	2.81E-12
np236m	2.08E-12	2.06E-12	2.06E-12	2.06E-12	2.06E-12	2.05E-12
np236	8.06E-11	9.04E-11	1.00E-10	1.10E-10	1.20E-10	1.20E-10
np237	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01
np238	1.56E-06	1.56E-06	1.56E-06	1.56E-06	1.56E-06	1.55E-06
np239	4.65E-05	4.61E-05	4.61E-05	4.61E-05	4.61E-05	4.61E-05
np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np240	8.63E-15	9.37E-15	9.37E-15	9.37E-15	9.37E-15	8.14E-15
np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu236	1.12E-10	1.25E-10	1.38E-10	1.50E-10	1.63E-10	1.63E-10
pu237	4.42E-16	5.24E-16	6.08E-16	6.95E-16	7.82E-16	7.82E-16
pu238	7.35E-05	8.28E-05	9.20E-05	1.01E-04	1.11E-04	1.11E-04
pu239	1.98E-03	2.22E-03	2.47E-03	2.72E-03	2.97E-03	2.97E-03
pu240	3.83E-09	4.87E-09	6.02E-09	7.29E-09	8.69E-09	8.69E-09
pu241	1.01E-14	1.44E-14	1.98E-14	2.63E-14	3.42E-14	3.42E-14
pu242	7.79E-21	1.25E-20	1.92E-20	2.81E-20	3.99E-20	3.99E-20
pu243	1.63E-29	2.65E-29	4.05E-29	5.95E-29	8.44E-29	8.19E-29
pu244	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu245	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu246	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
totals	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04
0 flux		2.74E+08	2.74E+08	2.74E+08	2.74E+08	2.74E-07

```
0        1q array has     20 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        4q array has      1 entries.
0       54q array has     12 entries.
1library information...

          cross-section data taken from position number  4 of library on unit 33.

          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          pass   1
          pass   0
          *scale-system control module sas2 library*
```

```
        used a time-dependent neutron spectrum, for each of the above passes
          pass 0 applies start-up fuel densiities
          pass n applies mid time densities of nth library interval
        first library updated was...
        ********************************************************************************
        *                                                                              *
        *            prelim lwr origen-s binary working library--id = 1143             *
        *         made from modified card-image origen-s libraries of scale 4.2        *
        *      data from the light element, actinide, and fission product libraries    *
        *        decay data, including gamma and total energy, are from endf/b-vi      *
        *                                                                              *
        *      neutron flux spectrum factors and cross sections were produced from     *
        *     the "presas2" case updating all nuclides on the scale "burnup" library   *
        *                                                                              *
        *                 fission product yields are from endf/b-v                     *
        *                                                                              *
        *               photon libraries use an 18-energy-group structure              *
        *              the photon data are from the master photon data base,           *
        *               produced to include bremsstrahlung from uo2 matrix             *
        *                                                                              *
        *        see information above this box (if present) for later updates        *
        *                                                                              *
        ********************************************************************************
        *                                                                              *
0       ********************************************************************************
0                 .other identification and sizes of library.
0                  data set name:  ft33f001
0              8/28/1996    date library was produced
0                   1697    total number of nuclides in library
                     689    number of light-element nuclides
                     129    number of actinide nuclides
                     879    number of fission product nuclides
0                   7993    number of nonzero off-diagonal matrix elements
0       ********************************************************************************
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                          page   27
       power=    .00mw, burnup=      1.mwd, flux= 2.71E+08n/cm**2-sec
0                                           basis =
0    (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                    initial        237.4 d        255.7 d        274.0 d        292.2 d        292.2 d
     productions   1.134699E+06   1.134700E+06   1.134700E+06   1.134700E+06   1.134701E+06   1.134701E+06
     absorptions   9.243443E+05   9.243449E+05   9.243456E+05   9.243463E+05   9.243468E+05   9.243468E+05
     k infinity    1.227572E+00   1.227571E+00   1.227571E+00   1.227570E+00   1.227570E+00   1.227570E+00
0                    initial        237.4 d        255.7 d        274.0 d        292.2 d        292.2 d
     actinide
     absorptions   9.211681E+05   9.211683E+05   9.211685E+05   9.211688E+05   9.211689E+05   9.211689E+05
     non-actinide
     abs. fracs.   3.436208E-03   3.436625E-03   3.437161E-03   3.437579E-03   3.437996E-03   3.437996E-03
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2         fission products     page   28
0                                 fraction of total absorption rate
       power=    .00mw, burnup=      1.mwd, flux= 2.71E+08n/cm**2-sec
0                 initial   237.4 d   255.7 d   274.0 d   292.2 d   292.2 d

     sm149       4.43E-06  4.81E-06  5.18E-06  5.56E-06  5.93E-06  5.93E-06
     xe135       2.33E-06  2.33E-06  2.33E-06  2.33E-06  2.33E-06  2.33E-06
     sm151       2.04E-07  2.21E-07  2.39E-07  2.56E-07  2.73E-07  2.73E-07
     nd143       9.07E-08  9.91E-08  1.07E-07  1.16E-07  1.24E-07  1.24E-07
     gd157       4.78E-08  5.18E-08  5.58E-08  5.97E-08  6.37E-08  6.37E-08
     cd113       3.95E-08  4.28E-08  4.61E-08  4.94E-08  5.27E-08  5.27E-08
     pm147       3.72E-08  4.03E-08  4.33E-08  4.63E-08  4.93E-08  4.93E-08
     rh103       3.09E-08  3.43E-08  3.77E-08  4.11E-08  4.45E-08  4.45E-08
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xe131	2.69E-08	2.93E-08	3.17E-08	3.40E-08	3.64E-08	3.64E-08
cs133	2.27E-08	2.46E-08	2.66E-08	2.86E-08	3.06E-08	3.06E-08
tc 99	1.60E-08	1.73E-08	1.87E-08	2.01E-08	2.14E-08	2.14E-08
eu155	1.35E-08	1.46E-08	1.56E-08	1.67E-08	1.77E-08	1.77E-08
nd145	1.27E-08	1.38E-08	1.48E-08	1.59E-08	1.69E-08	1.69E-08
sm152	6.56E-09	7.11E-09	7.65E-09	8.20E-09	8.75E-09	8.75E-09
rh105	8.37E-09	8.36E-09	8.36E-09	8.36E-09	8.36E-09	8.36E-09
kr 83	5.46E-09	5.91E-09	6.37E-09	6.82E-09	7.28E-09	7.28E-09
cs135	5.04E-09	5.47E-09	5.89E-09	6.31E-09	6.73E-09	6.73E-09
mo 95	3.72E-09	4.32E-09	4.94E-09	5.57E-09	6.22E-09	6.22E-09
ru101	3.80E-09	4.12E-09	4.44E-09	4.75E-09	5.07E-09	5.07E-09
gd155	2.61E-09	3.05E-09	3.53E-09	4.04E-09	4.58E-09	4.58E-09
eu153	3.29E-09	3.57E-09	3.85E-09	4.13E-09	4.40E-09	4.40E-09
pr141	2.94E-09	3.25E-09	3.56E-09	3.87E-09	4.18E-09	4.18E-09
la139	3.03E-09	3.28E-09	3.53E-09	3.79E-09	4.04E-09	4.04E-09
pr143	2.88E-09	2.88E-09	2.88E-09	2.88E-09	2.88E-09	2.88E-09
xe133	2.07E-09	2.07E-09	2.07E-09	2.07E-09	2.07E-09	2.07E-09
sm147	1.06E-09	1.25E-09	1.46E-09	1.68E-09	1.92E-09	1.92E-09
pd105	1.40E-09	1.52E-09	1.64E-09	1.75E-09	1.87E-09	1.87E-09
zr 93	1.25E-09	1.36E-09	1.46E-09	1.57E-09	1.67E-09	1.67E-09
ce141	1.61E-09	1.61E-09	1.62E-09	1.62E-09	1.62E-09	1.62E-09
i129	9.03E-10	9.81E-10	1.06E-09	1.14E-09	1.22E-09	1.22E-09
pm149	9.82E-10	9.82E-10	9.82E-10	9.82E-10	9.82E-10	9.82E-10
nd147	9.31E-10	9.31E-10	9.32E-10	9.32E-10	9.32E-10	9.31E-10
mo 97	6.83E-10	7.40E-10	7.97E-10	8.54E-10	9.11E-10	9.11E-10
ag109	4.71E-10	5.11E-10	5.50E-10	5.89E-10	6.29E-10	6.29E-10
eu151	3.49E-10	4.10E-10	4.76E-10	5.47E-10	6.22E-10	6.22E-10
ru102	2.78E-10	3.02E-10	3.25E-10	3.48E-10	3.71E-10	3.71E-10
ru103	3.51E-10	3.53E-10	3.54E-10	3.55E-10	3.56E-10	3.56E-10
nd144	2.04E-10	2.36E-10	2.70E-10	3.06E-10	3.44E-10	3.44E-10
sr 90	2.53E-10	2.74E-10	2.95E-10	3.16E-10	3.37E-10	3.37E-10
ce142	2.52E-10	2.73E-10	2.95E-10	3.16E-10	3.37E-10	3.37E-10
nd148	2.41E-10	2.61E-10	2.81E-10	3.01E-10	3.21E-10	3.21E-10
zr 91	2.10E-10	2.36E-10	2.61E-10	2.87E-10	3.14E-10	3.14E-10
y 89	2.12E-10	2.37E-10	2.61E-10	2.87E-10	3.12E-10	3.12E-10
ce144	2.50E-10	2.65E-10	2.80E-10	2.94E-10	3.07E-10	3.07E-10
nd146	2.03E-10	2.20E-10	2.37E-10	2.53E-10	2.70E-10	2.70E-10
ba138	1.73E-10	1.88E-10	2.02E-10	2.17E-10	2.31E-10	2.31E-10
in115	1.64E-10	1.78E-10	1.92E-10	2.06E-10	2.20E-10	2.20E-10
pd108	1.61E-10	1.74E-10	1.87E-10	2.01E-10	2.14E-10	2.14E-10
ce140	1.55E-10	1.69E-10	1.83E-10	1.98E-10	2.12E-10	2.12E-10

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 29

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.71E+08n/cm**2-sec

0	initial	237.4 d	255.7 d	274.0 d	292.2 d	292.2 d
xe132	1.43E-10	1.55E-10	1.67E-10	1.79E-10	1.91E-10	1.91E-10
zr 95	1.50E-10	1.53E-10	1.55E-10	1.57E-10	1.58E-10	1.58E-10
y 91	1.35E-10	1.37E-10	1.39E-10	1.41E-10	1.42E-10	1.42E-10
nb 95	1.24E-10	1.29E-10	1.33E-10	1.37E-10	1.40E-10	1.40E-10
mo 98	9.96E-11	1.08E-10	1.16E-10	1.25E-10	1.33E-10	1.33E-10
mo100	9.66E-11	1.05E-10	1.13E-10	1.21E-10	1.29E-10	1.29E-10
pd107	9.60E-11	1.04E-10	1.12E-10	1.20E-10	1.28E-10	1.28E-10
xe134	9.58E-11	1.04E-10	1.12E-10	1.20E-10	1.28E-10	1.28E-10
pm151	1.10E-10	1.11E-10	1.11E-10	1.11E-10	1.11E-10	1.10E-10
zr 92	7.84E-11	8.50E-11	9.15E-11	9.81E-11	1.05E-10	1.05E-10
zr 96	6.05E-11	6.55E-11	7.05E-11	7.56E-11	8.06E-11	8.06E-11
ru104	5.95E-11	6.44E-11	6.93E-11	7.43E-11	7.92E-11	7.93E-11
i127	5.65E-11	6.16E-11	6.67E-11	7.19E-11	7.71E-11	7.71E-11
nd150	5.33E-11	5.77E-11	6.22E-11	6.66E-11	7.10E-11	7.10E-11

cs137	5.20E-11	5.63E-11	6.06E-11	6.49E-11	6.92E-11	6.92E-11
xe136	5.17E-11	5.60E-11	6.03E-11	6.46E-11	6.89E-11	6.89E-11
br 81	3.87E-11	4.19E-11	4.51E-11	4.84E-11	5.16E-11	5.16E-11
ba140	4.75E-11	4.76E-11	4.76E-11	4.76E-11	4.76E-11	4.75E-11
zr 94	3.27E-11	3.54E-11	3.82E-11	4.09E-11	4.36E-11	4.36E-11
rb 85	3.02E-11	3.28E-11	3.53E-11	3.79E-11	4.04E-11	4.04E-11
sm153	3.82E-11	3.82E-11	3.82E-11	3.82E-11	3.82E-11	3.82E-11
eu156	3.48E-11	3.48E-11	3.48E-11	3.48E-11	3.48E-11	3.48E-11
cd111	2.38E-11	2.59E-11	2.80E-11	3.01E-11	3.21E-11	3.21E-11
te130	2.35E-11	2.55E-11	2.74E-11	2.94E-11	3.13E-11	3.13E-11
sr 89	2.94E-11	2.98E-11	3.01E-11	3.03E-11	3.04E-11	3.04E-11
sm154	2.27E-11	2.46E-11	2.65E-11	2.84E-11	3.03E-11	3.03E-11
kr 85	2.23E-11	2.41E-11	2.59E-11	2.77E-11	2.95E-11	2.95E-11
rb 87	2.19E-11	2.38E-11	2.56E-11	2.74E-11	2.92E-11	2.92E-11
se 77	1.74E-11	1.89E-11	2.03E-11	2.18E-11	2.33E-11	2.33E-11
kr 87	2.09E-11	2.32E-11	2.32E-11	2.32E-11	2.32E-11	2.01E-11
ba137	1.02E-11	1.19E-11	1.38E-11	1.58E-11	1.80E-11	1.80E-11
ce143	1.76E-11	1.76E-11	1.76E-11	1.76E-11	1.76E-11	1.76E-11
la140	1.62E-11	1.62E-11	1.62E-11	1.62E-11	1.62E-11	1.62E-11
kr 84	1.03E-11	1.11E-11	1.20E-11	1.29E-11	1.37E-11	1.37E-11
mo 99	1.31E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.31E-11
sb121	8.11E-12	8.79E-12	9.47E-12	1.02E-11	1.08E-11	1.08E-11
se 79	7.99E-12	8.66E-12	9.32E-12	9.99E-12	1.07E-11	1.07E-11
ru106	8.46E-12	9.02E-12	9.56E-12	1.01E-11	1.06E-11	1.06E-11
sb123	5.77E-12	6.27E-12	6.76E-12	7.26E-12	7.76E-12	7.76E-12
kr 86	5.77E-12	6.25E-12	6.73E-12	7.22E-12	7.70E-12	7.70E-12
te128	5.13E-12	5.56E-12	5.98E-12	6.41E-12	6.84E-12	6.84E-12
i131	6.81E-12	6.81E-12	6.81E-12	6.81E-12	6.81E-12	6.81E-12
te127m	5.55E-12	5.76E-12	5.95E-12	6.12E-12	6.27E-12	6.27E-12
sm150	2.92E-12	3.42E-12	3.96E-12	4.54E-12	5.15E-12	5.15E-12
se 80	3.72E-12	4.03E-12	4.34E-12	4.65E-12	4.96E-12	4.96E-12
gd156	3.59E-12	3.92E-12	4.26E-12	4.59E-12	4.92E-12	4.92E-12
dy161	3.06E-12	3.33E-12	3.59E-12	3.86E-12	4.13E-12	4.13E-12
pd106	1.97E-12	2.29E-12	2.62E-12	2.98E-12	3.35E-12	3.35E-12
tb159	2.30E-12	2.49E-12	2.68E-12	2.87E-12	3.06E-12	3.06E-12

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 30

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.71E+08n/cm**2-sec

0	initial	237.4 d	255.7 d	274.0 d	292.2 d	292.2 d
li 6	2.12E-12	2.30E-12	2.47E-12	2.65E-12	2.83E-12	2.83E-12
cd112	2.11E-12	2.29E-12	2.46E-12	2.64E-12	2.81E-12	2.81E-12
sb125	2.07E-12	2.23E-12	2.39E-12	2.55E-12	2.71E-12	2.71E-12
sn117	1.67E-12	1.81E-12	1.95E-12	2.09E-12	2.23E-12	2.23E-12
sn119	1.37E-12	1.49E-12	1.60E-12	1.72E-12	1.83E-12	1.83E-12
te129m	1.80E-12	1.81E-12	1.81E-12	1.81E-12	1.82E-12	1.82E-12
sn115	1.26E-12	1.37E-12	1.47E-12	1.58E-12	1.68E-12	1.68E-12
sr 88	1.06E-12	1.15E-12	1.24E-12	1.33E-12	1.41E-12	1.41E-12
pm148m	9.56E-13	1.06E-12	1.17E-12	1.28E-12	1.39E-12	1.39E-12
pd110	7.46E-13	8.08E-13	8.71E-13	9.33E-13	9.95E-13	9.95E-13
cd114	7.24E-13	7.84E-13	8.44E-13	9.05E-13	9.65E-13	9.65E-13
se 82	7.19E-13	7.79E-13	8.39E-13	8.99E-13	9.59E-13	9.59E-13
gd158	6.79E-13	7.36E-13	7.92E-13	8.49E-13	9.06E-13	9.06E-13
sn126	5.76E-13	6.25E-13	6.73E-13	7.21E-13	7.69E-13	7.69E-13
se 78	5.46E-13	5.92E-13	6.37E-13	6.83E-13	7.28E-13	7.28E-13
sn124	4.34E-13	4.70E-13	5.07E-13	5.43E-13	5.79E-13	5.79E-13
dy162	4.16E-13	4.50E-13	4.85E-13	5.19E-13	5.53E-13	5.53E-13
dy164	3.79E-13	4.10E-13	4.41E-13	4.73E-13	5.04E-13	5.04E-13
eu154	3.56E-13	3.88E-13	4.21E-13	4.55E-13	4.89E-13	4.89E-13
as 75	3.25E-13	3.53E-13	3.80E-13	4.07E-13	4.34E-13	4.34E-13

zr 90	2.17E-13	2.55E-13	2.96E-13	3.41E-13	3.88E-13	3.88E-13
te125	2.00E-13	2.36E-13	2.75E-13	3.16E-13	3.61E-13	3.61E-13
y 90	2.37E-13	2.57E-13	2.77E-13	2.96E-13	3.16E-13	3.16E-13
ag111	3.15E-13	3.15E-13	3.15E-13	3.15E-13	3.15E-13	3.15E-13
eu157	2.96E-13	2.97E-13	2.97E-13	2.97E-13	2.97E-13	2.95E-13
sn118	1.77E-13	1.92E-13	2.06E-13	2.21E-13	2.36E-13	2.36E-13
cd115m	2.30E-13	2.32E-13	2.33E-13	2.34E-13	2.35E-13	2.35E-13
ba136	1.57E-13	1.72E-13	1.86E-13	2.00E-13	2.15E-13	2.15E-13
sn122	1.51E-13	1.64E-13	1.76E-13	1.89E-13	2.01E-13	2.01E-13
cd116	1.51E-13	1.63E-13	1.76E-13	1.88E-13	2.01E-13	2.01E-13
sn120	1.13E-13	1.22E-13	1.31E-13	1.41E-13	1.50E-13	1.50E-13
kr 82	1.05E-13	1.14E-13	1.22E-13	1.31E-13	1.40E-13	1.40E-13
cs134	9.93E-14	1.08E-13	1.17E-13	1.26E-13	1.36E-13	1.36E-13
dy163	9.19E-14	9.95E-14	1.07E-13	1.15E-13	1.22E-13	1.22E-13
ge 73	8.84E-14	9.58E-14	1.03E-13	1.11E-13	1.18E-13	1.18E-13
ru 99	8.46E-14	9.20E-14	9.95E-14	1.07E-13	1.15E-13	1.15E-13
xe130	6.04E-14	6.54E-14	7.05E-14	7.56E-14	8.06E-14	8.06E-14
pm148	4.81E-14	5.23E-14	5.64E-14	6.05E-14	6.45E-14	6.44E-14
mo 96	4.37E-14	4.74E-14	5.11E-14	5.47E-14	5.84E-14	5.84E-14
cs136	5.54E-14	5.54E-14	5.54E-14	5.54E-14	5.54E-14	5.54E-14
ge 76	3.21E-14	3.48E-14	3.75E-14	4.02E-14	4.29E-14	4.29E-14
sn125	2.91E-14	2.92E-14	2.92E-14	2.92E-14	2.92E-14	2.91E-14
ru105	2.91E-14	2.94E-14	2.94E-14	2.94E-14	2.94E-14	2.89E-14
gd160	2.02E-14	2.18E-14	2.35E-14	2.52E-14	2.69E-14	2.69E-14
te126	1.50E-14	1.63E-14	1.76E-14	1.89E-14	2.02E-14	2.02E-14
rb 88	1.28E-14	1.30E-14	1.30E-14	1.30E-14	1.30E-14	1.27E-14
ru100	8.33E-15	9.07E-15	9.81E-15	1.06E-14	1.13E-14	1.13E-14
i135	1.00E-14	1.02E-14	1.02E-14	1.02E-14	1.02E-14	9.92E-15
te132	9.59E-15	9.60E-15	9.61E-15	9.61E-15	9.61E-15	9.59E-15

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 31

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.71E+08n/cm**2-sec

0	initial	237.4 d	255.7 d	274.0 d	292.2 d	292.2 d
ho165	6.35E-15	6.88E-15	7.41E-15	7.93E-15	8.46E-15	8.46E-15
sn123	6.97E-15	7.26E-15	7.52E-15	7.76E-15	7.98E-15	7.98E-15
in113	3.60E-15	4.22E-15	4.89E-15	5.61E-15	6.38E-15	6.38E-15
sr 87	3.70E-15	4.01E-15	4.32E-15	4.63E-15	4.93E-15	4.93E-15
te134	4.79E-15	5.90E-15	5.90E-15	5.90E-15	5.90E-15	4.46E-15
te124	2.47E-15	2.76E-15	3.05E-15	3.35E-15	3.65E-15	3.65E-15
eu152	1.91E-15	2.24E-15	2.62E-15	3.04E-15	3.51E-15	3.51E-15
sb126	3.01E-15	3.02E-15	3.02E-15	3.02E-15	3.02E-15	3.02E-15
nb 94	2.09E-15	2.26E-15	2.44E-15	2.61E-15	2.78E-15	2.78E-15
ge 74	1.79E-15	1.94E-15	2.09E-15	2.24E-15	2.39E-15	2.39E-15
in117m	2.10E-15	2.10E-15	2.10E-15	2.10E-15	2.10E-15	2.10E-15
sb124	1.93E-15	1.97E-15	1.99E-15	2.01E-15	2.03E-15	2.03E-15
ge 72	1.24E-15	1.34E-15	1.45E-15	1.55E-15	1.66E-15	1.66E-15
sr 86	9.20E-16	1.01E-15	1.10E-15	1.18E-15	1.27E-15	1.27E-15
se 76	7.52E-16	8.15E-16	8.79E-16	9.42E-16	1.00E-15	1.00E-15
ba135	6.45E-16	7.21E-16	8.01E-16	8.83E-16	9.69E-16	9.69E-16
sm148	4.66E-16	5.61E-16	6.64E-16	7.77E-16	8.99E-16	8.99E-16
i130	7.10E-16	7.17E-16	7.17E-16	7.17E-16	7.17E-16	7.08E-16
in117	6.18E-16	6.18E-16	6.18E-16	6.18E-16	6.18E-16	6.17E-16
nd142	3.07E-16	3.60E-16	4.18E-16	4.80E-16	5.46E-16	5.46E-16
gd154	2.76E-16	3.26E-16	3.79E-16	4.38E-16	5.00E-16	5.00E-16
ba134	1.74E-16	2.05E-16	2.39E-16	2.75E-16	3.14E-16	3.14E-16
tb160	2.67E-16	2.74E-16	2.79E-16	2.84E-16	2.88E-16	2.88E-16
pd104	1.26E-16	1.52E-16	1.81E-16	2.13E-16	2.47E-16	2.47E-16
rb 86	2.42E-16	2.43E-16	2.43E-16	2.43E-16	2.43E-16	2.43E-16
gd152	1.39E-16	1.60E-16	1.83E-16	2.08E-16	2.35E-16	2.35E-16

er166	1.74E-16	1.89E-16	2.04E-16	2.19E-16	2.34E-16	2.34E-16
xe128	1.67E-16	1.81E-16	1.95E-16	2.09E-16	2.23E-16	2.23E-16
dy165	2.03E-16	2.10E-16	2.10E-16	2.10E-16	2.10E-16	1.99E-16
cd110	8.94E-17	1.01E-16	1.13E-16	1.25E-16	1.38E-16	1.38E-16
dy160	7.91E-17	8.92E-17	9.95E-17	1.10E-16	1.21E-16	1.21E-16
cd118	1.02E-16	1.21E-16	1.21E-16	1.21E-16	1.21E-16	9.61E-17
ge 75	8.06E-17	8.71E-17	8.71E-17	8.71E-17	8.71E-17	7.78E-17
kr 80	5.01E-17	5.43E-17	5.85E-17	6.27E-17	6.69E-17	6.69E-17
br 79	2.24E-17	2.60E-17	2.99E-17	3.41E-17	3.85E-17	3.85E-17
xe129	1.08E-17	1.27E-17	1.48E-17	1.70E-17	1.93E-17	1.93E-17
in119m	2.17E-17	3.03E-17	3.03E-17	3.03E-17	3.03E-17	1.85E-17
ag107	1.03E-17	1.21E-17	1.40E-17	1.61E-17	1.83E-17	1.83E-17
te122	6.51E-18	7.08E-18	7.65E-18	8.23E-18	8.81E-18	8.81E-18
be 9	3.99E-18	4.32E-18	4.65E-18	4.98E-18	5.32E-18	5.32E-18
pr142	3.90E-18	4.28E-18	4.63E-18	4.98E-18	5.33E-18	5.28E-18
nb 93	2.48E-18	2.76E-18	3.04E-18	3.35E-18	3.67E-18	3.67E-18
sn116	2.19E-18	2.42E-18	2.64E-18	2.88E-18	3.12E-18	3.12E-18
te123	2.01E-18	2.25E-18	2.49E-18	2.74E-18	2.99E-18	2.99E-18
li 7	1.63E-18	1.77E-18	1.90E-18	2.04E-18	2.18E-18	2.18E-18
er167	6.55E-19	7.09E-19	7.63E-19	8.17E-19	8.74E-19	8.74E-19
in119	3.41E-19	2.37E-18	2.37E-18	2.37E-18	2.37E-18	1.65E-19
cd109	5.06E-20	5.74E-20	6.07E-20	6.41E-20	6.75E-20	6.75E-20
cd108	3.37E-20	3.71E-20	3.71E-20	4.05E-20	4.39E-20	4.39E-20

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 32

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.71E+08n/cm**2-sec

0	initial	237.4 d	255.7 d	274.0 d	292.2 d	292.2 d
cs134m	3.04E-20	3.37E-20	3.71E-20	4.05E-20	4.39E-20	4.05E-20

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 33

power= 4.000E-03mw, burnup=1.1688E+00mwd, flux= 2.71E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	237.4 d	255.7 d	274.0 d	292.2 d	292.2 d
h 1	5.18E-08	5.61E-08	6.03E-08	6.46E-08	6.88E-08	6.88E-08
h 2	1.54E-10	1.66E-10	1.79E-10	1.92E-10	2.04E-10	2.04E-10
h 3	1.11E-12	1.20E-12	1.29E-12	1.38E-12	1.46E-12	1.46E-12
h 4	.00E+00	4.87E-36	5.24E-36	5.60E-36	5.96E-36	.00E+00
he 3	1.89E-14	2.22E-14	2.57E-14	2.94E-14	3.34E-14	3.34E-14
he 4	8.57E-09	9.27E-09	9.97E-09	1.07E-08	1.14E-08	1.14E-08
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	1.03E-09	1.11E-09	1.20E-09	1.28E-09	1.37E-09	1.37E-09
ne 21	2.12E-17	2.46E-17	2.82E-17	3.21E-17	3.62E-17	3.62E-17
ne 22	5.14E-13	6.00E-13	6.92E-13	7.90E-13	8.94E-13	8.94E-13
ne 23	5.25E-21	7.03E-15	7.03E-15	7.03E-15	7.03E-15	4.64E-23
na 22	6.22E-12	6.68E-12	7.14E-12	7.60E-12	8.04E-12	8.04E-12
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	2.82E-08	2.77E-08	2.77E-08	2.77E-08	2.77E-08	2.73E-08
na 24m	4.68E-30	4.55E-15	4.55E-15	4.55E-15	4.55E-15	4.55E-30
na 25	4.81E-33	3.49E-29	3.75E-29	4.02E-29	4.28E-29	3.31E-34
mg 24	8.29E-06	8.89E-06	9.49E-06	1.01E-05	1.07E-05	1.07E-05
mg 25	1.13E-12	1.22E-12	1.32E-12	1.41E-12	1.50E-12	1.50E-12
mg 26	1.54E-10	1.66E-10	1.79E-10	1.92E-10	2.04E-10	2.04E-10
mg 27	8.34E-13	2.10E-12	2.10E-12	2.10E-12	2.10E-12	6.11E-13
mg 28	4.26E-24	4.29E-24	4.29E-24	4.29E-24	4.29E-24	4.25E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	4.24E-12	2.05E-10	2.05E-10	2.05E-10	2.05E-10	1.11E-12
al 29	1.27E-30	5.60E-30	6.44E-30	7.34E-30	8.29E-30	1.40E-30
al 30	.00E+00	7.29E-44	8.69E-44	1.02E-43	1.23E-43	.00E+00

si 28	2.31E-05	2.48E-05	2.64E-05	2.81E-05	2.98E-05	2.98E-05
si 29	1.88E-14	2.19E-14	2.52E-14	2.87E-14	3.25E-14	3.25E-14
si 30	1.61E-23	2.03E-23	2.52E-23	3.08E-23	3.71E-23	3.71E-23
si 31	1.09E-35	1.46E-35	1.81E-35	2.21E-35	2.67E-35	2.48E-35
si 32	1.12E-44	1.54E-44	2.10E-44	2.80E-44	3.64E-44	3.64E-44
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		2.71E+08	2.71E+08	2.71E+08	2.71E+08	2.71E-07

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 34
power= 4.000E-03mw, burnup=1.1688E+00mwd, flux= 2.71E+08n/cm**2-sec

0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	237.4 d	255.7 d	274.0 d	292.2 d	292.2 d
he 4	3.07E-05	3.33E-05	3.59E-05	3.85E-05	4.11E-05	4.11E-05
ra222	2.97E-30	3.45E-30	4.01E-30	4.62E-30	5.28E-30	5.35E-30
ra223	2.81E-15	3.40E-15	4.05E-15	4.76E-15	5.53E-15	5.53E-15
ra224	1.33E-16	1.67E-16	2.06E-16	2.51E-16	3.01E-16	3.01E-16
ra225	3.11E-17	3.82E-17	4.60E-17	5.46E-17	6.39E-17	6.39E-17
ra226	4.23E-11	4.96E-11	5.76E-11	6.61E-11	7.52E-11	7.52E-11
ra228	4.48E-17	5.24E-17	6.07E-17	6.95E-17	7.90E-17	7.90E-17
th226	1.43E-28	1.68E-28	1.96E-28	2.26E-28	2.58E-28	2.57E-28
th227	5.34E-15	6.38E-15	7.51E-15	8.74E-15	1.01E-14	1.01E-14
th228	2.72E-14	3.39E-14	4.17E-14	5.05E-14	6.05E-14	6.05E-14
th229	7.57E-12	9.11E-12	1.08E-11	1.26E-11	1.46E-11	1.46E-11
th230	1.53E-05	1.66E-05	1.79E-05	1.92E-05	2.04E-05	2.04E-05
th231	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	3.10E-06	3.36E-06	3.61E-06	3.87E-06	4.13E-06	4.13E-06
th233	1.92E-17	3.08E-17	3.31E-17	3.55E-17	3.79E-17	2.24E-17
th234	5.36E-07	5.36E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	4.65E-07	5.04E-07	5.43E-07	5.82E-07	6.21E-07	6.21E-07
pa232	7.96E-15	8.66E-15	9.33E-15	1.00E-14	1.07E-14	1.06E-14
pa233	1.45E-06	1.45E-06	1.45E-06	1.45E-06	1.46E-06	1.46E-06
pa234m	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11
pa234	8.07E-12	8.08E-12	8.08E-12	8.09E-12	8.09E-12	8.09E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	1.38E-25	1.63E-25	1.90E-25	2.19E-25	2.49E-25	2.49E-25
u231	4.94E-21	5.43E-21	5.94E-21	6.46E-21	6.97E-21	6.96E-21
u232	1.37E-11	1.59E-11	1.82E-11	2.07E-11	2.33E-11	2.33E-11
u233	6.74E-06	7.42E-06	8.10E-06	8.79E-06	9.47E-06	9.47E-06
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	3.11E-06	3.10E-06	3.10E-06	3.10E-06	3.10E-06	3.09E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	2.19E-07	3.18E-07	3.18E-07	3.18E-07	3.18E-07	1.93E-07
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	2.81E-12	2.99E-12	3.17E-12	3.34E-12	3.51E-12	3.51E-12
np236m	2.05E-12	2.05E-12	2.05E-12	2.05E-12	2.05E-12	2.03E-12
np236	1.20E-10	1.29E-10	1.39E-10	1.49E-10	1.59E-10	1.59E-10
np237	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01
np238	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06
np239	4.61E-05	4.59E-05	4.59E-05	4.59E-05	4.59E-05	4.59E-05
np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np240	8.14E-15	9.33E-15	9.33E-15	9.33E-15	9.33E-15	7.73E-15
np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu236	1.63E-10	1.75E-10	1.87E-10	1.99E-10	2.11E-10	2.11E-10
pu237	7.82E-16	8.69E-16	9.57E-16	1.05E-15	1.14E-15	1.14E-15
pu238	1.11E-04	1.20E-04	1.29E-04	1.38E-04	1.48E-04	1.48E-04
pu239	2.97E-03	3.22E-03	3.46E-03	3.71E-03	3.96E-03	3.96E-03

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     pu240    8.69E-09  1.02E-08  1.18E-08  1.36E-08  1.55E-08  1.55E-08
     pu241    3.42E-14  4.35E-14  5.43E-14  6.68E-14  8.10E-14  8.10E-14
     pu242    3.99E-20  5.50E-20  7.41E-20  9.77E-20  1.27E-19  1.27E-19
1
     sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                actinides         page   35
       power= 4.000E-03mw, burnup=1.1688E+00mwd, flux= 2.71E+08n/cm**2-sec
0                                           nuclide concentrations, gram atoms
                                            basis = single reactor assembly
               charge    237.4 d   255.7 d   274.0 d   292.2 d   292.2 d
     pu243    8.19E-29  1.16E-28  1.56E-28  2.06E-28  2.66E-28  2.56E-28
     pu244     .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
     pu245     .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
     pu246     .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
   totals     3.73E+04  3.73E+04  3.73E+04  3.73E+04  3.73E+04  3.73E+04
0    flux               2.71E+08  2.71E+08  2.71E+08  2.71E+08  2.71E-07
0        1q array has     20 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        4q array has      1 entries.
0       54q array has     12 entries.
1library information...

          cross-section data taken from position number  1 of library on unit 15.

          pass   5
          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          ******************************************************************************
          *                                                                            *
          *             prelim lwr origen-s binary working library--id = 1143          *
          *          made from modified card-image origen-s libraries of scale 4.2     *
          *       data from the light element, actinide, and fission product libraries *
          *         decay data, including gamma and total energy, are from endf/b-vi   *
          *                                                                            *
          *       neutron flux spectrum factors and cross sections were produced from  *
          *      the "presas2" case updating all nuclides on the scale "burnup" library *
          *                                                                            *
          *                   fission product yields are from endf/b-v                 *
          *                                                                            *
          *               photon libraries use an 18-energy-group structure            *
          *              the photon data are from the master photon data base,         *
          *               produced to include bremsstrahlung from uo2 matrix           *
          *                                                                            *
          *         see information above this box (if present) for later updates     *
          *                                                                            *
          ******************************************************************************
          *                                                                            *
```

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0        ****************************************************************************
0                 .other identification and sizes of library.
0                  data set name:  ft15f001
0              8/28/1996    date library was produced
0                   1697    total number of nuclides in library
                     689    number of light-element nuclides
                     129    number of actinide nuclides
                     879    number of fission product nuclides
0                   7993    number of nonzero off-diagonal matrix elements
0        ****************************************************************************
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                                  page   36
         power=    .00mw, burnup=      1.mwd, flux= 2.70E+08n/cm**2-sec
0                                                  basis =
0    (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                    initial        310.5 d        328.8 d        347.0 d        365.3 d
     productions   1.138348E+06   1.138348E+06   1.138348E+06   1.138349E+06   1.138349E+06
     absorptions   9.268934E+05   9.268941E+05   9.268948E+05   9.268954E+05   9.268959E+05
     k infinity    1.228132E+00   1.228132E+00   1.228131E+00   1.228131E+00   1.228130E+00
0                    initial        310.5 d        328.8 d        347.0 d        365.3 d
     actinide
     absorptions   9.237305E+05   9.237308E+05   9.237310E+05   9.237313E+05   9.237315E+05
     non-actinide
     abs. fracs.   3.412426E-03   3.412783E-03   3.413260E-03   3.413677E-03   3.414035E-03
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2          fission products          page   37
0                                      fraction of total absorption rate
         power=    .00mw, burnup=      1.mwd, flux= 2.70E+08n/cm**2-sec
0                 initial   310.5 d   328.8 d   347.0 d   365.3 d

     sm149      5.94E-06  6.31E-06  6.69E-06  7.06E-06  7.44E-06
     xe135      2.33E-06  2.34E-06  2.34E-06  2.34E-06  2.34E-06
     sm151      2.73E-07  2.90E-07  3.07E-07  3.24E-07  3.41E-07
     nd143      1.24E-07  1.33E-07  1.41E-07  1.49E-07  1.58E-07
     gd157      6.38E-08  6.77E-08  7.17E-08  7.57E-08  7.97E-08
     cd113      5.27E-08  5.60E-08  5.93E-08  6.26E-08  6.59E-08
     pm147      4.93E-08  5.22E-08  5.51E-08  5.79E-08  6.07E-08
     rh103      4.45E-08  4.79E-08  5.14E-08  5.48E-08  5.82E-08
     xe131      3.64E-08  3.88E-08  4.11E-08  4.35E-08  4.59E-08
     cs133      3.05E-08  3.25E-08  3.45E-08  3.64E-08  3.84E-08
     tc 99      2.14E-08  2.28E-08  2.41E-08  2.55E-08  2.68E-08
     eu155      1.77E-08  1.87E-08  1.98E-08  2.08E-08  2.18E-08
     nd145      1.69E-08  1.80E-08  1.91E-08  2.01E-08  2.12E-08
     sm152      8.74E-09  9.29E-09  9.84E-09  1.04E-08  1.09E-08
     kr 83      7.28E-09  7.74E-09  8.19E-09  8.65E-09  9.10E-09
     mo 95      6.22E-09  6.88E-09  7.55E-09  8.23E-09  8.92E-09
     cs135      6.73E-09  7.15E-09  7.57E-09  8.00E-09  8.42E-09
     rh105      8.37E-09  8.37E-09  8.37E-09  8.37E-09  8.37E-09
     gd155      4.59E-09  5.17E-09  5.78E-09  6.42E-09  7.10E-09
     ru101      5.07E-09  5.38E-09  5.70E-09  6.02E-09  6.33E-09
     eu153      4.40E-09  4.68E-09  4.96E-09  5.24E-09  5.51E-09
     pr141      4.18E-09  4.49E-09  4.81E-09  5.12E-09  5.43E-09
     la139      4.04E-09  4.29E-09  4.55E-09  4.80E-09  5.05E-09
     sm147      1.92E-09  2.17E-09  2.44E-09  2.72E-09  3.01E-09
     pr143      2.88E-09  2.88E-09  2.88E-09  2.88E-09  2.88E-09
     pd105      1.87E-09  1.99E-09  2.11E-09  2.23E-09  2.34E-09
     zr 93      1.67E-09  1.78E-09  1.88E-09  1.99E-09  2.09E-09
     xe133      2.07E-09  2.07E-09  2.07E-09  2.07E-09  2.07E-09
     ce141      1.62E-09  1.62E-09  1.62E-09  1.63E-09  1.63E-09
      i129      1.22E-09  1.30E-09  1.37E-09  1.45E-09  1.53E-09
     mo 97      9.12E-10  9.69E-10  1.03E-09  1.08E-09  1.14E-09
     pm149      9.82E-10  9.82E-10  9.82E-10  9.82E-10  9.82E-10
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eu151	6.22E-10	7.03E-10	7.88E-10	8.78E-10	9.73E-10
nd147	9.31E-10	9.31E-10	9.31E-10	9.31E-10	9.31E-10
ag109	6.28E-10	6.67E-10	7.07E-10	7.46E-10	7.85E-10
nd144	3.44E-10	3.83E-10	4.24E-10	4.66E-10	5.10E-10
ru102	3.71E-10	3.95E-10	4.18E-10	4.41E-10	4.64E-10
ce142	3.37E-10	3.58E-10	3.79E-10	4.00E-10	4.21E-10
zr 91	3.14E-10	3.40E-10	3.67E-10	3.94E-10	4.21E-10
sr 90	3.37E-10	3.58E-10	3.79E-10	4.00E-10	4.20E-10
y 89	3.12E-10	3.37E-10	3.63E-10	3.89E-10	4.14E-10
nd148	3.21E-10	3.42E-10	3.62E-10	3.82E-10	4.02E-10
ru103	3.56E-10	3.57E-10	3.57E-10	3.57E-10	3.58E-10
ce144	3.07E-10	3.20E-10	3.33E-10	3.45E-10	3.56E-10
nd146	2.70E-10	2.87E-10	3.04E-10	3.21E-10	3.38E-10
ba138	2.31E-10	2.46E-10	2.60E-10	2.75E-10	2.89E-10
in115	2.20E-10	2.34E-10	2.48E-10	2.62E-10	2.76E-10
ce140	2.12E-10	2.26E-10	2.40E-10	2.55E-10	2.69E-10
pd108	2.14E-10	2.27E-10	2.41E-10	2.54E-10	2.67E-10

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 38

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.70E+08n/cm**2-sec

0	initial	310.5 d	328.8 d	347.0 d	365.3 d
xe132	1.91E-10	2.03E-10	2.15E-10	2.28E-10	2.40E-10
mo 98	1.33E-10	1.41E-10	1.49E-10	1.58E-10	1.66E-10
zr 95	1.58E-10	1.60E-10	1.61E-10	1.61E-10	1.62E-10
mo100	1.29E-10	1.37E-10	1.45E-10	1.53E-10	1.61E-10
xe134	1.28E-10	1.36E-10	1.44E-10	1.52E-10	1.60E-10
pd107	1.28E-10	1.36E-10	1.44E-10	1.52E-10	1.60E-10
nb 95	1.40E-10	1.42E-10	1.44E-10	1.46E-10	1.47E-10
y 91	1.42E-10	1.43E-10	1.43E-10	1.44E-10	1.44E-10
zr 92	1.05E-10	1.11E-10	1.18E-10	1.24E-10	1.31E-10
pm151	1.10E-10	1.11E-10	1.11E-10	1.11E-10	1.11E-10
zr 96	8.05E-11	8.56E-11	9.06E-11	9.56E-11	1.01E-10
ru104	7.92E-11	8.42E-11	8.91E-11	9.41E-11	9.90E-11
i127	7.70E-11	8.22E-11	8.75E-11	9.27E-11	9.79E-11
nd150	7.10E-11	7.55E-11	7.99E-11	8.44E-11	8.88E-11
cs137	6.92E-11	7.35E-11	7.78E-11	8.20E-11	8.63E-11
xe136	6.89E-11	7.32E-11	7.76E-11	8.19E-11	8.62E-11
br 81	5.16E-11	5.48E-11	5.80E-11	6.12E-11	6.45E-11
zr 94	4.36E-11	4.63E-11	4.91E-11	5.18E-11	5.45E-11
rb 85	4.04E-11	4.30E-11	4.55E-11	4.81E-11	5.06E-11
ba140	4.75E-11	4.76E-11	4.76E-11	4.76E-11	4.76E-11
cd111	3.22E-11	3.42E-11	3.63E-11	3.84E-11	4.05E-11
te130	3.14E-11	3.33E-11	3.53E-11	3.72E-11	3.92E-11
sm153	3.82E-11	3.83E-11	3.83E-11	3.83E-11	3.83E-11
sm154	3.03E-11	3.22E-11	3.41E-11	3.60E-11	3.79E-11
kr 85	2.95E-11	3.13E-11	3.31E-11	3.49E-11	3.67E-11
rb 87	2.92E-11	3.11E-11	3.29E-11	3.47E-11	3.66E-11
eu156	3.48E-11	3.48E-11	3.48E-11	3.48E-11	3.48E-11
sr 89	3.04E-11	3.06E-11	3.07E-11	3.07E-11	3.08E-11
se 77	2.33E-11	2.47E-11	2.62E-11	2.77E-11	2.91E-11
ba137	1.80E-11	2.03E-11	2.27E-11	2.53E-11	2.80E-11
kr 87	2.01E-11	2.32E-11	2.32E-11	2.32E-11	2.32E-11
ce143	1.76E-11	1.76E-11	1.76E-11	1.76E-11	1.76E-11
kr 84	1.37E-11	1.46E-11	1.54E-11	1.63E-11	1.71E-11
la140	1.62E-11	1.62E-11	1.62E-11	1.62E-11	1.62E-11
sb121	1.08E-11	1.15E-11	1.22E-11	1.29E-11	1.35E-11
se 79	1.07E-11	1.13E-11	1.20E-11	1.27E-11	1.33E-11
mo 99	1.31E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11
ru106	1.06E-11	1.11E-11	1.15E-11	1.20E-11	1.24E-11

sb123	7.76E-12	8.26E-12	8.76E-12	9.27E-12	9.77E-12
kr 86	7.70E-12	8.18E-12	8.66E-12	9.15E-12	9.63E-12
te128	6.84E-12	7.27E-12	7.70E-12	8.12E-12	8.55E-12
sm150	5.15E-12	5.81E-12	6.50E-12	7.24E-12	8.01E-12
i131	6.81E-12	6.81E-12	6.81E-12	6.81E-12	6.81E-12
te127m	6.27E-12	6.40E-12	6.52E-12	6.63E-12	6.72E-12
gd156	4.92E-12	5.25E-12	5.58E-12	5.91E-12	6.24E-12
se 80	4.97E-12	5.28E-12	5.59E-12	5.90E-12	6.21E-12
dy161	4.13E-12	4.39E-12	4.66E-12	4.92E-12	5.19E-12
pd106	3.35E-12	3.75E-12	4.16E-12	4.58E-12	5.03E-12
tb159	3.06E-12	3.26E-12	3.45E-12	3.64E-12	3.83E-12

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 39

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.70E+08n/cm**2-sec

0	initial	310.5 d	328.8 d	347.0 d	365.3 d
li 6	2.83E-12	3.00E-12	3.18E-12	3.36E-12	3.53E-12
cd112	2.82E-12	2.99E-12	3.17E-12	3.35E-12	3.52E-12
sb125	2.71E-12	2.86E-12	3.01E-12	3.16E-12	3.31E-12
sn117	2.23E-12	2.37E-12	2.51E-12	2.65E-12	2.78E-12
sn119	1.83E-12	1.95E-12	2.06E-12	2.17E-12	2.29E-12
sn115	1.69E-12	1.79E-12	1.90E-12	2.01E-12	2.11E-12
te129m	1.82E-12	1.82E-12	1.82E-12	1.82E-12	1.82E-12
pm148m	1.39E-12	1.49E-12	1.60E-12	1.70E-12	1.80E-12
sr 88	1.41E-12	1.50E-12	1.59E-12	1.68E-12	1.77E-12
pd110	9.94E-13	1.06E-12	1.12E-12	1.18E-12	1.24E-12
cd114	9.64E-13	1.02E-12	1.08E-12	1.15E-12	1.21E-12
se 82	9.60E-13	1.02E-12	1.08E-12	1.14E-12	1.20E-12
gd158	9.05E-13	9.62E-13	1.02E-12	1.08E-12	1.13E-12
sn126	7.69E-13	8.17E-13	8.65E-13	9.14E-13	9.62E-13
se 78	7.28E-13	7.74E-13	8.19E-13	8.65E-13	9.11E-13
sn124	5.79E-13	6.15E-13	6.51E-13	6.87E-13	7.23E-13
dy162	5.53E-13	5.88E-13	6.22E-13	6.56E-13	6.90E-13
dy164	5.04E-13	5.36E-13	5.67E-13	5.98E-13	6.30E-13
eu154	4.89E-13	5.23E-13	5.58E-13	5.93E-13	6.29E-13
zr 90	3.88E-13	4.39E-13	4.92E-13	5.49E-13	6.09E-13
te125	3.61E-13	4.08E-13	4.58E-13	5.11E-13	5.66E-13
as 75	4.34E-13	4.61E-13	4.88E-13	5.15E-13	5.43E-13
y 90	3.17E-13	3.36E-13	3.56E-13	3.76E-13	3.96E-13
ag111	3.15E-13	3.15E-13	3.15E-13	3.15E-13	3.15E-13
eu157	2.95E-13	2.97E-13	2.97E-13	2.97E-13	2.97E-13
sn118	2.36E-13	2.50E-13	2.65E-13	2.80E-13	2.95E-13
ba136	2.15E-13	2.29E-13	2.43E-13	2.58E-13	2.72E-13
sn122	2.01E-13	2.14E-13	2.26E-13	2.39E-13	2.52E-13
cd116	2.01E-13	2.13E-13	2.26E-13	2.38E-13	2.51E-13
cd115m	2.35E-13	2.36E-13	2.36E-13	2.36E-13	2.37E-13
sn120	1.50E-13	1.60E-13	1.69E-13	1.78E-13	1.88E-13
kr 82	1.40E-13	1.49E-13	1.58E-13	1.67E-13	1.75E-13
cs134	1.36E-13	1.45E-13	1.54E-13	1.64E-13	1.73E-13
dy163	1.22E-13	1.30E-13	1.38E-13	1.45E-13	1.53E-13
ge 73	1.18E-13	1.25E-13	1.33E-13	1.40E-13	1.48E-13
ru 99	1.14E-13	1.22E-13	1.30E-13	1.37E-13	1.45E-13
xe130	8.07E-14	8.57E-14	9.08E-14	9.59E-14	1.01E-13
pm148	6.44E-14	6.84E-14	7.23E-14	7.62E-14	8.00E-14
mo 96	5.84E-14	6.21E-14	6.58E-14	6.94E-14	7.31E-14
cs136	5.54E-14	5.54E-14	5.54E-14	5.54E-14	5.54E-14
ge 76	4.29E-14	4.55E-14	4.82E-14	5.09E-14	5.36E-14
gd160	2.69E-14	2.85E-14	3.02E-14	3.19E-14	3.36E-14
ru105	2.88E-14	2.94E-14	2.94E-14	2.94E-14	2.94E-14
sn125	2.91E-14	2.91E-14	2.92E-14	2.92E-14	2.92E-14

te126	2.02E-14	2.15E-14	2.29E-14	2.42E-14	2.55E-14
ru100	1.13E-14	1.21E-14	1.28E-14	1.36E-14	1.44E-14
rb 88	1.27E-14	1.30E-14	1.30E-14	1.30E-14	1.30E-14
ho165	8.46E-15	8.99E-15	9.51E-15	1.00E-14	1.06E-14
i135	9.93E-15	1.02E-14	1.02E-14	1.02E-14	1.02E-14

0 fraction of total absorption rate

power= .00mw, burnup= 1.mwd, flux= 2.70E+08n/cm**2-sec

0	initial	310.5 d	328.8 d	347.0 d	365.3 d
in113	6.38E-15	7.19E-15	8.06E-15	8.97E-15	9.93E-15
te132	9.59E-15	9.61E-15	9.61E-15	9.61E-15	9.61E-15
sn123	7.97E-15	8.17E-15	8.35E-15	8.51E-15	8.66E-15
sr 87	4.94E-15	5.24E-15	5.55E-15	5.86E-15	6.17E-15
eu152	3.51E-15	4.03E-15	4.61E-15	5.25E-15	5.94E-15
te134	4.47E-15	5.90E-15	5.90E-15	5.90E-15	5.90E-15
te124	3.66E-15	3.96E-15	4.27E-15	4.57E-15	4.88E-15
nb 94	2.78E-15	2.96E-15	3.13E-15	3.31E-15	3.48E-15
sb126	3.02E-15	3.02E-15	3.02E-15	3.02E-15	3.02E-15
ge 74	2.39E-15	2.54E-15	2.69E-15	2.84E-15	2.99E-15
in117m	2.10E-15	2.11E-15	2.11E-15	2.11E-15	2.11E-15
ge 72	1.66E-15	1.76E-15	1.87E-15	1.97E-15	2.08E-15
sb124	2.03E-15	2.04E-15	2.06E-15	2.07E-15	2.07E-15
sr 86	1.27E-15	1.36E-15	1.45E-15	1.53E-15	1.62E-15
sm148	8.99E-16	1.03E-15	1.17E-15	1.32E-15	1.47E-15
ba135	9.69E-16	1.06E-15	1.15E-15	1.25E-15	1.35E-15
se 76	1.01E-15	1.07E-15	1.13E-15	1.20E-15	1.26E-15
nd142	5.46E-16	6.18E-16	6.93E-16	7.73E-16	8.58E-16
gd154	5.00E-16	5.68E-16	6.39E-16	7.16E-16	7.97E-16
i130	7.08E-16	7.17E-16	7.18E-16	7.18E-16	7.18E-16
in117	6.17E-16	6.19E-16	6.19E-16	6.19E-16	6.19E-16
ba134	3.14E-16	3.56E-16	4.01E-16	4.49E-16	4.99E-16
pd104	2.47E-16	2.85E-16	3.25E-16	3.67E-16	4.13E-16
gd152	2.36E-16	2.66E-16	2.99E-16	3.35E-16	3.74E-16
tb160	2.88E-16	2.91E-16	2.94E-16	2.97E-16	2.99E-16
er166	2.34E-16	2.49E-16	2.64E-16	2.79E-16	2.93E-16
xe128	2.23E-16	2.38E-16	2.52E-16	2.66E-16	2.80E-16
rb 86	2.43E-16	2.43E-16	2.43E-16	2.43E-16	2.43E-16
dy165	1.99E-16	2.10E-16	2.10E-16	2.10E-16	2.10E-16
cd110	1.39E-16	1.52E-16	1.66E-16	1.81E-16	1.96E-16
dy160	1.21E-16	1.32E-16	1.42E-16	1.54E-16	1.65E-16
cd118	9.62E-17	1.21E-16	1.21E-16	1.21E-16	1.21E-16
ge 75	7.78E-17	8.72E-17	8.72E-17	8.72E-17	8.72E-17
kr 80	6.69E-17	7.11E-17	7.53E-17	7.94E-17	8.36E-17
br 79	3.85E-17	4.32E-17	4.82E-17	5.35E-17	5.90E-17
in119m	1.86E-17	3.03E-17	3.03E-17	3.03E-17	3.03E-17
xe129	1.93E-17	2.18E-17	2.45E-17	2.73E-17	3.03E-17
ag107	1.83E-17	2.07E-17	2.32E-17	2.58E-17	2.86E-17
te122	8.80E-18	9.38E-18	9.96E-18	1.05E-17	1.11E-17
pr142	5.28E-18	5.68E-18	6.04E-18	6.39E-18	6.74E-18
be 9	5.31E-18	5.64E-18	5.98E-18	6.31E-18	6.64E-18
nb 93	3.67E-18	4.01E-18	4.37E-18	4.75E-18	5.16E-18
sn116	3.11E-18	3.36E-18	3.61E-18	3.86E-18	4.12E-18
te123	2.99E-18	3.25E-18	3.51E-18	3.78E-18	4.05E-18
li 7	2.18E-18	2.31E-18	2.45E-18	2.59E-18	2.72E-18
in119	1.65E-19	2.37E-18	2.37E-18	2.37E-18	2.37E-18
er167	8.74E-19	9.29E-19	9.84E-19	1.04E-18	1.09E-18
cd109	6.62E-20	6.95E-20	7.26E-20	7.57E-20	7.88E-20
cd108	4.40E-20	4.68E-20	4.96E-20	5.23E-20	5.51E-20

0 fraction of total absorption rate
power= .00mw, burnup= 1.mwd, flux= 2.70E+08n/cm**2-sec

0	initial	310.5 d	328.8 d	347.0 d	365.3 d
cs134m	4.02E-20	4.57E-20	4.84E-20	5.12E-20	5.40E-20
ag110	9.08E-24	1.40E-21	1.45E-21	1.50E-21	1.55E-21
sn114	5.77E-22	6.18E-22	6.59E-22	7.00E-22	7.42E-22
in120	4.33E-28	3.98E-22	3.98E-22	3.98E-22	3.98E-22
in120m	1.09E-29	4.28E-23	4.28E-23	4.28E-23	4.28E-23

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 42
power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	310.5 d	328.8 d	347.0 d	365.3 d
h 1	6.88E-08	7.31E-08	7.74E-08	8.16E-08	8.59E-08
h 2	2.04E-10	2.17E-10	2.29E-10	2.42E-10	2.55E-10
h 3	1.46E-12	1.55E-12	1.64E-12	1.73E-12	1.82E-12
h 4	.00E+00	6.32E-36	6.68E-36	7.03E-36	7.39E-36
he 3	3.34E-14	3.76E-14	4.21E-14	4.69E-14	5.18E-14
he 4	1.14E-08	1.21E-08	1.28E-08	1.35E-08	1.42E-08
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	1.37E-09	1.45E-09	1.54E-09	1.62E-09	1.70E-09
ne 21	3.62E-17	4.06E-17	4.52E-17	5.00E-17	5.51E-17
ne 22	8.94E-13	1.00E-12	1.12E-12	1.24E-12	1.37E-12
ne 23	4.64E-23	7.03E-15	7.03E-15	7.03E-15	7.03E-15
na 22	8.04E-12	8.49E-12	8.92E-12	9.35E-12	9.78E-12
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	2.73E-08	2.74E-08	2.74E-08	2.74E-08	2.74E-08
na 24m	4.55E-30	4.51E-15	4.51E-15	4.51E-15	4.51E-15
na 25	3.31E-34	4.54E-29	4.80E-29	5.07E-29	5.33E-29
mg 24	1.07E-05	1.13E-05	1.19E-05	1.25E-05	1.31E-05
mg 25	1.50E-12	1.59E-12	1.69E-12	1.78E-12	1.87E-12
mg 26	2.04E-10	2.17E-10	2.29E-10	2.42E-10	2.55E-10
mg 27	6.11E-13	2.10E-12	2.10E-12	2.10E-12	2.10E-12
mg 28	4.25E-24	4.29E-24	4.29E-24	4.29E-24	4.29E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	1.11E-12	2.03E-10	2.03E-10	2.03E-10	2.03E-10
al 29	1.40E-30	9.29E-30	1.03E-29	1.15E-29	1.26E-29
al 30	.00E+00	1.53E-43	1.75E-43	2.12E-43	2.40E-43
si 28	2.98E-05	3.14E-05	3.31E-05	3.47E-05	3.64E-05
si 29	3.25E-14	3.64E-14	4.06E-14	4.49E-14	4.95E-14
si 30	3.71E-23	4.43E-23	5.23E-23	6.12E-23	7.10E-23
si 31	2.48E-35	3.18E-35	3.76E-35	4.40E-35	5.10E-35
si 32	3.64E-44	4.62E-44	5.89E-44	7.29E-44	8.97E-44
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		2.70E+08	2.70E+08	2.70E+08	2.70E+08

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 43
power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	310.5 d	328.8 d	347.0 d	365.3 d
he 4	4.11E-05	4.37E-05	4.63E-05	4.89E-05	5.15E-05
ra222	5.35E-30	5.97E-30	6.70E-30	7.47E-30	8.28E-30
ra223	5.53E-15	6.36E-15	7.25E-15	8.19E-15	9.19E-15
ra224	3.01E-16	3.58E-16	4.20E-16	4.89E-16	5.65E-16
ra225	6.39E-17	7.40E-17	8.48E-17	9.64E-17	1.09E-16
ra226	7.52E-11	8.49E-11	9.51E-11	1.06E-10	1.17E-10
ra228	7.90E-17	8.90E-17	9.95E-17	1.11E-16	1.22E-16

th226	2.57E-28	2.91E-28	3.27E-28	3.65E-28	4.04E-28
th227	1.01E-14	1.15E-14	1.30E-14	1.46E-14	1.63E-14
th228	6.05E-14	7.15E-14	8.38E-14	9.74E-14	1.12E-13
th229	1.46E-11	1.68E-11	1.90E-11	2.15E-11	2.41E-11
th230	2.04E-05	2.17E-05	2.30E-05	2.43E-05	2.55E-05
th231	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	4.13E-06	4.39E-06	4.65E-06	4.91E-06	5.16E-06
th233	2.24E-17	4.02E-17	4.26E-17	4.50E-17	4.73E-17
th234	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	6.21E-07	6.60E-07	6.99E-07	7.38E-07	7.77E-07
pa232	1.06E-14	1.13E-14	1.20E-14	1.27E-14	1.34E-14
pa233	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06
pa234m	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11
pa234	8.09E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	2.49E-25	2.82E-25	3.17E-25	3.53E-25	3.92E-25
u231	6.96E-21	7.48E-21	7.99E-21	8.51E-21	9.02E-21
u232	2.33E-11	2.61E-11	2.90E-11	3.21E-11	3.53E-11
u233	9.47E-06	1.02E-05	1.08E-05	1.15E-05	1.22E-05
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	3.09E-06	3.09E-06	3.09E-06	3.09E-06	3.09E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	1.93E-07	3.17E-07	3.17E-07	3.17E-07	3.17E-07
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	3.51E-12	3.67E-12	3.82E-12	3.97E-12	4.12E-12
np236m	2.03E-12	2.05E-12	2.05E-12	2.05E-12	2.05E-12
np236	1.59E-10	1.68E-10	1.78E-10	1.88E-10	1.97E-10
np237	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01
np238	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06
np239	4.59E-05	4.59E-05	4.59E-05	4.59E-05	4.59E-05
np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np240	7.73E-15	9.32E-15	9.32E-15	9.32E-15	9.32E-15
np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu236	2.11E-10	2.22E-10	2.34E-10	2.45E-10	2.57E-10
pu237	1.14E-15	1.22E-15	1.31E-15	1.40E-15	1.49E-15
pu238	1.48E-04	1.57E-04	1.66E-04	1.75E-04	1.84E-04
pu239	3.96E-03	4.20E-03	4.45E-03	4.70E-03	4.94E-03
pu240	1.55E-08	1.75E-08	1.96E-08	2.18E-08	2.42E-08
pu241	8.10E-14	9.72E-14	1.15E-13	1.36E-13	1.58E-13
pu242	1.27E-19	1.61E-19	2.03E-19	2.52E-19	3.09E-19

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 44
power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	310.5 d	328.8 d	347.0 d	365.3 d
pu243	2.56E-28	3.39E-28	4.26E-28	5.29E-28	6.50E-28
pu244	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu245	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu246	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
totals	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04
0 flux		2.70E+08	2.70E+08	2.70E+08	2.70E+08

0 .results on logical unit no. 71, position 1, for time step 4, subcase 6. (run position 1, case position 1)
title: sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 45
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
na 23	1.73E+05	1.73E+05	1.73E+05	1.73E+05	1.73E+05	1.73E+05	1.73E+05
mg 24	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04
al 27	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06
si 28	1.02E-03	1.02E-03	1.02E-03	1.02E-03	1.02E-03	1.02E-03	1.02E-03
total	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 46
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 element radioactivity, curies
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
totals	2.55E+01	1.13E-06	9.10E-07	7.36E-07	5.97E-07	4.85E-07	3.95E-07

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 47
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
na	1.70E-01	1.52E-08	1.22E-08	9.77E-09	7.83E-09	6.27E-09	5.02E-09
totals	4.76E-01	1.52E-08	1.22E-08	9.77E-09	7.83E-09	6.27E-09	5.02E-09

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 48
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 nuclide gamma power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
na 22	1.75E-08	1.40E-08	1.12E-08	8.98E-09	7.19E-09	5.76E-09	4.61E-09
total	3.31E-01	1.40E-08	1.12E-08	8.98E-09	7.19E-09	5.76E-09	4.61E-09

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 49
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
he 4	5.15E-05	9.51E-05	1.39E-04	1.82E-04	2.26E-04	2.70E-04	3.13E-04
th230	2.55E-05	4.68E-05	6.81E-05	8.94E-05	1.11E-04	1.32E-04	1.53E-04
th232	5.16E-06	9.47E-06	1.38E-05	1.81E-05	2.24E-05	2.67E-05	3.10E-05
th234	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	7.77E-07	1.38E-06	1.98E-06	2.58E-06	3.19E-06	3.79E-06	4.39E-06
pa233	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06
u233	1.22E-05	2.50E-05	3.79E-05	5.07E-05	6.35E-05	7.64E-05	8.92E-05
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
np237	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01
pu238	1.84E-04	1.85E-04	1.84E-04	1.82E-04	1.81E-04	1.80E-04	1.79E-04
pu239	4.94E-03	4.99E-03	4.99E-03	4.99E-03	4.99E-03	4.99E-03	4.99E-03
total	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 50
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 element concentrations, gram atoms
basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
he	5.15E-05	9.51E-05	1.39E-04	1.82E-04	2.26E-04	2.70E-04	3.13E-04
th	3.13E-05	5.68E-05	8.24E-05	1.08E-04	1.34E-04	1.59E-04	1.85E-04

pa	2.23E-06	2.84E-06	3.44E-06	4.04E-06	4.64E-06	5.25E-06	5.85E-06
u	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04
np	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01
pu	5.13E-03	5.17E-03	5.17E-03	5.17E-03	5.17E-03	5.17E-03	5.17E-03
totals	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 51
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
he 4	2.06E-04	3.81E-04	5.55E-04	7.29E-04	9.04E-04	1.08E-03	1.25E-03
ra226	2.65E-08	8.92E-08	1.89E-07	3.25E-07	4.98E-07	7.08E-07	9.55E-07
th230	5.88E-03	1.08E-02	1.57E-02	2.06E-02	2.55E-02	3.04E-02	3.53E-02
th231	6.98E-07	6.98E-07	6.98E-07	6.98E-07	6.98E-07	6.98E-07	6.98E-07
th232	1.20E-03	2.20E-03	3.19E-03	4.19E-03	5.19E-03	6.19E-03	7.19E-03
th234	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04
pa231	1.79E-04	3.19E-04	4.58E-04	5.97E-04	7.36E-04	8.75E-04	1.01E-03
pa233	3.39E-04	3.39E-04	3.39E-04	3.39E-04	3.39E-04	3.39E-04	3.39E-04
u233	2.84E-03	5.83E-03	8.82E-03	1.18E-02	1.48E-02	1.78E-02	2.08E-02
u234	2.12E+03	2.12E+03	2.12E+03	2.12E+03	2.12E+03	2.12E+03	2.12E+03
u235	1.72E+05	1.72E+05	1.72E+05	1.72E+05	1.72E+05	1.72E+05	1.72E+05
u236	4.12E+04	4.12E+04	4.12E+04	4.12E+04	4.12E+04	4.12E+04	4.12E+04
u238	8.66E+06	8.66E+06	8.66E+06	8.66E+06	8.66E+06	8.66E+06	8.66E+06
np237	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03
pu238	4.39E-02	4.40E-02	4.37E-02	4.34E-02	4.31E-02	4.28E-02	4.26E-02
pu239	1.18E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00
pu240	5.81E-06	5.81E-06	5.81E-06	5.81E-06	5.81E-06	5.80E-06	5.80E-06
total	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 52
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0
element concentrations, grams
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
he	2.06E-04	3.81E-04	5.55E-04	7.29E-04	9.04E-04	1.08E-03	1.25E-03
ra	2.65E-08	8.92E-08	1.89E-07	3.25E-07	4.98E-07	7.08E-07	9.55E-07
th	7.20E-03	1.31E-02	1.90E-02	2.49E-02	3.08E-02	3.67E-02	4.26E-02
pa	5.19E-04	6.58E-04	7.97E-04	9.36E-04	1.08E-03	1.21E-03	1.35E-03
u	8.87E+06	8.87E+06	8.87E+06	8.87E+06	8.87E+06	8.87E+06	8.87E+06
np	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03
pu	1.23E+00	1.24E+00	1.24E+00	1.24E+00	1.24E+00	1.24E+00	1.23E+00
totals	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 53
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide radioactivity, curies
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
tl207	1.05E-07	4.38E-07	9.07E-07	1.54E-06	2.32E-06	3.26E-06	4.34E-06
pb211	1.05E-07	4.39E-07	9.10E-07	1.54E-06	2.33E-06	3.27E-06	4.35E-06
pb212	2.02E-08	9.61E-08	2.07E-07	3.34E-07	4.64E-07	5.89E-07	7.05E-07
pb214	2.55E-08	8.82E-08	1.87E-07	3.21E-07	4.93E-07	7.00E-07	9.44E-07
bi211	1.05E-07	4.39E-07	9.10E-07	1.54E-06	2.33E-06	3.27E-06	4.35E-06
bi212	2.02E-08	9.61E-08	2.07E-07	3.34E-07	4.64E-07	5.89E-07	7.05E-07
bi214	2.55E-08	8.82E-08	1.87E-07	3.21E-07	4.93E-07	7.00E-07	9.44E-07
po214	2.55E-08	8.82E-08	1.87E-07	3.21E-07	4.93E-07	7.00E-07	9.44E-07
po215	1.05E-07	4.39E-07	9.10E-07	1.54E-06	2.33E-06	3.27E-06	4.35E-06
po216	2.02E-08	9.61E-08	2.07E-07	3.34E-07	4.64E-07	5.89E-07	7.05E-07
po218	2.55E-08	8.82E-08	1.87E-07	3.21E-07	4.93E-07	7.00E-07	9.44E-07

rn219	1.05E-07	4.39E-07	9.10E-07	1.54E-06	2.33E-06	3.27E-06	4.35E-06
rn220	2.02E-08	9.61E-08	2.07E-07	3.34E-07	4.64E-07	5.89E-07	7.05E-07
rn222	2.55E-08	8.82E-08	1.87E-07	3.21E-07	4.93E-07	7.00E-07	9.44E-07
ra223	1.05E-07	4.39E-07	9.10E-07	1.54E-06	2.33E-06	3.27E-06	4.35E-06
ra224	2.02E-08	9.61E-08	2.07E-07	3.34E-07	4.64E-07	5.89E-07	7.05E-07
ra226	2.63E-08	8.82E-08	1.87E-07	3.21E-07	4.93E-07	7.00E-07	9.44E-07
ac227	1.34E-07	4.39E-07	9.09E-07	1.54E-06	2.32E-06	3.26E-06	4.34E-06
th227	1.14E-07	4.33E-07	8.97E-07	1.52E-06	2.29E-06	3.22E-06	4.29E-06
th228	2.10E-08	9.60E-08	2.07E-07	3.33E-07	4.63E-07	5.87E-07	7.02E-07
th230	1.21E-04	2.22E-04	3.23E-04	4.24E-04	5.25E-04	6.26E-04	7.27E-04
th231	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01
th234	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00
pa231	8.48E-06	1.51E-05	2.16E-05	2.82E-05	3.48E-05	4.14E-05	4.79E-05
pa233	7.04E+00	7.05E+00	7.05E+00	7.05E+00	7.05E+00	7.05E+00	7.05E+00
pa234m	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00
pa234	3.78E-03	3.79E-03	3.79E-03	3.79E-03	3.79E-03	3.79E-03	3.79E-03
u232	1.81E-07	4.17E-07	6.08E-07	7.62E-07	8.86E-07	9.86E-07	1.07E-06
u233	2.74E-05	5.62E-05	8.51E-05	1.14E-04	1.43E-04	1.72E-04	2.00E-04
u234	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01
u235	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01
u236	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00
u238	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00
np237	7.04E+00	7.04E+00	7.04E+00	7.04E+00	7.04E+00	7.04E+00	7.04E+00
pu236	3.16E-05	2.60E-05	2.13E-05	1.75E-05	1.43E-05	1.17E-05	9.61E-06
pu238	7.52E-01	7.53E-01	7.49E-01	7.44E-01	7.39E-01	7.34E-01	7.29E-01
pu239	7.33E-02	7.40E-02	7.40E-02	7.40E-02	7.40E-02	7.40E-02	7.40E-02
pu240	1.32E-06	1.32E-06	1.32E-06	1.32E-06	1.32E-06	1.32E-06	1.32E-06
total	5.28E+03	4.02E+01	4.02E+01	4.02E+01	4.02E+01	4.02E+01	4.02E+01

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 54
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0
element thermal power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
tl	4.78E-10	2.10E-09	4.42E-09	7.34E-09	1.07E-08	1.46E-08	1.87E-08
pb	4.45E-10	1.83E-09	3.81E-09	6.45E-09	9.69E-09	1.35E-08	1.79E-08
bi	4.86E-09	2.03E-08	4.22E-08	7.13E-08	1.07E-07	1.49E-07	1.98E-07
po	8.36E-09	3.44E-08	7.22E-08	1.22E-07	1.81E-07	2.51E-07	3.29E-07
rn	5.97E-09	2.48E-08	5.18E-08	8.72E-08	1.30E-07	1.81E-07	2.39E-07
ra	5.18E-09	2.15E-08	4.48E-08	7.55E-08	1.13E-07	1.57E-07	2.06E-07
th	1.61E-03	1.62E-03	1.62E-03	1.62E-03	1.62E-03	1.63E-03	1.63E-03
pa	3.22E-02	3.22E-02	3.22E-02	3.22E-02	3.22E-02	3.22E-02	3.22E-02
u	7.55E+00	5.36E-01	5.36E-01	5.36E-01	5.36E-01	5.36E-01	5.36E-01
np	7.11E+00	2.01E-01	2.01E-01	2.01E-01	2.01E-01	2.01E-01	2.01E-01
pu	2.72E-02	2.73E-02	2.71E-02	2.69E-02	2.68E-02	2.66E-02	2.65E-02
totals	1.47E+01	7.98E-01	7.97E-01	7.97E-01	7.97E-01	7.97E-01	7.97E-01

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 55
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide gamma power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
bi214	2.28E-10	7.88E-10	1.67E-09	2.87E-09	4.40E-09	6.26E-09	8.44E-09
th230	1.21E-09	2.21E-09	3.22E-09	4.23E-09	5.23E-09	6.24E-09	7.24E-09
th231	6.82E-05	6.82E-05	6.82E-05	6.82E-05	6.82E-05	6.82E-05	6.82E-05
th234	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.67E-04
pa231	2.01E-09	3.57E-09	5.13E-09	6.69E-09	8.25E-09	9.81E-09	1.14E-08
pa233	9.33E-03	9.34E-03	9.34E-03	9.34E-03	9.34E-03	9.34E-03	9.34E-03
pa234m	1.92E-04	1.92E-04	1.92E-04	1.92E-04	1.92E-04	1.92E-04	1.92E-04
pa234	4.40E-05	4.40E-05	4.40E-05	4.40E-05	4.40E-05	4.40E-05	4.40E-05

u234	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04
u235	3.66E-04	3.66E-04	3.66E-04	3.66E-04	3.66E-04	3.66E-04	3.66E-04
u236	2.68E-05	2.68E-05	2.68E-05	2.68E-05	2.68E-05	2.68E-05	2.68E-05
u238	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05
np237	1.47E-03	1.47E-03	1.47E-03	1.47E-03	1.47E-03	1.47E-03	1.47E-03
pu238	8.47E-06	8.49E-06	8.43E-06	8.38E-06	8.32E-06	8.27E-06	8.21E-06
pu239	3.52E-07	3.55E-07	3.55E-07	3.55E-07	3.55E-07	3.55E-07	3.55E-07
total	3.97E+00	1.18E-02	1.18E-02	1.18E-02	1.18E-02	1.18E-02	1.18E-02

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 56

decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec

0

nuclide concentrations, grams

basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
h 3	2.09E-06	2.00E-06	1.91E-06	1.82E-06	1.74E-06	1.66E-06	1.58E-06
ge 73	5.53E-07	5.53E-07	5.53E-07	5.53E-07	5.53E-07	5.53E-07	5.53E-07
as 75	5.67E-06	5.67E-06	5.67E-06	5.67E-06	5.67E-06	5.67E-06	5.67E-06
ge 76	1.88E-05	1.88E-05	1.88E-05	1.88E-05	1.88E-05	1.88E-05	1.88E-05
se 77	4.68E-05	4.70E-05	4.70E-05	4.70E-05	4.70E-05	4.70E-05	4.70E-05
se 78	1.10E-04	1.10E-04	1.10E-04	1.10E-04	1.10E-04	1.10E-04	1.10E-04
se 79	2.28E-04	2.28E-04	2.28E-04	2.28E-04	2.28E-04	2.28E-04	2.28E-04
se 80	6.79E-04	6.79E-04	6.79E-04	6.79E-04	6.79E-04	6.79E-04	6.79E-04
br 81	1.01E-03	1.01E-03	1.01E-03	1.01E-03	1.01E-03	1.01E-03	1.01E-03
se 82	1.75E-03	1.75E-03	1.75E-03	1.75E-03	1.75E-03	1.75E-03	1.75E-03
kr 83	2.92E-03	2.92E-03	2.92E-03	2.92E-03	2.92E-03	2.92E-03	2.92E-03
kr 84	5.87E-03	5.87E-03	5.87E-03	5.87E-03	5.87E-03	5.87E-03	5.87E-03
kr 85	1.43E-03	1.36E-03	1.29E-03	1.22E-03	1.15E-03	1.09E-03	1.04E-03
rb 85	5.45E-03	5.53E-03	5.60E-03	5.66E-03	5.73E-03	5.79E-03	5.85E-03
kr 86	1.10E-02	1.10E-02	1.10E-02	1.10E-02	1.10E-02	1.10E-02	1.10E-02
rb 87	1.44E-02	1.44E-02	1.44E-02	1.44E-02	1.44E-02	1.44E-02	1.44E-02
sr 88	2.08E-02	2.08E-02	2.08E-02	2.08E-02	2.08E-02	2.08E-02	2.08E-02
y 89	2.26E-02	2.81E-02	2.81E-02	2.81E-02	2.81E-02	2.81E-02	2.81E-02
sr 90	3.39E-02	3.32E-02	3.25E-02	3.19E-02	3.12E-02	3.06E-02	3.00E-02
y 90	8.72E-06	8.63E-06	8.45E-06	8.28E-06	8.11E-06	7.95E-06	7.79E-06
zr 90	4.10E-04	1.10E-03	1.77E-03	2.43E-03	3.08E-03	3.72E-03	4.34E-03
zr 91	2.74E-02	3.54E-02	3.56E-02	3.56E-02	3.56E-02	3.56E-02	3.56E-02
zr 92	3.61E-02	3.62E-02	3.62E-02	3.62E-02	3.62E-02	3.62E-02	3.62E-02
zr 93	2.64E-02	2.64E-02	2.64E-02	2.64E-02	2.64E-02	2.64E-02	2.64E-02
zr 94	3.95E-02	3.95E-02	3.95E-02	3.95E-02	3.95E-02	3.95E-02	3.95E-02
mo 95	2.49E-02	3.94E-02	4.02E-02	4.02E-02	4.02E-02	4.02E-02	4.02E-02
zr 96	3.94E-02	3.94E-02	3.94E-02	3.94E-02	3.94E-02	3.94E-02	3.94E-02
mo 96	3.67E-06	3.68E-06	3.68E-06	3.68E-06	3.68E-06	3.68E-06	3.68E-06
mo 97	3.58E-02	3.59E-02	3.59E-02	3.59E-02	3.59E-02	3.59E-02	3.59E-02
mo 98	3.72E-02	3.72E-02	3.72E-02	3.72E-02	3.72E-02	3.72E-02	3.72E-02
tc 99	3.98E-02	4.03E-02	4.03E-02	4.03E-02	4.03E-02	4.03E-02	4.03E-02
ru 99	1.36E-06	1.49E-06	1.60E-06	1.71E-06	1.82E-06	1.93E-06	2.04E-06
mo100	4.10E-02	4.10E-02	4.10E-02	4.10E-02	4.10E-02	4.10E-02	4.10E-02
ru101	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02
ru102	2.87E-02	2.87E-02	2.87E-02	2.87E-02	2.87E-02	2.87E-02	2.87E-02
rh103	1.79E-02	2.12E-02	2.12E-02	2.12E-02	2.12E-02	2.12E-02	2.12E-02
ru104	1.32E-02	1.32E-02	1.32E-02	1.32E-02	1.32E-02	1.32E-02	1.32E-02
pd105	8.13E-03	8.18E-03	8.18E-03	8.18E-03	8.18E-03	8.18E-03	8.18E-03
ru106	2.36E-03	1.34E-03	7.59E-04	4.30E-04	2.44E-04	1.38E-04	7.83E-05
pd106	8.97E-04	1.92E-03	2.50E-03	2.83E-03	3.01E-03	3.12E-03	3.18E-03
pd107	1.24E-03	1.24E-03	1.24E-03	1.24E-03	1.24E-03	1.24E-03	1.24E-03
pd108	5.94E-04	5.94E-04	5.94E-04	5.94E-04	5.94E-04	5.94E-04	5.94E-04
ag109	2.98E-04	2.99E-04	2.99E-04	2.99E-04	2.99E-04	2.99E-04	2.99E-04
pd110	2.43E-04	2.43E-04	2.43E-04	2.43E-04	2.43E-04	2.43E-04	2.43E-04
cd111	1.55E-04	1.60E-04	1.60E-04	1.60E-04	1.60E-04	1.60E-04	1.60E-04
cd112	1.30E-04	1.30E-04	1.30E-04	1.30E-04	1.30E-04	1.30E-04	1.30E-04

cd113	1.29E-04	1.30E-04	1.30E-04	1.30E-04	1.30E-04	1.30E-04	1.30E-04
cd113m	2.10E-06	2.02E-06	1.94E-06	1.86E-06	1.79E-06	1.72E-06	1.65E-06
cd114	1.11E-04	1.11E-04	1.11E-04	1.11E-04	1.11E-04	1.11E-04	1.11E-04
in115	8.51E-05	8.65E-05	8.65E-05	8.65E-05	8.65E-05	8.65E-05	8.65E-05
sn115	4.32E-06	4.36E-06	4.36E-06	4.36E-06	4.36E-06	4.36E-06	4.36E-06
cd116	1.35E-04	1.35E-04	1.35E-04	1.35E-04	1.35E-04	1.35E-04	1.35E-04

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 57

decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec

0

nuclide concentrations, grams

basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
sn117	8.95E-05	8.96E-05	8.96E-05	8.96E-05	8.96E-05	8.96E-05	8.96E-05
sn118	9.16E-05	9.16E-05	9.16E-05	9.16E-05	9.16E-05	9.16E-05	9.16E-05
sn119	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04
sn120	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04
sn121m	6.65E-07	6.58E-07	6.51E-07	6.44E-07	6.38E-07	6.31E-07	6.24E-07
sb121	1.19E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04
sn122	1.28E-04	1.28E-04	1.28E-04	1.28E-04	1.28E-04	1.28E-04	1.28E-04
sb123	1.28E-04	1.33E-04	1.34E-04	1.34E-04	1.34E-04	1.35E-04	1.35E-04
sn124	2.15E-04	2.15E-04	2.15E-04	2.15E-04	2.15E-04	2.15E-04	2.15E-04
sb125	2.16E-04	1.77E-04	1.43E-04	1.16E-04	9.38E-05	7.59E-05	6.14E-05
te125	2.60E-05	6.75E-05	1.02E-04	1.29E-04	1.52E-04	1.70E-04	1.85E-04
te125m	2.27E-06	2.49E-06	2.03E-06	1.65E-06	1.33E-06	1.08E-06	8.73E-07
sn126	3.54E-04	3.54E-04	3.54E-04	3.54E-04	3.54E-04	3.54E-04	3.54E-04
te126	2.01E-06	2.06E-06	2.06E-06	2.06E-06	2.06E-06	2.06E-06	2.07E-06
i127	9.74E-04	1.05E-03	1.06E-03	1.06E-03	1.06E-03	1.06E-03	1.06E-03
te128	2.99E-03	2.99E-03	2.99E-03	2.99E-03	2.99E-03	2.99E-03	2.99E-03
i129	6.30E-03	6.46E-03	6.46E-03	6.46E-03	6.46E-03	6.46E-03	6.46E-03
te130	1.50E-02	1.50E-02	1.50E-02	1.50E-02	1.50E-02	1.50E-02	1.50E-02
xe130	1.86E-06	1.86E-06	1.86E-06	1.86E-06	1.86E-06	1.86E-06	1.86E-06
xe131	2.44E-02	2.52E-02	2.52E-02	2.52E-02	2.52E-02	2.52E-02	2.52E-02
xe132	3.72E-02	3.77E-02	3.77E-02	3.77E-02	3.77E-02	3.77E-02	3.77E-02
cs133	6.18E-02	6.32E-02	6.32E-02	6.32E-02	6.32E-02	6.32E-02	6.32E-02
xe134	6.89E-02	6.89E-02	6.89E-02	6.89E-02	6.89E-02	6.89E-02	6.89E-02
cs135	5.95E-02	5.96E-02	5.96E-02	5.96E-02	5.96E-02	5.96E-02	5.96E-02
xe136	5.63E-02	5.63E-02	5.63E-02	5.63E-02	5.63E-02	5.63E-02	5.63E-02
ba136	4.52E-05	4.76E-05	4.76E-05	4.76E-05	4.76E-05	4.76E-05	4.76E-05
cs137	5.58E-02	5.47E-02	5.36E-02	5.26E-02	5.16E-02	5.06E-02	4.97E-02
ba137	6.55E-04	1.72E-03	2.76E-03	3.78E-03	4.79E-03	5.77E-03	6.74E-03
ba138	6.05E-02	6.05E-02	6.05E-02	6.05E-02	6.05E-02	6.05E-02	6.05E-02
la139	5.81E-02	5.81E-02	5.81E-02	5.81E-02	5.81E-02	5.81E-02	5.81E-02
ce140	5.74E-02	6.07E-02	6.07E-02	6.07E-02	6.07E-02	6.07E-02	6.07E-02
pr141	4.72E-02	5.42E-02	5.42E-02	5.42E-02	5.42E-02	5.42E-02	5.42E-02
ce142	5.47E-02	5.47E-02	5.47E-02	5.47E-02	5.47E-02	5.47E-02	5.47E-02
nd143	5.84E-02	6.19E-02	6.19E-02	6.19E-02	6.19E-02	6.19E-02	6.19E-02
ce144	3.41E-02	1.62E-02	7.75E-03	3.70E-03	1.76E-03	8.41E-04	4.01E-04
nd144	1.73E-02	3.52E-02	4.37E-02	4.77E-02	4.96E-02	5.06E-02	5.10E-02
nd145	3.79E-02	3.79E-02	3.79E-02	3.79E-02	3.79E-02	3.79E-02	3.79E-02
nd146	2.86E-02	2.87E-02	2.87E-02	2.87E-02	2.87E-02	2.87E-02	2.87E-02
pm147	1.84E-02	1.56E-02	1.25E-02	1.00E-02	8.04E-03	6.45E-03	5.18E-03
sm147	2.43E-03	6.27E-03	9.34E-03	1.18E-02	1.38E-02	1.54E-02	1.67E-02
nd148	1.63E-02	1.63E-02	1.63E-02	1.63E-02	1.63E-02	1.63E-02	1.63E-02
sm149	1.05E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02
nd150	6.57E-03	6.57E-03	6.57E-03	6.57E-03	6.57E-03	6.57E-03	6.57E-03
sm150	7.53E-06	7.53E-06	7.53E-06	7.53E-06	7.53E-06	7.53E-06	7.53E-06
sm151	4.62E-03	4.61E-03	4.58E-03	4.55E-03	4.52E-03	4.50E-03	4.47E-03
eu151	1.78E-05	4.75E-05	7.70E-05	1.06E-04	1.35E-04	1.64E-04	1.93E-04
sm152	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03
eu153	1.68E-03	1.70E-03	1.70E-03	1.70E-03	1.70E-03	1.70E-03	1.70E-03

sm154	7.86E-04	7.86E-04	7.86E-04	7.86E-04	7.86E-04	7.86E-04	7.86E-04
eu155	3.33E-04	2.94E-04	2.60E-04	2.30E-04	2.03E-04	1.80E-04	1.59E-04
gd155	2.53E-05	6.40E-05	9.81E-05	1.28E-04	1.55E-04	1.79E-04	2.00E-04
gd156	1.48E-04	1.57E-04	1.57E-04	1.57E-04	1.57E-04	1.57E-04	1.57E-04

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 58
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
gd157	7.73E-05	7.75E-05	7.75E-05	7.75E-05	7.75E-05	7.75E-05	7.75E-05
gd158	3.51E-05	3.51E-05	3.51E-05	3.51E-05	3.51E-05	3.51E-05	3.51E-05
tb159	1.35E-05	1.36E-05	1.36E-05	1.36E-05	1.36E-05	1.36E-05	1.36E-05
gd160	4.28E-06	4.28E-06	4.28E-06	4.28E-06	4.28E-06	4.28E-06	4.28E-06
dy161	1.26E-06	1.30E-06	1.30E-06	1.30E-06	1.30E-06	1.30E-06	1.30E-06
total	1.54E+00	1.54E+00	1.54E+00	1.54E+00	1.54E+00	1.54E+00	1.54E+00

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 59
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide radioactivity, curies
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
h 3	2.03E-02	1.93E-02	1.84E-02	1.76E-02	1.68E-02	1.60E-02	1.53E-02
se 79	3.13E-06	3.13E-06	3.13E-06	3.13E-06	3.13E-06	3.13E-06	3.13E-06
kr 85	5.62E-01	5.33E-01	5.05E-01	4.78E-01	4.53E-01	4.29E-01	4.07E-01
sr 90	4.78E+00	4.69E+00	4.59E+00	4.50E+00	4.41E+00	4.32E+00	4.23E+00
y 90	4.74E+00	4.69E+00	4.59E+00	4.50E+00	4.41E+00	4.32E+00	4.23E+00
y 91	1.99E+02	5.43E+00	1.48E-01	4.01E-03	1.09E-04	2.96E-06	8.03E-08
zr 93	6.63E-05	6.64E-05	6.64E-05	6.64E-05	6.64E-05	6.64E-05	6.64E-05
nb 93m	1.42E-06	3.70E-06	5.91E-06	8.04E-06	1.01E-05	1.21E-05	1.40E-05
zr 95	2.14E+02	7.94E+00	2.94E-01	1.09E-02	4.03E-04	1.49E-05	5.54E-07
nb 95	2.09E+02	1.69E+01	6.46E-01	2.40E-02	8.88E-04	3.29E-05	1.22E-06
tc 99	6.81E-04	6.89E-04	6.89E-04	6.89E-04	6.89E-04	6.89E-04	6.89E-04
rh102	1.69E-06	1.38E-06	1.13E-06	9.27E-07	7.60E-07	6.23E-07	5.10E-07
ru106	7.83E+00	4.44E+00	2.52E+00	1.43E+00	8.08E-01	4.58E-01	2.60E-01
rh106	7.83E+00	4.44E+00	2.52E+00	1.43E+00	8.08E-01	4.58E-01	2.60E-01
pd107	6.39E-07	6.39E-07	6.39E-07	6.39E-07	6.39E-07	6.39E-07	6.39E-07
cd113m	4.72E-04	4.54E-04	4.35E-04	4.18E-04	4.01E-04	3.85E-04	3.70E-04
sn119m	8.83E-04	4.30E-04	2.09E-04	1.02E-04	4.96E-05	2.42E-05	1.18E-05
sn121	4.68E-01	2.74E-05	2.71E-05	2.69E-05	2.66E-05	2.63E-05	2.60E-05
sn121m	3.57E-05	3.54E-05	3.50E-05	3.46E-05	3.43E-05	3.39E-05	3.35E-05
sn123	4.99E-02	9.75E-03	1.90E-03	3.72E-04	7.26E-05	1.42E-05	2.77E-06
sb125	2.26E-01	1.85E-01	1.50E-01	1.21E-01	9.83E-02	7.96E-02	6.44E-02
te125m	4.10E-02	4.49E-02	3.66E-02	2.97E-02	2.40E-02	1.94E-02	1.57E-02
sn126	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05
sb126	3.85E-03	1.41E-06	1.41E-06	1.41E-06	1.41E-06	1.41E-06	1.41E-06
sb126m	5.29E-03	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05
te127	4.14E+00	9.77E-02	1.41E-02	2.04E-03	2.94E-04	4.24E-05	6.13E-06
te127m	6.64E-01	9.98E-02	1.44E-02	2.08E-03	3.00E-04	4.33E-05	6.25E-06
i129	1.11E-06	1.14E-06	1.14E-06	1.14E-06	1.14E-06	1.14E-06	1.14E-06
cs134	1.57E-04	1.19E-04	8.99E-05	6.80E-05	5.14E-05	3.88E-05	2.93E-05
cs135	6.85E-05	6.87E-05	6.87E-05	6.87E-05	6.87E-05	6.87E-05	6.87E-05
cs137	4.85E+00	4.76E+00	4.67E+00	4.58E+00	4.49E+00	4.41E+00	4.32E+00
ba137m	4.60E+00	4.49E+00	4.41E+00	4.32E+00	4.24E+00	4.16E+00	4.08E+00
ce144	1.08E+02	5.17E+01	2.47E+01	1.18E+01	5.61E+00	2.68E+00	1.28E+00
pr144	1.08E+02	5.17E+01	2.47E+01	1.18E+01	5.61E+00	2.68E+00	1.28E+00
pr144m	1.52E+00	7.24E-01	3.45E-01	1.65E-01	7.86E-02	3.75E-02	1.79E-02
pm147	1.71E+01	1.44E+01	1.16E+01	9.30E+00	7.46E+00	5.98E+00	4.80E+00
sm151	1.22E-01	1.21E-01	1.21E-01	1.20E-01	1.19E-01	1.18E-01	1.18E-01
eu154	8.29E-06	7.75E-06	7.25E-06	6.78E-06	6.34E-06	5.92E-06	5.54E-06

eu155	1.64E-01	1.45E-01	1.28E-01	1.13E-01	1.00E-01	8.86E-02	7.83E-02
total	1.97E+04	1.81E+02	8.67E+01	5.47E+01	3.87E+01	3.02E+01	2.55E+01

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 60
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
h	6.83E-07	6.52E-07	6.22E-07	5.93E-07	5.66E-07	5.40E-07	5.16E-07
kr	1.29E+01	7.99E-04	7.57E-04	7.17E-04	6.80E-04	6.44E-04	6.10E-04
sr	2.00E+01	1.41E-02	5.47E-03	5.23E-03	5.12E-03	5.01E-03	4.91E-03
y	2.72E+01	4.55E-02	2.60E-02	2.49E-02	2.44E-02	2.39E-02	2.34E-02
zr	1.20E+01	4.00E-02	1.48E-03	5.49E-05	2.04E-06	8.28E-08	1.03E-08
nb	2.14E+01	8.09E-02	3.10E-03	1.15E-04	4.27E-06	1.60E-07	8.28E-09
tc	6.47E+00	3.46E-07	3.46E-07	3.46E-07	3.46E-07	3.46E-07	3.46E-07
ru	7.06E-01	1.90E-03	1.57E-04	8.48E-05	4.81E-05	2.72E-05	1.54E-05
rh	3.00E-01	4.27E-02	2.41E-02	1.37E-02	7.75E-03	4.39E-03	2.49E-03
cd	6.84E-02	1.04E-06	4.78E-07	4.55E-07	4.36E-07	4.19E-07	4.02E-07
sn	1.87E+00	3.07E-05	6.10E-06	1.26E-06	2.94E-07	9.83E-08	5.59E-08
sb	7.51E+00	5.87E-04	4.75E-04	3.84E-04	3.11E-04	2.52E-04	2.04E-04
te	9.30E+00	2.61E-04	5.78E-05	2.89E-05	2.08E-05	1.64E-05	1.32E-05
cs	1.81E+01	5.29E-03	5.19E-03	5.09E-03	4.99E-03	4.90E-03	4.80E-03
ba	1.12E+01	1.77E-02	1.73E-02	1.70E-02	1.67E-02	1.63E-02	1.60E-02
ce	4.36E+00	3.43E-02	1.61E-02	7.70E-03	3.67E-03	1.75E-03	8.35E-04
pr	5.72E+00	3.80E-01	1.81E-01	8.64E-02	4.12E-02	1.97E-02	9.37E-03
pm	3.18E-01	5.30E-03	4.25E-03	3.41E-03	2.74E-03	2.20E-03	1.76E-03
sm	2.00E-02	1.43E-05	1.42E-05	1.41E-05	1.40E-05	1.39E-05	1.38E-05
eu	8.23E-03	1.13E-04	9.97E-05	8.82E-05	7.79E-05	6.89E-05	6.09E-05
totals	2.58E+02	6.69E-01	2.86E-01	1.65E-01	1.08E-01	7.92E-02	6.46E-02

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 61
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 nuclide gamma power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	7.43E-06	7.04E-06	6.67E-06	6.32E-06	5.99E-06	5.68E-06	5.38E-06
y 90	4.77E-08	4.72E-08	4.63E-08	4.53E-08	4.44E-08	4.35E-08	4.26E-08
zr 95	9.30E-01	3.44E-02	1.28E-03	4.73E-05	1.75E-06	6.48E-08	2.40E-09
nb 95	9.48E-01	7.63E-02	2.93E-03	1.09E-04	4.03E-06	1.49E-07	5.52E-09
rh102	2.16E-08	1.77E-08	1.45E-08	1.19E-08	9.73E-09	7.97E-09	6.53E-09
rh106	9.56E-03	5.42E-03	3.07E-03	1.74E-03	9.87E-04	5.60E-04	3.17E-04
sb125	5.82E-04	4.77E-04	3.86E-04	3.13E-04	2.53E-04	2.05E-04	1.66E-04
te125m	8.64E-06	9.48E-06	7.73E-06	6.26E-06	5.07E-06	4.10E-06	3.32E-06
sn126	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09
sb126	6.28E-05	2.30E-08	2.30E-08	2.30E-08	2.30E-08	2.30E-08	2.30E-08
sb126m	4.88E-05	9.27E-08	9.27E-08	9.27E-08	9.27E-08	9.27E-08	9.26E-08
cs134	1.45E-06	1.10E-06	8.29E-07	6.26E-07	4.73E-07	3.58E-07	2.70E-07
ba137m	1.63E-02	1.60E-02	1.57E-02	1.54E-02	1.51E-02	1.48E-02	1.45E-02
ce144	1.22E-02	5.83E-03	2.78E-03	1.32E-03	6.32E-04	3.01E-04	1.44E-04
pr144	1.86E-02	8.86E-03	4.23E-03	2.02E-03	9.61E-04	4.59E-04	2.19E-04
pr144m	1.13E-04	5.37E-05	2.56E-05	1.22E-05	5.82E-06	2.78E-06	1.32E-06
pm147	4.44E-07	3.75E-07	3.01E-07	2.41E-07	1.94E-07	1.55E-07	1.25E-07
sm151	1.02E-08	1.02E-08	1.01E-08	1.01E-08	1.00E-08	9.96E-09	9.89E-09
eu154	6.16E-08	5.76E-08	5.39E-08	5.04E-08	4.71E-08	4.40E-08	4.12E-08
eu155	6.30E-05	5.57E-05	4.92E-05	4.35E-05	3.84E-05	3.40E-05	3.00E-05
total	1.28E+02	1.49E-01	3.04E-02	2.10E-02	1.80E-02	1.63E-02	1.54E-02

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 62
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+00mwd, flux= 2.79E+08n/cm**2-sec
0 element gamma power, watts

basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr	6.74E+00	7.04E-06	6.67E-06	6.32E-06	5.99E-06	5.68E-06	5.38E-06
y	9.80E+00	1.17E-04	3.21E-06	1.31E-07	4.68E-08	4.36E-08	4.26E-08
zr	4.79E+00	3.44E-02	1.28E-03	4.73E-05	1.75E-06	6.48E-08	2.40E-09
nb	9.09E+00	7.64E-02	2.93E-03	1.09E-04	4.03E-06	1.49E-07	5.70E-09
rh	9.50E-02	5.43E-03	3.07E-03	1.74E-03	9.87E-04	5.60E-04	3.17E-04
sn	1.23E+00	4.37E-07	1.01E-07	3.09E-08	1.51E-08	1.10E-08	9.69E-09
sb	5.15E+00	4.77E-04	3.86E-04	3.13E-04	2.53E-04	2.05E-04	1.66E-04
te	5.57E+00	2.30E-05	9.10E-06	6.46E-06	5.10E-06	4.10E-06	3.32E-06
cs	8.75E+00	1.10E-06	8.29E-07	6.26E-07	4.73E-07	3.58E-07	2.70E-07
ba	4.72E+00	1.60E-02	1.57E-02	1.54E-02	1.51E-02	1.48E-02	1.45E-02
ce	2.08E+00	5.96E-03	2.78E-03	1.32E-03	6.32E-04	3.01E-04	1.44E-04
pr	1.79E+00	8.92E-03	4.25E-03	2.03E-03	9.67E-04	4.61E-04	2.20E-04
pm	8.53E-02	3.87E-07	3.01E-07	2.41E-07	1.94E-07	1.55E-07	1.25E-07
sm	4.44E-03	1.02E-08	1.01E-08	1.01E-08	1.00E-08	9.96E-09	9.89E-09
eu	5.17E-03	5.57E-05	4.92E-05	4.35E-05	3.85E-05	3.40E-05	3.01E-05
totals	1.28E+02	1.49E-01	3.04E-02	2.10E-02	1.80E-02	1.63E-02	1.54E-02

1 photon spectrum as a function of time for light elements, cladding and structural materials

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2

power= .00 mw, burnup= 1.mwd, flux= 2.79E+08 n**2-sec

0 spectrum of photon release rates, photons/sec

basis = single reactor assembly

0 time after discharge

emean (mev)	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1.00E-02	5.14E+11	1.31E+04	1.05E+04	8.41E+03	6.73E+03	5.39E+03	4.32E+03
3.00E-02	1.69E+11	4.17E+03	3.34E+03	2.68E+03	2.14E+03	1.72E+03	1.37E+03
5.50E-02	1.18E+11	2.82E+03	2.26E+03	1.81E+03	1.45E+03	1.16E+03	9.29E+02
8.50E-02	6.89E+10	1.59E+03	1.27E+03	1.02E+03	8.15E+02	6.52E+02	5.23E+02
1.20E-01	4.90E+10	1.08E+03	8.68E+02	6.95E+02	5.57E+02	4.46E+02	3.57E+02
1.70E-01	5.12E+10	1.06E+03	8.53E+02	6.83E+02	5.47E+02	4.38E+02	3.51E+02
3.00E-01	5.87E+10	1.06E+03	8.48E+02	6.79E+02	5.44E+02	4.36E+02	3.49E+02
6.50E-01	2.89E+10	5.66E+04	4.53E+04	3.63E+04	2.91E+04	2.33E+04	1.87E+04
1.13E+00	4.96E+09	4.51E+04	3.61E+04	2.89E+04	2.32E+04	1.86E+04	1.49E+04
1.58E+00	9.03E+11	1.13E-01	9.05E-02	7.25E-02	5.80E-02	4.65E-02	3.72E-02
2.00E+00	1.79E+08	1.00E-02	8.05E-03	6.44E-03	5.16E-03	4.13E-03	3.31E-03
2.40E+00	3.62E+07	2.25E-03	1.80E-03	1.44E-03	1.16E-03	9.27E-04	7.42E-04
2.80E+00	2.13E+11	3.53E-05	2.82E-05	2.26E-05	1.81E-05	1.45E-05	1.16E-05
3.25E+00	1.35E+04	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
3.75E+00	1.39E+08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
4.25E+00	1.82E+06	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
4.75E+00	6.61E-22	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
5.50E+00	1.15E-22	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
0 total	2.18E+12	1.27E+05	1.01E+05	8.12E+04	6.50E+04	5.21E+04	4.17E+04
0 mev/sec	2.10E+12	8.87E+04	7.10E+04	5.69E+04	4.56E+04	3.65E+04	2.92E+04

0 spectrum of energy release rates, mev/watt-sec

basis = single reactor assembly

0 time after discharge

emean (mev)	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1.00E-02	1.29E+06	3.28E-02	2.62E-02	2.10E-02	1.68E-02	1.35E-02	1.08E-02
3.00E-02	1.27E+06	3.13E-02	2.51E-02	2.01E-02	1.61E-02	1.29E-02	1.03E-02
5.50E-02	1.62E+06	3.87E-02	3.10E-02	2.49E-02	1.99E-02	1.59E-02	1.28E-02
8.50E-02	1.46E+06	3.37E-02	2.70E-02	2.16E-02	1.73E-02	1.39E-02	1.11E-02
1.20E-01	1.47E+06	3.25E-02	2.60E-02	2.09E-02	1.67E-02	1.34E-02	1.07E-02
1.70E-01	2.18E+06	4.52E-02	3.62E-02	2.90E-02	2.32E-02	1.86E-02	1.49E-02
3.00E-01	4.41E+06	7.94E-02	6.36E-02	5.10E-02	4.08E-02	3.27E-02	2.62E-02

6.50E-01	4.70E+06	9.20E+00	7.37E+00	5.90E+00	4.72E+00	3.78E+00	3.03E+00
1.13E+00	1.40E+06	1.27E+01	1.02E+01	8.14E+00	6.52E+00	5.22E+00	4.18E+00
1.58E+00	3.56E+08	4.45E-05	3.56E-05	2.85E-05	2.29E-05	1.83E-05	1.47E-05
2.00E+00	8.95E+04	5.02E-06	4.02E-06	3.22E-06	2.58E-06	2.07E-06	1.66E-06
2.40E+00	2.17E+04	1.35E-06	1.08E-06	8.67E-07	6.94E-07	5.56E-07	4.45E-07
2.80E+00	1.49E+08	2.47E-08	1.98E-08	1.58E-08	1.27E-08	1.02E-08	8.13E-09
3.25E+00	1.10E+01	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
3.75E+00	1.30E+05	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
4.25E+00	1.93E+03	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
4.75E+00	7.85E-25	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
5.50E+00	1.58E-25	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
0 total	5.25E+08	2.22E+01	1.78E+01	1.42E+01	1.14E+01	9.12E+00	7.31E+00
0 gamma watts	3.37E-01	1.42E-08	1.14E-08	9.12E-09	7.30E-09	5.85E-09	4.69E-09

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1 photon spectrum as a function of time for fission products

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
power= .00 mw, burnup= 1.mwd, flux= 2.79E+08 n**2-sec
0 spectrum of photon release rates, photons/sec
basis = single reactor assembly

0

emean (mev)	initial	time after discharge 304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1.00E-02	2.53E+14	1.84E+12	9.01E+11	5.05E+11	3.13E+11	2.17E+11	1.69E+11
3.00E-02	1.11E+14	8.29E+11	4.10E+11	2.27E+11	1.38E+11	9.41E+10	7.20E+10
5.50E-02	5.92E+13	4.27E+11	2.10E+11	1.16E+11	7.01E+10	4.75E+10	3.62E+10
8.50E-02	4.11E+13	2.77E+11	1.36E+11	7.40E+10	4.38E+10	2.90E+10	2.15E+10
1.20E-01	3.34E+13	3.94E+11	1.91E+11	9.71E+10	5.20E+10	3.02E+10	1.96E+10
1.70E-01	5.44E+13	1.75E+11	8.40E+10	4.58E+10	2.73E+10	1.81E+10	1.35E+10
3.00E-01	1.10E+14	1.96E+11	9.67E+10	5.21E+10	3.04E+10	1.98E+10	1.45E+10
6.50E-01	2.23E+14	1.41E+12	2.80E+11	1.97E+11	1.71E+11	1.58E+11	1.49E+11
1.13E+00	7.81E+13	2.02E+10	1.00E+10	5.30E+09	2.93E+09	1.74E+09	1.13E+09
1.58E+00	4.08E+13	9.69E+09	4.74E+09	2.34E+09	1.18E+09	6.10E+08	3.32E+08
2.00E+00	1.23E+13	1.71E+10	8.21E+09	3.93E+09	1.89E+09	9.06E+08	4.37E+08
2.40E+00	1.06E+13	3.30E+08	1.73E+08	9.11E+07	4.84E+07	2.59E+07	1.39E+07
2.80E+00	4.23E+12	4.16E+07	2.25E+07	1.22E+07	6.64E+06	3.64E+06	2.00E+06
3.25E+00	2.48E+12	4.96E+06	2.81E+06	1.59E+06	9.03E+05	5.12E+05	2.90E+05
3.75E+00	1.26E+12	2.19E+03	1.24E+03	7.02E+02	3.98E+02	2.26E+02	1.28E+02
4.25E+00	1.40E+12	1.63E-09	1.71E-09	1.77E-09	1.82E-09	1.86E-09	1.89E-09
4.75E+00	4.09E+11	8.17E-10	8.56E-10	8.88E-10	9.13E-10	9.34E-10	9.50E-10
5.50E+00	3.04E+11	6.06E-10	6.35E-10	6.59E-10	6.78E-10	6.93E-10	7.05E-10
0 total	1.04E+15	5.60E+12	2.33E+12	1.33E+12	8.52E+11	6.17E+11	4.97E+11
0 mev/sec	4.40E+14	1.21E+12	3.28E+11	2.05E+11	1.55E+11	1.30E+11	1.16E+11

0 spectrum of energy release rates, mev/watt-sec
basis = single reactor assembly

0

emean (mev)	initial	time after discharge 304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1.00E-02	6.34E+08	4.61E+06	2.25E+06	1.26E+06	7.82E+05	5.43E+05	4.22E+05
3.00E-02	8.32E+08	6.22E+06	3.08E+06	1.70E+06	1.03E+06	7.05E+05	5.40E+05
5.50E-02	8.14E+08	5.88E+06	2.89E+06	1.59E+06	9.64E+05	6.53E+05	4.97E+05
8.50E-02	8.74E+08	5.88E+06	2.89E+06	1.57E+06	9.31E+05	6.16E+05	4.58E+05
1.20E-01	1.00E+09	1.18E+07	5.73E+06	2.91E+06	1.56E+06	9.07E+05	5.87E+05
1.70E-01	2.31E+09	7.43E+06	3.57E+06	1.95E+06	1.16E+06	7.69E+05	5.75E+05
3.00E-01	8.21E+09	1.47E+07	7.25E+06	3.91E+06	2.28E+06	1.48E+06	1.08E+06
6.50E-01	3.62E+10	2.29E+08	4.55E+07	3.20E+07	2.79E+07	2.56E+07	2.43E+07
1.13E+00	2.20E+10	5.69E+06	2.82E+06	1.49E+06	8.25E+05	4.89E+05	3.17E+05
1.58E+00	1.61E+10	3.82E+06	1.87E+06	9.23E+05	4.64E+05	2.40E+05	1.31E+05
2.00E+00	6.13E+09	8.57E+06	4.10E+06	1.97E+06	9.43E+05	4.53E+05	2.19E+05
2.40E+00	6.38E+09	1.98E+05	1.04E+05	5.47E+04	2.90E+04	1.55E+04	8.36E+03

	2.80E+00	2.96E+09	2.92E+04	1.57E+04	8.53E+03	4.65E+03	2.55E+03	1.40E+03
	3.25E+00	2.01E+09	4.03E+03	2.28E+03	1.29E+03	7.34E+02	4.16E+02	2.36E+02
	3.75E+00	1.18E+09	2.05E+00	1.16E+00	6.59E-01	3.73E-01	2.12E-01	1.20E-01
	4.25E+00	1.48E+09	1.73E-12	1.81E-12	1.88E-12	1.93E-12	1.98E-12	2.01E-12
	4.75E+00	4.85E+08	9.70E-13	1.02E-12	1.05E-12	1.08E-12	1.11E-12	1.13E-12
	5.50E+00	4.18E+08	8.33E-13	8.73E-13	9.06E-13	9.32E-13	9.52E-13	9.69E-13
0	total	1.10E+11	3.04E+08	8.20E+07	5.13E+07	3.88E+07	3.25E+07	2.91E+07
0	gamma watts	7.05E+01	1.95E-01	5.26E-02	3.29E-02	2.49E-02	2.08E-02	1.87E-02

1
0 principal photon sources in group 1, photons/sec

mean energy = .0100 mev. nuclides exceeding 1.0E-03 of total group release rate (2.17E+11) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	2.96E+09	2.81E+09	2.66E+09	2.52E+09	2.39E+09	2.27E+09	2.15E+09
sr 90	1.95E+10	1.91E+10	1.87E+10	1.83E+10	1.80E+10	1.76E+10	1.72E+10
y 90	9.48E+10	9.39E+10	9.20E+10	9.01E+10	8.83E+10	8.65E+10	8.47E+10
rh106	2.33E+11	1.32E+11	7.49E+10	4.24E+10	2.41E+10	1.36E+10	7.73E+09
cs137	1.71E+10	1.68E+10	1.65E+10	1.62E+10	1.59E+10	1.55E+10	1.53E+10
ba137m	8.07E+08	7.88E+08	7.73E+08	7.58E+08	7.43E+08	7.29E+08	7.15E+08
ce144	2.09E+11	9.96E+10	4.75E+10	2.26E+10	1.08E+10	5.15E+09	2.46E+09
pr144	2.77E+12	1.32E+12	6.29E+11	3.00E+11	1.43E+11	6.83E+10	3.26E+10
pm147	1.99E+10	1.68E+10	1.35E+10	1.08E+10	8.67E+09	6.95E+09	5.58E+09
eu155	4.34E+08	3.84E+08	3.39E+08	3.00E+08	2.65E+08	2.34E+08	2.07E+08

0 principal photon sources in group 2, photons/sec

mean energy = .0300 mev. nuclides exceeding 1.0E-03 of total group release rate (9.41E+10) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	8.64E+08	8.19E+08	7.76E+08	7.35E+08	6.97E+08	6.60E+08	6.26E+08
sr 90	5.51E+09	5.40E+09	5.29E+09	5.18E+09	5.08E+09	4.97E+09	4.87E+09
y 90	3.09E+10	3.06E+10	3.00E+10	2.93E+10	2.87E+10	2.82E+10	2.76E+10
rh106	7.78E+10	4.41E+10	2.50E+10	1.42E+10	8.03E+09	4.55E+09	2.58E+09
sb125	4.15E+09	3.40E+09	2.75E+09	2.23E+09	1.80E+09	1.46E+09	1.18E+09
te125m	1.75E+09	1.92E+09	1.57E+09	1.27E+09	1.03E+09	8.32E+08	6.73E+08
cs137	4.77E+09	4.68E+09	4.59E+09	4.50E+09	4.42E+09	4.33E+09	4.25E+09
ba137m	1.39E+10	1.35E+10	1.33E+10	1.30E+10	1.28E+10	1.25E+10	1.23E+10
ce144	4.85E+11	2.31E+11	1.10E+11	5.26E+10	2.51E+10	1.20E+10	5.70E+09
pr144	9.15E+11	4.37E+11	2.08E+11	9.93E+10	4.74E+10	2.26E+10	1.08E+10
pr144m	1.87E+10	8.91E+09	4.25E+09	2.03E+09	9.67E+08	4.61E+08	2.20E+08
pm147	4.37E+09	3.69E+09	2.96E+09	2.37E+09	1.91E+09	1.53E+09	1.23E+09

0 principal photon sources in group 3, photons/sec

mean energy = .0550 mev. nuclides exceeding 1.0E-03 of total group release rate (4.75E+10) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	5.30E+08	5.02E+08	4.76E+08	4.51E+08	4.27E+08	4.05E+08	3.84E+08
sr 90	3.26E+09	3.19E+09	3.13E+09	3.06E+09	3.00E+09	2.94E+09	2.88E+09
y 90	2.13E+10	2.11E+10	2.07E+10	2.03E+10	1.99E+10	1.95E+10	1.91E+10
rh106	5.51E+10	3.12E+10	1.77E+10	1.00E+10	5.69E+09	3.23E+09	1.83E+09
cs137	2.78E+09	2.72E+09	2.67E+09	2.62E+09	2.57E+09	2.52E+09	2.47E+09
ce144	7.01E+10	3.34E+10	1.60E+10	7.61E+09	3.63E+09	1.73E+09	8.25E+08
pr144	6.43E+11	3.06E+11	1.46E+11	6.97E+10	3.32E+10	1.59E+10	7.56E+09
pm147	1.84E+09	1.55E+09	1.24E+09	9.98E+08	8.01E+08	6.42E+08	5.15E+08
eu155	1.27E+09	1.12E+09	9.89E+08	8.74E+08	7.73E+08	6.83E+08	6.04E+08

1
0 principal photon sources in group 4, photons/sec

mean energy = .0850 mev. nuclides exceeding 1.0E-03 of total group release rate (2.90E+10) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	2.65E+08	2.51E+08	2.38E+08	2.26E+08	2.14E+08	2.03E+08	1.92E+08
sr 90	1.55E+09	1.52E+09	1.49E+09	1.46E+09	1.43E+09	1.40E+09	1.37E+09
y 90	1.24E+10	1.22E+10	1.20E+10	1.17E+10	1.15E+10	1.13E+10	1.10E+10

rh106	3.28E+10	1.86E+10	1.05E+10	5.97E+09	3.38E+09	1.92E+09	1.09E+09
cs137	1.30E+09	1.28E+09	1.25E+09	1.23E+09	1.20E+09	1.18E+09	1.16E+09
ce144	9.90E+10	4.72E+10	2.25E+10	1.07E+10	5.12E+09	2.44E+09	1.17E+09
pr144	3.78E+11	1.80E+11	8.60E+10	4.10E+10	1.96E+10	9.33E+09	4.45E+09
pm147	5.22E+08	4.41E+08	3.54E+08	2.84E+08	2.28E+08	1.83E+08	1.47E+08
eu155	1.92E+09	1.70E+09	1.50E+09	1.33E+09	1.17E+09	1.04E+09	9.17E+08

0 principal photon sources in group 5, photons/sec

mean energy = .1200 mev. nuclides exceeding 1.0E-03 of total group release rate (3.02E+10) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	1.60E+08	1.52E+08	1.44E+08	1.36E+08	1.29E+08	1.22E+08	1.16E+08
sr 90	8.84E+08	8.66E+08	8.48E+08	8.31E+08	8.14E+08	7.97E+08	7.81E+08
y 90	8.69E+09	8.61E+09	8.43E+09	8.26E+09	8.09E+09	7.93E+09	7.77E+09
rh106	2.37E+10	1.34E+10	7.60E+09	4.31E+09	2.44E+09	1.38E+09	7.85E+08
cs137	7.29E+08	7.15E+08	7.01E+08	6.88E+08	6.75E+08	6.62E+08	6.49E+08
ce144	4.86E+11	2.32E+11	1.10E+11	5.27E+10	2.51E+10	1.20E+10	5.71E+09
pr144	2.71E+11	1.29E+11	6.16E+10	2.94E+10	1.40E+10	6.68E+09	3.18E+09
pm147	1.66E+08	1.40E+08	1.12E+08	9.00E+07	7.22E+07	5.80E+07	4.65E+07
eu155	1.10E+09	9.70E+08	8.57E+08	7.58E+08	6.70E+08	5.92E+08	5.23E+08

0 principal photon sources in group 6, photons/sec

mean energy = .1700 mev. nuclides exceeding 1.0E-03 of total group release rate (1.81E+10) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	1.27E+08	1.20E+08	1.14E+08	1.08E+08	1.02E+08	9.71E+07	9.20E+07
sr 90	6.30E+08	6.17E+08	6.05E+08	5.93E+08	5.81E+08	5.69E+08	5.57E+08
y 90	8.96E+09	8.87E+09	8.69E+09	8.51E+09	8.34E+09	8.17E+09	8.00E+09
rh106	2.54E+10	1.44E+10	8.15E+09	4.62E+09	2.62E+09	1.48E+09	8.42E+08
sb125	6.25E+08	5.12E+08	4.15E+08	3.36E+08	2.72E+08	2.20E+08	1.78E+08
cs137	5.15E+08	5.05E+08	4.95E+08	4.86E+08	4.76E+08	4.67E+08	4.58E+08
ce144	1.04E+09	4.98E+08	2.38E+08	1.13E+08	5.41E+07	2.58E+07	1.23E+07
pr144	2.86E+11	1.36E+11	6.51E+10	3.10E+10	1.48E+10	7.06E+09	3.37E+09

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1

0 principal photon sources in group 7, photons/sec

mean energy = .3000 mev. nuclides exceeding 1.0E-03 of total group release rate (1.98E+10) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	7.67E+07	7.27E+07	6.89E+07	6.53E+07	6.19E+07	5.86E+07	5.55E+07
sr 90	2.86E+08	2.80E+08	2.74E+08	2.69E+08	2.63E+08	2.58E+08	2.53E+08
y 90	9.95E+09	9.85E+09	9.65E+09	9.45E+09	9.26E+09	9.07E+09	8.89E+09
rh106	3.06E+10	1.73E+10	9.83E+09	5.57E+09	3.16E+09	1.79E+09	1.02E+09
sb125	2.37E+08	1.94E+08	1.57E+08	1.27E+08	1.03E+08	8.33E+07	6.74E+07
cs137	2.60E+08	2.55E+08	2.51E+08	2.46E+08	2.41E+08	2.37E+08	2.32E+08
pr144	3.35E+11	1.60E+11	7.62E+10	3.63E+10	1.73E+10	8.27E+09	3.94E+09

0 principal photon sources in group 8, photons/sec

mean energy = .6500 mev. nuclides exceeding 1.0E-03 of total group release rate (1.58E+11) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
y 90	4.21E+09	4.16E+09	4.08E+09	4.00E+09	3.91E+09	3.83E+09	3.76E+09
rh106	9.45E+10	5.36E+10	3.04E+10	1.72E+10	9.75E+09	5.53E+09	3.13E+09
sb125	5.08E+09	4.16E+09	3.37E+09	2.73E+09	2.21E+09	1.79E+09	1.45E+09
ba137m	1.56E+11	1.52E+11	1.49E+11	1.46E+11	1.44E+11	1.41E+11	1.38E+11
pr144	2.29E+11	1.09E+11	5.20E+10	2.48E+10	1.18E+10	5.64E+09	2.69E+09

0 principal photon sources in group 9, photons/sec

mean energy = 1.1250 mev. nuclides exceeding 1.0E-03 of total group release rate (1.74E+09) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
y 90	5.48E+08	5.43E+08	5.32E+08	5.21E+08	5.11E+08	5.00E+08	4.90E+08
rh106	8.80E+09	4.99E+09	2.83E+09	1.60E+09	9.09E+08	5.15E+08	2.92E+08
pr144	2.93E+10	1.40E+10	6.65E+09	3.17E+09	1.51E+09	7.22E+08	3.44E+08

0 principal photon sources in group 10, photons/sec

mean energy = 1.5750 mev. nuclides exceeding 1.0E-03 of total group release rate (6.10E+08) at 1521.9 d

nuclide	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
y 90	7.00E+07	6.93E+07	6.79E+07	6.65E+07	6.52E+07	6.39E+07	6.26E+07
rh106	1.66E+09	9.41E+08	5.33E+08	3.02E+08	1.71E+08	9.71E+07	5.51E+07
pr144	1.82E+10	8.68E+09	4.14E+09	1.97E+09	9.42E+08	4.49E+08	2.14E+08

0 principal photon sources in group 11, photons/sec

mean energy = 2.0000 mev. nuclides exceeding 1.0E-03 of total group release rate (9.06E+08) at 1521.9 d

nuclide	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
y 90	4.19E+06	4.15E+06	4.06E+06	3.98E+06	3.90E+06	3.82E+06	3.74E+06
rh106	5.39E+08	3.06E+08	1.73E+08	9.82E+07	5.57E+07	3.16E+07	1.79E+07
pr144	3.53E+10	1.68E+10	8.03E+09	3.83E+09	1.83E+09	8.71E+08	4.15E+08

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0 principal photon sources in group 12, photons/sec

mean energy = 2.4000 mev. nuclides exceeding 1.0E-03 of total group release rate (2.59E+07) at 1521.9 d

nuclide	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
rh106	3.01E+08	1.71E+08	9.69E+07	5.49E+07	3.11E+07	1.76E+07	1.00E+07
pr144	3.34E+08	1.59E+08	7.59E+07	3.62E+07	1.73E+07	8.23E+06	3.92E+06

0 principal photon sources in group 13, photons/sec

mean energy = 2.8000 mev. nuclides exceeding 1.0E-03 of total group release rate (3.64E+06) at 1521.9 d

nuclide	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
rh106	5.09E+07	2.88E+07	1.63E+07	9.27E+06	5.25E+06	2.98E+06	1.69E+06
pr144	2.69E+07	1.28E+07	6.11E+06	2.91E+06	1.39E+06	6.63E+05	3.16E+05

0 principal photon sources in group 14, photons/sec

mean energy = 3.2500 mev. nuclides exceeding 1.0E-03 of total group release rate (5.12E+05) at 1521.9 d

nuclide	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
rh106	8.75E+06	4.96E+06	2.81E+06	1.59E+06	9.03E+05	5.12E+05	2.90E+05

0 principal photon sources in group 15, photons/sec

mean energy = 3.7500 mev. nuclides exceeding 1.0E-03 of total group release rate (2.26E+02) at 1521.9 d

nuclide	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
rh106	3.86E+03	2.19E+03	1.24E+03	7.02E+02	3.98E+02	2.26E+02	1.28E+02

0 principal photon sources in group 16, photons/sec

mean energy = 4.2500 mev. nuclides exceeding 1.0E-03 of total group release rate (1.86E-09) at 1521.9 d

nuclide	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
ce142	1.47E-09	1.47E-09	1.47E-09	1.47E-09	1.47E-09	1.47E-09	1.47E-09
sm147	6.24E-11	1.61E-10	2.40E-10	3.03E-10	3.54E-10	3.95E-10	4.27E-10

0 principal photon sources in group 17, photons/sec

mean energy = 4.7500 mev. nuclides exceeding 1.0E-03 of total group release rate (9.34E-10) at 1521.9 d

nuclide	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
ce142	7.36E-10	7.36E-10	7.36E-10	7.36E-10	7.36E-10	7.36E-10	7.36E-10
sm147	3.13E-11	8.07E-11	1.20E-10	1.52E-10	1.77E-10	1.98E-10	2.14E-10

0 principal photon sources in group 18, photons/sec

mean energy = 5.5000 mev. nuclides exceeding 1.0E-03 of total group release rate (6.93E-10) at 1521.9 d

nuclide	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
ce142	5.46E-10	5.46E-10	5.46E-10	5.46E-10	5.46E-10	5.46E-10	5.46E-10
sm147	2.32E-11	5.98E-11	8.92E-11	1.13E-10	1.32E-10	1.47E-10	1.59E-10

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photon spectrum as a function of time for heavy metals and their daughters

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2

power= .00 mw, burnup= 1.mwd, flux= 2.79E+08 n**2-sec

0 actinide photon release rates, photons/sec

basis = single reactor assembly

0

emean (mev)	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1.00E-02	1.33E+14	5.50E+11	5.50E+11	5.50E+11	5.50E+11	5.50E+11	5.50E+11
3.00E-02	8.46E+12	4.62E+10	4.62E+10	4.62E+10	4.62E+10	4.62E+10	4.62E+10
5.50E-02	1.09E+13	2.01E+10	2.01E+10	2.01E+10	2.01E+10	2.01E+10	2.01E+10
8.50E-02	5.26E+13	1.51E+11	1.51E+11	1.51E+11	1.51E+11	1.51E+11	1.51E+11
1.20E-01	5.42E+13	2.90E+10	2.90E+10	2.90E+10	2.90E+10	2.90E+10	2.90E+10
1.70E-01	1.72E+12	1.90E+10	1.90E+10	1.90E+10	1.90E+10	1.90E+10	1.90E+10
3.00E-01	2.87E+13	1.30E+11	1.30E+11	1.30E+11	1.30E+11	1.30E+11	1.30E+11
6.50E-01	1.45E+12	6.30E+09	6.30E+09	6.30E+09	6.30E+09	6.30E+09	6.30E+09
1.13E+00	1.86E+12	9.16E+08	9.16E+08	9.16E+08	9.16E+08	9.16E+08	9.16E+08
1.58E+00	1.07E+08	1.07E+08	1.07E+08	1.07E+08	1.07E+08	1.07E+08	1.07E+08
2.00E+00	3.65E+07	3.65E+07	3.65E+07	3.65E+07	3.65E+07	3.65E+07	3.65E+07
2.40E+00	2.90E+04	2.91E+04	2.93E+04	2.95E+04	2.97E+04	3.01E+04	3.05E+04
2.80E+00	1.75E+04	1.85E+04	1.98E+04	2.14E+04	2.30E+04	2.46E+04	2.60E+04
3.25E+00	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04
3.75E+00	5.89E+03	5.89E+03	5.89E+03	5.89E+03	5.89E+03	5.89E+03	5.89E+03
4.25E+00	3.41E+03	3.41E+03	3.41E+03	3.41E+03	3.41E+03	3.41E+03	3.41E+03
4.75E+00	1.97E+03	1.97E+03	1.97E+03	1.97E+03	1.97E+03	1.97E+03	1.97E+03
5.50E+00	1.78E+03	1.78E+03	1.78E+03	1.78E+03	1.78E+03	1.78E+03	1.78E+03
0 total	2.93E+14	9.52E+11	9.52E+11	9.52E+11	9.52E+11	9.52E+11	9.52E+11
0 mev/sec	2.51E+13	7.20E+10	7.20E+10	7.20E+10	7.20E+10	7.20E+10	7.20E+10

0 actinide energy release rates, mev/watt-sec

basis = single reactor assembly

0

emean (mev)	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1.00E-02	3.33E+08	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06	1.37E+06
3.00E-02	6.34E+07	3.46E+05	3.46E+05	3.46E+05	3.46E+05	3.46E+05	3.46E+05
5.50E-02	1.50E+08	2.77E+05	2.77E+05	2.77E+05	2.77E+05	2.77E+05	2.77E+05
8.50E-02	1.12E+09	3.20E+06	3.20E+06	3.20E+06	3.20E+06	3.20E+06	3.20E+06
1.20E-01	1.63E+09	8.69E+05	8.69E+05	8.69E+05	8.69E+05	8.69E+05	8.69E+05
1.70E-01	7.31E+07	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05
3.00E-01	2.15E+09	9.77E+06	9.77E+06	9.77E+06	9.77E+06	9.77E+06	9.77E+06
6.50E-01	2.36E+08	1.02E+06	1.02E+06	1.02E+06	1.02E+06	1.02E+06	1.02E+06
1.13E+00	5.24E+08	2.58E+05	2.58E+05	2.58E+05	2.58E+05	2.58E+05	2.58E+05
1.58E+00	4.20E+04	4.21E+04	4.21E+04	4.21E+04	4.21E+04	4.21E+04	4.21E+04
2.00E+00	1.82E+04	1.82E+04	1.82E+04	1.82E+04	1.82E+04	1.82E+04	1.82E+04
2.40E+00	1.74E+01	1.75E+01	1.76E+01	1.77E+01	1.78E+01	1.80E+01	1.83E+01
2.80E+00	1.23E+01	1.29E+01	1.39E+01	1.50E+01	1.61E+01	1.72E+01	1.82E+01
3.25E+00	8.26E+00	8.26E+00	8.27E+00	8.27E+00	8.27E+00	8.27E+00	8.27E+00
3.75E+00	5.52E+00	5.52E+00	5.52E+00	5.52E+00	5.52E+00	5.52E+00	5.52E+00
4.25E+00	3.62E+00	3.62E+00	3.62E+00	3.62E+00	3.62E+00	3.62E+00	3.62E+00
4.75E+00	2.34E+00	2.34E+00	2.34E+00	2.34E+00	2.34E+00	2.34E+00	2.34E+00
5.50E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00
0 total	6.27E+09	1.80E+07	1.80E+07	1.80E+07	1.80E+07	1.80E+07	1.80E+07
0 gamma watts	4.02E+00	1.15E-02	1.15E-02	1.15E-02	1.15E-02	1.15E-02	1.15E-02

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neutron source intensity as a function of time

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2

alpha-n neutron source, neutrons/sec/basis

basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
pb210	6.26E-16	3.94E-15	1.21E-14	2.73E-14	5.15E-14	8.68E-14	1.35E-13
bi210	1.50E-13	1.00E-12	3.09E-12	6.96E-12	1.31E-11	2.22E-11	3.45E-11

bi211	1.66E-04	6.97E-04	1.44E-03	2.44E-03	3.69E-03	5.18E-03	6.90E-03
bi212	8.84E-06	4.21E-05	9.07E-05	1.46E-04	2.03E-04	2.58E-04	3.09E-04
bi213	2.03E-08	9.90E-08	2.22E-07	3.93E-07	6.13E-07	8.83E-07	1.20E-06
bi214	7.14E-09	2.47E-08	5.23E-08	9.01E-08	1.38E-07	1.96E-07	2.65E-07
po210	5.98E-08	5.89E-07	2.20E-06	5.55E-06	1.13E-05	2.00E-05	3.25E-05
po211	6.59E-07	2.76E-06	5.71E-06	9.67E-06	1.46E-05	2.05E-05	2.73E-05
po212	4.52E-05	2.16E-04	4.65E-04	7.49E-04	1.04E-03	1.32E-03	1.58E-03
po213	2.67E-06	1.31E-05	2.92E-05	5.19E-05	8.09E-05	1.16E-04	1.58E-04
po214	6.36E-05	2.20E-04	4.66E-04	8.02E-04	1.23E-03	1.75E-03	2.36E-03
po215	2.35E-04	9.85E-04	2.04E-03	3.45E-03	5.22E-03	7.32E-03	9.76E-03
po216	3.53E-05	1.68E-04	3.63E-04	5.85E-04	8.12E-04	1.03E-03	1.23E-03
po218	3.02E-05	1.05E-04	2.22E-04	3.82E-04	5.85E-04	8.32E-04	1.12E-03
at217	1.73E-06	8.47E-06	1.90E-05	3.36E-05	5.25E-05	7.55E-05	1.03E-04
rn218	4.99E-15	1.96E-19	7.72E-24	.00E+00	.00E+00	.00E+00	.00E+00
rn219	1.87E-04	7.83E-04	1.62E-03	2.74E-03	4.15E-03	5.82E-03	7.76E-03
rn220	2.80E-05	1.33E-04	2.87E-04	4.63E-04	6.43E-04	8.17E-04	9.78E-04
rn222	2.21E-05	7.65E-05	1.62E-04	2.79E-04	4.27E-04	6.07E-04	8.19E-04
fr221	1.26E-06	6.18E-06	1.38E-05	2.45E-05	3.83E-05	5.51E-05	7.49E-05
fr223	9.02E-11	2.97E-10	6.14E-10	1.04E-09	1.57E-09	2.20E-09	2.93E-09
ra222	3.86E-15	1.52E-19	5.97E-24	2.50E-28	.00E+00	.00E+00	.00E+00
ra223	1.08E-04	4.53E-04	9.39E-04	1.59E-03	2.40E-03	3.37E-03	4.49E-03
ra224	1.98E-05	9.43E-05	2.03E-04	3.27E-04	4.55E-04	5.78E-04	6.91E-04
ra226	1.33E-05	4.47E-05	9.46E-05	1.63E-04	2.50E-04	3.55E-04	4.79E-04
ac225	9.09E-07	4.44E-06	9.94E-06	1.76E-05	2.75E-05	3.96E-05	5.39E-05
ac227	1.02E-06	3.34E-06	6.91E-06	1.17E-05	1.77E-05	2.48E-05	3.30E-05
ac228	1.33E-16	4.33E-16	8.87E-16	1.48E-15	2.20E-15	3.03E-15	3.97E-15
th226	3.48E-15	1.37E-19	5.39E-24	2.26E-28	.00E+00	.00E+00	.00E+00
th227	1.31E-04	5.00E-04	1.04E-03	1.75E-03	2.65E-03	3.72E-03	4.95E-03
th228	1.74E-05	7.94E-05	1.71E-04	2.75E-04	3.83E-04	4.86E-04	5.81E-04
th229	6.62E-07	2.59E-06	5.81E-06	1.03E-05	1.61E-05	2.31E-05	3.15E-05
th230	5.67E-02	1.04E-01	1.51E-01	1.98E-01	2.46E-01	2.93E-01	3.40E-01
th232	2.92E-08	5.36E-08	7.80E-08	1.02E-07	1.27E-07	1.51E-07	1.75E-07
pa231	5.14E-03	9.13E-03	1.31E-02	1.71E-02	2.11E-02	2.51E-02	2.91E-02
u230	2.74E-15	1.08E-19	4.24E-24	1.78E-28	.00E+00	.00E+00	.00E+00
u231	1.30E-14	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u232	1.40E-04	3.22E-04	4.69E-04	5.88E-04	6.84E-04	7.61E-04	8.22E-04
u233	1.45E-02	2.97E-02	4.50E-02	6.02E-02	7.55E-02	9.07E-02	1.06E-01
u234	6.63E+03	6.63E+03	6.63E+03	6.63E+03	6.63E+03	6.63E+03	6.63E+03
u235	1.37E+02	1.37E+02	1.37E+02	1.37E+02	1.37E+02	1.37E+02	1.37E+02
u236	1.04E+03	1.04E+03	1.04E+03	1.04E+03	1.04E+03	1.04E+03	1.04E+03
u238	8.32E+02	8.32E+02	8.32E+02	8.32E+02	8.32E+02	8.32E+02	8.32E+02
np235	1.15E-08	6.77E-09	3.98E-09	2.33E-09	1.37E-09	8.05E-10	4.72E-10
np237	3.35E+03	3.35E+03	3.35E+03	3.35E+03	3.35E+03	3.35E+03	3.35E+03
pu236	3.26E-02	2.69E-02	2.20E-02	1.80E-02	1.48E-02	1.21E-02	9.92E-03
pu237	1.46E-10	1.37E-12	1.28E-14	1.20E-16	1.13E-18	1.05E-20	9.88E-23
pu238	6.52E+02	6.53E+02	6.49E+02	6.45E+02	6.41E+02	6.36E+02	6.32E+02

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neutron source intensity as a function of time

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2

alpha-n neutron source, neutrons/sec/basis

basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
pu239	4.99E+01	5.04E+01	5.04E+01	5.04E+01	5.04E+01	5.04E+01	5.04E+01
pu240	9.04E-04	9.04E-04	9.04E-04	9.04E-04	9.04E-04	9.04E-04	9.04E-04
pu241	5.23E-11	5.02E-11	4.82E-11	4.63E-11	4.45E-11	4.27E-11	4.11E-11
pu242	1.66E-16	1.66E-16	1.66E-16	1.66E-16	1.66E-16	1.66E-16	1.66E-16
am239	1.42E-23	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00

am240	2.16E-23	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
am241	1.36E-09	5.80E-09	1.00E-08	1.41E-08	1.80E-08	2.18E-08	2.54E-08
am242m	7.95E-18	7.92E-18	7.88E-18	7.85E-18	7.82E-18	7.79E-18	7.76E-18
am243	6.04E-21	6.06E-21	6.06E-21	6.06E-21	6.06E-21	6.06E-21	6.06E-21
cm241	2.51E-26	4.04E-29	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
cm242	3.17E-12	8.85E-13	2.44E-13	6.87E-14	2.06E-14	7.39E-15	3.77E-15
cm243	4.24E-21	4.16E-21	4.07E-21	3.99E-21	3.91E-21	3.83E-21	3.76E-21
cm244	2.61E-24	2.55E-24	2.47E-24	2.39E-24	2.32E-24	2.25E-24	2.18E-24
0 total	1.27E+04	1.27E+04	1.27E+04	1.27E+04	1.27E+04	1.27E+04	1.27E+04

1 neutron source intensity as a function of time

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
spontaneous fission neutron source, neutrons/sec/basis
basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
th230	1.45E-06	2.67E-06	3.88E-06	5.09E-06	6.30E-06	7.52E-06	8.73E-06
pa231	6.45E-07	1.14E-06	1.65E-06	2.15E-06	2.65E-06	3.15E-06	3.65E-06
u232	8.58E-09	1.98E-08	2.88E-08	3.61E-08	4.20E-08	4.67E-08	5.05E-08
u234	1.43E+01	1.43E+01	1.43E+01	1.43E+01	1.43E+01	1.43E+01	1.43E+01
u235	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00
u236	1.57E+02	1.57E+02	1.57E+02	1.57E+02	1.57E+02	1.57E+02	1.57E+02
u237	1.22E-09	3.42E-23	1.77E-24	1.70E-24	1.63E-24	1.57E-24	1.50E-24
u238	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05
u239	9.66E-10	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np236	7.39E-12	7.39E-12	7.39E-12	7.39E-12	7.39E-12	7.39E-12	7.39E-12
np238	2.02E-08	2.32E-30	2.31E-30	2.30E-30	2.29E-30	2.29E-30	2.28E-30
np239	1.98E-05	6.28E-32	6.28E-32	6.28E-32	6.28E-32	6.28E-32	6.28E-32
pu236	2.21E-03	1.82E-03	1.49E-03	1.22E-03	1.00E-03	8.19E-04	6.71E-04
pu238	1.20E+02	1.21E+02	1.20E+02	1.19E+02	1.18E+02	1.18E+02	1.17E+02
pu239	2.67E-02	2.70E-02	2.70E-02	2.70E-02	2.70E-02	2.70E-02	2.70E-02
pu240	6.01E-03	6.01E-03	6.01E-03	6.01E-03	6.01E-03	6.01E-03	6.01E-03
pu241	1.88E-12	1.81E-12	1.74E-12	1.67E-12	1.60E-12	1.54E-12	1.48E-12
pu242	1.29E-13	1.29E-13	1.29E-13	1.29E-13	1.29E-13	1.29E-13	1.29E-13
pu243	1.04E-26	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
am241	5.23E-13	2.23E-12	3.87E-12	5.44E-12	6.94E-12	8.39E-12	9.77E-12
am242m	3.78E-17	3.76E-17	3.75E-17	3.73E-17	3.72E-17	3.70E-17	3.69E-17
am242	2.17E-16	4.09E-20	4.07E-20	4.05E-20	4.04E-20	4.02E-20	4.00E-20
am243	2.78E-23	2.79E-23	2.79E-23	2.79E-23	2.79E-23	2.79E-23	2.79E-23
am244	5.61E-31	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
cm242	1.58E-11	4.42E-12	1.22E-12	3.43E-13	1.03E-13	3.69E-14	1.88E-14
cm243	9.21E-23	9.03E-23	8.85E-23	8.67E-23	8.49E-23	8.32E-23	8.16E-23
cm244	3.40E-22	3.33E-22	3.22E-22	3.12E-22	3.02E-22	2.93E-22	2.84E-22
cm245	1.80E-34	1.80E-34	1.80E-34	1.80E-34	1.80E-34	1.80E-34	1.80E-34
cm246	2.77E-35	2.77E-35	2.77E-35	2.77E-35	2.77E-35	2.77E-35	2.77E-35
0 total	1.18E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05
0 total	1.30E+05	1.30E+05	1.30E+05	1.30E+05	1.30E+05	1.30E+05	1.30E+05

1 alpha-n neutron source spectrum as a function of time
(using reaction spectra for uranium dioxide)

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
alpha-n neutron spectra, neutrons/sec/basis
basis = single reactor assembly

boundaries, mev initial 304.4 d 608.8 d 913.1 d 1217.5 d 1521.9 d 1826.3 d

1	6.43E+00 - 2.00E+01	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
2	3.00E+00 - 6.43E+00	2.458E+03	2.458E+03	2.457E+03	2.456E+03	2.456E+03	2.455E+03	2.454E+03
3	1.85E+00 - 3.00E+00	6.963E+03	6.964E+03	6.961E+03	6.959E+03	6.957E+03	6.954E+03	6.952E+03
4	1.40E+00 - 1.85E+00	1.870E+03	1.870E+03	1.870E+03	1.869E+03	1.868E+03	1.868E+03	1.867E+03
5	9.00E-01 - 1.40E+00	1.052E+03	1.052E+03	1.052E+03	1.051E+03	1.051E+03	1.051E+03	1.050E+03
6	4.00E-01 - 9.00E-01	3.056E+02	3.056E+02	3.055E+02	3.054E+02	3.053E+02	3.052E+02	3.051E+02
7	1.00E-01 - 4.00E-01	4.775E+01	4.776E+01	4.774E+01	4.773E+01	4.771E+01	4.770E+01	4.768E+01
8	1.70E-02 - 1.00E-01	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
9	3.00E-03 - 1.70E-02	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
10	5.50E-04 - 3.00E-03	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
11	1.00E-04 - 5.50E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
12	3.00E-05 - 1.00E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
13	1.00E-05 - 3.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
14	3.05E-06 - 1.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
15	1.77E-06 - 3.05E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
16	1.30E-06 - 1.77E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
17	1.13E-06 - 1.30E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
18	1.00E-06 - 1.13E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
19	8.00E-07 - 1.00E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
20	4.00E-07 - 8.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
21	3.25E-07 - 4.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
22	2.25E-07 - 3.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
23	1.00E-07 - 2.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
24	5.00E-08 - 1.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
25	3.00E-08 - 5.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
26	1.00E-08 - 3.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
27	1.00E-11 - 1.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
0		1.270E+04	1.270E+04	1.269E+04	1.269E+04	1.268E+04	1.268E+04	1.268E+04

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spontaneous fission neutron source spectrum as a function of time

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
spontaneous fission neutron spectra, neutrons/sec/basis
basis = single reactor assembly

	boundaries, mev	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1	6.43E+00 - 2.00E+01	2.215E+03	2.214E+03	2.214E+03	2.214E+03	2.214E+03	2.214E+03	2.214E+03
2	3.00E+00 - 6.43E+00	2.465E+04	2.465E+04	2.465E+04	2.465E+04	2.465E+04	2.465E+04	2.465E+04
3	1.85E+00 - 3.00E+00	2.666E+04	2.666E+04	2.665E+04	2.665E+04	2.665E+04	2.665E+04	2.665E+04
4	1.40E+00 - 1.85E+00	1.538E+04	1.539E+04	1.539E+04	1.539E+04	1.539E+04	1.539E+04	1.539E+04
5	9.00E-01 - 1.40E+00	2.107E+04	2.107E+04	2.107E+04	2.107E+04	2.107E+04	2.107E+04	2.107E+04
6	4.00E-01 - 9.00E-01	2.313E+04	2.313E+04	2.312E+04	2.312E+04	2.312E+04	2.312E+04	2.312E+04
7	1.00E-01 - 4.00E-01	4.530E+03	4.528E+03	4.528E+03	4.528E+03	4.528E+03	4.528E+03	4.528E+03
8	1.70E-02 - 1.00E-01	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
9	3.00E-03 - 1.70E-02	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
10	5.50E-04 - 3.00E-03	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
11	1.00E-04 - 5.50E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
12	3.00E-05 - 1.00E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
13	1.00E-05 - 3.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
14	3.05E-06 - 1.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
15	1.77E-06 - 3.05E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
16	1.30E-06 - 1.77E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
17	1.13E-06 - 1.30E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
18	1.00E-06 - 1.13E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
19	8.00E-07 - 1.00E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
20	4.00E-07 - 8.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
21	3.25E-07 - 4.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
22	2.25E-07 - 3.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
23	1.00E-07 - 2.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00

24	5.00E-08 - 1.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
25	3.00E-08 - 5.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
26	1.00E-08 - 3.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
27	1.00E-11 - 1.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
0		1.176E+05	1.176E+05	1.176E+05	1.176E+05	1.176E+05	1.176E+05	1.176E+05

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total (alpha-n plus spon. fission) neutron source spectrum as a function of time
(using reaction spectra for uranium dioxide)

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
neutron spectra, neutrons/sec/basis
basis = single reactor assembly

	boundaries, mev	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1	6.43E+00 - 2.00E+01	2.215E+03	2.214E+03	2.214E+03	2.214E+03	2.214E+03	2.214E+03	2.214E+03
2	3.00E+00 - 6.43E+00	2.711E+04	2.711E+04	2.711E+04	2.711E+04	2.711E+04	2.711E+04	2.711E+04
3	1.85E+00 - 3.00E+00	3.362E+04	3.362E+04	3.362E+04	3.361E+04	3.361E+04	3.361E+04	3.361E+04
4	1.40E+00 - 1.85E+00	1.725E+04	1.726E+04	1.726E+04	1.726E+04	1.726E+04	1.726E+04	1.726E+04
5	9.00E-01 - 1.40E+00	2.212E+04	2.213E+04	2.213E+04	2.213E+04	2.213E+04	2.213E+04	2.213E+04
6	4.00E-01 - 9.00E-01	2.343E+04	2.343E+04	2.343E+04	2.343E+04	2.343E+04	2.343E+04	2.343E+04
7	1.00E-01 - 4.00E-01	4.578E+03	4.576E+03	4.576E+03	4.575E+03	4.575E+03	4.575E+03	4.575E+03
8	1.70E-02 - 1.00E-01	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
9	3.00E-03 - 1.70E-02	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
10	5.50E-04 - 3.00E-03	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
11	1.00E-04 - 5.50E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
12	3.00E-05 - 1.00E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
13	1.00E-05 - 3.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
14	3.05E-06 - 1.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
15	1.77E-06 - 3.05E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
16	1.30E-06 - 1.77E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
17	1.13E-06 - 1.30E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
18	1.00E-06 - 1.13E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
19	8.00E-07 - 1.00E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
20	4.00E-07 - 8.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
21	3.25E-07 - 4.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
22	2.25E-07 - 3.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
23	1.00E-07 - 2.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
24	5.00E-08 - 1.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
25	3.00E-08 - 5.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
26	1.00E-08 - 3.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
27	1.00E-11 - 1.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
0		1.303E+05	1.303E+05	1.303E+05	1.303E+05	1.303E+05	1.303E+05	1.303E+05

1

1 * gamma sources determined *

0case applies the following photon data base
master photon library
in binary mode

0 the sources include photons of nuclides for...

light elements
actinides
fission products

1 gamma source spectrum for gamma lines (sas2)
0 1826.25 day time of the requested nuclides
0
0

energy interval in mev			photons / second	mev / second
1.0000E-02	to	5.0000E-02	3.6132E+11	1.0840E+10
5.0000E-02	to	1.0000E-01	2.2149E+11	1.6612E+10
1.0000E-01	to	2.0000E-01	7.5224E+10	1.1284E+10

2.0000E-01 to	3.0000E-01	2.4711E+10	6.1779E+09
3.0000E-01 to	4.0000E-01	1.0664E+11	3.7325E+10
4.0000E-01 to	6.0000E-01	1.3796E+10	6.8981E+09
6.0000E-01 to	8.0000E-01	1.3357E+11	9.3496E+10
8.0000E-01 to	1.0000E+00	1.7698E+09	1.5928E+09
1.0000E+00 to	1.3300E+00	1.2218E+09	1.4234E+09
1.3300E+00 to	1.6600E+00	3.8588E+08	5.7690E+08
1.6600E+00 to	2.0000E+00	1.3192E+08	2.4142E+08
2.0000E+00 to	2.5000E+00	3.7967E+08	8.5425E+08
2.5000E+00 to	3.0000E+00	2.4432E+06	6.7187E+06
3.0000E+00 to	4.0000E+00	2.8191E+05	9.8669E+05
4.0000E+00 to	5.0000E+00	5.3042E+03	2.3869E+04
5.0000E+00 to	6.5000E+00	2.1242E+03	1.2214E+04
6.5000E+00 to	8.0000E+00	4.1589E+02	3.0152E+03
8.0000E+00 to	1.0000E+01	8.8185E+01	7.9367E+02
totals		9.4065E+11	1.8733E+11

```
0
0
0          total energy from nuclides with spectrum data    =  1.8733E+11
0          total energy from nuclides with no spectrum data =  4.6955E+04
1
0  .results on logical unit no. 71, position  2, for time step  6, subcase 7. (run position 1, case position 2)
   title: sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
0     .terminated logical unit no. 71 with zero flag record.
1  * normal termination of execution *
```

```
1          primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-    module sas2h     will be called
      SAS2H: Far-Field Crit based on B&W 15x15, 3.00wt%, 20gwd/mtu 40% H2O/ 8% UO2
      44group     latticecell
      '
      '  mixtures of tuff infinite slabs:
      arbm-ftuff  2.6344 14 0 0 0 1001 1.055 8016 40.755 11023 0.570 12000 0.354
                              13027 4.434 14000 20.193 19000 1.370 20000 1.439
                              26000 0.494 92235 0.567 92234 0.007 92236 0.136
                              92238 28.593 93237 0.033 1 1.0 538   end
      kr-83      1 0 1-20 538 end
      kr-85      1 0 1-20 538 end
      sr-90      1 0 1-20 538 end
       y-89      1 0 1-20 538 end
      mo-95      1 0 1-20 538 end
      zr-93      1 0 1-20 538 end
      zr-94      1 0 1-20 538 end
      zr-95      1 0 1-20 538 end
      nb-94      1 0 1-20 538 end
      tc-99      1 0 1-20 538 end
      rh-103     1 0 1-20 538 end
      rh-105     1 0 1-20 538 end
      ru-101     1 0 1-20 538 end
      ru-106     1 0 1-20 538 end
      pd-105     1 0 1-20 538 end
      pd-108     1 0 1-20 538 end
      ag-109     1 0 1-20 538 end
      sb-124     1 0 1-20 538 end
      xe-131     1 0 1-20 538 end
      xe-132     1 0 1-20 538 end
      xe-135     1 0 1-20 538 end
      xe-136     1 0 1-20 538 end
      cs-134     1 0 1-20 538 end
      cs-135     1 0 1-20 538 end
      cs-137     1 0 1-20 538 end
      ba-136     1 0 1-20 538 end
      la-139     1 0 1-20 538 end
      pr-141     1 0 1-20 538 end
      pr-143     1 0 1-20 538 end
      ce-144     1 0 1-20 538 end
      nd-143     1 0 1-20 538 end
      nd-145     1 0 1-20 538 end
      pm-147     1 0 1-20 538 end
      pm-148     1 0 1-20 538 end
      nd-147     1 0 1-20 538 end
      sm-147     1 0 1-20 538 end
      sm-149     1 0 1-20 538 end
      sm-150     1 0 1-20 538 end
      sm-151     1 0 1-20 538 end
      sm-152     1 0 1-20 538 end
      gd-155     1 0 1-20 538 end
      eu-153     1 0 1-20 538 end
      eu-154     1 0 1-20 538 end
      eu-155     1 0 1-20 538 end
      arbm-tuff1  1.90533 9 0 0 0 1001 2.326 8016 57.779 11023 0.789 12000 0.490
                              13027 6.130 14000 27.919 19000 1.894 20000 1.989
                              26000 0.683 2 1.0 323.   end
      arbm-tuff2  1.90533 9 0 0 0 1001 2.326 8016 57.779 11023 0.789 12000 0.490
                              13027 6.130 14000 27.919 19000 1.894 20000 1.989
                              26000 0.683 3 1.0 323.   end
```

```
'
'- - - - - - - - - - - - - - - - - - - - - - - - - - - - -
end comp
'
'- - - - - - - - - - - - - - - - - - - - - - - - - - - - -
'
'  fuel-pin-cell geometry:
'
symmslabcell  340.  280. 1 3 281. 2 end
'
'- - - - - - - - - - - - - - - - - - - - - - - - - - - - -
'
'
'  assembly and cycle parameters:
'
npin/assm=1 fuelngth=280. ncycles=1 nlib/cyc=5 volfueltot=1.1494E7
printlevel=6 inplevel=0 end
power=0.004 burn=3.6525e3 down=1.82625e3
   end
```

```
1  ooooooooooo     rrrrrrrrrrrr    iiiiiiiiiiii     ggggggggggg    eeeeeeeeeeeee   nn          nn   sssssssssss
  ooooooooooooo    rrrrrrrrrrrrr   iiiiiiiiiiii    ggggggggggggg   eeeeeeeeeeeee   nnn         nn  sssssssssssss
  oo         oo    rr         rr        ii         gg         gg   ee              nnnn        nn  ss         ss
  oo         oo    rr         rr        ii         gg              ee              nn nn       nn  ss
  oo         oo    rr         rr        ii         gg              ee              nn   nn     nn  ss
  oo         oo    rrrrrrrrrrrrr        ii         gg    ggggggg   eeeeeeeee       nn    nn    nn  ssssssssssss
  oo         oo    rrrrrrrrrrrr         ii         gg    ggggggg   eeeeeeeee       nn     nn   nn   ssssssssssss
  oo         oo    rr       rr          ii         gg         gg   ee              nn      nn  nn             ss
  oo         oo    rr        rr         ii         gg         gg   ee              nn       nn nn             ss
  oo         oo    rr         rr        ii         gg         gg   ee              nn        nnnn  ss         ss
  ooooooooooooo    rr          rr  iiiiiiiiiiii    ggggggggggggg   eeeeeeeeeeeee   nn         nnn  sssssssssssss
   ooooooooooo     rr          rr  iiiiiiiiiiii     ggggggggggg    eeeeeeeeeeeee   nn          nn   sssssssssss
0

  dddddddddddd       aaaaaaaaa     vv          vv  iiiiiiiiiiii     sssssssssss
  ddddddddddddd     aaaaaaaaaaa    vv          vv  iiiiiiiiiiii    sssssssssssss
  dd         dd    aa         aa   vv          vv       ii         ss         ss
  dd         dd    aa         aa   vv          vv       ii         ss
  dd         dd    aa         aa   vv          vv       ii         ss
  dd         dd    aaaaaaaaaaaaa   vv          vv       ii         ssssssssssss
  dd         dd    aaaaaaaaaaaaa    vv        vv        ii          ssssssssssss
  dd         dd    aa         aa      vv     vv         ii                    ss
  dd         dd    aa         aa       vv   vv          ii                    ss
  dd         dd    aa         aa        vv vv           ii         ss         ss
  ddddddddddddd    aa         aa         vvv       iiiiiiiiiiii    sssssssssssss
  dddddddddddd     aa         aa          v        iiiiiiiiiiii     sssssssssss
0

     0000000        88888888888               //    22222222222     88888888888               //    99999999999     666666666666
    000000000      8888888888888             //    2222222222222   8888888888888             //    9999999999999   6666666666666
   00       00     88         88            //     22         22   88         88            //     99         99   66
  00         00    88         88           //                 22   88         88           //      99         99   66
  00         00    88         88          //                  22   88         88          //       99         99   66
  00         00     88888888888          //                 22      88888888888          //        9999999999999   666666666666
  00         00     88888888888         //                22        88888888888         //          999999999999   6666666666666
  00         00    88         88       //               22         88         88       //                     99   66         66
  00         00    88         88      //              22           88         88      //                      99   66         66
   00       00     88         88     //             22             88         88     //                       99   66         66
    000000000      8888888888888    //             2222222222222   8888888888888    //             9999999999999   6666666666666
     0000000        88888888888    //              2222222222222    88888888888    //              999999999999     66666666666
```

```
0
       11      88888888888              0000000     99999999999              44   3333333333
      111     8888888888888            000000000   9999999999999            444  333333333333
     1111     88         88    :::    00       00  99         99    :::    4444  33         33
       11     88         88    :::   00         00 99         99    :::   44 44             33
       11     88         88    :::   00         00 99         99    :::  44  44             33
       11      88888888888           00         00 9999999999999        44   44            333
       11      88888888888           00         00  999999999999       44    44            333
       11     88         88    :::   00         00            99    ::: 44444444444         33
       11     88         88    :::   00         00            99    ::: 444444444444        33
       11     88         88    :::    00       00             99    :::          44  33         33
  11111111    8888888888888            000000000   9999999999999                 44  333333333333
  11111111     88888888888              0000000    999999999999                  44   3333333333
1
0
                               sssssssssss    cccccccccc    aaaaaaaaa   ll          eeeeeeeeeeee
                              sssssssssssss  cccccccccccc  aaaaaaaaaaa  ll          eeeeeeeeeeee
                              ss         ss  cc        cc aa         aa ll          ee
                              ss             cc           aa         aa ll          ee
                              ss             cc           aa         aa ll          ee
                              ssssssssssss   cc           aaaaaaaaaaaaa ll          eeeeeeee
                               ssssssssssss  cc           aaaaaaaaaaaaa ll          eeeeeeee
                                         ss  cc           aa         aa ll          ee
                                         ss  cc           aa         aa ll          ee
                              ss         ss  cc        cc aa         aa ll          ee
                              sssssssssssss  cccccccccccc aa         aa llllllllllll eeeeeeeeeeee
                               sssssssssss    cccccccccc  aa         aa llllllllllll eeeeeeeeeeee
```

```
**********************************************************************************
**********************************************************************************
**********************************************************************************
*****                                                                        *****
*****                  program verification information                      *****
*****                                                                        *****
*****                code system:    scale  version:    4.3                  *****
*****                                                                        *****
**********************************************************************************
**********************************************************************************
*****                                                                        *****
*****                                                                        *****
*****              program:  o0o004                                          *****
*****                                                                        *****
*****        creation date:  03/13/96                                        *****
*****                                                                        *****
*****              library:  /usr1/ornl/Scale/bin                            *****
*****                                                                        *****
*****                                                                        *****
*****            test code:  origens                                         *****
*****                                                                        *****
*****              version:  3.0                                             *****
*****                                                                        *****
*****              jobname:  davis                                           *****
*****                                                                        *****
*****    date of execution:  08/28/96                                        *****
*****                                                                        *****
*****    time of execution:  18:09:43                                        *****
```

```
                        *****                                                                       *****
                        *****                                                                       *****
                        *****************************************************************************
                        *****************************************************************************
                        *****************************************************************************
1
0        -1q array has      1 entries.
0         0q array has      1 entries.
0         0q array has      1 entries.
0         0q array has      1 entries.
0         0q array has      1 entries.
0          dbl. prec. machine word applied has, at least, a 16 significant figure accuracy.
0              short-lived split test fraction, qxn =    9.1188E-04
0              half-norm of matrix used, axn =    7.0000E+00
0              4-place-accuracy-retention ratio, ratio4 =    6.4516E-13
0         1q array has     20 entries.
0         3q array has      1 entries.
0         3q array has      1 entries.
0         3q array has      1 entries.
0         3q array has      1 entries.
0         4q array has      1 entries.
0        54q array has     12 entries.
1library information...

          cross-section data taken from position number  1 of library on unit 33.

          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          *******************************************************************************
          *                                                                             *
          *             prelim lwr origen-s binary working library--id = 1143           *
          *          made from modified card-image origen-s libraries of scale 4.2      *
          *       data from the light element, actinide, and fission product libraries  *
          *         decay data, including gamma and total energy, are from endf/b-vi    *
          *                                                                             *
          *       neutron flux spectrum factors and cross sections were produced from   *
          *      the "presas2" case updating all nuclides on the scale "burnup" library *
          *                                                                             *
          *                    fission product yields are from endf/b-v                 *
          *                                                                             *
          *                 photon libraries use an 18-energy-group structure           *
          *                the photon data are from the master photon data base,        *
          *                 produced to include bremsstrahlung from uo2 matrix          *
          *                                                                             *
          *         see information above this box (if present) for later updates      *
          *                                                                             *
          *******************************************************************************
          *                                                                             *
```

```
0         ********************************************************************************
0                    .other identification and sizes of library.
0                     data set name:  ft33f001
0                 8/28/1996    date library was produced
0                      1697    total number of nuclides in library
                        689    number of light-element nuclides
                        129    number of actinide nuclides
                        879    number of fission product nuclides
0                      7993    number of nonzero off-diagonal matrix elements
0         ********************************************************************************
1
     sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                    light elements         page    1
0                                                  nuclide concentrations, grams
                                                   basis =single reactor assembly
              initial   1E-18 d
     na 23   1.73E+05  1.73E+05
     al 27   1.35E+06  1.35E+06
   total     1.52E+06  1.52E+06
1
     sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                         actinides         page    2
0                                                  nuclide concentrations, grams
                                                   basis =single reactor assembly
              initial   1E-18 d
      u234   2.12E+03  2.12E+03
      u235   1.72E+05  1.72E+05
      u236   4.12E+04  4.12E+04
      u238   8.66E+06  8.66E+06
     np237   9.99E+03  9.99E+03
   total     8.88E+06  8.88E+06
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                                           page    3
         power=     .00mw, burnup=      3.mwd, flux= 3.00E+08n/cm**2-sec
0                                                 basis =
0    (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                  initial          182.6 d          365.3 d          547.9 d          730.5 d          730.5 d
     productions    1.023181E+06    1.023184E+06    1.023188E+06    1.023192E+06    1.023196E+06    1.023196E+06
     absorptions    8.460839E+05    8.460914E+05    8.460971E+05    8.461029E+05    8.461086E+05    8.461086E+05
     k infinity     1.209313E+00    1.209307E+00    1.209303E+00    1.209300E+00    1.209296E+00    1.209296E+00
0                  initial          182.6 d          365.3 d          547.9 d          730.5 d          730.5 d
     actinide
     absorptions    8.423189E+05    8.423211E+05    8.423233E+05    8.423256E+05    8.423276E+05    8.423276E+05
     non-actinide
     abs. fracs.    4.449964E-03    4.456222E-03    4.460275E-03    4.464388E-03    4.468620E-03    4.468620E-03
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                   fission products         page    4
0                                         fraction of total absorption rate
         power=     .00mw, burnup=      3.mwd, flux= 3.00E+08n/cm**2-sec
0                initial   182.6 d   365.3 d   547.9 d   730.5 d   730.5 d

     sm149       .00E+00  3.59E-06  7.24E-06  1.09E-05  1.45E-05  1.45E-05
     xe135       .00E+00  2.28E-06  2.28E-06  2.28E-06  2.28E-06  2.27E-06
     sm151       .00E+00  1.52E-07  3.06E-07  4.58E-07  6.10E-07  6.10E-07
     nd143       .00E+00  6.47E-08  1.38E-07  2.11E-07  2.85E-07  2.85E-07
     gd157       .00E+00  3.73E-08  7.47E-08  1.12E-07  1.49E-07  1.49E-07
     rh103       .00E+00  2.43E-08  5.85E-08  9.31E-08  1.28E-07  1.28E-07
     cd113       .00E+00  3.18E-08  6.36E-08  9.53E-08  1.27E-07  1.27E-07
     pm147       .00E+00  3.12E-08  6.13E-08  8.78E-08  1.11E-07  1.11E-07
     xe131       .00E+00  2.22E-08  4.59E-08  6.97E-08  9.34E-08  9.34E-08
     cs133       .00E+00  1.75E-08  3.59E-08  5.43E-08  7.28E-08  7.28E-08
     tc 99       .00E+00  1.33E-08  2.69E-08  4.04E-08  5.40E-08  5.40E-08
     nd145       .00E+00  1.04E-08  2.08E-08  3.12E-08  4.16E-08  4.16E-08
     eu155       .00E+00  1.14E-08  2.19E-08  3.17E-08  4.08E-08  4.08E-08
```

gd155	.00E+00	1.78E-09	6.93E-09	1.52E-08	2.64E-08	2.64E-08
mo 95	.00E+00	2.64E-09	8.99E-09	1.61E-08	2.34E-08	2.34E-08
sm152	.00E+00	5.54E-09	1.11E-08	1.66E-08	2.22E-08	2.22E-08
kr 83	.00E+00	4.45E-09	8.90E-09	1.34E-08	1.78E-08	1.78E-08
cs135	.00E+00	4.10E-09	8.23E-09	1.24E-08	1.65E-08	1.65E-08
ru101	.00E+00	3.25E-09	6.50E-09	9.74E-09	1.30E-08	1.30E-08
sm147	.00E+00	7.92E-10	3.19E-09	6.98E-09	1.20E-08	1.20E-08
pr141	.00E+00	2.27E-09	5.30E-09	8.34E-09	1.14E-08	1.14E-08
eu153	.00E+00	2.75E-09	5.54E-09	8.32E-09	1.11E-08	1.11E-08
la139	.00E+00	2.48E-09	4.96E-09	7.45E-09	9.93E-09	9.93E-09
rh105	.00E+00	8.28E-09	8.28E-09	8.28E-09	8.28E-09	8.27E-09
pd105	.00E+00	1.05E-09	2.12E-09	3.19E-09	4.25E-09	4.25E-09
zr 93	.00E+00	1.02E-09	2.05E-09	3.08E-09	4.11E-09	4.11E-09
eu151	.00E+00	2.17E-10	8.73E-10	1.96E-09	3.49E-09	3.49E-09
i129	.00E+00	7.29E-10	1.49E-09	2.26E-09	3.03E-09	3.03E-09
pr143	.00E+00	2.66E-09	2.66E-09	2.66E-09	2.66E-09	2.66E-09
mo 97	.00E+00	5.61E-10	1.13E-09	1.69E-09	2.26E-09	2.26E-09
xe133	.00E+00	1.99E-09	1.99E-09	1.99E-09	1.99E-09	1.99E-09
ag109	.00E+00	4.00E-10	8.03E-10	1.20E-09	1.61E-09	1.61E-09
nd144	.00E+00	1.43E-10	5.01E-10	9.97E-10	1.58E-09	1.58E-09
ce141	.00E+00	1.54E-09	1.57E-09	1.57E-09	1.57E-09	1.57E-09
pm149	.00E+00	9.62E-10	9.62E-10	9.62E-10	9.62E-10	9.61E-10
nd147	.00E+00	9.44E-10	9.44E-10	9.44E-10	9.44E-10	9.43E-10
zr 91	.00E+00	1.57E-10	4.10E-10	6.74E-10	9.40E-10	9.40E-10
ru102	.00E+00	2.29E-10	4.58E-10	6.87E-10	9.16E-10	9.16E-10
y 89	.00E+00	1.61E-10	4.07E-10	6.61E-10	9.15E-10	9.15E-10
ce142	.00E+00	2.05E-10	4.11E-10	6.16E-10	8.22E-10	8.22E-10
sr 90	.00E+00	2.08E-10	4.13E-10	6.16E-10	8.16E-10	8.16E-10
nd148	.00E+00	1.99E-10	3.99E-10	5.98E-10	7.98E-10	7.98E-10
nd146	.00E+00	1.66E-10	3.32E-10	4.99E-10	6.65E-10	6.65E-10
ba138	.00E+00	1.42E-10	2.83E-10	4.25E-10	5.66E-10	5.66E-10
pd108	.00E+00	1.37E-10	2.75E-10	4.12E-10	5.50E-10	5.50E-10
in115	.00E+00	1.34E-10	2.72E-10	4.10E-10	5.49E-10	5.49E-10
ce140	.00E+00	1.18E-10	2.50E-10	3.83E-10	5.15E-10	5.15E-10
ce144	.00E+00	2.15E-10	3.53E-10	4.42E-10	4.98E-10	4.98E-10
xe132	.00E+00	1.18E-10	2.39E-10	3.60E-10	4.81E-10	4.81E-10

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 5

0 fraction of total absorption rate

power= .00mw, burnup= 3.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	182.6 d	365.3 d	547.9 d	730.5 d	730.5 d
ru103	.00E+00	3.42E-10	3.56E-10	3.56E-10	3.56E-10	3.56E-10
mo 98	.00E+00	8.46E-11	1.69E-10	2.54E-10	3.38E-10	3.38E-10
mo100	.00E+00	8.09E-11	1.62E-10	2.43E-10	3.24E-10	3.24E-10
pd107	.00E+00	7.96E-11	1.59E-10	2.39E-10	3.19E-10	3.19E-10
xe134	.00E+00	7.85E-11	1.57E-10	2.35E-10	3.14E-10	3.14E-10
zr 92	.00E+00	6.37E-11	1.28E-10	1.91E-10	2.55E-10	2.55E-10
zr 96	.00E+00	5.21E-11	1.04E-10	1.56E-10	2.08E-10	2.08E-10
i127	.00E+00	4.54E-11	9.61E-11	1.48E-10	2.00E-10	2.00E-10
ru104	.00E+00	4.96E-11	9.93E-11	1.49E-10	1.99E-10	1.99E-10
nd150	.00E+00	4.44E-11	8.88E-11	1.33E-10	1.78E-10	1.78E-10
cs137	.00E+00	4.35E-11	8.65E-11	1.29E-10	1.71E-10	1.71E-10
xe136	.00E+00	4.25E-11	8.49E-11	1.27E-10	1.70E-10	1.70E-10
zr 95	.00E+00	1.45E-10	1.65E-10	1.67E-10	1.68E-10	1.68E-10
nb 95	.00E+00	1.12E-10	1.47E-10	1.52E-10	1.53E-10	1.53E-10
y 91	.00E+00	1.25E-10	1.40E-10	1.41E-10	1.42E-10	1.42E-10
br 81	.00E+00	3.23E-11	6.46E-11	9.69E-11	1.29E-10	1.29E-10
zr 94	.00E+00	2.75E-11	5.51E-11	8.27E-11	1.10E-10	1.10E-10
ba137	.00E+00	6.96E-12	2.74E-11	6.12E-11	1.08E-10	1.08E-10
pm151	.00E+00	1.09E-10	1.09E-10	1.09E-10	1.09E-10	1.08E-10

rb 85	.00E+00	2.48E-11	4.98E-11	7.51E-11	1.01E-10	1.01E-10
cd111	.00E+00	1.95E-11	4.02E-11	6.09E-11	8.16E-11	8.16E-11
te130	.00E+00	1.92E-11	3.85E-11	5.77E-11	7.69E-11	7.69E-11
sm154	.00E+00	1.88E-11	3.75E-11	5.63E-11	7.50E-11	7.50E-11
rb 87	.00E+00	1.82E-11	3.65E-11	5.47E-11	7.29E-11	7.29E-11
kr 85	.00E+00	1.81E-11	3.56E-11	5.26E-11	6.90E-11	6.90E-11
se 77	.00E+00	1.26E-11	2.53E-11	3.80E-11	5.07E-11	5.08E-11
ba140	.00E+00	4.72E-11	4.72E-11	4.72E-11	4.72E-11	4.71E-11
sm153	.00E+00	3.79E-11	3.79E-11	3.79E-11	3.79E-11	3.76E-11
kr 84	.00E+00	8.70E-12	1.74E-11	2.61E-11	3.48E-11	3.48E-11
eu156	.00E+00	3.38E-11	3.38E-11	3.38E-11	3.38E-11	3.38E-11
sm150	.00E+00	2.05E-12	7.95E-12	1.77E-11	3.13E-11	3.13E-11
sr 89	.00E+00	2.79E-11	3.02E-11	3.04E-11	3.04E-11	3.04E-11
se 79	.00E+00	6.52E-12	1.30E-11	1.96E-11	2.61E-11	2.61E-11
sb121	.00E+00	6.26E-12	1.26E-11	1.89E-11	2.52E-11	2.52E-11
sb123	.00E+00	4.82E-12	9.84E-12	1.50E-11	2.01E-11	2.01E-11
ru106	.00E+00	7.45E-12	1.27E-11	1.65E-11	1.92E-11	1.92E-11
kr 86	.00E+00	4.73E-12	9.47E-12	1.42E-11	1.89E-11	1.89E-11
ce143	.00E+00	1.74E-11	1.74E-11	1.74E-11	1.74E-11	1.73E-11
te128	.00E+00	4.26E-12	8.53E-12	1.28E-11	1.71E-11	1.71E-11
pd106	.00E+00	1.42E-12	5.11E-12	1.04E-11	1.69E-11	1.69E-11
kr 87	.00E+00	2.26E-11	2.26E-11	2.26E-11	2.26E-11	1.56E-11
la140	.00E+00	1.54E-11	1.54E-11	1.54E-11	1.54E-11	1.54E-11
gd156	.00E+00	2.96E-12	6.33E-12	9.71E-12	1.31E-11	1.31E-11
mo 99	.00E+00	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.31E-11
se 80	.00E+00	3.05E-12	6.10E-12	9.15E-12	1.22E-11	1.22E-11
dy161	.00E+00	2.55E-12	5.25E-12	7.95E-12	1.06E-11	1.06E-11
tb159	.00E+00	1.81E-12	3.64E-12	5.47E-12	7.29E-12	7.29E-12
te127m	.00E+00	4.91E-12	6.53E-12	7.03E-12	7.19E-12	7.19E-12
cd112	.00E+00	1.72E-12	3.46E-12	5.20E-12	6.94E-12	6.94E-12

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 6

0 fraction of total absorption rate

power= .00mw, burnup= 3.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	182.6 d	365.3 d	547.9 d	730.5 d	730.5 d
li 6	.00E+00	1.73E-12	3.46E-12	5.19E-12	6.92E-12	6.92E-12
i131	.00E+00	6.77E-12	6.77E-12	6.77E-12	6.77E-12	6.76E-12
sb125	.00E+00	1.75E-12	3.32E-12	4.71E-12	5.94E-12	5.94E-12
sn117	.00E+00	1.38E-12	2.75E-12	4.13E-12	5.51E-12	5.51E-12
sn119	.00E+00	1.12E-12	2.25E-12	3.38E-12	4.50E-12	4.50E-12
sn115	.00E+00	1.01E-12	2.04E-12	3.07E-12	4.10E-12	4.10E-12
pm148m	.00E+00	7.65E-13	1.84E-12	2.81E-12	3.66E-12	3.65E-12
sr 88	.00E+00	8.71E-13	1.74E-12	2.61E-12	3.49E-12	3.49E-12
pd110	.00E+00	6.31E-13	1.26E-12	1.89E-12	2.53E-12	2.53E-12
cd114	.00E+00	6.16E-13	1.23E-12	1.85E-12	2.47E-12	2.47E-12
zr 90	.00E+00	1.51E-13	6.08E-13	1.37E-12	2.42E-12	2.42E-12
se 82	.00E+00	5.91E-13	1.18E-12	1.77E-12	2.36E-12	2.36E-12
gd158	.00E+00	5.70E-13	1.14E-12	1.71E-12	2.29E-12	2.29E-12
te125	.00E+00	1.40E-13	5.73E-13	1.27E-12	2.21E-12	2.21E-12
sn126	.00E+00	4.71E-13	9.42E-13	1.41E-12	1.88E-12	1.88E-12
se 78	.00E+00	4.51E-13	9.03E-13	1.35E-12	1.81E-12	1.81E-12
te129m	.00E+00	1.74E-12	1.78E-12	1.78E-12	1.78E-12	1.78E-12
sn124	.00E+00	3.68E-13	7.37E-13	1.11E-12	1.47E-12	1.47E-12
eu154	.00E+00	2.88E-13	6.21E-13	9.97E-13	1.42E-12	1.42E-12
dy162	.00E+00	3.49E-13	6.97E-13	1.05E-12	1.40E-12	1.40E-12
dy164	.00E+00	3.12E-13	6.23E-13	9.36E-13	1.25E-12	1.25E-12
as 75	.00E+00	2.69E-13	5.39E-13	8.08E-13	1.08E-12	1.08E-12
y 90	.00E+00	1.97E-13	3.92E-13	5.85E-13	7.75E-13	7.75E-13
sn118	.00E+00	1.51E-13	3.03E-13	4.54E-13	6.05E-13	6.05E-13
ba136	.00E+00	1.29E-13	2.73E-13	4.17E-13	5.61E-13	5.61E-13

cd116	.00E+00	1.28E-13	2.55E-13	3.83E-13	5.10E-13	5.10E-13
sn122	.00E+00	1.25E-13	2.49E-13	3.74E-13	4.98E-13	4.98E-13
sn120	.00E+00	9.38E-14	1.88E-13	2.81E-13	3.75E-13	3.75E-13
cs134	.00E+00	8.05E-14	1.70E-13	2.67E-13	3.70E-13	3.70E-13
ag111	.00E+00	3.20E-13	3.20E-13	3.20E-13	3.20E-13	3.20E-13
kr 82	.00E+00	7.71E-14	1.55E-13	2.33E-13	3.11E-13	3.11E-13
dy163	.00E+00	7.67E-14	1.53E-13	2.30E-13	3.07E-13	3.07E-13
ru 99	.00E+00	6.90E-14	1.43E-13	2.21E-13	3.02E-13	3.02E-13
ge 73	.00E+00	7.27E-14	1.46E-13	2.18E-13	2.91E-13	2.91E-13
eu157	.00E+00	2.95E-13	2.95E-13	2.95E-13	2.95E-13	2.89E-13
cd115m	.00E+00	2.22E-13	2.35E-13	2.35E-13	2.35E-13	2.35E-13
xe130	.00E+00	4.74E-14	9.51E-14	1.43E-13	1.90E-13	1.90E-13
pm148	.00E+00	4.32E-14	8.57E-14	1.23E-13	1.56E-13	1.55E-13
mo 96	.00E+00	3.39E-14	6.81E-14	1.02E-13	1.37E-13	1.37E-13
ge 76	.00E+00	2.66E-14	5.33E-14	7.99E-14	1.07E-13	1.07E-13
gd160	.00E+00	1.69E-14	3.38E-14	5.06E-14	6.75E-14	6.75E-14
cs136	.00E+00	5.59E-14	5.59E-14	5.59E-14	5.59E-14	5.58E-14
te126	.00E+00	1.24E-14	2.53E-14	3.82E-14	5.12E-14	5.12E-14
in113	.00E+00	2.47E-15	9.79E-15	2.19E-14	3.86E-14	3.86E-14
eu152	.00E+00	1.29E-15	5.50E-15	1.55E-14	3.40E-14	3.40E-14
ru100	.00E+00	6.77E-15	1.41E-14	2.21E-14	3.07E-14	3.07E-14
sn125	.00E+00	2.94E-14	2.94E-14	2.94E-14	2.94E-14	2.93E-14
ru105	.00E+00	3.00E-14	3.00E-14	3.00E-14	3.00E-14	2.77E-14
ho165	.00E+00	5.26E-15	1.05E-14	1.58E-14	2.11E-14	2.11E-14

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 7

0 fraction of total absorption rate

power= .00mw, burnup= 3.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	182.6 d	365.3 d	547.9 d	730.5 d	730.5 d
sr 87	.00E+00	3.04E-15	6.08E-15	9.12E-15	1.22E-14	1.22E-14
rb 88	.00E+00	1.27E-14	1.27E-14	1.27E-14	1.27E-14	1.15E-14
te124	.00E+00	1.86E-15	4.78E-15	7.83E-15	1.09E-14	1.09E-14
sn123	.00E+00	6.46E-15	8.88E-15	9.79E-15	1.01E-14	1.01E-14
te132	.00E+00	9.49E-15	9.49E-15	9.49E-15	9.49E-15	9.44E-15
i135	.00E+00	1.00E-14	1.00E-14	1.00E-14	1.00E-14	9.31E-15
nb 94	.00E+00	1.75E-15	3.51E-15	5.26E-15	7.01E-15	7.01E-15
sm148	.00E+00	3.49E-16	1.60E-15	3.74E-15	6.71E-15	6.71E-15
ge 74	.00E+00	1.47E-15	2.93E-15	4.40E-15	5.86E-15	5.86E-15
ba135	.00E+00	4.99E-16	1.33E-15	2.49E-15	3.98E-15	3.98E-15
ge 72	.00E+00	9.64E-16	1.95E-15	2.93E-15	3.91E-15	3.91E-15
gd154	.00E+00	1.88E-16	7.86E-16	1.85E-15	3.45E-15	3.45E-15
sr 86	.00E+00	7.33E-16	1.59E-15	2.45E-15	3.31E-15	3.31E-15
nd142	.00E+00	1.98E-16	7.89E-16	1.80E-15	3.23E-15	3.23E-15
sb126	.00E+00	2.99E-15	2.99E-15	2.99E-15	2.99E-15	2.98E-15
te134	.00E+00	5.77E-15	5.77E-15	5.77E-15	5.77E-15	2.87E-15
se 76	.00E+00	5.64E-16	1.13E-15	1.70E-15	2.27E-15	2.27E-15
ba134	.00E+00	1.20E-16	4.95E-16	1.15E-15	2.11E-15	2.11E-15
sb124	.00E+00	1.84E-15	2.07E-15	2.10E-15	2.10E-15	2.10E-15
in117m	.00E+00	2.07E-15	2.07E-15	2.07E-15	2.07E-15	2.03E-15
pd104	.00E+00	8.36E-17	4.28E-16	1.06E-15	1.97E-15	1.97E-15
gd152	.00E+00	9.86E-17	3.46E-16	8.94E-16	1.89E-15	1.89E-15
i130	.00E+00	7.11E-16	7.12E-16	7.12E-16	7.13E-16	6.88E-16
cd110	.00E+00	6.76E-17	1.95E-16	3.74E-16	5.98E-16	5.98E-16
in117	.00E+00	6.07E-16	6.07E-16	6.07E-16	6.07E-16	5.96E-16
xe128	.00E+00	1.37E-16	2.75E-16	4.15E-16	5.56E-16	5.56E-16
er166	.00E+00	1.32E-16	2.68E-16	4.05E-16	5.42E-16	5.42E-16
dy160	.00E+00	6.00E-17	1.65E-16	2.81E-16	3.99E-16	3.99E-16
tb160	.00E+00	2.46E-16	2.93E-16	3.06E-16	3.12E-16	3.12E-16
rb 86	.00E+00	2.39E-16	2.40E-16	2.40E-16	2.40E-16	2.40E-16
br 79	.00E+00	1.59E-17	5.87E-17	1.28E-16	2.25E-16	2.25E-16

dy165	.00E+00	2.08E-16	2.09E-16	2.09E-16	2.09E-16	1.74E-16
kr 80	.00E+00	4.11E-17	8.23E-17	1.24E-16	1.65E-16	1.65E-16
xe129	.00E+00	7.46E-18	3.00E-17	6.77E-17	1.21E-16	1.21E-16
ag107	.00E+00	7.08E-18	2.83E-17	6.37E-17	1.13E-16	1.13E-16
cd118	.00E+00	1.19E-16	1.19E-16	1.19E-16	1.19E-16	6.67E-17
ge 75	.00E+00	8.51E-17	8.51E-17	8.51E-17	8.51E-17	6.16E-17
te122	.00E+00	5.41E-18	1.12E-17	1.72E-17	2.35E-17	2.35E-17
nb 93	.00E+00	1.96E-18	5.07E-18	1.04E-17	1.91E-17	1.91E-17
be 9	.00E+00	3.42E-18	6.84E-18	1.03E-17	1.37E-17	1.37E-17
pr142	.00E+00	3.17E-18	6.63E-18	1.01E-17	1.36E-17	1.32E-17
sn116	.00E+00	1.82E-18	4.23E-18	7.25E-18	1.09E-17	1.09E-17
te123	.00E+00	1.55E-18	4.03E-18	6.83E-18	9.73E-18	9.74E-18
in119m	.00E+00	2.97E-17	2.97E-17	2.97E-17	2.97E-17	6.93E-18
li 7	.00E+00	1.33E-18	2.66E-18	4.00E-18	5.33E-18	5.33E-18
er167	.00E+00	5.36E-19	1.07E-18	1.62E-18	2.17E-18	2.17E-18
cd109	.00E+00	4.32E-20	7.65E-20	1.03E-19	1.23E-19	1.23E-19
cd108	.00E+00	2.66E-20	5.32E-20	8.32E-20	1.10E-19	1.10E-19
cs134m	.00E+00	2.33E-20	4.99E-20	7.65E-20	1.03E-19	8.65E-20

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 8

0 fraction of total absorption rate

power= .00mw, burnup= 3.mwd, flux= 3.00E+08n/cm**2-sec

	initial	182.6 d	365.3 d	547.9 d	730.5 d	730.5 d
in119	.00E+00	2.32E-18	2.32E-18	2.32E-18	2.32E-18	2.66E-20

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 9

power= 4.000E-03mw, burnup=2.9220E+00mwd, flux= 3.00E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	182.6 d	365.3 d	547.9 d	730.5 d	730.5 d
h 1	.00E+00	4.40E-08	8.81E-08	1.32E-07	1.76E-07	1.76E-07
h 2	.00E+00	1.31E-10	2.61E-10	3.92E-10	5.22E-10	5.22E-10
h 3	.00E+00	9.44E-13	1.86E-12	2.76E-12	3.62E-12	3.62E-12
h 4	.00E+00	3.82E-36	7.53E-36	1.11E-35	1.47E-35	.00E+00
he 3	.00E+00	1.33E-14	5.28E-14	1.18E-13	2.08E-13	2.08E-13
he 4	.00E+00	7.28E-09	1.46E-08	2.18E-08	2.91E-08	2.91E-08
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	.00E+00	8.74E-10	1.75E-09	2.62E-09	3.50E-09	3.50E-09
ne 21	.00E+00	1.58E-17	6.33E-17	1.43E-16	2.54E-16	2.54E-16
ne 22	.00E+00	3.64E-13	1.40E-12	3.01E-12	5.14E-12	5.14E-12
ne 23	.00E+00	7.28E-15	7.28E-15	7.28E-15	7.28E-15	7.28E-30
na 22	.00E+00	5.35E-12	1.00E-11	1.41E-11	1.77E-11	1.77E-11
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	.00E+00	3.64E-08	3.64E-08	3.64E-08	3.64E-08	3.52E-08
na 24m	.00E+00	5.99E-15	5.99E-15	5.99E-15	5.99E-15	5.99E-30
na 25	.00E+00	2.88E-29	5.78E-29	8.68E-29	1.16E-28	2.08E-41
mg 24	.00E+00	7.55E-06	1.51E-05	2.27E-05	3.03E-05	3.03E-05
mg 25	.00E+00	9.59E-13	1.92E-12	2.89E-12	3.86E-12	3.86E-12
mg 26	.00E+00	1.31E-10	2.61E-10	3.92E-10	5.22E-10	5.22E-10
mg 27	.00E+00	2.18E-12	2.18E-12	2.18E-12	2.18E-12	9.98E-14
mg 28	.00E+00	4.41E-24	4.41E-24	4.41E-24	4.41E-24	4.31E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	.00E+00	2.70E-10	2.70E-10	2.70E-10	2.70E-10	6.00E-16
al 29	.00E+00	3.80E-30	1.52E-29	3.42E-29	6.08E-29	7.17E-31
al 30	.00E+00	3.64E-44	2.76E-43	9.39E-43	2.23E-42	.00E+00
si 28	.00E+00	2.20E-05	4.40E-05	6.59E-05	8.79E-05	8.79E-05
si 29	.00E+00	1.41E-14	5.64E-14	1.27E-13	2.26E-13	2.26E-13
si 30	.00E+00	9.70E-24	7.76E-23	2.62E-22	6.21E-22	6.21E-22
si 31	.00E+00	6.95E-36	5.56E-35	1.88E-34	4.45E-34	3.69E-34
si 32	.00E+00	5.61E-45	9.81E-44	4.97E-43	1.57E-42	1.57E-42

totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0	flux		3.00E+08	3.00E+08	3.00E+08	3.00E+08	3.00E-07

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 10

power= 4.000E-03mw, burnup=2.9220E+00mwd, flux= 3.00E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	182.6 d	365.3 d	547.9 d	730.5 d	730.5 d
he 4	.00E+00	2.56E-05	5.15E-05	7.79E-05	1.05E-04	1.05E-04
ra222	.00E+00	1.97E-30	8.37E-30	1.88E-29	3.27E-29	3.30E-29
ra223	.00E+00	2.03E-15	9.33E-15	2.20E-14	3.98E-14	3.98E-14
ra224	.00E+00	8.13E-17	5.62E-16	1.72E-15	3.75E-15	3.75E-15
ra225	.00E+00	2.54E-17	1.24E-16	2.99E-16	5.50E-16	5.50E-16
ra226	.00E+00	2.94E-11	1.17E-10	2.64E-10	4.70E-10	4.70E-10
ra228	.00E+00	3.12E-17	1.22E-16	2.70E-16	4.71E-16	4.71E-16
th226	.00E+00	9.63E-29	4.09E-28	9.16E-28	1.60E-27	1.60E-27
th227	.00E+00	3.26E-15	1.50E-14	3.54E-14	6.42E-14	6.42E-14
th228	.00E+00	1.55E-14	1.07E-13	3.28E-13	7.15E-13	7.15E-13
th229	.00E+00	4.93E-12	2.41E-11	5.80E-11	1.07E-10	1.07E-10
th230	.00E+00	1.28E-05	2.55E-05	3.83E-05	5.11E-05	5.11E-05
th231	.00E+00	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	.00E+00	2.58E-06	5.16E-06	7.74E-06	1.03E-05	1.03E-05
th233	.00E+00	2.39E-17	4.78E-17	7.17E-17	9.57E-17	2.59E-17
th234	.00E+00	5.34E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	.00E+00	3.57E-07	7.16E-07	1.08E-06	1.44E-06	1.44E-06
pa232	.00E+00	6.13E-15	1.23E-14	1.85E-14	2.47E-14	2.43E-14
pa233	.00E+00	1.44E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06
pa234m	.00E+00	1.80E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11
pa234	.00E+00	8.05E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	.00E+00	9.34E-26	3.96E-25	8.88E-25	1.55E-24	1.55E-24
u231	.00E+00	4.28E-21	9.70E-21	1.51E-20	2.06E-20	2.05E-20
u232	.00E+00	9.25E-12	3.39E-11	7.21E-11	1.22E-10	1.22E-10
u233	.00E+00	5.38E-06	1.22E-05	1.90E-05	2.59E-05	2.59E-05
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	.00E+00	3.24E-06	3.24E-06	3.24E-06	3.24E-06	3.23E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	.00E+00	3.29E-07	3.29E-07	3.29E-07	3.29E-07	9.48E-08
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	.00E+00	2.48E-12	4.29E-12	5.60E-12	6.55E-12	6.55E-12
np236m	.00E+00	2.16E-12	2.16E-12	2.16E-12	2.16E-12	2.11E-12
np236	.00E+00	1.02E-10	2.05E-10	3.07E-10	4.10E-10	4.10E-10
np237	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01
np238	.00E+00	1.58E-06	1.58E-06	1.58E-06	1.58E-06	1.56E-06
np239	.00E+00	4.75E-05	4.75E-05	4.75E-05	4.75E-05	4.73E-05
np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np240	.00E+00	9.74E-15	9.74E-15	9.74E-15	9.74E-15	6.08E-15
np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu236	.00E+00	1.31E-10	2.48E-10	3.52E-10	4.44E-10	4.44E-10
pu237	.00E+00	6.41E-16	1.60E-15	2.57E-15	3.54E-15	3.54E-15
pu238	.00E+00	9.27E-05	1.87E-04	2.80E-04	3.73E-04	3.73E-04
pu239	.00E+00	2.55E-03	5.15E-03	7.75E-03	1.03E-02	1.04E-02
pu240	.00E+00	6.28E-09	2.54E-08	5.72E-08	1.02E-07	1.02E-07
pu241	.00E+00	2.14E-14	1.71E-13	5.77E-13	1.36E-12	1.36E-12
pu242	.00E+00	2.09E-20	3.35E-19	1.70E-18	5.36E-18	5.36E-18

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 11

```
      power= 4.000E-03mw, burnup=2.9220E+00mwd, flux= 3.00E+08n/cm**2-sec
0                                         nuclide concentrations, gram atoms
                                          basis = single reactor assembly
                charge    182.6 d   365.3 d   547.9 d   730.5 d   730.5 d
     pu243     .00E+00   4.59E-29  7.36E-28  3.73E-27  1.18E-26  1.07E-26
     pu244     .00E+00    .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
     pu245     .00E+00    .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
     pu246     .00E+00    .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
   totals     3.73E+04   3.73E+04  3.73E+04  3.73E+04  3.73E+04  3.73E+04
0    flux                3.00E+08  3.00E+08  3.00E+08  3.00E+08  3.00E-07
0        1q array has      20 entries.
0        3q array has       1 entries.
0        3q array has       1 entries.
0        3q array has       1 entries.
0        4q array has       1 entries.
0       54q array has      12 entries.
1library information...

         cross-section data taken from position number  2 of library on unit 33.

         pass   1
         pass   0
         *scale-system control module sas2 library*
         used a time-dependent neutron spectrum, for each of the above passes
           pass 0 applies start-up fuel densiities
           pass n applies mid time densities of nth library interval
         first library updated was...
         pass   1
         pass   0
         *scale-system control module sas2 library*
         used a time-dependent neutron spectrum, for each of the above passes
           pass 0 applies start-up fuel densiities
           pass n applies mid time densities of nth library interval
         first library updated was...
         ****************************************************************************
         *                                                                          *
         *         prelim lwr origen-s binary working library--id = 1143            *
         *        made from modified card-image origen-s libraries of scale 4.2     *
         *     data from the light element, actinide, and fission product libraries *
         *      decay data, including gamma and total energy, are from endf/b-vi    *
         *                                                                          *
         *     neutron flux spectrum factors and cross sections were produced from  *
         *    the "presas2" case updating all nuclides on the scale "burnup" library *
         *                                                                          *
         *                 fission product yields are from endf/b-v                 *
         *                                                                          *
         *             photon libraries use an 18-energy-group structure            *
         *            the photon data are from the master photon data base,         *
         *             produced to include bremsstrahlung from uo2 matrix           *
         *                                                                          *
         *       see information above this box (if present) for later updates     *
         *                                                                          *
         ****************************************************************************
         *                                                                          *
0        ****************************************************************************
0               .other identification and sizes of library.
0                data set name:  ft33f001
0            8/28/1996   date library was produced
0                 1697   total number of nuclides in library
                   689   number of light-element nuclides
```

```
                    129    number of actinide nuclides
                    879    number of fission product nuclides
0                  7993    number of nonzero off-diagonal matrix elements
0          ***********************************************************************************
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                              page   12
         power=    .00mw, burnup=      6.mwd, flux= 2.81E+08n/cm**2-sec
0                                          basis =
0    (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                      initial         913.2 d       1095.8 d       1278.4 d       1461.0 d       1461.1 d
     productions    1.090712E+06   1.090715E+06   1.090719E+06   1.090723E+06   1.090727E+06   1.090727E+06
     absorptions    8.934652E+05   8.934711E+05   8.934772E+05   8.934830E+05   8.934893E+05   8.934893E+05
     k infinity     1.220765E+00   1.220762E+00   1.220758E+00   1.220754E+00   1.220750E+00   1.220750E+00
0                      initial         913.2 d       1095.8 d       1278.4 d       1461.0 d       1461.1 d
     actinide
     absorptions    8.900642E+05   8.900665E+05   8.900688E+05   8.900710E+05   8.900733E+05   8.900733E+05
     non-actinide
     abs. fracs.    3.806531E-03   3.810465E-03   3.814757E-03   3.818750E-03   3.823161E-03   3.823161E-03
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2          fission products       page   13
0                                 fraction of total absorption rate
         power=    .00mw, burnup=      6.mwd, flux= 2.81E+08n/cm**2-sec
0                 initial   913.2 d  1095.8 d  1278.4 d  1461.0 d  1461.1 d

     sm149      1.47E-05  1.84E-05  2.21E-05  2.58E-05  2.95E-05  2.95E-05
     xe135      2.31E-06  2.31E-06  2.31E-06  2.31E-06  2.31E-06  2.29E-06
     sm151      6.18E-07  7.72E-07  9.25E-07  1.08E-06  1.23E-06  1.23E-06
     nd143      2.88E-07  3.62E-07  4.36E-07  5.10E-07  5.85E-07  5.85E-07
     gd157      1.51E-07  1.89E-07  2.27E-07  2.64E-07  3.02E-07  3.02E-07
     rh103      1.27E-07  1.62E-07  1.96E-07  2.31E-07  2.65E-07  2.65E-07
     cd113      1.29E-07  1.61E-07  1.93E-07  2.25E-07  2.57E-07  2.57E-07
     xe131      9.27E-08  1.16E-07  1.40E-07  1.63E-07  1.87E-07  1.87E-07
     pm147      1.10E-07  1.30E-07  1.48E-07  1.63E-07  1.77E-07  1.77E-07
     cs133      7.22E-08  9.04E-08  1.09E-07  1.27E-07  1.45E-07  1.45E-07
     tc 99      5.35E-08  6.69E-08  8.04E-08  9.38E-08  1.07E-07  1.07E-07
     gd155      2.68E-08  4.10E-08  5.76E-08  7.67E-08  9.79E-08  9.79E-08
     nd145      4.16E-08  5.20E-08  6.24E-08  7.28E-08  8.32E-08  8.32E-08
     eu155      4.07E-08  4.92E-08  5.70E-08  6.42E-08  7.09E-08  7.09E-08
     mo 95      2.32E-08  3.04E-08  3.77E-08  4.49E-08  5.21E-08  5.21E-08
     sm152      2.20E-08  2.75E-08  3.30E-08  3.85E-08  4.40E-08  4.40E-08
     sm147      1.19E-08  1.80E-08  2.49E-08  3.28E-08  4.13E-08  4.13E-08
     kr 83      1.80E-08  2.25E-08  2.70E-08  3.15E-08  3.60E-08  3.60E-08
     cs135      1.64E-08  2.05E-08  2.46E-08  2.87E-08  3.28E-08  3.28E-08
     ru101      1.28E-08  1.60E-08  1.92E-08  2.24E-08  2.56E-08  2.56E-08
     pr141      1.15E-08  1.45E-08  1.76E-08  2.06E-08  2.37E-08  2.37E-08
     eu153      1.11E-08  1.39E-08  1.67E-08  1.94E-08  2.22E-08  2.22E-08
     la139      1.00E-08  1.25E-08  1.50E-08  1.75E-08  2.00E-08  2.00E-08
     eu151      3.53E-09  5.51E-09  7.93E-09  1.08E-08  1.41E-08  1.41E-08
     pd105      4.24E-09  5.30E-09  6.36E-09  7.42E-09  8.48E-09  8.48E-09
     rh105      8.35E-09  8.33E-09  8.33E-09  8.33E-09  8.33E-09  8.32E-09
     zr 93      4.07E-09  5.09E-09  6.11E-09  7.13E-09  8.15E-09  8.15E-09
      i129      3.06E-09  3.84E-09  4.61E-09  5.39E-09  6.16E-09  6.16E-09
     mo 97      2.27E-09  2.83E-09  3.40E-09  3.97E-09  4.54E-09  4.54E-09
     nd144      1.60E-09  2.25E-09  2.93E-09  3.64E-09  4.36E-09  4.36E-09
     ag109      1.59E-09  1.99E-09  2.39E-09  2.78E-09  3.18E-09  3.18E-09
     pr143      2.67E-09  2.67E-09  2.67E-09  2.67E-09  2.67E-09  2.67E-09
     zr 91      9.46E-10  1.21E-09  1.48E-09  1.75E-09  2.02E-09  2.02E-09
     xe133      2.01E-09  2.01E-09  2.01E-09  2.01E-09  2.01E-09  2.01E-09
      y 89      9.23E-10  1.18E-09  1.44E-09  1.69E-09  1.95E-09  1.95E-09
     ru102      9.24E-10  1.15E-09  1.39E-09  1.62E-09  1.85E-09  1.85E-09
     ce142      8.31E-10  1.04E-09  1.25E-09  1.46E-09  1.66E-09  1.66E-09
     sr 90      8.24E-10  1.02E-09  1.22E-09  1.42E-09  1.61E-09  1.61E-09
```

nd148	8.01E-10	1.00E-09	1.20E-09	1.40E-09	1.60E-09	1.60E-09
ce141	1.59E-09	1.59E-09	1.59E-09	1.59E-09	1.59E-09	1.59E-09
nd146	6.71E-10	8.39E-10	1.01E-09	1.17E-09	1.34E-09	1.34E-09
ba138	5.73E-10	7.16E-10	8.60E-10	1.00E-09	1.15E-09	1.15E+09
in115	5.49E-10	6.88E-10	8.26E-10	9.64E-10	1.10E-09	1.10E-09
pd108	5.43E-10	6.78E-10	8.13E-10	9.48E-10	1.08E-09	1.08E-09
ce140	5.22E-10	6.56E-10	7.90E-10	9.24E-10	1.06E-09	1.06E-09
pm149	9.74E-10	9.75E-10	9.74E-10	9.74E-10	9.74E-10	9.71E-10
xe132	4.80E-10	6.00E-10	7.21E-10	8.42E-10	9.63E-10	9.63E-10
nd147	9.35E-10	9.36E-10	9.36E-10	9.36E-10	9.36E-10	9.34E-10
mo 98	3.34E-10	4.18E-10	5.02E-10	5.85E-10	6.69E-10	6.69E-10

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 14

0 fraction of total absorption rate

power= .00mw, burnup= 6.mwd, flux= 2.81E+08n/cm**2-sec

0	initial	913.2 d	1095.8 d	1278.4 d	1461.0 d	1461.1 d
mo100	3.23E-10	4.03E-10	4.84E-10	5.65E-10	6.45E-10	6.45E-10
pd107	3.20E-10	4.00E-10	4.80E-10	5.59E-10	6.39E-10	6.39E-10
xe134	3.17E-10	3.96E-10	4.75E-10	5.54E-10	6.34E-10	6.34E-10
ce144	5.00E-10	5.37E-10	5.61E-10	5.76E-10	5.85E-10	5.85E-10
zr 92	2.57E-10	3.22E-10	3.86E-10	4.51E-10	5.15E-10	5.15E-10
ba137	1.09E-10	1.70E-10	2.44E-10	3.30E-10	4.30E-10	4.30E-10
i127	1.99E-10	2.52E-10	3.04E-10	3.56E-10	4.08E-10	4.08E-10
zr 96	2.04E-10	2.55E-10	3.06E-10	3.57E-10	4.08E-10	4.08E-10
ru104	1.98E-10	2.48E-10	2.97E-10	3.47E-10	3.96E-10	3.96E-10
ru103	3.57E-10	3.57E-10	3.57E-10	3.57E-10	3.57E-10	3.57E-10
nd150	1.78E-10	2.22E-10	2.66E-10	3.11E-10	3.55E-10	3.55E-10
xe136	1.71E-10	2.14E-10	2.57E-10	3.00E-10	3.43E-10	3.43E-10
cs137	1.71E-10	2.12E-10	2.53E-10	2.94E-10	3.34E-10	3.34E-10
br 81	1.29E-10	1.61E-10	1.93E-10	2.26E-10	2.58E-10	2.58E-10
zr 94	1.09E-10	1.37E-10	1.64E-10	1.91E-10	2.19E-10	2.19E-10
rb 85	1.01E-10	1.26E-10	1.52E-10	1.78E-10	2.04E-10	2.04E-10
zr 95	1.66E-10	1.66E-10	1.66E-10	1.66E-10	1.66E-10	1.66E-10
cd111	8.24E-11	1.03E-10	1.24E-10	1.45E-10	1.66E-10	1.66E-10
te130	7.78E-11	9.72E-11	1.17E-10	1.36E-10	1.56E-10	1.56E-10
nb 95	1.53E-10	1.53E-10	1.53E-10	1.53E-10	1.53E-10	1.53E-10
sm154	7.55E-11	9.44E-11	1.13E-10	1.32E-10	1.51E-10	1.51E-10
rb 87	7.28E-11	9.10E-11	1.09E-10	1.27E-10	1.46E-10	1.46E-10
y 91	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10
kr 85	6.96E-11	8.56E-11	1.01E-10	1.16E-10	1.31E-10	1.31E-10
sm150	3.14E-11	4.90E-11	7.04E-11	9.57E-11	1.25E-10	1.25E-10
pm151	1.09E-10	1.10E-10	1.10E-10	1.10E-10	1.10E-10	1.07E-10
se 77	5.14E-11	6.43E-11	7.72E-11	9.01E-11	1.03E-10	1.03E-10
kr 84	3.44E-11	4.31E-11	5.17E-11	6.03E-11	6.89E-11	6.89E-11
se 79	2.64E-11	3.30E-11	3.96E-11	4.62E-11	5.28E-11	5.28E-11
sb121	2.51E-11	3.14E-11	3.76E-11	4.39E-11	5.02E-11	5.02E-11
pd106	1.67E-11	2.40E-11	3.17E-11	3.99E-11	4.84E-11	4.84E-11
ba140	4.73E-11	4.74E-11	4.74E-11	4.74E-11	4.74E-11	4.73E-11
sb123	2.00E-11	2.51E-11	3.02E-11	3.54E-11	4.05E-11	4.05E-11
kr 86	1.91E-11	2.39E-11	2.87E-11	3.35E-11	3.82E-11	3.82E-11
sm153	3.79E-11	3.81E-11	3.81E-11	3.81E-11	3.81E-11	3.74E-11
te128	1.71E-11	2.13E-11	2.56E-11	2.99E-11	3.41E-11	3.41E-11
eu156	3.41E-11	3.40E-11	3.40E-11	3.40E-11	3.40E-11	3.40E-11
sr 89	3.07E-11	3.07E-11	3.07E-11	3.07E-11	3.07E-11	3.07E-11
gd156	1.29E-11	1.62E-11	1.95E-11	2.28E-11	2.62E-11	2.62E-11
se 80	1.23E-11	1.54E-11	1.85E-11	2.16E-11	2.47E-11	2.47E-11
ru106	1.90E-11	2.08E-11	2.21E-11	2.31E-11	2.37E-11	2.37E-11
dy161	1.08E-11	1.35E-11	1.62E-11	1.89E-11	2.16E-11	2.16E-11
ce143	1.74E-11	1.75E-11	1.75E-11	1.75E-11	1.75E-11	1.71E-11
la140	1.54E-11	1.54E-11	1.54E-11	1.54E-11	1.54E-11	1.54E-11

tb159	7.29E-12	9.10E-12	1.09E-11	1.27E-11	1.46E-11	1.46E-11
li 6	7.01E-12	8.76E-12	1.05E-11	1.23E-11	1.40E-11	1.40E-11
cd112	6.98E-12	8.72E-12	1.05E-11	1.22E-11	1.40E-11	1.40E-11
mo 99	1.31E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.30E-11
sn117	5.54E-12	6.93E-12	8.31E-12	9.69E-12	1.11E-11	1.11E-11

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 15

0 fraction of total absorption rate

power= .00mw, burnup= 6.mwd, flux= 2.81E+08n/cm**2-sec

0	initial	913.2 d	1095.8 d	1278.4 d	1461.0 d	1461.1 d
kr 87	1.58E-11	2.30E-11	2.30E-11	2.30E-11	2.30E-11	1.08E-11
zr 90	2.44E-12	3.80E-12	5.45E-12	7.40E-12	9.63E-12	9.63E-12
sb125	5.92E-12	7.00E-12	7.94E-12	8.78E-12	9.51E-12	9.51E-12
sn119	4.55E-12	5.69E-12	6.83E-12	7.97E-12	9.11E-12	9.11E-12
sn115	4.15E-12	5.20E-12	6.24E-12	7.28E-12	8.32E-12	8.32E-12
te125	2.21E-12	3.36E-12	4.69E-12	6.19E-12	7.82E-12	7.82E-12
te127m	7.25E-12	7.30E-12	7.32E-12	7.32E-12	7.33E-12	7.33E-12
sr 88	3.51E-12	4.39E-12	5.27E-12	6.15E-12	7.03E-12	7.03E-12
i131	6.77E-12	6.78E-12	6.78E-12	6.78E-12	6.78E-12	6.77E-12
pm148m	3.70E-12	4.38E-12	5.02E-12	5.59E-12	6.08E-12	6.08E-12
pd110	2.51E-12	3.13E-12	3.76E-12	4.38E-12	5.01E-12	5.01E-12
cd114	2.44E-12	3.04E-12	3.65E-12	4.26E-12	4.87E-12	4.87E-12
se 82	2.38E-12	2.98E-12	3.58E-12	4.17E-12	4.77E-12	4.77E-12
gd158	2.28E-12	2.85E-12	3.42E-12	4.00E-12	4.57E-12	4.57E-12
sn126	1.91E-12	2.38E-12	2.86E-12	3.34E-12	3.81E-12	3.81E-12
se 78	1.81E-12	2.26E-12	2.71E-12	3.17E-12	3.62E-12	3.62E-12
eu154	1.43E-12	1.89E-12	2.39E-12	2.92E-12	3.49E-12	3.49E-12
sn124	1.46E-12	1.82E-12	2.19E-12	2.55E-12	2.91E-12	2.91E-12
dy162	1.40E-12	1.75E-12	2.09E-12	2.44E-12	2.78E-12	2.78E-12
dy164	1.26E-12	1.58E-12	1.89E-12	2.21E-12	2.52E-12	2.52E-12
as 75	1.08E-12	1.35E-12	1.62E-12	1.89E-12	2.16E-12	2.16E-12
te129m	1.79E-12	1.79E-12	1.79E-12	1.79E-12	1.79E-12	1.79E-12
y 90	7.84E-13	9.74E-13	1.16E-12	1.35E-12	1.53E-12	1.53E-12
sn118	5.96E-13	7.45E-13	8.94E-13	1.04E-12	1.19E-12	1.19E-12
ba136	5.59E-13	7.03E-13	8.47E-13	9.91E-13	1.14E-12	1.14E-12
cd116	5.05E-13	6.32E-13	7.58E-13	8.84E-13	1.01E-12	1.01E-12
sn122	5.02E-13	6.27E-13	7.52E-13	8.77E-13	1.00E-12	1.00E-12
cs134	3.72E-13	4.80E-13	5.92E-13	7.08E-13	8.28E-13	8.27E-13
sn120	3.76E-13	4.70E-13	5.63E-13	6.57E-13	7.51E-13	7.51E-13
ru 99	3.01E-13	3.85E-13	4.72E-13	5.64E-13	6.58E-13	6.58E-13
kr 82	3.14E-13	3.92E-13	4.71E-13	5.50E-13	6.29E-13	6.29E-13
dy163	3.08E-13	3.85E-13	4.61E-13	5.38E-13	6.14E-13	6.14E-13
ge 73	2.93E-13	3.67E-13	4.40E-13	5.14E-13	5.87E-13	5.87E-13
xe130	1.93E-13	2.41E-13	2.90E-13	3.38E-13	3.87E-13	3.87E-13
ag111	3.17E-13	3.17E-13	3.17E-13	3.17E-13	3.17E-13	3.16E-13
eu157	2.91E-13	2.96E-13	2.96E-13	2.96E-13	2.96E-13	2.80E-13
mo 96	1.36E-13	1.71E-13	2.05E-13	2.40E-13	2.75E-13	2.75E-13
eu152	3.44E-14	6.45E-14	1.09E-13	1.70E-13	2.50E-13	2.50E-13
pm148	1.53E-13	1.79E-13	2.03E-13	2.25E-13	2.43E-13	2.42E-13
cd115m	2.37E-13	2.37E-13	2.37E-13	2.37E-13	2.37E-13	2.36E-13
ge 76	1.07E-13	1.34E-13	1.60E-13	1.87E-13	2.14E-13	2.14E-13
in113	3.85E-14	5.97E-14	8.53E-14	1.15E-13	1.49E-13	1.49E-13
gd160	6.76E-14	8.44E-14	1.01E-13	1.18E-13	1.35E-13	1.35E-13
te126	5.13E-14	6.43E-14	7.74E-14	9.04E-14	1.03E-13	1.03E-13
ru100	3.10E-14	4.03E-14	5.02E-14	6.06E-14	7.17E-14	7.17E-14
cs136	5.55E-14	5.57E-14	5.57E-14	5.57E-14	5.57E-14	5.55E-14
ho165	2.12E-14	2.64E-14	3.17E-14	3.69E-14	4.22E-14	4.22E-14
sn125	2.92E-14	2.93E-14	2.93E-14	2.93E-14	2.93E-14	2.91E-14
sm148	6.73E-15	1.04E-14	1.48E-14	1.99E-14	2.56E-14	2.56E-14

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 16

0 fraction of total absorption rate
power= .00mw, burnup= 6.mwd, flux= 2.81E+08n/cm**2-sec
0

	initial	913.2 d	1095.8 d	1278.4 d	1461.0 d	1461.1 d
ru105	2.75E-14	2.97E-14	2.97E-14	2.97E-14	2.97E-14	2.46E-14
sr 87	1.22E-14	1.53E-14	1.84E-14	2.14E-14	2.45E-14	2.45E-14
te124	1.10E-14	1.41E-14	1.72E-14	2.03E-14	2.35E-14	2.35E-14
gd154	3.48E-15	5.67E-15	8.50E-15	1.20E-14	1.63E-14	1.63E-14
nb 94	6.97E-15	8.72E-15	1.05E-14	1.22E-14	1.40E-14	1.40E-14
gd152	1.92E-15	3.55E-15	5.96E-15	9.31E-15	1.38E-14	1.38E-14
nd142	3.27E-15	5.14E-15	7.43E-15	1.02E-14	1.33E-14	1.33E-14
ba135	3.98E-15	5.80E-15	7.95E-15	1.04E-14	1.32E-14	1.32E-14
ge 74	5.92E-15	7.41E-15	8.89E-15	1.04E-14	1.19E-14	1.19E-14
sn123	9.97E-15	1.01E-14	1.01E-14	1.02E-14	1.02E-14	1.02E-14
rb 88	1.17E-14	1.29E-14	1.29E-14	1.29E-14	1.29E-14	9.98E-15
te132	9.51E-15	9.56E-15	9.56E-15	9.56E-15	9.56E-15	9.45E-15
ba134	2.11E-15	3.39E-15	4.99E-15	6.94E-15	9.23E-15	9.24E-15
i135	9.42E-15	1.01E-14	1.01E-14	1.01E-14	1.01E-14	8.75E-15
pd104	1.95E-15	3.12E-15	4.58E-15	6.31E-15	8.32E-15	8.32E-15
ge 72	3.96E-15	4.95E-15	5.95E-15	6.95E-15	7.94E-15	7.94E-15
sr 86	3.34E-15	4.21E-15	5.08E-15	5.96E-15	6.83E-15	6.83E-15
se 76	2.30E-15	2.88E-15	3.45E-15	4.03E-15	4.61E-15	4.61E-15
sb126	3.00E-15	3.01E-15	3.01E-15	3.01E-15	3.01E-15	3.00E-15
sb124	2.10E-15	2.10E-15	2.10E-15	2.10E-15	2.10E-15	2.10E-15
in117m	2.05E-15	2.09E-15	2.09E-15	2.09E-15	2.09E-15	1.94E-15
cd110	6.03E-16	8.68E-16	1.17E-15	1.51E-15	1.89E-15	1.89E-15
te134	2.91E-15	5.85E-15	5.85E-15	5.85E-15	5.85E-15	1.45E-15
xe128	5.61E-16	7.05E-16	8.51E-16	9.98E-16	1.15E-15	1.15E-15
er166	5.47E-16	6.86E-16	8.24E-16	9.64E-16	1.10E-15	1.10E-15
dy160	3.97E-16	5.17E-16	6.39E-16	7.64E-16	8.90E-16	8.90E-16
br 79	2.26E-16	3.50E-16	5.01E-16	6.78E-16	8.83E-16	8.83E-16
i130	6.90E-16	7.17E-16	7.18E-16	7.19E-16	7.19E-16	6.67E-16
in117	6.04E-16	6.14E-16	6.14E-16	6.14E-16	6.14E-16	5.74E-16
xe129	1.21E-16	1.89E-16	2.73E-16	3.72E-16	4.86E-16	4.86E-16
ag107	1.14E-16	1.79E-16	2.57E-16	3.50E-16	4.57E-16	4.57E-16
tb160	3.15E-16	3.21E-16	3.26E-16	3.31E-16	3.37E-16	3.36E-16
kr 80	1.66E-16	2.08E-16	2.49E-16	2.91E-16	3.32E-16	3.32E-16
rb 86	2.41E-16	2.42E-16	2.42E-16	2.42E-16	2.43E-16	2.42E-16
dy165	1.76E-16	2.10E-16	2.10E-16	2.10E-16	2.10E-16	1.42E-16
nb 93	1.92E-17	3.24E-17	5.10E-17	7.61E-17	1.09E-16	1.09E-16
te122	2.34E-17	2.99E-17	3.66E-17	4.36E-17	5.09E-17	5.09E-17
ge 75	6.24E-17	8.64E-17	8.64E-17	8.64E-17	8.64E-17	4.39E-17
cd118	6.76E-17	1.20E-16	1.20E-16	1.20E-16	1.20E-16	3.77E-17
sn116	1.07E-17	1.48E-17	1.96E-17	2.49E-17	3.08E-17	3.08E-17
be 9	1.34E-17	1.68E-17	2.01E-17	2.35E-17	2.69E-17	2.69E-17
pr142	1.33E-17	1.71E-17	2.06E-17	2.40E-17	2.75E-17	2.62E-17
te123	9.75E-18	1.27E-17	1.57E-17	1.87E-17	2.16E-17	2.16E-17
li 7	5.40E-18	6.75E-18	8.10E-18	9.45E-18	1.08E-17	1.08E-17
er167	2.19E-18	2.74E-18	3.30E-18	3.86E-18	4.43E-18	4.43E-18
in119m	7.02E-18	3.01E-17	3.01E-17	3.01E-17	3.01E-17	1.38E-18
cd108	1.11E-19	1.38E-19	1.64E-19	1.91E-19	2.22E-19	2.22E-19
cd109	1.24E-19	1.41E-19	1.51E-19	1.61E-19	1.68E-19	1.68E-19
cs134m	8.73E-20	1.28E-19	1.51E-19	1.78E-19	2.05E-19	1.44E-19

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 17
0 fraction of total absorption rate
power= .00mw, burnup= 6.mwd, flux= 2.81E+08n/cm**2-sec
0

	initial	913.2 d	1095.8 d	1278.4 d	1461.0 d	1461.1 d
in119	2.69E-20	2.35E-18	2.35E-18	2.35E-18	2.35E-18	6.71E-21
sn114	.00E+00	3.36E-21	3.36E-21	3.36E-21	3.36E-21	3.36E-21

1
sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 18
power= 4.000E-03mw, burnup=5.8440E+00mwd, flux= 2.81E+08n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	913.2 d	1095.8 d	1278.4 d	1461.0 d	1461.1 d
h 1	1.76E-07	2.19E-07	2.62E-07	3.05E-07	3.48E-07	3.48E-07
h 2	5.22E-10	6.50E-10	7.77E-10	9.04E-10	1.03E-09	1.03E-09
h 3	3.62E-12	4.44E-12	5.24E-12	6.02E-12	6.77E-12	6.77E-12
h 4	.00E+00	1.80E-35	2.13E-35	2.44E-35	2.75E-35	.00E+00
he 3	2.08E-13	3.21E-13	4.57E-13	6.15E-13	7.95E-13	7.95E-13
he 4	2.91E-08	3.62E-08	4.33E-08	5.04E-08	5.75E-08	5.75E-08
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	3.50E-09	4.35E-09	5.20E-09	6.05E-09	6.91E-09	6.91E-09
ne 21	2.54E-16	3.89E-16	5.51E-16	7.39E-16	9.52E-16	9.52E-16
ne 22	5.14E-12	7.70E-12	1.06E-11	1.39E-11	1.75E-11	1.75E-11
ne 23	7.28E-30	7.10E-15	7.10E-15	7.10E-15	7.10E-15	7.10E-30
na 22	1.77E-11	2.07E-11	2.33E-11	2.56E-11	2.77E-11	2.77E-11
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	3.52E-08	3.07E-08	3.07E-08	3.07E-08	3.07E-08	2.87E-08
na 24m	5.99E-30	5.05E-15	5.05E-15	5.05E-15	5.05E-15	5.05E-30
na 25	2.08E-41	1.40E-28	1.67E-28	1.95E-28	2.23E-28	2.41E-43
mg 24	3.03E-05	3.67E-05	4.31E-05	4.95E-05	5.59E-05	5.59E-05
mg 25	3.86E-12	4.80E-12	5.75E-12	6.71E-12	7.66E-12	7.66E-12
mg 26	5.22E-10	6.50E-10	7.77E-10	9.04E-10	1.03E-09	1.03E-09
mg 27	9.98E-14	2.12E-12	2.12E-12	2.12E-12	2.12E-12	4.42E-15
mg 28	4.31E-24	4.32E-24	4.32E-24	4.32E-24	4.32E-24	4.12E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	6.00E-16	2.28E-10	2.28E-10	2.28E-10	2.28E-10	1.08E-21
al 29	7.17E-31	9.14E-29	1.30E-28	1.75E-28	2.27E-28	3.11E-32
al 30	.00E+00	4.23E-42	7.28E-42	1.15E-41	1.70E-41	.00E+00
si 28	8.79E-05	1.06E-04	1.25E-04	1.44E-04	1.62E-04	1.62E-04
si 29	2.26E-13	3.51E-13	5.00E-13	6.73E-13	8.69E-13	8.69E-13
si 30	6.21E-22	1.21E-21	2.09E-21	3.30E-21	4.90E-21	4.90E-21
si 31	3.69E-34	8.72E-34	1.50E-33	2.37E-33	3.51E-33	2.42E-33
si 32	1.57E-42	3.85E-42	7.99E-42	1.48E-41	2.51E-41	2.51E-41
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		2.81E+08	2.81E+08	2.81E+08	2.81E+08	2.81E-07

1
sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 19
power= 4.000E-03mw, burnup=5.8440E+00mwd, flux= 2.81E+08n/cm**2-sec
0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	913.2 d	1095.8 d	1278.4 d	1461.0 d	1461.1 d
he 4	1.05E-04	1.32E-04	1.59E-04	1.87E-04	2.16E-04	2.16E-04
ra222	3.30E-29	4.82E-29	6.72E-29	8.86E-29	1.12E-28	1.12E-28
ra223	3.98E-14	6.29E-14	9.09E-14	1.24E-13	1.62E-13	1.62E-13
ra224	3.75E-15	6.78E-15	1.09E-14	1.60E-14	2.23E-14	2.23E-14
ra225	5.50E-16	8.77E-16	1.28E-15	1.76E-15	2.32E-15	2.32E-15
ra226	4.70E-10	7.34E-10	1.06E-09	1.44E-09	1.88E-09	1.88E-09
ra228	4.71E-16	7.22E-16	1.02E-15	1.36E-15	1.75E-15	1.75E-15
ac225	3.71E-16	5.93E-16	8.66E-16	1.19E-15	1.57E-15	1.57E-15
ac227	2.97E-11	4.62E-11	6.63E-11	8.97E-11	1.17E-10	1.17E-10
ac228	5.75E-20	8.81E-20	1.24E-19	1.66E-19	2.13E-19	2.13E-19
th226	1.60E-27	2.35E-27	3.28E-27	4.32E-27	5.46E-27	5.46E-27
th227	6.42E-14	1.01E-13	1.47E-13	2.00E-13	2.61E-13	2.61E-13
th228	7.15E-13	1.29E-12	2.07E-12	3.05E-12	4.25E-12	4.25E-12
th229	1.07E-10	1.71E-10	2.49E-10	3.43E-10	4.51E-10	4.51E-10
th230	5.11E-05	6.39E-05	7.66E-05	8.94E-05	1.02E-04	1.02E-04
th231	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09

th232	1.03E-05	1.29E-05	1.55E-05	1.81E-05	2.07E-05	2.07E-05
th233	2.59E-17	1.19E-16	1.43E-16	1.66E-16	1.90E-16	1.38E-17
th234	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	1.44E-06	1.80E-06	2.16E-06	2.51E-06	2.87E-06	2.87E-06
pa232	2.43E-14	3.09E-14	3.71E-14	4.32E-14	4.94E-14	4.79E-14
pa233	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06
pa234m	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11
pa234	8.09E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	1.55E-24	2.28E-24	3.18E-24	4.19E-24	5.29E-24	5.28E-24
u231	2.05E-20	2.52E-20	3.04E-20	3.57E-20	4.10E-20	4.06E-20
u232	1.22E-10	1.83E-10	2.53E-10	3.31E-10	4.16E-10	4.16E-10
u233	2.59E-05	3.27E-05	3.95E-05	4.63E-05	5.32E-05	5.32E-05
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	3.23E-06	3.15E-06	3.15E-06	3.15E-06	3.15E-06	3.13E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	9.48E-08	3.22E-07	3.22E-07	3.22E-07	3.22E-07	2.67E-08
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	6.55E-12	7.16E-12	7.61E-12	7.93E-12	8.16E-12	8.16E-12
np236m	2.11E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.00E-12
np236	4.10E-10	5.09E-10	6.08E-10	7.07E-10	8.06E-10	8.06E-10
np237	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.22E+01
np238	1.56E-06	1.56E-06	1.56E-06	1.56E-06	1.56E-06	1.53E-06
np239	4.73E-05	4.65E-05	4.65E-05	4.65E-05	4.65E-05	4.60E-05
np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np240	6.08E-15	9.48E-15	9.48E-15	9.48E-15	9.48E-15	3.69E-15
np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu236	4.44E-10	5.22E-10	5.90E-10	6.52E-10	7.06E-10	7.06E-10
pu237	3.54E-15	4.36E-15	5.28E-15	6.20E-15	7.11E-15	7.11E-15
pu238	3.73E-04	4.65E-04	5.56E-04	6.48E-04	7.38E-04	7.38E-04
pu239	1.04E-02	1.29E-02	1.54E-02	1.80E-02	2.05E-02	2.05E-02

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 20

power= 4.000E-03mw, burnup=5.8440E+00mwd, flux= 2.81E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	913.2 d	1095.8 d	1278.4 d	1461.0 d	1461.1 d
pu240	1.02E-07	1.59E-07	2.29E-07	3.11E-07	4.05E-07	4.05E-07
pu241	1.36E-12	2.62E-12	4.47E-12	7.04E-12	1.04E-11	1.04E-11
pu242	5.36E-18	1.30E-17	2.67E-17	4.92E-17	8.34E-17	8.34E-17
pu243	1.07E-26	2.78E-26	5.72E-26	1.05E-25	1.78E-25	1.47E-25
pu244	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu245	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu246	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
totals	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04
0 flux		2.81E+08	2.81E+08	2.81E+08	2.81E+08	2.81E-07

0 1q array has 20 entries.
0 3q array has 1 entries.
0 3q array has 1 entries.
0 3q array has 1 entries.
0 4q array has 1 entries.
0 54q array has 12 entries.
1library information...

cross-section data taken from position number 3 of library on unit 33.

pass 1

```
        pass   0
        *scale-system control module sas2 library*
        used a time-dependent neutron spectrum, for each of the above passes
          pass 0 applies start-up fuel densiities
          pass n applies mid time densities of nth library interval
        first library updated was...
        pass   1
        pass   0
        *scale-system control module sas2 library*
        used a time-dependent neutron spectrum, for each of the above passes
          pass 0 applies start-up fuel densiities
          pass n applies mid time densities of nth library interval
        first library updated was...
        *****************************************************************************
        *                                                                           *
        *          prelim lwr origen-s binary working library--id = 1143            *
        *        made from modified card-image origen-s libraries of scale 4.2      *
        *     data from the light element, actinide, and fission product libraries  *
        *       decay data, including gamma and total energy, are from endf/b-vi    *
        *                                                                           *
        *     neutron flux spectrum factors and cross sections were produced from   *
        *    the "presas2" case updating all nuclides on the scale "burnup" library *
        *                                                                           *
        *                fission product yields are from endf/b-v                   *
        *                                                                           *
        *              photon libraries use an 18-energy-group structure            *
        *             the photon data are from the master photon data base,         *
        *              produced to include bremsstrahlung from uo2 matrix           *
        *                                                                           *
        *        see information above this box (if present) for later updates      *
        *                                                                           *
        *****************************************************************************
        *                                                                           *
0       *****************************************************************************
0                .other identification and sizes of library.
0                 data set name:  ft33f001
0              8/28/1996    date library was produced
0                   1697    total number of nuclides in library
                     689    number of light-element nuclides
                     129    number of actinide nuclides
                     879    number of fission product nuclides
0                   7993    number of nonzero off-diagonal matrix elements
0       *****************************************************************************
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                       page   21
        power=     .00mw, burnup=      9.mwd, flux= 2.74E+08n/cm**2-sec
0                                         basis =
0    (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                  initial        1643.7 d       1826.3 d       2009.0 d       2191.6 d       2191.7 d
     productions   1.122459E+06   1.122463E+06   1.122467E+06   1.122471E+06   1.122474E+06   1.122474E+06
     absorptions   9.158321E+05   9.158383E+05   9.158444E+05   9.158505E+05   9.158566E+05   9.158566E+05
     k infinity    1.225616E+00   1.225612E+00   1.225608E+00   1.225605E+00   1.225601E+00   1.225601E+00
0                  initial        1643.7 d       1826.3 d       2009.0 d       2191.6 d       2191.7 d
     actinide
     absorptions   9.125684E+05   9.125708E+05   9.125731E+05   9.125754E+05   9.125776E+05   9.125776E+05
     non-actinide
     abs. fracs.   3.563583E-03   3.567815E-03   3.571987E-03   3.576040E-03   3.580332E-03   3.580332E-03
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2          fission products      page   22
0                                     fraction of total absorption rate
        power=     .00mw, burnup=      9.mwd, flux= 2.74E+08n/cm**2-sec
0             initial  1643.7 d  1826.3 d  2009.0 d  2191.6 d  2191.7 d
```

sm149	2.96E-05	3.33E-05	3.70E-05	4.07E-05	4.44E-05	4.44E-05
xe135	2.31E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.29E-06
sm151	1.24E-06	1.39E-06	1.54E-06	1.69E-06	1.84E-06	1.84E-06
nd143	5.87E-07	6.62E-07	7.36E-07	8.11E-07	8.86E-07	8.86E-07
gd157	3.03E-07	3.41E-07	3.79E-07	4.16E-07	4.54E-07	4.54E-07
rh103	2.65E-07	3.00E-07	3.34E-07	3.68E-07	4.03E-07	4.03E-07
cd113	2.59E-07	2.91E-07	3.23E-07	3.55E-07	3.88E-07	3.88E-07
xe131	1.86E-07	2.10E-07	2.33E-07	2.57E-07	2.80E-07	2.80E-07
cs133	1.45E-07	1.63E-07	1.81E-07	1.99E-07	2.18E-07	2.18E-07
pm147	1.76E-07	1.88E-07	1.98E-07	2.07E-07	2.15E-07	2.15E-07
gd155	9.85E-08	1.22E-07	1.47E-07	1.74E-07	2.03E-07	2.03E-07
tc 99	1.07E-07	1.20E-07	1.34E-07	1.47E-07	1.60E-07	1.60E-07
nd145	8.31E-08	9.35E-08	1.04E-07	1.14E-07	1.25E-07	1.25E-07
eu155	7.09E-08	7.71E-08	8.29E-08	8.83E-08	9.33E-08	9.33E-08
mo 95	5.20E-08	5.92E-08	6.64E-08	7.36E-08	8.08E-08	8.08E-08
sm147	4.11E-08	5.02E-08	5.99E-08	7.01E-08	8.06E-08	8.06E-08
sm152	4.38E-08	4.93E-08	5.48E-08	6.02E-08	6.57E-08	6.57E-08
kr 83	3.61E-08	4.06E-08	4.52E-08	4.97E-08	5.42E-08	5.42E-08
cs135	3.28E-08	3.69E-08	4.10E-08	4.51E-08	4.92E-08	4.92E-08
ru101	2.54E-08	2.86E-08	3.17E-08	3.49E-08	3.81E-08	3.81E-08
pr141	2.38E-08	2.68E-08	2.99E-08	3.30E-08	3.61E-08	3.61E-08
eu153	2.22E-08	2.50E-08	2.78E-08	3.06E-08	3.33E-08	3.33E-08
eu151	1.41E-08	1.79E-08	2.20E-08	2.66E-08	3.17E-08	3.17E-08
la139	2.01E-08	2.26E-08	2.51E-08	2.76E-08	3.01E-08	3.01E-08
pd105	8.46E-09	9.52E-09	1.06E-08	1.16E-08	1.27E-08	1.27E-08
zr 93	8.12E-09	9.14E-09	1.02E-08	1.12E-08	1.22E-08	1.22E-08
i129	6.19E-09	6.97E-09	7.75E-09	8.53E-09	9.31E-09	9.31E-09
rh105	8.35E-09	8.36E-09	8.36E-09	8.36E-09	8.36E-09	8.32E-09
nd144	4.38E-09	5.12E-09	5.86E-09	6.61E-09	7.36E-09	7.36E-09
mo 97	4.55E-09	5.12E-09	5.68E-09	6.25E-09	6.82E-09	6.82E-09
ag109	3.17E-09	3.56E-09	3.96E-09	4.35E-09	4.75E-09	4.75E-09
zr 91	2.02E-09	2.29E-09	2.56E-09	2.83E-09	3.10E-09	3.10E-09
y 89	1.96E-09	2.21E-09	2.47E-09	2.73E-09	2.99E-09	2.99E-09
ru102	1.85E-09	2.09E-09	2.32E-09	2.55E-09	2.78E-09	2.78E-09
pr143	2.68E-09	2.68E-09	2.68E-09	2.68E-09	2.68E-09	2.68E-09
ce142	1.67E-09	1.88E-09	2.09E-09	2.30E-09	2.51E-09	2.51E-09
nd148	1.61E-09	1.81E-09	2.01E-09	2.21E-09	2.41E-09	2.41E-09
sr 90	1.62E-09	1.81E-09	2.00E-09	2.18E-09	2.37E-09	2.37E-09
xe133	2.02E-09	2.02E-09	2.02E-09	2.02E-09	2.02E-09	2.02E-09
nd146	1.35E-09	1.52E-09	1.68E-09	1.85E-09	2.02E-09	2.02E-09
ba138	1.15E-09	1.30E-09	1.44E-09	1.58E-09	1.73E-09	1.73E-09
in115	1.10E-09	1.24E-09	1.38E-09	1.52E-09	1.66E-09	1.66E-09
pd108	1.08E-09	1.21E-09	1.35E-09	1.48E-09	1.61E-09	1.61E-09
ce140	1.06E-09	1.20E-09	1.33E-09	1.47E-09	1.60E-09	1.60E-09
ce141	1.60E-09	1.60E-09	1.60E-09	1.60E-09	1.60E-09	1.60E-09
xe132	9.62E-10	1.08E-09	1.20E-09	1.32E-09	1.44E-09	1.44E-09
mo 98	6.65E-10	7.49E-10	8.32E-10	9.15E-10	9.98E-10	9.98E-10
pm149	9.76E-10	9.80E-10	9.80E-10	9.80E-10	9.80E-10	9.73E-10
mo100	6.44E-10	7.25E-10	8.05E-10	8.86E-10	9.67E-10	9.67E-10

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 23

0 fraction of total absorption rate

power= .00mw, burnup= 9.mwd, flux= 2.74E+08n/cm**2-sec

0	initial	1643.7 d	1826.3 d	2009.0 d	2191.6 d	2191.7 d
pd107	6.41E-10	7.20E-10	8.00E-10	8.79E-10	9.59E-10	9.59E-10
ba137	4.32E-10	5.44E-10	6.69E-10	8.07E-10	9.56E-10	9.56E-10
xe134	6.36E-10	7.16E-10	7.95E-10	8.75E-10	9.54E-10	9.54E-10
nd147	9.30E-10	9.33E-10	9.33E-10	9.33E-10	9.33E-10	9.29E-10
zr 92	5.17E-10	5.81E-10	6.46E-10	7.11E-10	7.75E-10	7.75E-10

i127	4.08E-10	4.60E-10	5.12E-10	5.64E-10	6.16E-10	6.16E-10
zr 96	4.04E-10	4.55E-10	5.05E-10	5.56E-10	6.07E-10	6.07E-10
ce144	5.86E-10	5.93E-10	5.97E-10	5.99E-10	6.01E-10	6.01E-10
ru104	3.96E-10	4.46E-10	4.95E-10	5.45E-10	5.94E-10	5.94E-10
nd150	3.55E-10	4.00E-10	4.44E-10	4.88E-10	5.33E-10	5.33E-10
xe136	3.44E-10	3.87E-10	4.30E-10	4.73E-10	5.16E-10	5.16E-10
cs137	3.33E-10	3.73E-10	4.12E-10	4.51E-10	4.89E-10	4.89E-10
br 81	2.58E-10	2.90E-10	3.22E-10	3.54E-10	3.87E-10	3.87E-10
ru103	3.58E-10	3.58E-10	3.58E-10	3.58E-10	3.58E-10	3.57E-10
zr 94	2.18E-10	2.45E-10	2.73E-10	3.00E-10	3.27E-10	3.27E-10
rb 85	2.04E-10	2.31E-10	2.57E-10	2.84E-10	3.11E-10	3.11E-10
sm150	1.25E-10	1.58E-10	1.95E-10	2.36E-10	2.81E-10	2.81E-10
cd111	1.67E-10	1.88E-10	2.08E-10	2.29E-10	2.50E-10	2.50E-10
te130	1.56E-10	1.76E-10	1.95E-10	2.15E-10	2.35E-10	2.35E-10
sm154	1.51E-10	1.70E-10	1.89E-10	2.08E-10	2.27E-10	2.27E-10
rb 87	1.46E-10	1.64E-10	1.82E-10	2.00E-10	2.18E-10	2.18E-10
kr 85	1.31E-10	1.45E-10	1.59E-10	1.72E-10	1.85E-10	1.85E-10
zr 95	1.65E-10	1.66E-10	1.66E-10	1.66E-10	1.66E-10	1.65E-10
se 77	1.03E-10	1.16E-10	1.29E-10	1.42E-10	1.55E-10	1.55E-10
nb 95	1.53E-10	1.53E-10	1.53E-10	1.53E-10	1.53E-10	1.53E-10
y 91	1.44E-10	1.44E-10	1.44E-10	1.44E-10	1.44E-10	1.44E-10
pm151	1.07E-10	1.10E-10	1.10E-10	1.10E-10	1.10E-10	1.06E-10
kr 84	6.86E-11	7.72E-11	8.58E-11	9.43E-11	1.03E-10	1.03E-10
pd106	4.82E-11	5.69E-11	6.57E-11	7.46E-11	8.35E-11	8.35E-11
se 79	5.31E-11	5.98E-11	6.64E-11	7.31E-11	7.97E-11	7.97E-11
sb121	5.01E-11	5.63E-11	6.26E-11	6.88E-11	7.51E-11	7.51E-11
sb123	4.04E-11	4.55E-11	5.06E-11	5.57E-11	6.08E-11	6.08E-11
kr 86	3.84E-11	4.32E-11	4.80E-11	5.28E-11	5.76E-11	5.76E-11
te128	3.41E-11	3.84E-11	4.27E-11	4.69E-11	5.12E-11	5.12E-11
ba140	4.74E-11	4.75E-11	4.75E-11	4.75E-11	4.75E-11	4.73E-11
gd156	2.60E-11	2.93E-11	3.26E-11	3.59E-11	3.92E-11	3.92E-11
sm153	3.75E-11	3.82E-11	3.82E-11	3.82E-11	3.82E-11	3.72E-11
se 80	2.48E-11	2.79E-11	3.10E-11	3.41E-11	3.71E-11	3.71E-11
eu156	3.42E-11	3.41E-11	3.42E-11	3.42E-11	3.42E-11	3.42E-11
dy161	2.17E-11	2.44E-11	2.71E-11	2.98E-11	3.25E-11	3.25E-11
sr 89	3.09E-11	3.09E-11	3.09E-11	3.09E-11	3.09E-11	3.09E-11
ru106	2.36E-11	2.41E-11	2.44E-11	2.46E-11	2.48E-11	2.48E-11
tb159	1.45E-11	1.64E-11	1.82E-11	2.00E-11	2.18E-11	2.18E-11
zr 90	9.65E-12	1.22E-11	1.50E-11	1.80E-11	2.14E-11	2.14E-11
li 6	1.41E-11	1.59E-11	1.76E-11	1.94E-11	2.11E-11	2.11E-11
cd112	1.40E-11	1.57E-11	1.75E-11	1.92E-11	2.10E-11	2.10E-11
ce143	1.72E-11	1.76E-11	1.76E-11	1.76E-11	1.76E-11	1.70E-11
sn117	1.11E-11	1.25E-11	1.39E-11	1.53E-11	1.66E-11	1.66E-11
te125	7.82E-12	9.58E-12	1.15E-11	1.34E-11	1.55E-11	1.55E-11

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 24

0 fraction of total absorption rate

power= .00mw, burnup= 9.mwd, flux= 2.74E+08n/cm**2-sec

0	initial	1643.7 d	1826.3 d	2009.0 d	2191.6 d	2191.7 d
la140	1.53E-11	1.53E-11	1.53E-11	1.53E-11	1.53E-11	1.53E-11
sn119	9.15E-12	1.03E-11	1.14E-11	1.26E-11	1.37E-11	1.37E-11
mo 99	1.30E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.29E-11
sn115	8.37E-12	9.41E-12	1.05E-11	1.15E-11	1.26E-11	1.26E-11
sb125	9.50E-12	1.01E-11	1.07E-11	1.12E-11	1.17E-11	1.17E-11
sr 88	7.05E-12	7.94E-12	8.82E-12	9.70E-12	1.06E-11	1.06E-11
kr 87	1.09E-11	2.31E-11	2.31E-11	2.31E-11	2.31E-11	8.20E-12
pm148m	6.11E-12	6.50E-12	6.88E-12	7.21E-12	7.51E-12	7.50E-12
pd110	4.99E-12	5.61E-12	6.23E-12	6.86E-12	7.48E-12	7.48E-12
te127m	7.35E-12	7.35E-12	7.35E-12	7.35E-12	7.35E-12	7.35E-12
cd114	4.85E-12	5.45E-12	6.06E-12	6.66E-12	7.27E-12	7.27E-12

se 82	4.79E-12	5.39E-12	5.99E-12	6.58E-12	7.18E-12	7.18E-12
gd158	4.56E-12	5.14E-12	5.71E-12	6.29E-12	6.87E-12	6.87E-12
i131	6.77E-12	6.78E-12	6.78E-12	6.78E-12	6.78E-12	6.76E-12
eu154	3.51E-12	4.11E-12	4.75E-12	5.42E-12	6.12E-12	6.12E-12
sn126	3.83E-12	4.31E-12	4.79E-12	5.27E-12	5.75E-12	5.75E-12
se 78	3.62E-12	4.08E-12	4.53E-12	4.98E-12	5.44E-12	5.44E-12
sn124	2.90E-12	3.26E-12	3.63E-12	3.99E-12	4.35E-12	4.35E-12
dy162	2.79E-12	3.13E-12	3.48E-12	3.82E-12	4.17E-12	4.17E-12
dy164	2.53E-12	2.85E-12	3.16E-12	3.48E-12	3.79E-12	3.79E-12
as 75	2.16E-12	2.43E-12	2.70E-12	2.97E-12	3.24E-12	3.24E-12
y 90	1.54E-12	1.72E-12	1.90E-12	2.08E-12	2.25E-12	2.25E-12
te129m	1.79E-12	1.79E-12	1.79E-12	1.79E-12	1.79E-12	1.79E-12
sn118	1.18E-12	1.33E-12	1.48E-12	1.63E-12	1.77E-12	1.77E-12
ba136	1.13E-12	1.28E-12	1.42E-12	1.57E-12	1.71E-12	1.71E-12
cd116	1.01E-12	1.13E-12	1.26E-12	1.38E-12	1.51E-12	1.51E-12
sn122	1.01E-12	1.13E-12	1.26E-12	1.38E-12	1.51E-12	1.51E-12
cs134	8.30E-13	9.51E-13	1.07E-12	1.20E-12	1.33E-12	1.33E-12
sn120	7.52E-13	8.45E-13	9.39E-13	1.03E-12	1.13E-12	1.13E-12
ru 99	6.57E-13	7.55E-13	8.56E-13	9.61E-13	1.07E-12	1.07E-12
kr 82	6.31E-13	7.10E-13	7.90E-13	8.69E-13	9.48E-13	9.48E-13
dy163	6.15E-13	6.91E-13	7.68E-13	8.44E-13	9.21E-13	9.21E-13
ge 73	5.89E-13	6.63E-13	7.37E-13	8.10E-13	8.84E-13	8.84E-13
eu152	2.51E-13	3.53E-13	4.79E-13	6.31E-13	8.12E-13	8.12E-13
xe130	3.89E-13	4.38E-13	4.87E-13	5.36E-13	5.85E-13	5.85E-13
mo 96	2.74E-13	3.09E-13	3.44E-13	3.79E-13	4.14E-13	4.14E-13
in113	1.49E-13	1.87E-13	2.29E-13	2.75E-13	3.25E-13	3.25E-13
ge 76	2.14E-13	2.41E-13	2.68E-13	2.94E-13	3.21E-13	3.21E-13
ag111	3.15E-13	3.16E-13	3.16E-13	3.16E-13	3.16E-13	3.14E-13
pm148	2.40E-13	2.56E-13	2.71E-13	2.83E-13	2.94E-13	2.91E-13
eu157	2.81E-13	2.97E-13	2.97E-13	2.97E-13	2.97E-13	2.74E-13
cd115m	2.37E-13	2.37E-13	2.37E-13	2.37E-13	2.37E-13	2.37E-13
gd160	1.35E-13	1.52E-13	1.68E-13	1.85E-13	2.02E-13	2.02E-13
te126	1.04E-13	1.17E-13	1.30E-13	1.43E-13	1.56E-13	1.56E-13
ru100	7.20E-14	8.37E-14	9.60E-14	1.09E-13	1.22E-13	1.22E-13
ho165	4.23E-14	4.75E-14	5.28E-14	5.80E-14	6.33E-14	6.33E-14
cs136	5.54E-14	5.56E-14	5.56E-14	5.56E-14	5.56E-14	5.54E-14
sm148	2.56E-14	3.19E-14	3.87E-14	4.61E-14	5.40E-14	5.40E-14
gd152	1.38E-14	1.96E-14	2.68E-14	3.56E-14	4.61E-14	4.61E-14

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 25

0 fraction of total absorption rate

power= .00mw, burnup= 9.mwd, flux= 2.74E+08n/cm**2-sec

0	initial	1643.7 d	1826.3 d	2009.0 d	2191.6 d	2191.7 d
gd154	1.63E-14	2.14E-14	2.72E-14	3.39E-14	4.16E-14	4.16E-14
sr 87	2.46E-14	2.77E-14	3.07E-14	3.38E-14	3.69E-14	3.69E-14
te124	2.36E-14	2.67E-14	2.98E-14	3.30E-14	3.61E-14	3.61E-14
nd142	1.34E-14	1.69E-14	2.10E-14	2.54E-14	3.02E-14	3.02E-14
sn125	2.91E-14	2.92E-14	2.92E-14	2.92E-14	2.92E-14	2.90E-14
ba135	1.32E-14	1.64E-14	1.99E-14	2.37E-14	2.78E-14	2.78E-14
ru105	2.45E-14	2.95E-14	2.95E-14	2.95E-14	2.95E-14	2.25E-14
ba134	9.24E-15	1.19E-14	1.49E-14	1.83E-14	2.21E-14	2.21E-14
nb 94	1.39E-14	1.57E-14	1.74E-14	1.92E-14	2.09E-14	2.09E-14
pd104	8.28E-15	1.05E-14	1.31E-14	1.59E-14	1.90E-14	1.90E-14
ge 74	1.19E-14	1.34E-14	1.49E-14	1.64E-14	1.79E-14	1.79E-14
ge 72	7.98E-15	8.98E-15	9.98E-15	1.10E-14	1.20E-14	1.20E-14
sr 86	6.86E-15	7.74E-15	8.61E-15	9.49E-15	1.04E-14	1.04E-14
sn123	1.01E-14	1.01E-14	1.01E-14	1.01E-14	1.01E-14	1.01E-14
te132	9.48E-15	9.59E-15	9.59E-15	9.59E-15	9.59E-15	9.44E-15
rb 88	1.00E-14	1.30E-14	1.30E-14	1.30E-14	1.30E-14	8.88E-15
i135	8.79E-15	1.02E-14	1.02E-14	1.02E-14	1.02E-14	8.33E-15

se 76	4.63E-15	5.21E-15	5.80E-15	6.38E-15	6.96E-15	6.96E-15
cd110	1.90E-15	2.32E-15	2.77E-15	3.26E-15	3.78E-15	3.78E-15
sb126	3.01E-15	3.02E-15	3.02E-15	3.02E-15	3.02E-15	3.01E-15
sb124	2.10E-15	2.11E-15	2.11E-15	2.11E-15	2.11E-15	2.10E-15
br 79	8.84E-16	1.12E-15	1.38E-15	1.66E-15	1.98E-15	1.98E-15
in117m	1.95E-15	2.10E-15	2.10E-15	2.10E-15	2.10E-15	1.85E-15
xe128	1.15E-15	1.30E-15	1.45E-15	1.61E-15	1.76E-15	1.76E-15
er166	1.11E-15	1.25E-15	1.39E-15	1.53E-15	1.67E-15	1.67E-15
dy160	8.88E-16	1.02E-15	1.15E-15	1.28E-15	1.41E-15	1.41E-15
xe129	4.87E-16	6.17E-16	7.62E-16	9.22E-16	1.10E-15	1.10E-15
ag107	4.58E-16	5.80E-16	7.16E-16	8.66E-16	1.03E-15	1.03E-15
te134	1.46E-15	5.89E-15	5.89E-15	5.89E-15	5.89E-15	8.72E-16
i130	6.68E-16	7.21E-16	7.22E-16	7.23E-16	7.23E-16	6.52E-16
in117	5.78E-16	6.17E-16	6.17E-16	6.17E-16	6.17E-16	5.49E-16
kr 80	3.34E-16	3.75E-16	4.17E-16	4.59E-16	5.01E-16	5.01E-16
tb160	3.38E-16	3.43E-16	3.48E-16	3.54E-16	3.59E-16	3.59E-16
nb 93	1.09E-16	1.50E-16	2.01E-16	2.62E-16	3.34E-16	3.34E-16
rb 86	2.43E-16	2.44E-16	2.44E-16	2.44E-16	2.44E-16	2.43E-16
dy165	1.43E-16	2.11E-16	2.11E-16	2.11E-16	2.11E-16	1.23E-16
te122	5.08E-17	5.82E-17	6.59E-17	7.39E-17	8.21E-17	8.21E-17
sn116	3.06E-17	3.70E-17	4.40E-17	5.16E-17	5.97E-17	5.97E-17
be 9	2.67E-17	3.00E-17	3.33E-17	3.67E-17	4.00E-17	4.00E-17
pr142	2.62E-17	3.10E-17	3.45E-17	3.80E-17	4.15E-17	3.87E-17
ge 75	4.41E-17	8.69E-17	8.69E-17	8.69E-17	8.69E-17	3.41E-17
te123	2.17E-17	2.46E-17	2.76E-17	3.06E-17	3.36E-17	3.36E-17
cd118	3.79E-17	1.21E-16	1.21E-16	1.21E-16	1.21E-16	2.48E-17
li 7	1.09E-17	1.22E-17	1.36E-17	1.49E-17	1.63E-17	1.63E-17
er167	4.44E-18	5.02E-18	5.59E-18	6.17E-18	6.75E-18	6.75E-18
in119m	1.39E-18	3.02E-17	3.02E-17	3.02E-17	3.02E-17	4.21E-19
cd108	2.22E-19	2.49E-19	2.76E-19	3.07E-19	3.34E-19	3.34E-19
cs134m	1.45E-19	2.29E-19	2.53E-19	2.80E-19	3.07E-19	1.92E-19
cd109	1.68E-19	1.75E-19	1.79E-19	1.82E-19	1.85E-19	1.85E-19

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 26

0 fraction of total absorption rate

power= .00mw, burnup= 9.mwd, flux= 2.74E+08n/cm**2-sec

0	initial	1643.7 d	1826.3 d	2009.0 d	2191.6 d	2191.7 d
sn114	3.37E-21	3.37E-21	3.37E-21	6.74E-21	6.74E-21	6.74E-21

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 27

power= 4.000E-03mw, burnup=8.7659E+00mwd, flux= 2.74E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	1643.7 d	1826.3 d	2009.0 d	2191.6 d	2191.7 d
h 1	3.48E-07	3.91E-07	4.33E-07	4.76E-07	5.18E-07	5.18E-07
h 2	1.03E-09	1.16E-09	1.28E-09	1.41E-09	1.54E-09	1.54E-09
h 3	6.77E-12	7.50E-12	8.20E-12	8.89E-12	9.56E-12	9.56E-12
h 4	.00E+00	3.05E-35	3.34E-35	3.62E-35	3.89E-35	.00E+00
he 3	7.95E-13	9.96E-13	1.22E-12	1.46E-12	1.72E-12	1.72E-12
he 4	5.75E-08	6.45E-08	7.16E-08	7.86E-08	8.57E-08	8.57E-08
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	6.91E-09	7.75E-09	8.60E-09	9.44E-09	1.03E-08	1.03E-08
ne 21	9.52E-16	1.19E-15	1.45E-15	1.73E-15	2.04E-15	2.04E-15
ne 22	1.75E-11	2.13E-11	2.53E-11	2.95E-11	3.38E-11	3.38E-11
ne 23	7.10E-30	7.04E-15	7.04E-15	7.04E-15	7.04E-15	7.04E-30
na 22	2.77E-11	2.94E-11	3.09E-11	3.22E-11	3.33E-11	3.33E-11
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	2.87E-08	2.85E-08	2.85E-08	2.85E-08	2.85E-08	2.60E-08
na 24m	5.05E-30	4.68E-15	4.68E-15	4.68E-15	4.68E-15	4.68E-30
na 25	2.41E-43	2.47E-28	2.74E-28	3.02E-28	3.29E-28	3.62E-43

mg 24	5.59E-05	6.19E-05	6.78E-05	7.37E-05	7.97E-05	7.97E-05
mg 25	7.66E-12	8.61E-12	9.56E-12	1.05E-11	1.15E-11	1.15E-11
mg 26	1.03E-09	1.16E-09	1.28E-09	1.41E-09	1.54E-09	1.54E-09
mg 27	4.42E-15	2.10E-12	2.10E-12	2.10E-12	2.10E-12	4.55E-16
mg 28	4.12E-24	4.29E-24	4.29E-24	4.29E-24	4.29E-24	4.03E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	1.08E-21	2.11E-10	2.11E-10	2.11E-10	2.11E-10	2.88E-25
al 29	3.11E-32	2.80E-28	3.42E-28	4.10E-28	4.84E-28	2.53E-33
al 30	.00E+00	2.38E-41	3.24E-41	4.28E-41	5.52E-41	.00E+00
si 28	1.62E-04	1.79E-04	1.96E-04	2.14E-04	2.31E-04	2.31E-04
si 29	8.69E-13	1.09E-12	1.33E-12	1.60E-12	1.88E-12	1.88E-12
si 30	4.90E-21	6.92E-21	9.43E-21	1.25E-20	1.61E-20	1.61E-20
si 31	2.42E-33	4.98E-33	6.78E-33	8.96E-33	1.16E-32	6.95E-33
si 32	2.51E-41	4.00E-41	6.07E-41	8.85E-41	1.25E-40	1.25E-40
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		2.74E+08	2.74E+08	2.74E+08	2.74E+08	2.74E-07

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 28

power= 4.000E-03mw, burnup=8.7659E+00mwd, flux= 2.74E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	1643.7 d	1826.3 d	2009.0 d	2191.6 d	2191.7 d
he 4	2.16E-04	2.45E-04	2.74E-04	3.03E-04	3.33E-04	3.33E-04
ra222	1.12E-28	1.35E-28	1.61E-28	1.89E-28	2.18E-28	2.18E-28
ra223	1.62E-13	2.05E-13	2.52E-13	3.05E-13	3.62E-13	3.62E-13
ra224	2.23E-14	2.96E-14	3.80E-14	4.73E-14	5.76E-14	5.76E-14
ra225	2.32E-15	2.95E-15	3.66E-15	4.45E-15	5.31E-15	5.31E-15
ra226	1.88E-09	2.38E-09	2.93E-09	3.55E-09	4.22E-09	4.22E-09
ra228	1.75E-15	2.17E-15	2.63E-15	3.13E-15	3.65E-15	3.65E-15
ac225	1.57E-15	2.00E-15	2.47E-15	3.01E-15	3.59E-15	3.59E-15
ac227	1.17E-10	1.47E-10	1.80E-10	2.17E-10	2.57E-10	2.57E-10
ac228	2.13E-19	2.65E-19	3.21E-19	3.81E-19	4.46E-19	4.46E-19
th226	5.46E-27	6.59E-27	7.87E-27	9.22E-27	1.06E-26	1.06E-26
th227	2.61E-13	3.30E-13	4.07E-13	4.91E-13	5.83E-13	5.83E-13
th228	4.25E-12	5.64E-12	7.23E-12	9.00E-12	1.10E-11	1.10E-11
th229	4.51E-10	5.74E-10	7.12E-10	8.65E-10	1.03E-09	1.03E-09
th230	1.02E-04	1.15E-04	1.28E-04	1.41E-04	1.53E-04	1.53E-04
th231	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	2.07E-05	2.32E-05	2.58E-05	2.84E-05	3.10E-05	3.10E-05
th233	1.38E-17	2.13E-16	2.37E-16	2.61E-16	2.84E-16	7.92E-18
th234	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	2.87E-06	3.23E-06	3.59E-06	3.95E-06	4.31E-06	4.31E-06
pa232	4.79E-14	5.56E-14	6.18E-14	6.80E-14	7.42E-14	7.11E-14
pa233	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06
pa234m	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11
pa234	8.09E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	5.28E-24	6.39E-24	7.63E-24	8.93E-24	1.03E-23	1.03E-23
u231	4.06E-20	4.56E-20	5.08E-20	5.60E-20	6.12E-20	6.04E-20
u232	4.16E-10	5.07E-10	6.03E-10	7.04E-10	8.09E-10	8.09E-10
u233	5.32E-05	6.00E-05	6.68E-05	7.36E-05	8.05E-05	8.05E-05
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	3.13E-06	3.11E-06	3.11E-06	3.11E-06	3.11E-06	3.09E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	2.67E-08	3.19E-07	3.19E-07	3.19E-07	3.19E-07	1.06E-08
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	8.16E-12	8.30E-12	8.40E-12	8.47E-12	8.53E-12	8.53E-12

np236m	2.00E-12	2.06E-12	2.06E-12	2.06E-12	2.06E-12	1.94E-12
np236	8.06E-10	9.04E-10	1.00E-09	1.10E-09	1.20E-09	1.20E-09
np237	4.22E+01	4.22E+01	4.22E+01	4.22E+01	4.21E+01	4.21E+01
np238	1.53E-06	1.56E-06	1.56E-06	1.56E-06	1.56E-06	1.52E-06
np239	4.60E-05	4.61E-05	4.61E-05	4.61E-05	4.61E-05	4.53E-05
np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np240	3.69E-15	9.37E-15	9.37E-15	9.37E-15	9.37E-15	2.58E-15
np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu236	7.06E-10	7.52E-10	7.93E-10	8.30E-10	8.62E-10	8.62E-10
pu237	7.11E-15	7.92E-15	8.80E-15	9.69E-15	1.06E-14	1.06E-14
pu238	7.38E-04	8.28E-04	9.18E-04	1.01E-03	1.10E-03	1.10E-03
pu239	2.05E-02	2.31E-02	2.56E-02	2.81E-02	3.06E-02	3.06E-02

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 29
power= 4.000E-03mw, burnup=8.7659E+00mwd, flux= 2.74E+08n/cm**2-sec

0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	1643.7 d	1826.3 d	2009.0 d	2191.6 d	2191.7 d
pu240	4.05E-07	5.12E-07	6.31E-07	7.63E-07	9.06E-07	9.06E-07
pu241	1.04E-11	1.47E-11	2.00E-11	2.63E-11	3.39E-11	3.39E-11
pu242	8.34E-17	1.33E-16	2.01E-16	2.93E-16	4.12E-16	4.12E-16
pu243	1.47E-25	2.81E-25	4.25E-25	6.19E-25	8.71E-25	6.66E-25
pu244	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu245	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu246	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
totals	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04
0 flux		2.74E+08	2.74E+08	2.74E+08	2.74E+08	2.74E-07

0 1q array has 20 entries.
0 3q array has 1 entries.
0 3q array has 1 entries.
0 3q array has 1 entries.
0 4q array has 1 entries.
0 54q array has 12 entries.
1library information...

cross-section data taken from position number 4 of library on unit 33.

pass 1
pass 0
scale-system control module sas2 library
used a time-dependent neutron spectrum, for each of the above passes
pass 0 applies start-up fuel densities
pass n applies mid time densities of nth library interval
first library updated was...
pass 1
pass 0
scale-system control module sas2 library
used a time-dependent neutron spectrum, for each of the above passes
pass 0 applies start-up fuel densities
pass n applies mid time densities of nth library interval
first library updated was...

```
*****************************************************************************
*                                                                           *
*         prelim lwr origen-s binary working library--id = 1143             *
*       made from modified card-image origen-s libraries of scale 4.2       *
*     data from the light element, actinide, and fission product libraries  *
*      decay data, including gamma and total energy, are from endf/b-vi     *
*                                                                           *
*     neutron flux spectrum factors and cross sections were produced from   *
*    the "presas2" case updating all nuclides on the scale "burnup" library *
```

```
          *                                                                         *
          *                  fission product yields are from endf/b-v               *
          *                                                                         *
          *              photon libraries use an 18-energy-group structure          *
          *             the photon data are from the master photon data base,       *
          *              produced to include bremsstrahlung from uo2 matrix         *
          *                                                                         *
          *        see information above this box (if present) for later updates    *
          *                                                                         *
          ***************************************************************************
          *                                                                         *
0         ***************************************************************************
0                   .other identification and sizes of library.
0                    data set name:  ft33f001
0                8/28/1996    date library was produced
0                     1697    total number of nuclides in library
                       689    number of light-element nuclides
                       129    number of actinide nuclides
                       879    number of fission product nuclides
0                     7993    number of nonzero off-diagonal matrix elements
0         ***************************************************************************
```

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 page 30
power= .00mw, burnup= 12.mwd, flux= 2.71E+08n/cm**2-sec
0 basis =
0 (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)

0	initial	2374.3 d	2556.9 d	2739.5 d	2922.2 d	2922.2 d
productions	1.134728E+06	1.134732E+06	1.134735E+06	1.134739E+06	1.134743E+06	1.134743E+06
absorptions	9.244198E+05	9.244260E+05	9.244325E+05	9.244386E+05	9.244447E+05	9.244446E+05
k infinity	1.227502E+00	1.227498E+00	1.227494E+00	1.227490E+00	1.227486E+00	1.227486E+00

0	initial	2374.3 d	2556.9 d	2739.5 d	2922.2 d	2922.2 d
actinide absorptions	9.212016E+05	9.212040E+05	9.212063E+05	9.212086E+05	9.212108E+05	9.212108E+05
non-actinide abs. fracs.	3.481328E-03	3.485382E-03	3.489971E-03	3.493965E-03	3.498256E-03	3.498197E-03

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 31
0 fraction of total absorption rate
power= .00mw, burnup= 12.mwd, flux= 2.71E+08n/cm**2-sec

0	initial	2374.3 d	2556.9 d	2739.5 d	2922.2 d	2922.2 d
sm149	4.45E-05	4.82E-05	5.19E-05	5.56E-05	5.93E-05	5.93E-05
sm151	1.84E-06	1.99E-06	2.14E-06	2.29E-06	2.44E-06	2.44E-06
xe135	2.30E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.30E-06
nd143	8.87E-07	9.62E-07	1.04E-06	1.11E-06	1.19E-06	1.19E-06
gd157	4.55E-07	4.92E-07	5.30E-07	5.67E-07	6.05E-07	6.05E-07
rh103	4.03E-07	4.37E-07	4.72E-07	5.06E-07	5.40E-07	5.40E-07
cd113	3.88E-07	4.21E-07	4.53E-07	4.85E-07	5.17E-07	5.17E-07
xe131	2.80E-07	3.03E-07	3.27E-07	3.50E-07	3.74E-07	3.74E-07
gd155	2.03E-07	2.33E-07	2.65E-07	2.98E-07	3.32E-07	3.32E-07
cs133	2.17E-07	2.35E-07	2.54E-07	2.72E-07	2.90E-07	2.90E-07
pm147	2.15E-07	2.22E-07	2.28E-07	2.34E-07	2.38E-07	2.38E-07
tc 99	1.60E-07	1.73E-07	1.87E-07	2.00E-07	2.13E-07	2.13E-07
nd145	1.25E-07	1.35E-07	1.45E-07	1.56E-07	1.66E-07	1.66E-07
sm147	8.05E-08	9.15E-08	1.03E-07	1.14E-07	1.26E-07	1.26E-07
eu155	9.32E-08	9.79E-08	1.02E-07	1.06E-07	1.10E-07	1.10E-07
mo 95	8.07E-08	8.79E-08	9.51E-08	1.02E-07	1.10E-07	1.10E-07
sm152	6.56E-08	7.11E-08	7.66E-08	8.20E-08	8.75E-08	8.75E-08
kr 83	5.43E-08	5.88E-08	6.33E-08	6.79E-08	7.24E-08	7.24E-08
cs135	4.91E-08	5.32E-08	5.73E-08	6.14E-08	6.55E-08	6.55E-08
eu151	3.17E-08	3.72E-08	4.31E-08	4.94E-08	5.61E-08	5.61E-08
ru101	3.80E-08	4.12E-08	4.43E-08	4.75E-08	5.07E-08	5.07E-08

pr141	3.61E-08	3.92E-08	4.22E-08	4.53E-08	4.84E-08	4.84E-08
eu153	3.33E-08	3.61E-08	3.89E-08	4.17E-08	4.45E-08	4.45E-08
la139	3.02E-08	3.27E-08	3.52E-08	3.77E-08	4.02E-08	4.02E-08
pd105	1.27E-08	1.37E-08	1.48E-08	1.59E-08	1.69E-08	1.69E-08
zr 93	1.22E-08	1.32E-08	1.42E-08	1.52E-08	1.62E-08	1.62E-08
i129	9.33E-09	1.01E-08	1.09E-08	1.17E-08	1.24E-08	1.25E-08
nd144	7.37E-09	8.13E-09	8.88E-09	9.64E-09	1.04E-08	1.04E-08
mo 97	6.83E-09	7.40E-09	7.97E-09	8.54E-09	9.11E-09	9.11E-09
rh105	8.33E-09	8.37E-09	8.37E-09	8.37E-09	8.37E-09	8.33E-09
ag109	4.74E-09	5.13E-09	5.53E-09	5.92E-09	6.31E-09	6.31E-09
zr 91	3.10E-09	3.37E-09	3.64E-09	3.91E-09	4.17E-09	4.17E-09
y 89	2.99E-09	3.25E-09	3.51E-09	3.77E-09	4.03E-09	4.03E-09
ru102	2.78E-09	3.02E-09	3.25E-09	3.48E-09	3.71E-09	3.71E-09
ce142	2.51E-09	2.72E-09	2.93E-09	3.14E-09	3.35E-09	3.35E-09
nd148	2.41E-09	2.61E-09	2.81E-09	3.01E-09	3.21E-09	3.21E-09
sr 90	2.37E-09	2.55E-09	2.73E-09	2.91E-09	3.09E-09	3.09E-09
nd146	2.02E-09	2.19E-09	2.36E-09	2.53E-09	2.70E-09	2.70E-09
pr143	2.68E-09	2.68E-09	2.68E-09	2.68E-09	2.68E-09	2.68E-09
ba138	1.73E-09	1.88E-09	2.02E-09	2.16E-09	2.31E-09	2.31E-09
in115	1.66E-09	1.79E-09	1.93E-09	2.07E-09	2.21E-09	2.21E-09
ce140	1.61E-09	1.74E-09	1.88E-09	2.01E-09	2.15E-09	2.15E-09
pd108	1.61E-09	1.74E-09	1.88E-09	2.01E-09	2.14E-09	2.14E-09
xe133	2.03E-09	2.03E-09	2.03E-09	2.03E-09	2.03E-09	2.03E-09
xe132	1.44E-09	1.56E-09	1.69E-09	1.81E-09	1.93E-09	1.93E-09
ba137	9.58E-10	1.12E-09	1.29E-09	1.48E-09	1.68E-09	1.68E-09
ce141	1.61E-09	1.61E-09	1.61E-09	1.61E-09	1.61E-09	1.61E-09
mo 98	9.96E-10	1.08E-09	1.16E-09	1.25E-09	1.33E-09	1.33E-09
mo100	9.66E-10	1.05E-09	1.13E-09	1.21E-09	1.29E-09	1.29E-09

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 32

0 fraction of total absorption rate

power= .00mw, burnup= 12.mwd, flux= 2.71E+08n/cm**2-sec

0

	initial	2374.3 d	2556.9 d	2739.5 d	2922.2 d	2922.2 d
pd107	9.60E-10	1.04E-09	1.12E-09	1.20E-09	1.28E-09	1.28E-09
xe134	9.56E-10	1.04E-09	1.12E-09	1.19E-09	1.27E-09	1.27E-09
zr 92	7.76E-10	8.41E-10	9.06E-10	9.71E-10	1.04E-09	1.04E-09
pm149	9.75E-10	9.82E-10	9.82E-10	9.82E-10	9.82E-10	9.75E-10
nd147	9.27E-10	9.31E-10	9.31E-10	9.31E-10	9.31E-10	9.27E-10
i127	6.16E-10	6.68E-10	7.20E-10	7.72E-10	8.25E-10	8.25E-10
zr 96	6.04E-10	6.55E-10	7.05E-10	7.56E-10	8.06E-10	8.06E-10
ru104	5.94E-10	6.43E-10	6.93E-10	7.42E-10	7.92E-10	7.92E-10
nd150	5.33E-10	5.77E-10	6.22E-10	6.66E-10	7.10E-10	7.10E-10
xe136	5.17E-10	5.60E-10	6.03E-10	6.46E-10	6.89E-10	6.89E-10
cs137	4.89E-10	5.27E-10	5.64E-10	6.01E-10	6.37E-10	6.37E-10
ce144	6.01E-10	6.02E-10	6.03E-10	6.04E-10	6.04E-10	6.04E-10
br 81	3.86E-10	4.19E-10	4.51E-10	4.83E-10	5.15E-10	5.15E-10
sm150	2.81E-10	3.30E-10	3.82E-10	4.38E-10	4.99E-10	4.99E-10
zr 94	3.27E-10	3.54E-10	3.81E-10	4.09E-10	4.36E-10	4.36E-10
rb 85	3.11E-10	3.38E-10	3.65E-10	3.92E-10	4.20E-10	4.20E-10
ru103	3.58E-10	3.58E-10	3.58E-10	3.58E-10	3.58E-10	3.58E-10
cd111	2.51E-10	2.72E-10	2.93E-10	3.14E-10	3.35E-10	3.35E-10
te130	2.35E-10	2.55E-10	2.74E-10	2.94E-10	3.13E-10	3.13E-10
sm154	2.27E-10	2.46E-10	2.65E-10	2.84E-10	3.03E-10	3.03E-10
rb 87	2.18E-10	2.37E-10	2.55E-10	2.73E-10	2.91E-10	2.91E-10
kr 85	1.86E-10	1.98E-10	2.10E-10	2.22E-10	2.33E-10	2.33E-10
se 77	1.56E-10	1.69E-10	1.82E-10	1.95E-10	2.08E-10	2.08E-10
zr 95	1.65E-10	1.65E-10	1.65E-10	1.65E-10	1.65E-10	1.65E-10
nb 95	1.53E-10	1.53E-10	1.53E-10	1.53E-10	1.53E-10	1.53E-10
y 91	1.44E-10	1.44E-10	1.44E-10	1.44E-10	1.44E-10	1.44E-10
kr 84	1.03E-10	1.11E-10	1.20E-10	1.28E-10	1.37E-10	1.37E-10

pd106	8.34E-11	9.24E-11	1.01E-10	1.11E-10	1.20E-10	1.20E-10
se 79	7.99E-11	8.65E-11	9.32E-11	9.98E-11	1.07E-10	1.07E-10
pm151	1.06E-10	1.11E-10	1.11E-10	1.11E-10	1.11E-10	1.06E-10
sb121	7.50E-11	8.13E-11	8.75E-11	9.38E-11	1.00E-10	1.00E-10
sb123	6.08E-11	6.59E-11	7.10E-11	7.61E-11	8.12E-11	8.12E-11
kr 86	5.77E-11	6.25E-11	6.73E-11	7.21E-11	7.70E-11	7.70E-11
te128	5.12E-11	5.55E-11	5.97E-11	6.40E-11	6.83E-11	6.83E-11
gd156	3.91E-11	4.24E-11	4.56E-11	4.89E-11	5.22E-11	5.22E-11
se 80	3.72E-11	4.03E-11	4.34E-11	4.65E-11	4.96E-11	4.96E-11
ba140	4.74E-11	4.76E-11	4.76E-11	4.76E-11	4.76E-11	4.74E-11
dy161	3.26E-11	3.53E-11	3.80E-11	4.07E-11	4.34E-11	4.34E-11
zr 90	2.14E-11	2.50E-11	2.89E-11	3.31E-11	3.75E-11	3.75E-11
sm153	3.73E-11	3.82E-11	3.82E-11	3.82E-11	3.82E-11	3.72E-11
eu156	3.42E-11	3.42E-11	3.42E-11	3.42E-11	3.42E-11	3.42E-11
sr 89	3.09E-11	3.10E-11	3.10E-11	3.10E-11	3.10E-11	3.09E-11
tb159	2.18E-11	2.36E-11	2.54E-11	2.72E-11	2.90E-11	2.90E-11
li 6	2.12E-11	2.30E-11	2.47E-11	2.65E-11	2.83E-11	2.83E-11
cd112	2.10E-11	2.27E-11	2.45E-11	2.62E-11	2.80E-11	2.80E-11
ru106	2.48E-11	2.49E-11	2.49E-11	2.50E-11	2.50E-11	2.50E-11
te125	1.55E-11	1.76E-11	1.98E-11	2.21E-11	2.44E-11	2.44E-11
sn117	1.67E-11	1.80E-11	1.94E-11	2.08E-11	2.22E-11	2.22E-11
sn119	1.37E-11	1.49E-11	1.60E-11	1.72E-11	1.83E-11	1.83E-11

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 33

0 fraction of total absorption rate

power= .00mw, burnup= 12.mwd, flux= 2.71E+08n/cm**2-sec

0	initial	2374.3 d	2556.9 d	2739.5 d	2922.2 d	2922.2 d
ce143	1.70E-11	1.76E-11	1.76E-11	1.76E-11	1.76E-11	1.70E-11
sn115	1.26E-11	1.36E-11	1.47E-11	1.57E-11	1.68E-11	1.68E-11
la140	1.53E-11	1.53E-11	1.53E-11	1.53E-11	1.53E-11	1.53E-11
sr 88	1.06E-11	1.15E-11	1.24E-11	1.32E-11	1.41E-11	1.41E-11
sb125	1.17E-11	1.20E-11	1.24E-11	1.27E-11	1.30E-11	1.29E-11
mo 99	1.29E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.29E-11
pd110	7.47E-12	8.09E-12	8.71E-12	9.33E-12	9.95E-12	9.95E-12
cd114	7.26E-12	7.86E-12	8.47E-12	9.07E-12	9.68E-12	9.68E-12
se 82	7.19E-12	7.79E-12	8.39E-12	8.99E-12	9.59E-12	9.59E-12
eu154	6.12E-12	6.85E-12	7.61E-12	8.39E-12	9.19E-12	9.19E-12
gd158	6.86E-12	7.44E-12	8.02E-12	8.60E-12	9.18E-12	9.18E-12
pm148m	7.51E-12	7.75E-12	7.98E-12	8.17E-12	8.35E-12	8.34E-12
kr 87	8.22E-12	2.32E-11	2.32E-11	2.32E-11	2.32E-11	8.22E-12
sn126	5.76E-12	6.25E-12	6.73E-12	7.21E-12	7.69E-12	7.69E-12
te127m	7.36E-12	7.36E-12	7.36E-12	7.36E-12	7.36E-12	7.36E-12
se 78	5.44E-12	5.89E-12	6.34E-12	6.80E-12	7.25E-12	7.25E-12
i131	6.77E-12	6.79E-12	6.79E-12	6.79E-12	6.79E-12	6.77E-12
sn124	4.34E-12	4.70E-12	5.07E-12	5.43E-12	5.79E-12	5.79E-12
dy162	4.17E-12	4.51E-12	4.86E-12	5.20E-12	5.55E-12	5.55E-12
dy164	3.80E-12	4.12E-12	4.43E-12	4.75E-12	5.07E-12	5.07E-12
as 75	3.24E-12	3.51E-12	3.78E-12	4.05E-12	4.32E-12	4.32E-12
y 90	2.26E-12	2.43E-12	2.60E-12	2.77E-12	2.94E-12	2.94E-12
sn118	1.77E-12	1.92E-12	2.06E-12	2.21E-12	2.36E-12	2.36E-12
ba136	1.71E-12	1.85E-12	2.00E-12	2.14E-12	2.29E-12	2.29E-12
sn122	1.51E-12	1.64E-12	1.76E-12	1.89E-12	2.01E-12	2.01E-12
cd116	1.51E-12	1.63E-12	1.76E-12	1.88E-12	2.01E-12	2.01E-12
eu152	8.13E-13	1.03E-12	1.27E-12	1.55E-12	1.87E-12	1.87E-12
cs134	1.33E-12	1.46E-12	1.58E-12	1.71E-12	1.84E-12	1.84E-12
te129m	1.80E-12	1.80E-12	1.80E-12	1.80E-12	1.80E-12	1.80E-12
ru 99	1.07E-12	1.18E-12	1.30E-12	1.41E-12	1.54E-12	1.54E-12
sn120	1.13E-12	1.22E-12	1.31E-12	1.41E-12	1.50E-12	1.50E-12
kr 82	9.49E-13	1.03E-12	1.11E-12	1.19E-12	1.27E-12	1.27E-12
dy163	9.21E-13	9.98E-13	1.07E-12	1.15E-12	1.23E-12	1.23E-12

ge 73	8.85E-13	9.59E-13	1.03E-12	1.11E-12	1.18E-12	1.18E-12
xe130	5.86E-13	6.35E-13	6.84E-13	7.33E-13	7.83E-13	7.83E-13
in113	3.25E-13	3.78E-13	4.35E-13	4.96E-13	5.60E-13	5.60E-13
mo 96	4.14E-13	4.49E-13	4.84E-13	5.19E-13	5.55E-13	5.55E-13
ge 76	3.21E-13	3.48E-13	3.75E-13	4.02E-13	4.28E-13	4.28E-13
pm148	2.90E-13	3.02E-13	3.10E-13	3.18E-13	3.24E-13	3.21E-13
ag111	3.14E-13	3.15E-13	3.15E-13	3.15E-13	3.15E-13	3.14E-13
eu157	2.75E-13	2.97E-13	2.97E-13	2.97E-13	2.97E-13	2.74E-13
gd160	2.02E-13	2.19E-13	2.35E-13	2.52E-13	2.69E-13	2.69E-13
cd115m	2.37E-13	2.37E-13	2.37E-13	2.37E-13	2.37E-13	2.37E-13
te126	1.56E-13	1.69E-13	1.82E-13	1.95E-13	2.09E-13	2.09E-13
ru100	1.23E-13	1.37E-13	1.51E-13	1.67E-13	1.83E-13	1.83E-13
gd152	4.62E-14	5.88E-14	7.35E-14	9.05E-14	1.10E-13	1.10E-13
sm148	5.41E-14	6.25E-14	7.14E-14	8.07E-14	9.05E-14	9.05E-14
ho165	6.33E-14	6.86E-14	7.39E-14	7.91E-14	8.44E-14	8.44E-14
gd154	4.16E-14	5.02E-14	5.98E-14	7.04E-14	8.20E-14	8.20E-14

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 34

0 fraction of total absorption rate

power= .00mw, burnup= 12.mwd, flux= 2.71E+08n/cm**2-sec

0	initial	2374.3 d	2556.9 d	2739.5 d	2922.2 d	2922.2 d
cs136	5.53E-14	5.56E-14	5.56E-14	5.56E-14	5.56E-14	5.54E-14
nd142	3.03E-14	3.56E-14	4.13E-14	4.75E-14	5.40E-14	5.40E-14
sr 87	3.69E-14	4.00E-14	4.31E-14	4.62E-14	4.93E-14	4.93E-14
te124	3.61E-14	3.93E-14	4.24E-14	4.56E-14	4.87E-14	4.87E-14
ba135	2.78E-14	3.23E-14	3.71E-14	4.22E-14	4.76E-14	4.76E-14
ba134	2.21E-14	2.62E-14	3.08E-14	3.57E-14	4.10E-14	4.10E-14
pd104	1.90E-14	2.23E-14	2.60E-14	2.99E-14	3.41E-14	3.41E-14
sn125	2.90E-14	2.92E-14	2.92E-14	2.92E-14	2.92E-14	2.90E-14
nb 94	2.09E-14	2.26E-14	2.44E-14	2.61E-14	2.78E-14	2.78E-14
ge 74	1.79E-14	1.94E-14	2.09E-14	2.24E-14	2.39E-14	2.39E-14
ru105	2.25E-14	2.94E-14	2.94E-14	2.94E-14	2.94E-14	2.25E-14
ge 72	1.20E-14	1.30E-14	1.40E-14	1.50E-14	1.60E-14	1.60E-14
sr 86	1.04E-14	1.13E-14	1.22E-14	1.30E-14	1.39E-14	1.39E-14
sn123	1.01E-14	1.01E-14	1.01E-14	1.01E-14	1.01E-14	1.01E-14
te132	9.45E-15	9.60E-15	9.60E-15	9.60E-15	9.60E-15	9.45E-15
se 76	6.97E-15	7.56E-15	8.14E-15	8.73E-15	9.31E-15	9.31E-15
rb 88	8.90E-15	1.30E-14	1.30E-14	1.30E-14	1.30E-14	8.90E-15
i135	8.34E-15	1.02E-14	1.02E-14	1.02E-14	1.02E-14	8.35E-15
cd110	3.79E-15	4.35E-15	4.95E-15	5.58E-15	6.25E-15	6.25E-15
br 79	1.98E-15	2.32E-15	2.68E-15	3.08E-15	3.50E-15	3.50E-15
sb126	3.01E-15	3.03E-15	3.03E-15	3.03E-15	3.03E-15	3.02E-15
xe128	1.76E-15	1.92E-15	2.08E-15	2.24E-15	2.40E-15	2.40E-15
er166	1.67E-15	1.81E-15	1.95E-15	2.10E-15	2.24E-15	2.24E-15
sb124	2.10E-15	2.11E-15	2.11E-15	2.11E-15	2.11E-15	2.11E-15
dy160	1.41E-15	1.54E-15	1.68E-15	1.82E-15	1.96E-15	1.96E-15
xe129	1.10E-15	1.29E-15	1.50E-15	1.72E-15	1.95E-15	1.95E-15
in117m	1.85E-15	2.11E-15	2.11E-15	2.11E-15	2.11E-15	1.85E-15
ag107	1.03E-15	1.21E-15	1.40E-15	1.61E-15	1.83E-15	1.83E-15
te134	8.74E-16	5.90E-15	5.90E-15	5.90E-15	5.90E-15	8.74E-16
nb 93	3.34E-16	4.19E-16	5.17E-16	6.29E-16	7.55E-16	7.55E-16
kr 80	5.01E-16	5.43E-16	5.85E-16	6.27E-16	6.69E-16	6.69E-16
i130	6.52E-16	7.25E-16	7.25E-16	7.26E-16	7.26E-16	6.54E-16
in117	5.50E-16	6.19E-16	6.19E-16	6.19E-16	6.19E-16	5.50E-16
tb160	3.59E-16	3.65E-16	3.70E-16	3.75E-16	3.80E-16	3.80E-16
rb 86	2.44E-16	2.45E-16	2.45E-16	2.45E-16	2.45E-16	2.45E-16
dy165	1.23E-16	2.12E-16	2.12E-16	2.12E-16	2.12E-16	1.23E-16
te122	8.20E-17	9.05E-17	9.91E-17	1.08E-16	1.17E-16	1.17E-16
sn116	5.96E-17	6.83E-17	7.76E-17	8.75E-17	9.79E-17	9.79E-17
be 9	3.99E-17	4.32E-17	4.65E-17	4.98E-17	5.32E-17	5.32E-17

pr142	3.87E-17	4.50E-17	4.85E-17	5.20E-17	5.55E-17	5.17E-17
te123	3.36E-17	3.66E-17	3.96E-17	4.26E-17	4.56E-17	4.56E-17
ge 75	3.41E-17	8.71E-17	8.71E-17	8.71E-17	8.71E-17	3.41E-17
cd118	2.48E-17	1.21E-16	1.21E-16	1.21E-16	1.21E-16	2.48E-17
li 7	1.63E-17	1.77E-17	1.90E-17	2.04E-17	2.18E-17	2.18E-17
er167	6.76E-18	7.35E-18	7.94E-18	8.53E-18	9.13E-18	9.13E-18
cd108	3.34E-19	3.61E-19	3.91E-19	4.18E-19	4.49E-19	4.49E-19
in119m	4.22E-19	3.03E-17	3.03E-17	3.03E-17	3.03E-17	4.22E-19
cs134m	1.92E-19	3.31E-19	3.58E-19	3.81E-19	4.08E-19	2.56E-19
cd109	1.86E-19	1.89E-19	1.92E-19	1.92E-19	1.96E-19	1.96E-19

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 35

0 fraction of total absorption rate

power= .00mw, burnup= 12.mwd, flux= 2.71E+08n/cm**2-sec

0	initial	2374.3 d	2556.9 d	2739.5 d	2922.2 d	2922.2 d
sn114	6.75E-21	6.75E-21	6.75E-21	6.75E-21	1.01E-20	1.01E-20

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 36

power= 4.000E-03mw, burnup=1.1688E+01mwd, flux= 2.71E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	2374.3 d	2556.9 d	2739.5 d	2922.2 d	2922.2 d
h 1	5.18E-07	5.61E-07	6.03E-07	6.46E-07	6.89E-07	6.89E-07
h 2	1.54E-09	1.66E-09	1.79E-09	1.92E-09	2.04E-09	2.04E-09
h 3	9.56E-12	1.02E-11	1.08E-11	1.14E-11	1.20E-11	1.20E-11
h 4	.00E+00	4.15E-35	4.41E-35	4.66E-35	4.90E-35	.00E+00
he 3	1.72E-12	1.99E-12	2.29E-12	2.60E-12	2.93E-12	2.93E-12
he 4	8.57E-08	9.27E-08	9.97E-08	1.07E-07	1.14E-07	1.14E-07
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	1.03E-08	1.11E-08	1.20E-08	1.28E-08	1.37E-08	1.37E-08
ne 21	2.04E-15	2.36E-15	2.71E-15	3.09E-15	3.48E-15	3.48E-15
ne 22	3.38E-11	3.84E-11	4.30E-11	4.77E-11	5.26E-11	5.26E-11
ne 23	7.04E-30	7.03E-15	7.03E-15	7.03E-15	7.03E-15	7.03E-30
na 22	3.33E-11	3.43E-11	3.52E-11	3.60E-11	3.66E-11	3.66E-11
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	2.60E-08	2.77E-08	2.77E-08	2.77E-08	2.77E-08	2.53E-08
na 24m	4.68E-30	4.55E-15	4.55E-15	4.55E-15	4.55E-15	4.55E-30
na 25	3.62E-43	3.55E-28	3.82E-28	4.10E-28	4.37E-28	4.82E-43
mg 24	7.97E-05	8.54E-05	9.12E-05	9.70E-05	1.03E-04	1.03E-04
mg 25	1.15E-11	1.24E-11	1.34E-11	1.44E-11	1.53E-11	1.53E-11
mg 26	1.54E-09	1.66E-09	1.79E-09	1.92E-09	2.04E-09	2.04E-09
mg 27	4.55E-16	2.10E-12	2.10E-12	2.10E-12	2.10E-12	4.54E-16
mg 28	4.03E-24	4.29E-24	4.29E-24	4.29E-24	4.29E-24	4.03E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	2.88E-25	2.05E-10	2.05E-10	2.05E-10	2.05E-10	2.80E-25
al 29	2.53E-33	5.60E-28	6.44E-28	7.34E-28	8.29E-28	4.34E-33
al 30	.00E+00	6.93E-41	8.60E-41	1.05E-40	1.27E-40	.00E+00
si 28	2.31E-04	2.48E-04	2.64E-04	2.81E-04	2.98E-04	2.98E-04
si 29	1.88E-12	2.19E-12	2.52E-12	2.87E-12	3.25E-12	3.25E-12
si 30	1.61E-20	2.03E-20	2.52E-20	3.08E-20	3.71E-20	3.71E-20
si 31	6.95E-33	1.46E-32	1.81E-32	2.21E-32	2.67E-32	1.61E-32
si 32	1.25E-40	1.71E-40	2.28E-40	2.99E-40	3.85E-40	3.85E-40
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		2.71E+08	2.71E+08	2.71E+08	2.71E+08	2.71E-07

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 37

power= 4.000E-03mw, burnup=1.1688E+01mwd, flux= 2.71E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

charge 2374.3 d 2556.9 d 2739.5 d 2922.2 d 2922.2 d

he 4	3.33E-04	3.64E-04	3.94E-04	4.25E-04	4.57E-04	4.57E-04
pb206	1.19E-13	1.67E-13	2.28E-13	3.05E-13	4.00E-13	4.00E-13
pb207	1.73E-11	2.20E-11	2.74E-11	3.37E-11	4.08E-11	4.08E-11
pb208	7.06E-12	9.23E-12	1.18E-11	1.48E-11	1.82E-11	1.82E-11
pb209	4.90E-17	5.72E-17	6.65E-17	7.65E-17	8.72E-17	8.78E-17
pb210	3.48E-12	4.41E-12	5.49E-12	6.73E-12	8.14E-12	8.14E-12
pb211	7.93E-16	9.28E-16	1.07E-15	1.23E-15	1.39E-15	1.39E-15
pb212	6.97E-15	8.32E-15	9.76E-15	1.13E-14	1.29E-14	1.29E-14
pb214	1.30E-16	1.58E-16	1.83E-16	2.10E-16	2.39E-16	2.32E-16
ra222	2.18E-28	2.46E-28	2.77E-28	3.08E-28	3.40E-28	3.40E-28
ra223	3.62E-13	4.23E-13	4.89E-13	5.59E-13	6.34E-13	6.34E-13
ra224	5.76E-14	6.87E-14	8.06E-14	9.33E-14	1.07E-13	1.07E-13
ra225	5.31E-15	6.25E-15	7.27E-15	8.36E-15	9.53E-15	9.53E-15
ra226	4.22E-09	4.96E-09	5.75E-09	6.60E-09	7.51E-09	7.51E-09
ra228	3.65E-15	4.21E-15	4.80E-15	5.42E-15	6.06E-15	6.06E-15
ac225	3.59E-15	4.22E-15	4.91E-15	5.65E-15	6.44E-15	6.44E-15
ac227	2.57E-10	3.00E-10	3.46E-10	3.96E-10	4.48E-10	4.48E-10
ac228	4.46E-19	5.14E-19	5.86E-19	6.61E-19	7.39E-19	7.39E-19
th226	1.06E-26	1.20E-26	1.35E-26	1.50E-26	1.66E-26	1.66E-26
th227	5.83E-13	6.82E-13	7.88E-13	9.01E-13	1.02E-12	1.02E-12
th228	1.10E-11	1.31E-11	1.53E-11	1.77E-11	2.03E-11	2.03E-11
th229	1.03E-09	1.22E-09	1.41E-09	1.62E-09	1.85E-09	1.85E-09
th230	1.53E-04	1.66E-04	1.79E-04	1.92E-04	2.04E-04	2.04E-04
th231	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	3.10E-05	3.36E-05	3.61E-05	3.87E-05	4.13E-05	4.13E-05
th233	7.92E-18	3.08E-16	3.31E-16	3.55E-16	3.79E-16	1.05E-17
th234	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	4.31E-06	4.67E-06	5.03E-06	5.39E-06	5.75E-06	5.75E-06
pa232	7.11E-14	8.03E-14	8.65E-14	9.27E-14	9.89E-14	9.48E-14
pa233	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06
pa234m	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11
pa234	8.09E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	1.03E-23	1.16E-23	1.31E-23	1.46E-23	1.61E-23	1.60E-23
u231	6.04E-20	6.60E-20	7.12E-20	7.64E-20	8.16E-20	8.05E-20
u232	8.09E-10	9.18E-10	1.03E-09	1.15E-09	1.26E-09	1.26E-09
u233	8.05E-05	8.73E-05	9.41E-05	1.01E-04	1.08E-04	1.08E-04
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	3.09E-06	3.10E-06	3.10E-06	3.10E-06	3.10E-06	3.07E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	1.06E-08	3.18E-07	3.18E-07	3.18E-07	3.18E-07	1.06E-08
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	8.53E-12	8.55E-12	8.57E-12	8.58E-12	8.59E-12	8.59E-12
np236m	1.94E-12	2.05E-12	2.05E-12	2.05E-12	2.05E-12	1.93E-12
np236	1.20E-09	1.29E-09	1.39E-09	1.49E-09	1.59E-09	1.59E-09
np237	4.21E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01
np238	1.52E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06	1.51E-06

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 38
power= 4.000E-03mw, burnup=1.1688E+01mwd, flux= 2.71E+08n/cm**2-sec

0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	2374.3 d	2556.9 d	2739.5 d	2922.2 d	2922.2 d
np239	4.53E-05	4.59E-05	4.59E-05	4.59E-05	4.59E-05	4.51E-05
np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np240	2.58E-15	9.33E-15	9.33E-15	9.33E-15	9.33E-15	2.57E-15
np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00

```
     pu236    8.62E-10  8.90E-10  9.15E-10  9.37E-10  9.57E-10  9.57E-10
     pu237    1.06E-14  1.14E-14  1.23E-14  1.31E-14  1.40E-14  1.40E-14
     pu238    1.10E-03  1.18E-03  1.27E-03  1.36E-03  1.45E-03  1.45E-03
     pu239    3.06E-02  3.31E-02  3.56E-02  3.82E-02  4.07E-02  4.07E-02
     pu240    9.06E-07  1.06E-06  1.23E-06  1.41E-06  1.60E-06  1.60E-06
     pu241    3.39E-11  4.28E-11  5.30E-11  6.47E-11  7.79E-11  7.79E-11
     pu242    4.12E-16  5.64E-16  7.55E-16  9.90E-16  1.27E-15  1.27E-15
     pu243    6.66E-25  1.19E-24  1.59E-24  2.08E-24  2.68E-24  2.05E-24
     pu244     .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
     pu245     .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
     pu246     .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
   totals     3.73E+04  3.73E+04  3.73E+04  3.73E+04  3.73E+04  3.73E+04
0    flux               2.71E+08  2.71E+08  2.71E+08  2.71E+08  2.71E-07
0        1q array has     20 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        4q array has      1 entries.
0       54q array has     12 entries.
1library information...

          cross-section data taken from position number  1 of library on unit 15.

          pass   5
          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          ********************************************************************************
          *                                                                              *
          *             prelim lwr origen-s binary working library--id = 1143            *
          *          made from modified card-image origen-s libraries of scale 4.2       *
          *       data from the light element, actinide, and fission product libraries   *
          *         decay data, including gamma and total energy, are from endf/b-vi     *
          *                                                                              *
          *       neutron flux spectrum factors and cross sections were produced from    *
          *      the "presas2" case updating all nuclides on the scale "burnup" library  *
          *                                                                              *
          *                   fission product yields are from endf/b-v                   *
          *                                                                              *
          *                 photon libraries use an 18-energy-group structure            *
          *                the photon data are from the master photon data base,         *
          *                 produced to include bremsstrahlung from uo2 matrix           *
          *                                                                              *
          *         see information above this box (if present) for later updates      *
          *                                                                              *
          ********************************************************************************
          *                                                                              *
0         ********************************************************************************
0                   .other identification and sizes of library.
```

0 data set name: ft15f001
0 8/28/1996 date library was produced
0 1697 total number of nuclides in library
689 number of light-element nuclides
129 number of actinide nuclides
879 number of fission product nuclides
0 7993 number of nonzero off-diagonal matrix elements
0 **
1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 page 39
power= .00mw, burnup= 15.mwd, flux= 2.70E+08n/cm**2-sec
0 basis =
0 (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)

0	initial	3104.9 d	3287.5 d	3470.1 d	3652.7 d
productions	1.138387E+06	1.138390E+06	1.138394E+06	1.138398E+06	1.138402E+06
absorptions	9.269936E+05	9.269998E+05	9.270060E+05	9.270122E+05	9.270183E+05
k infinity	1.228041E+00	1.228037E+00	1.228033E+00	1.228029E+00	1.228025E+00

0	initial	3104.9 d	3287.5 d	3470.1 d	3652.7 d
actinide absorptions	9.237744E+05	9.237767E+05	9.237790E+05	9.237813E+05	9.237836E+05
non-actinide abs. fracs.	3.472745E-03	3.476918E-03	3.481090E-03	3.485322E-03	3.489256E-03

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 40
0 fraction of total absorption rate
power= .00mw, burnup= 15.mwd, flux= 2.70E+08n/cm**2-sec

0	initial	3104.9 d	3287.5 d	3470.1 d	3652.7 d
sm149	5.94E-05	6.31E-05	6.67E-05	7.04E-05	7.41E-05
sm151	2.44E-06	2.59E-06	2.73E-06	2.88E-06	3.03E-06
xe135	2.30E-06	2.34E-06	2.34E-06	2.34E-06	2.34E-06
nd143	1.19E-06	1.26E-06	1.34E-06	1.41E-06	1.49E-06
gd157	6.05E-07	6.42E-07	6.80E-07	7.17E-07	7.54E-07
rh103	5.40E-07	5.75E-07	6.09E-07	6.44E-07	6.78E-07
cd113	5.18E-07	5.50E-07	5.82E-07	6.14E-07	6.47E-07
gd155	3.32E-07	3.68E-07	4.04E-07	4.41E-07	4.80E-07
xe131	3.74E-07	3.97E-07	4.20E-07	4.44E-07	4.67E-07
cs133	2.90E-07	3.08E-07	3.26E-07	3.44E-07	3.63E-07
tc 99	2.13E-07	2.27E-07	2.40E-07	2.53E-07	2.67E-07
pm147	2.38E-07	2.42E-07	2.46E-07	2.49E-07	2.52E-07
nd145	1.66E-07	1.77E-07	1.87E-07	1.97E-07	2.08E-07
sm147	1.26E-07	1.38E-07	1.50E-07	1.63E-07	1.75E-07
mo 95	1.09E-07	1.17E-07	1.24E-07	1.31E-07	1.38E-07
eu155	1.10E-07	1.13E-07	1.16E-07	1.19E-07	1.22E-07
sm152	8.75E-08	9.29E-08	9.84E-08	1.04E-07	1.09E-07
kr 83	7.24E-08	7.69E-08	8.15E-08	8.60E-08	9.05E-08
eu151	5.61E-08	6.33E-08	7.09E-08	7.89E-08	8.73E-08
cs135	6.55E-08	6.96E-08	7.37E-08	7.78E-08	8.19E-08
ru101	5.06E-08	5.38E-08	5.70E-08	6.01E-08	6.33E-08
pr141	4.84E-08	5.15E-08	5.45E-08	5.76E-08	6.07E-08
eu153	4.45E-08	4.72E-08	5.00E-08	5.28E-08	5.56E-08
la139	4.02E-08	4.27E-08	4.53E-08	4.78E-08	5.03E-08
pd105	1.69E-08	1.80E-08	1.90E-08	2.01E-08	2.11E-08
zr 93	1.62E-08	1.72E-08	1.82E-08	1.93E-08	2.03E-08
i129	1.25E-08	1.32E-08	1.40E-08	1.48E-08	1.56E-08
nd144	1.04E-08	1.12E-08	1.19E-08	1.27E-08	1.34E-08
mo 97	9.11E-09	9.68E-09	1.02E-08	1.08E-08	1.14E-08
rh105	8.34E-09	8.37E-09	8.37E-09	8.37E-09	8.37E-09
ag109	6.31E-09	6.71E-09	7.10E-09	7.49E-09	7.89E-09
zr 91	4.18E-09	4.44E-09	4.71E-09	4.98E-09	5.25E-09
y 89	4.03E-09	4.29E-09	4.54E-09	4.80E-09	5.06E-09
ru102	3.71E-09	3.95E-09	4.18E-09	4.41E-09	4.64E-09

ce142	3.35E-09	3.56E-09	3.77E-09	3.98E-09	4.19E-09
nd148	3.21E-09	3.41E-09	3.62E-09	3.82E-09	4.02E-09
sr 90	3.09E-09	3.26E-09	3.43E-09	3.60E-09	3.77E-09
nd146	2.70E-09	2.87E-09	3.04E-09	3.21E-09	3.38E-09
ba138	2.31E-09	2.45E-09	2.60E-09	2.74E-09	2.89E-09
in115	2.21E-09	2.35E-09	2.49E-09	2.62E-09	2.76E-09
ce140	2.15E-09	2.28E-09	2.42E-09	2.55E-09	2.69E-09
pr143	2.68E-09	2.68E-09	2.68E-09	2.68E-09	2.68E-09
pd108	2.14E-09	2.28E-09	2.41E-09	2.54E-09	2.68E-09
ba137	1.68E-09	1.89E-09	2.11E-09	2.34E-09	2.58E-09
xe132	1.93E-09	2.05E-09	2.17E-09	2.29E-09	2.41E-09
xe133	2.03E-09	2.03E-09	2.03E-09	2.03E-09	2.03E-09
mo 98	1.33E-09	1.41E-09	1.49E-09	1.58E-09	1.66E-09
mo100	1.29E-09	1.37E-09	1.45E-09	1.53E-09	1.61E-09
ce141	1.61E-09	1.61E-09	1.61E-09	1.61E-09	1.61E-09

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 41

0 fraction of total absorption rate

power= .00mw, burnup= 15.mwd, flux= 2.70E+08n/cm**2-sec

0	initial	3104.9 d	3287.5 d	3470.1 d	3652.7 d
pd107	1.28E-09	1.36E-09	1.44E-09	1.52E-09	1.60E-09
xe134	1.28E-09	1.35E-09	1.43E-09	1.51E-09	1.59E-09
zr 92	1.04E-09	1.10E-09	1.17E-09	1.23E-09	1.29E-09
i127	8.24E-10	8.76E-10	9.29E-10	9.81E-10	1.03E-09
zr 96	8.05E-10	8.56E-10	9.06E-10	9.56E-10	1.01E-09
ru104	7.92E-10	8.41E-10	8.91E-10	9.40E-10	9.90E-10
pm149	9.75E-10	9.82E-10	9.82E-10	9.82E-10	9.82E-10
nd147	9.27E-10	9.31E-10	9.31E-10	9.31E-10	9.31E-10
nd150	7.10E-10	7.55E-10	7.99E-10	8.44E-10	8.88E-10
xe136	6.89E-10	7.32E-10	7.75E-10	8.18E-10	8.62E-10
cs137	6.37E-10	6.73E-10	7.09E-10	7.44E-10	7.79E-10
sm150	4.99E-10	5.63E-10	6.31E-10	7.03E-10	7.78E-10
br 81	5.15E-10	5.47E-10	5.80E-10	6.12E-10	6.44E-10
ce144	6.04E-10	6.04E-10	6.04E-10	6.04E-10	6.04E-10
zr 94	4.36E-10	4.63E-10	4.90E-10	5.17E-10	5.45E-10
rb 85	4.20E-10	4.47E-10	4.75E-10	5.03E-10	5.31E-10
cd111	3.35E-10	3.56E-10	3.77E-10	3.98E-10	4.19E-10
te130	3.13E-10	3.33E-10	3.53E-10	3.72E-10	3.92E-10
sm154	3.03E-10	3.22E-10	3.41E-10	3.60E-10	3.79E-10
rb 87	2.91E-10	3.09E-10	3.28E-10	3.46E-10	3.64E-10
ru103	3.58E-10	3.58E-10	3.58E-10	3.58E-10	3.58E-10
kr 85	2.33E-10	2.44E-10	2.55E-10	2.65E-10	2.75E-10
se 77	2.08E-10	2.21E-10	2.34E-10	2.47E-10	2.60E-10
kr 84	1.37E-10	1.46E-10	1.54E-10	1.63E-10	1.71E-10
zr 95	1.65E-10	1.65E-10	1.65E-10	1.65E-10	1.65E-10
pd106	1.20E-10	1.29E-10	1.38E-10	1.47E-10	1.56E-10
nb 95	1.53E-10	1.53E-10	1.53E-10	1.53E-10	1.53E-10
y 91	1.44E-10	1.44E-10	1.44E-10	1.44E-10	1.44E-10
se 79	1.07E-10	1.13E-10	1.20E-10	1.27E-10	1.33E-10
sb121	1.00E-10	1.06E-10	1.12E-10	1.19E-10	1.25E-10
pm151	1.06E-10	1.11E-10	1.11E-10	1.11E-10	1.11E-10
sb123	8.12E-11	8.63E-11	9.14E-11	9.65E-11	1.02E-10
kr 86	7.70E-11	8.18E-11	8.66E-11	9.14E-11	9.62E-11
te128	6.83E-11	7.25E-11	7.68E-11	8.11E-11	8.53E-11
gd156	5.22E-11	5.55E-11	5.88E-11	6.21E-11	6.54E-11
se 80	4.96E-11	5.28E-11	5.59E-11	5.90E-11	6.21E-11
zr 90	3.75E-11	4.22E-11	4.71E-11	5.23E-11	5.77E-11
dy161	4.34E-11	4.61E-11	4.88E-11	5.16E-11	5.43E-11
ba140	4.74E-11	4.76E-11	4.76E-11	4.76E-11	4.76E-11
sm153	3.73E-11	3.83E-11	3.83E-11	3.83E-11	3.83E-11

tb159	2.90E-11	3.08E-11	3.27E-11	3.45E-11	3.63E-11
li 6	2.83E-11	3.00E-11	3.18E-11	3.36E-11	3.53E-11
cd112	2.80E-11	2.98E-11	3.15E-11	3.32E-11	3.50E-11
eu156	3.42E-11	3.42E-11	3.42E-11	3.42E-11	3.42E-11
te125	2.44E-11	2.67E-11	2.91E-11	3.16E-11	3.40E-11
sr 89	3.10E-11	3.10E-11	3.10E-11	3.10E-11	3.10E-11
sn117	2.22E-11	2.36E-11	2.50E-11	2.64E-11	2.78E-11
ru106	2.50E-11	2.51E-11	2.51E-11	2.51E-11	2.51E-11
kr 87	8.22E-12	2.32E-11	2.32E-11	2.32E-11	2.32E-11

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 42

0 fraction of total absorption rate

power= .00mw, burnup= 15.mwd, flux= 2.70E+08n/cm**2-sec

0	initial	3104.9 d	3287.5 d	3470.1 d	3652.7 d
sn119	1.83E-11	1.95E-11	2.06E-11	2.18E-11	2.29E-11
sn115	1.68E-11	1.78E-11	1.89E-11	1.99E-11	2.10E-11
sr 88	1.41E-11	1.50E-11	1.59E-11	1.68E-11	1.77E-11
ce143	1.70E-11	1.76E-11	1.76E-11	1.76E-11	1.76E-11
la140	1.53E-11	1.53E-11	1.53E-11	1.53E-11	1.53E-11
sb125	1.29E-11	1.32E-11	1.34E-11	1.36E-11	1.37E-11
mo 99	1.29E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11
eu154	9.20E-12	1.00E-11	1.09E-11	1.18E-11	1.27E-11
pd110	9.95E-12	1.06E-11	1.12E-11	1.18E-11	1.24E-11
cd114	9.68E-12	1.03E-11	1.09E-11	1.15E-11	1.21E-11
se 82	9.60E-12	1.02E-11	1.08E-11	1.14E-11	1.20E-11
gd158	9.18E-12	9.77E-12	1.04E-11	1.09E-11	1.15E-11
sn126	7.69E-12	8.17E-12	8.65E-12	9.14E-12	9.62E-12
se 78	7.25E-12	7.70E-12	8.16E-12	8.61E-12	9.06E-12
pm148m	8.34E-12	8.49E-12	8.63E-12	8.74E-12	8.84E-12
te127m	7.37E-12	7.36E-12	7.37E-12	7.37E-12	7.37E-12
sn124	5.79E-12	6.15E-12	6.51E-12	6.87E-12	7.23E-12
dy162	5.55E-12	5.90E-12	6.24E-12	6.59E-12	6.93E-12
i131	6.77E-12	6.79E-12	6.79E-12	6.79E-12	6.79E-12
dy164	5.07E-12	5.39E-12	5.70E-12	6.02E-12	6.34E-12
as 75	4.32E-12	4.59E-12	4.86E-12	5.13E-12	5.40E-12
y 90	2.94E-12	3.10E-12	3.27E-12	3.43E-12	3.59E-12
eu152	1.87E-12	2.22E-12	2.62E-12	3.06E-12	3.54E-12
sn118	2.36E-12	2.50E-12	2.65E-12	2.80E-12	2.95E-12
ba136	2.29E-12	2.43E-12	2.57E-12	2.72E-12	2.86E-12
sn122	2.01E-12	2.14E-12	2.26E-12	2.39E-12	2.52E-12
cd116	2.01E-12	2.13E-12	2.26E-12	2.38E-12	2.51E-12
cs134	1.85E-12	1.98E-12	2.11E-12	2.24E-12	2.37E-12
ru 99	1.54E-12	1.66E-12	1.79E-12	1.92E-12	2.06E-12
sn120	1.50E-12	1.60E-12	1.69E-12	1.78E-12	1.88E-12
te129m	1.80E-12	1.80E-12	1.80E-12	1.80E-12	1.80E-12
kr 82	1.27E-12	1.35E-12	1.43E-12	1.51E-12	1.59E-12
dy163	1.23E-12	1.30E-12	1.38E-12	1.46E-12	1.53E-12
ge 73	1.18E-12	1.25E-12	1.33E-12	1.40E-12	1.48E-12
xe130	7.83E-13	8.33E-13	8.82E-13	9.32E-13	9.81E-13
in113	5.60E-13	6.27E-13	6.98E-13	7.71E-13	8.48E-13
mo 96	5.55E-13	5.90E-13	6.26E-13	6.62E-13	6.97E-13
ge 76	4.29E-13	4.55E-13	4.82E-13	5.09E-13	5.36E-13
pm148	3.21E-13	3.29E-13	3.34E-13	3.38E-13	3.42E-13
gd160	2.69E-13	2.86E-13	3.02E-13	3.19E-13	3.36E-13
ag111	3.14E-13	3.15E-13	3.15E-13	3.15E-13	3.15E-13
eu157	2.75E-13	2.97E-13	2.97E-13	2.97E-13	2.97E-13
te126	2.09E-13	2.22E-13	2.35E-13	2.48E-13	2.61E-13
ru100	1.83E-13	1.99E-13	2.16E-13	2.34E-13	2.52E-13
cd115m	2.37E-13	2.37E-13	2.37E-13	2.37E-13	2.37E-13
gd152	1.10E-13	1.32E-13	1.57E-13	1.85E-13	2.16E-13

```
    gd154      8.21E-14  9.48E-14  1.09E-13  1.24E-13  1.40E-13
    sm148      9.06E-14  1.01E-13  1.12E-13  1.23E-13  1.34E-13
    ho165      8.44E-14  8.97E-14  9.50E-14  1.00E-13  1.06E-13
1   sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2           fission products        page   43
0                                 fraction of total absorption rate
        power=     .00mw, burnup=     15.mwd, flux= 2.70E+08n/cm**2-sec
0              initial  3104.9 d  3287.5 d  3470.1 d  3652.7 d

    nd142      5.41E-14  6.11E-14  6.85E-14  7.64E-14  8.46E-14
    ba135      4.76E-14  5.34E-14  5.95E-14  6.60E-14  7.28E-14
    ba134      4.10E-14  4.67E-14  5.28E-14  5.93E-14  6.62E-14
    sr 87      4.93E-14  5.24E-14  5.54E-14  5.85E-14  6.16E-14
    te124      4.87E-14  5.19E-14  5.50E-14  5.81E-14  6.13E-14
    cs136      5.54E-14  5.56E-14  5.56E-14  5.57E-14  5.57E-14
    pd104      3.41E-14  3.85E-14  4.32E-14  4.82E-14  5.35E-14
    nb 94      2.78E-14  2.96E-14  3.13E-14  3.31E-14  3.48E-14
    ge 74      2.39E-14  2.54E-14  2.69E-14  2.84E-14  2.99E-14
    ru105      2.25E-14  2.94E-14  2.94E-14  2.94E-14  2.94E-14
    sn125      2.90E-14  2.92E-14  2.92E-14  2.92E-14  2.92E-14
    ge 72      1.60E-14  1.70E-14  1.80E-14  1.90E-14  2.00E-14
    sr 86      1.39E-14  1.48E-14  1.57E-14  1.66E-14  1.75E-14
    rb 88      8.90E-15  1.30E-14  1.30E-14  1.30E-14  1.30E-14
    se 76      9.32E-15  9.90E-15  1.05E-14  1.11E-14  1.17E-14
     i135      8.35E-15  1.02E-14  1.02E-14  1.02E-14  1.02E-14
    sn123      1.01E-14  1.01E-14  1.01E-14  1.01E-14  1.01E-14
    te132      9.45E-15  9.61E-15  9.61E-15  9.61E-15  9.61E-15
    cd110      6.25E-15  6.96E-15  7.70E-15  8.47E-15  9.29E-15
    te134      8.74E-16  5.90E-15  5.90E-15  5.90E-15  5.90E-15
    br 79      3.50E-15  3.95E-15  4.43E-15  4.93E-15  5.46E-15
    xe128      2.40E-15  2.56E-15  2.73E-15  2.89E-15  3.06E-15
    xe129      1.95E-15  2.21E-15  2.47E-15  2.76E-15  3.05E-15
    sb126      3.02E-15  3.03E-15  3.03E-15  3.03E-15  3.03E-15
    ag107      1.83E-15  2.07E-15  2.32E-15  2.58E-15  2.86E-15
    er166      2.24E-15  2.38E-15  2.52E-15  2.67E-15  2.81E-15
    dy160      1.96E-15  2.11E-15  2.25E-15  2.40E-15  2.55E-15
    sb124      2.11E-15  2.11E-15  2.11E-15  2.11E-15  2.11E-15
    in117m     1.85E-15  2.11E-15  2.11E-15  2.11E-15  2.11E-15
    nb 93      7.56E-16  8.98E-16  1.06E-15  1.23E-15  1.43E-15
    kr 80      6.69E-16  7.11E-16  7.53E-16  7.95E-16  8.37E-16
     i130      6.55E-16  7.27E-16  7.28E-16  7.29E-16  7.29E-16
    in117      5.50E-16  6.19E-16  6.19E-16  6.19E-16  6.19E-16
    tb160      3.80E-16  3.85E-16  3.90E-16  3.96E-16  4.01E-16
    rb 86      2.45E-16  2.46E-16  2.46E-16  2.46E-16  2.46E-16
    dy165      1.23E-16  2.12E-16  2.12E-16  2.13E-16  2.13E-16
    te122      1.17E-16  1.27E-16  1.36E-16  1.46E-16  1.56E-16
    sn116      9.79E-17  1.09E-16  1.20E-16  1.33E-16  1.45E-16
    cd118      2.48E-17  1.21E-16  1.21E-16  1.21E-16  1.21E-16
    ge 75      3.42E-17  8.72E-17  8.72E-17  8.72E-17  8.72E-17
    pr142      5.17E-17  5.90E-17  6.24E-17  6.59E-17  6.94E-17
    be  9      5.31E-17  5.64E-17  5.98E-17  6.31E-17  6.64E-17
    te123      4.56E-17  4.86E-17  5.16E-17  5.46E-17  5.76E-17
    in119m     4.22E-19  3.03E-17  3.03E-17  3.03E-17  3.03E-17
    li  7      2.18E-17  2.31E-17  2.45E-17  2.59E-17  2.72E-17
    er167      9.13E-18  9.74E-18  1.03E-17  1.09E-17  1.16E-17
    in119      1.62E-21  2.37E-18  2.37E-18  2.37E-18  2.37E-18
    cd108      4.48E-19  4.77E-19  5.06E-19  5.35E-19  5.63E-19
    cs134m     2.58E-19  4.33E-19  4.58E-19  4.84E-19  5.09E-19
1   sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2           fission products        page   44
0                                 fraction of total absorption rate
        power=     .00mw, burnup=     15.mwd, flux= 2.70E+08n/cm**2-sec
```

0

	initial	3104.9 d	3287.5 d	3470.1 d	3652.7 d
cd109	1.95E-19	1.96E-19	1.98E-19	1.99E-19	2.00E-19
sn114	8.58E-21	9.40E-21	1.03E-20	1.12E-20	1.22E-20
ag110	2.03E-23	9.36E-21	9.88E-21	1.04E-20	1.09E-20
in120	.00E+00	3.98E-22	3.98E-22	3.98E-22	3.98E-22
in120m	.00E+00	4.28E-23	4.28E-23	4.28E-23	4.29E-23

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 45
power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec

0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	3104.9 d	3287.5 d	3470.1 d	3652.7 d
h 1	6.89E-07	7.31E-07	7.74E-07	8.16E-07	8.59E-07
h 2	2.04E-09	2.17E-09	2.29E-09	2.42E-09	2.55E-09
h 3	1.20E-11	1.26E-11	1.32E-11	1.37E-11	1.43E-11
h 4	.00E+00	5.14E-35	5.37E-35	5.59E-35	5.81E-35
he 3	2.93E-12	3.28E-12	3.64E-12	4.02E-12	4.41E-12
he 4	1.14E-07	1.21E-07	1.28E-07	1.35E-07	1.42E-07
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	1.37E-08	1.45E-08	1.54E-08	1.62E-08	1.70E-08
ne 21	3.48E-15	3.90E-15	4.35E-15	4.81E-15	5.30E-15
ne 22	5.26E-11	5.75E-11	6.25E-11	6.75E-11	7.27E-11
ne 23	7.03E-30	7.03E-15	7.03E-15	7.03E-15	7.03E-15
na 22	3.66E-11	3.72E-11	3.77E-11	3.82E-11	3.86E-11
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	2.53E-08	2.74E-08	2.74E-08	2.74E-08	2.74E-08
na 24m	4.55E-30	4.51E-15	4.51E-15	4.51E-15	4.51E-15
na 25	4.82E-43	4.64E-28	4.92E-28	5.19E-28	5.47E-28
mg 24	1.03E-04	1.08E-04	1.14E-04	1.20E-04	1.26E-04
mg 25	1.53E-11	1.63E-11	1.73E-11	1.82E-11	1.92E-11
mg 26	2.04E-09	2.17E-09	2.29E-09	2.42E-09	2.55E-09
mg 27	4.54E-16	2.10E-12	2.10E-12	2.10E-12	2.10E-12
mg 28	4.03E-24	4.29E-24	4.29E-24	4.29E-24	4.29E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	2.80E-25	2.03E-10	2.03E-10	2.03E-10	2.03E-10
al 29	4.34E-33	9.29E-28	1.03E-27	1.15E-27	1.26E-27
al 30	.00E+00	1.51E-40	1.78E-40	2.08E-40	2.42E-40
si 28	2.98E-04	3.14E-04	3.31E-04	3.47E-04	3.64E-04
si 29	3.25E-12	3.64E-12	4.06E-12	4.49E-12	4.95E-12
si 30	3.71E-20	4.43E-20	5.23E-20	6.12E-20	7.10E-20
si 31	1.61E-32	3.18E-32	3.76E-32	4.40E-32	5.10E-32
si 32	3.85E-40	4.89E-40	6.11E-40	7.55E-40	9.22E-40
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		2.70E+08	2.70E+08	2.70E+08	2.70E+08

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 46
power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec

0 nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	3104.9 d	3287.5 d	3470.1 d	3652.7 d
he 4	4.57E-04	4.89E-04	5.21E-04	5.54E-04	5.87E-04
pb206	4.00E-13	5.15E-13	6.53E-13	8.18E-13	1.01E-12
pb207	4.08E-11	4.89E-11	5.79E-11	6.79E-11	7.90E-11
pb208	1.82E-11	2.22E-11	2.66E-11	3.15E-11	3.69E-11
pb209	8.78E-17	9.86E-17	1.11E-16	1.24E-16	1.37E-16
pb210	8.14E-12	9.72E-12	1.15E-11	1.35E-11	1.57E-11
pb211	1.39E-15	1.56E-15	1.75E-15	1.94E-15	2.14E-15
pb212	1.29E-14	1.46E-14	1.64E-14	1.82E-14	2.01E-14
pb214	2.32E-16	2.70E-16	3.03E-16	3.37E-16	3.73E-16

ra222	3.40E-28	3.72E-28	4.05E-28	4.39E-28	4.73E-28
ra223	6.34E-13	7.13E-13	7.96E-13	8.83E-13	9.74E-13
ra224	1.07E-13	1.21E-13	1.35E-13	1.50E-13	1.66E-13
ra225	9.53E-15	1.08E-14	1.21E-14	1.35E-14	1.50E-14
ra226	7.51E-09	8.48E-09	9.50E-09	1.06E-08	1.17E-08
ra228	6.06E-15	6.72E-15	7.41E-15	8.12E-15	8.85E-15
ac225	6.44E-15	7.28E-15	8.17E-15	9.12E-15	1.01E-14
ac227	4.48E-10	5.03E-10	5.61E-10	6.22E-10	6.86E-10
ac228	7.39E-19	8.21E-19	9.05E-19	9.91E-19	1.08E-18
th226	1.66E-26	1.82E-26	1.98E-26	2.14E-26	2.31E-26
th227	1.02E-12	1.15E-12	1.28E-12	1.42E-12	1.57E-12
th228	2.03E-11	2.29E-11	2.57E-11	2.86E-11	3.15E-11
th229	1.85E-09	2.09E-09	2.35E-09	2.62E-09	2.91E-09
th230	2.04E-04	2.17E-04	2.30E-04	2.43E-04	2.55E-04
th231	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	4.13E-05	4.39E-05	4.65E-05	4.91E-05	5.16E-05
th233	1.05E-17	4.02E-16	4.26E-16	4.50E-16	4.73E-16
th234	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	5.75E-06	6.11E-06	6.47E-06	6.83E-06	7.19E-06
pa232	9.48E-14	1.05E-13	1.11E-13	1.17E-13	1.24E-13
pa233	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06
pa234m	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11
pa234	8.09E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	1.60E-23	1.76E-23	1.92E-23	2.08E-23	2.24E-23
u231	8.05E-20	8.66E-20	9.18E-20	9.69E-20	1.02E-19
u232	1.26E-09	1.38E-09	1.50E-09	1.63E-09	1.75E-09
u233	1.08E-04	1.15E-04	1.21E-04	1.28E-04	1.35E-04
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	3.07E-06	3.09E-06	3.09E-06	3.09E-06	3.09E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	1.06E-08	3.17E-07	3.17E-07	3.17E-07	3.17E-07
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	8.59E-12	8.60E-12	8.60E-12	8.60E-12	8.60E-12
np236m	1.93E-12	2.05E-12	2.05E-12	2.05E-12	2.05E-12
np236	1.59E-09	1.68E-09	1.78E-09	1.88E-09	1.97E-09
np237	4.21E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01
np238	1.51E-06	1.55E-06	1.55E-06	1.55E-06	1.55E-06

1

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 47
power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec

0

nuclide concentrations, gram atoms
basis = single reactor assembly

	charge	3104.9 d	3287.5 d	3470.1 d	3652.7 d
np239	4.51E-05	4.59E-05	4.59E-05	4.59E-05	4.59E-05
np240m	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np240	2.57E-15	9.32E-15	9.32E-15	9.32E-15	9.32E-15
np241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
pu236	9.57E-10	9.74E-10	9.89E-10	1.00E-09	1.01E-09
pu237	1.40E-14	1.48E-14	1.57E-14	1.65E-14	1.74E-14
pu238	1.45E-03	1.53E-03	1.62E-03	1.71E-03	1.79E-03
pu239	4.07E-02	4.32E-02	4.57E-02	4.82E-02	5.07E-02
pu240	1.60E-06	1.81E-06	2.03E-06	2.26E-06	2.50E-06
pu241	7.79E-11	9.28E-11	1.09E-10	1.28E-10	1.48E-10
pu242	1.27E-15	1.62E-15	2.02E-15	2.50E-15	3.05E-15
pu243	2.05E-24	3.40E-24	4.25E-24	5.25E-24	6.42E-24
pu244	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00

	pu245	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	pu246	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	totals	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04
0	flux		2.70E+08	2.70E+08	2.70E+08	2.70E+08

0 .results on logical unit no. 71, position 1, for time step 4, subcase 6. (run position 1, case position 1)
title: sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2

1
sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 48
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
h 1	8.59E-07	8.59E-07	8.59E-07	8.59E-07	8.59E-07	8.59E-07	8.59E-07
he 4	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07
na 23	1.73E+05	1.73E+05	1.73E+05	1.73E+05	1.73E+05	1.73E+05	1.73E+05
mg 24	3.01E-03	3.01E-03	3.01E-03	3.01E-03	3.01E-03	3.01E-03	3.01E-03
al 27	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06
si 28	1.02E-02	1.02E-02	1.02E-02	1.02E-02	1.02E-02	1.02E-02	1.02E-02
total	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06	1.52E+06

1
sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 49
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
element radioactivity, curies
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
na	8.39E+00	4.25E-06	3.40E-06	2.73E-06	2.18E-06	1.75E-06	1.40E-06
totals	2.55E+01	4.64E-06	3.78E-06	3.08E-06	2.53E-06	2.08E-06	1.71E-06

1
sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 50
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
element thermal power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
na	1.70E-01	6.01E-08	4.81E-08	3.86E-08	3.09E-08	2.47E-08	1.98E-08
totals	4.76E-01	6.01E-08	4.82E-08	3.86E-08	3.09E-08	2.47E-08	1.98E-08

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 51
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide gamma power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
na 22	6.90E-08	5.52E-08	4.42E-08	3.54E-08	2.84E-08	2.27E-08	1.82E-08
total	3.31E-01	5.52E-08	4.42E-08	3.54E-08	2.84E-08	2.27E-08	1.82E-08

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 52
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide concentrations, gram atoms
basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
he 4	5.87E-04	6.42E-04	6.97E-04	7.52E-04	8.07E-04	8.62E-04	9.17E-04
th230	2.55E-04	2.77E-04	2.98E-04	3.19E-04	3.41E-04	3.62E-04	3.83E-04
th232	5.16E-05	5.59E-05	6.02E-05	6.45E-05	6.88E-05	7.31E-05	7.75E-05
th234	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	7.19E-06	7.79E-06	8.40E-06	9.00E-06	9.60E-06	1.02E-05	1.08E-05
pa233	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06
u233	1.35E-04	1.48E-04	1.61E-04	1.74E-04	1.86E-04	1.99E-04	2.12E-04
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
np237	4.21E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01
pu238	1.79E-03	1.78E-03	1.77E-03	1.76E-03	1.75E-03	1.74E-03	1.73E-03
pu239	5.07E-02	5.07E-02	5.07E-02	5.07E-02	5.07E-02	5.07E-02	5.07E-02
pu240	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.50E-06
total	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04

1
sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 53
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
element concentrations, gram atoms
basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
he	5.87E-04	6.42E-04	6.97E-04	7.52E-04	8.07E-04	8.62E-04	9.17E-04
th	3.08E-04	3.33E-04	3.59E-04	3.84E-04	4.10E-04	4.36E-04	4.61E-04
pa	8.65E-06	9.25E-06	9.85E-06	1.05E-05	1.11E-05	1.17E-05	1.23E-05
u	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04
np	4.21E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01
pu	5.25E-02	5.25E-02	5.25E-02	5.25E-02	5.25E-02	5.25E-02	5.25E-02
totals	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04	3.73E+04

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 54
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
he 4	2.35E-03	2.57E-03	2.79E-03	3.01E-03	3.23E-03	3.45E-03	3.67E-03
ra226	2.65E-06	3.11E-06	3.61E-06	4.14E-06	4.71E-06	5.32E-06	5.96E-06
th229	6.66E-07	7.84E-07	9.13E-07	1.05E-06	1.20E-06	1.36E-06	1.53E-06
th230	5.88E-02	6.37E-02	6.85E-02	7.34E-02	7.83E-02	8.32E-02	8.81E-02
th231	6.98E-07	6.98E-07	6.98E-07	6.98E-07	6.98E-07	6.98E-07	6.98E-07
th232	1.20E-02	1.30E-02	1.40E-02	1.50E-02	1.60E-02	1.70E-02	1.80E-02
th234	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04
pa231	1.66E-03	1.80E-03	1.94E-03	2.08E-03	2.22E-03	2.36E-03	2.50E-03
pa233	3.39E-04	3.39E-04	3.39E-04	3.39E-04	3.39E-04	3.39E-04	3.39E-04
u232	4.07E-07	4.46E-07	4.77E-07	5.01E-07	5.20E-07	5.35E-07	5.46E-07
u233	3.15E-02	3.45E-02	3.75E-02	4.04E-02	4.34E-02	4.64E-02	4.94E-02
u234	2.12E+03	2.12E+03	2.12E+03	2.12E+03	2.12E+03	2.12E+03	2.12E+03
u235	1.72E+05	1.72E+05	1.72E+05	1.72E+05	1.72E+05	1.72E+05	1.72E+05
u236	4.12E+04	4.12E+04	4.12E+04	4.12E+04	4.12E+04	4.12E+04	4.12E+04
u238	8.66E+06	8.66E+06	8.66E+06	8.66E+06	8.66E+06	8.66E+06	8.66E+06
np237	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03
pu238	4.27E-01	4.24E-01	4.22E-01	4.19E-01	4.16E-01	4.13E-01	4.11E-01
pu239	1.21E+01	1.21E+01	1.21E+01	1.21E+01	1.21E+01	1.21E+01	1.21E+01
pu240	6.00E-04	6.00E-04	5.99E-04	5.99E-04	5.99E-04	5.99E-04	5.99E-04
total	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 55
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
element concentrations, grams
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
he	2.35E-03	2.57E-03	2.79E-03	3.01E-03	3.23E-03	3.45E-03	3.67E-03
ra	2.65E-06	3.11E-06	3.61E-06	4.14E-06	4.71E-06	5.32E-06	5.96E-06
th	7.09E-02	7.68E-02	8.27E-02	8.85E-02	9.44E-02	1.00E-01	1.06E-01
pa	2.00E-03	2.14E-03	2.28E-03	2.42E-03	2.56E-03	2.70E-03	2.84E-03
u	8.87E+06	8.87E+06	8.87E+06	8.87E+06	8.87E+06	8.87E+06	8.87E+06
np	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03	9.99E+03
pu	1.25E+01	1.26E+01	1.26E+01	1.25E+01	1.25E+01	1.25E+01	1.25E+01
totals	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06	8.88E+06

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 56

decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0 nuclide radioactivity, curies
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
tl207	1.11E-05	1.31E-05	1.51E-05	1.72E-05	1.94E-05	2.17E-05	2.41E-05
tl208	2.13E-06	2.46E-06	2.78E-06	3.07E-06	3.33E-06	3.56E-06	3.76E-06
pb210	2.51E-07	3.17E-07	3.94E-07	4.82E-07	5.81E-07	6.93E-07	8.17E-07
pb211	1.11E-05	1.31E-05	1.51E-05	1.72E-05	1.94E-05	2.18E-05	2.42E-05
pb212	5.91E-06	6.84E-06	7.73E-06	8.55E-06	9.27E-06	9.91E-06	1.05E-05
pb214	2.62E-06	3.08E-06	3.57E-06	4.09E-06	4.66E-06	5.26E-06	5.89E-06
bi210	2.51E-07	3.18E-07	3.94E-07	4.82E-07	5.81E-07	6.93E-07	8.18E-07
bi211	1.11E-05	1.31E-05	1.51E-05	1.72E-05	1.94E-05	2.18E-05	2.42E-05
bi212	5.91E-06	6.84E-06	7.73E-06	8.55E-06	9.27E-06	9.91E-06	1.05E-05
bi214	2.62E-06	3.08E-06	3.57E-06	4.09E-06	4.66E-06	5.26E-06	5.89E-06
po210	2.12E-07	2.71E-07	3.40E-07	4.20E-07	5.10E-07	6.13E-07	7.27E-07
po212	3.79E-06	4.38E-06	4.95E-06	5.47E-06	5.94E-06	6.35E-06	6.70E-06
po214	2.62E-06	3.08E-06	3.57E-06	4.09E-06	4.66E-06	5.26E-06	5.89E-06
po215	1.11E-05	1.31E-05	1.51E-05	1.72E-05	1.94E-05	2.18E-05	2.42E-05
po216	5.91E-06	6.84E-06	7.73E-06	8.55E-06	9.27E-06	9.91E-06	1.05E-05
po218	2.62E-06	3.08E-06	3.57E-06	4.10E-06	4.66E-06	5.26E-06	5.89E-06
rn219	1.11E-05	1.31E-05	1.51E-05	1.72E-05	1.94E-05	2.18E-05	2.42E-05
rn220	5.91E-06	6.84E-06	7.73E-06	8.55E-06	9.27E-06	9.91E-06	1.05E-05
rn222	2.62E-06	3.08E-06	3.57E-06	4.10E-06	4.66E-06	5.26E-06	5.89E-06
ra223	1.11E-05	1.31E-05	1.51E-05	1.72E-05	1.94E-05	2.18E-05	2.42E-05
ra224	5.91E-06	6.84E-06	7.73E-06	8.55E-06	9.27E-06	9.91E-06	1.05E-05
ra226	2.62E-06	3.08E-06	3.57E-06	4.10E-06	4.66E-06	5.26E-06	5.89E-06
ac227	1.13E-05	1.31E-05	1.51E-05	1.72E-05	1.94E-05	2.17E-05	2.41E-05
th227	1.10E-05	1.30E-05	1.49E-05	1.70E-05	1.92E-05	2.15E-05	2.39E-05
th228	5.89E-06	6.82E-06	7.70E-06	8.52E-06	9.24E-06	9.87E-06	1.04E-05
th230	1.21E-03	1.31E-03	1.41E-03	1.51E-03	1.62E-03	1.72E-03	1.82E-03
th231	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01
th234	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00
pa231	7.85E-05	8.51E-05	9.16E-05	9.82E-05	1.05E-04	1.11E-04	1.18E-04
pa233	7.04E+00	7.05E+00	7.05E+00	7.05E+00	7.05E+00	7.05E+00	7.05E+00
pa234m	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00
pa234	3.78E-03	3.79E-03	3.79E-03	3.79E-03	3.79E-03	3.79E-03	3.79E-03
u232	8.98E-06	9.84E-06	1.05E-05	1.11E-05	1.15E-05	1.18E-05	1.21E-05
u233	3.03E-04	3.32E-04	3.61E-04	3.90E-04	4.19E-04	4.48E-04	4.76E-04
u234	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01	1.32E+01
u235	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01
u236	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00	2.66E+00
u238	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00	2.91E+00
np237	7.04E+00	7.04E+00	7.04E+00	7.04E+00	7.04E+00	7.04E+00	7.04E+00
pu236	1.25E-04	1.03E-04	8.41E-05	6.89E-05	5.65E-05	4.63E-05	3.79E-05
pu238	7.31E+00	7.27E+00	7.22E+00	7.18E+00	7.13E+00	7.08E+00	7.04E+00
pu239	7.52E-01	7.53E-01	7.53E-01	7.53E-01	7.53E-01	7.53E-01	7.53E-01
pu240	1.36E-04	1.36E-04	1.36E-04	1.36E-04	1.36E-04	1.36E-04	1.36E-04
pu241	3.69E-06	3.54E-06	3.40E-06	3.27E-06	3.14E-06	3.02E-06	2.90E-06
total	5.29E+03	4.74E+01	4.74E+01	4.73E+01	4.73E+01	4.73E+01	4.72E+01

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 57
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0 element thermal power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
tl	8.25E-08	9.62E-08	1.09E-07	1.23E-07	1.35E-07	1.47E-07	1.59E-07
pb	5.42E-08	6.37E-08	7.31E-08	8.29E-08	9.30E-08	1.03E-07	1.14E-07
bi	5.78E-07	6.80E-07	7.80E-07	8.85E-07	9.93E-07	1.10E-06	1.22E-06
po	1.17E-06	1.37E-06	1.57E-06	1.77E-06	1.98E-06	2.18E-06	2.39E-06
at	5.64E-09	6.63E-09	7.72E-09	8.90E-09	1.02E-08	1.15E-08	1.30E-08

rn	7.73E-07	9.07E-07	1.04E-06	1.17E-06	1.31E-06	1.45E-06	1.60E-06
fr	5.48E-09	6.44E-09	7.49E-09	8.63E-09	9.85E-09	1.12E-08	1.26E-08
ra	6.75E-07	7.91E-07	9.06E-07	1.02E-06	1.14E-06	1.27E-06	1.39E-06
ac	1.01E-08	1.18E-08	1.36E-08	1.56E-08	1.77E-08	1.99E-08	2.23E-08
th	1.64E-03	1.65E-03	1.65E-03	1.65E-03	1.66E-03	1.66E-03	1.66E-03
pa	3.22E-02	3.22E-02	3.22E-02	3.22E-02	3.22E-02	3.22E-02	3.22E-02
u	7.55E+00	5.36E-01	5.36E-01	5.36E-01	5.36E-01	5.36E-01	5.36E-01
np	7.11E+00	2.01E-01	2.01E-01	2.01E-01	2.01E-01	2.01E-01	2.01E-01
pu	2.66E-01	2.64E-01	2.63E-01	2.61E-01	2.60E-01	2.58E-01	2.57E-01
totals	1.50E+01	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 actinides page 58

decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec

0 nuclide gamma power, watts

basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
tl208	4.23E-08	4.90E-08	5.53E-08	6.12E-08	6.64E-08	7.10E-08	7.49E-08
pb211	4.46E-09	5.27E-09	6.06E-09	6.90E-09	7.79E-09	8.72E-09	9.70E-09
pb212	5.08E-09	5.88E-09	6.64E-09	7.35E-09	7.97E-09	8.52E-09	8.99E-09
pb214	3.88E-09	4.56E-09	5.29E-09	6.07E-09	6.90E-09	7.79E-09	8.73E-09
bi211	3.09E-09	3.65E-09	4.19E-09	4.78E-09	5.39E-09	6.04E-09	6.71E-09
bi212	3.69E-09	4.27E-09	4.82E-09	5.33E-09	5.78E-09	6.18E-09	6.52E-09
bi214	2.34E-08	2.75E-08	3.19E-08	3.66E-08	4.16E-08	4.70E-08	5.27E-08
rn219	3.70E-09	4.36E-09	5.02E-09	5.71E-09	6.45E-09	7.22E-09	8.03E-09
ra223	8.87E-09	1.05E-08	1.20E-08	1.37E-08	1.55E-08	1.73E-08	1.93E-08
th227	7.21E-09	8.53E-09	9.81E-09	1.12E-08	1.26E-08	1.41E-08	1.57E-08
th230	1.21E-08	1.31E-08	1.41E-08	1.51E-08	1.61E-08	1.71E-08	1.81E-08
th231	6.82E-05	6.82E-05	6.82E-05	6.82E-05	6.82E-05	6.82E-05	6.82E-05
th234	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.67E-04
pa231	1.86E-08	2.02E-08	2.17E-08	2.33E-08	2.48E-08	2.64E-08	2.80E-08
pa233	9.33E-03	9.34E-03	9.34E-03	9.34E-03	9.34E-03	9.34E-03	9.34E-03
pa234m	1.92E-04	1.92E-04	1.92E-04	1.92E-04	1.92E-04	1.92E-04	1.92E-04
pa234	4.40E-05	4.40E-05	4.40E-05	4.40E-05	4.40E-05	4.40E-05	4.40E-05
u234	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04
u235	3.66E-04	3.66E-04	3.66E-04	3.66E-04	3.66E-04	3.66E-04	3.66E-04
u236	2.68E-05	2.68E-05	2.68E-05	2.68E-05	2.68E-05	2.68E-05	2.68E-05
u238	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05
np237	1.47E-03	1.47E-03	1.47E-03	1.47E-03	1.47E-03	1.47E-03	1.47E-03
pu238	8.24E-05	8.19E-05	8.14E-05	8.08E-05	8.03E-05	7.98E-05	7.93E-05
pu239	3.61E-06	3.61E-06	3.61E-06	3.61E-06	3.61E-06	3.61E-06	3.61E-06
total	3.97E+00	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.19E-02

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 59

decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec

0 nuclide concentrations, grams

basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
h 3	1.65E-05	1.57E-05	1.50E-05	1.43E-05	1.37E-05	1.30E-05	1.24E-05
ge 72	1.26E-06	1.26E-06	1.26E-06	1.26E-06	1.26E-06	1.26E-06	1.26E-06
ge 73	5.53E-06	5.53E-06	5.53E-06	5.53E-06	5.53E-06	5.53E-06	5.53E-06
ge 74	4.84E-06	4.84E-06	4.84E-06	4.84E-06	4.84E-06	4.84E-06	4.84E-06
as 75	5.64E-05	5.64E-05	5.64E-05	5.64E-05	5.64E-05	5.64E-05	5.64E-05
ge 76	1.88E-04	1.88E-04	1.88E-04	1.88E-04	1.88E-04	1.88E-04	1.88E-04
se 77	4.17E-04	4.17E-04	4.17E-04	4.17E-04	4.17E-04	4.17E-04	4.17E-04
se 78	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03
se 79	2.28E-03	2.28E-03	2.28E-03	2.28E-03	2.28E-03	2.28E-03	2.28E-03
se 80	6.79E-03	6.79E-03	6.79E-03	6.79E-03	6.79E-03	6.79E-03	6.79E-03
br 81	1.01E-02	1.01E-02	1.01E-02	1.01E-02	1.01E-02	1.01E-02	1.01E-02
se 82	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02
kr 82	3.25E-06	3.25E-06	3.25E-06	3.25E-06	3.25E-06	3.25E-06	3.25E-06

kr 83	2.91E-02	2.91E-02	2.91E-02	2.91E-02	2.91E-02	2.91E-02	2.91E-02
kr 84	5.86E-02	5.86E-02	5.86E-02	5.86E-02	5.86E-02	5.86E-02	5.86E-02
kr 85	1.07E-02	1.02E-02	9.64E-03	9.14E-03	8.66E-03	8.20E-03	7.77E-03
rb 85	5.71E-02	5.77E-02	5.82E-02	5.87E-02	5.92E-02	5.96E-02	6.01E-02
kr 86	1.10E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01	1.10E-01
rb 87	1.44E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01	1.44E-01
sr 88	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.07E-01
y 89	2.76E-01	2.81E-01	2.81E-01	2.81E-01	2.81E-01	2.81E-01	2.81E-01
sr 90	3.04E-01	2.98E-01	2.92E-01	2.86E-01	2.80E-01	2.74E-01	2.69E-01
y 90	7.90E-05	7.74E-05	7.59E-05	7.43E-05	7.28E-05	7.13E-05	6.99E-05
zr 90	3.89E-02	4.51E-02	5.12E-02	5.71E-02	6.29E-02	6.86E-02	7.42E-02
zr 91	3.43E-01	3.51E-01	3.51E-01	3.51E-01	3.51E-01	3.51E-01	3.51E-01
zr 92	3.58E-01	3.58E-01	3.58E-01	3.58E-01	3.58E-01	3.58E-01	3.58E-01
zr 93	2.56E-01	2.56E-01	2.56E-01	2.56E-01	2.56E-01	2.56E-01	2.56E-01
nb 93m	5.05E-07	5.82E-07	6.56E-07	7.28E-07	7.98E-07	8.64E-07	9.29E-07
zr 94	3.94E-01	3.94E-01	3.94E-01	3.94E-01	3.94E-01	3.94E-01	3.94E-01
mo 95	3.86E-01	4.01E-01	4.02E-01	4.02E-01	4.02E-01	4.02E-01	4.02E-01
zr 96	3.94E-01	3.94E-01	3.94E-01	3.94E-01	3.94E-01	3.94E-01	3.94E-01
mo 96	3.50E-05	3.50E-05	3.50E-05	3.50E-05	3.50E-05	3.50E-05	3.50E-05
mo 97	3.58E-01	3.58E-01	3.58E-01	3.58E-01	3.58E-01	3.58E-01	3.58E-01
mo 98	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01
tc 99	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01
ru 99	1.94E-05	2.05E-05	2.15E-05	2.26E-05	2.37E-05	2.48E-05	2.59E-05
mo100	4.10E-01	4.10E-01	4.10E-01	4.10E-01	4.10E-01	4.10E-01	4.10E-01
ru100	3.68E-06	3.68E-06	3.68E-06	3.68E-06	3.68E-06	3.68E-06	3.68E-06
ru101	3.39E-01	3.39E-01	3.39E-01	3.39E-01	3.39E-01	3.39E-01	3.39E-01
ru102	2.87E-01	2.87E-01	2.87E-01	2.87E-01	2.87E-01	2.87E-01	2.87E-01
rh103	2.09E-01	2.12E-01	2.12E-01	2.12E-01	2.12E-01	2.12E-01	2.12E-01
ru104	1.32E-01	1.32E-01	1.32E-01	1.32E-01	1.32E-01	1.32E-01	1.32E-01
pd104	4.54E-06	4.54E-06	4.54E-06	4.54E-06	4.54E-06	4.54E-06	4.54E-06
pd105	7.34E-02	7.34E-02	7.34E-02	7.34E-02	7.34E-02	7.34E-02	7.34E-02
ru106	4.77E-03	2.71E-03	1.53E-03	8.69E-04	4.93E-04	2.79E-04	1.58E-04
pd106	2.78E-02	2.99E-02	3.11E-02	3.17E-02	3.21E-02	3.23E-02	3.24E-02
pd107	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02
pd108	5.95E-03	5.95E-03	5.95E-03	5.95E-03	5.95E-03	5.95E-03	5.95E-03
ag109	2.99E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03
pd110	2.43E-03	2.43E-03	2.43E-03	2.43E-03	2.43E-03	2.43E-03	2.43E-03
cd111	1.60E-03	1.61E-03	1.61E-03	1.61E-03	1.61E-03	1.61E-03	1.61E-03
cd112	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 60
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
cd113	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03
cd113m	1.67E-05	1.61E-05	1.54E-05	1.48E-05	1.42E-05	1.36E-05	1.31E-05
in113	4.45E-06	5.12E-06	5.76E-06	6.38E-06	6.98E-06	7.55E-06	8.09E-06
cd114	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.12E-03
in115	8.52E-04	8.53E-04	8.53E-04	8.53E-04	8.53E-04	8.53E-04	8.53E-04
sn115	4.29E-05	4.29E-05	4.29E-05	4.29E-05	4.29E-05	4.29E-05	4.29E-05
cd116	1.35E-03	1.35E-03	1.35E-03	1.35E-03	1.35E-03	1.35E-03	1.35E-03
sn117	8.93E-04	8.93E-04	8.93E-04	8.93E-04	8.93E-04	8.93E-04	8.93E-04
sn118	9.16E-04	9.16E-04	9.16E-04	9.16E-04	9.16E-04	9.16E-04	9.16E-04
sn119	1.01E-03	1.01E-03	1.01E-03	1.01E-03	1.01E-03	1.01E-03	1.01E-03
sn120	1.01E-03	1.01E-03	1.01E-03	1.01E-03	1.01E-03	1.01E-03	1.01E-03
sn121m	6.29E-06	6.22E-06	6.16E-06	6.09E-06	6.03E-06	5.97E-06	5.91E-06
sb121	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03
sn122	1.28E-03	1.28E-03	1.28E-03	1.28E-03	1.28E-03	1.28E-03	1.28E-03
sb123	1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.34E-03

sn124	2.15E-03	2.15E-03	2.15E-03	2.15E-03	2.15E-03	2.15E-03	2.15E-03
te124	9.58E-07	9.79E-07	9.80E-07	9.80E-07	9.80E-07	9.80E-07	9.80E-07
sb125	8.94E-04	7.26E-04	5.88E-04	4.76E-04	3.85E-04	3.11E-04	2.52E-04
te125	1.56E-03	1.73E-03	1.87E-03	1.99E-03	2.08E-03	2.15E-03	2.21E-03
te125m	1.19E-05	1.03E-05	8.35E-06	6.76E-06	5.47E-06	4.42E-06	3.58E-06
sn126	3.54E-03	3.54E-03	3.54E-03	3.54E-03	3.54E-03	3.54E-03	3.54E-03
te126	2.06E-05	2.07E-05	2.07E-05	2.07E-05	2.07E-05	2.08E-05	2.08E-05
i127	1.03E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02
te128	2.99E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02
i129	6.41E-02	6.42E-02	6.42E-02	6.42E-02	6.42E-02	6.42E-02	6.42E-02
te130	1.50E-01	1.50E-01	1.50E-01	1.50E-01	1.50E-01	1.50E-01	1.50E-01
xe130	1.81E-05	1.81E-05	1.81E-05	1.81E-05	1.81E-05	1.81E-05	1.81E-05
xe131	2.48E-01	2.49E-01	2.49E-01	2.49E-01	2.49E-01	2.49E-01	2.49E-01
xe132	3.74E-01	3.75E-01	3.75E-01	3.75E-01	3.75E-01	3.75E-01	3.75E-01
cs133	5.83E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01
xe134	6.87E-01	6.87E-01	6.87E-01	6.87E-01	6.87E-01	6.87E-01	6.87E-01
ba134	2.62E-06	3.02E-06	3.33E-06	3.56E-06	3.74E-06	3.87E-06	3.97E-06
cs135	5.79E-01	5.79E-01	5.79E-01	5.79E-01	5.79E-01	5.79E-01	5.79E-01
ba135	9.61E-07	1.11E-06	1.25E-06	1.40E-06	1.54E-06	1.69E-06	1.83E-06
xe136	5.63E-01	5.63E-01	5.63E-01	5.63E-01	5.63E-01	5.63E-01	5.63E-01
ba136	4.75E-04	4.78E-04	4.78E-04	4.78E-04	4.78E-04	4.78E-04	4.78E-04
cs137	5.03E-01	4.94E-01	4.84E-01	4.75E-01	4.66E-01	4.57E-01	4.49E-01
ba137	6.05E-02	7.01E-02	7.95E-02	8.87E-02	9.78E-02	1.07E-01	1.15E-01
ba138	6.04E-01	6.04E-01	6.04E-01	6.04E-01	6.04E-01	6.04E-01	6.04E-01
la138	3.03E-06	3.03E-06	3.03E-06	3.03E-06	3.03E-06	3.03E-06	3.03E-06
la139	5.78E-01	5.78E-01	5.78E-01	5.78E-01	5.78E-01	5.78E-01	5.78E-01
ce140	5.75E-01	5.78E-01	5.78E-01	5.78E-01	5.78E-01	5.78E-01	5.78E-01
pr141	5.28E-01	5.35E-01	5.35E-01	5.35E-01	5.35E-01	5.35E-01	5.35E-01
ce142	5.44E-01	5.44E-01	5.44E-01	5.44E-01	5.44E-01	5.44E-01	5.44E-01
nd142	5.71E-07	5.72E-07	5.72E-07	5.72E-07	5.72E-07	5.72E-07	5.72E-07
nd143	5.51E-01	5.54E-01	5.54E-01	5.54E-01	5.54E-01	5.54E-01	5.54E-01
ce144	5.79E-02	2.76E-02	1.32E-02	6.28E-03	2.99E-03	1.43E-03	6.81E-04
nd144	4.56E-01	4.86E-01	5.01E-01	5.08E-01	5.11E-01	5.13E-01	5.13E-01
nd145	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01
nd146	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01
pm147	7.65E-02	6.21E-02	4.98E-02	4.00E-02	3.21E-02	2.57E-02	2.07E-02
sm147	1.42E-01	1.57E-01	1.69E-01	1.79E-01	1.87E-01	1.93E-01	1.98E-01

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 61
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
nd148	1.63E-01	1.63E-01	1.63E-01	1.63E-01	1.63E-01	1.63E-01	1.63E-01
sm148	4.73E-06	4.78E-06	4.78E-06	4.78E-06	4.78E-06	4.78E-06	4.78E-06
sm149	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01
nd150	6.57E-02	6.57E-02	6.57E-02	6.57E-02	6.57E-02	6.57E-02	6.57E-02
sm150	7.32E-04	7.32E-04	7.32E-04	7.32E-04	7.32E-04	7.32E-04	7.32E-04
sm151	4.10E-02	4.07E-02	4.05E-02	4.02E-02	4.00E-02	3.97E-02	3.95E-02
eu151	1.60E-03	1.86E-03	2.12E-03	2.38E-03	2.64E-03	2.89E-03	3.15E-03
sm152	2.75E-02	2.75E-02	2.75E-02	2.75E-02	2.75E-02	2.75E-02	2.75E-02
eu153	1.70E-02	1.70E-02	1.70E-02	1.70E-02	1.70E-02	1.70E-02	1.70E-02
sm154	7.86E-03	7.86E-03	7.86E-03	7.86E-03	7.86E-03	7.86E-03	7.86E-03
eu155	1.87E-03	1.65E-03	1.46E-03	1.29E-03	1.14E-03	1.01E-03	8.90E-04
gd155	1.71E-03	1.93E-03	2.12E-03	2.29E-03	2.44E-03	2.57E-03	2.69E-03
gd156	1.55E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03
gd157	7.32E-04	7.32E-04	7.32E-04	7.32E-04	7.32E-04	7.32E-04	7.32E-04
gd158	3.57E-04	3.57E-04	3.57E-04	3.57E-04	3.57E-04	3.57E-04	3.57E-04
tb159	1.28E-04	1.28E-04	1.28E-04	1.28E-04	1.28E-04	1.28E-04	1.28E-04
gd160	4.29E-05	4.29E-05	4.29E-05	4.29E-05	4.29E-05	4.29E-05	4.29E-05

dy161	1.32E-05	1.32E-05	1.32E-05	1.32E-05	1.32E-05	1.32E-05	1.32E-05
dy162	3.64E-06	3.64E-06	3.64E-06	3.64E-06	3.64E-06	3.64E-06	3.64E-06
dy163	1.21E-06	1.21E-06	1.21E-06	1.21E-06	1.21E-06	1.21E-06	1.21E-06
total	1.52E+01	1.52E+01	1.52E+01	1.52E+01	1.52E+01	1.52E+01	1.52E+01

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 62
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide radioactivity, curies
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
h 3	1.59E-01	1.52E-01	1.45E-01	1.38E-01	1.32E-01	1.26E-01	1.20E-01
se 79	3.13E-05	3.13E-05	3.13E-05	3.13E-05	3.13E-05	3.13E-05	3.13E-05
kr 85	4.22E+00	3.99E+00	3.78E+00	3.59E+00	3.40E+00	3.22E+00	3.05E+00
sr 90	4.29E+01	4.21E+01	4.12E+01	4.04E+01	3.95E+01	3.87E+01	3.80E+01
y 90	4.29E+01	4.21E+01	4.12E+01	4.04E+01	3.96E+01	3.88E+01	3.80E+01
y 91	1.98E+02	5.43E+00	1.47E-01	4.00E-03	1.09E-04	2.95E-06	8.02E-08
zr 93	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04
nb 93m	1.20E-04	1.39E-04	1.57E-04	1.74E-04	1.90E-04	2.06E-04	2.21E-04
zr 95	2.18E+02	8.09E+00	3.00E-01	1.11E-02	4.11E-04	1.52E-05	5.64E-07
nb 95	2.18E+02	1.72E+01	6.58E-01	2.44E-02	9.05E-04	3.35E-05	1.24E-06
tc 99	6.77E-03	6.78E-03	6.78E-03	6.78E-03	6.78E-03	6.78E-03	6.78E-03
rh102	7.21E-06	5.91E-06	4.84E-06	3.97E-06	3.25E-06	2.66E-06	2.18E-06
ru106	1.58E+01	8.97E+00	5.08E+00	2.88E+00	1.63E+00	9.26E-01	5.25E-01
rh106	1.58E+01	8.97E+00	5.08E+00	2.88E+00	1.63E+00	9.26E-01	5.25E-01
pd107	6.39E-06	6.39E-06	6.39E-06	6.39E-06	6.39E-06	6.39E-06	6.39E-06
cd113m	3.76E-03	3.61E-03	3.46E-03	3.32E-03	3.19E-03	3.06E-03	2.94E-03
sn119m	1.53E-03	7.43E-04	3.62E-04	1.76E-04	8.57E-05	4.17E-05	2.03E-05
sn121	4.68E-01	2.60E-04	2.57E-04	2.54E-04	2.51E-04	2.49E-04	2.46E-04
sn121m	3.38E-04	3.34E-04	3.31E-04	3.27E-04	3.24E-04	3.21E-04	3.17E-04
sn123	5.81E-02	1.14E-02	2.22E-03	4.33E-04	8.45E-05	1.65E-05	3.22E-06
sb125	9.37E-01	7.61E-01	6.16E-01	4.98E-01	4.03E-01	3.26E-01	2.64E-01
te125m	2.15E-01	1.85E-01	1.50E-01	1.22E-01	9.85E-02	7.97E-02	6.45E-02
sn126	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04
sb126	3.87E-03	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05
sb126m	5.40E-03	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04
te127	4.19E+00	1.07E-01	1.54E-02	2.23E-03	3.21E-04	4.64E-05	6.69E-06
te127m	7.28E-01	1.09E-01	1.57E-02	2.27E-03	3.28E-04	4.73E-05	6.83E-06
i129	1.13E-05	1.13E-05	1.13E-05	1.13E-05	1.13E-05	1.13E-05	1.13E-05
cs134	2.16E-03	1.63E-03	1.23E-03	9.30E-04	7.03E-04	5.31E-04	4.01E-04
cs135	6.67E-04	6.67E-04	6.67E-04	6.67E-04	6.67E-04	6.67E-04	6.67E-04
cs137	4.38E+01	4.30E+01	4.22E+01	4.14E+01	4.06E+01	3.98E+01	3.90E+01
ba137m	4.14E+01	4.06E+01	3.98E+01	3.91E+01	3.83E+01	3.76E+01	3.69E+01
ce144	1.84E+02	8.79E+01	4.19E+01	2.00E+01	9.53E+00	4.55E+00	2.17E+00
pr144	1.84E+02	8.79E+01	4.19E+01	2.00E+01	9.53E+00	4.55E+00	2.17E+00
pr144m	2.58E+00	1.23E+00	5.87E-01	2.80E-01	1.33E-01	6.36E-02	3.04E-02
pm147	7.09E+01	5.76E+01	4.62E+01	3.71E+01	2.98E+01	2.39E+01	1.92E+01
sm151	1.08E+00	1.07E+00	1.07E+00	1.06E+00	1.05E+00	1.05E+00	1.04E+00
eu152	5.90E-05	5.65E-05	5.41E-05	5.18E-05	4.96E-05	4.75E-05	4.55E-05
eu154	1.67E-04	1.56E-04	1.46E-04	1.36E-04	1.28E-04	1.19E-04	1.12E-04
eu155	9.20E-01	8.13E-01	7.19E-01	6.35E-01	5.61E-01	4.96E-01	4.39E-01
total	2.01E+04	4.62E+02	3.13E+02	2.50E+02	2.16E+02	1.95E+02	1.81E+02

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 63
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
element thermal power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
h	5.37E-06	5.13E-06	4.89E-06	4.67E-06	4.45E-06	4.25E-06	4.06E-06
se	3.33E+00	9.80E-09	9.80E-09	9.80E-09	9.80E-09	9.80E-09	9.80E-09
kr	1.30E+01	5.99E-03	5.68E-03	5.38E-03	5.10E-03	4.83E-03	4.58E-03

sr	2.00E+01	5.75E-02	4.80E-02	4.69E-02	4.59E-02	4.50E-02	4.41E-02
y	2.74E+01	2.52E-01	2.29E-01	2.24E-01	2.19E-01	2.15E-01	2.10E-01
zr	1.20E+01	4.08E-02	1.51E-03	5.60E-05	2.14E-06	1.49E-07	7.53E-08
nb	2.15E+01	8.25E-02	3.16E-03	1.17E-04	4.38E-06	1.97E-07	4.42E-08
tc	6.47E+00	3.40E-06	3.40E-06	3.40E-06	3.40E-06	3.40E-06	3.40E-06
ru	7.07E-01	2.17E-03	3.10E-04	1.71E-04	9.71E-05	5.51E-05	3.12E-05
rh	3.77E-01	8.61E-02	4.87E-02	2.76E-02	1.57E-02	8.88E-03	5.03E-03
cd	6.85E-02	4.48E-06	3.77E-06	3.62E-06	3.47E-06	3.33E-06	3.20E-06
sn	1.87E+00	3.63E-05	7.52E-06	1.85E-06	7.12E-07	4.74E-07	4.19E-07
sb	7.51E+00	2.41E-03	1.95E-03	1.58E-03	1.28E-03	1.03E-03	8.37E-04
te	9.30E+00	3.96E-04	1.56E-04	1.07E-04	8.35E-05	6.72E-05	5.43E-05
i	2.08E+01	5.31E-09	5.31E-09	5.31E-09	5.31E-09	5.31E-09	5.31E-09
cs	1.81E+01	4.78E-02	4.69E-02	4.60E-02	4.51E-02	4.42E-02	4.34E-02
ba	1.14E+01	1.59E-01	1.56E-01	1.53E-01	1.50E-01	1.48E-01	1.45E-01
ce	4.41E+00	5.79E-02	2.74E-02	1.31E-02	6.24E-03	2.97E-03	1.42E-03
pr	6.24E+00	6.45E-01	3.08E-01	1.47E-01	7.00E-02	3.34E-02	1.59E-02
pm	3.37E-01	2.11E-02	1.70E-02	1.36E-02	1.09E-02	8.77E-03	7.03E-03
sm	2.01E-02	1.26E-04	1.25E-04	1.25E-04	1.24E-04	1.23E-04	1.22E-04
eu	8.73E-03	6.34E-04	5.60E-04	4.95E-04	4.38E-04	3.87E-04	3.42E-04
totals	2.59E+02	1.46E+00	8.94E-01	6.79E-01	5.70E-01	5.12E-01	4.78E-01

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sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 64
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
nuclide gamma power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	5.57E-05	5.28E-05	5.00E-05	4.74E-05	4.49E-05	4.26E-05	4.03E-05
y 90	4.33E-07	4.24E-07	4.15E-07	4.07E-07	3.99E-07	3.90E-07	3.83E-07
zr 95	9.47E-01	3.51E-02	1.30E-03	4.82E-05	1.78E-06	6.61E-08	2.45E-09
nb 95	9.89E-01	7.79E-02	2.98E-03	1.11E-04	4.10E-06	1.52E-07	5.63E-09
rh102	9.23E-08	7.56E-08	6.20E-08	5.08E-08	4.16E-08	3.41E-08	2.79E-08
rh106	1.93E-02	1.10E-02	6.21E-03	3.52E-03	1.99E-03	1.13E-03	6.41E-04
sn121m	1.00E-08	9.91E-09	9.81E-09	9.70E-09	9.60E-09	9.50E-09	9.40E-09
sb125	2.41E-03	1.96E-03	1.58E-03	1.28E-03	1.04E-03	8.40E-04	6.80E-04
te125m	4.53E-05	3.91E-05	3.17E-05	2.57E-05	2.08E-05	1.68E-05	1.36E-05
sn126	7.78E-08	7.78E-08	7.78E-08	7.78E-08	7.78E-08	7.78E-08	7.78E-08
sb126	6.31E-05	2.30E-07	2.30E-07	2.30E-07	2.30E-07	2.30E-07	2.30E-07
sb126m	4.97E-05	9.27E-07	9.27E-07	9.27E-07	9.27E-07	9.27E-07	9.27E-07
cs134	1.99E-05	1.50E-05	1.13E-05	8.58E-06	6.48E-06	4.90E-06	3.70E-06
ba137m	1.47E-01	1.44E-01	1.41E-01	1.39E-01	1.36E-01	1.33E-01	1.31E-01
ce144	2.07E-02	9.89E-03	4.72E-03	2.25E-03	1.07E-03	5.12E-04	2.44E-04
pr144	3.16E-02	1.51E-02	7.18E-03	3.42E-03	1.63E-03	7.79E-04	3.71E-04
pr144m	1.91E-04	9.11E-05	4.35E-05	2.07E-05	9.89E-06	4.72E-06	2.25E-06
pm147	1.84E-06	1.50E-06	1.20E-06	9.63E-07	7.73E-07	6.20E-07	4.97E-07
sm151	9.08E-08	9.03E-08	8.97E-08	8.91E-08	8.85E-08	8.80E-08	8.74E-08
eu152	4.06E-07	3.89E-07	3.73E-07	3.57E-07	3.42E-07	3.27E-07	3.13E-07
eu154	1.24E-06	1.16E-06	1.08E-06	1.01E-06	9.48E-07	8.87E-07	8.29E-07
eu155	3.53E-04	3.12E-04	2.76E-04	2.44E-04	2.15E-04	1.90E-04	1.68E-04
total	1.28E+02	2.97E-01	1.66E-01	1.50E-01	1.42E-01	1.37E-01	1.33E-01

1
sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 65
decay, following reactor irradiation identified by: power= 4.000E-03mw, burnup=1.4610E+01mwd, flux= 2.79E+08n/cm**2-sec
0
element gamma power, watts
basis =single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr	6.74E+00	5.28E-05	5.00E-05	4.74E-05	4.49E-05	4.26E-05	4.03E-05
y	9.80E+00	1.18E-04	3.58E-06	4.93E-07	4.01E-07	3.91E-07	3.83E-07
zr	4.81E+00	3.51E-02	1.30E-03	4.82E-05	1.78E-06	6.61E-08	2.45E-09
nb	9.13E+00	7.79E-02	2.98E-03	1.11E-04	4.11E-06	1.55E-07	8.28E-09
rh	1.05E-01	1.10E-02	6.21E-03	3.52E-03	1.99E-03	1.13E-03	6.41E-04

sn	1.23E+00	6.03E-07	2.03E-07	1.17E-07	9.67E-08	9.08E-08	8.88E-08
sb	5.16E+00	1.96E-03	1.59E-03	1.28E-03	1.04E-03	8.41E-04	6.81E-04
te	5.57E+00	5.34E-05	3.32E-05	2.59E-05	2.08E-05	1.68E-05	1.36E-05
cs	8.75E+00	1.50E-05	1.13E-05	8.58E-06	6.48E-06	4.90E-06	3.70E-06
ba	4.85E+00	1.44E-01	1.41E-01	1.39E-01	1.36E-01	1.33E-01	1.31E-01
ce	2.08E+00	1.00E-02	4.72E-03	2.25E-03	1.07E-03	5.12E-04	2.44E-04
pr	1.80E+00	1.51E-02	7.22E-03	3.45E-03	1.64E-03	7.84E-04	3.74E-04
pm	8.53E-02	1.55E-06	1.20E-06	9.63E-07	7.73E-07	6.20E-07	4.97E-07
sm	4.44E-03	9.03E-08	8.97E-08	8.91E-08	8.85E-08	8.80E-08	8.74E-08
eu	5.40E-03	3.13E-04	2.77E-04	2.45E-04	2.17E-04	1.92E-04	1.69E-04
totals	1.28E+02	2.97E-01	1.66E-01	1.50E-01	1.42E-01	1.37E-01	1.33E-01

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photon spectrum as a function of time for light elements, cladding and structural materials

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2

power= .00 mw, burnup= 15.mwd, flux= 2.79E+08 n**2-sec

0 spectrum of photon release rates, photons/sec

basis = single reactor assembly

0

emean		time after discharge					
(mev)	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1.00E-02	5.14E+11	5.17E+04	4.14E+04	3.32E+04	2.66E+04	2.13E+04	1.70E+04
3.00E-02	1.69E+11	1.65E+04	1.32E+04	1.06E+04	8.46E+03	6.77E+03	5.43E+03
5.50E-02	1.18E+11	1.11E+04	8.91E+03	7.13E+03	5.71E+03	4.58E+03	3.66E+03
8.50E-02	6.89E+10	6.26E+03	5.01E+03	4.01E+03	3.22E+03	2.58E+03	2.06E+03
1.20E-01	4.90E+10	4.28E+03	3.43E+03	2.74E+03	2.20E+03	1.76E+03	1.41E+03
1.70E-01	5.12E+10	4.20E+03	3.36E+03	2.69E+03	2.16E+03	1.73E+03	1.38E+03
3.00E-01	5.87E+10	4.18E+03	3.35E+03	2.68E+03	2.15E+03	1.72E+03	1.38E+03
6.50E-01	2.89E+10	2.23E+05	1.79E+05	1.43E+05	1.15E+05	9.19E+04	7.36E+04
1.13E+00	4.97E+09	1.78E+05	1.43E+05	1.14E+05	9.14E+04	7.32E+04	5.87E+04
1.58E+00	9.03E+11	4.46E-01	3.57E-01	2.86E-01	2.29E-01	1.83E-01	1.47E-01
2.00E+00	1.79E+08	3.96E-02	3.18E-02	2.54E-02	2.04E-02	1.63E-02	1.31E-02
2.40E+00	3.62E+07	8.89E-03	7.12E-03	5.70E-03	4.57E-03	3.66E-03	2.93E-03
2.80E+00	2.13E+11	1.39E-04	1.11E-04	8.93E-05	7.15E-05	5.73E-05	4.59E-05
3.25E+00	1.35E+04	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
3.75E+00	1.39E+08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
4.25E+00	1.82E+06	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
4.75E+00	6.63E-19	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
5.50E+00	1.10E-19	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
0 total	2.18E+12	5.00E+05	4.00E+05	3.20E+05	2.57E+05	2.06E+05	1.65E+05
0 mev/sec	2.10E+12	3.50E+05	2.80E+05	2.25E+05	1.80E+05	1.44E+05	1.15E+05

0 spectrum of energy release rates, mev/watt-sec

basis = single reactor assembly

0

emean		time after discharge					
(mev)	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1.00E-02	1.29E+06	1.29E-01	1.04E-01	8.29E-02	6.64E-02	5.32E-02	4.26E-02
3.00E-02	1.27E+06	1.23E-01	9.89E-02	7.92E-02	6.34E-02	5.08E-02	4.07E-02
5.50E-02	1.62E+06	1.53E-01	1.22E-01	9.81E-02	7.86E-02	6.29E-02	5.04E-02
8.50E-02	1.46E+06	1.33E-01	1.07E-01	8.53E-02	6.83E-02	5.47E-02	4.38E-02
1.20E-01	1.47E+06	1.28E-01	1.03E-01	8.23E-02	6.59E-02	5.28E-02	4.23E-02
1.70E-01	2.18E+06	1.79E-01	1.43E-01	1.15E-01	9.17E-02	7.35E-02	5.88E-02
3.00E-01	4.41E+06	3.13E-01	2.51E-01	2.01E-01	1.61E-01	1.29E-01	1.03E-01
6.50E-01	4.70E+06	3.63E+01	2.91E+01	2.33E+01	1.86E+01	1.49E+01	1.20E+01
1.13E+00	1.40E+06	5.01E+01	4.01E+01	3.21E+01	2.57E+01	2.06E+01	1.65E+01
1.58E+00	3.56E+08	1.76E-04	1.41E-04	1.13E-04	9.02E-05	7.22E-05	5.79E-05
2.00E+00	8.95E+04	1.98E-05	1.59E-05	1.27E-05	1.02E-05	8.16E-06	6.53E-06
2.40E+00	2.17E+04	5.33E-06	4.27E-06	3.42E-06	2.74E-06	2.19E-06	1.76E-06
2.80E+00	1.49E+08	9.74E-08	7.80E-08	6.25E-08	5.01E-08	4.01E-08	3.21E-08
3.25E+00	1.10E+01	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00

	3.75E+00	1.30E+05	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	4.25E+00	1.93E+03	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	4.75E+00	7.87E-22	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
	5.50E+00	1.51E-22	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
0	total	5.25E+08	8.75E+01	7.01E+01	5.61E+01	4.50E+01	3.60E+01	2.88E+01
0	gamma watts	3.37E-01	5.61E-08	4.49E-08	3.60E-08	2.88E-08	2.31E-08	1.85E-08

1

photon spectrum as a function of time for fission products

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
power= .00 mw, burnup= 15.mwd, flux= 2.79E+08 n**2-sec

0 spectrum of photon release rates, photons/sec
basis = single reactor assembly

0

	emean (mev)	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
			time after discharge					
	1.00E-02	2.57E+14	4.09E+12	2.53E+12	1.83E+12	1.47E+12	1.28E+12	1.17E+12
	3.00E-02	1.12E+14	1.81E+12	1.11E+12	7.88E+11	6.24E+11	5.39E+11	4.92E+11
	5.50E-02	5.99E+13	9.26E+11	5.64E+11	3.97E+11	3.14E+11	2.70E+11	2.46E+11
	8.50E-02	4.15E+13	5.86E+11	3.50E+11	2.40E+11	1.85E+11	1.56E+11	1.41E+11
	1.20E-01	3.41E+13	7.47E+11	4.04E+11	2.42E+11	1.62E+11	1.23E+11	1.03E+11
	1.70E-01	5.47E+13	3.67E+11	2.18E+11	1.51E+11	1.17E+11	9.93E+10	8.98E+10
	3.00E-01	1.10E+14	4.10E+11	2.42E+11	1.63E+11	1.24E+11	1.04E+11	9.36E+10
	6.50E-01	2.25E+14	2.83E+12	1.59E+12	1.45E+12	1.38E+12	1.34E+12	1.30E+12
	1.13E+00	7.81E+13	3.94E+10	2.18E+10	1.33E+10	8.99E+09	6.76E+09	5.58E+09
	1.58E+00	4.04E+13	1.73E+10	8.72E+09	4.56E+09	2.53E+09	1.53E+09	1.04E+09
	2.00E+00	1.23E+13	2.93E+10	1.40E+10	6.74E+09	3.25E+09	1.58E+09	7.75E+08
	2.40E+00	1.06E+13	6.16E+08	3.25E+08	1.72E+08	9.22E+07	4.96E+07	2.69E+07
	2.80E+00	4.23E+12	8.00E+07	4.34E+07	2.37E+07	1.30E+07	7.14E+06	3.95E+06
	3.25E+00	2.48E+12	1.00E+07	5.68E+06	3.22E+06	1.82E+06	1.03E+06	5.86E+05
	3.75E+00	1.26E+12	4.42E+03	2.50E+03	1.42E+03	8.05E+02	4.56E+02	2.59E+02
	4.25E+00	1.40E+12	1.86E-08	1.89E-08	1.92E-08	1.94E-08	1.96E-08	1.97E-08
	4.75E+00	4.09E+11	9.34E-09	9.50E-09	9.63E-09	9.73E-09	9.81E-09	9.87E-09
	5.50E+00	3.04E+11	6.93E-09	7.05E-09	7.14E-09	7.22E-09	7.28E-09	7.32E-09
0	total	1.04E+15	1.18E+13	7.06E+12	5.28E+12	4.39E+12	3.92E+12	3.65E+12
0	mev/sec	4.41E+14	2.44E+12	1.38E+12	1.17E+12	1.06E+12	1.00E+12	9.61E+11

0 spectrum of energy release rates, mev/watt-sec
basis = single reactor assembly

0

	emean (mev)	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
			time after discharge					
	1.00E-02	6.42E+08	1.02E+07	6.33E+06	4.56E+06	3.67E+06	3.20E+06	2.94E+06
	3.00E-02	8.42E+08	1.36E+07	8.35E+06	5.91E+06	4.68E+06	4.04E+06	3.69E+06
	5.50E-02	8.24E+08	1.27E+07	7.76E+06	5.46E+06	4.31E+06	3.71E+06	3.38E+06
	8.50E-02	8.82E+08	1.24E+07	7.43E+06	5.10E+06	3.93E+06	3.32E+06	2.99E+06
	1.20E-01	1.02E+09	2.24E+07	1.21E+07	7.25E+06	4.87E+06	3.70E+06	3.10E+06
	1.70E-01	2.32E+09	1.56E+07	9.27E+06	6.40E+06	4.96E+06	4.22E+06	3.82E+06
	3.00E-01	8.23E+09	3.07E+07	1.82E+07	1.23E+07	9.33E+06	7.82E+06	7.02E+06
	6.50E-01	3.65E+10	4.59E+08	2.58E+08	2.35E+08	2.24E+08	2.17E+08	2.11E+08
	1.13E+00	2.20E+10	1.11E+07	6.14E+06	3.74E+06	2.53E+06	1.90E+06	1.57E+06
	1.58E+00	1.59E+10	6.80E+06	3.43E+06	1.80E+06	9.97E+05	6.04E+05	4.08E+05
	2.00E+00	6.14E+09	1.46E+07	7.01E+06	3.37E+06	1.62E+06	7.89E+05	3.88E+05
	2.40E+00	6.37E+09	3.69E+05	1.95E+05	1.03E+05	5.53E+04	2.98E+04	1.61E+04
	2.80E+00	2.96E+09	5.60E+04	3.04E+04	1.66E+04	9.08E+03	5.00E+03	2.76E+03
	3.25E+00	2.01E+09	8.14E+03	4.61E+03	2.62E+03	1.48E+03	8.40E+02	4.76E+02
	3.75E+00	1.18E+09	4.14E+00	2.35E+00	1.33E+00	7.54E-01	4.28E-01	2.42E-01
	4.25E+00	1.48E+09	1.98E-11	2.01E-11	2.04E-11	2.06E-11	2.08E-11	2.09E-11
	4.75E+00	4.85E+08	1.11E-11	1.13E-11	1.14E-11	1.16E-11	1.16E-11	1.17E-11
	5.50E+00	4.18E+08	9.53E-12	9.69E-12	9.82E-12	9.92E-12	1.00E-11	1.01E-11
0	total	1.10E+11	6.10E+08	3.45E+08	2.91E+08	2.65E+08	2.50E+08	2.40E+08

0 gamma watts 7.07E+01 3.91E-01 2.21E-01 1.87E-01 1.70E-01 1.60E-01 1.54E-01

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0 principal photon sources in group 1, photons/sec

mean energy = .0100 mev. nuclides exceeding 1.0E-03 of total group release rate (1.28E+12) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	2.22E+10	2.11E+10	2.00E+10	1.89E+10	1.79E+10	1.70E+10	1.61E+10
sr 90	1.75E+11	1.71E+11	1.68E+11	1.64E+11	1.61E+11	1.58E+11	1.55E+11
y 90	8.60E+11	8.42E+11	8.25E+11	8.08E+11	7.92E+11	7.76E+11	7.60E+11
rh106	4.71E+11	2.67E+11	1.51E+11	8.58E+10	4.86E+10	2.76E+10	1.56E+10
cs137	1.55E+11	1.52E+11	1.49E+11	1.46E+11	1.43E+11	1.40E+11	1.38E+11
ba137m	7.25E+09	7.11E+09	6.98E+09	6.84E+09	6.71E+09	6.59E+09	6.46E+09
ce144	3.55E+11	1.69E+11	8.07E+10	3.85E+10	1.83E+10	8.75E+09	4.17E+09
pr144	4.70E+12	2.24E+12	1.07E+12	5.10E+11	2.43E+11	1.16E+11	5.53E+10
pm147	8.24E+10	6.69E+10	5.37E+10	4.31E+10	3.46E+10	2.77E+10	2.23E+10
eu155	2.43E+09	2.15E+09	1.90E+09	1.68E+09	1.49E+09	1.31E+09	1.16E+09

0 principal photon sources in group 2, photons/sec

mean energy = .0300 mev. nuclides exceeding 1.0E-03 of total group release rate (5.39E+11) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	6.48E+09	6.14E+09	5.82E+09	5.51E+09	5.23E+09	4.95E+09	4.69E+09
sr 90	4.94E+10	4.84E+10	4.74E+10	4.65E+10	4.55E+10	4.46E+10	4.37E+10
y 90	2.80E+11	2.74E+11	2.69E+11	2.63E+11	2.58E+11	2.53E+11	2.48E+11
rh106	1.57E+11	8.91E+10	5.05E+10	2.86E+10	1.62E+10	9.20E+09	5.22E+09
sb125	1.72E+10	1.40E+10	1.13E+10	9.15E+09	7.40E+09	5.99E+09	4.85E+09
te125m	9.19E+09	7.94E+09	6.44E+09	5.21E+09	4.22E+09	3.41E+09	2.76E+09
cs137	4.31E+10	4.23E+10	4.14E+10	4.07E+10	3.99E+10	3.91E+10	3.84E+10
ba137m	1.25E+11	1.22E+11	1.20E+11	1.18E+11	1.15E+11	1.13E+11	1.11E+11
ce144	8.23E+11	3.93E+11	1.87E+11	8.93E+10	4.26E+10	2.03E+10	9.69E+09
pr144	1.55E+12	7.42E+11	3.54E+11	1.69E+11	8.04E+10	3.84E+10	1.83E+10
pr144m	3.18E+10	1.51E+10	7.22E+09	3.44E+09	1.64E+09	7.83E+08	3.74E+08
pm147	1.81E+10	1.47E+10	1.18E+10	9.48E+09	7.60E+09	6.10E+09	4.90E+09

0 principal photon sources in group 3, photons/sec

mean energy = .0550 mev. nuclides exceeding 1.0E-03 of total group release rate (2.70E+11) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	3.97E+09	3.77E+09	3.57E+09	3.38E+09	3.20E+09	3.04E+09	2.88E+09
sr 90	2.92E+10	2.86E+10	2.80E+10	2.75E+10	2.69E+10	2.64E+10	2.58E+10
y 90	1.94E+11	1.90E+11	1.86E+11	1.82E+11	1.78E+11	1.75E+11	1.71E+11
rh106	1.11E+11	6.31E+10	3.58E+10	2.03E+10	1.15E+10	6.52E+09	3.69E+09
cs137	2.51E+10	2.46E+10	2.41E+10	2.37E+10	2.32E+10	2.28E+10	2.23E+10
ce144	1.19E+11	5.68E+10	2.71E+10	1.29E+10	6.16E+09	2.94E+09	1.40E+09
pr144	1.09E+12	5.21E+11	2.48E+11	1.18E+11	5.65E+10	2.69E+10	1.28E+10
pm147	7.61E+09	6.18E+09	4.96E+09	3.98E+09	3.19E+09	2.56E+09	2.06E+09
eu155	7.09E+09	6.27E+09	5.54E+09	4.90E+09	4.33E+09	3.83E+09	3.38E+09

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0 principal photon sources in group 4, photons/sec

mean energy = .0850 mev. nuclides exceeding 1.0E-03 of total group release rate (1.56E+11) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	1.99E+09	1.89E+09	1.79E+09	1.69E+09	1.60E+09	1.52E+09	1.44E+09
sr 90	1.39E+10	1.36E+10	1.34E+10	1.31E+10	1.28E+10	1.26E+10	1.23E+10
y 90	1.12E+11	1.10E+11	1.07E+11	1.05E+11	1.03E+11	1.01E+11	9.90E+10
rh106	6.62E+10	3.75E+10	2.13E+10	1.21E+10	6.83E+09	3.87E+09	2.20E+09
cs137	1.17E+10	1.15E+10	1.13E+10	1.11E+10	1.09E+10	1.07E+10	1.05E+10
ce144	1.68E+11	8.02E+10	3.83E+10	1.82E+10	8.70E+09	4.15E+09	1.98E+09
pr144	6.42E+11	3.06E+11	1.46E+11	6.97E+10	3.32E+10	1.59E+10	7.56E+09
pm147	2.17E+09	1.76E+09	1.41E+09	1.13E+09	9.09E+08	7.29E+08	5.85E+08
eu155	1.08E+10	9.52E+09	8.41E+09	7.44E+09	6.57E+09	5.81E+09	5.14E+09

0 principal photon sources in group 5, photons/sec

mean energy = .1200 mev. nuclides exceeding 1.0E-03 of total group release rate (1.23E+11) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	1.20E+09	1.14E+09	1.08E+09	1.02E+09	9.67E+08	9.16E+08	8.68E+08
sr 90	7.93E+09	7.77E+09	7.61E+09	7.45E+09	7.30E+09	7.15E+09	7.01E+09
y 90	7.88E+10	7.72E+10	7.56E+10	7.41E+10	7.26E+10	7.11E+10	6.97E+10
rh106	4.78E+10	2.71E+10	1.54E+10	8.71E+09	4.94E+09	2.80E+09	1.59E+09
cs137	6.58E+09	6.45E+09	6.33E+09	6.21E+09	6.09E+09	5.98E+09	5.86E+09
ce144	8.25E+11	3.93E+11	1.88E+11	8.95E+10	4.27E+10	2.04E+10	9.71E+09
pr144	4.60E+11	2.19E+11	1.05E+11	4.99E+10	2.38E+10	1.13E+10	5.41E+09
pm147	6.87E+08	5.58E+08	4.48E+08	3.59E+08	2.88E+08	2.31E+08	1.86E+08
eu155	6.15E+09	5.43E+09	4.80E+09	4.25E+09	3.75E+09	3.32E+09	2.93E+09

0 principal photon sources in group 6, photons/sec

mean energy = .1700 mev. nuclides exceeding 1.0E-03 of total group release rate (9.93E+10) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	9.53E+08	9.03E+08	8.56E+08	8.11E+08	7.68E+08	7.28E+08	6.90E+08
sr 90	5.65E+09	5.54E+09	5.43E+09	5.32E+09	5.21E+09	5.10E+09	5.00E+09
y 90	8.12E+10	7.96E+10	7.80E+10	7.64E+10	7.48E+10	7.33E+10	7.18E+10
rh106	5.13E+10	2.91E+10	1.65E+10	9.34E+09	5.29E+09	3.00E+09	1.70E+09
sb125	2.59E+09	2.10E+09	1.70E+09	1.38E+09	1.11E+09	9.02E+08	7.30E+08
cs137	4.65E+09	4.56E+09	4.47E+09	4.39E+09	4.30E+09	4.22E+09	4.14E+09
pr144	4.86E+11	2.32E+11	1.11E+11	5.27E+10	2.51E+10	1.20E+10	5.72E+09

0 principal photon sources in group 7, photons/sec

mean energy = .3000 mev. nuclides exceeding 1.0E-03 of total group release rate (1.04E+11) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
kr 85	5.75E+08	5.45E+08	5.17E+08	4.89E+08	4.64E+08	4.39E+08	4.16E+08
sr 90	2.56E+09	2.51E+09	2.46E+09	2.41E+09	2.36E+09	2.31E+09	2.27E+09
y 90	9.02E+10	8.84E+10	8.66E+10	8.48E+10	8.31E+10	8.14E+10	7.98E+10
rh106	6.18E+10	3.51E+10	1.99E+10	1.13E+10	6.38E+09	3.62E+09	2.05E+09
sb125	9.81E+08	7.96E+08	6.44E+08	5.22E+08	4.22E+08	3.42E+08	2.76E+08
cs137	2.35E+09	2.31E+09	2.26E+09	2.22E+09	2.18E+09	2.14E+09	2.10E+09
pr144	5.69E+11	2.71E+11	1.29E+11	6.17E+10	2.94E+10	1.40E+10	6.70E+09

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0 principal photon sources in group 8, photons/sec

mean energy = .6500 mev. nuclides exceeding 1.0E-03 of total group release rate (1.34E+12) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
y 90	3.81E+10	3.74E+10	3.66E+10	3.58E+10	3.51E+10	3.44E+10	3.37E+10
rh106	1.91E+11	1.08E+11	6.13E+10	3.48E+10	1.97E+10	1.12E+10	6.33E+09
sb125	2.10E+10	1.71E+10	1.38E+10	1.12E+10	9.06E+09	7.33E+09	5.93E+09
ba137m	1.40E+12	1.37E+12	1.35E+12	1.32E+12	1.30E+12	1.27E+12	1.25E+12
pr144	3.88E+11	1.85E+11	8.83E+10	4.21E+10	2.01E+10	9.58E+09	4.57E+09

0 principal photon sources in group 9, photons/sec

mean energy = 1.1250 mev. nuclides exceeding 1.0E-03 of total group release rate (6.76E+09) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
y 90	4.97E+09	4.87E+09	4.77E+09	4.68E+09	4.58E+09	4.49E+09	4.40E+09
rh106	1.78E+10	1.01E+10	5.71E+09	3.24E+09	1.84E+09	1.04E+09	5.90E+08
pr144	4.97E+10	2.37E+10	1.13E+10	5.39E+09	2.57E+09	1.23E+09	5.85E+08

0 principal photon sources in group 10, photons/sec

mean energy = 1.5750 mev. nuclides exceeding 1.0E-03 of total group release rate (1.53E+09) at 1521.9 d

nuclide	time after discharge						
	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
y 90	6.35E+08	6.22E+08	6.09E+08	5.97E+08	5.85E+08	5.73E+08	5.61E+08
rh106	3.35E+09	1.90E+09	1.08E+09	6.11E+08	3.46E+08	1.96E+08	1.11E+08
pr144	3.09E+10	1.47E+10	7.03E+09	3.35E+09	1.60E+09	7.63E+08	3.64E+08

0 principal photon sources in group 11, photons/sec

mean energy = 2.0000 mev. nuclides exceeding 1.0E-03 of total group release rate (1.58E+09) at 1521.9 d

nuclide	time after discharge initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
y 90	3.80E+07	3.72E+07	3.64E+07	3.57E+07	3.50E+07	3.43E+07	3.36E+07
rh106	1.09E+09	6.18E+08	3.50E+08	1.99E+08	1.13E+08	6.38E+07	3.62E+07
pr144	6.00E+10	2.86E+10	1.36E+10	6.50E+09	3.10E+09	1.48E+09	7.06E+08

0 principal photon sources in group 12, photons/sec
mean energy = 2.4000 mev. nuclides exceeding 1.0E-03 of total group release rate (4.96E+07) at 1521.9 d

nuclide	time after discharge initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
rh106	6.09E+08	3.45E+08	1.96E+08	1.11E+08	6.29E+07	3.56E+07	2.02E+07
pr144	5.67E+08	2.70E+08	1.29E+08	6.15E+07	2.93E+07	1.40E+07	6.67E+06

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0 principal photon sources in group 13, photons/sec
mean energy = 2.8000 mev. nuclides exceeding 1.0E-03 of total group release rate (7.14E+06) at 1521.9 d

nuclide	time after discharge initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
rh106	1.03E+08	5.83E+07	3.30E+07	1.87E+07	1.06E+07	6.02E+06	3.41E+06
pr144	4.56E+07	2.18E+07	1.04E+07	4.95E+06	2.36E+06	1.13E+06	5.37E+05

0 principal photon sources in group 14, photons/sec
mean energy = 3.2500 mev. nuclides exceeding 1.0E-03 of total group release rate (1.03E+06) at 1521.9 d

nuclide	time after discharge initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
rh106	1.77E+07	1.00E+07	5.68E+06	3.22E+06	1.82E+06	1.03E+06	5.86E+05

0 principal photon sources in group 15, photons/sec
mean energy = 3.7500 mev. nuclides exceeding 1.0E-03 of total group release rate (4.56E+02) at 1521.9 d

nuclide	time after discharge initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
rh106	7.79E+03	4.42E+03	2.50E+03	1.42E+03	8.05E+02	4.56E+02	2.59E+02

0 principal photon sources in group 16, photons/sec
mean energy = 4.2500 mev. nuclides exceeding 1.0E-03 of total group release rate (1.96E-08) at 1521.9 d

nuclide	time after discharge initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
ce142	1.46E-08	1.46E-08	1.46E-08	1.46E-08	1.46E-08	1.46E-08	1.46E-08
sm147	3.63E-09	4.02E-09	4.34E-09	4.59E-09	4.79E-09	4.96E-09	5.09E-09

0 principal photon sources in group 17, photons/sec
mean energy = 4.7500 mev. nuclides exceeding 1.0E-03 of total group release rate (9.81E-09) at 1521.9 d

nuclide	time after discharge initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
ce142	7.32E-09	7.32E-09	7.32E-09	7.32E-09	7.32E-09	7.32E-09	7.32E-09
sm147	1.82E-09	2.02E-09	2.18E-09	2.30E-09	2.40E-09	2.49E-09	2.55E-09

0 principal photon sources in group 18, photons/sec
mean energy = 5.5000 mev. nuclides exceeding 1.0E-03 of total group release rate (7.28E-09) at 1521.9 d

nuclide	time after discharge initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
ce142	5.43E-09	5.43E-09	5.43E-09	5.43E-09	5.43E-09	5.43E-09	5.43E-09
sm147	1.35E-09	1.50E-09	1.61E-09	1.71E-09	1.78E-09	1.84E-09	1.89E-09

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1 photon spectrum as a function of time for heavy metals and their daughters

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
power= .00 mw, burnup= 15.mwd, flux= 2.79E+08 n**2-sec
0 actinide photon release rates, photons/sec
basis = single reactor assembly
0

emean (mev)	time after discharge initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1.00E-02	1.33E+14	5.89E+11	5.89E+11	5.89E+11	5.88E+11	5.88E+11	5.88E+11
3.00E-02	8.46E+12	4.62E+10	4.62E+10	4.62E+10	4.62E+10	4.62E+10	4.62E+10
5.50E-02	1.09E+13	2.02E+10	2.02E+10	2.02E+10	2.02E+10	2.02E+10	2.02E+10
8.50E-02	5.26E+13	1.51E+11	1.51E+11	1.51E+11	1.51E+11	1.51E+11	1.51E+11

	1.20E-01	5.42E+13	2.90E+10	2.90E+10	2.90E+10	2.90E+10	2.90E+10	2.90E+10
	1.70E-01	1.72E+12	1.90E+10	1.90E+10	1.90E+10	1.90E+10	1.90E+10	1.90E+10
	3.00E-01	2.87E+13	1.30E+11	1.30E+11	1.30E+11	1.30E+11	1.30E+11	1.30E+11
	6.50E-01	1.45E+12	6.30E+09	6.30E+09	6.30E+09	6.30E+09	6.30E+09	6.30E+09
	1.13E+00	1.86E+12	9.16E+08	9.16E+08	9.16E+08	9.16E+08	9.16E+08	9.16E+08
	1.58E+00	1.07E+08	1.07E+08	1.07E+08	1.07E+08	1.07E+08	1.07E+08	1.07E+08
	2.00E+00	3.65E+07	3.65E+07	3.65E+07	3.65E+07	3.65E+07	3.65E+07	3.65E+07
	2.40E+00	3.35E+04	3.42E+04	3.50E+04	3.58E+04	3.67E+04	3.77E+04	3.87E+04
	2.80E+00	9.08E+04	1.02E+05	1.13E+05	1.24E+05	1.33E+05	1.40E+05	1.47E+05
	3.25E+00	1.03E+04	1.03E+04	1.03E+04	1.03E+04	1.03E+04	1.03E+04	1.04E+04
	3.75E+00	5.95E+03	5.95E+03	5.95E+03	5.95E+03	5.95E+03	5.95E+03	5.95E+03
	4.25E+00	3.45E+03	3.44E+03	3.44E+03	3.44E+03	3.44E+03	3.44E+03	3.44E+03
	4.75E+00	1.99E+03	1.99E+03	1.99E+03	1.99E+03	1.99E+03	1.99E+03	1.99E+03
	5.50E+00	1.80E+03	1.80E+03	1.80E+03	1.80E+03	1.80E+03	1.80E+03	1.80E+03
0	total	2.93E+14	9.92E+11	9.92E+11	9.91E+11	9.91E+11	9.91E+11	9.91E+11
0	mev/sec	2.51E+13	7.24E+10	7.24E+10	7.24E+10	7.24E+10	7.24E+10	7.24E+10

0 actinide energy release rates, mev/watt-sec

basis = single reactor assembly

0

	emean (mev)	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
			time after discharge					
	1.00E-02	3.33E+08	1.47E+06	1.47E+06	1.47E+06	1.47E+06	1.47E+06	1.47E+06
	3.00E-02	6.34E+07	3.46E+05	3.46E+05	3.46E+05	3.46E+05	3.46E+05	3.46E+05
	5.50E-02	1.50E+08	2.78E+05	2.78E+05	2.78E+05	2.78E+05	2.78E+05	2.78E+05
	8.50E-02	1.12E+09	3.20E+06	3.20E+06	3.20E+06	3.20E+06	3.20E+06	3.20E+06
	1.20E-01	1.63E+09	8.70E+05	8.70E+05	8.70E+05	8.70E+05	8.70E+05	8.70E+05
	1.70E-01	7.31E+07	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05	8.07E+05
	3.00E-01	2.15E+09	9.77E+06	9.77E+06	9.77E+06	9.77E+06	9.77E+06	9.77E+06
	6.50E-01	2.36E+08	1.02E+06	1.02E+06	1.02E+06	1.02E+06	1.02E+06	1.02E+06
	1.13E+00	5.24E+08	2.58E+05	2.58E+05	2.58E+05	2.58E+05	2.58E+05	2.58E+05
	1.58E+00	4.21E+04	4.21E+04	4.21E+04	4.21E+04	4.21E+04	4.21E+04	4.21E+04
	2.00E+00	1.82E+04	1.82E+04	1.82E+04	1.82E+04	1.82E+04	1.82E+04	1.82E+04
	2.40E+00	2.01E+01	2.05E+01	2.10E+01	2.15E+01	2.20E+01	2.26E+01	2.32E+01
	2.80E+00	6.36E+01	7.16E+01	7.94E+01	8.65E+01	9.28E+01	9.83E+01	1.03E+02
	3.25E+00	8.38E+00	8.39E+00	8.39E+00	8.40E+00	8.40E+00	8.41E+00	8.41E+00
	3.75E+00	5.58E+00	5.58E+00	5.58E+00	5.58E+00	5.58E+00	5.58E+00	5.58E+00
	4.25E+00	3.66E+00	3.66E+00	3.66E+00	3.66E+00	3.66E+00	3.66E+00	3.66E+00
	4.75E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00	2.37E+00
	5.50E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00	2.48E+00
0	total	6.27E+09	1.81E+07	1.81E+07	1.81E+07	1.81E+07	1.81E+07	1.81E+07
0	gamma watts	4.02E+00	1.16E-02	1.16E-02	1.16E-02	1.16E-02	1.16E-02	1.16E-02

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neutron source intensity as a function of time

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2

alpha-n neutron source, neutrons/sec/basis

basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
pb210	6.08E-13	7.68E-13	9.54E-13	1.17E-12	1.41E-12	1.68E-12	1.98E-12
bi210	1.55E-10	1.96E-10	2.43E-10	2.98E-10	3.59E-10	4.28E-10	5.05E-10
bi211	1.77E-02	2.08E-02	2.40E-02	2.73E-02	3.08E-02	3.45E-02	3.84E-02
bi212	2.59E-03	3.00E-03	3.39E-03	3.75E-03	4.06E-03	4.34E-03	4.58E-03
bi213	3.06E-06	3.60E-06	4.19E-06	4.83E-06	5.51E-06	6.25E-06	7.04E-06
bi214	7.34E-07	8.62E-07	9.99E-07	1.15E-06	1.31E-06	1.47E-06	1.65E-06
po210	1.61E-04	2.06E-04	2.59E-04	3.19E-04	3.88E-04	4.66E-04	5.53E-04
po211	6.99E-05	8.25E-05	9.49E-05	1.08E-04	1.22E-04	1.37E-04	1.52E-04
po212	1.33E-02	1.54E-02	1.73E-02	1.92E-02	2.08E-02	2.22E-02	2.35E-02
po213	4.03E-04	4.75E-04	5.53E-04	6.37E-04	7.28E-04	8.25E-04	9.29E-04

po214	6.54E-03	7.68E-03	8.90E-03	1.02E-02	1.16E-02	1.31E-02	1.47E-02
po215	2.50E-02	2.95E-02	3.39E-02	3.86E-02	4.35E-02	4.88E-02	5.42E-02
po216	1.04E-02	1.20E-02	1.35E-02	1.50E-02	1.62E-02	1.74E-02	1.83E-02
po218	3.11E-03	3.65E-03	4.24E-03	4.86E-03	5.53E-03	6.24E-03	7.00E-03
at217	2.61E-04	3.08E-04	3.58E-04	4.13E-04	4.72E-04	5.35E-04	6.02E-04
rn218	2.85E-13	1.12E-17	4.41E-22	1.74E-26	.00E+00	.00E+00	.00E+00
rn219	1.98E-02	2.34E-02	2.69E-02	3.07E-02	3.46E-02	3.88E-02	4.31E-02
rn220	8.20E-03	9.49E-03	1.07E-02	1.19E-02	1.29E-02	1.37E-02	1.45E-02
rn222	2.27E-03	2.67E-03	3.09E-03	3.55E-03	4.04E-03	4.56E-03	5.11E-03
fr221	1.91E-04	2.24E-04	2.61E-04	3.01E-04	3.44E-04	3.90E-04	4.39E-04
fr223	7.61E-09	8.86E-09	1.02E-08	1.16E-08	1.31E-08	1.47E-08	1.63E-08
ra222	2.20E-13	8.67E-18	3.41E-22	1.34E-26	.00E+00	.00E+00	.00E+00
ra223	1.15E-02	1.36E-02	1.56E-02	1.78E-02	2.00E-02	2.24E-02	2.50E-02
ra224	5.80E-03	6.71E-03	7.58E-03	8.38E-03	9.09E-03	9.72E-03	1.03E-02
ra226	1.33E-03	1.56E-03	1.81E-03	2.08E-03	2.36E-03	2.67E-03	2.99E-03
ac225	1.37E-04	1.61E-04	1.88E-04	2.17E-04	2.47E-04	2.80E-04	3.16E-04
ac227	8.57E-05	9.97E-05	1.15E-04	1.31E-04	1.47E-04	1.65E-04	1.84E-04
ac228	9.62E-15	1.10E-14	1.24E-14	1.39E-14	1.54E-14	1.69E-14	1.85E-14
th226	1.99E-13	7.82E-18	3.08E-22	1.21E-26	.00E+00	.00E+00	.00E+00
th227	1.26E-02	1.50E-02	1.72E-02	1.96E-02	2.21E-02	2.48E-02	2.75E-02
th228	4.87E-03	5.64E-03	6.37E-03	7.04E-03	7.64E-03	8.17E-03	8.62E-03
th229	8.01E-05	9.43E-05	1.10E-04	1.27E-04	1.45E-04	1.64E-04	1.84E-04
th230	5.67E-01	6.14E-01	6.61E-01	7.09E-01	7.56E-01	8.03E-01	8.50E-01
th232	2.92E-07	3.17E-07	3.41E-07	3.66E-07	3.90E-07	4.14E-07	4.39E-07
pa231	4.76E-02	5.16E-02	5.56E-02	5.96E-02	6.36E-02	6.76E-02	7.15E-02
u230	1.57E-13	6.16E-18	2.42E-22	9.52E-27	.00E+00	.00E+00	.00E+00
u231	1.47E-13	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u232	6.93E-03	7.59E-03	8.12E-03	8.54E-03	8.87E-03	9.12E-03	9.31E-03
u233	1.60E-01	1.76E-01	1.91E-01	2.06E-01	2.21E-01	2.37E-01	2.52E-01
u234	6.63E+03	6.63E+03	6.63E+03	6.63E+03	6.63E+03	6.63E+03	6.63E+03
u235	1.37E+02	1.37E+02	1.37E+02	1.37E+02	1.37E+02	1.37E+02	1.37E+02
u236	1.04E+03	1.04E+03	1.04E+03	1.04E+03	1.04E+03	1.04E+03	1.04E+03
u238	8.32E+02	8.32E+02	8.32E+02	8.32E+02	8.32E+02	8.32E+02	8.32E+02
np235	2.41E-08	1.41E-08	8.30E-09	4.88E-09	2.86E-09	1.68E-09	9.87E-10
np237	3.35E+03	3.35E+03	3.35E+03	3.35E+03	3.35E+03	3.35E+03	3.35E+03
pu236	1.29E-01	1.06E-01	8.68E-02	7.11E-02	5.83E-02	4.78E-02	3.91E-02
pu237	1.70E-09	1.59E-11	1.49E-13	1.40E-15	1.31E-17	1.23E-19	1.15E-21
pu238	6.34E+03	6.31E+03	6.26E+03	6.22E+03	6.18E+03	6.14E+03	6.10E+03

1

neutron source intensity as a function of time

0

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
alpha-n neutron source, neutrons/sec/basis
basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
pu239	5.12E+02	5.12E+02	5.12E+02	5.12E+02	5.12E+02	5.12E+02	5.12E+02
pu240	9.34E-02	9.34E-02	9.34E-02	9.33E-02	9.33E-02	9.33E-02	9.33E-02
pu241	4.90E-08	4.70E-08	4.52E-08	4.34E-08	4.17E-08	4.00E-08	3.85E-08
pu242	1.64E-12	1.64E-12	1.64E-12	1.64E-12	1.64E-12	1.64E-12	1.64E-12
am239	1.36E-19	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
am240	2.14E-19	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
am241	1.31E-05	1.72E-05	2.12E-05	2.50E-05	2.86E-05	3.21E-05	3.55E-05
am242m	7.75E-13	7.71E-13	7.68E-13	7.65E-13	7.62E-13	7.59E-13	7.56E-13
am243	7.43E-16	7.43E-16	7.43E-16	7.43E-16	7.43E-16	7.43E-16	7.42E-16
cm241	1.24E-21	1.99E-24	3.21E-27	5.12E-30	.00E+00	.00E+00	.00E+00
cm242	9.90E-08	2.74E-08	7.69E-09	2.28E-09	7.96E-10	3.89E-10	2.77E-10
cm243	1.43E-15	1.41E-15	1.38E-15	1.35E-15	1.32E-15	1.30E-15	1.27E-15
cm244	3.03E-18	2.94E-18	2.84E-18	2.76E-18	2.67E-18	2.58E-18	2.50E-18

cm245	7.66E-27	7.66E-27	7.66E-27	7.66E-27	7.66E-27	7.66E-27	7.66E-27
0 total	1.88E+04	1.88E+04	1.88E+04	1.87E+04	1.87E+04	1.86E+04	1.86E+04

1

neutron source intensity as a function of time

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
spontaneous fission neutron source, neutrons/sec/basis
basis = single reactor assembly

	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
th230	1.45E-05	1.58E-05	1.70E-05	1.82E-05	1.94E-05	2.06E-05	2.18E-05
pa231	5.97E-06	6.47E-06	6.97E-06	7.47E-06	7.97E-06	8.47E-06	8.97E-06
u232	4.25E-07	4.66E-07	4.99E-07	5.25E-07	5.45E-07	5.60E-07	5.72E-07
u234	1.43E+01	1.43E+01	1.43E+01	1.43E+01	1.43E+01	1.43E+01	1.43E+01
u235	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00	1.68E+00
u236	1.57E+02	1.57E+02	1.57E+02	1.57E+02	1.57E+02	1.57E+02	1.57E+02
u237	1.22E-09	1.75E-21	1.65E-21	1.59E-21	1.53E-21	1.47E-21	1.41E-21
u238	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05
u239	9.66E-10	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np236	7.39E-11	7.39E-11	7.39E-11	7.39E-11	7.39E-11	7.39E-11	7.39E-11
np238	2.02E-08	2.26E-25	2.25E-25	2.25E-25	2.24E-25	2.23E-25	2.22E-25
np239	1.98E-05	7.70E-27	7.70E-27	7.70E-27	7.70E-27	7.70E-27	7.69E-27
pu236	8.74E-03	7.17E-03	5.87E-03	4.81E-03	3.94E-03	3.23E-03	2.65E-03
pu238	1.17E+03	1.16E+03	1.16E+03	1.15E+03	1.14E+03	1.13E+03	1.13E+03
pu239	2.74E-01	2.74E-01	2.74E-01	2.74E-01	2.74E-01	2.74E-01	2.74E-01
pu240	6.21E-01	6.21E-01	6.21E-01	6.21E-01	6.21E-01	6.20E-01	6.20E-01
pu241	1.76E-09	1.69E-09	1.63E-09	1.56E-09	1.50E-09	1.44E-09	1.38E-09
pu242	1.28E-09	1.28E-09	1.28E-09	1.28E-09	1.28E-09	1.28E-09	1.28E-09
pu243	1.03E-22	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
am241	5.03E-09	6.62E-09	8.15E-09	9.61E-09	1.10E-08	1.24E-08	1.37E-08
am242m	3.68E-12	3.67E-12	3.65E-12	3.64E-12	3.62E-12	3.61E-12	3.59E-12
am242	2.09E-12	3.98E-15	3.97E-15	3.95E-15	3.93E-15	3.92E-15	3.90E-15
am243	3.42E-18	3.42E-18	3.42E-18	3.42E-18	3.42E-18	3.42E-18	3.42E-18
am244	6.89E-26	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
cm242	4.94E-07	1.37E-07	3.84E-08	1.14E-08	3.97E-09	1.94E-09	1.38E-09
cm243	3.12E-17	3.05E-17	2.99E-17	2.93E-17	2.87E-17	2.82E-17	2.76E-17
cm244	3.95E-16	3.83E-16	3.71E-16	3.59E-16	3.48E-16	3.37E-16	3.27E-16
cm245	2.08E-27	2.08E-27	2.08E-27	2.08E-27	2.08E-27	2.08E-27	2.08E-27
cm246	3.47E-27	3.47E-27	3.47E-27	3.47E-27	3.47E-27	3.47E-27	3.47E-27
0 total	1.19E+05	1.19E+05	1.19E+05	1.19E+05	1.19E+05	1.19E+05	1.19E+05
0 total	1.38E+05	1.37E+05	1.37E+05	1.37E+05	1.37E+05	1.37E+05	1.37E+05

1

alpha-n neutron source spectrum as a function of time
(using reaction spectra for uranium dioxide)

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
alpha-n neutron spectra, neutrons/sec/basis
basis = single reactor assembly

	boundaries, mev	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1	6.43E+00 - 2.00E+01	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
2	3.00E+00 - 6.43E+00	3.649E+03	3.642E+03	3.634E+03	3.626E+03	3.618E+03	3.610E+03	3.603E+03
3	1.85E+00 - 3.00E+00	1.034E+04	1.032E+04	1.029E+04	1.027E+04	1.025E+04	1.023E+04	1.021E+04
4	1.40E+00 - 1.85E+00	2.776E+03	2.771E+03	2.765E+03	2.759E+03	2.753E+03	2.747E+03	2.741E+03
5	9.00E-01 - 1.40E+00	1.562E+03	1.559E+03	1.555E+03	1.552E+03	1.549E+03	1.545E+03	1.542E+03
6	4.00E-01 - 9.00E-01	4.536E+02	4.528E+02	4.518E+02	4.508E+02	4.498E+02	4.488E+02	4.479E+02
7	1.00E-01 - 4.00E-01	7.090E+01	7.076E+01	7.061E+01	7.045E+01	7.030E+01	7.015E+01	7.000E+01

8	1.70E-02 - 1.00E-01	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
9	3.00E-03 - 1.70E-02	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
10	5.50E-04 - 3.00E-03	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
11	1.00E-04 - 5.50E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
12	3.00E-05 - 1.00E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
13	1.00E-05 - 3.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
14	3.05E-06 - 1.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
15	1.77E-06 - 3.05E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
16	1.30E-06 - 1.77E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
17	1.13E-06 - 1.30E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
18	1.00E-06 - 1.13E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
19	8.00E-07 - 1.00E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
20	4.00E-07 - 8.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
21	3.25E-07 - 4.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
22	2.25E-07 - 3.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
23	1.00E-07 - 2.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
24	5.00E-08 - 1.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
25	3.00E-08 - 5.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
26	1.00E-08 - 3.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
27	1.00E-11 - 1.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
0		1.885E+04	1.881E+04	1.877E+04	1.873E+04	1.869E+04	1.865E+04	1.861E+04

1

spontaneous fission neutron source spectrum as a function of time

0

sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
spontaneous fission neutron spectra, neutrons/sec/basis
basis = single reactor assembly

	boundaries, mev	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1	6.43E+00 - 2.00E+01	2.267E+03	2.267E+03	2.266E+03	2.265E+03	2.263E+03	2.261E+03	2.259E+03
2	3.00E+00 - 6.43E+00	2.485E+04	2.484E+04	2.484E+04	2.484E+04	2.484E+04	2.484E+04	2.484E+04
3	1.85E+00 - 3.00E+00	2.708E+04	2.707E+04	2.707E+04	2.706E+04	2.705E+04	2.704E+04	2.703E+04
4	1.40E+00 - 1.85E+00	1.534E+04	1.534E+04	1.534E+04	1.535E+04	1.536E+04	1.537E+04	1.538E+04
5	9.00E-01 - 1.40E+00	2.106E+04	2.106E+04	2.106E+04	2.106E+04	2.107E+04	2.109E+04	2.110E+04
6	4.00E-01 - 9.00E-01	2.347E+04	2.346E+04	2.346E+04	2.346E+04	2.345E+04	2.344E+04	2.343E+04
7	1.00E-01 - 4.00E-01	4.633E+03	4.633E+03	4.632E+03	4.630E+03	4.626E+03	4.621E+03	4.617E+03
8	1.70E-02 - 1.00E-01	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
9	3.00E-03 - 1.70E-02	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
10	5.50E-04 - 3.00E-03	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
11	1.00E-04 - 5.50E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
12	3.00E-05 - 1.00E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
13	1.00E-05 - 3.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
14	3.05E-06 - 1.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
15	1.77E-06 - 3.05E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
16	1.30E-06 - 1.77E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
17	1.13E-06 - 1.30E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
18	1.00E-06 - 1.13E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
19	8.00E-07 - 1.00E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
20	4.00E-07 - 8.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
21	3.25E-07 - 4.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
22	2.25E-07 - 3.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
23	1.00E-07 - 2.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
24	5.00E-08 - 1.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
25	3.00E-08 - 5.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
26	1.00E-08 - 3.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
27	1.00E-11 - 1.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
0		1.187E+05	1.187E+05	1.187E+05	1.187E+05	1.187E+05	1.187E+05	1.186E+05

1

total (alpha-n plus spon. fission) neutron source spectrum as a function of time

(using reaction spectra for uranium dioxide)

0 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
neutron spectra, neutrons/sec/basis
basis = single reactor assembly

	boundaries, mev	initial	304.4 d	608.8 d	913.1 d	1217.5 d	1521.9 d	1826.3 d
1	6.43E+00 - 2.00E+01	2.267E+03	2.267E+03	2.266E+03	2.265E+03	2.263E+03	2.261E+03	2.259E+03
2	3.00E+00 - 6.43E+00	2.849E+04	2.849E+04	2.848E+04	2.847E+04	2.846E+04	2.845E+04	2.845E+04
3	1.85E+00 - 3.00E+00	3.741E+04	3.739E+04	3.737E+04	3.734E+04	3.730E+04	3.726E+04	3.723E+04
4	1.40E+00 - 1.85E+00	1.812E+04	1.811E+04	1.811E+04	1.811E+04	1.811E+04	1.812E+04	1.812E+04
5	9.00E-01 - 1.40E+00	2.262E+04	2.262E+04	2.261E+04	2.261E+04	2.262E+04	2.263E+04	2.264E+04
6	4.00E-01 - 9.00E-01	2.392E+04	2.392E+04	2.391E+04	2.391E+04	2.390E+04	2.388E+04	2.388E+04
7	1.00E-01 - 4.00E-01	4.704E+03	4.703E+03	4.702E+03	4.700E+03	4.696E+03	4.691E+03	4.687E+03
8	1.70E-02 - 1.00E-01	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
9	3.00E-03 - 1.70E-02	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
10	5.50E-04 - 3.00E-03	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
11	1.00E-04 - 5.50E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
12	3.00E-05 - 1.00E-04	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
13	1.00E-05 - 3.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
14	3.05E-06 - 1.00E-05	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
15	1.77E-06 - 3.05E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
16	1.30E-06 - 1.77E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
17	1.13E-06 - 1.30E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
18	1.00E-06 - 1.13E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
19	8.00E-07 - 1.00E-06	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
20	4.00E-07 - 8.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
21	3.25E-07 - 4.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
22	2.25E-07 - 3.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
23	1.00E-07 - 2.25E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
24	5.00E-08 - 1.00E-07	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
25	3.00E-08 - 5.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
26	1.00E-08 - 3.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
27	1.00E-11 - 1.00E-08	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00	.000E+00
0		1.375E+05	1.375E+05	1.374E+05	1.374E+05	1.374E+05	1.373E+05	1.373E+05

1
1 * gamma sources determined *
0case applies the following photon data base
master photon library
in binary mode
0 the sources include photons of nuclides for...

light elements
actinides
fission products
1 gamma source spectrum for gamma lines (sas2)
0 1826.25 day time of the requested nuclides

energy interval in mev			photons / second	mev / second
1.0000E-02	to	5.0000E-02	1.1389E+12	3.4166E+10
5.0000E-02	to	1.0000E-01	4.4703E+11	3.3528E+10
1.0000E-01	to	2.0000E-01	2.2869E+11	3.4304E+10
2.0000E-01	to	3.0000E-01	7.1950E+10	1.7988E+10
3.0000E-01	to	4.0000E-01	1.4071E+11	4.9249E+10
4.0000E-01	to	6.0000E-01	4.2383E+10	2.1191E+10
6.0000E-01	to	8.0000E-01	1.1773E+12	8.2409E+11
8.0000E-01	to	1.0000E+00	6.2471E+09	5.6224E+09
1.0000E+00	to	1.3300E+00	4.0598E+09	4.7297E+09
1.3300E+00	to	1.6600E+00	1.0379E+09	1.5517E+09

	1.6600E+00 to	2.0000E+00	2.5559E+08	4.6772E+08
	2.0000E+00 to	2.5000E+00	6.5386E+08	1.4712E+09
	2.5000E+00 to	3.0000E+00	4.9296E+06	1.3556E+07
	3.0000E+00 to	4.0000E+00	5.5379E+05	1.9383E+06
	4.0000E+00 to	5.0000E+00	5.3567E+03	2.4105E+04
	5.0000E+00 to	6.5000E+00	2.1440E+03	1.2328E+04
	6.5000E+00 to	8.0000E+00	4.1954E+02	3.0417E+03
	8.0000E+00 to	1.0000E+01	8.8927E+01	8.0034E+02
0	totals		3.2592E+12	1.0284E+12

```
0
0                        total energy from nuclides with spectrum data    =   1.0284E+12
0                        total energy from nuclides with no spectrum data =   2.3297E+05
1
0  .results on logical unit no. 71, position  2, for time step  6, subcase 7. (run position 1, case position 2)
   title: sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2
0     .terminated logical unit no. 71 with zero flag record.
1  * normal termination of execution *
```

```
1          primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-     module sas2h    will be called
        SAS2H: Far-Field Crit based on B&W 15x15, 3.00wt%, 20gwd/mtu 40% H2O/ 8% UO2
        44group     latticecell
        '
        '  mixtures of tuff infinite slabs:
        arbm-ftuff  2.6344 14 0 0 0 1001 1.055 8016 40.755 11023 0.570 12000 0.354
                                    13027 4.434 14000 20.193 19000 1.370 20000 1.439
                                    26000 0.494 92235 0.567 92234 0.007 92236 0.136
                                    92238 28.593 93237 0.033 1 1.0 538   end
        kr-83       1 0 1-20 538 end
        kr-85       1 0 1-20 538 end
        sr-90       1 0 1-20 538 end
         y-89       1 0 1-20 538 end
        mo-95       1 0 1-20 538 end
        zr-93       1 0 1-20 538 end
        zr-94       1 0 1-20 538 end
        zr-95       1 0 1-20 538 end
        nb-94       1 0 1-20 538 end
        tc-99       1 0 1-20 538 end
        rh-103      1 0 1-20 538 end
        rh-105      1 0 1-20 538 end
        ru-101      1 0 1-20 538 end
        ru-106      1 0 1-20 538 end
        pd-105      1 0 1-20 538 end
        pd-108      1 0 1-20 538 end
        ag-109      1 0 1-20 538 end
        sb-124      1 0 1-20 538 end
        xe-131      1 0 1-20 538 end
        xe-132      1 0 1-20 538 end
        xe-135      1 0 1-20 538 end
        xe-136      1 0 1-20 538 end
        cs-134      1 0 1-20 538 end
        cs-135      1 0 1-20 538 end
        cs-137      1 0 1-20 538 end
        ba-136      1 0 1-20 538 end
        la-139      1 0 1-20 538 end
        pr-141      1 0 1-20 538 end
        pr-143      1 0 1-20 538 end
        ce-144      1 0 1-20 538 end
        nd-143      1 0 1-20 538 end
        nd-145      1 0 1-20 538 end
        pm-147      1 0 1-20 538 end
        pm-148      1 0 1-20 538 end
        nd-147      1 0 1-20 538 end
        sm-147      1 0 1-20 538 end
        sm-149      1 0 1-20 538 end
        sm-150      1 0 1-20 538 end
        sm-151      1 0 1-20 538 end
        sm-152      1 0 1-20 538 end
        gd-155      1 0 1-20 538 end
        eu-153      1 0 1-20 538 end
        eu-154      1 0 1-20 538 end
        eu-155      1 0 1-20 538 end
        arbm-tuff1  1.90533 9 0 0 0 1001 2.326 8016 57.779 11023 0.789 12000 0.490
                                    13027 6.130 14000 27.919 19000 1.894 20000 1.989
                                    26000 0.683 2 1.0 323.   end
        arbm-tuff2  1.90533 9 0 0 0 1001 2.326 8016 57.779 11023 0.789 12000 0.490
                                    13027 6.130 14000 27.919 19000 1.894 20000 1.989
                                    26000 0.683 3 1.0 323.   end
```

```
'
'- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
end comp
'
'- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
'
'  fuel-pin-cell geometry:
'
symmslabcell  340.  280. 1 3 281. 2 end
'
'- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
'
'
'  assembly and cycle parameters:
'
npin/assm=1 fuelngth=280. ncycles=1 nlib/cyc=5 volfueltot=1.1494E7
printlevel=6 inplevel=0 end
power=0.004 burn=3.6525e4 down=1.82625e3
   end

1  ooooooooooo    rrrrrrrrrrr    iiiiiiiiiiii    gggggggggg    eeeeeeeeeeeee  nn          nn   sssssssssss
  ooooooooooooo   rrrrrrrrrrrr   iiiiiiiiiiii   gggggggggggg   eeeeeeeeeeeee  nnn         nn  sssssssssssss
  oo         oo   rr         rr       ii        gg          gg  ee             nnnn        nn  ss          ss
  oo         oo   rr         rr       ii        gg              ee             nn nn       nn  ss
  oo         oo   rr         rr       ii        gg              ee             nn   nn     nn  ss
  oo         oo   rrrrrrrrrrrr        ii        gg     ggggggg  eeeeeeeee      nn    nn    nn  ssssssssssss
  oo         oo   rrrrrrrrrrr         ii        gg     ggggggg  eeeeeeeee      nn     nn   nn   ssssssssssss
  oo         oo   rr       rr         ii        gg          gg  ee             nn      nn  nn             ss
  oo         oo   rr        rr        ii        gg          gg  ee             nn       nn nn             ss
  oo         oo   rr         rr       ii        gg          gg  ee             nn        nnnn  ss         ss
  ooooooooooooo   rr          rr iiiiiiiiiiii   gggggggggggg   eeeeeeeeeeeee  nn         nnn  sssssssssssss
   ooooooooooo    rr          rr iiiiiiiiiiii    gggggggggg    eeeeeeeeeeeee  nn          nn   sssssssssss
0

  ddddddddddd      aaaaaaaaa    vv          vv iiiiiiiiiiii   sssssssssss
  dddddddddddd    aaaaaaaaaaa   vv          vv iiiiiiiiiiii  sssssssssssss
  dd         dd   aa         aa vv          vv      ii       ss          ss
  dd         dd   aa         aa vv          vv      ii       ss
  dd         dd   aa         aa vv          vv      ii       ss
  dd         dd   aaaaaaaaaaaaa vv          vv      ii       ssssssssssss
  dd         dd   aaaaaaaaaaaaa  vv        vv       ii        ssssssssssss
  dd         dd   aa         aa    vv    vv         ii                   ss
  dd         dd   aa         aa     vv  vv          ii                   ss
  dd         dd   aa         aa      vv vv          ii       ss          ss
  dddddddddddd    aa         aa       vvv      iiiiiiiiiiii  sssssssssssss
  ddddddddddd     aa         aa        v       iiiiiiiiiiii   sssssssssss
0

     0000000       88888888888              //   22222222222   88888888888             //   99999999999    66666666666
    000000000     8888888888888            //   2222222222222 8888888888888           //   9999999999999  6666666666666
   00       00    88         88           //   22          22 88         88          //   99         99  66
  00         00   88         88          //              22  88         88         //    99         99  66
  00         00   88         88         //              22   88         88        //     99         99  66
  00         00    88888888888         //             22      88888888888        //      9999999999999  66666666666
  00         00    88888888888        //            22        88888888888       //        999999999999  6666666666666
  00         00   88         88      //           22         88         88     //                   99  66          66
  00         00   88         88     //          22           88         88    //                    99  66          66
   00       00    88         88    //         22             88         88   //                     99  66          66
    000000000     8888888888888   //         2222222222222  8888888888888  //          9999999999999  6666666666666
     0000000       88888888888   //          2222222222222   88888888888  //            999999999999    66666666666
```

```
0
       11        88888888888                     22222222222   33333333333                     22222222222        11
      111       8888888888888                   2222222222222 3333333333333                   2222222222222      111
     1111       88         88       :::         22         22 33         33       :::         22         22     1111
       11       88         88       :::                    22            33       :::                    22       11
       11       88         88       :::                    22            33       :::                    22       11
       11        88888888888                             22           333                              22         11
       11        88888888888                           22             333                            22           11
       11       88         88       :::              22                  33       :::              22             11
       11       88         88       :::            22                    33       :::            22               11
       11       88         88       :::          22           33         33       :::          22                 11
    11111111    8888888888888                   2222222222222 3333333333333                   2222222222222   11111111
    11111111     88888888888                    2222222222222  33333333333                    2222222222222   11111111
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
                                    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
                                    sssssssssssss  ccccccccccccc  aa         aa  lllllllllllll  eeeeeeeeeeeee
                                     sssssssssss    ccccccccccc   aa         aa  lllllllllllll  eeeeeeeeeeeee
```

```
*******************************************************************************
*******************************************************************************
*******************************************************************************
*****                                                                     *****
*****                    program verification information                 *****
*****                                                                     *****
*****                   code system:    scale  version:    4.3            *****
*****                                                                     *****
*******************************************************************************
*******************************************************************************
*****                                                                     *****
*****                                                                     *****
*****                  program:  o0o004                                   *****
*****                                                                     *****
*****            creation date:  03/13/96                                 *****
*****                                                                     *****
*****                  library:  /usr1/ornl/Scale/bin                     *****
*****                                                                     *****
*****                                                                     *****
*****                test code:  origens                                  *****
*****                                                                     *****
*****                  version:  3.0                                      *****
*****                                                                     *****
*****                  jobname:  davis                                    *****
*****                                                                     *****
*****        date of execution:  08/28/96                                 *****
*****                                                                     *****
*****        time of execution:  18:23:21                                 *****
```

```
                     *****                                                                      *****
                     *****                                                                      *****
                     ***********************************************************************************
                     ***********************************************************************************
                     ***********************************************************************************
1
0       -1q array has      1 entries.
0        0q array has      1 entries.
0        0q array has      1 entries.
0        0q array has      1 entries.
0        0q array has      1 entries.
0         dbl. prec. machine word applied has, at least, a 16 significant figure accuracy.
0             short-lived split test fraction, qxn =    9.1188E-04
0             half-norm of matrix used, axn =    7.0000E+00
0             4-place-accuracy-retention ratio, ratio4 =    6.4516E-13
0        1q array has     20 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        4q array has      1 entries.
0       54q array has     12 entries.
1library information...

          cross-section data taken from position number  1 of library on unit 33.

          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          ******************************************************************************
          *                                                                            *
          *            prelim lwr origen-s binary working library--id = 1143           *
          *         made from modified card-image origen-s libraries of scale 4.2      *
          *      data from the light element, actinide, and fission product libraries *
          *        decay data, including gamma and total energy, are from endf/b-vi    *
          *                                                                            *
          *      neutron flux spectrum factors and cross sections were produced from   *
          *     the "presas2" case updating all nuclides on the scale "burnup" library *
          *                                                                            *
          *                  fission product yields are from endf/b-v                  *
          *                                                                            *
          *                photon libraries use an 18-energy-group structure           *
          *               the photon data are from the master photon data base,        *
          *                produced to include bremsstrahlung from uo2 matrix          *
          *                                                                            *
          *         see information above this box (if present) for later updates      *
          *                                                                            *
          ******************************************************************************
          *                                                                            *
```

```
0         *****************************************************************************
0                   .other identification and sizes of library.
0                    data set name:   ft33f001
0                8/28/1996     date library was produced
0                     1697     total number of nuclides in library
                       689     number of light-element nuclides
                       129     number of actinide nuclides
                       879     number of fission product nuclides
0                     7993     number of nonzero off-diagonal matrix elements
0         *****************************************************************************
1
    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                   light elements          page    1
0                                                 nuclide concentrations, grams
                                                  basis =single reactor assembly
               initial   1E-18 d
     na 23    1.73E+05  1.73E+05
     al 27    1.35E+06  1.35E+06
   total      1.52E+06  1.52E+06
1
    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                        actinides          page    2
0                                                 nuclide concentrations, grams
                                                  basis =single reactor assembly
               initial   1E-18 d
      u234    2.12E+03  2.12E+03
      u235    1.72E+05  1.72E+05
      u236    4.12E+04  4.12E+04
      u238    8.66E+06  8.66E+06
     np237    9.99E+03  9.99E+03
   total      8.88E+06  8.88E+06
1   sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                                            page    3
        power=     .00mw, burnup=      29.mwd, flux= 3.00E+08n/cm**2-sec
0                                                basis =
0   (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                    initial          1826.3 d        3652.5 d        5478.8 d        7305.0 d        7305.1 d
    productions    1.023168E+06    1.023204E+06    1.023241E+06    1.023278E+06    1.023315E+06    1.023315E+06
    absorptions    8.460999E+05    8.461583E+05    8.462148E+05    8.462709E+05    8.463270E+05    8.463269E+05
    k infinity     1.209275E+00    1.209235E+00    1.209198E+00    1.209161E+00    1.209125E+00    1.209125E+00
0                    initial          1826.3 d        3652.5 d        5478.8 d        7305.0 d        7305.1 d
    actinide
    absorptions    8.423347E+05    8.423564E+05    8.423781E+05    8.423998E+05    8.424216E+05    8.424216E+05
    non-actinide
    abs. fracs.    4.450142E-03    4.493117E-03    4.533887E-03    4.574358E-03    4.614592E-03    4.614472E-03
1   sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                  fission products          page    4
0                                       fraction of total absorption rate
        power=     .00mw, burnup=      29.mwd, flux= 3.00E+08n/cm**2-sec
0                initial  1826.3 d  3652.5 d  5478.8 d  7305.0 d  7305.1 d

     sm149      .00E+00  3.63E-05  7.24E-05  1.08E-04  1.44E-04  1.44E-04
     sm151      .00E+00  1.51E-06  2.96E-06  4.36E-06  5.70E-06  5.70E-06
     nd143      .00E+00  7.23E-07  1.45E-06  2.19E-06  2.92E-06  2.92E-06
     xe135      .00E+00  2.28E-06  2.28E-06  2.28E-06  2.28E-06  2.24E-06
     gd157      .00E+00  3.72E-07  7.41E-07  1.11E-06  1.47E-06  1.47E-06
     rh103      .00E+00  3.35E-07  6.81E-07  1.03E-06  1.37E-06  1.37E-06
     gd155      .00E+00  1.44E-07  4.69E-07  8.80E-07  1.33E-06  1.33E-06
     cd113      .00E+00  3.17E-07  6.34E-07  9.49E-07  1.26E-06  1.26E-06
     xe131      .00E+00  2.35E-07  4.72E-07  7.09E-07  9.46E-07  9.46E-07
     cs133      .00E+00  1.83E-07  3.67E-07  5.51E-07  7.35E-07  7.35E-07
     tc 99      .00E+00  1.36E-07  2.71E-07  4.07E-07  5.43E-07  5.43E-07
     sm147      .00E+00  6.04E-08  1.77E-07  3.08E-07  4.43E-07  4.43E-07
     nd145      .00E+00  1.04E-07  2.08E-07  3.12E-07  4.16E-07  4.16E-07
```

eu151	.00E+00	2.17E-08	8.55E-08	1.90E-07	3.33E-07	3.33E-07
mo 95	.00E+00	6.69E-08	1.39E-07	2.12E-07	2.85E-07	2.85E-07
pm147	.00E+00	2.00E-07	2.54E-07	2.69E-07	2.73E-07	2.73E-07
sm152	.00E+00	5.55E-08	1.11E-07	1.67E-07	2.22E-07	2.22E-07
kr 83	.00E+00	4.45E-08	8.91E-08	1.34E-07	1.78E-07	1.78E-07
cs135	.00E+00	4.12E-08	8.24E-08	1.24E-07	1.65E-07	1.65E-07
eu155	.00E+00	8.33E-08	1.23E-07	1.42E-07	1.51E-07	1.51E-07
ru101	.00E+00	3.25E-08	6.50E-08	9.74E-08	1.30E-07	1.30E-07
pr141	.00E+00	2.97E-08	6.01E-08	9.05E-08	1.21E-07	1.21E-07
eu153	.00E+00	2.78E-08	5.57E-08	8.35E-08	1.11E-07	1.11E-07
la139	.00E+00	2.48E-08	4.96E-08	7.45E-08	9.93E-08	9.93E-08
pd105	.00E+00	1.06E-08	2.13E-08	3.20E-08	4.26E-08	4.26E-08
zr 93	.00E+00	1.03E-08	2.06E-08	3.08E-08	4.11E-08	4.11E-08
i129	.00E+00	7.63E-09	1.53E-08	2.30E-08	3.06E-08	3.06E-08
nd144	.00E+00	5.77E-09	1.32E-08	2.06E-08	2.80E-08	2.80E-08
mo 97	.00E+00	5.64E-09	1.13E-08	1.69E-08	2.26E-08	2.26E-08
ag109	.00E+00	4.03E-09	8.06E-09	1.21E-08	1.62E-08	1.62E-08
zr 91	.00E+00	2.54E-09	5.20E-09	7.86E-09	1.05E-08	1.05E-08
y 89	.00E+00	2.44E-09	4.98E-09	7.52E-09	1.01E-08	1.01E-08
ba137	.00E+00	6.58E-10	2.53E-09	5.49E-09	9.41E-09	9.41E-09
ru102	.00E+00	2.29E-09	4.58E-09	6.87E-09	9.16E-09	9.16E-09
rh105	.00E+00	8.28E-09	8.28E-09	8.28E-09	8.28E-09	8.25E-09
ce142	.00E+00	2.05E-09	4.11E-09	6.16E-09	8.21E-09	8.21E-09
nd148	.00E+00	1.99E-09	3.99E-09	5.98E-09	7.98E-09	7.98E-09
nd146	.00E+00	1.66E-09	3.32E-09	4.98E-09	6.65E-09	6.65E-09
sr 90	.00E+00	1.97E-09	3.71E-09	5.24E-09	6.60E-09	6.60E-09
ba138	.00E+00	1.42E-09	2.83E-09	4.25E-09	5.66E-09	5.66E-09
in115	.00E+00	1.38E-09	2.76E-09	4.15E-09	5.53E-09	5.53E-09
pd108	.00E+00	1.38E-09	2.75E-09	4.13E-09	5.51E-09	5.51E-09
ce140	.00E+00	1.31E-09	2.64E-09	3.96E-09	5.29E-09	5.29E-09
xe132	.00E+00	1.21E-09	2.42E-09	3.62E-09	4.83E-09	4.83E-09
mo 98	.00E+00	8.46E-10	1.69E-09	2.54E-09	3.38E-09	3.38E-09
mo100	.00E+00	8.09E-10	1.62E-09	2.43E-09	3.24E-09	3.24E-09
pd107	.00E+00	7.97E-10	1.59E-09	2.39E-09	3.19E-09	3.19E-09
xe134	.00E+00	7.85E-10	1.57E-09	2.35E-09	3.14E-09	3.14E-09
sm150	.00E+00	1.93E-10	7.70E-10	1.73E-09	3.06E-09	3.06E-09

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 5

0 fraction of total absorption rate

power= .00mw, burnup= 29.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	1826.3 d	3652.5 d	5478.8 d	7305.0 d	7305.1 d
pr143	.00E+00	2.66E-09	2.66E-09	2.66E-09	2.66E-09	2.66E-09
zr 92	.00E+00	6.38E-10	1.28E-09	1.91E-09	2.55E-09	2.55E-09
i127	.00E+00	5.14E-10	1.04E-09	1.56E-09	2.09E-09	2.09E-09
zr 96	.00E+00	5.21E-10	1.04E-09	1.56E-09	2.08E-09	2.08E-09
xe133	.00E+00	1.99E-09	1.99E-09	1.99E-09	1.99E-09	1.99E-09
ru104	.00E+00	4.96E-10	9.93E-10	1.49E-09	1.99E-09	1.99E-09
nd150	.00E+00	4.44E-10	8.88E-10	1.33E-09	1.78E-09	1.78E-09
xe136	.00E+00	4.25E-10	8.49E-10	1.27E-09	1.70E-09	1.70E-09
ce141	.00E+00	1.58E-09	1.58E-09	1.58E-09	1.58E-09	1.58E-09
cs137	.00E+00	4.13E-10	7.81E-10	1.11E-09	1.40E-09	1.40E-09
br 81	.00E+00	3.23E-10	6.46E-10	9.68E-10	1.29E-09	1.29E-09
rb 85	.00E+00	2.57E-10	5.30E-10	8.14E-10	1.11E-09	1.11E-09
zr 94	.00E+00	2.76E-10	5.51E-10	8.26E-10	1.10E-09	1.10E-09
pm149	.00E+00	9.62E-10	9.62E-10	9.62E-10	9.62E-10	9.55E-10
nd147	.00E+00	9.44E-10	9.44E-10	9.44E-10	9.44E-10	9.40E-10
cd111	.00E+00	2.04E-10	4.10E-10	6.16E-10	8.23E-10	8.23E-10
te130	.00E+00	1.92E-10	3.85E-10	5.77E-10	7.69E-10	7.69E-10
sm154	.00E+00	1.88E-10	3.75E-10	5.63E-10	7.50E-10	7.50E-10
rb 87	.00E+00	1.82E-10	3.65E-10	5.47E-10	7.29E-10	7.29E-10

ce144	.00E+00	5.93E-10	6.00E-10	6.00E-10	6.00E-10	5.99E-10
se 77	.00E+00	1.27E-10	2.54E-10	3.82E-10	5.09E-10	5.09E-10
kr 85	.00E+00	1.57E-10	2.71E-10	3.53E-10	4.13E-10	4.13E-10
ru103	.00E+00	3.56E-10	3.56E-10	3.56E-10	3.56E-10	3.56E-10
kr 84	.00E+00	8.70E-11	1.74E-10	2.61E-10	3.48E-10	3.48E-10
pd106	.00E+00	6.65E-11	1.59E-10	2.52E-10	3.45E-10	3.45E-10
se 79	.00E+00	6.52E-11	1.30E-10	1.96E-10	2.61E-10	2.61E-10
sb121	.00E+00	6.31E-11	1.26E-10	1.89E-10	2.53E-10	2.53E-10
zr 90	.00E+00	1.48E-11	5.70E-11	1.23E-10	2.11E-10	2.11E-10
sb123	.00E+00	5.10E-11	1.03E-10	1.54E-10	2.06E-10	2.06E-10
kr 86	.00E+00	4.73E-11	9.47E-11	1.42E-10	1.89E-10	1.89E-10
te128	.00E+00	4.26E-11	8.53E-11	1.28E-10	1.71E-10	1.71E-10
zr 95	.00E+00	1.68E-10	1.68E-10	1.68E-10	1.68E-10	1.68E-10
nb 95	.00E+00	1.53E-10	1.53E-10	1.53E-10	1.53E-10	1.53E-10
y 91	.00E+00	1.42E-10	1.42E-10	1.42E-10	1.42E-10	1.42E-10
gd156	.00E+00	3.28E-11	6.62E-11	9.98E-11	1.34E-10	1.34E-10
se 80	.00E+00	3.05E-11	6.10E-11	9.14E-11	1.22E-10	1.22E-10
dy161	.00E+00	2.64E-11	5.31E-11	7.98E-11	1.07E-10	1.07E-10
pm151	.00E+00	1.09E-10	1.09E-10	1.09E-10	1.09E-10	1.05E-10
te125	.00E+00	1.16E-11	3.43E-11	6.02E-11	8.69E-11	8.69E-11
tb159	.00E+00	1.82E-11	3.65E-11	5.48E-11	7.31E-11	7.31E-11
cd112	.00E+00	1.74E-11	3.48E-11	5.22E-11	6.96E-11	6.96E-11
li 6	.00E+00	1.73E-11	3.46E-11	5.19E-11	6.92E-11	6.92E-11
sn117	.00E+00	1.38E-11	2.76E-11	4.14E-11	5.52E-11	5.52E-11
ba140	.00E+00	4.72E-11	4.72E-11	4.72E-11	4.72E-11	4.70E-11
sn119	.00E+00	1.13E-11	2.25E-11	3.38E-11	4.51E-11	4.51E-11
sn115	.00E+00	1.03E-11	2.06E-11	3.09E-11	4.12E-11	4.12E-11
sm153	.00E+00	3.80E-11	3.80E-11	3.80E-11	3.80E-11	3.70E-11
sr 88	.00E+00	8.72E-12	1.74E-11	2.61E-11	3.49E-11	3.49E-11
eu154	.00E+00	4.71E-12	1.26E-11	2.26E-11	3.40E-11	3.40E-11

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 6

0 fraction of total absorption rate

power= .00mw, burnup= 29.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	1826.3 d	3652.5 d	5478.8 d	7305.0 d	7305.1 d
eu156	.00E+00	3.38E-11	3.39E-11	3.39E-11	3.39E-11	3.39E-11
sr 89	.00E+00	3.04E-11	3.04E-11	3.04E-11	3.04E-11	3.03E-11
ru106	.00E+00	2.50E-11	2.58E-11	2.58E-11	2.59E-11	2.58E-11
pd110	.00E+00	6.32E-12	1.26E-11	1.90E-11	2.53E-11	2.53E-11
cd114	.00E+00	6.18E-12	1.24E-11	1.86E-11	2.49E-11	2.49E-11
eu152	.00E+00	4.70E-13	3.46E-12	1.09E-11	2.41E-11	2.41E-11
gd158	.00E+00	5.76E-12	1.16E-11	1.77E-11	2.38E-11	2.38E-11
se 82	.00E+00	5.91E-12	1.18E-11	1.77E-11	2.36E-11	2.36E-11
sn126	.00E+00	4.71E-12	9.42E-12	1.41E-11	1.88E-11	1.88E-11
se 78	.00E+00	4.52E-12	9.03E-12	1.35E-11	1.81E-11	1.81E-11
ce143	.00E+00	1.74E-11	1.74E-11	1.74E-11	1.74E-11	1.68E-11
la140	.00E+00	1.54E-11	1.54E-11	1.54E-11	1.54E-11	1.54E-11
sb125	.00E+00	1.08E-11	1.38E-11	1.46E-11	1.49E-11	1.49E-11
sn124	.00E+00	3.68E-12	7.37E-12	1.11E-11	1.47E-11	1.47E-11
dy162	.00E+00	3.49E-12	7.01E-12	1.05E-11	1.41E-11	1.41E-11
mo 99	.00E+00	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.29E-11
dy164	.00E+00	3.13E-12	6.27E-12	9.44E-12	1.26E-11	1.26E-11
as 75	.00E+00	2.69E-12	5.39E-12	8.08E-12	1.08E-11	1.08E-11
pm148m	.00E+00	7.01E-12	8.99E-12	9.52E-12	9.66E-12	9.65E-12
kr 87	.00E+00	2.26E-11	2.26E-11	2.26E-11	2.26E-11	8.03E-12
te127m	.00E+00	7.36E-12	7.36E-12	7.36E-12	7.36E-12	7.36E-12
i131	.00E+00	6.77E-12	6.77E-12	6.77E-12	6.77E-12	6.75E-12
y 90	.00E+00	1.87E-12	3.52E-12	4.98E-12	6.27E-12	6.27E-12
sn118	.00E+00	1.51E-12	3.03E-12	4.54E-12	6.05E-12	6.05E-12
ba136	.00E+00	1.42E-12	2.87E-12	4.32E-12	5.77E-12	5.77E-12

ru 99	.00E+00	8.61E-13	2.07E-12	3.63E-12	5.54E-12	5.54E-12
cs134	.00E+00	1.07E-12	2.39E-12	3.76E-12	5.13E-12	5.13E-12
cd116	.00E+00	1.28E-12	2.55E-12	3.83E-12	5.10E-12	5.10E-12
sn122	.00E+00	1.25E-12	2.49E-12	3.74E-12	4.98E-12	4.98E-12
sn120	.00E+00	9.38E-13	1.88E-12	2.81E-12	3.75E-12	3.75E-12
kr 82	.00E+00	7.81E-13	1.57E-12	2.36E-12	3.15E-12	3.15E-12
dy163	.00E+00	7.69E-13	1.54E-12	2.32E-12	3.11E-12	3.11E-12
in113	.00E+00	2.30E-13	8.51E-13	1.78E-12	2.95E-12	2.95E-12
ge 73	.00E+00	7.28E-13	1.46E-12	2.18E-12	2.91E-12	2.91E-12
xe130	.00E+00	4.78E-13	9.60E-13	1.45E-12	1.94E-12	1.94E-12
te129m	.00E+00	1.78E-12	1.78E-12	1.78E-12	1.78E-12	1.78E-12
gd152	.00E+00	2.62E-14	2.11E-13	7.25E-13	1.75E-12	1.75E-12
mo 96	.00E+00	3.45E-13	7.00E-13	1.06E-12	1.44E-12	1.44E-12
ge 76	.00E+00	2.66E-13	5.32E-13	7.99E-13	1.06E-12	1.06E-12
ru100	.00E+00	9.50E-14	2.51E-13	4.67E-13	7.45E-13	7.45E-13
gd154	.00E+00	2.69E-14	1.39E-13	3.69E-13	7.43E-13	7.43E-13
gd160	.00E+00	1.69E-13	3.38E-13	5.07E-13	6.77E-13	6.77E-13
te126	.00E+00	1.29E-13	2.60E-13	3.91E-13	5.24E-13	5.24E-13
sm148	.00E+00	3.96E-14	1.37E-13	2.79E-13	4.60E-13	4.60E-13
pm148	.00E+00	2.80E-13	3.56E-13	3.77E-13	3.82E-13	3.78E-13
nd142	.00E+00	2.10E-14	8.38E-14	1.88E-13	3.35E-13	3.35E-13
ag111	.00E+00	3.20E-13	3.21E-13	3.21E-13	3.21E-13	3.20E-13
ba134	.00E+00	1.50E-14	6.69E-14	1.59E-13	2.93E-13	2.93E-13
ba135	.00E+00	1.99E-14	7.28E-14	1.59E-13	2.78E-13	2.78E-13

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 7

0 fraction of total absorption rate

power= .00mw, burnup= 29.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	1826.3 d	3652.5 d	5478.8 d	7305.0 d	7305.1 d
eu157	.00E+00	2.95E-13	2.96E-13	2.96E-13	2.96E-13	2.74E-13
cd115m	.00E+00	2.35E-13	2.35E-13	2.35E-13	2.35E-13	2.35E-13
pd104	.00E+00	1.39E-14	5.63E-14	1.27E-13	2.27E-13	2.27E-13
ho165	.00E+00	5.28E-14	1.06E-13	1.59E-13	2.13E-13	2.13E-13
te124	.00E+00	2.93E-14	6.00E-14	9.08E-14	1.22E-13	1.22E-13
sr 87	.00E+00	3.04E-14	6.08E-14	9.12E-14	1.22E-13	1.22E-13
nb 94	.00E+00	1.75E-14	3.51E-14	5.26E-14	7.01E-14	7.01E-14
ge 74	.00E+00	1.47E-14	2.93E-14	4.40E-14	5.86E-14	5.86E-14
cs136	.00E+00	5.60E-14	5.61E-14	5.63E-14	5.64E-14	5.62E-14
ge 72	.00E+00	9.81E-15	1.96E-14	2.95E-14	3.93E-14	3.93E-14
sr 86	.00E+00	8.48E-15	1.71E-14	2.59E-14	3.47E-14	3.47E-14
cd110	.00E+00	2.77E-15	9.38E-15	1.97E-14	3.37E-14	3.37E-14
sn125	.00E+00	2.94E-14	2.94E-14	2.94E-14	2.94E-14	2.92E-14
ru105	.00E+00	3.00E-14	3.00E-14	3.00E-14	3.00E-14	2.30E-14
se 76	.00E+00	5.69E-15	1.14E-14	1.71E-14	2.29E-14	2.29E-14
br 79	.00E+00	1.37E-15	5.44E-15	1.22E-14	2.16E-14	2.16E-14
xe129	.00E+00	7.62E-16	3.05E-15	6.86E-15	1.22E-14	1.22E-14
ag107	.00E+00	7.08E-16	2.83E-15	6.37E-15	1.13E-14	1.13E-14
sn123	.00E+00	1.03E-14	1.03E-14	1.03E-14	1.03E-14	1.03E-14
nb 93	.00E+00	2.00E-16	1.42E-15	4.49E-15	1.01E-14	1.01E-14
te132	.00E+00	9.49E-15	9.49E-15	9.49E-15	9.49E-15	9.34E-15
rb 88	.00E+00	1.27E-14	1.27E-14	1.27E-14	1.27E-14	8.70E-15
i135	.00E+00	1.00E-14	1.00E-14	1.00E-14	1.00E-14	8.18E-15
xe128	.00E+00	1.43E-15	3.02E-15	4.75E-15	6.63E-15	6.63E-15
dy160	.00E+00	1.16E-15	2.58E-15	4.19E-15	6.01E-15	6.01E-15
er166	.00E+00	1.37E-15	2.77E-15	4.19E-15	5.64E-15	5.64E-15
sb126	.00E+00	2.99E-15	3.00E-15	3.01E-15	3.02E-15	3.01E-15
sb124	.00E+00	2.10E-15	2.11E-15	2.11E-15	2.11E-15	2.11E-15
in117m	.00E+00	2.07E-15	2.07E-15	2.07E-15	2.07E-15	1.82E-15
kr 80	.00E+00	4.12E-16	8.25E-16	1.24E-15	1.65E-15	1.65E-15
te134	.00E+00	5.77E-15	5.77E-15	5.77E-15	5.77E-15	8.55E-16

i130	.00E+00	7.17E-16	7.23E-16	7.30E-16	7.36E-16	6.63E-16
sn116	.00E+00	4.53E-17	1.51E-16	3.17E-16	5.43E-16	5.43E-16
in117	.00E+00	6.07E-16	6.07E-16	6.08E-16	6.08E-16	5.40E-16
tb160	.00E+00	3.46E-16	3.98E-16	4.49E-16	5.01E-16	5.01E-16
te122	.00E+00	6.63E-17	1.57E-16	2.73E-16	4.14E-16	4.14E-16
rb 86	.00E+00	2.41E-16	2.43E-16	2.45E-16	2.47E-16	2.46E-16
be 9	.00E+00	3.42E-17	6.84E-17	1.03E-16	1.37E-16	1.37E-16
pr142	.00E+00	3.44E-17	6.91E-17	1.04E-16	1.38E-16	1.29E-16
dy165	.00E+00	2.10E-16	2.11E-16	2.12E-16	2.14E-16	1.24E-16
te123	.00E+00	2.75E-17	5.73E-17	8.73E-17	1.17E-16	1.17E-16
li 7	.00E+00	1.33E-17	2.66E-17	4.00E-17	5.33E-17	5.33E-17
ge 75	.00E+00	8.51E-17	8.51E-17	8.51E-17	8.51E-17	3.34E-17
cd118	.00E+00	1.19E-16	1.19E-16	1.19E-16	1.19E-16	2.44E-17
er167	.00E+00	5.52E-18	1.14E-17	1.76E-17	2.41E-17	2.41E-17
cd108	.00E+00	2.76E-19	5.55E-19	8.45E-19	1.14E-18	1.14E-18
cs134m	.00E+00	2.56E-19	5.12E-19	7.68E-19	1.02E-18	6.49E-19
in119m	.00E+00	2.97E-17	2.97E-17	2.97E-17	2.97E-17	4.16E-19
cd109	.00E+00	1.76E-19	1.96E-19	2.06E-19	2.13E-19	2.13E-19

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 8

0 fraction of total absorption rate

power= .00mw, burnup= 29.mwd, flux= 3.00E+08n/cm**2-sec

0	initial	1826.3 d	3652.5 d	5478.8 d	7305.0 d	7305.1 d
sn114	.00E+00	3.33E-21	1.33E-20	2.66E-20	4.66E-20	4.66E-20

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 light elements page 9

power= 4.000E-03mw, burnup=2.9220E+01mwd, flux= 3.00E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	1826.3 d	3652.5 d	5478.8 d	7305.0 d	7305.1 d
h 1	.00E+00	4.41E-07	8.81E-07	1.32E-06	1.76E-06	1.76E-06
h 2	.00E+00	1.31E-09	2.61E-09	3.92E-09	5.22E-09	5.22E-09
h 3	.00E+00	8.35E-12	1.47E-11	1.94E-11	2.30E-11	2.30E-11
h 4	.00E+00	3.38E-35	5.93E-35	7.85E-35	9.30E-35	.00E+00
he 3	.00E+00	1.23E-12	4.50E-12	9.32E-12	1.53E-11	1.53E-11
he 4	.00E+00	7.28E-08	1.46E-07	2.18E-07	2.91E-07	2.91E-07
he 6	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
ne 20	.00E+00	8.74E-09	1.75E-08	2.62E-08	3.50E-08	3.50E-08
ne 21	.00E+00	1.58E-15	6.32E-15	1.42E-14	2.53E-14	2.53E-14
ne 22	.00E+00	2.56E-11	7.43E-11	1.29E-10	1.85E-10	1.86E-10
ne 23	.00E+00	7.28E-15	7.28E-15	7.28E-15	7.28E-15	7.28E-30
na 22	.00E+00	3.15E-11	3.98E-11	4.20E-11	4.26E-11	4.26E-11
na 23	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03	7.53E+03
na 24	.00E+00	3.64E-08	3.64E-08	3.64E-08	3.64E-08	3.33E-08
na 24m	.00E+00	5.99E-15	5.99E-15	5.99E-15	5.99E-15	5.99E-30
na 25	.00E+00	2.93E-28	5.94E-28	9.05E-28	1.22E-27	1.21E-42
mg 24	.00E+00	7.55E-05	1.51E-04	2.27E-04	3.02E-04	3.02E-04
mg 25	.00E+00	9.73E-12	1.98E-11	3.01E-11	4.07E-11	4.07E-11
mg 26	.00E+00	1.31E-09	2.61E-09	3.92E-09	5.22E-09	5.22E-09
mg 27	.00E+00	2.18E-12	2.18E-12	2.18E-12	2.18E-12	4.70E-16
mg 28	.00E+00	4.41E-24	4.41E-24	4.41E-24	4.41E-24	4.14E-24
al 27	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04	4.99E+04
al 28	.00E+00	2.70E-10	2.70E-10	2.70E-10	2.70E-10	3.67E-25
al 29	.00E+00	3.80E-28	1.52E-27	3.42E-27	6.08E-27	3.18E-32
al 30	.00E+00	3.49E-41	2.79E-40	9.42E-40	2.23E-39	.00E+00
si 28	.00E+00	2.20E-04	4.40E-04	6.59E-04	8.79E-04	8.79E-04
si 29	.00E+00	1.41E-12	5.64E-12	1.27E-11	2.26E-11	2.26E-11
si 30	.00E+00	9.70E-21	7.76E-20	2.62E-19	6.21E-19	6.21E-19
si 31	.00E+00	6.95E-33	5.56E-32	1.88E-31	4.45E-31	2.68E-31
si 32	.00E+00	6.12E-41	9.75E-40	4.92E-39	1.55E-38	1.55E-38

	charge					
totals	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04	5.75E+04
0 flux		3.00E+08	3.00E+08	3.00E+08	3.00E+08	3.00E-07

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power= 4.000E-03mw, burnup=2.9220E+01mwd, flux= 3.00E+08n/cm**2-sec

0 nuclide concentrations, gram atoms

basis = single reactor assembly

	charge	1826.3 d	3652.5 d	5478.8 d	7305.0 d	7305.1 d
he 4	.00E+00	2.74E-04	5.87E-04	9.39E-04	1.33E-03	1.33E-03
pb206	.00E+00	7.11E-14	1.14E-12	5.75E-12	1.79E-11	1.79E-11
pb207	.00E+00	9.49E-12	7.37E-11	2.41E-10	5.52E-10	5.52E-10
pb208	.00E+00	3.81E-12	3.76E-11	1.26E-10	2.81E-10	2.81E-10
pb209	.00E+00	3.42E-17	1.38E-16	3.12E-16	5.56E-16	5.60E-16
pb210	.00E+00	2.03E-12	1.57E-11	5.10E-11	1.17E-10	1.17E-10
pb211	.00E+00	5.69E-16	2.16E-15	4.64E-15	7.85E-15	7.85E-15
pb212	.00E+00	4.63E-15	2.05E-14	4.22E-14	6.61E-14	6.61E-14
pb214	.00E+00	9.34E-17	3.73E-16	8.40E-16	1.49E-15	1.45E-15
ra222	.00E+00	1.76E-28	5.20E-28	9.13E-28	1.32E-27	1.32E-27
ra223	.00E+00	2.59E-13	9.87E-13	2.11E-12	3.58E-12	3.58E-12
ra224	.00E+00	3.82E-14	1.69E-13	3.49E-13	5.46E-13	5.46E-13
ra225	.00E+00	3.74E-15	1.51E-14	3.41E-14	6.08E-14	6.08E-14
ra226	.00E+00	2.93E-09	1.17E-08	2.64E-08	4.68E-08	4.68E-08
ra228	.00E+00	2.63E-15	8.85E-15	1.70E-14	2.63E-14	2.63E-14
ac225	.00E+00	2.53E-15	1.02E-14	2.31E-14	4.11E-14	4.11E-14
ac227	.00E+00	1.80E-10	6.86E-10	1.47E-09	2.49E-09	2.49E-09
ac228	.00E+00	3.21E-19	1.08E-18	2.08E-18	3.21E-18	3.21E-18
th226	.00E+00	8.59E-27	2.54E-26	4.45E-26	6.43E-26	6.42E-26
th227	.00E+00	4.19E-13	1.59E-12	3.41E-12	5.78E-12	5.78E-12
th228	.00E+00	7.29E-12	3.23E-11	6.66E-11	1.04E-10	1.04E-10
th229	.00E+00	7.27E-10	2.94E-09	6.64E-09	1.18E-08	1.18E-08
th230	.00E+00	1.28E-04	2.55E-04	3.83E-04	5.11E-04	5.11E-04
th231	.00E+00	3.02E-09	3.02E-09	3.02E-09	3.02E-09	3.02E-09
th232	.00E+00	2.58E-05	5.16E-05	7.74E-05	1.03E-04	1.03E-04
th233	.00E+00	2.39E-16	4.78E-16	7.17E-16	9.57E-16	2.66E-17
th234	.00E+00	5.37E-07	5.37E-07	5.37E-07	5.37E-07	5.37E-07
pa231	.00E+00	3.59E-06	7.19E-06	1.08E-05	1.44E-05	1.44E-05
pa232	.00E+00	6.18E-14	1.24E-13	1.85E-13	2.47E-13	2.37E-13
pa233	.00E+00	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06
pa234m	.00E+00	1.81E-11	1.81E-11	1.81E-11	1.81E-11	1.81E-11
pa234	.00E+00	8.09E-12	8.09E-12	8.09E-12	8.09E-12	8.09E-12
pa235	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u230	.00E+00	8.33E-24	2.46E-23	4.32E-23	6.23E-23	6.21E-23
u231	.00E+00	5.33E-20	1.08E-19	1.62E-19	2.17E-19	2.14E-19
u232	.00E+00	6.11E-10	1.80E-09	3.16E-09	4.57E-09	4.57E-09
u233	.00E+00	6.68E-05	1.35E-04	2.03E-04	2.72E-04	2.72E-04
u234	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00	9.06E+00
u235	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02	7.30E+02
u236	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02	1.74E+02
u237	.00E+00	3.24E-06	3.24E-06	3.24E-06	3.24E-06	3.21E-06
u238	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04	3.64E+04
u239	.00E+00	3.29E-07	3.29E-07	3.29E-07	3.29E-07	1.09E-08
u240	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
u241	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
np235	.00E+00	8.71E-12	9.06E-12	9.08E-12	9.08E-12	9.07E-12
np236m	.00E+00	2.16E-12	2.16E-12	2.16E-12	2.16E-12	2.03E-12
np236	.00E+00	1.02E-09	2.05E-09	3.07E-09	4.10E-09	4.10E-09
np237	4.22E+01	4.22E+01	4.21E+01	4.21E+01	4.21E+01	4.21E+01
np238	.00E+00	1.58E-06	1.58E-06	1.58E-06	1.58E-06	1.54E-06

1

```
        power= 4.000E-03mw, burnup=2.9220E+01mwd, flux= 3.00E+08n/cm**2-sec
0                                              nuclide concentrations, gram atoms
                                               basis = single reactor assembly
             charge   1826.3 d  3652.5 d  5478.8 d  7305.0 d  7305.1 d
    np239    .00E+00  4.75E-05  4.75E-05  4.75E-05  4.75E-05  4.67E-05
    np240m   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
    np240    .00E+00  9.74E-15  9.74E-15  9.74E-15  9.74E-15  2.68E-15
    np241    .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
    pu236    .00E+00  8.16E-10  1.06E-09  1.14E-09  1.16E-09  1.16E-09
    pu237    .00E+00  9.61E-15  1.89E-14  2.78E-14  3.64E-14  3.63E-14
    pu238    .00E+00  9.24E-04  1.81E-03  2.67E-03  3.49E-03  3.49E-03
    pu239    .00E+00  2.55E-02  5.11E-02  7.66E-02  1.02E-01  1.02E-01
    pu240    .00E+00  6.28E-07  2.51E-06  5.66E-06  1.01E-05  1.01E-05
    pu241    .00E+00  2.03E-11  1.53E-10  4.90E-10  1.10E-09  1.10E-09
    pu242    .00E+00  2.03E-16  3.15E-15  1.55E-14  4.75E-14  4.75E-14
    pu243    .00E+00  4.46E-25  6.91E-24  3.39E-23  1.04E-22  7.97E-23
    pu244    .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
    pu245    .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
    pu246    .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
    am239    .00E+00  3.56E-28  5.43E-27  2.63E-26  7.94E-26  7.10E-26
    am240    .00E+00  1.63E-25  2.49E-24  1.20E-23  3.64E-23  3.54E-23
    am241    .00E+00  1.24E-12  1.89E-11  9.13E-11  2.76E-10  2.76E-10
    am242m   .00E+00  3.20E-18  9.80E-17  7.13E-16  2.88E-15  2.88E-15
    am242    .00E+00  4.35E-20  6.65E-19  3.22E-18  9.73E-18  8.96E-18
    am243    .00E+00  6.23E-22  2.16E-20  1.76E-19  7.89E-19  7.89E-19
    am244m   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
    am244    .00E+00  4.90E-30  1.70E-28  1.39E-27  6.21E-27  5.44E-27
    am245    .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
    am246    .00E+00   .00E+00   .00E+00   .00E+00   .00E+00   .00E+00
  totals    3.73E+04  3.73E+04  3.73E+04  3.73E+04  3.73E+04  3.73E+04
0   flux              3.00E+08  3.00E+08  3.00E+08  3.00E+08  3.00E-07
0        1q array has     20 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        3q array has      1 entries.
0        4q array has      1 entries.
0       54q array has     12 entries.
1library information...

          cross-section data taken from position number  2 of library on unit 33.

          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          pass   1
          pass   0
          *scale-system control module sas2 library*
          used a time-dependent neutron spectrum, for each of the above passes
            pass 0 applies start-up fuel densiities
            pass n applies mid time densities of nth library interval
          first library updated was...
          ********************************************************************************
          *                                                                              *
          *             prelim lwr origen-s binary working library--id = 1143            *
          *          made from modified card-image origen-s libraries of scale 4.2       *
          *       data from the light element, actinide, and fission product libraries   *
```

```
          *       decay data, including gamma and total energy, are from endf/b-vi      *
          *                                                                             *
          *     neutron flux spectrum factors and cross sections were produced from     *
          *    the "presas2" case updating all nuclides on the scale "burnup" library   *
          *                                                                             *
          *                fission product yields are from endf/b-v                     *
          *                                                                             *
          *             photon libraries use an 18-energy-group structure               *
          *            the photon data are from the master photon data base,            *
          *             produced to include bremsstrahlung from uo2 matrix              *
          *                                                                             *
          *       see information above this box (if present) for later updates        *
          *                                                                             *
          *******************************************************************************
          *                                                                             *
0         *******************************************************************************
0                   .other identification and sizes of library.
0                    data set name:  ft33f001
0                 8/28/1996     date library was produced
0                      1697     total number of nuclides in library
                        689     number of light-element nuclides
                        129     number of actinide nuclides
                        879     number of fission product nuclides
0                      7993     number of nonzero off-diagonal matrix elements
0         *******************************************************************************
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2                       page   12
         power=     .00mw, burnup=      58.mwd, flux= 2.81E+08n/cm**2-sec
0                                              basis =
0    (note, k-infinities, clad and moderator absorptions are correct, only, if correctly weighted cross sections are applied.)
0                     initial        9131.3 d      10957.6 d      12783.8 d      14610.1 d      14610.2 d
     productions    1.090805E+06   1.090842E+06   1.090879E+06   1.090916E+06   1.090953E+06   1.090953E+06
     absorptions    8.937227E+05   8.937811E+05   8.938394E+05   8.938971E+05   8.939546E+05   8.939546E+05
     k infinity     1.220518E+00   1.220480E+00   1.220441E+00   1.220404E+00   1.220367E+00   1.220367E+00
0                     initial        9131.3 d      10957.6 d      12783.8 d      14610.1 d      14610.2 d
     actinide
     absorptions    8.901883E+05   8.902102E+05   8.902321E+05   8.902540E+05   8.902759E+05   8.902759E+05
     non-actinide
     abs. fracs.    3.954649E-03   3.995299E-03   4.035652E-03   4.075527E-03   4.115045E-03   4.115045E-03
1    sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2       fission products    page   13
0                                   fraction of total absorption rate
         power=     .00mw, burnup=      58.mwd, flux= 2.81E+08n/cm**2-sec
0                   initial  9131.3 d 10957.6 d 12783.8 d 14610.1 d 14610.2 d

     sm149       1.46E-04  1.82E-04  2.17E-04  2.53E-04  2.88E-04  2.88E-04
     sm151       5.78E-06  7.08E-06  8.34E-06  9.55E-06  1.07E-05  1.07E-05
     nd143       2.95E-06  3.69E-06  4.43E-06  5.17E-06  5.91E-06  5.91E-06
     gd155       1.35E-06  1.83E-06  2.31E-06  2.79E-06  3.28E-06  3.28E-06
     gd157       1.49E-06  1.85E-06  2.21E-06  2.56E-06  2.91E-06  2.91E-06
     rh103       1.37E-06  1.71E-06  2.06E-06  2.40E-06  2.75E-06  2.75E-06
     cd113       1.28E-06  1.60E-06  1.91E-06  2.23E-06  2.54E-06  2.54E-06
     xe135       2.27E-06  2.31E-06  2.31E-06  2.31E-06  2.31E-06  2.28E-06
     xe131       9.39E-07  1.17E-06  1.41E-06  1.64E-06  1.88E-06  1.88E-06
     cs133       7.29E-07  9.11E-07  1.09E-06  1.28E-06  1.46E-06  1.46E-06
     eu151       3.37E-07  5.21E-07  7.40E-07  9.94E-07  1.28E-06  1.28E-06
     tc 99       5.37E-07  6.72E-07  8.06E-07  9.40E-07  1.07E-06  1.07E-06
     sm147       4.40E-07  5.75E-07  7.10E-07  8.46E-07  9.81E-07  9.81E-07
     nd145       4.16E-07  5.20E-07  6.24E-07  7.28E-07  8.32E-07  8.32E-07
     mo 95       2.83E-07  3.55E-07  4.27E-07  5.00E-07  5.72E-07  5.72E-07
     sm152       2.20E-07  2.76E-07  3.31E-07  3.86E-07  4.41E-07  4.41E-07
     kr 83       1.80E-07  2.25E-07  2.70E-07  3.15E-07  3.60E-07  3.60E-07
```

cs135	1.64E-07	2.05E-07	2.46E-07	2.87E-07	3.28E-07	3.28E-07
pm147	2.70E-07	2.72E-07	2.72E-07	2.72E-07	2.72E-07	2.72E-07
ru101	1.28E-07	1.60E-07	1.92E-07	2.24E-07	2.56E-07	2.56E-07
pr141	1.22E-07	1.52E-07	1.83E-07	2.14E-07	2.44E-07	2.44E-07
eu153	1.11E-07	1.39E-07	1.67E-07	1.95E-07	2.22E-07	2.22E-07
la139	1.00E-07	1.25E-07	1.50E-07	1.75E-07	2.00E-07	2.00E-07
eu155	1.51E-07	1.55E-07	1.57E-07	1.58E-07	1.58E-07	1.58E-07
pd105	4.25E-08	5.31E-08	6.37E-08	7.43E-08	8.49E-08	8.49E-08
zr 93	4.07E-08	5.09E-08	6.11E-08	7.13E-08	8.15E-08	8.15E-08
i129	3.10E-08	3.87E-08	4.65E-08	5.42E-08	6.20E-08	6.20E-08
nd144	2.83E-08	3.58E-08	4.33E-08	5.08E-08	5.83E-08	5.83E-08
mo 97	2.27E-08	2.84E-08	3.40E-08	3.97E-08	4.54E-08	4.54E-08
ba137	9.52E-09	1.44E-08	2.00E-08	2.63E-08	3.32E-08	3.32E-08
ag109	1.60E-08	2.00E-08	2.41E-08	2.81E-08	3.22E-08	3.22E-08
zr 91	1.06E-08	1.33E-08	1.59E-08	1.86E-08	2.13E-08	2.13E-08
y 89	1.02E-08	1.27E-08	1.53E-08	1.79E-08	2.04E-08	2.04E-08
ru102	9.23E-09	1.15E-08	1.39E-08	1.62E-08	1.85E-08	1.85E-08
ce142	8.31E-09	1.04E-08	1.25E-08	1.45E-08	1.66E-08	1.66E-08
nd148	8.01E-09	1.00E-08	1.20E-08	1.40E-08	1.60E-08	1.60E-08
nd146	6.71E-09	8.38E-09	1.01E-08	1.17E-08	1.34E-08	1.34E-08
sm150	3.07E-09	4.79E-09	6.88E-09	9.35E-09	1.22E-08	1.22E-08
ba138	5.73E-09	7.16E-09	8.59E-09	1.00E-08	1.15E-08	1.15E-08
in115	5.54E-09	6.92E-09	8.30E-09	9.69E-09	1.11E-08	1.11E-08
pd108	5.45E-09	6.81E-09	8.17E-09	9.53E-09	1.09E-08	1.09E-08
sr 90	6.67E-09	7.88E-09	8.96E-09	9.91E-09	1.07E-08	1.07E-08
ce140	5.35E-09	6.69E-09	8.03E-09	9.37E-09	1.07E-08	1.07E-08
xe132	4.83E-09	6.03E-09	7.24E-09	8.45E-09	9.65E-09	9.65E-09
rh105	8.32E-09	8.34E-09	8.34E-09	8.34E-09	8.34E-09	8.31E-09
mo 98	3.34E-09	4.18E-09	5.01E-09	5.85E-09	6.69E-09	6.69E-09
mo100	3.22E-09	4.03E-09	4.84E-09	5.64E-09	6.45E-09	6.45E-09
pd107	3.21E-09	4.01E-09	4.81E-09	5.61E-09	6.42E-09	6.42E-09
xe134	3.17E-09	3.96E-09	4.75E-09	5.54E-09	6.33E-09	6.33E-09

1 sas2h: far-field crit based on b&w 15x15, 3.00wt%, 20gwd/mtu 40% h2o/ 8% uo2 fission products page 14

0 fraction of total absorption rate

power= .00mw, burnup= 58.mwd, flux= 2.81E+08n/cm**2-sec

0	initial	9131.3 d	10957.6 d	12783.8 d	14610.1 d	14610.2 d
zr 92	2.57E-09	3.22E-09	3.86E-09	4.50E-09	5.15E-09	5.15E-09
i127	2.08E-09	2.60E-09	3.12E-09	3.65E-09	4.17E-09	4.17E-09
zr 96	2.04E-09	2.55E-09	3.06E-09	3.57E-09	4.08E-09	4.08E-09
ru104	1.98E-09	2.48E-09	2.97E-09	3.47E-09	3.96E-09	3.96E-09
nd150	1.78E-09	2.22E-09	2.66E-09	3.11E-09	3.55E-09	3.55E-09
xe136	1.71E-09	2.14E-09	2.57E-09	3.00E-09	3.42E-09	3.42E-09
pr143	2.67E-09	2.67E-09	2.67E-09	2.67E-09	2.67E-09	2.67E-09
br 81	1.29E-09	1.61E-09	1.93E-09	2.26E-09	2.58E-09	2.58E-09
rb 85	1.11E-09	1.41E-09	1.71E-09	2.02E-09	2.32E-09	2.32E-09
cs137	1.40E-09	1.66E-09	1.89E-09	2.10E-09	2.28E-09	2.28E-09
zr 94	1.09E-09	1.37E-09	1.64E-09	1.91E-09	2.19E-09	2.19E-09
xe133	2.01E-09	2.01E-09	2.01E-09	2.01E-09	2.01E-09	2.01E-09
cd111	8.31E-10	1.04E-09	1.25E-09	1.46E-09	1.66E-09	1.66E-09
ce141	1.59E-09	1.60E-09	1.60E-09	1.60E-09	1.60E-09	1.60E-09
te130	7.77E-10	9.72E-10	1.17E-09	1.36E-09	1.56E-09	1.56E-09
sm154	7.55E-10	9.44E-10	1.13E-09	1.32E-09	1.51E-09	1.51E-09
rb 87	7.28E-10	9.10E-10	1.09E-09	1.27E-09	1.46E-09	1.46E-09
se 77	5.15E-10	6.44E-10	7.73E-10	9.02E-10	1.03E-09	1.03E-09
pm149	9.67E-10	9.74E-10	9.74E-10	9.74E-10	9.74E-10	9.67E-10
nd147	9.32E-10	9.36E-10	9.36E-10	9.36E-10	9.36E-10	9.32E-10
zr 90	2.13E-10	3.20E-10	4.44E-10	5.84E-10	7.36E-10	7.36E-10
pd106	3.42E-10	4.34E-10	5.26E-10	6.18E-10	7.10E-10	7.10E-10
kr 84	3.44E-10	4.30E-10	5.17E-10	6.03E-10	6.89E-10	6.89E-10