

2  
1-5-78  
**MASTER**

**LA-6746-MS**

Informal Report  
(EPRI NP-356)

Special Distribution

Issued: December 1976

**Fission Product Data for  
Thermal Reactors  
Part 2: Users Manual for  
EPRI-CINDER Code and Data**

T. R. England  
W. B. Wilson  
M. G. Stamatelatos



**Los Alamos  
scientific laboratory**

of the University of California

LOS ALAMOS, NEW MEXICO 87545

An Affirmative Action/Equal Opportunity Employer

UNITED STATES  
DEPARTMENT OF ENERGY  
CONTRACT W-7405-ENG. 36

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

## ABSTRACT

A four-group fission-product absorption chain library using ENDF/B-IV decay data and cross sections processed with a typical light water reactor spectrum for a modified version of the original CINDER code has been developed as described in Part 1. CINDER is a general point-depletion and fission product code based on an analytical solution of the equations describing nuclides coupled in any linear sequence of radioactive decays and neutron absorptions. The basic code has been in wide use for a number of years. Previously, the user was required to specify all physical data. This report describes the chain library in detail and a modified version of the basic CINDER code (EPRI-CINDER) that is still compatible with existing libraries.

### NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

#### ACKNOWLEDGMENT

We gratefully appreciate the assistance of N. L. Whittemore for aid in preparing tabular data and computer runs.

## CONTENTS

<u>Section</u>		<u>Page</u>
1	INTRODUCTION TO CODE AND DATA LIBRARIES	1
	Introduction	1
	Nuclide Data	3
	Nominal Dimensions of Data	4
2	CODE METHODOLOGY	5
	General Solution for Coupled Nuclides	5
	Associated Equations	7
	$K_{\infty}$ Calculation	10
	Decay Heating	12
3	ROUND OFF CONTROL	14
4	FISSION PRODUCT DATA LIBRARIES	17
	Linear Chain Structures for Absorption Buildup	17
	EPRI-CINDER Libraries	18
5	INPUT FORMAT	28
	General Information	28
	Options	28
	Print Options	28
	Punch Options	29
	Yield Ordering	30
	Input Deck Structure	31
	Notes on Input Preparation	31
	EPRI-CINDER Card Data and Format	33
6	CODE OUTPUT	41
7	SUGGESTIONS FOR USE IN CODE MODIFICATIONS	42
	Variable Dimensions	47
	Suggestions for Storage Reduction	47
	Numerics	48
	REFERENCES	49

Section (continued)

	<u>Page</u>
APPENDIX A. EPRI-CINDER 84-Chain Library	A-1
APPENDIX B. EPRI-CINDER 12-Chain Library	B-1
APPENDIX c. Source Listing of Code	C-1

## SUMMARY

This publication constitutes the second part of a 2-part, final report describing work carried out under project RP453. The objective of this project has been the production of a data library suitable for calculating the buildup of fission product nuclides during the operation of a thermal power reactor. This has been accomplished by reducing the fission product data from the fourth version of the national reference nuclear data base -- ENDF/B into a series of linearized decay chains and calculating the effective yields and cross sections of the relevant nuclides. Two versions of the fission product library have been prepared: an 84 chain master library and a reduced 12 chain library, both of which can be used as input for the computer program CINDER. The theory and procedures followed in preparing the libraries are described in Part I of the final report. The present publication constituting Part II is a users manual for an upgraded version of the burnup program CINDER (renamed EPRI-CINDER).

Complete listings of the 84 and 12 decay chain libraries are given in Appendices A and B. A listing of EPRI-CINDER is given in Appendix C. Pages A-3 to A-31 in Appendix A contain cross section and decay information for the fission product nuclides appearing in the 84 chain set. The first record for each nuclide can be recognized by a hollerith symbol in the first six columns, followed by five numeric entries. These represent the initial density (zero at the beginning of life) and the four group cross sections. The cross sections can also be found on Table 4 of Part I of the final report. A convention of preceding the symbol of the first nuclide in each chain by an asterisk has been followed. (The chain structures can be seen on Figure 3 of Part I and Figure 1 of Part II of the final report.)

Effective yield information is given in two sets. The first set, listed on pages A-31 to A-44, gives one record for each nuclide which contains, in addition to the symbol, five numbers representing the effective yield of this nuclide due to:

- 1)  $^{235}\text{U}$  thermal fission
- 2)  $^{238}\text{U}$  fast fission
- 3)  $^{239}\text{Pu}$  thermal fission
- 4)  $^{233}\text{U}$  thermal fission
- 5)  $^{232}\text{Th}$  fast fission

The second set given on pages A-44 to A-58 contains similar information due to fast fissions in  $^{235}\text{U}$ , 14 Mev fissions in  $^{235}\text{U}$  and  $^{238}\text{U}$ , fast fissions in  $^{239}\text{Pu}$  and thermal fissions in  $^{241}\text{Pu}$ . Whether each entry represents the direct or cumulative yield depends on the organization of the decay chains, and can be determined by consulting Table 1 of Part I.

The structure of the 12 chain data in Appendix B is analogous to the 84 chain data.

Odelli Ozer  
EPRI Project Manager

## Section 1

### INTRODUCTION TO CODE AND DATA LIBRARIES

#### Introduction

Part 1 of this report describes basic fission-product nuclide parameters formed into a comprehensive set of nuclide chains for use in survey calculations, reactor safety studies, and data testing. Calculations were made for fission-product absorption build-up for the six fissionable nuclides having yield data at one or more energies in ENDF/B-IV. In addition, a 12-chain library containing 1 pseudo-chain has been shown to accurately reproduce the absorption build-up and transient behavior of the total-fission product ensemble. The 12-chain library is small enough for use in spatial depletion codes.

This report describes the actual EPRI-CINDER input libraries, the details of the code and the input format. It has been prepared as an aid to users, including those who may desire to modify the code.

The EPRI-CINDER code described here is particularly suitable for efficient calculations of actinide concentrations and associated fission-product absorption build-up. The fission product libraries use four-group cross sections appropriate for thermal reactors, as described in Part 1; the same chain libraries can be used for fast reactors using appropriate cross sections, although a less extensive set of chains would be sufficient for fast-reactor applications.

EPRI-CINDER is a general program that calculates the time-dependent concentrations of nuclides coupled in any physically possible sequence of radioactive decays and neutron absorptions in a specified neutron flux spectrum. The solution is determined for a sequence of timesteps, that is, finite time intervals, during which the flux and fission rate are held constant. Time variations in the flux and cross sections are incorporated by use of these time-increments.

The EPRI-CINDER program can calculate, for example, the time-dependent concentrations of the hafnium isotopes, including transitions through the isomeric

states, beginning with some initial nuclide density distribution in any specified time-dependent flux. It can also calculate the build-up of  $^{239}\text{U}$ ,  $^{239}\text{Np}$ ,  $^{239}\text{Pu}$ ,  $^{240}\text{Pu}$ ,  $^{241}\text{Pu}$ , etc., when  $^{238}\text{U}$  is irradiated. In the latter case, the concentration of fission products in chains generated by yields from fissionable nuclides such as  $^{238}\text{U}$  and  $^{239}\text{Pu}$  can also be calculated. The nuclides included in the calculations are controlled by the user.

For absorption calculations the user specifies the actinide parameters (cross sections, decay constants, branching fractions, type of coupling, etc.), flux (or power) level, and any desired structural or impurity chains. The extensive fission product chains are the same for all fissionable nuclides and are coupled to the actinides only through fission yields. The libraries referred to in this report apply only to the fission-product ensemble and associated yields. These particular libraries permit calculations of absorption build-up from combinations of the fissionable nuclides  $^{233}\text{U}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{239}\text{Pu}$ ,  $^{241}\text{Pu}$ , and  $^{232}\text{Th}$ . The libraries contain all ENDF/B-IV fission products having half-lives greater than 4 hours and are, therefore, sufficient for many reactor safety studies related to radiological hazards. The code permits calculations of beta and gamma decay energies if an energy deck is added to the library.

The nuclide parameters needed to calculate concentrations are also used to provide output, for example, of macroscopic absorption and barns/fission (in four-energy groups), and activities for individual nuclides and for the total ensemble. Other quantities normally of interest in reactor design and safety studies are output in print and punch form. A multiplication factor ( $k_{\text{eff}}$ ) option is also incorporated into the code.

The code description duplicates some information available in older publications.<sup>1-3</sup> This is necessary for a self-contained users' manual. The code is an updating of the basic version described in Refs. 1 and 2, incorporating some new options and greatly improved numerical roundoff control.

Newer versions of CINDER are available which incorporate free-form input formats and variable dimensioning.<sup>4</sup> Such versions are more suitable for use with larger data libraries, as required, for example, in calculating decay heating and gamma spectra at short cooling times. However, these newer versions are more computer-dependent and incorporate some non-standard

FORTTRAN and other data handling features that make compiling times comparable to the normal running time of the modified basic version described in this manual, which uses standard ANSI FORTRAN (1966).

### Nuclide Data

Version IV of the Evaluated Nuclear Data File (ENDF/B-IV) is the basic source of all fission-product data used in forming the EPRI-CINDER libraries. Four-group cross sections are collapsed from a 154-group set using a thermal reactor spectrum as described in Part 1. The initial multigroup structure used for processing the ENDF/B-IV cross sections with the same spectra is described in Ref. 5 and the decay parameters are as listed in Ref. 6. For the EPRI-CINDER libraries, the thermal (4th group) cross section is an effective 2200 m/s value

$$\sigma_{\text{eff}}^4 \equiv \frac{\sigma^4}{\langle \sigma_{1/v} \rangle} \quad ,$$

where  $\sigma^4$  is the flux-weighted thermal-group cross section, and  $\langle \sigma_{1/v} \rangle$  is the thermal-group flux-weighted value of a cross section equal to unity at 2200 m/s and having a  $1/v$  dependence. In these libraries,  $\langle \sigma_{1/v} \rangle = 0.55402$ . In effect, the group 4 cross section is a 2200 m/s value incorporating any non- $1/v$  dependence. It should be used with a group-4 flux weighted by  $\langle \sigma_{1/v} \rangle$  (determined by the users' spectrum) or  $\langle \sigma_{1/v} \rangle$  should be inserted as a thermal-spectrum factor.

The rationale associated with this treatment of thermal-group cross sections and fluxes is directed at providing flexibility for a variety of user-required flux descriptions. Group-averaged cross section values used in the EPRI-CINDER libraries reflect the unique energy dependence of the Power Reactor Studies (PRS) Flux Weighting Function described in Part 1, which may differ from that of the user. The use of the effective thermal cross section and of  $\langle \sigma_{1/v} \rangle$ -weighted thermal flux allows the user to compensate for flux and spectral differences. The thermal group correction is exact where fission-product cross sections vary as  $1/v$  below 0.62506 eV. Since flux descriptions at higher energies are less reactor-type dependent, no similar treatment is given to parameters of other groups.

Other ENDF/B-IV nuclide parameters have been tabulated in Ref. 6, including branching fractions (decay and absorption), half-lives, and average beta and total gamma energies per decay. The libraries in this report do not include

a decay energy library; it can be inserted, if desired, using the tabulated data in Ref. 6. Beta and gamma spectral data in multigroup form are available in Ref. 7.

The final ENDF/B-IV yield data have not been published. The final values include some late corrections to those in Ref. 8, a report that originally was to serve as the ENDF/B-IV yield reference. The final corrections apply to independent (direct) yields and are generally small; for mass-chain yields, the corrections are negligible.

#### Nominal Dimensions of Data

In the following exposition, many quantities are given explicit dimensions. The code does not require any set of particular dimensions or, for example, that the flux be a neutron flux; but the dimensions should be consistent. The exposition and some formatted print statements presume the following nominal units and/or dimensions:

Microscopic cross sections: barns

Macroscopic cross sections:  $\text{cm}^{-1}$

Nuclide concentrations: number/b-cm

Flux (neutron):  $\text{n/cm}^2/\text{s}$

Decay constant:  $\text{s}^{-1}$

Decay energies: MeV

Time increments: h

Power: Watts

Yields: fraction/fission (not percent)

Fission: number/b-cm

Neutron flux groups: energy structure (width) is arbitrary; it is only necessary that the cross sections correspond to the flux groups. (For use with the fission-product library in this report, the following group structure is used: 0-0.625 eV, 0.625-5530 eV, 5530- $8.21 \times 10^5$  eV,  $8.21 \times 10^5$ - $10^7$  eV, and the cross sections for the 0-0.625 eV group require a  $\langle \sigma_{1/v} \rangle$ -weighted neutron flux as previously described.)

## Section 2

### CODE METHODOLOGY

#### General Solution for Coupled Nuclides

A Nuclide can be transformed by several modes of radioactive decay or by neutron (or other particle) absorption. Similarly, it can be created when parent nuclides undergo such processes. In addition it can be generated by a direct fission yield. Thus, the concentration of a particular nuclide may depend on more than one immediate parent as well as its own radioactive decay, neutron absorption, and fission yield. A complete schematic of all coupling mechanisms which feed and transform each nuclide may appear to be quite complicated. However, it is always possible to resolve the couplings so as to obtain nuclides fed by a single parent. Such resolutions into "linear" chains are discussed in Part 1 and in Refs. 2 and 3. The use of linear chains is precise, permits an analytical solution of the differential equations, and makes possible this generalized depletion code that is independent of specific nuclide parameters and nuclide chains. Perhaps of equal importance, the numerics associated with a large number of coupled nuclides, or nuclides having greatly differing reactor or decay rates, can be accurately controlled. Thus, during each calculation of a nuclide concentration, the code can check for errors arising from the limitation of a finite computer-word length. This feature allows a maximum utilization of the significant digits available in the computer while preventing large errors that could otherwise arise.

In terms of a few-energy-group structure, the concentration of the  $i^{\text{th}}$  nuclide in a linear chain is determined by the following coupled differential equations:

$$\frac{dN_i}{dt} = \sum_k y_i^k S^k + \alpha_{i-1} \gamma_{i-1} N_{i-1} - (\lambda_i + A_i^a) N_i \quad , \quad (1)$$

$$i = 1, 2, 3, \dots$$

where

$y_i^k$  = yield fraction/fission from fissionable nuclide k,

$S^k$  = fission rate of  $k_{th}$  fissionable nuclide,

$\lambda$  = decay constant,

$$A_i^a = \sum_{j=1}^4 g_i^j \sigma_{a_i}^j \phi^j = \text{neutron absorption rate per unit nuclide density,}$$

where

$\sigma_{a_i}^j$  = total absorption cross section of the  $i^{th}$  nuclide in the energy group j;  $g_i^j$  = shielding factor, etc.

$A_{i-1}^c$  = capture rate,  $A^c = A^a - A^f$ , where  $A^f$  is the fission rate analogous to  $A^a$ . In lieu of branching fractions, fictitious fission cross sections may be specified for the fission products in order to achieve the correct activation cross sections leading to more than one daughter isomer.

$\gamma_{i-1}$  = either  $\lambda_{i-1}$  or  $A_{i-1}^{a,c}$  depending on coupling from precursor i-1.

$\alpha_{i-1}$  = fraction of specified coupling directly feeding nuclide i (the branching fraction in radioactive decay); this is used for  $\lambda_{i-1}$  and  $A_{i-1}^a$  but not normally for  $A_{i-1}^c$ .

This set of equations can equally well describe the nuclides in the depletion chains (in which case  $y = 0$ ) and in the fission-product chains.

The general solution of Eq. set (1) for the  $n^{th}$  nuclide in a chain, assuming constant flux and fission rate during time increment  $\Delta t$ , is<sup>2,3</sup>

$$\begin{aligned}
N_n(t+\Delta t) = & \sum_{m=1}^n \frac{1}{\alpha_n \gamma_n} \prod_{k=m}^n \alpha_k \gamma_k \left\{ \overline{y_m S} \left[ \frac{1}{\prod_{\ell=m}^n (\lambda_\ell + A_\ell^a)} - \sum_{j=m}^n \frac{\exp[-(\lambda_j + A_j^a)] \Delta t}{\prod_{i=m}^n (\lambda_i + A_i^a - \lambda_j - A_j^a)} \right] \right. \\
& \left. + N_m(t) \left( \sum_{\substack{j=m \\ j \neq i}}^n \frac{\exp[-(\lambda_j + A_j^a)] \Delta t}{\prod_{i=m}^n (\lambda_i + A_i^a - \lambda_j - A_j^a)} \right) \right\} . \quad (2)
\end{aligned}$$

Here,  $\overline{y_m S}$  = average fission yield rate of nuclide m from all fissionable nuclides.

The EPRI-CINDER code is based on this general solution that can be written in other forms more suitable for computation.  $N_n$  is actually a partial concentration of the  $n^{\text{th}}$  nuclide. If any nuclide has more than one source, there will be a concentration resulting from each source; these are added by the code, as specified by the user, in all aggregate summations. In Eq. (2), if 2 nuclides happen to have identical removal rates,  $\lambda + A^a$ , the equation indicates a division by zero. In the actual coding, this presents no problem and the same nuclide can, in fact, appear more than once in any chain.

Equation (2) could be coded for any number of neutron groups. In the present version of the code, up to four groups are permitted. Users requiring more groups for any other libraries can collapse to a four-group structure and unfold the results using  $N_n$ .

#### Associated Equations

Depending on option, either the power density or the thermal flux ( $\phi^4$ ) per time step is determined from the relation

$$P = K \sum_k N_k A_k^f , \quad (3)$$

where

$P$  = power density (Watts/cm<sup>3</sup> is assumed but the user can specify other units)

$k$  = indexes the fissionable nuclides that are specified by the user to be included in this summation

$N_k$  = number density of the fissionable nuclide  $k$  at initiation of time step (atoms/barn-cm)

$K$  = Joules/fission (that is, for 200 MeV/fis,  $K = 3.2042 \times 10^{-11}$ )

$$A_k^f = \phi^4 \sum_{j=1}^4 g_k^j \frac{\phi^j}{\phi^4} \sigma_{f,k}^j, \text{ the fission rate per nuclide } k, \text{ previously defined [Eq. (2)].}$$

The number of fissions/barn-cm (fission density) during a time step of fissionable nuclide  $k$  is dependent on each fuel chain structure. Therefore, it is approximated by

$$\Delta F_k = \frac{N_k(t) + N_k(t + \Delta t)}{2} A_k^f \Delta t, \quad (4)$$

where  $N_k$  is computed by Eq. (2) with  $\overline{y_m S}$  set to zero.

For the fission product  $m$  the average yield rate  $\overline{y_m S}$  during a given time increment  $\Delta t$  summed over  $k$  fissionable nuclides is

$$\overline{y_m S} = \sum_k \frac{y_m^k \Delta F_k}{\Delta t} \quad (5)$$

The total number of fissions during a time step is

$$\Delta F = \sum_k (\Delta F_k) \text{ (fissions/barn-cm)}, \quad (6)$$

where the summation in Eqs. (5) and (6) is carried over all nuclides in the power calculation of Eq. (3).

Unlike the exact number density calculations, the use of an average number density from Eq. (4) is an approximation to  $\Delta F$ , the fractional error term being

$$\leq \frac{1}{12} (A^a \Delta t)^2$$

for a depleting fuel nuclide like  $^{235}\text{U}$  and considerably smaller for a fuel nuclide having a source like  $^{239}\text{Pu}$ . (For  $^{235}\text{U}$  fuel in a flux of  $1/2 \times 10^{14}$ ,  $\langle \sigma_a \rangle = 300$  b and  $\Delta t = 1000$  hr, the maximum error is only 0.024%.) A similar comment applies to the power calculation.

The energy-group macroscopic absorption cross section of nuclide  $i$  is

$$\Sigma_{a_{i\ell}}^j = g_{i\ell}^j N_{i\ell} \sigma_{a_i}^j \quad (\text{cm}^{-1}), \quad (7)$$

where  $j$  denotes group,  $g^1 = g^2 = 1$ , and  $\ell$  denotes time step.

The groupwise barns/fission\* of nuclide  $i$  after  $L$  time steps is defined by

$$\hat{\sigma}_{a_{iL}}^j = \frac{\Sigma_{a_{iL}}^j}{\sum_{\ell=1}^L \Delta F_{\ell}} \quad (8)$$

The disintegration rate of nuclide  $i$  at time step  $\ell$  is

$$\lambda_i N_{i\ell} \quad (\text{disintegrations/barn-cm/sec}) \quad (9)$$

A summation in each energy group  $j$  for  $\Sigma_{a_{i\ell}}^j$  and  $\hat{\sigma}_{a_{i\ell}}^j$  is carried out over nuclides specified by the user at each time step. Similarly,  $\lambda_i N_{i\ell}$  is summed over the same specified nuclides.

The thermal flux-time is

$$Z = \sum_{\ell} \phi_{\ell}^4 \Delta t_{\ell} \quad (\text{n/cm}^2) \quad (10)$$

---

\* The caret (^) is used to denote barns/fission.

The fission energy/cm<sup>3</sup> is

$$E = \sum_{\ell} (P_{\ell} \Delta t_{\ell}) \quad (W-s/cm^3) \quad . \quad (11)$$

The integrated neutron absorption is

$$\eta = \sum_{i,j,\ell} \left( \frac{\Sigma_{a,i}^j \phi_{\ell}^j \Delta t_{\ell}}{\Sigma_{a,i}^j} \right) (n/cm^3) \quad , \quad (12)$$

where the summation is carried out over the same nuclides included in the total barns/fission and macroscopic absorption summation.

### K<sub>∞</sub> Calculation

Using up to four neutron energy groups J, K<sub>∞</sub> (or K<sub>eff</sub>) is calculated from

$$K = \frac{\sum_{j=1}^J \sum_i v_i^j \Sigma_{f,i}^j (\phi^j / \phi^J)}{(\Sigma_r^1 + \Sigma_a^1) (\phi^1 / \phi^J)} \quad (13)$$

where

J = number of energy groups being used (group J is the thermal group)

i = nuclide in power

v<sub>i</sub><sup>j</sup> = total neutrons emitted by fissionable nuclide i from fission in group j

Σ<sub>r</sub> = removal cross section; Σ<sub>a</sub> is defined by Eq. 15.

The flux ratios φ<sup>k</sup>/φ<sup>4</sup> are not those normally input in an EPRI-CINDER calculation. Instead, they are calculated from

$$\frac{\phi^{J-1}}{\phi^J} = \frac{\Sigma_a^J}{\Sigma_r^{J-1}}$$

$$\frac{\phi^{J-2}}{\phi^J} = \frac{\left( \Sigma_a^{J-1} + \Sigma_r^{J-1} \right) \Sigma_a^J}{\Sigma_r^{J-2} \Sigma_r^{J-1}}$$

$$\frac{\phi^{J-3}}{\phi^J} = \frac{(\Sigma_a^{J-2} + \Sigma_r^{J-2})(\Sigma_a^{J-1} + \Sigma_r^{J-1})\Sigma_a^J}{\Sigma_r^{J-3}\Sigma_r^{J-2}\Sigma_r^{J-1}} \quad (14)$$

These equations, derivable from group-diffusion equations (for  $\chi_1 = 1$ ), are used to generate flux ratios in succeeding time steps. Initial flux ratios are required.

At the end of each time step,  $\Sigma_a^j$  is reevaluated in each energy group  $j$

$$\Sigma_a^j = \Sigma_c^j + \sum_i N_i \sigma_{a_i}^j \quad (15)$$

where

$$\Sigma_c^j = \text{a user-supplied, non-depletable macroscopic absorption cross section (and/or leakage, } D_j B_j^2 \text{),}$$

and

$$\sum_i N_i \sigma_{a_i}^j = \text{total macroscopic absorption cross section generated by EPRI-CINDER (i = index of those nuclides included in EPRI-CINDER summations).}$$

In addition to the initial  $\phi^j/\phi^J$  and  $\Sigma_c^j$  values, the user supplies the values of  $\nu_i^j$  for each energy group  $j$  per nuclide in power and the group-removal cross sections  $\Sigma_r^j$ . These are input using three types of " $K_\infty$  cards" following the yield deck as described in the program format.

The output for this option includes:

1. The normal EPRI-CINDER output at each time step excluding the barns/fission and activity  $\lambda N$  of each nuclide.
2. In the summary output, the following six quantities are tabulated for each time step:
  - a.  $K_\infty$  (or  $K_{\text{eff}}$  if leakage is included in  $\Sigma_c$ )
  - b. Calculated fast to thermal flux ratios  $\Sigma_r^j$
  - c.  $\rho = (K_\infty - 1.0)/K_\infty$ , the reactivity
  - d. Fuel fraction for a specified nuclide
  - e. Thermal flux time
  - f. Total macroscopic absorption cross sections  $\Sigma_a^j$  (including  $\Sigma_c^j$ 's).

### Decay Heating

This option permits calculation of the energy release rate from radioactive decay of both depletion and fission-product nuclides.

In general, one can input an energy release per decay  $E_i^j$  for each nuclide in J groups. These energy groups can be arbitrary in the sense of energy range per group (these are not related to the neutron energy groups).

The units of  $E_i^j$  are arbitrary but the program printout is labeled as if

1. All  $E_i^j$ 's are input as MeV per decay
2. Group 1 is  $\beta^-$ -decay and the remaining groups are  $\gamma$ -decay.

The program is set up to handle a total of nine energy groups. However, in order to reduce required storage, the EPRI version has been dimensioned so that only three groups are currently used. To increase the number of energy groups, it is only necessary to change the dimension of variables E, RSL, TOTLR, and the range of the DO loop that sums the groups to the number of groups plus 2. The following discussion will assume that nine energy groups are available; this corresponds to the actual format.)

The energy release rate per unit volume for nuclide i in decay group j is

$$\lambda_i N_i(t) E_i^j \quad (16)$$
$$j = 1, 2, \dots, 9$$

where

$\lambda_i$  = radioactive decay constant ( $s^{-1}$ )

$N_i$  = nuclide number density (number/(barn-cm))

$E_i^j$  = energy/decay (labeled MeV, MeV/s, etc.)

j = 1 is labeled  $\beta^-$ -decay

j = 2, ...9 are labeled as  $\gamma$ -decay in units of MeV, etc.

At the end of each time step, the printout provides

1.  $\lambda_i N_i E_i^j$  = energy release rate of nuclide i in group j, where

$$j = 1, 2, \dots, 9.$$

2.  $\sum_{j=2}^9 \lambda_i N_i E_i^j$  = total  $\gamma$  energy release rate of nuclide i

3.  $\sum_{j=1}^9 \lambda_i N_i E_i^j$  = total  $\beta^- + \gamma$  energy release rate of nuclide i

4.  $\sum_i \lambda_i N_i E_i^j$  = total energy release rate in each energy group j for all nuclides specified for inclusion in total summation

5.  $\sum_{i,j=2}^9 \lambda_i N_i E_i^j$  = total  $\gamma$  energy release rate

6.  $\sum_{i,j=1}^9 \lambda_i N_i E_i^j$  = total  $(\beta^- + \gamma)$  energy release rate.

The summation over nuclides i includes only those nuclides specified as being in all total summations.

This option requires that an energy deck be inserted after the yield deck (or  $K_\infty$  cards if present) that specifies the  $E_i^j$  values for each nuclide i (even if  $E_i^j$  is zero) as described in the program format. If there is no yield deck (no fission products), the energy deck follows the NUCLIDE CARD SET (or  $K_\infty$  cards when present).

The Program Summary print lists the total  $\beta^-$ , total  $\gamma$ , and total  $\beta^- + \gamma$  energy release rate for each time step and also these values in terms of MeV/fission. The latter calculation uses the average fission rate (over all fissionable nuclides in power) based on the last time step at power:

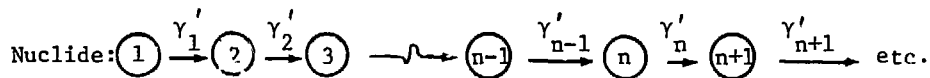
$$\text{MeV/Fission} = \frac{\text{Energy release rate at end of time step}}{\text{Fission rate during last time step at power}} = \frac{\text{MeV/s}}{\text{Fissions/s}} \quad (17)$$

Note that unlike a *births/fission* ratio based on the total number of fissions, Eq. (17) is a ratio of rates, and the cancelling time dimension in these rates refers to different times.

### Section 3 ROUNDOFF CONTROL

A general nuclide code must contend with a large disparity in decay and absorption rates and time increments. The computer limitation to a finite word length can, therefore, lead to a variety of numerical errors, referred to here as "roundoff" for simplicity.<sup>1</sup> The EPRI-CINDER code continuously checks for various errors, some of which are discussed in this section. In all cases, the potential errors are either obviated by special routines or the code is stopped with an appropriate message. The control is based on the computer word length, which can be input by the user, and the incremental time of each time step, also an input quantity.

The types of potential error in a naive coding of Eq. (2) can easily be understood by considering a linear sequence of coupled nuclides:



where  $\gamma'$  is  $\alpha\gamma$ , and  $\gamma$  is either  $\lambda$  or  $A$ .

Conceptually, the source to the  $n^{\text{th}}$  nuclide, other than its direct fission source, can be resolved into components, one from each preceding nuclide in the chain. Thus, during a time increment, nuclide  $n-1$  directly feeds  $n$ , nuclide  $n-2$  feeds  $n$  by first forming  $n-1$ , etc. Equation (2) can be interpreted in this way. Thus, each term  $m$  of the overall summation  $\sum_{m=1}^n$  represents the amount of the  $m^{\text{th}}$  nuclide that adds to the accumulation of the  $n^{\text{th}}$  during  $\Delta t$ . This can be further resolved as follows. The terms in brackets [ ] in Eq. (2) represent the contribution from the yield source of  $m$  while the last internal summation in parenthesis ( ) is the contribution from the accumulation of  $m$  existing at the beginning of the time step.

It is physically clear that, during a small time increment, such partial contributions must tend to zero for large values of  $n-m$ . In Eq. (2) the

terms in brackets [ ] and the terms in parentheses must approach zero. In either case, let the terms within the brackets or parentheses be represented by  $X_j$ :

$$\left[ X_m + X_{m+1} + \dots + X_j + \dots + X_n \right]$$

Since the computer word length limits us to N significant figures, this summation cannot be correctly calculated if it is smaller than  $|\bar{X}_\ell| \times 10^{-N}$ , where  $|\bar{X}_\ell|$  is the largest of the terms  $|X_j|$ . More specifically, N should be equal to or less than the number of significant digits guaranteed by the exponential function in FORTRAN. Accordingly, the check

$$\frac{\left[ X_m + X_{m+1} + \dots + X_j + \dots + X_n \right]}{|\bar{X}_\ell|} \geq 10^{-N} \quad (18)$$

has been incorporated into the EPRI-CINDER program as consecutive terms  $X_m$  (and  $|\bar{X}_\ell|$ ) are computed. When Eq. (18) is not satisfied, the corresponding partial contribution and contributions from all nuclides further removed from m are set to zero. Since such partial contributions are several orders of magnitude smaller than the contribution from the more immediate neighbors of the  $n^{\text{th}}$  nuclide, this criterion makes no significant error but, in fact, permits a maximum utilization of the available significant digits. Also, since it obviates non-significant calculations, it reduces the program running time.

It is worth noting that without this feature very large errors can and do arise, depending on the computer in use. Thus, once all significance has been lost for a given n-m, then, due to binary roundoff, the terms in [ ] or ( ) of Eq. (2) are replaced by  $Y \times 10^{-N}$ , where Y is random but is of the same order of magnitude as X above, but is otherwise random. Therefore,

$$\frac{1}{Y_n} \prod_{k=m}^n \gamma_k \left[ \sum_{j=m}^n x_j \right] \approx \prod_{k=m}^n \gamma_k |Y_\ell| \times 10^{-N}$$

The factor  $|Y_\ell|$  varies as  $\exp[-\lambda_\ell + A_\ell^a] \Delta t$ , hence as  $\Delta t \rightarrow 0$ ,  $|Y_\ell|$  increases. Thus, when all numerical significance is lost, a further decrease in  $\Delta t$  causes an increase rather than a decrease in the partial density being calculated. Similarly, for the next nuclide in the chain, its partial density due to the

$m^{\text{th}}$  nuclide can be even larger than the  $m^{\text{th}}$  nuclides contribution to its immediate daughter -- a physical impossibility. The net result is that, for very long chains and short time increments, an error of many orders of magnitude, not simply a loss in significant digits, could result in the number density for the last few nuclides in a chain in the absence of the criterion expressed by Eq. (18).

If there are 32 binary bits available, N should not be larger than 10 in order for the smallest partial density calculation to contain at least one significant figure. The value 9 is automatically used unless otherwise specified by the user.

An output option is available that prints the nuclides and chains that activate this criterion. It distinguishes between the terms in brackets (labeled "direct yield") and the terms in parentheses (unlabeled) of Eq. (2).

For essentially the same reason as given in the above discussion, errors could arise if there is a small divisor in the terms

$$\frac{\exp [-(\beta_j \Delta t)]}{\prod_{\substack{i=m \\ i \neq j}}^n (\beta_i - \beta_j)}$$

where  $\beta \equiv \lambda + A^a$ . The error is a function of  $\Delta\beta \equiv (\beta_i - \beta_j)$ , and  $\beta_j$  and of  $\Delta t$ . The following conservative criteria have been incorporated into the program:

$$|(\beta_i - \beta_j) \Delta t| \geq 10^{-M} \quad , \quad (19)$$

and

$$\beta_j \Delta t \geq 10^{-M} \quad , \quad (20)$$

where, again, M should not be larger than about 10 for computers using a 32 bit word length. When these criteria are not satisfied, calculational errors could arise even in the coupling from near neighbors of a nuclide. If two nuclides in a chain have identical destruction rates ( $\equiv \beta$ ) by accident or

in fact [as in (n,2n) reactions, or as is possible in combinations of absorptions and, for example, alpha decay], the criterion of Eq. (20) is clearly violated. At each time increment, the code checks each chain for violations of criteria of Eqs. (18)-(20). Values of  $t$  are increased by a small multiple of  $10^{-M}/\Delta t$  if necessary. The increase in  $\beta_j \Delta t$  is negligible, being on the order of  $10^{-M}$ . By default,  $M = 6$  unless otherwise specified by the user. Again, a print option provides the user with output messages when these criteria are activated.

Actually, the code algorithms are more extensive than these criteria imply. There are other potential sources of numerical error, primarily associated with the coupling parameter  $\alpha\gamma$ . These are examined and the calculation is stopped if there is no way to temporarily adjust parameters in a way that would not affect calculated quantities.

#### Section 4

### FISSION PRODUCT DATA LIBRARIES

#### Linear Chain Structures for Absorption Buildup

The linear chains contain all ENDF/B-IV nuclides having half-lives in excess of ~4 hours. For absorption buildup calculations, shorter half-lives result in concentrations too small to affect aggregate absorption buildup or nuclide coupling by absorption. Thus, for a four hour half-life nuclide to have an (n, $\gamma$ ) rate equal to the decay rate in a flux of  $10^{13}$  n/(cm<sup>2</sup>/s), its cross section would have to exceed  $5 \times 10^6$  barns. Similarly, to affect a nuclide concentration by 10%, the cross section would have to exceed  $5 \times 10^5$  barns. There are no known fission products with half-lives < 4 hours which have cross sections of this magnitude.

In effect, the short-lived nuclides are assumed to decay instantaneously and are not included explicitly in the chain structure. However, if there is more than one decay branch listed in Ref. 6, this is correctly incorporated into the chains in the form of effective branching fractions. Longer-lived nuclides are retained even where their cross sections are negligible; these may affect transient behavior or be of interest for other reasons, for example, in radiological studies.

The resolution of the complex chains into a linear sequence, discussed in Part 1, can take several equivalent forms. The particular form used in the EPRI-CINDER library is illustrated in the schematic of Fig. 1. There are 84 chains and many contribute an insignificant amount to the total absorption. The intent is to include all chains and coupling sequences sufficient to calculate any significant absorption buildup from any fuel during the lifetime of any contemporary reactor.

As discussed in Part 1, it is possible to accurately reproduce the absorption buildup of the 84 chains using 11 real and 1 fictitious chains for all fuels. These chains, which can be incorporated into spatial depletion calculations, are illustrated in Fig. 2. The fictitious chain parameters were obtained from calculations using the full 84 chain structure (see Part 1 for a discussion of these chains).

#### EPRI-CINDER Libraries

Appendix A lists the actual 84-chain library and Appendix B the 12-chain library. In both cases there are two yield decks listed. This version of the code is currently dimensioned for five yield sets. The two yield sets can be combined by changing the dimensions of the variables Y, NY, and YLD. The reason for the current division is simply to reduce the required computer memory.

Yield set A contains the yields appropriate for most light water reactors (LWR) and set B the remaining miscellaneous yields; Table I lists the types of yields in each set. The user may prefer a different grouping or, if computer memory size permits, a combined yield deck.

The listed libraries contain actinide chains and specified time cards. In fact, for the user's convenience in interpreting the input formats, the listed libraries are complete with all data necessary for a typical EPRI-CINDER run. (Table II in Sec. 6 provides summary output for the input data in Appendix A.) *In actual use, all actinide parameters and chains should be replaced by the input appropriate for the reactor and spectrum being studied.* (See also Sec. 1 for discussion on the thermal cross sections.)

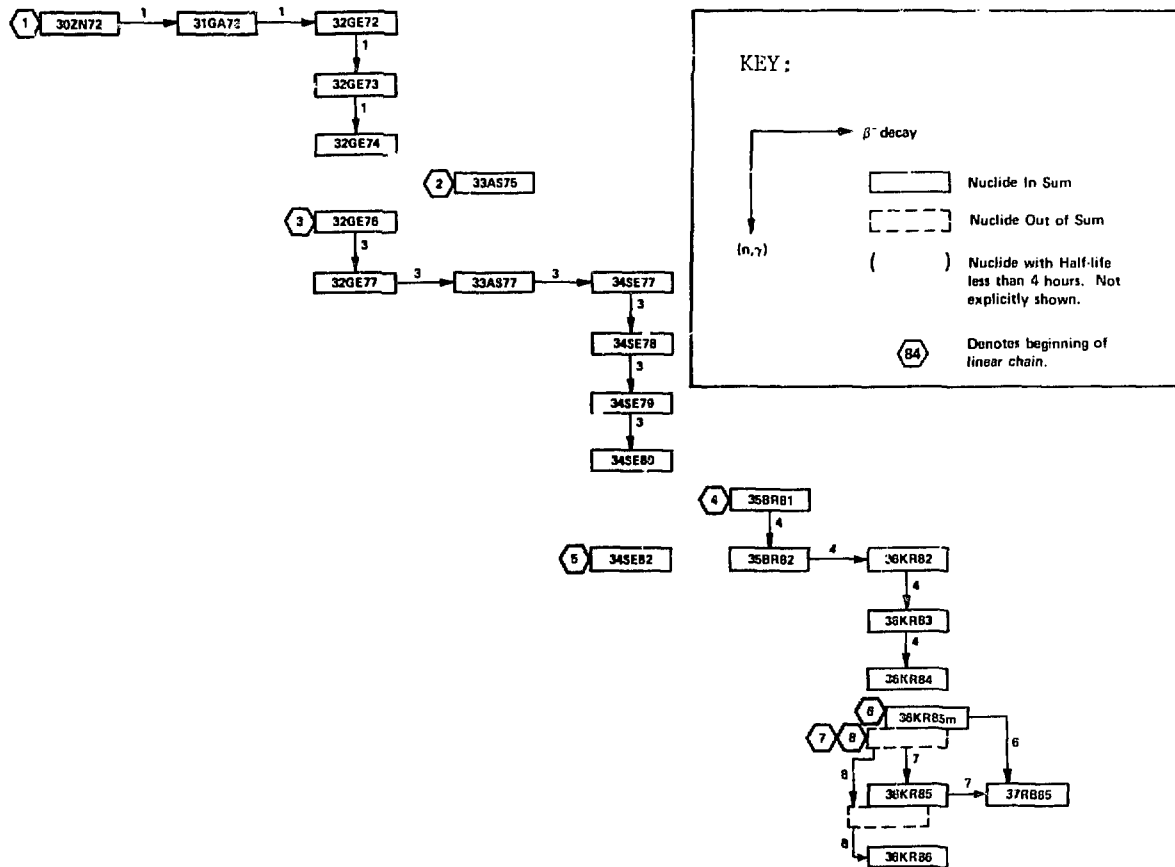


Fig. 1. EPRI-CINDER absorption-decay chain structure.

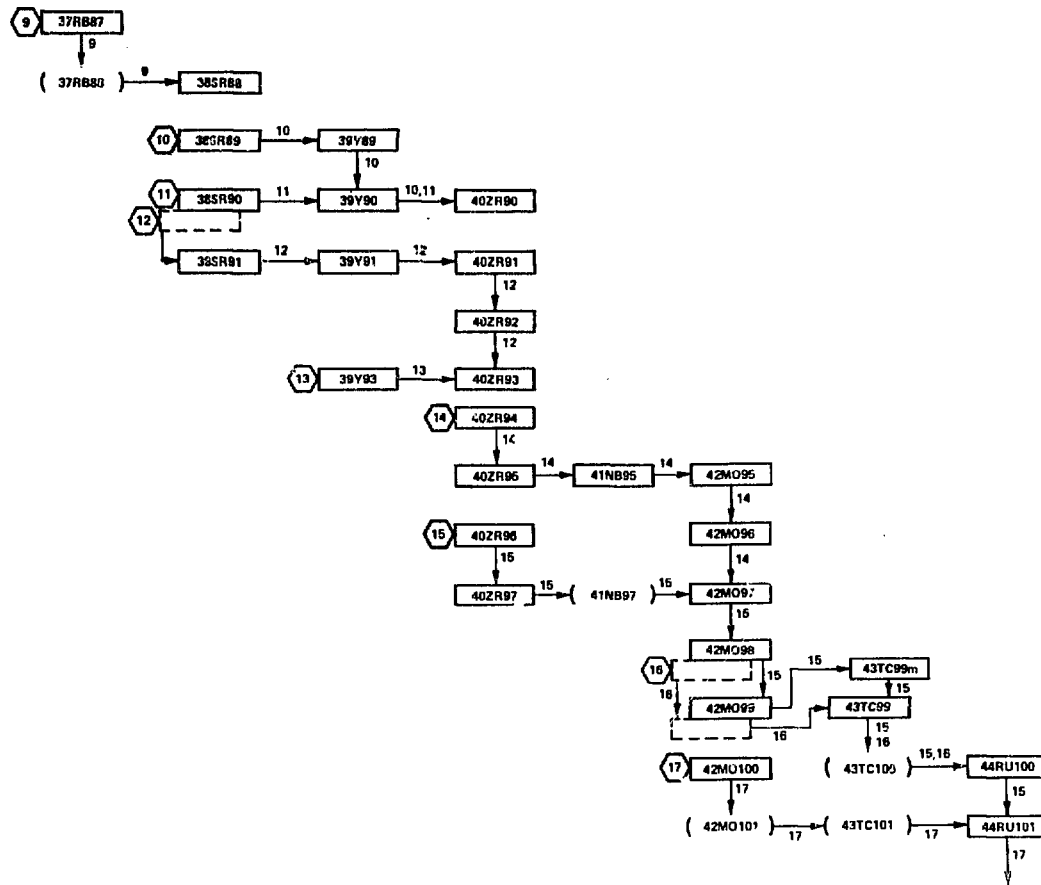


Fig. 1. (continued)

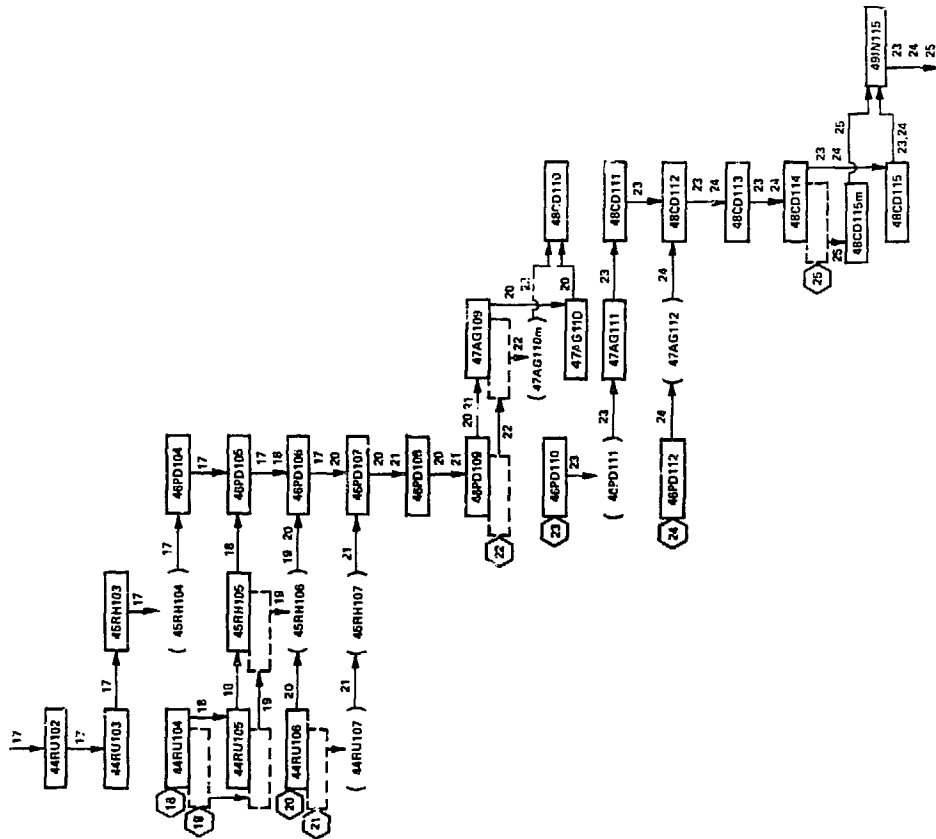


Fig. 1. (continued)

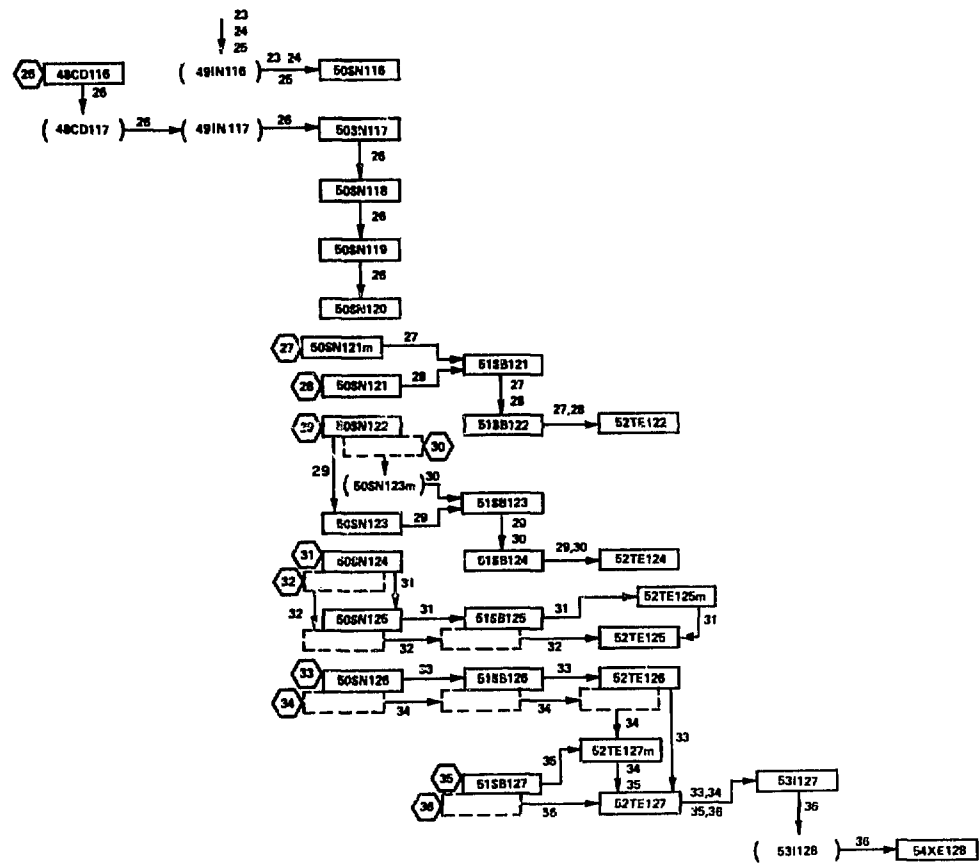


Fig. 1. (continued)

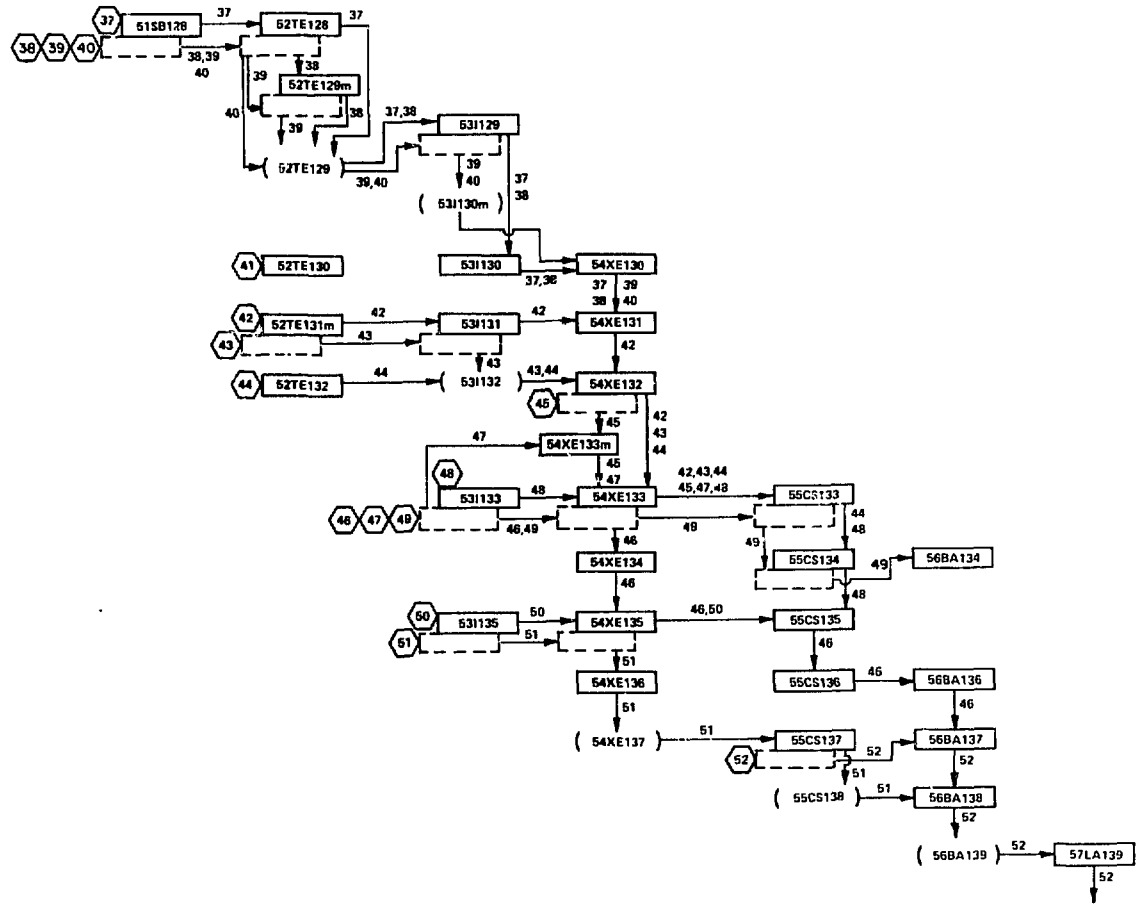


Fig. 1. (continued)

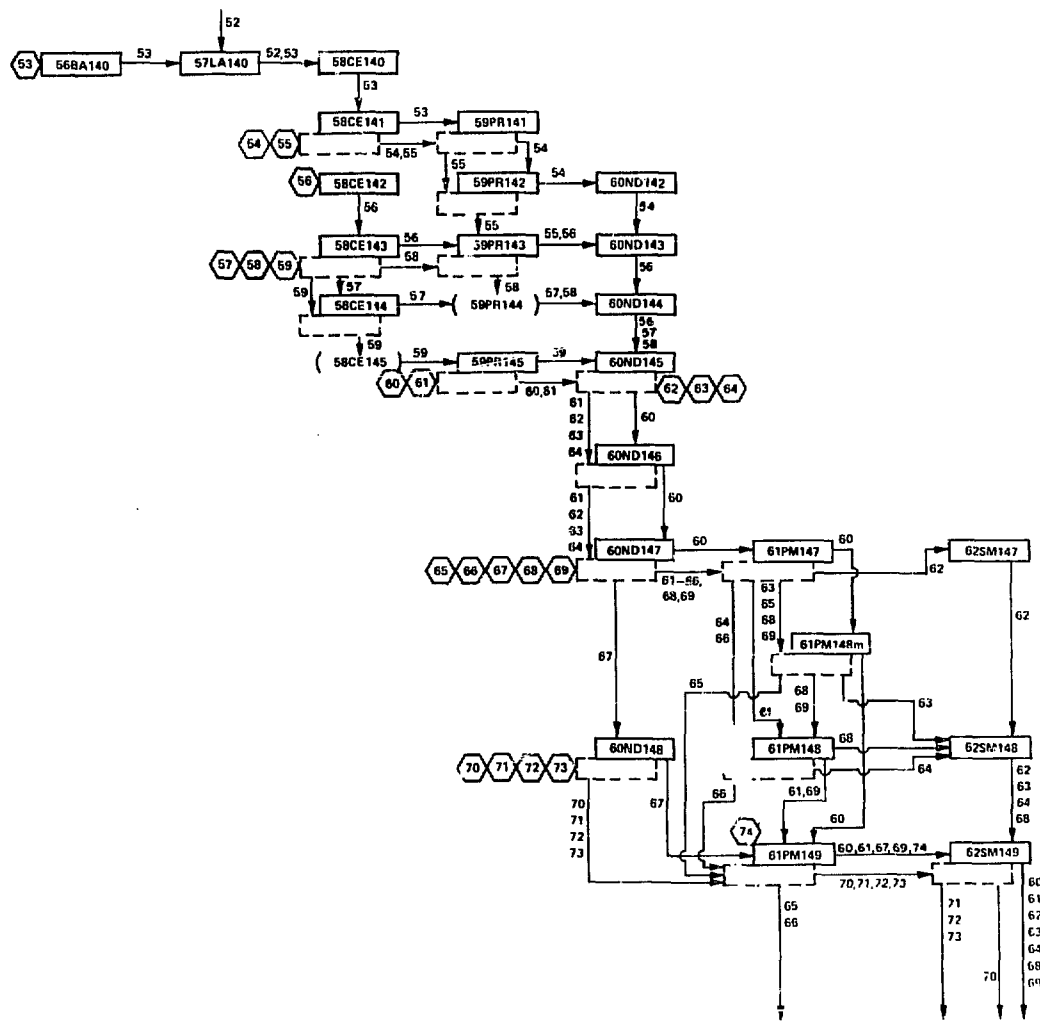


Fig. 1. (continued)

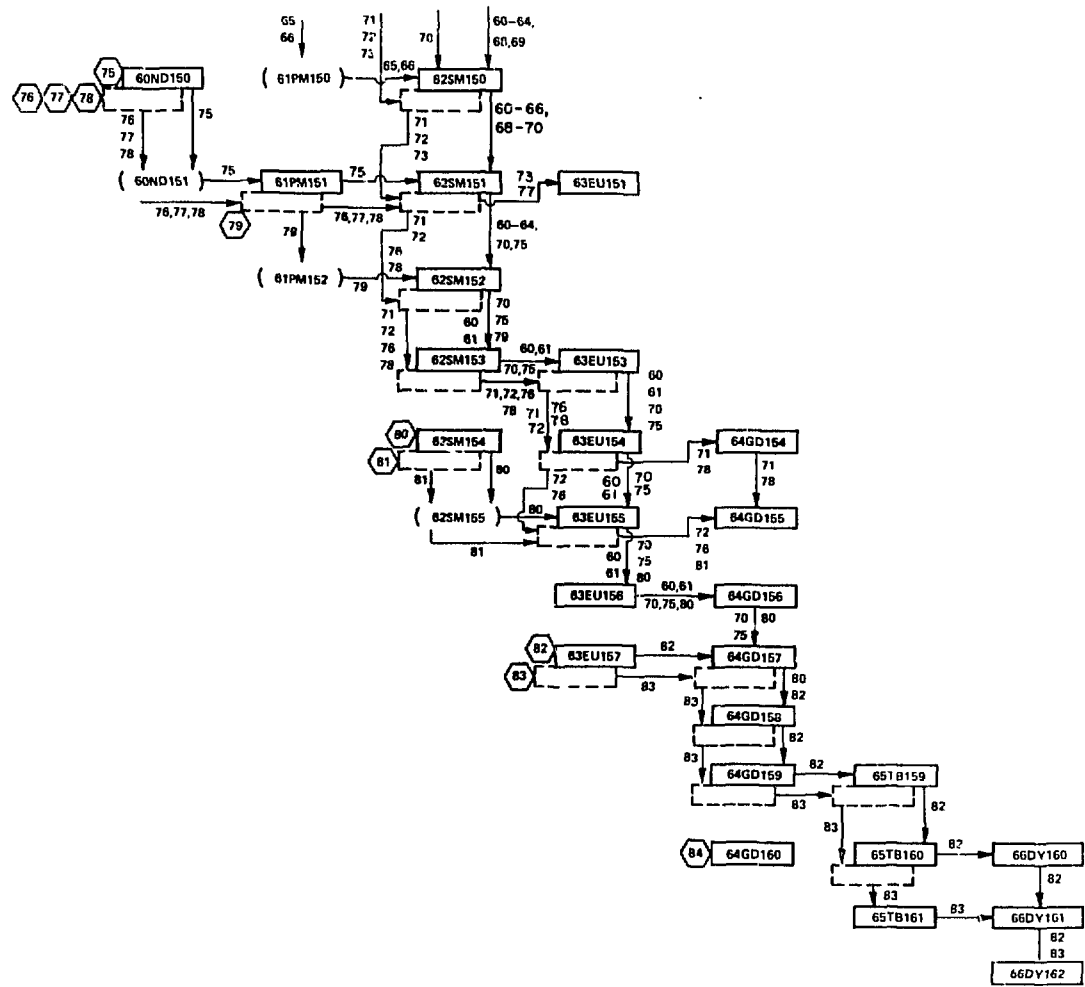


Fig. 1. (continued)

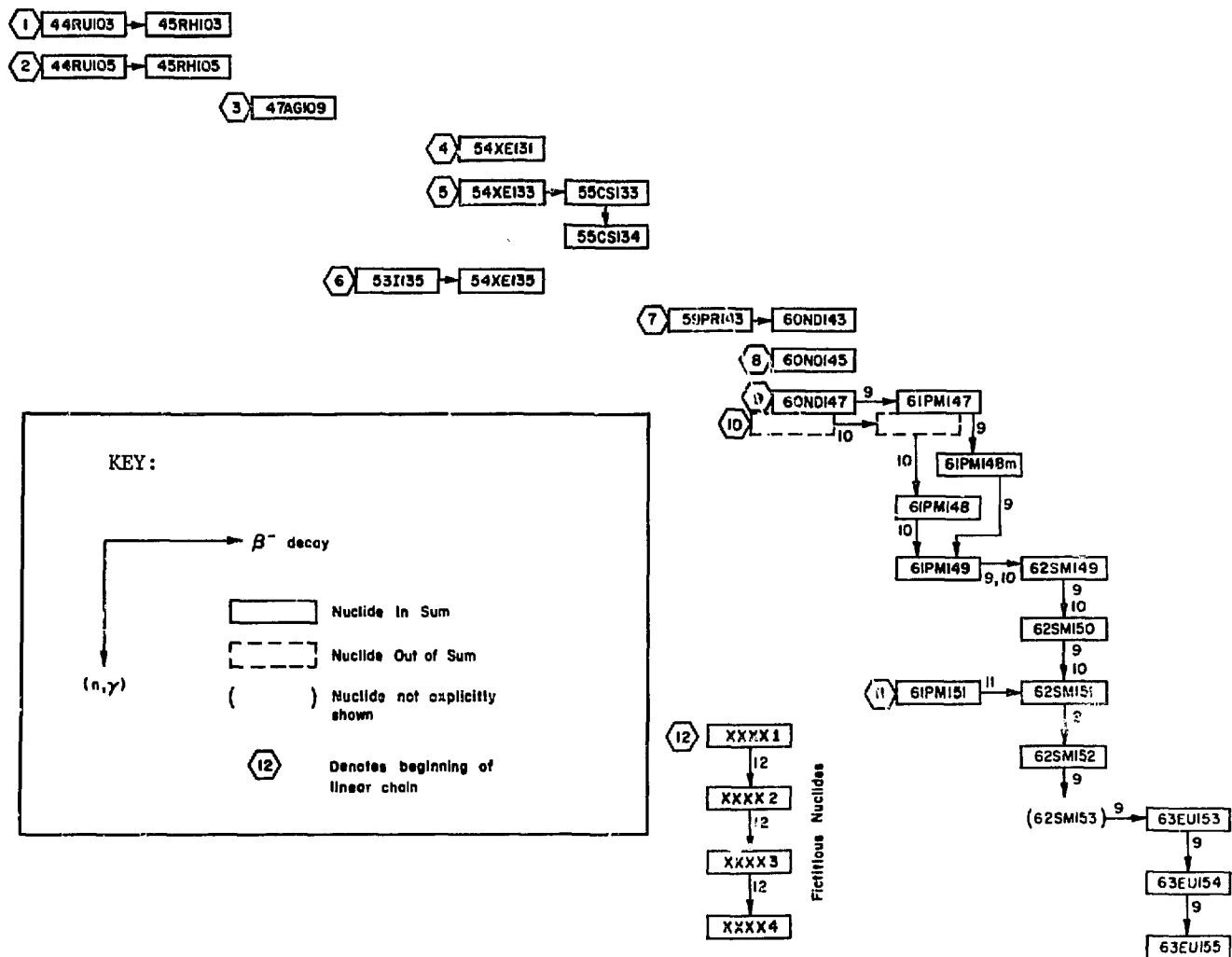


Fig. 2. EPRI-CINDER absorption-decay reduced chain structure.

TABLE 1  
YIELD SETS

<u>Set A</u>	<u>Set B</u>
235 U(T) <sup>a</sup>	235 U(F)
238 U(F)	235 U(HE)
239Pu(T)	238U(HE)
233U(T)	239Pu(F)
232Th(F)	241Pu(T)

---

<sup>a</sup>T denotes the thermal fission yields.

F denotes fast fission yields.

HE denotes high-energy (14 MeV) fission yields.

## Section 5

### INPUT FORMAT

#### General Information

Appendix C contains a listing of the FORTRAN code. It is currently dimensioned for:

- 525 nuclides
- 40 actinides
- 450 fission product chains
- 17 nuclides per chain
- 75 time steps
- 5 yield sets (which can be applied to 7 fissionable nuclides)
- 3 time-dependent g-factors in groups 3 and 4 (factors for 3 nuclides in addition to factors applied to all nuclides)
- 4 neutron energy groups
- 3 energy groups per decay

The actual coding (format) permits ten nuclides in power (ten yield sets) and nine decay energy groups. These and other limitations can be removed by changing the dimension statements.

Actual code variables are extensively defined in the comment cards for user's convenience in interpreting or modifying the code.

The running time depends on the computer and on various factors such as the length and number of time steps, number of nuclides and chains, etc.

#### Options

Most options are sufficiently detailed in the description of the input preparation in the Section entitled "Notes on Input Preparation." The following additional details should answer questions regarding some of the options.

#### Print Options

Normally, EPRI- CINDER provides a print of individual nuclide data at the end of each time step for quantities such as number densities, decay rates, group bars/fission, macroscopic group cross sections, energy decay rates, and other data as itemized in Sec. 6. A full print of all these data, particularly in a decay heat calculation, would be excessive.

The following selectivity in printouts is available. For the fission products only, if 1, 2, or 3 is specified in column 66 of the CONTROL CARD, the program recognizes Column 72 of each TIME CARD and provides prints as noted in the following table.

<u>COLUMN 66 OF CONT CARD</u>	<u>COLUMN 72 OF TIME CARD</u>	<u>PRINTS OR SUPPRESSIONS</u>
Blank or Neg.	Not recognized	Full print, all TS, all nuclides
1	Blank or 0	Barns/fission, macroscopic absorption, number densities and activities per nuclide suppressed
2	Blank or 0	Additional suppression of individual nuclide decay energies
1	1	Full print, all nuclides
2	1	Prints decay energies per nuclide (but not barns/fission, etc.)
3	1	Prints only those nuclides in sum having a decay energy equal to or greater than EMINCT, a per cent of the total MeV/fis for the time step (input on CONTROL CARD)

Note that no print suppressions occur unless column 66 on the CONTROL CARD contains a 1, 2, or 3 punch.

These print suppressions do not affect listings of input data, nuclide data in the depletion group, total summations, or summary output.

To suppress a print of the input fission product data, one must use a 1 punch in column 71 of the CONTROL CARD. Similarly, a zero (or blank) punch in column 35 of the CONTROL CARD suppresses statements of roundoff bypass, and a zero or blank in column 36 suppresses statements on coupling criteria. Normally columns 35 and 36 would be blank.

#### Punch Options

Three subsets of punched output can be obtained by a 1 punch in column 70 of the CONTROL CARD. The cards are headed by the program TITLE CARD and each set of punched data is preceded by a header card labeling the punched columns. In addition, the entire set is sequentially numbered except for the header cards.

Each subset, useful for different purposes, contains some punches redundant with the other sets.

PUNCH SET 1

<u>Format</u>	<u>Columns</u>	<u>Data</u>
6X	1 - 6	Blank
I3	7 - 9	Time step number
2X	10 - 11	Blank
F14.8	12 - 25	TS increment (hrs)
2X	26 - 27	Blank
F14.6	28 - 41	Accumulated time (hrs)
2X	42 - 43	Blank
E12.6	44 - 55	Fission density (fis/barn-cm)
2X	56 - 57	Blank
E12.6	58 - 69	Accumulated fission density (fis/barn-cm)
5X	70 - 72	Blank
I8	73 - 80	Sequential card number

PUNCH CARD SET 2

<u>Format</u>	<u>Columns</u>	<u>Data</u>
6X	1 - 6	Blank
I2	7 - 8	Time-step number
F14.8	9 - 22	TS increments (hrs)
F14.6	23 - 36	Accumulated time (hrs)
E12.5	37 - 48	Total $\beta^-$ energy rates (MeV/s)
E12.5	49 - 60	Total $\gamma$ energy rate (MeV/s)
E12.5	61 - 72	Total $\beta^+ + \gamma$ energy rate (MeV/s)
I8	73 - 80	Sequential card number (continued from set 1)

PUNCH SET 3

Same as Set 2 except energy rates are in MeV/fis.

These punched card data have been added to the summary output normally provided by EPRI-CINDER.

Yield Ordering

Five input yield sets per fission product can be specified. These are normally assigned in sequence to the first five fissionable nuclides specified

as being in power (by a 1 punch in column 69 of the respective NUCLIDE card 2). The order of the nuclides can be changed and assigned to seven fissionable nuclides by inserting a YIELD ORDERING card before the yield deck. This is elected by a 1 punch in column 68 of the CONTROL CARD. For example, if the yield ordering card contains the sequence of numbers 1, 1, 5, 2, 3, 1, 1, then the first input yield is assigned to the first 2 nuclides in power and also to the 6th and 7th nuclides in power; the 5th input yield set is assigned to the 3rd nuclide in power, the 2nd set to the 4th, etc. Yield sets exceeding the number of nuclides in power are ignored. When there are several cases per job using the same fission product deck, the initially stored yields can be reorded without re-inputting the yield deck. This feature permits the use of a single master yield deck (five sets) for several problems.

### Input Deck Structure

Cards or card sets described in the format are supplied in the following sequence:

- \*TITLE (one card)
- \*CONTROL (one card)
- CONTINUATION (one card)
- \*TIME (card set)
- \*DEPELTION NUCLIDES/CHAIN (one or more cards)
- FISSION PRODUCT NUCLIDES/CHAIN (one or more cards)
- \*NUCLIDE SET (2 to 6 cards per nuclide)
- YIELD ORDERING (one card)
- YIELD (card set)
- $K_{\infty}$  (card set)
- DECAY (card set)
- \*JUMP (one card)

Of these, only those with an asterisk must be supplied. The others depend on the option and type of calculation desired. In addition, the full nuclide card set consists of six cards per nuclide, but only the first two per nuclide must always be supplied.

### Notes on Input Preparation

1. Except where specified, it is unnecessary to punch zeros.
2. All quantities must be right-adjusted.
3. A single fission-product deck consisting of CHAIN, NUCLIDE SET, YIELD, AND ENERGY DECKS can be used for any number of cases in a single job. Each case after the first one requires a TITLE, CONTROL, CONTINUATION, TIME, DEPLETION CHAIN, NUCLIDE SET (for depletion nuclides only), YIELD

ORDERING, and  $K_{\infty}$  SET (the CONTINUATION, YIELD ORDERING AND  $K_{\infty}$  cards are options). Thus, the fission product data need be supplied only once. This option requires a 1 punch in column 64 of the CONTROL CARD. The cases are separated by a JUMP CARD (a card having a 1 punched in column 10). All input information per case can be changed except the total number of nuclides in the depletion chains. The stored yields, which can be reordered as desired, will be sequentially associated with the power-contributing nuclides as specified in the depletion chains (case 2 of the nuclide card set). The number of nuclides in power can be changed as can the number of depletion nuclides per chain, cross sections, etc.

4. In the last case of a job, the end JUMP CARD should have a zero punch in column 10.
5. Group-3 and/or -4 shielding factors per nuclide per time step can be supplied for X nuclides (X = 3 in this version).
6. The group-4 spectrum (or shielding) factor supplied on each time card is applied to all nuclides except those having individually specified shielding factors.
7. All total summations over nuclides include only those specified as being in sum (by a 1 punch in column 69 on card 2 of each nuclide card set).
8. If  $(\lambda+A)\Delta t$  is  $\geq 1400$ , then  $\exp[-(\lambda+A)\Delta t]$  is set to zero and, similarly, if  $(\lambda+a)\Delta t$  is less than  $10^{-9}$ ,  $\exp[-(\lambda+A)\Delta t]$  is set to  $1 - (\lambda+A)\Delta t$ .
9. Negative number densities result only when there are input errors, or the roundoff and computing criteria (Sec. 3) are too small for the user's computer. In particular, if an input fission cross section exceeds the absorption cross section in some group, this can result in a negative density of its progeny (coupling type 4).
10. The input number densities are multiplied by  $10^{+24}$  by the code and output densities are reduced by the same factor.
11. Nuclides can have fission cross sections in both depletion and fission product chains. For fission products, this is simply an artifice for accurately representing absorption branching to more than one progeny. However, only nuclides in the depletion group can have power generated by fission. The user must specify that a depletion nuclide is in power; otherwise the fission cross section affects only the coupling.
12. Any depletion nuclide in power must have a specified yield set.
13. For nuclides in power, some non-zero group-3 and -4 cross section must be specified

14. The branching factors [ $\alpha$  in Eq. (2)] can be specified for decay or absorption coupling. For absorption branching this single factor is generally sufficient for all energy groups; when the (n, $\gamma$ ) branching is different in each energy group, the branching can be precisely represented by specifying the cross sections of the opposite branch as "fission" cross sections (type 4 coupling). Note that the code uses  $\alpha = 1.0$  unless column 68 on NUCLIDE CARD type 1 specifies that another factor is used.
15. For some applications, it is desirable to eliminate fuel depletion. This can be done to any desired, but finite, degree by simply reducing the fuel cross sections by, say, a factor of  $10^4$ . A corresponding increase in the initial fuel density will leave the power unchanged.
16. The fourth-group (thermal) cross section in the libraries of Appendices A and B are effective 2200 M/s values (see Sec. 1). Also, cross sections for the actinide chains are reasonable for LWRs, but these are not based on ENDF/B-IV data. The user is expected to supply actinide chains and data for his application; those listed in Appendices A and B are retained only as an aid for the user in interpreting the input format.

EPRI-CINDER Card Data and Format

<u>CARD TYPE</u>	<u>COLUMNS(s)</u>	<u>FORMAT and CARD CONTENT</u>
<u>TITLE</u>		FORMAT (16A5)
	1	Blank
	2-72	Problem description (alphanumeric)
<u>CONTROL</u>		FORMAT (6I3, I2, E12.8, 4I1, 2E12.8 5I2, I1, 2X, F7.6)
	1-3	Number of time steps
	4-6	Number of depletion (non-fission product) chains
	7-9	Total number of nuclides in depletion chains
	10-12	Number of fission product chains
	13-15	Total number of nuclides in fission product chains
	16-18	Input option: blank -- $\phi^4$ is specified (flux groups 1 to 3 are specified as ratios to group 4 as noted on the TIME card); 1 -- power (Watts/cm <sup>3</sup> ) is specified instead of $\phi^4$

- 19-20 Number of expansions, if any. (An expansion is a set of sequential time steps that contain the same values of all quantities on each TIME card; that is, number of expansions is equal to the number of actual time cards, not the number of time steps. This can be blank if data are input for each time step.)
- 21-32 Joules/fission. (The value  $0.32042 \times 10^{-10}$  corresponds to 200 MeV/fission.)
- 33 Maximum number of decay energy groups supplied if decay heat desired.
- 34 Blank -- normal CINDER; 1 --  $K_{\infty}$  options.
- 35 If  $\leq 0$  the print of roundoff bypass is suppressed.
- 36 1 -- print: "Contribution to (nuclide X) from (nuclide y) and preceding nuclides in chain (Z) set to 0" (see roundoff discussion in text).
- 37-48 M: coupling criterion. Check against near zero divisors from  $\beta$  and  $\Delta\beta$ . If blank or negative,  $10^{-6}$  is used.\*
- 49-60 N: roundoff criterion. If blank or negative,  $10^{-9}$  is used.\*
- 61-62 Blank -- new job; 1 -- continuation.
- 63-64 Blank -- denotes that this case requires a new fission product deck if fission product chains are being calculated; 1 -- fission product deck same as preceding case. (The number of nuclides in the depletion chains must be equal to that of preceding case.)
- 65-66 Blank -- all time step data printed.  
 1 -- b/f,  $\Sigma s$ , N,  $\lambda N$ , etc. per nuclide printed only at selected time step.  
 2 -- b/f,  $\Sigma s$ , N,  $\lambda N$ ,  $\lambda NE$  per nuclide printed only at selected time step.  
 3 -- at selected time step print  $N_s$ ,  $\lambda N$ ,  $\lambda NE_s$  for all non-redundant nuclides having a net decay energy exceeding EMINCT (specified in column 74-80 on this card).
- 67-68 Blank -- yield ordered as input; 1 -- yield ordering card will be supplied.
- 69-70 1 -- gives punch output described in Sec. 5, "Print Options."
- 71 1 -- print of input data suppressed.

---

\* M and N must be evaluated for user's machine if default values are not used (see Sec. 3). For CDC 6600, values as small as  $10^{-10}$  and  $10^{-12}$  are suitable for M and N, respectively.

74-80

EMINCT value. This is set to zero if blank. Print option 3 (Column 66 above) will then print only data for those nuclides having decay energies (MeV/s) exceeding EMINCT % of total time step MeV/fis. Therefore, if blank, only the (non-redundant) nuclides are printed. If given a small positive value, only radioactive nuclide data are printed, etc.

CONTINUATION\*

Supply card only if 1 appears in column 62 of CONTROL CARD.

FORMAT (6E11.7)

Initial values of following quantities can be supplied:

- 1-11 Elapsed time (h)
- 12-22 Thermal flux time ( $n/cm^2$ ).
- 23-33 Integrated power (Watt-s/cm<sup>3</sup>)
- 34-44 Integrated neutron absorption (neut/cm<sup>3</sup>).

Any of the above quantities may be zero.

TIME

Supply one card per time step (or expansion) in sequence.

FORMAT (6E11.7, 2I3).

- 1-11 Time step length(s) in h.
- 12-22 Spectrum or shielding factor. This multiplies all thermal cross sections except those given individual factors (card 5 of NUCLIDE CARD SET).
- 23-33  $\phi^1/\phi^4$  } fast-to-thermal flux ratios.
- 34-44  $\phi^2/\phi^4$  } Blank if  $K_\infty$  option is used (1 in column 34 of CONTROL CARD). Then initial values are supplied on a  $K_\infty$  card, following.)
- 45-55  $\phi^3/\phi^4$  }
- 55-66 Either  $\phi^4$  ( $n/cm^2$ -s) or power density (Watts/cm<sup>3</sup>), depending on option specified in columns 16-18 on CONTROL CARD.
- 67-69 Last time step to which above information on this card applies without change; that is, it is not necessary to specify the above information in succeeding time steps until one or more of the TIME CARD quantities change. If data is input each time step, time step number can be specified.
- 70 Punch 1 if full time step print or other print options are desired (recognized only if column 66 of CONTROL CARD has a 1, 2, or 3 punch).

\* This does not refer to a restart of a previous problem. It simply permits specification of initial values of the quantities noted that are otherwise assumed to be zero.

CHAIN CARDS  
(nuclides/chain)

Specified number of nuclides in each chain. There must be at least one card beginning with depletion chains. Start a new card for fission product chain(s), if any (that is, if column 64 of CONTROL CARD is blank).

FORMAT (9X, 20I3).

- 1-9 Blank.
- 10-12 Number nuclides, chain 1.
- 13-15 Number nuclides, chain 2.
- 16-18 Number nuclides, chain 3.
- 19-21 Number nuclides; chain 4.

Continue to column 69 in same manner, 20 values per card. The chains are formed sequentially from the NUCLIDE CARD SET.

NUCLIDE CARD SET

Supply this set of two to six cards for each nuclide in sequence. Only cards 1 and 2 must be supplied.

Card 1

FORMAT (1A6, 5E12.8, I2, I1, I3).

- 1-6 Nuclide identification -- alphabetic and/or numeric information such as U-235, U-238, 92235, etc.
- 7-18 Initial number density (atoms/barn-cm).
- 19-30  $\sigma_a^1$  } Total nuclide microscopic absorption cross section (barns) in each energy group.
- 31-42  $\sigma_a^2$  }
- 43-54  $\sigma_a^3$  }
- 55-66  $\sigma_a^4$  }
- 67-68 Blank: branching factor ( $\alpha$ ) is unity:  
1 -- branching factor follows on card 6.
- 69 1 -- include this nuclide in "total" absorption, barns/fission, decay energy, and disintegration rate summations.  
  
Blank -- omit this nuclide in summations.
- 70-72 1 -- group 3 shielding factors will follow in this series for each time step or expansion.  
  
Blank -- group 3 shielding factor set to 1 at each time step.

Card 2

FORMAT (4X, I2, 5E12,8, 2I3),

- 1-4 May be used for nuclide identification; the information is not used by the program.
- 5-6 Type of coupling to next nuclide where:  
1 = last nuclide in chain (no coupling).  
2 = radioactive decay ( $\gamma = \lambda$ ).  
3 = total absorption cross section ( $\gamma = A^a$ ),  
4 = capture cross section [ $\gamma = (A^a - A^f)$ ].
- 7-18  $\lambda$ , radioactive decay constant ( $\text{sec}^{-1}$ ).
- 19-30  $\sigma_f^1$  }  
31-42  $\sigma_f^2$  } Total nuclide microscopic fission  
43-54  $\sigma_f^3$  } cross section (barns) in each energy  
55-66  $\sigma_f^4$  } group. (Can specify non-zero values  
for fission products for use in coupling type 4, although such products cannot be included in power.)
- 67-69 1 -- include this nuclide in power calculation. NOTE: Yield fractions must be supplied for all fissionable nuclides included in the power calculation (see YIELD cards below).  
Blank -- omit this nuclide in power calculation.
- 70-72 Blank -- thermal shielding factor for this nuclide will follow in this series for each time step or expansion.

Card 3

Supply only if 1 appears in Column 62 of CONTROL CARD, and only for fissionable nuclides included in the power calculation.

FORMAT (6X, 2E12.8)

- 1-6 May be used for identification (not used by code).
- 7-18 Initial fission density (fission/barn-cm).
- 19-30 Initial number density to be used for fuel fraction calculation -- this need not be same as value in column 7-18 of card 1.

Card 4

Supply these cards only if columns 70-72 on Card 1 of NUCLIDE CARD SET contain 1.

Shielding factors multiplying group 3 cross section of this nuclide at each time step or expansion.

FORMAT (6X, 5E12.8)

- 1-6            May be used for identification (not used by code).
- 7-18           Factor for time step 1 or expansion 1.
- 19-30          Factor for time step 2 or expansion 2.
- 31-42          Factor for time step 3 or expansion 3.
- 43-54          Factor for time step 4 or expansion 4.
- 55-66          Factor for time step 5 or expansion 5.

If there are more than five time steps or expansions, continue on new card in same format.

Card 5

Supply these cards only if columns 70-72 on card 2 of NUCLIDE CARD SET contain 1.

Shielding factors multiplying group 4 cross section of this nuclide.

FORMAT (6X, 5E12.8)

- 1-6            May be used for identification (not used by code).
- 7-18           Factor for time step 1 or expansion 1
- 19-30          Factor for time step 2 or expansion 2.
- 31-42          Factor for time step 3 or expansion 3.
- 43-54          Factor for time step 4 or expansion 4.
- 55-66          Factor for time step 5 or expansion 5.

If there are more than five timesteps or expansions, continue on new card in same format.

Card 6

FORMAT (6X, E12.8).

- 1-6            Can be used for nuclide identification (not used by code).
- 7-18            $\alpha$  factor (branching fraction).

YIELD ORDERING

FORMAT (6X, 7I3)

Supply only if column 68 of CONTROL CARD contains a 1 punch. The yields supplied in the next card set will be associated with the fissionable nuclides in the specified numerical order.

- 7-9            Numerical order of the yield set to be used for first nuclide in power.
- 10-12         Numerical order of the yield set to be used for second nuclide in power.
- 13-15         }  
                   .  
                   .  
                   .  
                   }  
- 25-27         Same as above. As many as seven values may be supplied. (See Sec. 5, "Options.")

YIELD

Supply a yield fraction per fission (even if zero) for each fission product (in the NUCLIDE CARD SET sequence) from each fissionable nuclide included sequentially in power, as indicated by card 2 of NUCLIDE CARD SET (columns 67-69). Yield cards must be omitted if there are no fission products.

FORMAT (6X, 5E12.8)

- 1-6 May be used for identification (not used by code).
- 7-18 Fractional yield from fissionable nuclide 1
- 19-30 Fractional yield from fissionable nuclide 2
- 31-42 Fractional yield from fissionable nuclide 3
- 43-54 Fractional yield from fissionable nuclide 4
- 55-66 Fractional yield from fissionable nuclide 5

The yield cards are sequentially associated with the nuclide cards (nuclides in power) unless a yield ordering card is supplied. Sequential cases of the same job use the last specified yield ordering. Yield sets past the number of nuclides in power are ignored.

K<sub>∞</sub> Option Cards

This option requires that column 34 of the CONTROL CARD have a 1 punch. It is otherwise blank. Also, on the TIME CARD, columns 23-55 --  $\phi^1/\phi^4$ ,  $\phi^2/\phi^4$ , and  $\phi^3/\phi^4$  should be blank. The calculated fast-to-thermal flux ratios from the preceding time step are used for each succeeding time step. The initial flux ratios are supplied as noted below.

(NOTE: Macroscopic cross sections are not multiplied by g factors.) After the last YIELD CARD, include, in order noted, the following cards (when there are no YIELD or YIELD ORDERING CARDS, insert these after the NUCLIDE CARD SET):

Card 1

NU CARD(S) -- (6X, 5F12.8) -- one card for each nuclide in power in sequence (card 2 of NUCLIDE CARD SET, column 69).

- 1-6 May be used for nuclide identification (not used by code).
- 7-18  $v^1$  } Average number of neutrons produced
- 19-30  $v^2$  } per fission in each energy group.
- 31-42  $v^3$  }
- 43-54  $v^4$  }

Card 2

Removal and initial Fast-to-Thermal Flux Ratio Card (E 12.8).

1-12	$\Sigma_r^1$	} Total constant macroscopic removal cross section, in each energy group.
13-24	$\Sigma_r^2$	
25-36	$\Sigma_r^3$	
37-48	$\phi^1/\phi^4$	} Initial fast-to-thermal flux ratios. ( $\phi^1/\phi^4$ is blank on TIME CARD.)
49-60	$\phi^2/\phi^4$	
61-72	$\phi^3/\phi^4$	

Card 3

Macroscopic capture parameters (4E12.8,2I2).

1-12	$\Sigma_c^1$	} Total constant macroscopic capture cross sections (and/or leakage $DB^2$ ) in each energy group.
13-24	$\Sigma_c^2$	
25-36	$\Sigma_c^3$	
37-48	$\Sigma_c^4$	

50 Number of neutron energy groups (1 to 4).

52 Numerical position of the nuclide (of those included in the power calculation) for which the fuel fraction will be edited (counting the first nuclide in power as 1).

ENERGY CARDS (DECAY HEAT)

To elect this option, insert the number of decay energy groups in column 33 of CONTROL CARD. The ENERGY CARD SET is input after the YIELD deck (or after the  $K_\infty$  set when present). When no YIELD deck is input, insert after NUCLIDE CARD SET. For each nuclide, the following card(s) are necessary even if all energies are zero.

Card 1

FORMAT (6X,5E12.8)

1-6	May be used for nuclide identification (not used by code).
7-18	$E^\beta$ MeV/disintegration
19-30	$E_1^\gamma$ MeV/disintegration
31-42	$E_2^\gamma$ MeV/disintegration
43-54	$E_3^\gamma$ MeV/disintegration
55-66	$E_4^\gamma$ MeV/disintegration

Card 2 (if necessary)

FORMAT (6X, 5E12,8).

1-6	May be used for nuclide identification (not used by code).
7-18	$E_5^\gamma$ MeV/disintegration
19-30	$E_6^\gamma$ MeV/disintegration
31-42	$E_7^\gamma$ MeV/disintegration
43-54	$E_8^\gamma$ MeV/disintegration

JUMP OR SPACER

The last card of each case is a spacer card. If the preceding case is the last (or only) one in the job, this card must have a 0 punch in column 10. If at least one more case is to follow, a 1 must be punched in column 10. Succeeding cases must supply all depletion nuclide cards except decay energies. The only restriction to using the previously stored fission product data is that the total number of nuclides in the depletion group must not change. Previously stored yields can be reordered by supplying a YIELD ORDERING CARD.

Section 6

CODE OUTPUT

Depending on the print option chosen, the following information is printed:

1. A summary of all input data used in the actual calculations.
2. At the end of each time step:
  - time increment
  - elapsed time
  - fissions (during the increment and total per nuclide in power)
  - total thermal flux time
  - flux levels per group
  - barns/fission per nuclide per group
  - macroscopic absorption per nuclide per group
  - density per nuclide
  - activity per nuclide
  - total barns/fission and macroscopic absorption for nuclides in sum per group
  - fuel fractions
  - total activity for nuclides in sum

3. A summary of aggregate data per time step following the last time increment is also given consisting of barns/fission, macroscopic absorption, elapsed time, thermal flux time, an effective (one group) cross section, and a resonance integral.\*\*

Other information is also printed, depending on the options specified in the previous section, such as reactivity and specific activation of some roundoff criteria. A summary output for the total library in Appendix A is given in Table II. Punched output is also provided, depending on the options itemized in the previous section. Decay energy information is provided per nuclide per decay group and aggregate values if an energy deck is supplied.

## Section 7

### SUGGESTIONS FOR USE IN CODE MODIFICATIONS

Many users of CINDER have existing libraries for special purposes (for example, actinide chains for use in waste disposal studies, chains for use in calculating irradiation effects on structural materials and impurities, etc). Therefore, the basic input format has been retained; it is compatible with earlier versions of the code. EPRI-CINDER incorporates the added capabilities described in Ref. 2 and additional roundoff control incorporated into CINDER-7,<sup>4</sup> but these changes do not alter the original input format. Some users may need to reduce required storage, and others may

\*The effective cross section, in the units of barns/fission, is simply

$$\hat{\sigma}_{\text{eff}} = \hat{\sigma}^4 + \frac{\phi^3}{\phi^4} \hat{\sigma}^3 + \frac{\phi^2}{\phi^4} \hat{\sigma}^2 + \frac{\phi^1}{\phi^4} \hat{\sigma}^1 ,$$

which will give the same reaction rate as the sum of the group values when multiplied by the thermal (group 4) flux.

\*\*The resonance integral (barns/fission) is defined as

$$\hat{\text{RI}} = 9.088 \hat{\sigma}^3 + 5 \hat{\sigma}^2 + 2.5 \hat{\sigma}^1 ,$$

where the numerical factors are the group lethargies (for the libraries in Appendices A and B).

TABLE 2

SAMPLE OF SUMMARY OUTPUT FROM EPRI-CINDER

SUMMARY OF PROBLEM OUTPUT:  
 EPRI-CINDER 64-CHAIN FISSION-PRODUCT ABSORPTION LIBRARY.ENDF/B-4.LASL DEC.1976 (PWR EXAMPLE)

TIME STEP	ELAPSED TIME	THERMAL FLUX TIME	TOTAL BARNS/FISSION			
			GROUP 1	GROUP 2	GROUP 3	GROUP 4
1	1000.0000	2.714439E+19	4.913950E-02	2.323602E-01	1.816104E+01	1.712375E+03
2	2000.0000	5.419078E+19	5.046383E-02	2.385250E-01	1.884384E+01	9.204578E+02
3	3000.0000	8.116896E+19	5.105207E-02	2.417094E-01	1.924589E+01	6.427351E+02
4	4000.0000	1.081057E+20	5.141245E-02	2.438497E-01	1.951407E+01	5.018577E+02
5	5000.0000	1.350251E+20	5.167656E-02	2.454460E-01	1.969803E+01	4.163074E+02
6	6000.0000	1.619493E+20	5.189169E-02	2.467119E-01	1.982506E+01	3.585872E+02
7	7000.0000	1.888986E+20	5.207858E-02	2.477600E-01	1.991218E+01	3.168507E+02
8	8000.0000	2.158917E+20	5.224756E-02	2.486560E-01	1.997054E+01	2.851620E+02
9	9000.0000	2.429459E+20	5.240424E-02	2.494412E-01	2.000767E+01	2.602146E+02
10	10000.0000	2.700775E+20	5.255189E-02	2.501424E-01	2.002878E+01	2.400179E+02
11	11000.0000	2.973019E+20	5.269251E-02	2.507781E-01	2.003756E+01	2.233004E+02
12	12000.0000	3.246335E+20	5.282740E-02	2.513511E-01	2.003668E+01	2.092107E+02
13	13000.0000	3.520859E+20	5.295744E-02	2.519037E-01	2.002809E+01	1.971567E+02
14	14000.0000	3.796722E+20	5.308325E-02	2.524036E-01	2.001326E+01	1.867133E+02
15	15000.0000	4.074049E+20	5.320532E-02	2.528752E-01	1.999330E+01	1.775672E+02
16	16000.0000	4.352961E+20	5.332402E-02	2.533194E-01	1.996907E+01	1.694823E+02
17	17000.0000	4.633572E+20	5.343963E-02	2.537393E-01	1.994123E+01	1.622771E+02
18	18000.0000	4.915995E+20	5.355243E-02	2.541374E-01	1.991031E+01	1.558096E+02
19	19000.0000	5.200337E+20	5.366261E-02	2.545158E-01	1.987674E+01	1.499674E+02
20	20000.0000	5.486704E+20	5.377037E-02	2.548761E-01	1.984084E+01	1.446600E+02

TABLE 2 (continued)

TIME STEP	ELAPSED TIME	THERMAL FLUX TIME	TOTAL MACROSCOPIC POISON			
			GROUP 1	GROUP 2	GROUP 3	GROUP 4
1	1000.0000	2.714439E+19	5.530950E-07	2.615356E-06	2.044135E-04	1.927383E-02
2	2000.0000	5.419078E+19	1.135692E-06	5.368020E-06	4.240819E-04	2.071496E-02
3	3000.0000	8.116896E+19	1.722955E-06	8.157443E-06	6.495288E-04	2.169334E-02
4	4000.0000	1.081057E+20	2.312935E-06	1.097027E-05	8.778955E-04	2.257749E-02
5	5000.0000	1.350251E+20	2.905364E-06	1.379948E-05	1.107464E-03	2.340567E-02
6	6000.0000	1.619493E+20	3.500204E-06	1.664124E-05	1.337242E-03	2.418746E-02
7	7000.0000	1.888986E+20	4.097452E-06	1.949332E-05	1.566656E-03	2.492926E-02
8	8000.0000	2.158917E+20	4.697098E-06	2.235438E-05	1.795368E-03	2.563630E-02
9	9000.0000	2.429459E+20	5.299119E-06	2.522350E-05	2.023176E-03	2.631290E-02
10	10000.0000	2.700775E+20	5.903478E-06	2.810004E-05	2.249956E-03	2.696269E-02
11	11000.0000	2.973019E+20	6.510127E-06	3.098348E-05	2.475629E-03	2.758863E-02
12	12000.0000	3.246335E+20	7.119015E-06	3.387340E-05	2.700141E-03	2.819322E-02
13	13000.0000	3.520859E+20	7.730085E-06	3.676941E-05	2.923458E-03	2.877855E-02
14	14000.0000	3.796722E+20	8.343279E-06	3.967116E-05	3.145553E-03	2.934638E-02
15	15000.0000	4.074049E+20	8.958543E-06	4.257833E-05	3.366408E-03	2.989820E-02
16	16000.0000	4.352961E+20	9.575823E-06	4.549060E-05	3.586006E-03	3.043530E-02
17	17000.0000	4.633572E+20	1.019507E-05	4.840769E-05	3.804333E-03	3.095878E-02
18	18000.0000	4.915995E+20	1.081623E-05	5.132930E-05	4.021378E-03	3.146959E-02
19	19000.0000	5.200337E+20	1.143927E-05	5.425516E-05	4.237127E-03	3.196858E-02
20	20000.0000	5.486704E+20	1.206413E-05	5.718501E-05	4.451570E-03	3.245648E-02

TABLE 2 (continued)

SUMMARY OF PROBLEM OUTPUT  
 EPRI-CINDER 84-CHAIN FISSION-PRODUCT ABSORPTION LIBRARY.ENDF/B-4.LASL DECK.1976 (PWR EXAMPLE)

TIMESTEP	ELAPSED TIME	LAMBDA * N	TOT B	TOT G	TOT B PLUS G
1	1000.0000	3.382613E+12	0.	0.	0.
2	2000.0000	3.712262E+12	0.	0.	0.
3	3000.0000	3.884642E+12	0.	0.	0.
4	4000.0000	3.992770E+12	0.	0.	0.
5	5000.0000	4.064316E+12	0.	0.	0.
6	6000.0000	4.113258E+12	0.	0.	0.
7	7000.0000	4.147892E+12	0.	0.	0.
8	8000.0000	4.173339E+12	0.	0.	0.
9	9000.0000	4.192802E+12	0.	0.	0.
10	10000.0000	4.208301E+12	0.	0.	0.
11	11000.0000	4.221119E+12	0.	0.	0.
12	12000.0000	4.232078E+12	0.	0.	0.
13	13000.0000	4.241712E+12	0.	0.	0.
14	14000.0000	4.250369E+12	0.	0.	0.
15	15000.0000	4.258283E+12	0.	0.	0.
16	16000.0000	4.265613E+12	0.	0.	0.
17	17000.0000	4.272471E+12	0.	0.	0.
18	18000.0000	4.278935E+12	0.	0.	0.
19	19000.0000	4.285068E+12	0.	0.	0.
20	20000.0000	4.290914E+12	0.	0.	0.

TABLE 2 (continued)

TIME STEP	ELAPSED TIME IN HOURS	THERMAL FLUX TIME	EFFECTIVE CROSS SECTION	RESONANCE INTEGRAL
1	1000.0000	2.71444E+19	1.7719445E+03	1.6633217E+02
2	2000.0000	5.41908E+19	9.8225424E+02	1.7257161E+02
3	3000.0000	8.11690E+19	7.0589076E+02	1.7624280E+02
4	4000.0000	1.08106E+20	5.6583856E+02	1.7869163E+02
5	5000.0000	1.35025E+20	4.8086583E+02	1.8037213E+02
6	6000.0000	1.61949E+20	4.2358044E+02	1.8153344E+02
7	7000.0000	1.88899E+20	3.8212930E+02	1.8233089E+02
8	8000.0000	2.15892E+20	3.5063267E+02	1.8286618E+02
9	9000.0000	2.42946E+20	3.2580846E+02	1.8320793E+02
10	10000.0000	2.70078E+20	3.0568309E+02	1.8340366E+02
11	11000.0000	2.97302E+20	2.8899694E+02	1.8348700E+02
12	12000.0000	3.24633E+20	2.7490726E+02	1.8348222E+02
13	13000.0000	3.52086E+20	2.6282821E+02	1.8340718E+02
14	14000.0000	3.79672E+20	2.5233950E+02	1.8327522E+02
15	15000.0000	4.07405E+20	2.4313148E+02	1.8309649E+02
16	16000.0000	4.35296E+20	2.3497076E+02	1.8287878E+02
17	17000.0000	4.63357E+20	2.2767802E+02	1.8262818E+02
18	18000.0000	4.91599E+20	2.2111306E+02	1.8234949E+02
19	19000.0000	5.20034E+20	2.1516469E+02	1.8204654E+02
20	20000.0000	5.48670E+20	2.0974349E+02	1.8172240E+02

END OF OUTPUT FOR THIS PROBLEM

desire to use the additional but unused information in the data libraries (that is, charge and mass numbers per nuclide) on the data cards of Appendices A and B for special edits or data checking. Some simple suggestions are incorporated here.

#### Variable Dimensions

Because the code is used in a variety of applications, the ideal storage would use variable dimensioning. This would require major code modifications and has already been done, along with other automatic data interpretation and handling procedures in Version-7 (Ref. 4). There are some non-standard FORTRAN routines in Version-7 but these are now compatible with most major computers. Some users may therefore desire to use Version-7 (available from the Argonne Code Center or EPRI). The input format of Version-7 is very different from EPRI-CINDER. A code to change the data libraries of Appendices A and B to the Version-7 format would not be complicated to write. However, as noted in Sec. 1, EPRI-CINDER is fast, uses standard ANSI FORTRAN and, for absorption calculations with the data set of Appendix A, it is the recommended version. Users who desire to modify the code for some special purpose or to reduce storage may find the comments in this section helpful. In addition, the source listing of the code in Appendix C now has extensive comments.

#### Suggestions for Storage Reduction

The dimensioned variables E(525,3) and RSL(525,5) are used only for decay heat calculations. These dimensions can be greatly reduced for absorption calculations.

The quantity 75 in all dimensioned variables refers to the maximum number of time increments. Most users would not require more than 20. The 525 dimension refers to the maximum number of nuclides (fission products plus depletion-chain nuclides). This can also be reduced for many applications, although the data set of Appendix A requires most of this storage.

Some yields are redundantly stored in YLD(524,4) and Y(524,7). If yield reordering is not used, these can be made equivalent. Further significant reductions in storage require coding changes.

Currently, the state of knowledge on nuclide cross sections is such that branching by  $(n,\gamma)$  reactions in the fission products can be adequately represented by a single branching fraction for all groups. The use of the fictitious fission cross section to delineate  $(n,\gamma)$  branching by groups as described in Sec. 5 is not justified by current data. The single branching fraction  $\alpha$  is sufficient. The code could, therefore, be altered to permit fission cross sections only for depletion chains. This would permit the dimensions of several variables to be reduced from 525 to the maximum number of depletion nuclides. In particular the the dimensions of the variables F, NPWR, FSN1, FSN2, FSN3, and FSN4 could be reduced. To make the coding change, the variable NETDP (the number of nuclides in the depletion chain specified on the control card could be used in specifying the reading of the nuclide card set, and the code variable MPART(=2) used to eliminate calculated and printed values involving the fission cross sections during computations of the fission product chains.

#### Numerics

The only difficulty ever reported with the basic CINDER algorithms is overflow in calculating the products of coupling parameters and destruction rates in Eq. (2), and this problem has only been reported by UNIVAC 1108 users. Short of altering the coding sequence, UNIVAC 1108 users may find that the use of double precision for calculated values of PRGOG, PRODA, PRODB, and related variables, and relaxing the roundoff control will suffice.

## REFERENCES

1. T. R. England, "CINDER -- A One-Point Depletion and Fission Product Program," Bettis Atomic Power Laboratory report WAPD-TM-334 (Rev) (1964).
2. T. R. England, "An Investigation of Fission Product Behavior and Decay Heating in Nuclear Reactors," Thesis, University of Wisconsin, (University Microfilm Order No. 70-12, 727) (1969).
3. T. R. England, "Time-Dependent Fission-Product Thermal and Resonance Absorption Cross Sections," Bettis Atomic Power Laboratory report WAPD-TM-333 (April 1962) and Addendum 1 (January 1965).
4. T. R. England, R. Wilczynski, and N. L. Whitemore, "CINDER-7: An Interim Report for Users," Los Alamos Scientific Laboratory report LA-5885-MS (April 1975).
5. R. J. LaBauve and W. B. Wilson, "Proposal to Extend CSEWG Neutron and Photon Multigroup Structure for Wider Applications," Los Alamos Scientific Laboratory report LA-6240-P (February 1976).
6. T. R. England and R. E. Schenter, "ENDF/B-IV Fission-Product Files: Summary of Major Nuclide Data," Los Alamos Scientific Laboratory report LA-6116-MS (ENDF-223) (October 1975).
7. T. R. England and M. G. Stamatiatos, "Multigroup Beta and Gamma Spectra of Individual ENDF/B Fission-Product Nuclides," Los Alamos Scientific Laboratory report LA-NUREG-6622-MS (December 1976).
8. W. E. Meek and B. F. Rider, "Compilation of Fission Product Yields," Vallecitos Nuclear Center report NEDO-12154-1, 74-NED6 (January 1974).

APPENDIX A

\*\*\*\*\*  
 \*\*\* EPRI-CINDER 84-CHAIN LIBRARY \*\*\*  
 \*\*\*\*\*

\*\*\*\*\*  
 \*THE DATA FILE LISTED HERE INCLUDES YIELD DECK A AS DESCRIBED IN TABLE I OF \*\*  
 \*SECTION 4.THREE DEPLETION CHAINS FROM A PREVIOUS CINDER LIBRARY ARE INCLUD- \*\*  
 \*ED.THIS DATA FILE, CONSISTING OF 1538 RECORDS, HAS THE INITIAL FUEL NUMRER \*\*  
 \*DENSITIES REQUIRED FOR CALCULATING THE TYPICAL PWR FUEL PROBLEM OF EXAMPLE 1\*\*  
 \*IN SECTION 6 OF PART 1,WITH SUMMARY OUTPUT LISTED IN TABLE 2,SECTION 6 OF \*\*  
 \*PART 2.THE CONTENT OF EACH RECORD IS DESCRIBED IN SECTION 5--EPRI-CINDER \*\*  
 \*CARD DATA AND FORMAT. RECORDS ARE IDENTIFIED AS FOLLOWS \*\*  
 \* \*\*

RECORD(S)	DESCRIPTION
1	TITLE CARD
2	CONTROL CARD
3	TIME CARD
4	CHAIN CARD FOR DEPLETION CHAINS
5-9	CHAIN CARDS FOR FISSION-PRODUCT CHAINS
10-39	NUCLIDE CARD SETS FOR DEPLETION CHAIN NUCLIDES
40-1052	NUCLIDE CARD SETS FOR FISSION-PRODUCT CHAIN NUCLIDES
1053	YIELD ORDERING CARD
1054-1537	YIELD CARDS (YIELD DECK A)
1538	JUMP CARD

\*\*\*\*\*  
 \* \*\*\*\*\*  
 \* YIELD DECK B (484 RECORDS) IS LISTED SEPERATELY, FOLLOWING THIS DATA FILE \*\*  
 \* \*\*  
 \*\*\*\*\*

EPRI-CINDER 84-CHAIN FISSION-PRODUCT ABSORPTION LIBRARY. ENDF/R-4.LASL DEC.1976  
 20 3 15 84484 1 13.2042 -11 11.0 -121.0 -14 1

A-1

1.000 +03 1.0 2.6499R 4.22387 3.21885 1.0 +02 20  
 9 2 4  
 5 1 7 5 1 2 3 3 2 4 3 6 2 6 9 4 0 R 4 R  
 5 3 9 7 4 5 4 4 5 4 5 4 5 6 4 4 6 7 6 R  
 1 6 5 5 4 R 4 5 5 3 5 6 5 5 5 6 4 4 4 17  
 17 10 10 10 6 6 4 8 R 13 11 11 6 2 11 9 4 0 3 6  
 3 9 9 1

*TH232	0.0		1.66	-01	2.94	-01	1.87	+00	7.33	+00		90232X01
A 1 4	0.0		9.20	-02	0.0	-01	0.0		0.0			90232X02
PA233	0.0		7.65	-01	1.98	-01	5.83	+01	4.32	+01		91233X03
A 2 2	2.971	-07	7.64	-01	8.26	-03	0.0		0.0			91233X04
U-233	0.0		1.99	+00	3.21	+00	6.01	+01	5.85	+02		92233X05
A 3 4	0.0		1.93	+00	2.93	+00	5.10	+01	5.35	+02		92233X06
U-234	5.9	-06	1.56	+00	7.99	-01	3.40	+01	9.20	+01		92234X07
A 4 4	0.0		1.41	+00	2.43	-01	0.0		0.0			92234X08
U-235	6.3	-04	1.29	+00	2.25	+00	3.80	+01	6.32	+02		92235X09
A 5 4	0.312	-16	1.19	+00	1.76	+00	2.44	+01	5.34	+02	i	92235X10
U-236	0.0		8.44	-01	3.92	-01	3.68	+01	6.00	+00		92236X11
A 6 4	0.0		7.26	-01	7.24	-03	0.0		0.0			92236X12
NP237	0.0		1.67	+01	1.37	+01	6.20	+01	3.70	+02		93237X13
A 7 4	0.0		1.46	+00	9.24	-01	1.0	-03	0.0			93237X14
PU238	0.0		0.0		0.0		2.00	+01	4.12	+02		94238X15
A 8 4	2.45	-10	0.0		0.0		1.40	+00	1.70	+01		94238X16
PU239	0.0		3.10	+00	3.10	+00	5.30	+01	2.23	+03		94239X17
A 9 1	0.0		1.94	+00	1.86	+00	2.92	+01	1.37	+03	i	94239X18
U-238	2.16	-02	4.42	-01	2.62	-01	2.30	+00	2.73	+00		92238X19
B 1 4	0.0		3.70	-01	4.00	-04	0.0		0.0		i	92238X20
PU239	0.0		3.10	+00	3.10	+00	5.30	+01	2.23	+03		94239X21
B 2 1	0.0		1.94	+00	1.86	+00	2.92	+01	1.37	+03	i	94239X22
*TH232	0.0		1.66	-01	2.94	-01	1.87	+00	7.33	+00		90232X23
C 1 4	0.0		9.20	-02	0.0	-01	0.0		0.0			90232X24
PA233	0.0		7.65	-01	1.98	-01	5.83	+01	4.32	+01		91233X25
C 2 4	2.971	-07	7.64	-01	8.26	-03	0.0		0.0			91233X26
U-234	0.0		1.56	+00	7.99	-01	3.40	+01	9.20	+01		92234X27
C 3 4	0.0		1.41	+00	2.43	-01	0.0		0.0			92234X28
U-235	0.0		1.29	+00	2.25	+00	3.80	+01	6.32	+02		92235X29

	C 4 1 0.0	1.19	+00 1.76	+00 2.44	+01 5.34	+02	92235x30
*7N	720.0	0.	0.	0.	0.	1	30 72 1
1 1	24.140700E-060.0	0.0	0.0	0.0	0.0	1	30 72 2
GA	720.0	0.	0.	0.	0.	1	31 72 3
1 2	21.365500E-050.0	0.0	0.0	0.0	0.0	1	31 72 4
GE	720.0	2.099716E-025.432289E-028.043696E-029.885840E-01	0.0	0.0	0.0	1	32 72 5
1 3	30.	0.0	0.0	0.0	0.0	1	32 72 6
GF	730.0	4.379093E-021.769910E-018.051782E+001.512879E+01	0.0	0.0	0.0	1	32 73 7
1 4	30.	0.0	0.0	0.0	0.0	1	32 73 8
GE	740.0	9.484258E-033.185640E-024.402824E-023.865945E-01	0.0	0.0	0.0	1	32 74 9
1 5	10.	0.0	0.0	0.0	0.0	1	32 74 10
*AS	750.0	3.174023E-022.399267E-017.066404E+004.347936E+00	0.0	0.0	0.0	1	33 75 11
2 1	10.	0.0	0.0	0.0	0.0	1	33 75 12
*GE	760.0	2.668907E-039.284226E-031.632492E-011.433464E-01	0.0	0.0	0.0	1	32 76 13
3 1	30.	0.0	0.0	0.0	0.0	1	32 76 14
GE	770.0	0.	0.	0.	0.	1	32 77 15
3 2	21.703900E-050.0	0.0	0.0	0.0	0.0	1	32 77 16
AS	770.0	0.	0.	0.	0.	1	33 77 17
3 3	24.962400E-060.0	0.0	0.0	0.0	0.0	1	33 77 18
SE	770.0	2.397412E-022.570206E-013.571884E+004.234688E+01	0.0	0.0	0.0	1	34 77 19
3 4	30.	0.0	0.0	0.0	0.0	1	34 77 20
SE	780.0	1.233979E-024.559968E-025.350889E-014.032650E-01	0.0	0.0	0.0	1	34 78 21
3 5	30.	0.0	0.0	0.0	0.0	1	34 78 22
SE	790.0	0.	0.	5.000000E-031.111110E-01	0.0	1	34 79 23
3 6	33.381500E-130.0	0.0	0.0	0.0	0.0	1	34 79 24
SE	800.0	1.224080E-024.557911E-028.982662E-026.159067E-01	0.0	0.0	0.0	1	34 80 25
3 7	10.	0.0	0.0	0.0	0.0	1	34 80 26
*RR	810.0	4.217740E-022.809681E-015.719193E+002.714348E+00	0.0	0.0	0.0	1	35 81 27
4 1	30.	0.0	0.0	0.0	0.0	1	35 81 28
RR	820.0	0.	0.	0.	0.	1	35 82 29
4 2	25.439000E-060.0	0.0	0.0	0.0	0.0	1	35 82 30
KR	820.0	3.209819E-021.243721E-011.984202E+013.043078E+01	0.0	0.0	0.0	1	36 82 31
4 3	30.	0.0	0.0	0.0	0.0	1	36 82 32
KR	830.0	6.710060E-023.993954E-011.841473E+012.019790E+02	0.0	0.0	0.0	1	36 83 33
4 4	30.	0.0	0.0	0.0	0.0	1	36 83 34
KR	840.0	4.472712E-031.912670E-024.376474E-018.362721E-02	0.0	0.0	0.0	1	36 84 35

4 5 10.	0.0	0.0	0.0	0.0		36 84 36
*SF 820.0	3.747510E-03	1.079513E-02	1.686126E-03	4.536163E-02	1	34 82 37
5 1 10.	0.0	0.0	0.0	0.0		34 82 38
*KR85M0.0	0.	0.	0.	0.	11	36 85 39
6 1 24.297800E-05	0.0	0.0	0.0	0.0		36 85 40
6 1BF7.880000E-01						36 85 41
RR 850.0	2.080914E-02	2.157803E-01	5.395468E-01	4.649955E-01	1	37 85 42
6 2 10.	0.0	0.0	0.0	0.0		37 85 43
*KR85M0.0	0.	0.	0.	0.	1	36 85 44
7 1 24.297800E-05	0.0	0.0	0.0	0.0		36 85 45
7 1BF2.120000E-01						36 85 46
KR 850.0	4.363354E-03	2.864559E-02	1.600506E-01	1.677860E+00	1	36 85 47
7 2 22.047000E-09	0.0	0.0	0.0	0.0		36 85 48
RR 850.0	2.080914E-02	2.157803E-01	5.395468E-01	4.649955E-01	1	37 85 49
7 3 10.	0.0	0.0	0.0	0.0		37 85 50
*KR85M0.0	0.	0.	0.	0.	1	36 85 51
8 1 24.297800E-05	0.0	0.0	0.0	0.0		36 85 52
8 1BF2.120000E-01						36 85 53
KR 850.0	4.363354E-03	2.864559E-02	1.600506E-01	1.677860E+00		36 85 54
8 2 32.047000E-09	0.0	0.0	0.0	0.0		36 85 55
KR 860.0	1.108820E-03	3.162755E-03	1.545394E-02	6.212414E-02	1	36 86 56
8 3 10.	0.0	0.0	0.0	0.0		36 86 57
*RR 870.0	1.287127E-03	8.266649E-03	2.536605E-01	1.211208E-01	1	37 87 58
9 1 34.676500E-19	0.0	0.0	0.0	0.0		37 87 59
SR 880.0	1.329117E-03	1.164227E-03	2.201289E-04	5.853738E-03	1	38 88 60
9 2 10.	0.0	0.0	0.0	0.0		38 88 61
*SR 890.0	8.295338E-03	2.038841E-02	3.876896E-02	4.239056E-01	1	38 89 62
10 1 21.542800E-07	0.0	0.0	0.0	0.0		38 89 63
Y 890.0	7.136131E-03	2.253723E-02	8.228017E-02	1.293395E+00	1	39 89 64
10 2 30.	0.0	0.0	0.0	0.0		39 89 65
Y 900.0	1.138581E-02	1.465555E-01	4.323381E-01	3.527849E+00	1	39 90 66
10 3 23.004700E-06	0.0	0.0	0.0	0.0		39 90 67
ZR 900.0	1.508096E-02	2.520652E-02	1.987868E-02	1.008428E-01	1	40 90 68
10 4 10.	0.0	0.0	0.0	0.0		40 90 69
*SR 900.0	4.920037E-03	1.560162E-02	3.315065E-02	9.072648E-01	1	38 90 70
11 1 27.816500E-10	0.0	0.0	0.0	0.0		38 90 71

Y 900.0	1.138581E-021.146555E-014.323381E-013.527849E+00	1	39 90 72
11 2 23.004700E-060.0	0.0	0.0	39 90 73
ZR 900.0	1.508096E-022.520652E-021.987868E-021.008428E-01	1	40 90 74
11 3 10.	0.0	0.0	40 90 75
*SR 900.0	4.920037E-031.560162E-023.315065E-029.072648E-01		38 90 76
12 1 37.816500E-100.0	0.0	0.0	38 90 77
SR 910.0	0.	0.	38 91 78
12 2 22.031000E-050.0	0.0	0.0	38 91 79
Y 910.0	4.217073E-033.284697E-021.639328E-011.412780E+00	1	39 91 80
12 3 21.369000E-070.0	0.0	0.0	39 91 81
ZR 910.0	1.715130E-025.507396E-026.700606E-011.039463E+00	1	40 91 82
12 4 30.	0.0	0.0	40 91 83
ZR 920.0	1.042367E-023.130879E-028.308115E-022.622433E-01	1	40 92 84
12 5 30.	0.0	0.0	40 92 85
ZR 930.0	2.089521E-025.150402E-023.654891E+002.521495E+00	1	40 93 86
12 6 12.313700E-140.0	0.0	0.0	40 93 87
* Y 930.0	0.	0.	39 93 88
13 1 21.887700E-050.0	0.0	0.0	39 93 89
ZR 970.0	2.089521E-025.150402E-023.654891E+002.521495E+00	1	40 93 90
13 2 12.313700E-140.0	0.0	0.0	40 93 91
*ZR 940.0	5.447404E-032.595021E-022.019570E-025.647657E-02	1	40 94 92
14 1 30.	0.0	0.0	40 94 93
ZR 950.0	3.771503E-021.168058E-015.797035E-014.947719E-01	1	40 95 94
14 2 21.224800E-070.0	0.0	0.0	40 95 95
NR 950.0	5.266054E-022.650329E-012.503124E+001.512606E+00	1	41 95 96
14 3 22.285700E-070.0	0.0	0.0	41 95 97
MO 950.0	3.417280E-022.320601E-011.257062E+011.462043E+01	1	42 95 98
14 4 30.	0.0	0.0	42 95 99
MO 960.0	1.622694E-024.895069E-022.259064E+001.009049E+00	1	42 96100
14 5 30.	0.0	0.0	42 96101
MO 970.0	2.907559E-022.248807E-011.719731E+002.1945556E+00	1	42 97102
14 6 10.	0.0	0.0	42 97103
*ZR 960.0	2.648158E-022.165040E-026.357653E-011.599754E-02	1	40 96104
15 1 30.	0.0	0.0	40 96105
ZR 970.0	0.	0.	40 97106
15 2 21.146100E-050.0	0.0	0.0	40 97107

MO 970.0	2.907559E-022.248807E-011.719731E+002.194556E+00	1	42 97108
15 3 30.	0.0 0.0 0.0 0.0		42 97109
MO 980.0	2.516355E-027.168378E-027.678803E-011.286203E-01	1	42 98110
15 4 30.	0.0 0.0 0.0 0.0		42 98111
MO 990.0	4.286153E-024.063070E-012.849176E+001.713337E+00	11	42 99112
15 5 22.916400E-060.0	0.0 0.0 0.0 0.0		42 99113
15 5BF8.630000E-01			42 99114
TC99M0.0	0. 0. 0. 0.	1	43 99115
15 6 23.198400E-050.0	0.0 0.0 0.0 0.0		43 99116
TC 990.0	3.673952E-023.614800E-013.069278E+011.955253E+01	1	43 99117
15 7 30.	0.0 0.0 0.0 0.0		43 99118
RU1000.0	3.858774E-021.136596E-011.132016E+005.847999E+00	1	44100119
15 8 30.	0.0 0.0 0.0 0.0		44100120
RU1010.0	2.690347E-024.480972E-019.421788E+003.147543E+00	1	44101121
15 9 10.	0.0 0.0 0.0 0.0		44101122
*MO 980.0	2.516355E-027.168378E-027.678803E-011.286203E-01		42 98123
16 1 30.	0.0 0.0 0.0 0.0		42 98124
MO 990.0	4.286153E-024.063070E-012.849176E+001.713337E+00	1	42 99125
16 2 22.916400E-060.0	0.0 0.0 0.0 0.0		42 99126
16 2BF1.370000E-01			42 99127
TC 990.0	3.673952E-023.614800E-013.069278E+011.955253E+01	1	43 99128
16 3 30.	0.0 0.0 0.0 0.0		43 99129
RU1000.0	3.858774E-021.136596E-011.132016E+005.847999E+00	1	44100130
16 4 10.	0.0 0.0 0.0 0.0		44100131
*MO1000.0	9.074271E-035.494819E-024.423330E-012.005538E-01	1	42100132
17 1 30.	0.0 0.0 0.0 0.0		42100133
RU1010.0	2.690347E-024.480972E-019.421788E+003.147543E+00	1	44101134
17 2 30.	0.0 0.0 0.0 0.0		44101135
RU1020.0	6.954545E-021.577507E-013.499625E-011.313913E+00	1	44102136
17 3 30.	0.0 0.0 0.0 0.0		44102137
RU1030.0	2.468305E-023.671989E-017.404899E+007.763290E+00	1	44103138
17 4 22.025900E-070.0	0.0 0.0 0.0 0.0		44103139
RH1030.0	4.648621E-025.571160E-019.047802E+011.751074E+02	1	45103140
17 5 30.	0.0 0.0 0.0 0.0		45103141
PD1040.0	8.530148E-022.169388E-012.016123E+003.910315E-01	1	46104142
17 6 30.	0.0 0.0 0.0 0.0		46104143

PD1050.0	8.900761E-027.121473E-019.287985E+001.415726E+01	1	46105144
17 7 30.	0.0 0.0 0.0 0.0		46105145
PD1060.0	4.789705E-021.283831E-017.720379E-012.404604E-01	1	46106146
17 8 30.	0.0 0.0 0.0 0.0		46106147
PD1070.0	6.726203E-024.894277E-017.143654E+001.008729E+01	1	46107148
17 9 13.381500E-150.0	0.0 0.0 0.0 0.0		46107149
*RU1040.0	3.070218E-021.059028E-017.196752E-014.404508E-01	1	44104150
18 1 30.	0.0 0.0 0.0 0.0		44104151
RU1050.0	2.325016E-023.233188E-016.399468E-012.017520E-01	1	44105152
18 2 24.336500E-050.0	0.0 0.0 0.0 0.0		44105153
RH1050.0	9.125643E-024.919683E-017.002262E+028.906837E+03	1	45105154
18 3 25.423700E-060.0	0.0 0.0 0.0 0.0		45105155
PD1050.0	8.900761E-027.121473E-019.287985E+001.415726E+01	1	46105156
18 4 30.	0.0 0.0 0.0 0.0		46105157
PD1060.0	4.789705E-021.283831E-017.720379E-012.404604E-01	1	46106158
18 5 10.	0.0 0.0 0.0 0.0		46106159
*RU1040.0	3.070218E-021.059028E-017.196752E-014.404508E-01		44104160
19 1 30.	0.0 0.0 0.0 0.0		44104161
RU1050.0	2.325016E-023.233188E-016.399468E-012.017520E-01		44105162
19 2 24.336500E-050.0	0.0 0.0 0.0 0.0		44105163
RH1050.0	9.125643E-024.919683E-017.002262E+028.906837E+03		45105164
19 3 35.423700E-060.0	0.0 0.0 0.0 0.0		45105165
PD1060.0	4.789705E-021.283831E-017.720379E-012.404604E-01	1	46106166
19 4 10.	0.0 0.0 0.0 0.0		46106167
*RU1060.0	8.344953E-035.233636E-022.475373E-011.471686E-01	1	44106168
20 1 22.174100E-080.0	0.0 0.0 0.0 0.0		44106169
PD1060.0	4.789705E-021.283831E-017.720379E-012.404604E-01	1	46106170
20 2 30.	0.0 0.0 0.0 0.0		46106171
PD1070.0	6.726203E-024.894277E-017.143654E+001.008729E+01	1	46107172
20 3 33.381500E-150.0	0.0 0.0 0.0 0.0		46107173
PD1080.0	4.149806E-021.255796E-012.259456E+011.235599E+01	1	46108174
20 4 30.	0.0 0.0 0.0 0.0		46108175
PD1090.0	0. 0. 0. 0.	1	46109176
20 5 21.430500E-050.0	0.0 0.0 0.0 0.0		46109177
AG1090.0	4.458553E-023.535820E-011.302363E+029.488969E+01	11	47109178
20 6 30.	0.0 0.0 0.0 0.0		47109179

20 68F9.526700E-01						47109180
AG1100.0	0.	0.	0.	0.	1	47110181
20 7 23.183500E-080.0	0.0	0.0	0.0	0.0		47110182
CD1100.0	1.158795E-012.033491E-014.663889E+001.120475E+01				1	48110183
20 8 10.	0.0	0.0	0.0	0.0		48110184
*RU1060.0	8.344953E-035.233636E-022.475373E-011.471686E-01					44106185
21 1 32.174100E-080.0	0.0	0.0	0.0	0.0		44106186
PD1070.0	6.726203E-024.894277E-017.143654E+001.008729E+01				1	46107187
21 2 33.381500E-150.0	0.0	0.0	0.0	0.0		46107188
PD1080.0	4.149806E-021.255796E-012.259456E+011.235599E+01				1	46108189
21 3 30.	0.0	0.0	0.0	0.0		46108190
PD1090.0	0.	0.	0.	0.	1	46109191
21 4 21.430500E-050.0	0.0	0.0	0.0	0.0		46109192
AG1090.0	4.458553E-023.535820E-011.302363E+029.488969E+01				1	47109193
21 5 10.	0.0	0.0	0.0	0.0		47109194
*PD1090.0	0.	0.	0.	0.		46109195
22 1 21.430500E-050.0	0.0	0.0	0.0	0.0		46109196
AG1090.0	4.458553E-023.535820E-011.302363E+029.488969E+01				1	47109197
22 2 30.	0.0	0.0	0.0	0.0		47109198
22 28F4.733000E-02						47109199
CD1100.0	1.158785E-012.033491E-014.663889E+001.120475E+01				1	48110200
22 3 10.	0.0	0.0	0.0	0.0		48110201
*PD1100.0	1.580939E-027.311286E-028.358860E-012.219828E-01				1	46110202
23 1 30.	0.0	0.0	0.0	0.0		46110203
AG1110.0	2.611568E-023.334252E-011.231271E+013.027507E+00				1	47111204
23 2 21.074000E-060.0	0.0	0.0	0.0	0.0		47111205
CD1110.0	3.549300E-023.246907E-015.577368E+002.449936E+01				1	48111206
23 3 30.	0.0	0.0	0.0	0.0		48111207
CD1120.0	9.319133E-021.924481E-011.147311E+002.220285E+00				1	48112208
23 4 30.	0.0	0.0	0.0	0.0		48112209
CD1130.0	4.035480E-022.936839E-012.050547E+014.923287E+04				1	48113210
23 5 30.	0.0	0.0	0.0	0.0		48113211
CD1140.0	9.644373E-022.058760E-012.208012E+003.389589E-01				11	48114212
23 6 30.	0.0	0.0	0.0	0.0		48114213
23 68F8.930000E-01						48114214
CD1150.0	0.	0.	0.	0.	1	48115215

23 7 23.598900E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	48115216
IN1150.0	1.228192E-013.755484E-012.854463E+022.327855E+02	1					49115217
23 8 34.395900E-230.0	0.0	0.0	0.0	0.0	0.0	0.0	49115218
SN1160.0	3.175388E-024.364059E-021.356454E+001.215301E-01	1					50116219
23 9 10.	0.0	0.0	0.0	0.0	0.0	0.0	50116220
*PD1120.0	0.	0.	0.	0.	0.	0.	46112221
24 1 29.579100E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	46112222
CD1120.0	9.319133E-021.924481E-011.147311E+002.220285E+00	1					48112223
24 2 30.	0.0	0.0	0.0	0.0	0.0	0.0	48112224
CD1130.0	4.035980E-022.936839E-012.050547E+014.923287E+04	1					48113225
24 3 30.	0.0	0.0	0.0	0.0	0.0	0.0	48113226
CD1140.0	9.644373E-022.058760E-012.208012E+003.389589E-01	1					48114227
24 4 30.	0.0	0.0	0.0	0.0	0.0	0.0	48114228
24 48F8.930000E-01							48114229
CD1150.0	0.	0.	0.	0.	0.	0.	48115230
24 5 23.598900E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	48115231
IN1150.0	1.228192E-013.755484E-012.854463E+022.327855E+02	1					49115232
24 6 34.395900E-230.0	0.0	0.0	0.0	0.0	0.0	0.0	49115233
SN1160.0	3.175388E-024.364059E-021.356454E+001.215301E-01	1					50116234
24 7 10.	0.0	0.0	0.0	0.0	0.0	0.0	50116235
*CD1140.0	9.644373E-022.058760E-012.208012E+003.389589E-01	1					48114236
25 1 30.	0.0	0.0	0.0	0.0	0.0	0.0	48114237
25 18F1.070000E-01							48114238
CD1500.0	3.428619E-022.347852E-012.226469E+013.126916E+01	1					48115239
25 2 21.798800E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	48115240
IN1150.0	1.228192E-013.755484E-012.854463E+022.327855E+02	1					49115241
25 3 34.395900E-230.0	0.0	0.0	0.0	0.0	0.0	0.0	49115242
SN1160.0	3.175388E-024.364059E-021.356454E+001.215301E-01	1					50116243
25 4 10.	0.0	0.0	0.0	0.0	0.0	0.0	50116244
*CD1160.0	4.177477E-029.279391E-022.2352261E-017.749719E-02	1					48116245
26 1 30.	0.0	0.0	0.0	0.0	0.0	0.0	48116246
SN1170.0	3.274490E-021.661797E-011.984944E+002.627627E+00	1					50117247
26 2 30.	0.0	0.0	0.0	0.0	0.0	0.0	50117248
SN1180.0	7.690040E-028.667272E-026.911670E-018.321949E-02	1					50118249
26 3 30.	0.0	0.0	0.0	0.0	0.0	0.0	50118250
SN1190.0	6.371977E-034.040596E-023.974212E-012.317637E+00	1					50119251

26 4 30.	0.0	0.0	0.0	0.0		50119252
SN1200.0	1.800320E-022	933619E-021	337315E-011	422657E-01	1	50120253
26 5 10.	0.0	0.0	0.0	0.0		50120254
*SN21M0.0	0.	0.	0.	0.	1	50121255
27 1 24.395900E-100	0.0	0.0	0.0	0.0		50121256
SB1210.0	1.106325E-014	009508E-011	677825E+016	427007E+00	1	51121257
27 2 30.	0.0	0.0	0.0	0.0		51121258
SB1220.0	0.	0.	0.	0.	1	51122259
27 3 22.949400E-060	0.0	0.0	0.0	0.0		51122260
TE1220.0	1.202321E-012	504961E-018	412152E+002	832800E+00	1	52122261
27 4 10.	0.0	0.0	0.0	0.0		52122262
*SN1210.0	0.	0.	0.	0.	1	50121263
28 1 27.184400E-060	0.0	0.0	0.0	0.0		50121264
SB1210.0	1.106325E-014	009508E-011	677825E+016	427007E+00	1	51121265
28 2 30.	0.0	0.0	0.0	0.0		51121266
SB1220.0	0.	0.	0.	0.	1	51122267
28 3 22.949400E-060	0.0	0.0	0.0	0.0		51122268
TE1220.0	1.202321E-012	504961E-018	412152E+002	832800E+00	1	52122269
28 4 10.	0.0	0.0	0.0	0.0		52122270
*SN1220.0	1.337318E-021	827124E-027	595520E-021	823978E-01	11	50122271
29 1 30.	0.0	0.0	0.0	0.0		50122272
29 1BF9.940000E-01						50122273
SN1230.0	3.947307E-028	523844E-022	774607E-013	330650E-02	1	50123274
29 2 26.218800E-080	0.0	0.0	0.0	0.0		50123275
SB1230.0	5.059958E-022	100477E-018	328224E+004	394987E+00	1	51123276
29 3 30.	0.0	0.0	0.0	0.0		51123277
SB1240.0	2.543705E-025	863286E-012	475458E+006	552687E+00	1	51124278
29 4 21.332600E-070	0.0	0.0	0.0	0.0		51124279
TE1240.0	1.104859E-011	937552E-017	708467E-016	873755E+00	1	52124280
29 5 10.	0.0	0.0	0.0	0.0		52124281
*SN1220.0	1.337318E-021	827124E-027	595520E-021	823978E-01	1	50122282
30 1 30.	0.0	0.0	0.0	0.0		50122283
30 1BF6.000000E-03						50122284
SB1230.0	5.059958E-022	100477E-018	328224E+004	394987E+00	1	51123285
30 2 30.	0.0	0.0	0.0	0.0		51123286
SB1240.0	2.543705E-025	863286E-012	475458E+006	552687E+00	1	51124287

30	3	21.332600E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	51124288
TE1240.0		1.104859E-011.937552E-017.708467E-016.873755E+00							52124289
30	4	10.	0.0	0.0	0.0	0.0	0.0	0.0	52124290
*SN1240.0		1.849413E-022.415400E-028.102987E-011.312637E-01							50124291
31	1	30.	0.0	0.0	0.0	0.0	0.0	0.0	50124292
SN1250.0		9.919385E-034.686948E-021.984130E+005.550044E-01							50125293
31	2	28.313500E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	50125294
SA1250.0		7.517359E-022.103150E-012.103414E+001.009459E+00							51125295
31	3	28.045600E-090.0	0.0	0.0	0.0	0.0	0.0	0.0	51125296
31	3BF2.300000E-01								51125297
TE25M0.0		0.	0.	0.	0.	0.	0.	0.	52125298
31	4	21.383200E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	52125299
TE1250.0		2.613155E-022.557467E-012.647459E+001.562828E+00							52125300
31	5	10.	0.0	0.0	0.0	0.0	0.0	0.0	52125301
*SN1240.0		1.849913E-02.415400E-028.102987E-011.312637E-01							50124302
32	1	30.	0.0	0.0	0.0	0.0	0.0	0.0	50124303
SN1250.0		9.919385E-034.686948E-021.984130E+005.550044E-01							50125304
32	2	28.313500E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	50125305
SA1250.0		7.517359E-022.103150E-012.103414E+001.009459E+00							51125306
32	3	28.045600E-090.0	0.0	0.0	0.0	0.0	0.0	0.0	51125307
32	3BF7.700000E-01								51125308
TE1250.0		2.613155E-022.557467E-012.647459E+001.562828E+00							52125309
32	4	10.	0.0	0.0	0.0	0.0	0.0	0.0	52125310
*SN1260.0		5.678309E-037.303296E-031.098527E-023.028272E-01							50126311
33	1	22.196500E-130.0	0.0	0.0	0.0	0.0	0.0	0.0	50126312
SA1260.0		1.848180E-023.033790E-015.136429E+005.862222E+00							51126313
33	2	26.469500E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	51126314
TE1260.0		3.714886E-028.357152E-021.185596E+001.043253E+00							52126315
33	3	30.	0.0	0.0	0.0	0.0	0.0	0.0	52126316
33	3BF8.700000E-01								52126317
TF1270.0		0.	0.	0.	0.	0.	0.	0.	52127318
33	4	22.059300E-050.0	0.0	0.0	0.0	0.0	0.0	0.0	52127319
I1270.0		5.610752E-023.939301E-011.539254E+016.278681E+00							53127320
33	5	10.	0.0	0.0	0.0	0.0	0.0	0.0	53127321
*SN1260.0		5.678309E-037.303296E-031.098527E-023.028272E-01							50126322
34	1	22.196500E-130.0	0.0	0.0	0.0	0.0	0.0	0.0	50126323



37 38F9.000000E-01						53129360
I1300.0	1.837486E-022.696179E-011.985659E+011.814018E+01	1				53130361
37 4 21.552700E-050.0	0.0 0.0 0.0 0.0					53130362
XE1300.0	3.404525E-021.127239E-013.154451E-016.220203E+00	1				54130363
37 5 30.	0.0 0.0 0.0 0.0					54130364
XE1310.0	1.332154E-021.837029E-018.832394E+019.102450E+01	1				54131365
37 6 10.	0.0 0.0 0.0 0.0					54131366
*SB1280.0	0. 0. 0. 0.					51128367
38 1 22.139300E-050.0	0.0 0.0 0.0 0.0					51128368
TF1280.0	4.529906E-028.662364E-022.271823E-012.170070E-01	1				52128369
38 2 30.	0.0 0.0 0.0 0.0					52128370
38 28F7.000000E-02						52128371
TE29M0.0	9.472597E-038.205984E-026.885660E-011.108693E+00	1				52129372
38 3 22.401900E-070.0	0.0 0.0 0.0 0.0					52129373
I1290.0	4.800948E-022.804701E-013.709139E+002.725637E+01	11				53129374
38 4 31.382400E-150.0	0.0 0.0 0.0 0.0					53129375
38 48F9.000000E-01						53129376
I1300.0	1.837486E-022.696179E-011.985659E+011.814018E+01	1				53130377
38 5 21.552700E-050.0	0.0 0.0 0.0 0.0					53130378
XE1300.0	3.404525E-021.127239E-013.154451E-016.220203E+00	1				54130379
38 6 30.	0.0 0.0 0.0 0.0					54130380
XE1310.0	1.332154E-021.837029E-018.832394E+019.102450E+01	1				54131381
38 7 10.	0.0 0.0 0.0 0.0					54131382
*SB1280.0	0. 0. 0. 0.					51128383
39 1 22.139300E-050.0	0.0 0.0 0.0 0.0					51128384
TF1280.0	4.529906E-028.662364E-022.271823E-012.170070E-01	1				52128385
39 2 30.	0.0 0.0 0.0 0.0					52128386
39 28F7.000000E-02						52128387
TE29M0.0	9.472597E-038.205984E-026.885660E-011.108693E+00					52129388
39 3 22.401900E-070.0	0.0 0.0 0.0 0.0					52129389
I1290.0	4.800948E-022.804701E-013.709139E+002.725637E+01	1				53129390
39 4 31.382400E-150.0	0.0 0.0 0.0 0.0					53129391
39 48F1.000000E-01						53129392
XE1300.0	3.404525E-021.127239E-013.154451E-016.220203E+00	1				54130393
39 5 30.	0.0 0.0 0.0 0.0					54130394
XE1310.0	1.332154E-021.837029E-018.832394E+019.102450E+01	1				54131395

39 6 10.	0.0	0.0	0.0	0.0	0.0	0.0	54131396
*S81280.0	0.	0.	0.	0.	0.	0.	51128397
40 1 22.139300E-050.0	0.0	0.0	0.0	0.0	0.0	0.0	51128398
TE1280.0	4.529906E-028.662364E-022.271823E-012.170070E-01	1					52128399
40 2 30.	0.0	0.0	0.0	0.0	0.0	0.0	52128400
40 28F9.300000E-01							52128401
I1290.0	4.800948E-022.804701E-013.709139E+002.725637E+01	1					53129402
40 3 31.382400E-150.0	0.0	0.0	0.0	0.0	0.0	0.0	53129403
40 38F1.000000E-01							53129404
XE1300.0	3.404525E-021.127239E-013.154451E-016.220203E+00	1					54130405
40 4 30.	0.0	0.0	0.0	0.0	0.0	0.0	54130406
XE1310.0	1.332154E-021.837029E-018.832394E+019.102450E+01	1					54131407
40 5 10.	0.0	0.0	0.0	0.0	0.0	0.0	54131408
*TE1300.0	3.760774E-031.329507E-022.826283E-022.927259E-01	1					52130409
41 1 10.	0.0	0.0	0.0	0.0	0.0	0.0	52130410
*TE31M0.0	0.	0.	0.	0.	0.	0.	52131411
42 1 26.418000E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	52131412
I1310.0	9.472026E-037.367629E-029.685281E-017.059400E-01	1					53131413
42 2 29.977100E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	53131414
XE1310.0	1.332154E-021.837029E-018.832394E+019.102450E+01	1					54131415
42 3 30.	0.0	0.0	0.0	0.0	0.0	0.0	54131416
XE1320.0	1.814070E-026.651676E-021.568604E-014.514423E-01	1					54132417
42 4 30.	0.0	0.0	0.0	0.0	0.0	0.0	54132418
42 48F9.350000E-01							54132419
XE1330.0	5.950709E-035.286344E-023.435562E+011.918434E+02	1					54133420
42 5 21.516500E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	54133421
CS1330.0	5.103384E-023.777516E-013.378401E+013.003107E+01	1					55133422
42 6 10.	0.0	0.0	0.0	0.0	0.0	0.0	55133423
*TE31M0.0	0.	0.	0.	0.	0.	0.	52131424
43 1 26.418000E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	52131425
I1310.0	9.472026E-037.367629E-029.685281E-017.059400E-01	1					53131426
43 2 39.977100E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	53131427
XE1320.0	1.814070E-026.651676E-021.568604E-014.514423E-01	1					54132428
43 3 30.	0.0	0.0	0.0	0.0	0.0	0.0	54132429
43 38F9.150000E-01							54132430
XE1330.0	5.950709E-035.286344E-023.435562E+011.918434E+02	1					54133431

43	4	21	516500E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	54133432
CS1330.0	5.103384E-023.777516E-013.378401E+013.003107E+01	1								55133433
43	5	10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55133434
*XE1320.0	5.710111E-044.443987E-047.327881E-052.017314E-03	1								52132435
44	1	22.468500E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52132436
XE1320.0	1.814070E-026.651674E-021.568604E-014.514423E-01	11								54132437
44	2	30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54132438
44	2BF9.350000E-01									54132439
XE1330.0	5.950709E-035.286344E-023.435562E+011.918434E+02	1								54133440
44	3	21.516500E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54133441
CS1330.0	5.103384E-023.777516E-013.378401E+013.003107E+01	1								55133442
44	4	30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55133443
CS1340.0	1.286883E-023.448577E-012.079022E+011.413007E+02	1								55134444
44	5	11.066200E-080.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55134445
*XE1320.0	1.814070E-026.651674E-021.568604E-014.514423E-01	1								54132446
45	1	30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54132447
45	1RF6.500000E-02									54132448
XE33M0.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	54133449
45	2	23.597600E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54133450
XE1330.0	5.950709E-035.286344E-023.435562E+011.918434E+02	1								54133451
45	3	21.516500E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54133452
CS1330.0	5.103384E-023.777516E-013.378401E+013.003107E+01	1								55133453
45	4	10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55133454
*I1330.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	53133455
46	1	29.256800E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53133456
46	1BF8.600000E-01									53133457
XE1330.0	5.950709E-035.286344E-023.435562E+011.918434E+02									54133458
46	2	31.516500E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54133459
XE1340.0	1.054011E-023.432525E-023.981692E-022.588703E-01	1								54134460
46	3	30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54134461
XE1350.0	5.564618E-043.218521E-033.634285E+023.015526E+06	1								54135462
46	4	22.099700E-050.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54135463
CS1350.0	3.180215E-034.148685E-024.381765E+008.784359E+00	1								55135464
46	5	39.556300E-150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55135465
CS1360.0	1.942282E-021.635070E-013.303652E+001.315445E+00	1								55136466
46	6	26.171200E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55136467

BA1360.0	1.312605E-023.583927E-022.133971E-014.133242E-01	1	56136468
46 7 30.	0.0 0.0 0.0		56136469
BA1370.0	7.225130E-033.743974E-024.969716E-015.143966E+00	1	56137470
46 8 10.	0.0 0.0 0.0		56137471
* I1330.0	0. 0. 0.	1	53133472
47 1 29.256800E-060.0	0.0 0.0 0.0		53133473
47 1BF1.600000E-01			53133474
XF33M0.0	0. 0. 0.	1	54133475
47 2 23.597600E-060.0	0.0 0.0 0.0		54133476
XE1330.0	5.950709E-035.286344E-023.435562E+011.918434E+02	1	54133477
47 3 21.516500E-060.0	0.0 0.0 0.0		54133478
CS1330.0	5.103384E-023.777516E-013.378401E+013.003107E+01	1	55133479
47 4 10.	0.0 0.0 0.0		55133480
* I1330.0	0. 0. 0.	11	53133481
48 1 29.256800E-060.0	0.0 0.0 0.0		53133482
48 1BF8.600000E-01			53133483
XE1330.0	5.950709E-035.286344E-023.435562E+011.918434E+02	1	54133484
48 2 21.516500E-060.0	0.0 0.0 0.0		54133485
CS1330.0	5.103384E-023.777516E-013.378401E+013.003107E+01	1	55133486
48 3 30.	0.0 0.0 0.0		55133487
CS1340.0	1.286883E-023.448577E-012.079022E+011.413007E+02	1	55134488
48 4 31.066200E-080.0	0.0 0.0 0.0		55134489
CS1350.0	3.180215E-034.148685E-024.381765E+008.784359E+00	1	55135490
48 5 19.556300E-150.0	0.0 0.0 0.0		55135491
* I1330.0	0. 0. 0.	1	53133492
49 1 29.256800E-060.0	0.0 0.0 0.0		53133493
49 1BF8.600000E-01			53133494
XE1330.0	5.950709E-035.286344E-023.435562E+011.918434E+02		54133495
49 2 21.516500E-060.0	0.0 0.0 0.0		54133496
CS1330.0	5.103384E-023.777516E-013.378401E+013.003107E+01		55133497
49 3 30.	0.0 0.0 0.0		55133498
CS1340.0	1.286883E-023.448577E-012.079022E+011.413007E+02		55134499
49 4 21.066200E-080.0	0.0 0.0 0.0		55134500
BA1340.0	3.524396E-028.612855E-022.724576E+002.175576E+00	1	56134501
49 5 10.	0.0 0.0 0.0		56134502
* I1350.0	4.684394E-045.736313E-047.324264E-042.019617E-02	1	53135503

50	1	22.923900E-050.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53135504
XF1350.0		5.564618E-043.218521E-033.634285E+023.015526E+06								54135505
50	2	22.099700E-050.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54135506
CS1350.0		3.180215E-034.148685E-024.381765E+008.784359E+00								55135507
50	3	19.556300E-150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55135508
* I1350.0		4.684394E-045.736313E-047.324264E-042.019617E-02								53135509
51	1	22.923900E-050.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53135510
XF1350.0		5.564618E-043.218521E-033.634285E+023.015526E+06								54135511
51	2	32.099700E-050.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54135512
XE1360.0		1.072229E-032.288886E-031.069663E-021.601768E-01								54136513
51	3	30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54136514
CS1370.0		1.502562E-035.543158E-035.867613E-021.108631E-01								55137515
51	4	37.297200E-100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55137516
BA1380.0		9.214468E-035.529264E-031.282347E-023.529736E-01								56138517
51	5	10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56138518
*CS1370.0		1.502562E-035.543158E-035.867613E-021.108631E-01								55137519
52	1	27.297200E-100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55137520
RA1370.0		7.225130E-033.743974E-024.969716E-015.143966E+00								56137521
52	2	30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56137522
RA1380.0		9.214468E-035.529264E-031.282347E-023.529736E-01								56138523
52	3	30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56138524
LA1390.0		6.009337E-032.967405E-021.244460E+009.048625E+00								57139525
52	4	30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57139526
LA1400.0		2.948971E-021.295762E-017.885135E+002.722765E+00								57140527
52	5	24.785900E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57140528
CE1400.0		1.703531E-021.73715E-022.903654E-025.759285E-01								58140529
52	6	10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58140530
*BA1400.0		1.689069E-033.743996E-031.567531E+001.608698E+00								56140531
53	1	26.272300E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56140532
LA1400.0		2.948971E-021.295762E-017.885135E+002.722765E+00								57140533
53	2	24.785900E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57140534
CE1400.0		1.703531E-021.73715E-022.903654E-025.759285E-01								58140535
53	3	30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58140536
CE1410.0		4.510816E-021.054578E-012.342997E+002.923631E+01								58141537
53	4	22.466200E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58141538
PR1410.0		2.548600E-029.959114E-022.105239E+001.162319E+01								59141539

53 5 10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59141540
*CE1410.0	4.510816E-021.05457AE-012.342997E+002.923631E+01									58141541
54 1 22.466200E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58141542
PR1410.0	2.548600E-029.959114E-022.105239E+001.162319E+01									59141543
54 2 30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59141544
PR1420.0	1.604911E-022.54718AE-011.527271E+012.017310E+01									59142545
54 3 21.004900E-050.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59142546
ND1420.0	2.773231E-023.12766AE-027.312854E-011.884892E+01									60142547
54 4 30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60142548
ND1430.0	5.923333E-021.93859AE-011.209111E+013.200445E+02									60143549
54 5 10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60143550
*CE1410.0	4.510816E-021.05457AE-012.342997E+002.923631E+01									58141551
55 1 22.466200E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58141552
PR1410.0	2.548600E-029.959114E-022.105239E+001.162319E+01									59141553
55 2 30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59141554
PR1420.0	1.604911E-022.54718AE-011.527271E+012.017310E+01									59142555
55 3 31.004900E-050.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59142556
PR1430.0	4.842014E-022.161496E-011.913981E+018.984881E+01									59143557
55 4 25.907700E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59143558
ND1430.0	5.923333E-021.93859AE-011.209111E+013.200445E+02									60143559
55 5 10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60143560
*CE1420.0	1.485239E-023.294434E-025.925282E-029.579417E-01									58142561
56 1 32.093300E-190.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58142562
CE1430.0	9.577707E-037.577132E-025.095466E+006.046496E+00									58143563
56 2 25.834600E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58143564
PR1430.0	4.842014E-022.161496E-011.913981E+018.984881E+01									59143565
56 3 25.907700E-070.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59143566
ND1430.0	5.923333E-021.93859AE-011.209111E+013.200445E+02									60143567
56 4 30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60143568
ND1440.0	4.188978E-026.863372E-025.867006E-013.635226E+00									60144569
56 5 31.0046600E-230.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60144570
ND1450.0	6.803414E-021.983824E-012.256161E+014.252540E+01									60145571
56 6 10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60145572
*CE1430.0	9.577707E-037.577132E-025.095466E+006.046496E+00									58143573
57 1 35.834600E-060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58143574
CE1440.0	1.090923E-022.405806E-022.314846E-011.008316E+00									58144575

57 2 22.820900E-080.0	0.0	0.0	0.0	58144576
ND1440.0	4.188978E-026.863372E-025.867006E-013.635226E+00	1	60144577	
57 3 31.046600E-230.0	0.0	0.0	0.0	60144578
ND1450.0	6.803414E-021.983824E-012.256161E+014.252540E+01	1	60145579	
57 4 10.	0.0	0.0	0.0	60145580
*CE1430.0	9.577707E-037.577132E-025.095466E+006.046496E+00		58143581	
58 1 25.834600E-060.0	0.0	0.0	0.0	58143582
PR1430.0	4.842014E-022.161496E-011.913981E+018.984881E+01		59143583	
58 2 35.907700E-070.0	0.0	0.0	0.0	59143584
ND1440.0	4.188978E-026.863372E-025.867006E-013.635226E+00	1	60144585	
58 3 31.046600E-230.0	0.0	0.0	0.0	60144586
ND1450.0	6.803414E-021.983824E-012.256161E+014.252540E+01	1	60145587	
58 4 10.	0.0	0.0	0.0	60145588
*CE1430.0	9.577707E-037.577132E-025.095466E+006.046496E+00		58143589	
59 1 35.834600E-060.0	0.0	0.0	0.0	58143590
CE1440.0	1.090923E-022.405806E-022.314846E-011.008316E+00		58144591	
59 2 32.820900E-080.0	0.0	0.0	0.0	58144592
PR1450.0	0.	0.	0.	1
59 3 23.219700E-050.0	0.0	0.0	0.0	59145593
ND1450.0	6.803414E-021.983824E-012.256161E+014.252540E+01	1	60145594	
59 4 10.	0.0	0.0	0.0	60145595
*PR1450.0	0.	0.	0.	60145596
60 1 23.219700E-050.0	0.0	0.0	0.0	59145597
ND1450.0	6.803414E-021.983824E-012.256161E+014.252540E+01		59145598	
60 2 30.	0.0	0.0	0.0	60145599
ND1460.0	5.710881E-021.082823E-012.963151E-011.412896E+00	1	60146600	
60 3 30.	0.0	0.0	0.0	60146601
ND1470.0	5.106341E-023.928675E-016.013407E+014.945773E+01	1	60146602	
60 4 27.299800E-070.0	0.0	0.0	0.0	60147603
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	11	60147604	
60 5 38.373800E-090.0	0.0	0.0	0.0	61147605
60 5BF4.700000E-01				61147606
PM48M0.0	4.921928E-012.574234E+003.182157E+023.446023E+04	1	61147607	
60 6 31.942500E-070.0	0.0	0.0	0.0	61148608
PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03	1	61148609	
60 7 23.626000E-060.0	0.0	0.0	0.0	61149610
				61149611

SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04	1	62149612
60 8 32.198000E-240.0	0.0 0.0 0.0 0.0		62149613
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01	1	62150614
60 9 30.	0.0 0.0 0.0 0.0		62150615
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	1	62151616
6010 32.363400E-100.0	0.0 0.0 0.0 0.0		62151617
SM1520.0	7.520442E-022.877061E-012.755117E+022.118281E+02	1	62152618
6011 30.	0.0 0.0 0.0 0.0		62152619
SM1530.0	2.260670E-041.191724E-022.418654E+023.333276E+02	1	62153620
6012 24.122900E-060.0	0.0 0.0 0.0 0.0		62153621
EU1530.0	2.431446E-011.539698E+001.478631E+023.966174E+02	1	63153622
6013 30.	0.0 0.0 0.0 0.0		63153623
EU1540.0	7.241065E-021.875663E+002.228416E+028.974997E+02	1	63154624
6014 32.555800E-090.0	0.0 0.0 0.0 0.0		63154625
EU1550.0	9.062116E-011.543263E+001.540107E+024.077187E+03	1	63155626
6015 34.579200E-090.0	0.0 0.0 0.0 0.0		63155627
EU1560.0	5.008924E-043.539738E-021.016701E+024.866885E+02	1	63156628
6016 25.277900E-070.0	0.0 0.0 0.0 0.0		63156629
GD1560.0	1.177736E-012.925910E-011.328447E+011.496788E+00	1	64156630
6017 10.	0.0 0.0 0.0 0.0		64156631
*PR1450.0	0. 0. 0. 0.		59145632
61 1 23.219700E-050.0	0.0 0.0 0.0 0.0		59145633
ND1450.0	6.803414E-021.983824E-012.256161E+014.252540E+01		60145634
61 2 30.	0.0 0.0 0.0 0.0		60145635
ND1460.0	5.710881E-021.082823E-012.963151E-011.412896E+00		60146636
61 3 30.	0.0 0.0 0.0 0.0		60146637
ND1470.0	5.106341E-023.928675E-016.013407E+014.945773E+01		60147638
61 4 27.299800E-070.0	0.0 0.0 0.0 0.0		60147639
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	1	61147640
61 5 38.373800E-090.0	0.0 0.0 0.0 0.0		61147641
61 5BF5.300000E-01			61147642
PM1480.0	4.921928E-012.574234E+002.332976E+034.682426E+03	1	61148643
61 6 31.493900E-060.0	0.0 0.0 0.0 0.0		61148644
PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03	1	61149645
61 7 23.626000E-060.0	0.0 0.0 0.0 0.0		61149646
SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04	1	62149647



62 9 32.363400E-100.0	0.0	0.0	0.0	0.0	0.0	62151684
SM1520.0	7.520442E-022.877061E-012.755117E+022.118281E+02	1				62152685
6210 10.	0.0	0.0	0.0	0.0	0.0	62152686
*ND1450.0	6.803414E-021.983824E-012.256161E+014.252540E+01					60145687
63 1 30.	0.0	0.0	0.0	0.0	0.0	60145688
ND1460.0	5.710881E-021.082823E-012.963151E-011.412896E+00					60146689
63 2 30.	0.0	0.0	0.0	0.0	0.0	60146690
ND1470.0	5.106341E-023.928675E-016.013407E+014.945773E+01					60147691
63 3 27.299800E-070.0	0.0	0.0	0.0	0.0	0.0	60147692
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	1				61147693
63 4 38.373800E-090.0	0.0	0.0	0.0	0.0	0.0	61147694
63 4BF4.700000E-01						61147695
PM48M0.0	4.921928E-012.574234E+003.182157E+023.446023E+04	1				61148696
63 5 21.942500E-070.0	0.0	0.0	0.0	0.0	0.0	61148697
63 5BF9.400000E-01						61148698
SM1480.0	2.023254E-012.596780E-013.134887E+002.724549E+00	1				62148699
63 6 32.747400E-240.0	0.0	0.0	0.0	0.0	0.0	62148700
SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04	1				62149701
63 7 32.198000E-240.0	0.0	0.0	0.0	0.0	0.0	62149702
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01	1				62150703
63 8 30.	0.0	0.0	0.0	0.0	0.0	62150704
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	1				62151705
63 9 32.363400E-100.0	0.0	0.0	0.0	0.0	0.0	62151706
SM1520.0	7.520442E-022.877061E-012.755117E+022.118281E+02	1				62152707
6310 10.	0.0	0.0	0.0	0.0	0.0	62152708
*ND1450.0	6.803414E-021.983824E-012.256161E+014.252540E+01					60145709
64 1 30.	0.0	0.0	0.0	0.0	0.0	60145710
ND1460.0	5.710881E-021.082823E-012.963151E-011.412896E+00					60146711
64 2 30.	0.0	0.0	0.0	0.0	0.0	60146712
ND1470.0	5.106341E-023.928675E-016.013407E+014.945773E+01					60147713
64 3 27.299800E-070.0	0.0	0.0	0.0	0.0	0.0	60147714
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	1				61147715
64 4 38.373800E-090.0	0.0	0.0	0.0	0.0	0.0	61147716
64 4BF5.300000E-01						61147717
PM1480.0	4.921928E-012.574234E+002.332976E+034.682426E+03					61148718
64 5 21.493900E-060.0	0.0	0.0	0.0	0.0	0.0	61148719

SM1480.0	2.023254E-012.596780E-013.134887E+002.724549E+00	I	62148720
64 6 32.747400E-240.0	0.0 0.0 0.0		62148721
SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04	I	62149722
64 7 32.198000E-240.0	0.0 0.0 0.0		62149723
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01	I	62150724
64 8 30.	0.0 0.0 0.0		62150725
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	I	62151726
64 9 32.363400E-100.0	0.0 0.0 0.0		62151727
SM1520.0	7.520442E-022.877061E-012.755117E+022.118281E+02	I	62152728
64 10 10.	0.0 0.0 0.0		62152729
*ND1470.0	5.106341E-023.928675E-016.013407E+014.945773E+01		60147730
65 1 27.299800E-070.0	0.0 0.0 0.0		61147731
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	I	61147732
65 2 38.373800E-090.0	0.0 0.0 0.0		61147733
65 2HF4.700000E-01			61147734
PM48M0.0	4.921928E-012.574234E+003.182157E+023.446023E+04		61148735
65 3 31.942500E-070.0	0.0 0.0 0.0		61148736
PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03		61149737
65 4 33.626000E-060.0	0.0 0.0 0.0		61149738
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01	I	62150739
65 5 30.	0.0 0.0 0.0		62150740
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	I	62151741
65 6 12.363400E-100.0	0.0 0.0 0.0		62151742
*ND1470.0	5.106341E-023.928675E-016.013407E+014.945773E+01		60147743
66 1 27.299800E-070.0	0.0 0.0 0.0		60147744
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	I	61147745
66 2 38.373800E-090.0	0.0 0.0 0.0		61147746
66 2BF5.700000E-01			61147747
PM1480.0	4.921928E-012.574234E+002.332976E+034.682426E+03		61148748
66 3 31.493900E-060.0	0.0 0.0 0.0		61148749
PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03		61149750
66 4 33.626000E-060.0	0.0 0.0 0.0		61149751
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01	I	62150752
66 5 30.	0.0 0.0 0.0		62150753
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	I	62151754
66 6 12.363400E-100.0	0.0 0.0 0.0		62151755

*ND1470.0	5.106341E-020.92R675E-016.013407E+014.945773E+01	60147756
67 1 37.299800E-070.0	0.0 0.0 0.0	60147757
ND1480.0	1.435365E-011.318842E-012.284639F+002.526102E+00	60148758
67 2 30.	0.0 0.0 0.0	60148759
PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03	61149760
67 3 23.626000E-060.0	0.0 0.0 0.0	61149761
SM1490.0	5.637011E-029.344686E-012.770684F+028.738108E+04	62149762
67 4 12.198000E-240.0	0.0 0.0 0.0	62149763
*ND1470.0	5.106341E-023.92R675E-016.013407E+014.945773E+01	60147764
68 1 27.299800E-070.0	0.0 0.0 0.0	60147765
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	61147766
68 2 38.373800E-090.0	0.0 0.0 0.0	61147767
6A 2BF4.700000E-01		61147768
PM48M0.0	4.921928E-012.574234E+003.182157E+023.446023E+04	61148769
68 3 21.942500E-070.0	0.0 0.0 0.0	61148770
68 3BF6.000000E-02		61148771
PM1480.0	4.921928E-012.574234E+002.332976E+034.682426E+03	61148772
68 4 21.493900E-060.0	0.0 0.0 0.0	61148773
SM1480.0	2.023254E-012.596780E-013.134887E+002.724549E+00	62148774
68 5 32.747400E-240.0	0.0 0.0 0.0	62148775
SM1490.0	5.637011E-029.344686E-012.770684F+028.738108E+04	62149776
68 6 32.198000E-240.0	0.0 0.0 0.0	62149777
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01	62150778
68 7 30.	0.0 0.0 0.0	62150779
SM1510.0	2.315641E-011.356167E+002.894601E+028.426850E+03	62151780
68 8 12.363400E-100.0	0.0 0.0 0.0	62151781
*ND1470.0	5.106341E-023.92R675E-016.013407E+014.945773E+01	60147782
69 1 27.299800E-070.0	0.0 0.0 0.0	60147783
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	61147784
69 2 38.373800E-090.0	0.0 0.0 0.0	61147785
69 2BF4.700000E-01		61147786
PM48M0.0	4.921928E-012.574234E+003.182157E+023.446023E+04	61148787
69 3 21.942500E-070.0	0.0 0.0 0.0	61148788
69 3BF6.000000E-02		61148789
PM1480.0	4.921928E-012.574234E+002.332976E+034.682426E+03	61148790
69 4 31.493900E-060.0	0.0 0.0 0.0	61148791

PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03	1	61149792
69 5 23.626000E-060.0	0.0	0.0	61149793
SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04	1	62149794
69 6 32.198000E-240.0	0.0	0.0	62149795
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01	1	62150796
69 7 30.	0.0	0.0	62150797
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	1	62151798
69 8 12.363400E-100.0	0.0	0.0	62151799
*ND1480.0	1.435365E-011.318842E-012.284639E+002.526102E+00		60148800
70 1 30.	0.0	0.0	60148801
PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03		61149802
70 2 23.626000E-060.0	0.0	0.0	61149803
SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04		62149804
70 3 32.198000E-240.0	0.0	0.0	62149805
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01	1	62150806
70 4 30.	0.0	0.0	62150807
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	1	62151808
70 5 32.363400E-100.0	0.0	0.0	62151809
SM1520.0	7.520442E-022.877063E-012.755117E+022.118281E+02	1	62152810
70 6 30.	0.0	0.0	62152811
SM1530.0	2.260670E-041.191724E-022.418654E+023.333276E+02	1	62153812
70 7 24.122900E-060.0	0.0	0.0	62153813
EU1530.0	2.431446E-011.539698E+001.478631E+023.966174E+02	1	63153814
70 8 30.	0.0	0.0	63153815
EU1540.0	7.241066E-021.875663E+002.228416E+028.974997E+02	1	63154816
70 9 32.555800E-090.0	0.0	0.0	63154817
EU1550.0	9.062116E-011.543263E+001.540107E+024.077187E+03	1	63155818
7010 34.579200E-090.0	0.0	0.0	63155819
EU1560.0	5.008924E-043.539738E-021.016701E+024.866885E+02	1	63156820
7011 25.277900E-070.0	0.0	0.0	63156821
GD1560.0	1.177736E-012.925910E-011.328447E+011.496788E+00	1	64156822
7012 30.	0.0	0.0	64156823
GD1570.0	1.068337E-017.103253E-018.871128E+011.491231E+05	1	64157824
7013 10.	0.0	0.0	64157825
*ND1480.0	1.435365E-011.318842E-012.284639E+002.526102E+00		60148826
71 1 30.	0.0	0.0	60148827



EU1540.0	7.241066E-021.875663E+002.228416E+028.974997E+02		63154864
72 9 32.555800E-090.0	0.0	0.0	63154865
EU1550.0	9.062116E-011.543263E+001.540107E+024.077187E+03		63155866
7210 24.579200E-090.0	0.0	0.0	63155867
GD1550.0	1.251320E-011.467746E+001.313204E+023.466494E+04	1	64155868
7211 10.	0.0	0.0	64155869
*ND1480.0	1.435365E-011.318842E-012.284639E+002.526102E+00		60148870
73 1 30.	0.0	0.0	60148871
PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03		61149872
73 2 23.626000E-060.0	0.0	0.0	61149873
SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04		62149874
73 3 32.198000E-240.0	0.0	0.0	62149875
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01		62150876
73 4 30.	0.0	0.0	62150877
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03		62151878
73 5 22.363400E-100.0	0.0	0.0	62151879
EU1510.0	4.181577E-012.402754E+002.044278E+028.515005E+03	1	63151880
73 6 10.	0.0	0.0	63151881
*PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03	1	61149882
74 1 23.626000E-060.0	0.0	0.0	61149883
SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04	1	62149884
74 2 12.198000E-240.0	0.0	0.0	62149885
*ND1500.0	5.230297E-021.742186E-011.865556E+001.211749E+00	1	60150886
75 1 30.	0.0	0.0	60150887
PM1510.0	1.012214E-032.037358E-021.742050E+027.058672E+02	1	61151888
75 2 26.779600E-060.0	0.0	0.0	61151889
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	1	62151890
75 3 32.363400E-100.0	0.0	0.0	62151891
SM1520.0	7.520442E-022.877061E-012.755117E+022.118281E+02	1	62152892
75 4 30.	0.0	0.0	62152893
SM1530.0	2.260670E-041.191724E-022.418654E+023.333276E+02	1	62153894
75 5 24.122900E-060.0	0.0	0.0	62153895
EU1530.0	2.431446E-011.539698E+001.478631E+023.966174E+02	1	63153896
75 6 30.	0.0	0.0	63153897
EU1540.0	7.241066E-021.875663E+002.228416E+028.974997E+02	1	63154898
75 7 32.555800E-090.0	0.0	0.0	63154899

EU1550.0	9.062116E-011.543263E+001.540107E+024.077187E+03	1	63155900
75 8 34.579200E-090.0	0.0 0.0 0.0 0.0		63155901
EU1560.0	5.008924E-043.539738E-021.016701E+024.866885E+02	1	63156902
75 9 25.277900E-070.0	0.0 0.0 0.0 0.0		63156903
GD1560.0	1.177736E-012.925910E-011.328447E+011.496788E+00	1	64156904
7510 30.	0.0 0.0 0.0 0.0		64156905
GD1570.0	1.068337E-017.103253E-018.871128E+011.491231E+05	1	64157906
7511 10.	0.0 0.0 0.0 0.0		64157907
*ND1500.0	5.230297E-021.742186E-011.865556E+001.211749E+00		60150908
76 1 30.	0.0 0.0 0.0 0.0		60150909
PM1510.0	1.012214E-032.037358E-021.742050E+027.058672E+02		61151910
76 2 26.779600E-060.0	0.0 0.0 0.0 0.0		61151911
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03		62151912
76 3 32.363400E-100.0	0.0 0.0 0.0 0.0		62151913
SM1520.0	7.520442E-022.877061E-012.755117E+022.118281E+02		62152914
76 4 30.	0.0 0.0 0.0 0.0		62152915
SM1530.0	2.260670E-041.191724E-022.418654E+023.33276E+02		62153916
76 5 24.122900E-060.0	0.0 0.0 0.0 0.0		62153917
EU1530.0	2.431446E-011.539698E+001.478631E+023.966174E+02		63153918
76 6 30.	0.0 0.0 0.0 0.0		63153919
EU1540.0	7.241066E-021.875663E+002.228416E+028.974997E+02		63154920
76 7 32.555800E-090.0	0.0 0.0 0.0 0.0		63154921
EU1550.0	9.062116E-011.543263E+001.540107E+024.077187E+03		63155922
76 8 24.579200E-090.0	0.0 0.0 0.0 0.0		63155923
GD1550.0	1.251320E-011.467746E+001.313204E+023.466494E+04	1	64155924
76 9 10.	0.0 0.0 0.0 0.0		64155925
*ND1500.0	5.230297E-021.742186E-011.865556E+001.211749E+00		60150926
77 1 30.	0.0 0.0 0.0 0.0		60150927
PM1510.0	1.012214E-032.037358E-021.742050E+027.058672E+02		61151928
77 2 26.779600E-060.0	0.0 0.0 0.0 0.0		61151929
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03		62151930
77 3 22.363400E-100.0	0.0 0.0 0.0 0.0		62151931
EU1510.0	4.181577E-012.402754E+002.044278E+028.515005E+03	1	63151932
77 4 10.	0.0 0.0 0.0 0.0		63151933
*ND1500.0	5.230297E-021.742186E-011.865556E+001.211749E+00		60150934
78 1 30.	0.0 0.0 0.0 0.0		60150935

PM1510.0	1.012214E-032.037358E-021.742050E+027.058672E+02	61151936
78 2 26.779600E-060.0	0.0 0.0 0.0 0.0	61151937
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	62151938
78 3 32.363400E-100.0	0.0 0.0 0.0 0.0	62151939
SM1520.0	7.520442E-022.877061E-012.755117E+022.118281E+02	62152940
78 4 30.	0.0 0.0 0.0 0.0	62152941
SM1530.0	2.260670E-041.191724E-022.418654E+023.333276E+02	62153942
78 5 24.122900E-060.0	0.0 0.0 0.0 0.0	62153943
EU1530.0	2.431446E-011.539698E+001.478631E+023.966174E+02	63153944
78 6 30.	0.0 0.0 0.0 0.0	63153945
EU1540.0	7.241066E-021.875663E+002.228416E+028.974997E+02	63154946
78 7 22.555800E-090.0	0.0 0.0 0.0 0.0	63154947
GD1540.0	3.041554E-016.280531E-012.531751E+018.582805E+01	64154948
78 8 30.	0.0 0.0 0.0 0.0	64154949
GD1550.0	1.251320E-011.467746E+001.313204E+023.466494E+04	64155950
78 9 10.	0.0 0.0 0.0 0.0	64155951
*PM1510.0	1.012214E-032.037358E-021.742050E+027.058672E+02	61151952
79 1 36.779600E-060.0	0.0 0.0 0.0 0.0	61151953
SM1520.0	7.520442E-022.877061E-012.755117E+022.118281E+02	62152954
79 2 30.	0.0 0.0 0.0 0.0	62152955
SM1530.0	2.260670E-041.191724E-022.418654E+023.333276E+02	62153956
79 3 14.122900E-060.0	0.0 0.0 0.0 0.0	62153957
*SM1540.0	5.706727E-021.425114E-013.851160E+005.552533E+00	62154958
80 1 30.	0.0 0.0 0.0 0.0	62154959
EU1550.0	9.062116E-011.543263E+001.540107E+024.077187E+03	63155960
80 2 34.579200E-090.0	0.0 0.0 0.0 0.0	63155961
EU1560.0	5.008924E-043.539738E-021.016701E+024.866885E+02	63156962
80 3 25.277900E-070.0	0.0 0.0 0.0 0.0	63156963
GD1560.0	1.177736E-012.925910E-011.328447E+011.496788E+00	64156964
80 4 30.	0.0 0.0 0.0 0.0	64156965
GD1570.0	1.068337E-017.103253E-018.871128E+011.491231E+05	64157966
80 5 30.	0.0 0.0 0.0 0.0	64157967
GD1580.0	4.647452E-021.882511E-016.519250E+002.533814E+00	64158968
80 6 10.	0.0 0.0 0.0 0.0	64158969
*SM1540.0	5.706727E-021.425114E-013.851160E+005.552533E+00	62154970
81 1 30.	0.0 0.0 0.0 0.0	62154971

EU1550.0	9.062116E-011.543263E+001.540107E+024.0771A7E+03		63155972
81 2 24.579200E-090.0	0.0	0.0	63155973
GD1550.0	1.251320E-011.467746E+001.313204E+023.466494E+04	1	64155974
81 3 10.	0.0	0.0	64155975
*EU1570.0	3.221641E-032.526199E-028.471598E+011.9120A9E+02	1	63157976
82 1 21.266700E-050.0	0.0	0.0	63157977
GD1570.0	1.068337E-017.103253E-018.871128E+011.491231E+05	1	64157978
82 2 30.	0.0	0.0	64157979
GD1580.0	4.647452E-021.8A2511E-016.519250E+002.533814E+00	1	64158980
82 3 30.	0.0	0.0	64158981
GD1590.0	0.	0.	64159982
82 4 21.035200E-050.0	0.0	0.0	64159983
TA1590.0	9.138282E-027.922879E-014.634842E+012.595299E+01	1	65159984
82 5 30.	0.0	0.0	65159985
TA1600.0	1.434563E-037.845290E-028.018238E+015.2A5275E+02	1	65160986
82 6 21.109600E-070.0	0.0	0.0	65160987
DY1600.0	7.939346E-011.200462E+001.508596E+026.514924E+01	1	66160988
82 7 30.	0.0	0.0	66160989
DY1610.0	5.945760E-021.227134E+001.166236E+025.61A201E+02	1	66161990
82 8 30.	0.0	0.0	66161991
DY1620.0	2.803023E-015.297747E-012.471440E+022.071357E+02	1	66162992
82 9 10.	0.0	0.0	66162993
*EU1570.0	3.221641E-032.526199E-028.471598E+011.9120A9E+02		63157994
83 1 21.266700E-050.0	0.0	0.0	63157995
GD1570.0	1.068337E-017.103253E-018.871128E+011.491231E+05		64157996
83 2 30.	0.0	0.0	64157997
GD1580.0	4.647452E-021.8A2511E-016.519250E+002.533814E+00		64158998
83 3 30.	0.0	0.0	64158999
GD1590.0	0.	0.	64159000
83 4 21.035200E-050.0	0.0	0.0	64159001
TA1590.0	9.138282E-027.922879E-014.634842E+012.595299E+01		65159002
83 5 30.	0.0	0.0	65159003
TA1600.0	1.434563E-037.845290E-028.018238E+015.2A5275E+02		65160004
83 6 31.109600E-070.0	0.0	0.0	65160005
TA1610.0	0.	0.	65161006
83 7 21.159300E-060.0	0.0	0.0	65161007

DY1610.0	5.945760E-021.227134E+001.166236E+025.618201E+02	1	66161008
83 8 30.	0.0 0.0 0.0 0.0		66161009
DY1620.0	2.803023E-015.297747E-012.471440E+022.071357E+02	1	66162010
83 9 10.	0.0 0.0 0.0 0.0		66162011
0GD1600.0	8.083934E-021.503781E-019.311768E-017.762493E-01	1	64160012
84 1 10.	0.0 0.0 0.0 0.0		64160013
	1 3 2 3		
*ZN0722.483345E-072.903709E-071.037633E-065.152036E-064.215583E-06			30 72 1
GA0721.670910E-108.869180E-121.149840E-082.169880E-081.699810E-10			31 72 2
GE0721.160630E-130.	3.799460E-113.959780E-113.359620E-14		32 72 3
GF0731.057043E-064.625445E-072.373684E-061.127502E-056.196207E-06			32 73 4
GE0743.484152E-061.275791E-065.607919E-062.814694E-051.051476E-05			32 74 5
*AS0751.124858E-054.521200E-061.311179E-058.445047E-052.763160E-05			33 75 6
*GF0763.592223E-058.238108E-062.898564E-051.501023E-046.912278E-05			32 76 7
GE0772.928474E-059.403786E-062.980387E-059.799851E-054.343709E-05			32 77 8
AS0775.358643E-052.094917E-054.321448E-051.629230E-048.504415E-05			33 77 9
SE0777.243930E-111.391870E-131.793862E-094.443860E-081.238861E-12			34 77 10
SE0781.663682E-048.732211E-052.212574E-046.224747E-043.749051E-04			34 78 11
SE0795.079143E-041.570990E-044.781033E-041.429788E-038.303185E-04			34 79 12
SE0801.225681E-034.998095E-041.161426E-032.438569E-032.006525E-03			34 80 13
*RR0812.103294E-031.273732E-031.765155E-033.117142E-034.364688E-03			35 81 14
RR0821.250679E-061.011906E-073.959437E-051.393924E-057.359180E-07			35 82 15
KR0821.020550E-091.989820E-115.459230E-081.809900E-089.678920E-11			36 82 16
KR0835.312762E-033.765026E-032.961744E-031.017763E-022.123794E-02			36 83 17
KR0849.882825E-037.529980E-034.802135E-031.703439E-023.903844E-02			36 84 18
*SE0823.343102E-032.548765E-032.109052E-035.626244E-031.211809E-02			34 82 19
*KR85M1.311311E-027.578210E-035.612475E-032.173120E-024.056017E-02			36 85 20
RR0850.	0. 0. 0. 0.		37 85 21
*KR85M1.311311E-027.578210E-035.612475E-032.173120E-024.056017E-02			36 85 22
KR0852.333270E-051.509860E-066.873030E-052.150380E-046.019330E-06			36 85 23
RR0858.234493E-075.189520E-065.850792E-076.530832E-072.269790E-09			37 85 24
*KR85M1.311311E-027.578210E-035.612475E-032.173120E-024.056017E-02			36 85 25
KR0852.333270E-051.509860E-066.873030E-052.150380E-046.019330E-06			36 85 26
KR0861.952032E-021.195331E-027.580687E-032.858085E-026.375583E-02			36 86 27
*RR0872.546474E-021.523485E-029.491751E-034.008767E-026.791227E-02			37 87 28
SR0883.626761E-022.292385E-021.369879E-025.495257E-027.123812E-02			38 88 29

*SR0894.845960E-022.975173E-021.709117E-026.256757E-028.432777E-02	38	89	30
Y0895.843321E-098.679200E-119.229351E-081.544005E-073.664588E-09	39	89	31
Y0900. 0. 0. 0. 0.	39	90	32
ZR0900. 0. 0. 0. 0.	40	90	33
*SR0905.913379E-023.354421E-022.117339E-026.795162E-028.246125E-02	38	90	34
Y0902.348279E-064.929540E-092.122699E-063.849790E-062.623708E-08	39	90	35
ZR0902.071120E-111.317878E-136.839040E-107.399600E-106.379302E-08	40	90	36
*SR0905.913379E-023.354421E-022.117339E-026.795162E-028.246125E-02	38	90	37
SR0915.918764E-023.874343E-022.486226E-026.513428E-027.373748E-02	38	91	38
Y0915.563020E-063.879640E-079.573650E-055.951670E-051.194863E-06	39	91	39
ZR0911.580860E-091.529860E-111.402800E-053.849790E-083.429620E-10	40	91	40
ZR0925.959925E-024.210787E-023.017505E-026.594485E-026.687161E-02	40	92	41
ZR0930. 0. 0. 0. 0.	40	93	42
*Y0936.370531E-024.843397E-023.849347E-027.006416E-027.360390E-02	39	93	43
ZR0932.411310E-067.379310E-081.921730E-052.578860E-059.258960E-08	40	93	44
*ZR0946.423790E-024.526561E-024.441619E-026.807624E-025.612404E-02	40	94	45
ZR0956.464271E-025.323509E-024.921522E-026.247775E-025.268251E-02	40	95	46
NB0951.641888E-061.006906E-081.491788E-051.231933E-057.639140E-09	41	95	47
MO0953.041650E-111.369870E-131.049850E-091.459920E-091.899790E-13	42	95	48
MO0965.995001E-061.409967E-073.780219E-056.801700E-051.919951E-07	42	96	49
MO0970. 0. 0. 0. 0.	42	97	50
*ZR0966.252114E-025.291753E-025.093127E-025.669350E-024.317376E-02	40	96	51
ZR0975.947958E-025.517831E-025.497317E-025.372572E-024.288922E-02	40	97	52
MO0971.460181E-041.241494E-041.019416E-038.072159E-044.000650E-06	42	97	53
MO0985.781094E-025.553701E-025.856800E-025.158694E-023.674058E-02	42	98	54
MO0996.127275E-026.246666E-026.144199E-024.957288E-022.965416E-02	42	99	55
TC99M3.431860E-091.729840E-116.269110E-088.629530E-082.979670E-11	43	99	56
TC0993.431860E-091.729840E-116.269110E-088.629530E-082.979670E-11	43	99	57
RU1002.381477E-071.749865E-093.240220E-053.200641E-061.049901E-09	44100	58	
RU1010. 0. 0. 0. 0.	44101	59	
*MO0985.781094E-025.553701E-025.856800E-025.158694E-023.674058E-02	42	98	60
MO0996.127275E-026.246666E-026.144199E-024.957288E-022.965416E-02	42	99	61
TC0990. 0. 0. 0. 0.	43	99	62
RU1000. 0. 0. 0. 0.	44100	63	
*MO1006.305478E-026.132815E-026.982387E-024.409405E-021.376844E-02	42100	64	
RU1015.043481E-026.579438E-025.911485E-023.225787E-027.266525E-03	44101	65	

RU1024.199153E-026.791924E-026.008344E-022.449247E-023.625557E-03	44102	66
RU1033.137420E-026.336271E-026.991221E-021.706601E-021.644892E-03	44103	67
RH1031.857008E-113.779640E-131.357825E-091.421922E-110.	45103	68
PD1046.513637E-105.009530E-115.309492E-086.559762E-102.499720E-13	46104	69
PD1059.825330E-135.789460E-062.029710E-103.499810E-130.	46105	70
PD1060. 0. 0. 0. 0.	46106	71
PD1070. 0. 0. 0. 0.	46107	72
*RU1041.824198E-025.436672E-025.953263E-021.027615E-028.500043E-04	44104	73
RU1051.020488E-024.209891E-025.419310E-024.712564E-033.406040E-04	44105	74
RH1051.878019E-082.999720E-091.273820E-066.459640E-097.839120E-12	45105	75
PD1050. 0. 0. 0. 0.	46105	76
PD1060. 0. 0. 0. 0.	46106	77
*RU1041.824198E-025.436672E-025.953263E-021.027615E-028.500043E-04	44104	78
RU1051.020488E-024.209891E-025.419310E-024.712564E-033.406040E-04	44105	79
RH1051.878019E-082.999720E-091.273820E-066.459640E-097.839120E-12	45105	80
PD1060. 0. 0. 0. 0.	46106	81
*RU1063.912368E-032.752392E-024.274920E-022.579253E-034.261271E-04	44106	82
PD1066.924171E-091.119986E-071.462863E-052.385948E-074.099736E-10	46106	83
PD1071.628656E-031.272245E-023.235527E-021.141665E-034.618927E-04	46107	84
PD1087.106789E-046.226969E-032.234249E-026.148129E-044.210805E-04	46108	85
PD1092.995048E-042.840505E-031.411333E-024.336274E-046.114486E-04	46109	86
AG1092.621430E-120. 9.678819E-101.254932E-103.219640E-12	47109	87
AG1102.621420E-114.759560E-131.139840E-081.479920E-104.059550E-11	47110	88
CD1102.821530E-115.019530E-131.270025E-081.600078E-104.379510E-11	48110	89
*RU1063.912368E-032.752392E-024.274920E-022.579253E-034.261271E-04	44106	90
PD1070. 0. 0. 0. 0.	46107	91
PD1080. 0. 0. 0. 0.	46108	92
PD1090. 0. 0. 0. 0.	46109	93
AG1090. 0. 0. 0. 0.	47109	94
*PD1092.995048E-042.840505E-031.411333E-024.336274E-046.114486E-04	46109	95
AG1092.621430E-120. 9.678819E-101.254932E-103.219640E-12	47109	96
CD1100. 0. 0. 0. 0.	48110	97
*PD1102.236568E-041.322679E-036.216885E-032.537568E-045.931168E-04	46110	98
AG1111.976448E-048.171941E-042.743421E-032.026759E-048.192801E-04	47111	99
CD1113.031640E-130. 4.339380E-112.929840E-121.336851E-13	48111100	
CD1121.438384E-061.059969E-097.644549E-074.214269E-082.340137E-08	48112101	

CD1131.242646E-044.754439E-047.811412E-041.315169E-045.142045E-04	48113102
CD1141.125426E-044.107055E-044.678295E-041.226850E-047.333581E-04	48114103
CD1158.907208E-053.641816E-043.173004E-049.594489E-058.022612E-04	48115104
IN1151.078586E-111.285880E-137.488930E-103.859790E-101.871790E-12	49115105
SN1163.101902E-105.999440E-126.400028E-091.111940E-115.319400E-11	50116106
*PD1121.266063E-045.131325E-041.069507E-031.459752E-049.069144E-04	46112107
CD1120. 0. 0. 0. 0.	48112108
CD1130. 0. 0. 0. 0.	48113109
CD1140. 0. 0. 0. 0.	48114110
CD1150. 0. 0. 0. 0.	48115111
IN1150. 0. 0. 0. 0.	49115112
SN1160. 0. 0. 0. 0.	50116113
*CD1141.125426E-044.107055E-044.678295E-041.226850E-047.333581E-04	48114114
CD15M1.395552E-055.692495E-055.158605E-051.600697E-051.256846E-04	48115115
IN1150. 0. 0. 0. 0.	49115116
SN1160. 0. 0. 0. 0.	50116117
*CD1161.060148E-043.797155E-043.428704E-041.205511E-047.665602E-04	48116118
SN1171.077424E-043.612662E-043.425785E-041.097795E-046.445361E-04	50117119
SN1181.208545E-043.581292E-043.388535E-041.169839E-046.486599E-04	50118120
SN1191.119539E-043.492686E-043.496633E-041.204174E-046.385623E-04	50119121
SN1201.174069E-043.496843E-043.500069E-041.326177E-045.920511E-04	50120122
*SN21M5.953230E-083.029720E-093.449510E-073.079830E-075.119430E-09	50121123
SB1210. 0. 0. 0. 0.	51121124
SB1220. 0. 0. 0. 0.	51122125
TE1220. 0. 0. 0. 0.	52122126
*SN1211.283820E-043.608918E-043.630350E-041.415893E-045.080366E-04	50121127
SB1212.201190E-073.409680E-132.909591E-072.819850E-103.269630E-12	51121128
SB1224.452420E-108.089240E-121.847738E-086.349650E-091.019886E-11	51122129
TE1223.471880E-140. 4.109420E-121.139940E-120.	52122130
*SN1221.326944E-043.682263E-043.795219E-042.184688E-043.941646E-04	50122131
SN1238.922496E-051.984028E-042.202088E-041.636871E-041.759222E-04	50123132
SB1237.407211E-051.984030E-042.203548E-041.637891E-041.686673E-04	51123133
SB1246.173350E-081.495861E-098.628780E-071.227934E-069.688920E-10	51124134
TE1242.991620E-111.129900E-139.138700E-101.609910E-097.139200E-14	52124135
*SN1221.326944E-043.682263E-043.795219E-042.184688E-043.941646E-04	50122136
SB1230. 0. 0. 0. 0.	51123137

SB1240.	0.	0.	0.	0.	0.	0.	0.	0.	0.	51124138
TE1240.	0.	0.	0.	0.	0.	0.	0.	0.	0.	52124139
*SN1242.	195614E-044.	341714E-045.	49229AE-045.	243261E-043.	018169E-04					50124140
SN1252.	960670E-045.	401002E-041.	248392E-031.	091382E-033.	63839AE-04					50125141
SB1255.	933220E-071.	839830E-087.	528930E-061.	798900E-059.	168970E-09					51125142
TE25M3.	561910E-101.	709840E-127.	079000E-093.	909790E-088.	029100E-13					52125143
TE1253.	562120E-101.	709840E-127.	079802E-093.	910532E-088.	029100E-13					52125144
*SN1242.	195614E-044.	341714E-045.	49229AE-045.	243261E-043.	018169E-04					50124145
SN1252.	960670E-045.	401002E-041.	248392E-031.	091382E-033.	63839AE-04					50125146
SB1255.	933220E-071.	839830E-087.	528930E-061.	798900E-059.	168970E-09					51125147
TE1250.	0.	0.	0.	0.	0.					52125148
*SN1265.	667383E-046.	981991E-041.	936435E-032.	258062E-035.	199840E-04					50126149
SN1268.	873815E-061.	310875E-073.	354121E-058.	421604E-057.	591545E-08					51126150
TE1262.	916784E-069.	900453E-082.	567739E-056.	529637E-055.	732814E-08					52126151
TE1270.	0.	0.	0.	0.	0.					52127152
TE1270.	0.	0.	0.	0.	0.					53127153
*SN1265.	667383E-046.	981991E-041.	936435E-032.	258062E-035.	199840E-04					50126154
SN1268.	873815E-061.	310875E-073.	354121E-058.	421604E-057.	591545E-08					51126155
TE1262.	916784E-069.	900453E-082.	567739E-056.	529637E-055.	732814E-08					52126156
TE27M0.	0.	0.	0.	0.	0.					52127157
TE1270.	0.	0.	0.	0.	0.					52127158
TE1270.	0.	0.	0.	0.	0.					53127159
TE1270.	0.	0.	0.	0.	0.					51127160
*SR1271.	302907E-031.	296181E-034.	913334E-036.	743097E-039.	41354AE-04					52127161
TE27M6.	013260E-071.	909820E-094.	019430E-062.	109890E-059.	728910E-10					52127162
TE1270.	0.	0.	0.	0.	0.					52127163
TE1270.	0.	0.	0.	0.	0.					53127163
*SR1271.	302907E-031.	296181E-034.	913334E-036.	743097E-039.	41354AE-04					51127164
TE1272.	031100E-071.	909820E-094.	019430E-062.	109890E-059.	738910E-10					52127165
TE1271.	000540E-101.	159890E-133.	639635E-094.	200172E-083.	139650E-13					53127166
XE1281.	432781E-073.	449680E-111.	219026E-061.	081941E-064.	019550E-12					54128167
*SR1281.	104500E-043.	935630E-059.	427360E-041.	703670E-039.	458940E-06					51128168
TE1283.	392456E-035.	050608E-037.	564225E-037.	755533E-031.	873361E-03					52128169
TE1290.	0.	0.	0.	0.	0.					53129170
TE1300.	0.	0.	0.	0.	0.					53130171
TE1300.	0.	0.	0.	0.	0.					54130172
TE1310.	0.	0.	0.	0.	0.					54131173

*SBI281.104500E-043.935630E-059.427360E-041.703670E-039.458940E-06	51128174
TE1283.392456E-035.050608E-037.564225E-037.755533E-031.873361E-03	52128175
TE29M1.636986E-032.701922E-033.765776E-034.488684E-039.448323E-04	52129176
I1294.952045E-038.406749E-031.126840E-021.167171E-022.990338E-03	53129177
I1301.720930E-062.439770E-094.799320E-052.657860E-059.538930E-09	54130178
XE1303.131700E-101.499460E-131.219830E-082.389870E-081.239860E-12	54130179
XE1310.0.0.0.0.	54131180
*SBI281.104500E-043.935630E-059.427360E-041.703670E-039.458940E-06	51128181
TE1283.392456E-035.050608E-037.564225E-037.755533E-031.873361E-03	52128182
TE29M1.636986E-032.701922E-033.765776E-034.488684E-039.448323E-04	52129183
I1294.952045E-038.406749E-031.126840E-021.167171E-022.990338E-03	53129184
XE1300.0.0.0.0.	54130185
XE1310.0.0.0.0.	54131186
*SBI281.104500E-043.935630E-059.427360E-041.703670E-039.458940E-06	51128187
TE1283.392456E-035.050608E-037.564225E-037.755533E-031.873361E-03	52128188
TE29M1.636986E-032.701922E-033.765776E-034.488684E-039.448323E-04	53129189
I1294.952045E-038.406749E-031.126840E-021.167171E-022.990338E-03	54130190
XE1300.0.0.0.0.	54131191
XE1310.0.0.0.0.	52130192
*TE1301.446812E-021.775702E-022.500978E-022.367145E-028.336956E-03	52131193
*TE31M3.630438E-032.302405E-036.495399E-031.157044E-021.223950E-03	53131194
I1312.472727E-022.981688E-023.093372E-022.351804E-021.481254E-02	54131195
XE1311.540860E-085.969469E-061.651826E-078.480074E-072.159760E-10	54132196
XE1320.0.0.0.0.	54133197
XE1330.0.0.0.0.	55133198
CS1330.0.0.0.0.	52131199
*TE31M3.630438E-032.302405E-036.495399E-031.157044E-021.223950E-03	53131200
I1312.472727E-022.981688E-023.093372E-022.351804E-021.481254E-02	54132201
XE1320.0.0.0.0.	54133202
XE1330.0.0.0.0.	55133203
CS1330.0.0.0.0.	52132204
*TE1324.230911E-025.027471E-025.122800E-024.524284E-022.842687E-02	54132205
XE1321.704162E-041.225426E-051.414510E-032.795614E-032.622850E-05	54133206
XE1330.0.0.0.0.	55133207
CS1330.0.0.0.0.	55134208
CS1340.0.0.0.0.	54132209
*XE1321.704162E-041.225426E-051.414510E-032.795614E-032.622850E-05	

XE33M0.	0.	0.	0.	0.	54133210
XE1330.	0.	0.	0.	0.	54133211
CS1330.	0.	0.	0.	0.	55133212
* I1336.787045E-026.355588E-026.922810E-025.974409E-023.857510E-02					53133213
XE1336.513530E-065.739470E-069.644630E-051.531720E-045.429390E-07					54133214
XE1347.680617E-027.098847E-027.392476E-026.128919E-025.440736E-02					54134215
XE1352.545185E-031.498561E-041.151654E-021.337418E-024.027740E-04					54135216
CS1351.436779E-055.699470E-087.993860E-052.104480E-043.959550E-07					55135217
CS1365.307880E-058.229240E-061.052920E-031.125460E-031.389840E-06					55136218
BA1367.123860E-088.099250E-102.249680E-065.299710E-061.019890E-07					56136219
BA1370.	0.	0.	0.	0.	56137220
* I1336.787045E-026.355588E-026.922810E-025.974409E-023.857510E-02					53133221
XE33M1.908040E-051.220890E-053.387920E-044.100580E-045.429390E-07					54133222
XE1330.	0.	0.	0.	0.	54133223
CS1330.	0.	0.	0.	0.	55133224
* I1336.787045E-026.355588E-026.922810E-025.974409E-023.857510E-02					53133225
XE1336.513530E-065.739470E-069.644630E-051.531720E-045.429390E-07					54133226
CS1335.082762E-071.289880E-111.609852E-073.700134E-077.459170E-11					55133227
CS1343.571930E-071.840829E-094.609340E-061.196934E-051.161870E-08					55134228
CS1350.	0.	0.	0.	0.	55135229
* I1336.787045E-026.355588E-026.922810E-025.974409E-023.857510E-02					53133230
XE1336.513530E-065.739470E-069.644630E-051.531720E-045.429390E-07					54133231
CS1335.082762E-071.289880E-111.609852E-073.700134E-077.459170E-11					55133232
CS1343.571930E-071.840829E-094.609340E-061.196934E-051.161870E-08					55134233
BA1343.521910E-102.589760E-141.129840E-094.959730E-093.269630E-13					56134234
* I1356.349246E-026.547839E-026.303188E-024.859691E-025.238701E-02					53135235
XE1350.	0.	0.	0.	0.	54135236
CS1350.	0.	0.	0.	0.	55135237
* I1356.349246E-026.547839E-026.303188E-024.859691E-025.238701E-02					53135238
XE1352.545185E-031.498561E-041.151654E-021.337418E-024.027740E-04					54135239
XE1366.271846E-026.010435E-026.623027E-026.793390E-025.596754E-02					54136240
CS1376.268077E-026.194019E-026.691228E-026.788906E-027.018821E-02					55137241
BA1380.	0.	0.	0.	0.	56138242
* CS1376.268077E-026.194019E-026.691228E-026.788906E-027.018821E-02					55137243
BA1375.023216E-061.659866E-083.068222E-051.377755E-043.418419E-05					56137244
BA1386.824373E-025.959686E-025.713888E-025.886487E-027.459823E-02					56138245

LA1396.486390E-026.110052E-025.641990E-026.384953E-027.040133E-02	57139246
LA1400. 0. 0. 0. 0.	57140247
CE1400. 0. 0. 0. 0.	58140248
*BA1406.320245E-025.889230E-025.550442E-026.410090E-027.678098E-02	56140249
LA1405.671080E-056.069440E-082.453350E-042.281580E-048.879010E-07	57140250
CE1406.733710E-091.009910E-074.509366E-071.445922E-051.069880E-10	58140251
CE1415.889526E-025.142611E-025.360558E-026.622424E-027.241736E-02	58141252
PR1417.424030E-122.669750E-124.809320E-111.399920E-095.949330E-14	59141253
*CE1415.889526E-025.142611E-025.360558E-026.622424E-027.241736E-02	58141254
PR1417.424030E-122.669750E-124.809320E-111.399920E-095.949330E-14	59141255
PR1425.763120E-101.784834E-132.629620E-096.029680E-086.399280E-12	59142256
ND1420. 0. 4.619350E-142.799850E-120.	60142257
ND1430. 0. 0. 0. 0.	60143258
*CE1415.889526E-025.142611E-025.360558E-026.622424E-027.241736E-02	58141259
PR1417.424030E-122.669750E-124.809320E-111.399920E-095.949330E-14	59141260
PR1425.763120E-101.784834E-132.629620E-096.029680E-086.399280E-12	59142261
PR1430. 0. 0. 0. 0.	59143262
ND1430. 0. 0. 0. 0.	60143263
*CE1425.931060E-024.930523E-025.015649E-026.630372E-026.038414E-02	58142264
CE1435.972113E-024.834113E-024.560898E-025.880850E-026.619276E-02	58143265
PR1432.731480E-082.649750E-109.408670E-081.519920E-063.989550E-09	59143266
ND1439.495150E-130. 4.899310E-122.479860E-100.	60143267
ND1441.065878E-052.726882E-073.106431E-061.525317E-052.819776E-08	60144268
ND1454.062237E-092.969720E-121.179847E-083.289979E-076.809240E-11	60145269
*CE1435.972113E-024.834113E-024.560898E-025.880850E-026.619276E-02	58143270
CE1445.456643E-024.750981E-023.837465E-024.647984E-027.839377E-02	58144271
ND1440. 0. 0. 0. 0.	60144272
ND1450. 0. 0. 0. 0.	60145273
*CE1435.972113E-024.834113E-024.560898E-025.880850E-026.619276E-02	58143274
PR1432.731480E-082.649750E-109.408670E-081.519920E-063.989550E-09	59143275
ND1440. 0. 0. 0. 0.	60144276
ND1450. 0. 0. 0. 0.	60145277
*CE1435.972113E-024.834113E-024.560898E-025.880850E-026.619276E-02	58143278
CE1445.456643E-024.750981E-023.837465E-024.647984E-027.839377E-02	58144279
PR1453.934222E-023.997650E-023.078146E-023.364792E-025.356450E-02	59145280
ND1450. 0. 0. 0. 0.	60145281

*PR1453.93422E-023.997650E-023.07A146E-023.364792E-025.356450E-02	591452A2
ND1454.062237E-092.969720E-121.179847E-083.289979E-076.809240E-11	601452A3
ND1462.992683E-023.610422E-022.537683E-022.537295E-024.538207E-02	601462A4
ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	601472A5
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	611472A6
PM48M7.494070E-091.189890E-112.089700E-082.789850E-072.169760E-10	611482A7
PM1490.0.0.0.0.	611492A8
SM1490.0.0.0.0.	621492A9
SM1500.0.0.0.0.	621502A0
SM1510.0.0.0.0.	621512A1
SM1520.0.0.0.0.	621522A2
SM1530.0.0.0.0.	621532A3
FU1530.0.0.0.0.	631532A4
FU1540.0.0.0.0.	631542A5
FU1550.0.0.0.0.	631552A6
FU1560.0.0.0.0.	631562A7
GD1560.0.0.0.0.	641562A8
*PR1453.93422E-023.997650E-023.07A146E-023.364792E-025.356450E-02	59145299
ND1454.062237E-092.969720E-121.179847E-083.289979E-076.809240E-11	60145300
ND1462.992683E-023.610422E-022.537683E-022.537295E-024.538207E-02	60146301
ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	60147302
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	61147303
PM1485.733110E-081.189890E-112.089700E-089.479480E-092.169760E-10	61148304
PM1490.0.0.0.0.	61149305
SM1490.0.0.0.0.	62149306
SM1500.0.0.0.0.	62150307
SM1510.0.0.0.0.	62151308
SM1520.0.0.0.0.	62152309
SM1530.0.0.0.0.	62153310
FU1530.0.0.0.0.	63153311
FU1540.0.0.0.0.	63154312
FU1550.0.0.0.0.	63155313
FU1560.0.0.0.0.	63156314
GD1560.0.0.0.0.	64156315
*ND1454.062237E-092.969720E-121.179847E-083.289979E-076.809240E-11	60145316
ND1462.992683E-023.610422E-022.537683E-022.537295E-024.538207E-02	60146317

ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	60147318
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	61147319
SM1470.0.	62147320
SM1486.953770E-130.2.429660E-142.009890E-120.	62148321
SM1490.0.	62149322
SM1500.0.	62150323
SM1510.0.	62151324
SM1520.0.	62152325
*ND1454.062237E-092.969720E-121.179847E-083.289979E-076.809240E-11	60145326
ND1462.992683E-023.610422E-022.537683E-022.537295E-024.538207E-02	60146327
ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	60147328
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	61147329
PM48M7.494070E-091.189890E-112.089700E-082.789850E-072.169760E-10	61148330
SM1480.0.	62148331
SM1490.0.	62149332
SM1500.0.	62150333
SM1510.0.	62151334
SM1520.0.	62152335
*ND1454.062237E-092.969720E-121.179847E-083.289979E-076.809240E-11	60145336
ND1462.992683E-023.610422E-022.537683E-022.537295E-024.538207E-02	60146337
ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	60147338
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	61147339
PM1485.733110E-081.189890E-112.089700E-089.479480E-092.169760E-10	61148340
SM1480.0.	62148341
SM1490.0.	62149342
SM1500.0.	62150343
SM1510.0.	62151344
SM1520.0.	62152345
*ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	60147346
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	61147347
PM48M7.494070E-091.189890E-112.089700E-082.789850E-072.169760E-10	61148348
PM1491.089753E-021.765354E-021.261239E-027.692321E-038.254346E-03	61149349
SM1500.0.	62150350
SM1510.0.	62151351
*ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	60147352
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	61147353

PM1485.733110E-081.189890E-112.089700E-089.479480E-092.169760E-10	61148354
PM1491.088753E-021.765354E-021.261239E-027.692321E-038.254346E-03	61149355
SM1500. 0. 0. 0. 0.	62150356
SM1510. 0. 0. 0. 0.	62151357
*ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	60147358
ND1481.690673E-022.259347E-021.694488E-021.286738E-022.003016E-02	60148359
PM1490. 0. 0. 0. 0.	61149360
SM1490. 0. 0. 0. 0.	62149361
*ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	60147362
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	61147363
PM48M7.494070E-091.189890E-112.089700E-082.789850E-072.169760E-10	61148364
PM1480. 0. 0. 0. 0.	61148365
SM1480. 0. 0. 0. 0.	62148366
SM1490. 0. 0. 0. 0.	62149367
SM1500. 0. 0. 0. 0.	62150368
SM1510. 0. 0. 0. 0.	62151369
*ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02	60147370
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	61147371
PM48M7.494070E-091.189890E-112.089700E-082.789850E-072.169760E-10	61148372
PM1480. 0. 0. 0. 0.	61148373
PM1490. 0. 0. 0. 0.	61149374
SM1490. 0. 0. 0. 0.	62149375
SM1500. 0. 0. 0. 0.	62150376
SM1510. 0. 0. 0. 0.	62151377
*ND1481.690673E-022.259347E-021.694488E-021.286738E-022.003016E-02	60148378
PM1491.088753E-021.765354E-021.261239E-027.692321E-038.254346E-03	61149379
SM1496.723650E-112.999720E-141.929730E-102.979881E-093.619590E-13	62149380
SM1505.415962E-065.969946E-081.701641E-052.578170E-058.280480E-08	62150381
SM1513.972160E-082.759740E-102.619630E-078.359540E-073.749580E-10	62151382
SM1522.709454E-035.571170E-035.964915E-032.078376E-036.836812E-04	62152383
SM1531.621132E-034.118398E-033.726900E-031.062029E-032.874791E-04	62153384
EU1536.883731E-072.959720E-121.939892E-086.079684E-066.239300E-12	63153385
EU1541.630880E-088.799180E-113.539500E-073.719800E-075.789350E-11	63154386
EU1550. 0. 0. 0. 0.	63155387
EU1560. 0. 0. 0. 0.	63156388
GD1560. 0. 0. 0. 0.	64156389

GD1570.	0.	0.	0.	0.	64157390
*ND1481.690673E-022.259347E-021.694488E-021.286738E-022.003016E-02					60148391
PM1491.088753E-021.765354E-021.261239E-027.692321E-038.254346E-03					61149392
SM1496.723650E-112.999720E-141.929730E-102.979881E-093.619590E-13					62149393
SM1505.415962E-065.969946E-081.701641E-052.578170E-058.280480E-08					62150394
SM1513.972160E-082.759740E-102.619630E-078.359540E-073.749580E-10					62151395
SM1522.709454E-035.571170E-035.964915E-032.078376E-036.836812E-04					62152396
SM1531.621132E-034.118398E-033.726900E-031.062029E-032.874791E-04					62153397
EU1536.883731E-072.959720E-121.939892E-086.079684E-066.239300E-12					63153398
EU1540.	0.	0.	0.	0.	63154399
GD1540.	0.	0.	0.	0.	64154400
GD1550.	0.	0.	0.	0.	64155401
*ND1481.690673E-022.259347E-021.694488E-021.286738E-022.003016E-02					60148402
PM1491.088753E-021.765354E-021.261239E-027.692321E-038.254346E-03					61149403
SM1496.723650E-112.999720E-141.929730E-102.979881E-093.619590E-13					62149404
SM1505.415962E-065.969946E-081.701641E-052.578170E-058.280480E-08					62150405
SM1510.	0.	0.	0.	0.	62151406
SM1520.	0.	0.	0.	0.	62152407
SM1530.	0.	0.	0.	0.	62153408
EU1530.	0.	0.	0.	0.	63153409
EU1540.	0.	0.	0.	0.	63154410
EU1550.	0.	0.	0.	0.	63155411
GD1550.	0.	0.	0.	0.	64155412
*ND1481.690673E-022.259347E-021.694488E-021.286738E-022.003016E-02					60148413
PM1491.088753E-021.765354E-021.261239E-027.692321E-038.254346E-03					61149414
SM1496.723650E-112.999720E-141.929730E-102.979881E-093.619590E-13					62149415
SM1505.415962E-065.969946E-081.701641E-052.578170E-058.280480E-08					62150416
SM1510.	0.	0.	0.	0.	62151417
EU1510.	0.	0.	0.	0.	63151418
*PM1491.088753E-021.765354E-021.261239E-027.692321E-038.254346E-03					61149419
SM1496.723650E-112.999720E-141.929730E-102.979881E-093.619590E-13					62149420
*ND1506.461993E-031.362350E-029.943808E-034.984633E-032.994166E-03					60150421
PM1514.202799E-038.535369E-037.775491E-033.221451E-031.542136E-03					61151422
SM1510.	0.	0.	0.	0.	62151423
SM1520.	0.	0.	0.	0.	62152424
SM1530.	0.	0.	0.	0.	62153425

EU1530.	0.	0.	0.	0.	63153426
FU1540.	0.	0.	0.	0.	63154427
EU1550.	0.	0.	0.	0.	63155428
EU1560.	0.	0.	0.	0.	63156429
GD1560.	0.	0.	0.	0.	64156430
GD1570.	0.	0.	0.	0.	64157431
*ND1506.461993E-031.362350E-029.943808E-034.984633E-032.994166E-03					60150432
PM1514.202799E-038.535369E-037.775491E-033.221451E-031.542136E-03					61151433
SM1513.972160E-082.759740E-102.619630E-078.359540E-073.749580E-10					62151434
SM1522.709454E-035.571170E-035.954915E-032.078376E-036.836812E-04					62152435
SM1531.621132E-034.118398E-033.726900E-031.062029E-032.874791E-04					62153436
EU1536.883731E-072.959720E-121.939892E-086.079684E-066.239300E-12					63153437
EU1541.630880E-088.799180E-113.539500E-073.719800E-075.789350E-11					63154438
EU1550.	0.	0.	0.	0.	63155439
GD1554.412390E-114.219110E-142.829664E-093.619995E-098.079100E-14					64155440
*ND1506.461993E-031.362350E-029.943808E-034.984633E-032.994166E-03					60150441
PM1514.202799E-038.535369E-037.775491E-033.221451E-031.542136E-03					61151442
SM1513.972160E-082.759740E-102.619630E-078.359540E-073.749580E-10					62151443
EU1515.713100E-070.		1.599770E-111.519920E-100.			63151444
*ND1506.461993E-031.362350E-029.943808E-034.984633E-032.994166E-03					60150445
PM1514.202799E-038.535369E-037.775491E-033.221451E-031.542136E-03					61151446
SM1510.	0.	0.	0.	0.	62151447
SM1520.	0.	0.	0.	0.	62152448
SM1530.	0.	0.	0.	0.	62153449
EU1530.	0.	0.	0.	0.	63153450
EU1541.630880E-088.799180E-113.539500E-073.719800E-075.789350E-11					63154451
GD1542.531370E-120.		1.139840E-102.829850E-100.			64154452
GD1550.	0.	0.	0.	0.	64155453
*PM1514.202799E-038.535369E-037.775491E-033.221451E-031.542136E-03					61151454
SM1520.	0.	0.	0.	0.	62152455
SM1530.	0.	0.	0.	0.	62153456
*SM1547.472103E-042.296511E-032.771937E-034.558008E-047.071697E-05					62154457
FU1553.296332E-041.325778E-031.707181E-032.125258E-043.673247E-05					63155458
EU1561.351492E-046.911918E-041.198661E-031.173380E-042.516001E-05					63156459
GD1565.653070E-101.179890E-122.559791E-082.850316E-081.709810E-12					64156460
GD1570.	0.	0.	0.	0.	64157461



GE0739.6731A4E-061.159901E-045.227343E-058.319057E-066.063156E-07 32 73 4  
 GE0742.274867E-051.730812E-047.926859E-051.674031E-051.009724E-06 32 74 5  
 \*AS0753.926227E-052.752458E-041.387723E-042.677538E-053.030029E-06 33 75 6  
 \*GE0761.072166E-044.068063E-042.174302E-045.533824E-051.008705E-05 32 76 7  
 GE0777.486529E-052.232941E-049.800194E-054.942951E-056.599828E-06 32 77 8  
 AS0771.508913E-044.566218E-042.155671E-047.350064E-051.361171E-05 33 77 9  
 SE0777.2411A0E-111.520944E-101.9A1054E-111.065236E-083.6216A0E-12 34 77 10  
 SE0784.822815E-048.604024E-044.409444E-042.087714E-047.300352E-05 34 78 11  
 SF0796.649967E-041.081479E-031.427026E-034.002546E-041.666349E-04 34 79 12  
 SE0801.499622E-031.792436E-031.641154E-035.856892E-043.347768E-04 34 80 13  
 \*RR0812.356227E-032.545356E-033.224089E-038.352317E-046.469027E-04 35 81 14  
 RR0821.685272E-066.837245E-062.838640E-078.084090E-065.302440E-07 35 82 15  
 KR0821.030170E-097.334900E-106.956670E-111.758710E-083.051410E-10 36 83 16  
 KR0835.764873E-034.871585E-036.330809E-033.548116E-032.049752E-03 36 84 17  
 KR0841.025343E-028.945479E-038.991051E-035.398733E-033.539335E-03 36 84 18  
 \*SE0823.218676E-033.610J25E-034.277505E-031.434913E-031.160168E-03 34 82 19  
 \*KR85M1.306309E-021.627977E-021.007180E-026.063056E-033.955964E-03 36 85 20  
 RR0850. 0. 0. 0. 0. 37 85 21  
 \*KR85M1.306309E-021.627977E-021.007180E-026.063056E-033.955964E-03 36 85 22  
 KR0851.882300E-051.602890E-051.617730E-047.995150E-055.792670E-06 36 85 23  
 RR0852.220486E-081.489039E-089.035680E-102.090871E-045.302715E-09 37 85 24  
 \*KR85M1.306309E-021.627977E-021.007180E-026.063056E-033.955964E-03 36 85 25  
 KR0851.882300E-051.602890E-051.617730E-047.995150E-055.792670E-06 36 85 26  
 KR0861.910828E-021.931553E-021.285297E-028.490190E-036.139216E-03 36 86 27  
 \*RR0872.415140E-022.411330E-021.616333E-021.109661E-027.570932E-03 37 87 28  
 SR0883.585696E-023.314067E-022.146784E-021.378213E-029.747270E-03 38 88 29  
 \*SR0894.56237E-023.963387E-022.773055E-021.820135E-021.214575E-02 38 89 30  
 Y0891.0731A5E-081.798782E-093.61A260E-119.254020E-089.044160E-10 39 89 31  
 Y0900. 0. 0. 0. 0. 39 90 32  
 ZR0900. 0. 0. 0. 0. 40 90 33  
 \*SR0905.505497E-024.596918E-023.111074E-022.127969E-021.536338E-02 38 90 34  
 Y0902.983487E-068.773910E-081.669201E-092.857910E-064.141910E-08 39 90 35  
 ZR0906.645670E-046.665360E-123.158480E-141.036242E-092.831300E-12 40 90 36  
 \*SR0905.505497E-024.596918E-023.111074E-022.127969E-021.536338E-02 38 90 37  
 SR0915.588158E-024.801714E-023.629929E-022.464730E-021.831216E-02 38 91 38  
 Y0913.323537E-051.958640E-065.977140E-084.520700E-052.564177E-06 39 91 39

ZR0916.751090E-083.677440E-101.759160E-115.266150E-081.680770E-07 40 91 40  
 ZR0925.724305E-025.120207E-023.899939E-022.994856E-022.278090E-02 40 92 41  
 ZR0930. 0. 0. 0. 0. 40 93 42  
 \* Y0936.096218E-025.210221E-024.385548E-023.763344E-022.964232E-02 39 93 43  
 ZR0931.760280E-068.464120E-072.918600E-082.498170E-055.662610E-07 40 93 44  
 \* ZP0946.187064E-025.191451E-024.027210E-024.231506E-023.401845E-02 40 94 45  
 ZR0956.383320E-025.045231E-025.199580E-024.741859E-024.045569E-02 40 95 46  
 NB0952.200360E-071.736794E-074.697760E-094.596640E-061.292595E-07 41 95 47  
 M00951.660270E-111.329080E-119.935250E-141.388980E-091.080500E-11 42 95 48  
 M00964.391820E-063.781818E-051.069503E-065.986196E-051.295707E-04 42 96 49  
 M00970. 0. 0. 42 97 50  
 \* ZR0966.086164E-025.107320E-025.007889E-024.897306E-024.423214E-02 40 96 51  
 ZR0975.881457E-025.093332E-025.269576E-025.179773E-024.816145E-02 40 97 52  
 M00977.900782E-043.714271E-031.655210E-054.670682E-044.660002E-05 42 97 53  
 M00985.869268E-024.876123E-025.232980E-025.568463E-025.221684E-02 42 98 54  
 M00995.700777E-025.099710E-025.708602E-025.869241E-026.208452E-02 42 99 55  
 TC099M2.740440E-091.938650E-094.607800E-115.985620E-082.050940E-09 43 99 56  
 TC0993.350540E-061.938650E-094.607800E-115.985620E-082.050940E-09 43 99 57  
 RU1001.670386E-071.978786E-074.987716E-092.548641E-061.080564E-07 44100 58  
 RU1010. 0. 0. 44101 59  
 \* M00985.869268E-024.876123E-025.232980E-025.568463E-025.221684E-02 42 98 60  
 M00995.700777E-025.099710E-025.708602E-025.869241E-026.208452E-02 42 99 61  
 TC0990. 0. 0. 43 99 62  
 RU1000. 0. 0. 44100 63  
 \* M01006.245236E-025.208224E-025.520558E-026.484275E-026.231112E-02 42100 64  
 RU1015.419547E-024.415137E-025.697025E-026.548314E-026.094825E-02 44101 65  
 RU1024.593365E-023.930272E-025.661326E-026.642587E-026.484292E-02 44102 66  
 RU1033.289945E-023.086239E-024.527316E-026.710377E-026.261076E-02 44103 67  
 RH1036.375332E-099.215569E-078.635870E-131.542892E-095.602832E-07 45103 68  
 PD1041.208216E-099.803555E-097.936200E-116.375661E-087.923650E-10 46104 69  
 PD1053.640590E-081.638860E-131.819130E-132.817940E-101.690780E-08 46105 70  
 PD1060. 0. 0. 46106 71  
 PD1070. 0. 0. 46107 72  
 \* RH1042.311812E-022.276203E-024.510529E-026.498256E-026.976389E-02 44104 73  
 RU1051.110034E-021.831735E-023.518245E-025.006164E-026.218264E-02 44105 74  
 RH1054.216485E-041.324+34E-05A.619875E-081.570850E-063.541640E-08 45105 75

PD1050.	0.	0.	0.	0.	0.	0.	46105	76
PD1060.	0.	0.	0.	0.	0.	0.	46106	77
*RU1042.	311812E-022.	276203E-024.	510529E-026.	49A256E-026.	9763A9E-02	0.	44104	78
RU1051.	110034E-021.	831735E-023.	51A245E-025.	006164E-026.	21A2K4E-02	0.	44105	79
RH1054.	2164A5E-041.	324434E-05A.	619875E-081.	570850E-063.	541640E-08	0.	45105	80
PD1060.	0.	0.	0.	0.	0.	0.	46106	81
*RU1065.	752903E-031.	528958E-022.	42A530E-024.	526706E-026.	206A39E-02	0.	44106	82
PD1061.	090177E-081.	508332E-073.	269442E-072.	192739E-051.	052632E-06	0.	46106	83
PD1073.	7668A4E-031.	383073E-021.	74A473E-023.	041305E-025.	333922E-02	0.	46107	84
PD1082.	084472E-031.	1966A5E-021.	334242E-022.	209476E-024.	0190A7E-02	0.	46108	85
PD1091.	163948E-031.	281644E-021.	210142E-021.	64A268E-022.	2835A7E-02	0.	46109	86
AG1092.	400380E-123.	197780E-111.	09A476E-136.	395421E-101.	695793E-08	0.	47109	87
AG1109.	A61600E-116.	275640E-102.	398850E-121.	538870E-081.	710790E-08	0.	47110	88
CH1101.	070170E-106.	855562E-102.	54A780E-121.	479164E-081.	901159E-08	0.	48110	89
*RU1065.	752903E-031.	528958E-022.	42A530E-024.	526706E-026.	206A39E-02	0.	44106	90
PD1070.	0.	0.	0.	0.	0.	0.	46107	91
PD1080.	0.	0.	0.	0.	0.	0.	46108	92
PD1090.	0.	0.	0.	0.	0.	0.	46109	93
AG1090.	0.	0.	0.	0.	0.	0.	47109	94
*PD1091.	163948E-031.	281644E-021.	210142E-021.	64A268E-022.	2835A7E-02	0.	46109	95
AG1092.	400380E-123.	197780E-111.	09A476E-136.	395421E-101.	695793E-08	0.	47109	96
CD1100.	0.	0.	0.	0.	0.	0.	4A110	97
*PD1107.	720273E-041.	115727E-021.	04A524E-026.	675614E-031.	209074E-02	0.	46110	98
AG1114.	4741A6E-041.	139501E-021.	010524E-023.	619638E-035.	7260A3E-03	0.	47111	99
CD1119.	021460E-137.	384A70E-120.		6.395320E-114.	151910E-11	0.	48111	100
CD1125.	A33070E-085.	333118E-047.	316503E-071.	909A59E-067.	5A7232E-07	0.	48112	101
CD1133.	384730E-041.	092316E-028.	890302E-031.	296239E-031.	549437E-03	0.	48113	102
CD1143.	322308E-041.	054776E-027.	131099E-039.	452402E-047.	551412E-04	0.	48114	103
CD1152.	5864A8E-049.	129107E-037.	536108E-036.	748403E-043.	941A89E-04	0.	48115	104
IN1152.	500400E-114.	916580E-103.	093520E-058.	214000E-103.	301520E-11	0.	49115	105
SN1167.	A81792E-101.	551009E-089.	555420E-111.	409193E-084.	822496E-10	0.	50116	106
*PD1123.	79A945E-049.	785579E-039.	507138E-031.	964707E-032.	299273E-03	0.	46112	107
CD1120.	0.	0.	0.	0.	0.	0.	48112	108
CD1130.	0.	0.	0.	0.	0.	0.	48113	109
CD1140.	0.	0.	0.	0.	0.	0.	48114	110
CD1150.	0.	0.	0.	0.	0.	0.	48115	111

IN1150.	0.	0.	0.	0.	49115112
SN1160.	0.	0.	0.	0.	50116113
*CD1143.322308E-041.054776E-027.131099E-039.452402E-047.551412E-04					48114114
CD15M4.106820E-051.443631E-031.177610E-031.092167E-046.245598E-05					48115115
IN1150.	0.	0.	0.	0.	49115116
SN1160.	0.	0.	0.	0.	50116117
*CD1163.478780E-041.030883E-026.695367E-036.089207E-043.004053E-04					48116118
SN1173.026005E-041.050808E-026.922779E-036.094312E-042.621176E-04					50117119
SN1183.442548E-041.057322E-026.591554E-036.123715E-042.505068E-04					50118120
SN1193.174217E-041.039604E-026.547998E-036.054593E-042.514366E-04					50119121
SN1203.450080E-041.067755E-026.596944E-036.057375E-042.398836E-04					50120122
*SN21M1.510240E-075.436220E-069.715350E-081.438950E-062.881330E-08					50121123
SB1210.	0.	0.	0.	0.	51121124
SB1220.	0.	0.	0.	0.	51122125
TF1220.	0.	0.	0.	0.	52122126
*SN1213.530080E-041.022486E-026.761644E-036.505555E-042.388887E-04					50121127
SB1219.801590E-114.197094E-081.359350E-112.338471E-091.010470E-11					51121128
SB1221.266205E-091.189174E-073.928120E-102.757990E-081.550714E-10					51122129
TF1229.851590E-141.439000E-110.			5.356080E-120.		52122130
*SN1223.772920E-041.118985E-027.137869E-036.845372E-042.362945E-04					50122131
SN1232.331971E-045.504481E-033.873854E-034.213858E-041.249958E-04					50123132
SB1232.332109E-045.505890E-033.873863E-034.216376E-041.249995E-04					51123133
SB1241.124214E-072.100540E-051.720177E-071.806678E-061.453669E-08					51124134
TF1245.450880E-112.298400E-082.568770E-111.968560E-093.151450E-12					52124135
*SN1223.772920E-041.118985E-027.137869E-036.845372E-042.362945E-04					50122136
SB1230.	0.	0.	0.	0.	51123137
SB1240.	0.	0.	0.	0.	51124138
TF1240.	0.	0.	0.	0.	52124139
*SN1245.957984E-041.248757E-028.592765E-031.090877E-032.927553E-04					50124140
SN1257.702252E-041.337340E-021.023280E-021.879464E-034.157715E-04					50125141
SB1251.200190E-061.704320E-042.089000E-061.415960E-051.460670E-07					51125142
TF25M7.111150E-103.107840E-074.557820E-101.878630E-083.721710E-11					52125143
TF1259.131484E-083.108328E-074.557820E-102.688272E-083.721710E-11					52125144
*SN1245.957984E-041.248757E-028.592765E-031.090877E-032.927553E-04					50124145
SN1257.702252E-041.337340E-021.023280E-021.879464E-034.157715E-04					50125146
SB1251.200190E-061.704320E-042.089000E-061.415960E-051.460670E-07					51125147

TE1250.	0.	0.	0.	0.	0.	52125148
*SNI261.	431442E-031.	575434E-021.	116634E-022.	677580E-037.	695814E-04	50126149
SA1267.	148951E-065.	036092E-041.	078192E-044.	885363E-059.	591812E-07	51126150
TE1265.	428977E-063.	679377E-041.	051790E-053.	731542E-057.	257239E-07	52126151
TE1270.	0.	0.	0.	0.	0.	52127152
I1270.	0.	0.	0.	0.	0.	53127153
*SNI261.	431442E-031.	575434E-021.	116634E-022.	677580E-037.	695814E-04	50126154
SA1267.	148951E-065.	036092E-041.	078192E-044.	885363E-059.	591812E-07	51126155
TE1265.	428977E-063.	679377E-041.	051790E-053.	731542E-057.	257239E-07	52126156
TE27M0.	0.	0.	0.	0.	0.	52127157
TE1270.	0.	0.	0.	0.	0.	52127158
I1270.	0.	0.	0.	0.	0.	53127159
*SA1273.	116984E-032.	162041E-021.	579146E-025.	404179E-032.	304580E-03	51127160
TE27M5.	930960E-079.	344510E-055.	787230E-074.	636610E-063.	331530E-08	52127161
TE1270.	0.	0.	0.	0.	0.	52127162
I1270.	0.	0.	0.	0.	0.	53127163
*SA1273.	116984E-032.	162041E-021.	579146E-025.	404179E-032.	304580E-03	51127164
TE1275.	930960E-079.	345510E-051.	199430E-064.	636610E-063.	331530E-08	52127165
I1272.	590420E-102.	168732E-073.	508320E-064.	526891E-094.	952280E-12	53127166
XE1281.	530364E-081.	669035E-071.	109520E-081.	289230E-072.	801290E-10	54128167
*SB1284.	584540E-042.	211590E-038.	515430E-048.	992720E-047.	255340E-05	51128168
TE1286.	449801E-032.	144215E-021.	918829E-027.	076297E-033.	482947E-03	52128169
I1290.	0.	0.	0.	0.	0.	53129170
I1300.	0.	0.	0.	0.	0.	53130171
XE1300.	0.	0.	0.	0.	0.	54130172
XE1310.	0.	0.	0.	0.	0.	54131173
*SA1284.	584540E-042.	211590E-038.	515430E-048.	992720E-047.	255340E-05	51128174
TE1286.	449801E-032.	144215E-021.	918829E-027.	076297E-033.	482947E-03	52128175
TE29M2.	565838E-036.	537384E-035.	090529E-033.	554314E-031.	874839E-03	52129176
I1297.	840217E-032.	305948E-021.	626478E-021.	063996E-025.	911578E-03	53129177
I1303.	830620E-072.	878000E-052.	848640E-071.	400970E-053.	051410E-07	53130178
XE1301.	510240E-106.	315610E-087.	986180E-111.	738730E-081.	170540E-10	54130179
XFI310.	0.	0.	0.	0.	0.	54131180
*SA1284.	584540E-042.	211590E-038.	515430E-048.	992720E-047.	255340E-05	51129181
TE1286.	449801E-032.	144215E-021.	918829E-027.	076297E-033.	482947E-03	52128182
TF29M2.	565838E-036.	537384E-035.	090529E-033.	554314E-031.	874839E-03	52129183

I1297.840217E-032.305948E-021.626478E-021.063996E-025.911578E-03	53129184
XE1300. 0. 0. 0. 0.	54130185
XE1310. 0. 0. 0. 0.	54131186
*SR1284.584540E-042.211590E-038.515430E-048.992720E-047.255340E-05	51128187
TE1286.449801E-032.144215E-021.918829E-027.076297E-033.482947E-03	52128188
I1297.840217E-032.305948E-021.626478E-021.063996E-025.911578E-03	53129189
XE1300. 0. 0. 0. 0.	54130190
XE1310. 0. 0. 0. 0.	54131191
*TE1301.917619E-023.432230E-023.326447E-022.304601E-021.661659E-02	52130192
*TE31M3.636095E-039.914356E-035.773759E-036.297272E-033.486537E-03	52131193
I1312.868277E-023.045111E-023.524510E-023.344641E-022.792428E-02	53131194
XE1311.496264E-081.732962E-065.301560E-071.578893E-071.306620E-08	54131195
XE1320. 0. 0. 0. 0.	54132196
XE1330. 0. 0. 0. 0.	54133197
CS1330. 0. 0. 0. 0.	55133198
*TE31M3.636095E-039.914356E-035.773759E-036.297272E-033.486537E-03	52131199
I1312.868277E-023.045111E-023.524510E-023.344641E-022.792428E-02	53131200
XE1320. 0. 0. 0. 0.	54132201
XE1330. 0. 0. 0. 0.	54133202
CS1330. 0. 0. 0. 0.	55133203
*TE1324.621964E-024.026240E-024.793637E-025.165661E-024.595514E-02	52132204
XE1323.157612E-045.997264E-031.585908E-031.211846E-034.561897E-04	54132205
XE1330. 0. 0. 0. 0.	54133206
CS1330. 0. 0. 0. 0.	55133207
CS1340. 0. 0. 0. 0.	55134208
*XE1323.157612E-045.997264E-031.585908E-031.211846E-034.561897E-04	54132209
XE33M0. 0. 0. 0. 0.	54133210
XF1330. 0. 0. 0. 0.	54133211
CS1330. 0. 0. 0. 0.	55133212
*I1336.465138E-025.298832E-026.245878E-026.663819E-026.738822E-02	53133213
XE1331.496240E-053.987530E-045.816220E-051.383690E-041.066490E-05	54133214
XE1347.617470E-026.277584E-026.646015E-027.261910E-028.108105E-02	54134215
XE1353.200610E-031.770046E-023.378350E-038.549250E-032.292349E-03	54135216
CS1359.131470E-065.023810E-046.756770E-064.704550E-058.473900E-06	55135217
CS1361.565050E-042.207920E-032.403050E-041.484330E-031.744800E-04	55136218
RA1361.590260E-078.963770E-061.739170E-072.787960E-061.790820E-07	56136219



PR1423.500560E-101.995613E-081.393334E-102.448210E-092.481140E-10	59142256
ND1420. 7.015130E-130. 4.276870E-140.	60142257
ND1430. 0. 0. 0. 0.	60143258
*CE1415.995323E-024.569412E-024.423491E-025.563680E-024.853380E-02	58141259
PR1415.280850E-124.197080E-101.469300E-104.466730E-112.741260E-11	59141260
PR1423.500560E-101.995613E-081.393334E-102.448210E-092.481140E-10	59142261
PR1430. 0. 0. 0. 0.	59143262
ND1430. 0. 0. 0. 0.	60143263
*CE1425.459487E-024.876956E-024.424965E-024.823961E-024.814977E-02	58142264
CE1435.697594E-023.893995E-023.819688E-024.371863E-024.501720E-02	58143265
PR1433.640590E-083.737400E-075.107560E-097.444550E-082.711250E-08	59143266
ND1435.790940E-136.125740E-101.319370E-134.446750E-121.210560E-12	60143267
ND1444.726760E-066.895210E-061.387448E-071.597481E-062.961656E-07	60144268
ND1452.550433E-095.596240E-085.607320E-101.309061E-081.930904E-09	60145269
*CE1435.697594E-023.893995E-023.819688E-024.371863E-024.501720E-02	58143270
CE1445.267240E-023.228309E-023.440913E-023.620126E-024.156381E-02	58144271
ND1440. 0. 0. 0. 0.	60144272
ND1450. 0. 0. 0. 0.	60145273
*CE1435.697594E-023.893995E-023.819688E-024.371863E-024.501720E-02	58143274
PR1433.640590E-083.737400E-075.107560E-097.444550E-082.711250E-08	59143275
ND1440. 0. 0. 0. 0.	60144276
ND1450. 0. 0. 0. 0.	60145277
*CE1435.697594E-023.893995E-023.819688E-024.371863E-024.501720E-02	58143278
CE1445.267240E-023.228309E-023.440913E-023.620126E-024.156381E-02	58144279
PR1453.748672E-023.050730E-023.151507E-023.028538E-023.204634E-02	59145280
ND1450. 0. 0. 0. 0.	60145281
*PR1453.748672E-023.050730E-023.151507E-023.028538E-023.204634E-02	59145282
ND1452.550433E-095.596240E-085.607320E-101.309061E-081.930904E-09	60145283
ND1462.895588E-022.371766E-022.734084E-022.507473E-022.740127E-02	60146284
ND1472.369471E-021.736717E-022.087017E-022.063860E-022.260066E-02	60147285
PM1471.870300E-082.328380E-081.729170E-061.259080E-092.341080E-10	61147286
PM48M5.700920E-095.286330E-081.329360E-091.888620E-085.412490E-09	61148287
PM1490. 0. 0. 0. 0.	61149288
SM1490. 0. 0. 0. 0.	62149289
SM1500. 0. 0. 0. 0.	62150290
SM1510. 0. 0. 0. 0.	62151291

SM1520.	0.	0.	0.	0.	62152292	
SM1530.	0.	0.	0.	0.	62153293	
EU1530.	0.	0.	0.	0.	63153294	
EU1540.	0.	0.	0.	0.	63154295	
EU1550.	0.	0.	0.	0.	63155296	
EU1560.	0.	0.	0.	0.	63156297	
GD1560.	0.	0.	0.	0.	64156298	
*PR1453.	748672E-023.	050730E-023.	151507E-023.	028538E-023.	204634E-02	59145299
ND1452.	550433E-095.	596240E-085.	607320E-101.	309061E-081.	930904E-09	60145300
ND1462.	895588E-022.	371766E-022.	734084E-022.	507473E-022.	740127E-02	60146301
ND1472.	369471E-021.	736717E-022.	087617E-022.	063860E-022.	260066E-02	60147302
PM1471.	870300E-082.	328380E-081.	729170E-061.	259080E-092.	341080E-10	61147303
PM1485.	700920E-095.	286330E-081.	329360E-091.	888620E-085.	412490E-09	61148304
PM1490.	0.	0.	0.	0.	61149305	
SM1490.	0.	0.	0.	0.	62149306	
SM1500.	0.	0.	0.	0.	62150307	
SM1510.	0.	0.	0.	0.	62151308	
SM1520.	0.	0.	0.	0.	62152309	
SM1530.	0.	0.	0.	0.	62153310	
EU1530.	0.	0.	0.	0.	63153311	
EU1540.	0.	0.	0.	0.	63154312	
EU1550.	0.	0.	0.	0.	63155313	
EU1560.	0.	0.	0.	0.	63156314	
GD1560.	0.	0.	0.	0.	64156315	
*ND1452.	550433E-095.	596240E-085.	607320E-101.	309061E-081.	930904E-09	60145316
ND1462.	895588E-022.	371766E-022.	734084E-022.	507473E-022.	740127E-02	60146317
ND1472.	369471E-021.	736717E-022.	087617E-022.	063860E-022.	260066E-02	60147318
PM1471.	870300E-082.	328380E-081.	729170E-061.	259080E-092.	341080E-10	61147319
SM1471.	150190E-142.	828030E-060.		2.338290E-140.		62147320
SM1484.	800780E-131.	099240E-116.	566860E-142.	438220E-124.	271970E-13	62148321
SM1490.	0.	0.	0.	0.	62149322	
SM1500.	0.	0.	0.	0.	62150323	
SM1510.	0.	0.	0.	0.	62151324	
SM1520.	0.	0.	0.	0.	62152325	
*ND1452.	550433E-095.	596240E-085.	607320E-101.	309061E-081.	930904E-09	60145326
ND1462.	895588E-022.	371766E-022.	734084E-022.	507473E-022.	740127E-02	60146327

ND1472	.369471E-021	.736717E-022	.0A7617E-022	.063860E-022	.260066E-02	60147328
PM1471	.870300E-082	.328380E-081	.729170E-061	.259080E-092	.341080E-10	61147329
PM48M5	.700920E-095	.286330E-081	.329360E-091	.888620E-085	.412490E-09	61148330
SM1480	0.	0.	0.	0.	0.	62148331
SM1490	0.	0.	0.	0.	0.	62149332
SM1500	0.	0.	0.	0.	0.	62150333
SM1510	0.	0.	0.	0.	0.	62151334
SM1520	0.	0.	0.	0.	0.	62152335
*ND1452	.550433E-095	.596240E-085	.607320E-101	.309061E-081	.930904E-09	60145336
ND1462	.895588E-022	.371766E-022	.734084E-022	.507473E-022	.740127E-02	60146337
ND1472	.369471E-021	.736717E-022	.0A7617E-022	.063860E-022	.260066E-02	60147338
PM1471	.870300E-082	.328380E-081	.729170E-061	.259080E-092	.341080E-10	61147339
PM1485	.700920E-095	.286330E-081	.329360E-091	.888620E-085	.412490E-09	61148340
SM1480	0.	0.	0.	0.	0.	62148341
SM1490	0.	0.	0.	0.	0.	62149342
SM1500	0.	0.	0.	0.	0.	62150343
SM1510	0.	0.	0.	0.	0.	62151344
SM1520	0.	0.	0.	0.	0.	62152345
*ND1472	.369471E-021	.736717E-022	.0A7617E-022	.063860E-022	.260066E-02	60147346
PM1471	.870300E-082	.328380E-081	.729170E-061	.259080E-092	.341080E-10	61147347
PM48M5	.700920E-095	.286330E-081	.329360E-091	.888620E-085	.412490E-09	61148348
PM1491	.091076E-027	.562322E-031	.391199E-021	.325500E-021	.463496E-02	61149349
SM1500	0.	0.	0.	0.	0.	62150350
SM1510	0.	0.	0.	0.	0.	62151351
*ND1472	.369471E-021	.736717E-022	.0A7617E-022	.063860E-022	.260066E-02	60147352
PM1471	.870300E-082	.328380E-081	.729170E-061	.259080E-092	.341080E-10	61147353
PM1485	.700920E-095	.286330E-081	.329360E-091	.888620E-085	.412490E-09	61148354
PM1491	.091076E-027	.562322E-031	.391199E-021	.325500E-021	.463496E-02	61149355
SM1500	0.	0.	0.	0.	0.	62150356
SM1510	0.	0.	0.	0.	0.	62151357
*ND1472	.369471E-021	.736717E-022	.0A7617E-022	.063860E-022	.260066E-02	60147358
ND1481	.684767E-021	.332114E-021	.842015E-021	.693390E-021	.925721E-02	60148359
PM1490	0.	0.	0.	0.	0.	61149360
SM1490	0.	0.	0.	0.	0.	62149361
*ND1472	.369471E-021	.736717E-022	.0A7617E-022	.063860E-022	.260066E-02	60147362
PM1471	.870300E-082	.328380E-081	.729170E-061	.259080E-092	.341080E-10	61147363

PM48M5.700920E-095.286330E-081.329360E-091.88A620E-085.412490E-093	
PM1480. 0. 0. 0. 0.	61148364
SM1480. 0. 0. 0. 0.	61148365
SM1490. 0. 0. 0. 0.	62148366
SM1500. 0. 0. 0. 0.	62149367
SM1510. 0. 0. 0. 0.	62150368
*ND1471.369471E-021.736717E-022.6A7617E-022.063860E-022.260066E-02	62151369
PM1471.870300E-082.328380E-081.729170E-061.259080E-092.3410A0E-10	60147370
PM48M5.700920E-095.286330E-081.329360E-091.88A620E-085.412490E-09	61147371
PM1480. 0. 0. 0. 0.	61148372
PM1490. 0. 0. 0. 0.	61148373
SM1490. 0. 0. 0. 0.	61149374
SM1500. 0. 0. 0. 0.	62149375
SM1510. 0. 0. 0. 0.	62150376
*ND1481.684767E-021.332114E-021.842015E-021.693390E-021.925721E-02	62151377
PM1491.091076E-027.562322E-031.391199E-021.325500E-021.463496E-02	60148378
SM1493.860620E-115.805970E-107.956190E-121.788690E-103.491610E-11	61149379
SM1502.281500E-061.058659E-051.739784E-068.710395E-063.943771E-06	62149380
SM1512.200360E-081.788760E-076.137060E-061.378990E-076.152A30E-08	62150381
SM1522.989565E-032.165568E-035.603731E-036.649085E-037.170393E-03	62151382
SM1532.007664E-031.743748E-033.995139E-034.122196E-035.281465E-03	62152383
EU1531.760358E-091.708999E-087.316691E-104.916643E-092.991492E-09	62153384
EU1541.790290E-082.768080E-071.249400E-084.986350E-085.562560E-08	63153385
EU1550. 0. 0. 0. 0.	63154386
EU1560. 0. 0. 0. 0.	63155387
GD1560. 0. 0. 0. 0.	63156388
GD1570. 0. 0. 0. 0.	64156389
*ND1481.684767E-021.332114E-021.842015E-021.693390E-021.925721E-02	64157390
PM1491.091076E-027.562322E-031.391199E-021.325500E-021.463496E-02	60148391
SM1493.860620E-115.805970E-107.956190E-121.788690E-103.491610E-11	61149392
SM1502.281500E-061.058659E-051.739784E-068.710395E-063.943771E-06	62149393
SM1512.200360E-081.788760E-076.137060E-061.378990E-076.152830E-08	62150394
SM1522.989565E-032.165568E-035.603731E-036.649085E-037.170393E-03	62151395
SM1532.007664E-031.743748E-033.995139E-034.122196E-035.281465E-03	62152396
EU1531.760358E-091.708999E-087.316691E-104.916643E-092.991492E-09	62153397
EU1540. 0. 0. 0. 0.	63153398
	63154399

GD1540.	0.	0.	0.	0.	0.	0.	0.	0.	64154400
GD1550.	0.	0.	0.	0.	0.	0.	0.	0.	64155401
*ND1481.	684767E-021.	332114E-021.	842015E-021.	693390E-021.	925727E-02				60148402
PM1491.	091076E-027.	562322E-031.	391199E-021.	325500E-021.	463496E-02				61149403
SM1493.	860620E-115.	805970E-107.	956190E-121.	788690E-103.	491610E-11				62149404
SM1502.	281500E-061.	058659E-051.	739784E-068.	710395E-063.	943777E-06				62150405
SM1510.	0.	0.	0.	0.	0.				62151406
SM1520.	0.	0.	0.	0.	0.				62152407
SM1530.	0.	0.	0.	0.	0.				62153408
EU1530.	0.	0.	0.	0.	0.				63153409
EU1540.	0.	0.	0.	0.	0.				63154410
EU1550.	0.	0.	0.	0.	0.				63155411
GD1550.	0.	0.	0.	0.	0.				64155412
*ND1481.	684767E-021.	332114E-021.	842015E-021.	693390E-021.	925727E-02				60148413
PM1491.	091076E-027.	562322E-031.	391199E-021.	325500E-021.	463496E-02				61149414
SM1493.	860620E-115.	805970E-107.	956190E-121.	788690E-103.	491610E-11				62149415
SM1502.	281500E-061.	058659E-051.	739784E-068.	710395E-063.	943777E-06				62150416
SM1510.	0.	0.	0.	0.	0.				62151417
EU1510.	0.	0.	0.	0.	0.				63151418
*PM1491.	091076E-027.	562322E-031.	391199E-021.	325500E-021.	463496E-02				61149419
SM1493.	860620E-115.	805970E-107.	956190E-121.	788690E-103.	491610E-11				62149420
*ND1506.	871690E-034.	483072E-031.	110481E-021.	020879E-021.	196037E-02				60150421
PM1514.	368875E-033.	121797E-038.	456446E-038.	175331E-039.	023766E-03				61151422
SM1510.	0.	0.	0.	0.	0.				62151423
SM1520.	0.	0.	0.	0.	0.				62152424
SM1530.	0.	0.	0.	0.	0.				62153425
EU1530.	0.	0.	0.	0.	0.				63153426
EU1540.	0.	0.	0.	0.	0.				63154427
EU1550.	0.	0.	0.	0.	0.				63155428
EU1560.	0.	0.	0.	0.	0.				63156429
GD1560.	0.	0.	0.	0.	0.				64156430
GD1570.	0.	0.	0.	0.	0.				64157431
*ND1506.	871690E-034.	483072E-031.	110481E-021.	020879E-021.	196037E-02				60150432
PM1514.	368875E-033.	121797E-038.	456446E-038.	175331E-039.	023766E-03				61151433
SM1512.	200360E-081.	788760E-076.	137060E-061.	378990E-076.	152830E-08				62151434
SM1522.	989565E-032.	165568E-035.	603731E-036.	649085E-037.	170393E-03				62152435

SM1532.007664E-031.743748E-033.995139E-034.122196E-035.281465E-03	62153436
EU1531.760358E-091.708999E-087.316691E-104.916643E-092.991092E-09	63153437
EU1541.790290E-082.768080E-071.249400E-084.986350E-085.562560E-08	63154438
EU1550. 0. 0. 0. 0.	63155439
GD1551.390220E-102.348439E-092.249220E-111.029250E-101.910880E-10	64155440
*ND1506.871690E-034.483072E-031.110481E-021.020879E-021.196031E-02	60150441
PM1514.368875E-033.121797E-038.456446E-038.175331E-039.023766E-03	61151442
SM1512.200360E-081.788760E-076.137060E-061.378990E-076.152830E-08	62151443
EU1514.030650E-121.658850E-111.729170E-097.504510E-121.820840E-12	63151444
*ND1506.871690E-034.483072E-031.110481E-021.020879E-021.196031E-02	60150445
PM1514.368875E-033.121797E-038.456446E-038.175331E-039.023766E-03	61151446
SM1510. 0. 0. 0. 0.	62151447
SM1520. 0. 0. 0. 0.	62152448
SM1530. 0. 0. 0. 0.	62153449
EU1530. 0. 0. 0. 0.	63153450
EU1541.790290E-082.768080E-071.249400E-084.986350E-085.562560E-08	63154451
GD1542.670430E-121.299100E-101.099470E-126.765050E-127.333380E-12	64154452
GD1550. 0. 0. 0. 0.	64155453
*PM1514.368875E-033.121797E-038.456446E-038.175331E-039.023766E-03	61151454
SM1520. 0. 0. 0. 0.	62152455
SM1530. 0. 0. 0. 0.	62153456
*SM1548.854701E-049.400237E-042.407072E-033.156848E-033.797929E-03	62154457
EU1555.772413E-046.967509E-041.532964E-032.166031E-032.318058E-03	63155458
EU1562.431900E-045.491631E-041.116073E-031.430794E-031.695543E-03	63156459
GD1561.851300E-053.637755E-088.635870E-102.244360E-053.071482E-09	64156460
GD1570. 0. 0. 0. 0.	64157461
GD1580. 0. 0. 0. 0.	64158462
*SM1548.854701E-049.400237E-042.407072E-033.156848E-033.797929E-03	62154463
EU1555.772413E-046.967509E-041.532964E-032.166031E-032.318058E-03	63155464
GD1550. 0. 0. 0. 0.	64155465
*EU1571.587982E-043.922391E-048.221509E-041.064961E-031.315236E-03	63157466
GD1571.190190E-083.197780E-074.847680E-094.836460E-084.081880E-08	64157467
GD1588.533838E-052.424479E-044.078405E-046.791765E-048.670716E-04	64158468
GD1593.059299E-051.242894E-042.587123E-043.919044E-044.674066E-04	64159469
TR1594.310700E-102.997920E-083.688240E-101.179140E-091.470680E-09	65159470
TB1601.530250E-102.038580E-072.108990E-071.538870E-081.290590E-08	65160471

DY1601.790290E-141.948650E-108.875750E-133.627350E-123.151450E-12	66160472
DY1617.201160E-123.967638E-091.769150E-117.044850E-066.322910E-11	66161473
DY1622.831680E-062.883080E-056.141343E-056.215578E-052.509166E-05	66162474
*EU1571.587982E-043.922391E-048.221509E-041.064961E-031.315236E-03	63157475
GD1571.190190E-083.197780E-074.847680E-094.836460E-084.081880E-08	64157476
GD1588.533838E-052.424479E-044.078405E-046.791765E-048.670716E-04	64158477
GD1593.059299E-051.242894E-042.587123E-043.919044E-044.674066E-04	64159478
T81594.310700E-102.997920E-083.688240E-101.179140E-091.470680E-09	65159479
T81601.530250E-102.038580E-072.108990E-071.538870E-081.290590E-08	65160480
T81614.059837E-065.587539E-058.558170E-051.016307E-048.258252E-05	65161481
DY1610. 0. 0. 0. 0.	66161482
DY1620. 0. 0. 0. 0.	66162483
*GD1601.420682E-057.440205E-051.403269E-042.475129E-041.928609E-04	64160484



A 9 1 0.0		1.94	+00 1.86	+00 2.92	+01 1.37	+03	1	94239X18
*U-238 2.16	-02	4.42	-01 2.62	-01 2.30	+00 2.73	+00		92238X19
B 1 4 0.0		3.70	-01 4.00	-04 0.0	0.0		1	92238X20
PU239 0.0		3.10	+00 3.10	+00 5.30	+01 2.23	+03		94239X21
B 2 1 0.0		1.94	+00 1.86	+00 2.92	+01 1.37	+03	1	94239X22
*TH232 0.0		1.66	-01 2.04	-01 1.87	+00 7.33	+00		90232X23
C 1 4 0.0		9.20	-02 0.0	0.0	0.0			90232X24
PA233 0.0		7.65	-01 1.98	-01 5.83	+01 4.32	+01		91233X25
C 2 4 2.971	-07	7.64	-01 8.26	-03 0.0	0.0			91233X26
U-234 0.0		1.56	+00 7.99	-01 3.40	+01 9.20	+01		92234X27
C 3 4 0.0		1.41	+00 2.43	-01 0.0	0.0			92234X28
U-235 0.0		1.23	+00 2.25	+00 3.80	+01 6.32	+02		92235X29
C 4 1 0.0		1.19	+00 1.76	+00 2.44	+01 5.34	+02		92235X30
*RU1030.0		2.468305E-023.671989E-017.404899E+007.763290E+00					1	44103 1
1 1 22.025900E-070.0		0.0	0.0	0.0	0.0			44103 2
RH1030.0		4.648621E-025.571160E-019.047802E+011.751074E+02					1	45103 3
1 2 10.		0.0	0.0	0.0	0.0			45103 4
*RU1050.0		2.325016E-023.233188E-016.399468E-012.017520E-01					1	44105 5
2 1 24.336500E-050.0		0.0	0.0	0.0	0.0			44105 6
RH1050.0		9.125643E-024.919683E-017.002262E+028.906837E+03					1	45105 7
2 2 15.423700E-060.0		0.0	0.0	0.0	0.0			45105 8
*AG1090.0		4.458553E-023.535820E-011.302363E+029.488969E+01					1	47109 9
3 1 10.		0.0	0.0	0.0	0.0			47109 10
*XE1310.0		1.332154E-021.837029E-018.832394E+019.102450E+01					1	54131 11
4 1 10.		0.0	0.0	0.0	0.0			54131 12
*XE1330.0		5.950709E-035.286344E-023.435562E+011.918434E+02					1	54133 13
5 1 21.516500E-060.0		0.0	0.0	0.0	0.0			54133 14
CS1330.0		5.103384E-023.777516E-013.378401E+013.003107E+01					1	55133 15
5 2 30.		0.0	0.0	0.0	0.0			55133 16
CS1340.0		1.286883E-023.448577E-012.079022E+011.413007E+02					1	55134 17
5 3 11.066200E-080.0		0.0	0.0	0.0	0.0			55134 18
*I1350.0		4.684394E-045.736313E-047.324264E-042.019617E-02					1	53135 19
6 1 22.923900E-050.0		0.0	0.0	0.0	0.0			53135 20
XE1350.0		5.564618E-043.218521E-033.634285E+023.015526E+06					1	54135 21
6 2 12.099700E-050.0		0.0	0.0	0.0	0.0			54135 22
*PR1430.0		4.842014E-022.161496E-011.913981E+018.984881E+01					1	59143 23

7 1 25.907700E-070.0	0.0	0.0	0.0	0.0	0.0	59143 24
ND1430.0	5.923333E-021.938598E-011.209111E+013.200445E+02	0.0	0.0	0.0	0.0	60143 25
7 2 10.	0.0	0.0	0.0	0.0	0.0	60143 26
*ND1450.0	6.803414E-021.9A3824E-012.256161E+014.252540E+01	0.0	0.0	0.0	0.0	60145 27
8 1 10.	0.0	0.0	0.0	0.0	0.0	60145 28
*ND1470.0	5.106341E-023.92R675E-016.013407E+014.945773E+01	0.0	0.0	0.0	0.0	60147 29
9 1 27.299800E-070.0	0.0	0.0	0.0	0.0	0.0	60147 30
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	0.0	0.0	0.0	0.0	61147 31
9 2 38.373800E-090.0	0.0	0.0	0.0	0.0	0.0	61147 32
9 28F4.700000E-01						61147 33
PM48M0.0	4.921928E-012.574234E+003.182157E+023.446023E+04	0.0	0.0	0.0	0.0	61148 34
9 3 31.942500E-070.0	0.0	0.0	0.0	0.0	0.0	61148 35
PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03	0.0	0.0	0.0	0.0	61149 36
9 4 23.626000E-060.0	0.0	0.0	0.0	0.0	0.0	61149 37
SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04	0.0	0.0	0.0	0.0	62149 38
9 5 32.198000E-240.0	0.0	0.0	0.0	0.0	0.0	62149 39
SM1500.0	1.313093E-012.862238E-011.160902E+019.876290E+01	0.0	0.0	0.0	0.0	62150 40
9 6 30.	0.0	0.0	0.0	0.0	0.0	62150 41
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	0.0	0.0	0.0	0.0	62151 42
9 7 32.363400E-100.0	0.0	0.0	0.0	0.0	0.0	62151 43
SM1520.0	7.520442E-022.877061E-012.755117E+022.118281E+02	0.0	0.0	0.0	0.0	62152 44
9 8 30.	0.0	0.0	0.0	0.0	0.0	62152 45
EU1530.0	2.431446E-011.539698E+001.478631E+023.966174E+02	0.0	0.0	0.0	0.0	63153 46
9 9 30.	0.0	0.0	0.0	0.0	0.0	63153 47
EU1540.0	7.241066E-021.875663E+002.228416E+028.974997E+02	0.0	0.0	0.0	0.0	63154 48
9 10 32.555800E-090.0	0.0	0.0	0.0	0.0	0.0	63154 49
EU1550.0	9.062116E-011.543263E+001.540107E+024.077187E+03	0.0	0.0	0.0	0.0	63155 50
9 11 14.579200E-090.0	0.0	0.0	0.0	0.0	0.0	63155 51
*ND1470.0	5.106341E-023.928675E-016.013407E+014.945773E+01	0.0	0.0	0.0	0.0	60147 52
10 1 27.299800E-070.0	0.0	0.0	0.0	0.0	0.0	60147 53
PM1470.0	1.382808E-018.170927E-011.918335E+021.790017E+02	0.0	0.0	0.0	0.0	61147 54
10 2 38.373800E-090.0	0.0	0.0	0.0	0.0	0.0	61147 55
10 28F5.300000E-01						61147 56
PM1480.0	4.921928E-012.574234E+002.332976E+014.682426E+03	0.0	0.0	0.0	0.0	61148 57
10 3 31.493900E-060.0	0.0	0.0	0.0	0.0	0.0	61148 58
PM1490.0	5.268164E-012.133433E+007.332632E+011.410044E+03	0.0	0.0	0.0	0.0	61149 59

10 4 23.626000E-060.0	0.0	0.0	0.0	0.0	61149 60
SM1490.0	5.637011E-029.344686E-012.770684E+028.738108E+04	1			62149 61
10 5 32.198000E-240.0	0.0	0.0	0.0	0.0	62149 62
SM1500.0	1.313093E-012.862238E-011.160902E+019.876240E+01	1			62150 63
10 6 30.	0.0	0.0	0.0	0.0	62150 64
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	1			62151 65
10 7 12.363400E-100.0	0.0	0.0	0.0	0.0	62151 66
*PM1510.0	1.012214E-032.037358E-021.742050E+027.058672E+02	1			61151 67
11 1 26.779600E-060.0	0.0	0.0	0.0	0.0	61151 68
SM1510.0	2.315641E-011.356167E+002.894601E+028.428850E+03	1			62151 69
11 2 12.363400E-100.0	0.0	0.0	0.0	0.0	62151 70
*XXXX10.0	1.0	0.0	0.0	0.0	71
12 1 30.0	0.0	0.0	0.0	0.0	72
XXXX20.0	0.0	1.0	0.0	0.0	73
12 2 30.0	0.0	0.0	0.0	0.0	74
XXXX30.0	0.0	0.0	1.0	0.0	75
12 3 30.0	0.0	0.0	0.0	0.0	76
XXXX40.0	0.0	0.0	0.0	1.0	77
12 4 10.0	0.0	0.0	0.0	0.0	78
1 3 2 3					
*RU1033.137420E-026.336271E-026.991221E-021.706601E-021.644892E-03					44103 1
RH1031.857008E-113.779640E-131.357825E-091.421922E-110.					45103 2
*RU1051.020488E-024.209891E-025.419310E-024.712564E-033.406040E-04					44105 3
RH1051.878019E-082.999720E-091.273820E-066.459640E-097.839120E-12					45105 4
*AG1092.995048E-042.840505E-031.411333E-024.336276E-046.114486E-04					47109 5
*XE1312.835772E-023.212525E-023.742929E-023.508933E-021.603649E-02					54131 6
*XE1336.789605E-026.357383E-026.986334E-026.030732E-023.857618E-02					54133 7
CS1335.082762E-071.289880E-111.609852E-073.700134E-077.459170E-11					55133 8
CS1343.571930E-071.840829E-094.609340E-061.196934E-051.161870E-08					55134 9
* I1356.349246E-026.547839E-026.307188E-024.859691E-025.238701E-02					53135 10
XE1352.545185E-031.498561E-041.151654E-021.337418E-024.027740E-04					54135 11
*PR1435.972116E-024.834113E-024.560908E-025.881002E-026.619276E-02					59143 12
ND1439.495150E-130. 4.899310E-122.479860E-100.					60143 13
*ND1453.934222E-023.997650E-023.078147E-023.364825E-025.356450E-02					60145 14
*ND1472.271323E-022.710506E-022.072702E-021.775326E-023.078098E-02					60147 15
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12					61147 16

PM48M7.494070E-091.189490E-112.089700E-082.789850E-072.169760E-10	61148	17
PM1491.088753E-021.765335E-021.261239E-027.692321E-038.254346E-03	61149	18
SM1496.723650E-112.999720E-141.929730E-102.979881E-093.619590E-13	62149	19
SM1505.415962E-065.969946E-081.701641E-052.578170E-058.280480E-08	62150	20
SM1513.972160E-082.759740E-102.619630E-078.359540E-073.749580E-10	62151	21
SM1522.709454E-035.571170E-035.964915E-032.078376E-036.835812E-04	62152	22
FU1531.621821E-034.118398E-033.726920E-031.068109E-032.874791E-04	63153	23
FU1541.630880E-088.799180E-113.539500E-073.719800E-075.789350E-11	63154	24
FU1553.296332E-041.325778E-031.707181E-032.125258E-043.673247E-05	63155	25
*ND1472.271323E-022.710506E-022.072702E-021.715326E-023.078098E-02	60147	26
PM1474.042190E-102.369780E-132.219690E-093.309820E-087.779130E-12	61147	27
PM1485.733110E-081.189490E-112.089700E-089.479480E-092.169760E-10	61148	28
PM1490. 0. 0. 0. 0.	61149	29
SM1490. 0. 0. 0. 0.	62149	30
SM1500. 0. 0. 0. 0.	62150	31
SM1510. 0. 0. 0. 0.	62151	32
*PM1514.202709E-038.535369E-037.775491E-033.221451E-031.542116E-03	61151	33
SM1510. 0. 0. 0. 0.	62151	34
*XXX13.732241 -024.598954 -024.701424 -023.413918 -023.267500 -02	35	
XXXX21.541094 -011.994706 -012.152065 -011.389358 -011.125001 -01	36	
XXXX35.298920 +006.899230 +007.269000 +004.635081 +003.710167 +00	37	
XXXX48.254500 +001.094353 +011.137582 +018.822610 +009.601140 +00	38	

\*\*\*\*\*  
 THE 12-CHAIN LIRRARY ABOVE INCLUDES THE EFFEECTIVE FISSION YIELD FRACTIONS OF  
 DECK A. AS DESCRIBED IN TABLE 1 OF SECTION 4. THE DECK B YIFLDS FOLLOW.  
 \*\*\*\*\*

*RU1033.289945E-023.086239E-024.527316E-026.710377E-026.261076E-02	44103	1
RH1036.195332E-099.215569E-078.635870E-131.542892E-095.602832E-07	45103	2
*RU1051.110034E-021.831735E-023.518245E-025.006164E-026.218264E-02	44105	3
RH1054.216485E-041.324434E-058.619875E-081.570850E-063.541640E-08	45105	4
*AG1091.163948E-031.281644E-021.210142E-021.648268E-022.283588E-02	47109	5
*XF1313.231888E-024.036720E-024.101939E-023.974384E-023.141084E-02	54131	6
*XF1336.471216E-025.477083E-026.265952E-026.722540E-026.740955E-02	54133	7

CS1335.721046E-095.136972E-073.198471E-078.784077E-084.302059E-09	55133	8
CS1343.660600E-071.672838E-052.25A920E-073.277600E-063.541640E-07	55134	9
* I1355.955484E-023.554671E-025.344813E-026.474868E-026.950014E-02	53135	10
XE1353.200610E-031.770046E-023.378350E-038.549250E-032.292349E-03	54135	11
*PR1435.697597E-023.894033E-023.819688E-024.371871E-024.501723E-02	59143	12
ND1435.790940E-136.125740E-101.319370E-134.446750E-121.210560E-12	60143	13
*ND1453.748672E-023.050736E-023.151507E-023.028539E-023.204634E-02	60145	14
*ND1472.369471E-021.736717E-022.087617E-022.063860E-022.260066E-02	60147	15
PM1471.870300E-082.328380E-081.729170E-061.259080E-092.341080E-10	61147	16
PM48M5.700920E-095.286330E-081.329360E-091.888620E-085.412490E-09	61148	17
PM1491.091076E-027.562322E-031.391199E-021.325500E-021.463496E-02	61149	18
SM1493.860620E-115.805970E-107.956190E-121.788690E-103.491610E-11	62149	19
SM1502.281500E-061.058659E-051.739784E-068.710395E-063.943771E-06	62150	20
SM1512.200360E-081.788760E-076.137060E-061.378990E-076.152830E-08	62151	21
SM1522.989565E-032.165568E-035.603731E-036.649085E-037.170393E-03	62152	22
EU1532.007666E-031.743765E-033.995140E-034.122201E-035.281468E-03	63153	23
EU1541.790290E-082.768080E-071.249400E-084.986350E-085.562560E-08	63154	24
FU1555.772413E-046.967509E-041.532964E-032.166031E-032.318058E-03	63155	25
*ND1472.369471E-021.736717E-022.087617E-022.063860E-022.260066E-02	60147	26
PM1471.870300E-082.328380E-081.729170E-061.259080E-092.341080E-10	61147	27
PM1485.700920E-095.286330E-081.329360E-091.888620E-085.412490E-09	61148	28
PM1490. 0. 0. 0. 0.	61149	29
SM1490. 0. 0. 0. 0.	62149	30
SM1500. 0. 0. 0. 0.	62150	31
SM1510. 0. 0. 0. 0.	62151	32
*PM1514.368875E-033.121797E-038.456446E-038.175331E-039.023766E-03	61151	33
SM1510. 0. 0. 0. 0.	62151	34
*XXXXX13.854346 -024.638949 -024.979662 -024.741687 -025.021338 -02	35	
XXXXX21.604519 -011.911515 -012.127259 -012.152624 -012.309834 -01	36	
XXXXX35.404830 +007.211940 +008.470080 +007.375970 +008.170290 +00	37	
XXXXX48.73336 +001.598076 +011.757648 +011.214678 +011.302646 +01	38	

APPENDIX C

\*\*\*\*\*  
 \*\*\* EPRI-CINDER PROGRAM \*\*\*  
 \*\*\*\*\*

PROGRAM CINDER(INPUT,OUTPUT,TAPE8=INPUT,TAPE10=OUTPUT,PUNCH)	EPRI	1
C=====FPRI VERSION =====	EPRI	2
C===== 7/76 =====	FPRI	3
C *** MAYDAY VERSION OF CINDER (LASL) UPDATED FOR FPRI ABSORPTION	EPRI	4
C     CALCULATIONS AND GENERAL UTILITY IN SOLUTION OF COUPLED	EPRI	5
C     NUCLIDES.	FPRI	6
C	EPRI	7
C *** ROUNDOFF CONTROL IMPROVED (SEE COMMENTS FOLLOWING STATEMENT 8)	EPRI	8
C	EPRI	9
C *** THIS VERSION IS COMPATIBLE WITH FORTRAN 2-4.	EPRI	10
C	EPRI	11
C *** K-EFFECTIVE ROUTINE INCORPORATED FOR USE IN SURVEY CALCULATIONS	EPRI	12
C     (FLUXES AND K-EFF CAN BE CALCULATED BY THIS OPTION)	EPRI	13
C	EPRI	14
C *** DECAY HEAT AND SPECTRA CALCULATIONS	EPRI	15
C	EPRI	16
C *** MULTIPLE CASES PER JOB USING SAME OR NEW FISSION PRODUCT DECK	EPRI	17
C     (FUEL OR ACTINIDE CHAINS TO BE SPECIFIED FOR EACH CASE)	EPRI	18
C	EPRI	19
C *** ENDF/B-IV ABSORPTION CHAIN LIBRARIES (FISSION PRODUCTS)	EPRI	20
C     AVAILABLE FOR THIS VERSION	EPRI	21
C	EPRI	22
C *** DIMENSIONED FOR	FPRI	23
C     525 NUCLIDES	FPRI	24
C     40 ACTINIDE OR FUEL CHAINS	EPRI	25
C     450 FISSION PRODUCT CHAINS	EPRI	26
C     17 NUCLIDES PER CHAIN	EPRI	27
C     3 TIME DEPENDENT G-FACTORS (E.G., FOR 3 NUCLIDES)	FPRI	28
C     IN GROUPS 3 AND 4	EPRI	29

C	3 ENERGY GROUPS PER DECAY	EPRI	30
C	4 NEUTRON ENERGY GROUPS	EPRI	31
C	75 TIME INCREMENTS, EACH HAVING A GROUP 4 SPECTRUM FACTOR	EPRI	32
C	7 NUCLIDES IN POWER (5 YIELD SETS)	EPRI	33
C		EPRI	34
C	*** (NOTE THAT ANY OF THESE LIMITS CAN BE ALTERED IF NEEDED BY	EPRI	35
C	SIMPLY CHANGING THE DIMENSION STATEMENTS BELOW. FORMAT STATEMENTS	EPRI	36
C	PERMIT UP TO 21 DECAY ENERGY GROUPS.)	EPRI	37
C	*** SUMMARY PRINT INCLUDES MOST AGGREGATE DATA OF INTEREST,	EPRI	38
C	INCLUDING AN EFFECTIVE CROSS SECTION AND RESONANCE	EPRI	39
C	INTEGRAL.	EPRI	40
C	PRINT OPTIONS PER TIME STEP PARTIALLY DESCRIBED BY OLDER	EPRI	41
C	COMMENTS BELOW AND IN MAIN TFXT.	EPRI	42
C		EPRI	43
C		EPRI	44
C	=====	EPRI	45
C	ADDED TO PRINT SUPPRESSIONS---IF JPRINT (ON CONTROL CRD) = OR	EPRI	46
C	IS LESS THAN 0, ALL INFO EACH TS IS PRINTED**IF =1, R/F ,SIGMAS	EPRI	47
C	ARE SUPPRESSED**IF =2 R/F,SIGMAS AND DECAY ENERGIES SUPPRESSED.	EPRI	48
C	IF JPRINT IS LEFT BLANK, IS NEG OR ZERO, THEN THE SFLECTED PRINT	EPRI	49
C	OPTION ON TIME CARD (JPRT =1) IS IGNORED.**	EPRI	50
C		EPRI	51
C	3/26/69 **NEW YIELD ROUTINE AND OPTION VARIABLE KYOP. YIELDS ARE	EPRI	52
C	INPUT AS YLD(LE,KN) WHERE KN=1,5. THESE ARE REDUNDANTLY STORED	EPRI	53
C	AS Y(LE,K) WHERE K =1,7 UNLESS KYOP (COL 68 OF CONTRL CRD. NE	EPRI	54
C	ZERO , IN WHICH CASE THEY ARE REORDERED BY READING A YIELD	EPRI	55
C	ORDERING CRD FOLLOWING THE NUC CRD SET...NOTE..CAN REORDER THE	EPRI	56
C	YIELDS WITHOUT N-PUTING A NEW YIELD DECK FOR EACH CASE	EPRI	57
C	BY SPFCIFYING LSAME =1 AND KYOP = 1 *****	EPRI	58
C	**MOD. FOR SELECTED DECAY ENERGY PRINT. ADDED EMINUM TO	EPRI	59
C	1 CTRL CRD, COL. 71--80, AND CORRES. F10.4 TO FMT 82.	EPRI	60
C	2 INITIALIZED EMINUM TO 0.0. ADDED IF JPRINT =2 OR	EPRI	61
C	3 GT 2, THEN NPRDH=JPRT AND IF IT = 3, NPRINT=0	EPRI	62
C	4 (AFTER NO. 154+2). NEW ROUTINE PRINTS ONLY F S NSUM AND	EPRI	63
C	5 ONLY THOSE GT THAN EMINUM PERCENT. IF EMINUM IS	EPRI	64
C	6 BLANK ALL ENERGIES NSUM PRINTED.	EPRI	65

```

C   7   STATEMENT NO.5 RUN FROM 4510 THRU 4526.OTHER CRDS CHNGDEPRI 66
C   8   FOR PRNT OF 3 DIGIT CHN NO. ARE 426,435,505,553,560,571EPRI 67
C       NEW VARIABLES OR INDICES ARE EPRI 68
C   1   KNCH = 1 FOR DP CHNS AND 2 FOR FP CHNS. EPRI 69
C   2   NNCHN = NO. OF DP OR FP CHNS TO BE PROCESSED. EPRI 70
C   3   NNC = CHAIN NO. (DP OR FP) BEING PROCESSED EPRI 71
C   4   KLINUS = INDEX -- ONE + TOT NO. NUCS (DP+FP) PROCESSED EPRI 72
C   5   NN = NO. NUCS IN CHN BEING PROCESSED EPRI 73
C   6   KNES = NO OF THE NUC BEING PROCESSED (DP+FP) EPRI 74
C   7   KNPICK = LAST NO. OF THE NUC BEING PROCESSED (DP+FP). EPRI 75
C   8   NKE = INDEX . LOOPS THRE NO. NUCS IN CH BEING PROCESSEDEPRI 76
C   9   KNEIL = CURRENT NO. OF NUC BEING PROCESSED (DP+FP) EPRI 77
C----- ADDED PRINT SUPPRESSION OF ROUND OFF CRITERIA WHEN EPRI 78
C       IPRC COL 35 ON CONTROL CARD .LE. 0 EPRI 79
C----- ADDED PRINT CONTROL INDICES IP1, IP2, AND IP3 IN COLS 70, EPRI 80
C       71, AND 72 AND REDUCED EMINCT FIELD TO E7.4. IP1=1 WILL RE EPRI 81
C       USED TO SUPPRESS PRINT OF INPUT FISSION PRODUCT DATA. EPRI 82
C       IP1=1 SUPRESSES PRINT OF INPUT FISSION PRODUCT IP2, IP3 EPRI 83
C       NOT ASSIGNED AS OF 3/76. EPRI 84
C*****EPRI 85
C*****7*****EPRI 86
C
C   DIMENSION P1(525), P2(525), P3(525), P4(525) EPRI 88
C   1,B1F(525),B2F(525), B3F(525),B4F(525),TOTE(525),FGAM(525) EPRI 89
C
C   COMMON/1/ PRODA(17,17,17),IGAM(525),Y(524, 7),SFON3( 3,75), EPRI 91
C   1SFON4( 3,75),F(525),YLD(524, 5),NY( 7) EPRI 92
C
C   COMMON/2/ ABAR(17,17), TOTDEN(75), EPRI 94
C   2   ARN(525),COMENT(16),OT(75),SPEC4(75),F104(75) EPRI 95
C   3,F204(75),F304(75),FOPIN(75),LEDT0(75),FPTS(75) EPRI 96
C   4,TLFXTM(75),TOTLP1(75),TOTLP2(75),TOTLP3(75),TOTLP4(75) EPRI 97
C   5,TIME(75),TOTLB1(75),TOTLB2(75),TOTLB3(75),TOTLR4(75) EPRI 98
C   6,TOTAC(75),ALPHA(75),FPE(75),AFPE(75) EPRI 99
C   7,   FY(10),D(10), NPWR(525),SYMBOL(525) EPRI 100
C   8,OND(525),A1(525),A2(525),A3(525),A4(525),NSUM(525),KOC(525) EPRI 101

```

```

          9, INSF3(525), ALAMV(525), FSN1(525), FSN2(525), FSN3(525), FSN4(525)      EPRI 102
C
COMMON/3/ BND(525), YIELD(525), DEN(525), PT1(525), PT2(525)                      EPRI 103
1, A3S(525), A4S(525), INSF4(525), PRODB(17,17), OVPR(17,17)                      EPRI 105
2, SM1(17,17), SM2(17,17), ALAMDA(17), A(17), G(17), YS(17), DAT(17)             EPRI 106
3, EXFLAM(17), NEDP(40), NEFP(450), R(17)                                         EPRI 107
4, JPRT(75), FGAMA(17)                                                            EPRI 108
C---ADDITION FOR K INFINITY CALCULATION                                           EPRI 109
5, RHO(75), FFS(75), ANU1(10), ANU2(10), ANU3(10), ANU4(10), AKO(75)             EPRI 110
6, FLXR(3,75), R(3), AC(4), EA(4), SFNU(4), DA(4,75)                             EPRI 111
C---INSERT FOR DECAY HEAT CALCULATION                                             EPRI 112
7, E(525, 3), RSL(525, 5), TOTLR(6)                                              EPRI 113
C---INSERT FOR PUNCHED CARDS FOR PWR                                           EPRI 114
8, PCR(75), AFD(75), TOBET(75), TOGAM(75), TOBPG(75), SDT(75)                   EPRI 115
9, BFTPF(75), GAMPF(75), BPGPF(75)                                               EPRI 116
C
C
EQUIVALENCE (PRODA(1), P1), (PRODA(526), P2), (PRODA(1051), P3)                    EPRI 118
1, (PRODA(1576), P4), (PRODA(2101), B1F), (PRODA(2626), B2F)                      EPRI 119
2, (PRODA(3151), B3F), (PRODA(3676), B4F), (PRODA(4201), TOTF)                   EPRI 121
3, (IGAM, FGAM)                                                                    EPRI 122
C
C IF EPRI DEBUG STATEMENTS ARE USED, ADD MAS(525) IN COMMON/2/                    EPRI 124
C .....
C .....
C----- BEGIN NEW CASE ----- EPRI 127
7 CONTINUE                                EPRI 128
  LTDO=1                                  EPRI 129
  ITEST=0                                  EPRI 130
C----- TITLE CRD ----- EPRI 131
  READ(8,81) (COMENT(I), I=1,16)           EPRI 132
81 FORMAT (16A5)                            EPRI 133
  WRITE (10,443)                            EPRI 134
  WRITE(10,4000) (COMENT(I), I=1,16)       EPRI 135
4000 FORMAT(16A5 // )                      EPRI 136
  NYINP = 0                                 EPRI 137

```

```

LPAGE=0                                EPRI 138
IP1=0                                    EPRI 139
IP2=0                                    EPRI 140
IP3=0                                    EPRI 141
EMINUM = 0.0                            EPRI 142
LTS = 1                                  EPRI 143
235 FORMAT(1H0,/)                        EPRI 144
WRITE (10,221)                            EPRI 145
221 FORMAT (1H0,45X,31HINPUT DATA AS STORED BY PROGRAM,/) EPRI 146
C----- CONTROL CRD ----- EPRI 147
READ(8,82) NTS,NOCDP,NETDP,NOCFP,NETFP,KOP,NEXPS,WFC,INEG,IDLW, EPRI 148
1IPRC,IPRON,CM,CN,JCONT,LSAMF,JPRINT,KYOP,JPNCB,IP1,IP2,IP3,EMINCT EPRI 149
82 FORMAT (6I3,I2,E12.8,4I1,2E12.8,3I2,2I2,3I1,E7.4) EPRI 150
C---LPRINT=0 NORMAL CINDER PRINT 1 IN COL 66 SUPPRESS PRINTS EPRI 151
C---UNLFSS OTHERWISE INDICATED EPRI 152
C--- 1 IN COL 70 PUNCHES CARD OUTPUT REQUESTED EPRI 153
1021 WRITE (10,132)NTS,NOCDP,NETDP,NOCFP,NETFP,WFC EPRI 154
132 FORMAT (1H0,I3,11H TIME STEPS,3X,I3,18H DEPLETION CHAINS ,I3,9H ELE EPRI 155
ELEMENTS,3X,I3,24H FISSION PRODUCT CHAINS ,I3, 9H ELEMENTS,3X,5HWFC= EPRI 156
2 ,F14.6) EPRI 157
ACNUAB = 0.0 EPRI 158
FSMST = 0.0 EPRI 159
PREVTI = 0.0 EPRI 160
TPOWER = 0.0 EPRI 161
TFPREV = 0.0 EPRI 162
FNDO= 1.0 EPRI 163
C----- CONTINUATION CRD ----- EPRI 164
IF(JCONT.GT.0) READ(8,981) PREVTI,TFPREV,TPOWER,ACNUAB EPRI 165
981 FORMAT(6E11.7) EPRI 166
IF(CN.LE.0.0) CN=1.0E-9 EPRI 167
IF(CM.LE.0.0) CM=1.0E-6 EPRI 168
IF(CN.GT.CM/100.0) CN=CM/100.0 EPRI 169
WRITE(10,353) CM,CN EPRI 170
353 FORMAT(1H0,4X,36HBETA T AND DELTA BETA T GREATER THAN,F10.2,30X,21 EPRI 171
1HROUND OFF CRITERION =,E10.2) EPRI 172
IF(1-PRC.LE.0) PRINT 4700 EPRI 173

```

```

4700 FORMAT(1H0,74X,37H(PRINT OF ROUND OFF BYPASS SUPPRESSED))      EPRI 174
      IF(NEXPS.NE.0) GO TO 185                                         EPRI 175
      INPOTC=NTS                                                       EPRI 176
      GO TO 87                                                         EPRI 177
185 INPOTC=NEXPS                                                       EPRI 178
C-----TIME CRD -----FOPIN(I)EPRI 179
      87 READ (8,88)(DT(I),SPEC4(I),F104(I),F204(I),F304(I),          EPRI 180
      1,LEDTO(I),JPRT(I),I=1,INPOTC)                                  EPRI 181
      88 FORMAT(6E11.7,2I3)                                           EPRI 182
COLUMN 72 HAS 1 IF FULL PRINT IS DESIRED FOR THIS TIMESTEP OR EXPANSION EPRI 183
C---INSERT 05 IN ALL LOCATIONS TO AVOID -0 ON OUTPUT                 EPRI 184
      DO 6 I=1,INPOTC                                                 EPRI 185
      IF(JPRT(I).NE.1) JPRT(I)=0                                     EPRI 186
      6 CONTINUE                                                       EPRI 187
      N8FP=NFTDP+1                                                    EPRI 188
      NT=NETDP+NETFP                                                  EPRI 189
      IF(NEXPS.NE.0) GO TO 95                                         EPRI 190
      LEDTO(I)=1                                                       EPRI 191
      IF(NTS.EQ.1)GO TO 95                                           EPRI 192
      DO 429 I=2,NTS                                                  EPRI 193
      IM1=I-1                                                          EPRI 194
429 LEDTO(I) = LEDTO(IM1) + 1                                         EPRI 195
      95 L=1                                                            EPRI 196
      IF(IDIW.EQ.1) GO TO 2000                                         EPRI 197
      IF(KOP.NE.0) GO TO 137                                          EPRI 198
      WRITE (10,133)                                                  EPRI 199
133 FORMAT (1H0,7X,8HTIME INC,4X,16HSPEC FACTOR GP 4,5X,7HPHI 1/4,9X,7EPRI 200
      1HPHI 2/4,9X,7HPHI 3/4,6X,10HFLUX INPUT,3X,17HEXPAND TO PRINT) EPRI 201
      GO TO 54                                                         EPRI 202
137 WRITE (10,138)                                                   EPRI 203
138 FORMAT (1H0,7X,8HTIME INC,4X,16HSPEC FACTOR GP 4,5X,7HPHI 1/4,9X,7EPRI 204
      1HPHI 2/4,9X,7HPHI 3/4,5X,11HPOWER INPUT,2X,15HEXPAND TO PRINT) EPRI 205
      54 DO 136 I=1,INPOTC                                           EPRI 206
      WRITE (10,139)(DT(I),SPEC4(I),F104(I),F204(I),F304(I), FOPIN(I),LFPRI 207
      LEDTO(I), JPRT(I) )                                           EPRI 208
139 FORMAT(1H ,5(2X,E14.6),2X,E14.6,8X, I3,I5)                       EPRI 209

```

136	CONTINUE	EPRI 210
	GO TO 2006	EPRI 211
2000	IF(KOP.NE.0) GO TO 2062	EPRI 212
	WRITE(10,2001)	EPRI 213
2001	FORMAT(1H0,7X,8HTIME INC,4X,16HSPEC FACTOR GP 4,50X,10HFLUX INPUT,	EPRI 214
	1 2X,15HEXPAND TO PRINT)	EPRI 215
	GO TO 2064	EPRI 216
2062	WRITE(10,2063)	EPRI 217
2063	FORMAT(1H0,7X,8HTIME INC,4X,16HSPEC FACTOR GP 4,49X,11HPOWER INPUT	EPRI 218
	1,2X,15HEXPAND TO PRINT)	EPRI 219
2064	DO 2005 I=1,INPOTC	EPRI 220
	WRITE(10,2004) DT(I),SPEC4(I),FOPIN(I),LEDT(I),JPRT(I)	EPRI 221
2004	FOPMAT(1H 2(2X,E14.6),50X,E14.6,8X,I3,I5)	EPRI 222
2005	CONTINUE	EPRI 223
2006	LTS=0	EPRI 224
C*****	BEGIN NEW TS AT 997 (FROM 3090+1 OR 3092,*****EPRI 225	
997	LTS=LTS+1	EPRI 226
	IF (LTS.GT.NTS) GO TO 886	EPRI 227
	DO 3010 I=1,4	EPRI 228
	FA(I)=0.0	EPRI 229
3010	SFNU(I)=0.0	EPRI 230
	NCP=0	EPRI 231
	FPTS(LTS) = 0.0	EPRI 232
	FSAE=0.0	EPRI 233
	NCCON = 0	EPRI 234
	J=0	EPRI 235
	K4=0	EPRI 236
	TOTLP1(LTS)=0.0	EPRI 237
	TOTLP2(LTS)=0.0	EPRI 238
	TOTLP3(LTS)=0.0	EPRI 239
	TOTLP4(LTS)=0.0	EPRI 240
	TOTLB1(LTS)=0.0	EPRI 241
	TOTLB2(LTS)=0.0	EPRI 242
	TOTLB3(LTS)=0.0	EPRI 243
	TOTLB4(LTS)=0.0	EPRI 244
	TOTAC(LTS) = 0.0	EPRI 245

SDT(LTS)= 0.0	EPRI 246
TORET(LTS)= 0.0	EPRI 247
TOGAM(LTS)= 0.0	EPRI 248
TOBPG(LTS)= 0.0	EPRI 249
BETPF(LTS)= 0.0	EPRI 250
GAMPF(LTS)= 0.0	EPRI 251
BPGPF(LTS)= 0.0	EPRI 252
TOTDEN(LTS)=0.0	EPRI 253
NPART=1	EPRI 254
LTSC=LFDTO(L)	EPRI 255
IT=1	EPRI 256
NE=0	EPRI 257
IF(LTS.GT.LTSC)L=L+1	EPRI 258
IF(LTS.NE.1) GO TO 92	EPRI 259
TIME(LTS)= DT(L)+PREVTI	EPRI 260
GO TO 93	EPRI 261
92 LTSM1=LTS-1	EPRI 262
TIME(LTS) = TIME(LTSM1) + DT(L)	EPRI 263
93 DTS=DT(L)*3600.0	EPRI 264
SDT(LTS)= DT(L)	EPRI 265
C---LPRINT=1 SUPPRESS PRINTS UNLESS OTHERWISE INDICATED	EPRI 266
COLUMN 66 ON CONTROL CRD =0 GET NORMAL CIND PRINTS. IF =1 SUPPRESS	EPRI 267
C PRINTS OF NORM CIND. IF =2 ALSO SUPPRESS PRINTS OF DECAY HEAT .**	EPRI 268
IF(JPRINT.LE.0) GO TO 1004	EPRI 269
NPRINT= JPR(T(L)	EPRI 270
NPRDH= 1	EPRI 271
IF(JPRINT.GE.2) NPRDH= JPR(T(L)	EPRI 272
IF(JPRINT.EQ.3) NPRINT=0	EPRI 273
GO TO 1005	EPRI 274
1004 NPRINT=1	EPRI 275
NPRDH= 1	EPRI 276
C*****AFTER FIRST TS SKIP TO 989*****	EPRI 277
1005 IF(LTS.NE.1) GO TO 989	EPRI 278
C-----DEP. CH. CRD -----	EPRI 279
READ (8,189) (NEDP(I),I=1,NDCDP)	EPRI 280
189 FORMAT (9X,20I3)	EPRI 281

```

WRITE (10,222)
222 FORMAT(1H0,/,1H ,2X,42HNUMBER OF ELEMENTS IN EACH DEPLETION CHAIN
1 )
WRITE (10,223)(NEOP(I),I=1,NOCDP)
223 FORMAT (1H ,2X,2015)
IF(LSAME.EQ.0) GO TO 781
LT=NETDP
DO 783 I=1,NT
783 OND(I) = 0.0
GO TO 295
781 LT = NT
IF(NOCFP.EQ.0) GO TO 295
C----- FP CH CRD-----
READ (8,189) (NEFP(I),I=1,NOCFP)
WRITE (10,224)
224 FORMAT (1H0,2X,45HNUMBER ELEMENTS IN EACH FISSION PRODUCT CHAIN)
WRITE (10,223)(NEFP(I),I=1,NOCFP)
295 WRITE (10,225)
225 FORMAT (1H0,58HSPECTRUM FACTOR - GROUP 3 AND/OR 4 PER TIME STEP FXE
IPANSION)
JIM=1
C----- BEGIN READ OF NUC CRD SET -----
IF(IP1.EQ.1) WRITE (10,4737)
4737 FORMAT(1H0,50HPRINT OF ANY INPUT FISSION PRODUCT DATA SUPPRESSED)
DO 297 I=1,LT
C----- NUC CRD 1 -----
READ (8,190)(SYMBOL(I),OND (I), A1(I), A2(I), A3(I)
1,A4(I),IGAM(I),NSUM(I),INSF3(I))
C---IGAM IN COLUMN 68, NSUM-69, INSF3-72
C---INSERT CARD FOR GAMMA AFTER SPECTRUM FACTOR ON GROUP 4
190 FORMAT(1A6,5E12.8,I2,I1,I3,5X)
C (IF DESIRED, THE MASS CAN BE READ FROM THE ENDF/B-IV ABSORPTION
C DECK. ADD MAS(I) TO READ (8,190) AND CHANGE STATEMENT 190 ---
C REPLACE LAST 5X WITH 2X,I3, ALSO ADD MAS(525) TO DIMENSION
C STATEMENT)
C----- NUC CRD 2-----

```

```

EPRI 282
EPRI 283
EPRI 284
EPRI 285
EPRI 286
EPRI 287
EPRI 288
EPRI 289
EPRI 290
EPRI 291
EPRI 292
EPRI 293
EPRI 294
EPRI 295
EPRI 296
EPRI 297
EPRI 298
EPRI 299
EPRI 300
EPRI 301
EPRI 302
EPRI 303
EPRI 304
EPRI 305
EPRI 306
EPRI 307
EPRI 308
EPRI 309
EPRI 310
EPRI 311
EPRI 312
EPRI 313
EPRI 314
EPRI 315
EPRI 316
EPRI 317

```

READ (8,191)(KOC(I),ALAMV(I),FSN1(I),FSN2(I),	FSN3(I),	EPRI 318
IFSN4(I), NPWR(I),INSF4(I) )		EPRI 319
191 FORMAT (4X, 12, 5E12.8, 2I3 )		EPRI 320
IF(I.GT.NETDP) GO TO 984		EPRI 321
RND(I)=0.0		EPRI 322
IF(NPWR(I).EQ.0) GO TO 984		EPRI 323
NYINP=NYINP+1		EPRI 324
FY(NYINP)=SYMBOL(I)		EPRI 325
IF(JCONT.EQ.0) GO TO 982		EPRI 326
C----- NUC CRD 3 -----		EPRI 327
READ(8,985) AFPE(I),BND(I)		EPRI 328
985 FORMAT (6X,2F12.8)		EPRI 329
FSMTS = AFPE(I) + FSMTS		EPRI 330
IF(BND(I).EQ.0.0) GO TO 984		EPRI 331
BND(I)= BND(I)*1.0E24		EPRI 332
GO TO 984		EPRI 333
982 AFPE(I) = 0.0		EPRI 334
986 RND(I)=OND(I) * 1.0E24		EPRI 335
984 YIELD(I)=0.0		EPRI 336
IF(INSF3(I).NE.1) GO TO 761		EPRI 337
IF( (INPOTC.GT.7).OR.(J.NE.0) ) GO TO 89		EPRI 338
WRITE(10,522) (LEDTO(IX),IX=1,INPOTC)		EPRI 339
522 FORMAT (1H0,9X,7(3X,9HTIME STEP,I?))		EPRI 340
89 J=J+1		EPRI 341
C----- NUC CRD 4 -----		EPRI 342
READ (8,192)(SFON3(J,M),M=1,INPOTC)		EPRI 343
192 FORMAT (6X,5E12.8)		EPRI 344
WRITE (10,230)SYMBOL(I)		EPRI 345
230 FORMAT (1H+, 1A6, 104X, 7HGROUP 3)		EPRI 346
WRITE (10,763)(SFON3(J,M) , M=1,INPOTC)		EPRI 347
761 IF(INSF4(I).NE.1) GO TO 1297		EPRI 348
K4= K4+1		EPRI 349
C----- NUC CRD 5 -----		EPRI 350
READ (8,192)(SFON4(K4,M), M=1,INPOTC)		EPRI 351
WRITE (10,804)SYMBOL(I)		EPRI 352
804 FORMAT (1H+, 1A6, 104X, 7HGROUP 4)		EPRI 353

```

        WRITE (10,763)(SFON4(K4,M), M=1,INPOTC)
763 FORMAT (1H, 8X, 7F14.6)
1297 IF(IGAM(I)) 1200,1201,1200
1201 FGAM(I)=1.0
        GO TO 297
C----- NUC CRD 6-----
1200 READ( R,192) FGAM(I)
297 CONTINUE
C***** END READ OF NUC CRD SET *****
        IF(J.EQ.0) WRITE (10,227)
227 FORMAT (1H0, 49X, 42HNO DATA INPUT, FACTORS SET = 1.0 - GROUP 3)
        IF(K4.EQ.0)WRITE (10,956)
956 FORMAT (1H0, 29X, 62HTHE SPECTRUM FACTORS ABOVE MULTIPLY ALL THERME
        AL CROSS SECTIONS)
        IF(JCONT.EQ.0) GO TO 609
        WRITE (10,350)PREVTI ,TFPREV,TPOWER,ACNUAR
350 FORMAT(1H0,6X,12HFLAPSED TIME,5X,29HINTEGRATED THERMAL FLUX TIME,
        16X,16HINTEGRATED POWER,5X,29HINTEGRATED NEUTRON ABSORPTION,/,6X,
        2F14.4,11X,E14.6,2(14X,E14.6),/,1H0,4X,7HELEMENT,5X,20HACC. FISSIO
        3N DENSITY)
        DO 359 IPC=1,NETDP
        IF (NPWR(IPC).GT.0) WRITE(10,358)SYMBOL(IPC),AFPE(IPC)
358 FORMAT (1H, 5X,1A6,8X,E14.6)
359 CONTINUE
        WRITE (10,329)FSMTS
329 FORMAT (1H0,5X,5HTOTAL,9X,E14.6)
609 WRITE(10,231)
231 FORMAT(1H0,/,1H0,7HELEMENT,4X,10HINITIAL NO,7X,8HSIGMA A1,8X,8HSI
        IGMA A2,8X,8HSIGMA A3,8X,8HSIGMA A4,5X,6HIN SUM,2X,6HSPFC 3)
        IF(JCONT.NE.0) WRITE(10,732)
732 FORMAT (1H+,105X,14HFF BASED ON ND)
C---INSERT 0S TO AVOID -0 ON OUTPUT
        DO 5 I=1,NT
        IF(NPWR(I).NE.1) NPWR(I)=0
        IF(NSUM(I).NE.1) NSUM(I)=0
        IF(INSF3(I).NE.1) INSF3(I)=0

```

```

EPRI 354
EPRI 355
EPRI 356
EPRI 357
EPRI 358
EPRI 359
EPRI 360
EPRI 361
EPRI 362
EPRI 363
EPRI 364
EPRI 365
EPRI 366
EPRI 367
EPRI 368
EPRI 369
EPRI 370
EPRI 371
EPRI 372
EPRI 373
EPRI 374
EPRI 375
EPRI 376
EPRI 377
EPRI 378
EPRI 379
EPRI 380
EPRI 381
EPRI 382
EPRI 383
EPRI 384
EPRI 385
EPRI 386
EPRI 387
EPRI 388
EPRI 389

```

```

IF(INSF4(I).NE.1) INSF4(I)=0
5 CONTINUE
DO 55 I=1,NT
IF((IP1.EQ.1).AND.(I.GT.NETDP)) GO TO 4733
IF( (I.GT.NETDP).OR.(JCONT.FQ.0).OR.(BND(I).EQ.0.0) ) GO TO 736
ARND= BND(I)*1.0E-24
WRITE (10,735)ARND
735 FORMAT (1H+,106X,E13.5)
736 WRITE (10,232)(SYMBOL(I),OND(I),A1(I),A2(I),A3(I),A4(I),NSUM(I),INEPRI
ISF3(I))
232 FORMAT (1H ,1A6,2X,5(2X,E14.6),2(4X,I2))
4733 CONTINUE
55 CONTINUE
443 FORMAT (1H1)
775 WRITE (10,233)
233 FORMAT(1H0,7HELEMENT,2X,5HC0UPL,6X,5HLAMDA,9X,8HSIGMA F1,8X,8HSIGMEPRI
1A F2,8X,8HSIGMA F3,8X,8HSIGMA F4,6X,8PIN POWER,10X,5HALPHA)
DO 124 I=1,NT
IF((IP1.EQ.1).AND.(I.GT.NETDP)) GO TO 4734
WRITE (10,234)(SYMBOL(I),KOC(I),ALAMV(I),FSN1(I),FSN2(I),FSN3(I),FEPRI
ISN4(I),NPWR(I),FGAM(I))
234 FORMAT (1H ,1A6,4X,I2,5(2X,F14.6),5X,I2,7X,E14.6)
4734 CONTINUE
124 CONTINUE
188 FORMAT(1H0,8X,48HFISSION FRAGMENT YIELDS FROM FISSIONING ISOTOPES)
C***** FOLLOWING YIELD ORDER USED IF NO YIELD ORDER CARD GIVEN
NY(1) = 1
NY(2) = 2
NY(3) = 3
NY(4) = 4
NY(5) = 5
NY(6) = 5
NY(7) = 5
IF(NOCFP.EQ.0) GO TO 2081
128 WRITE (10,188)
IF(KYOP.EQ.0) GO TO 4500

```

```

EPRI 390
EPRI 391
EPRI 392
EPRI 393
EPRI 394
EPRI 395
EPRI 396
EPRI 397
EPRI 398
EPRI 399
EPRI 400
EPRI 401
EPRI 402
EPRI 403
EPRI 404
EPRI 405
EPRI 406
EPRI 407
EPRI 408
EPRI 409
EPRI 410
EPRI 411
EPRI 412
EPRI 413
EPRI 414
EPRI 415
EPRI 416
EPRI 417
EPRI 418
EPRI 419
EPRI 420
EPRI 421
EPRI 422
EPRI 423
EPRI 424
EPRI 425

```

C-----	READ YIELD ORDER CRD-----	EPRI 426
	READ(R,4501) (NY(I),I=1,7)	EPRI 427
4500	CONTINUE	EPRI 428
4501	FORMAT(6X,7I3)	EPRI 429
	IF (LSAME.EQ.0) GO TO 786	EPRI 430
	IF (KYOP.NE.0) GO TO 4502	EPRI 431
	WRITE (10,785)	EPRI 432
785	FORMAT(1H0,50HCHAINS, YIELDS AND ENERGIES SAME AS PRECFDING CASE)	EPRI 433
	GO TO 2081	EPRI 434
4502	WRITE(10,4503) (NY(I),I=1,7)	EPRI 435
4503	FORMAT(1H0,15HNEW YIELD ORDER,7(1X,I3),14H(SAME FP DECK))	EPRI 436
	WRITE(10,186) (FY(I),I=1,NYINP)	EPRI 437
	GO TO 4739	EPRI 438
786	IF(NYINP.LE.7) WRITE(10,186) (FY(I),I=1,NYINP)	EPRI 439
186	FORMAT(1H0,4X,7(8X,1A6))	EPRI 440
	DO 4504 LE=1,NETFP	EPRI 441
C-----	YIELD CRDS -----	EPRI 442
	READ(R,192) (YLD(LE,KN),KN=).5)	EPRI 443
4504	CONTINUE	EPRI 444
4739	CONTINUE	EPRI 445
119	FORMAT(1H ,8X,7E14.6)	EPRI 446
	DO 4506 LE=1,NETFP	EPRI 447
	DO 4505 K=1,NYINP	EPRI 448
	NK = NY(K)	EPRI 449
	Y(LE,K) = YLD(LE,NK)	EPRI 450
4505	CONTINUE	EPRI 451
	LEPP=LE+NETDP	EPRI 452
	IF (IP1.EQ.1) GO TO 4735	EPRI 453
	WRITE (10,685) SYMBOL (LEPP), (Y(LE,K),K=1,NYINP)	EPRI 454
685	FORMAT(3X,1A6,7E14.6/9X,7E14.6)	EPRI 455
4735	CONTINUE	EPRI 456
4506	CONTINUE	EPRI 457
2081	IF(ID1W.NE.1) GO TO 4600	EPRI 458
	WRITE(10,2010)	EPRI 459
2010	FORMAT(1H0,50X,9HNU VALUES,/,19X,7HELEMENT,9X,7HGROUP 1,9X,7HGROUP	EPRI 460
	1 2,9X,7HGROUP 3,9X,7HGROUP 4)	EPRI 461

```

          LTDO=1                                     EPRI 462
          DO 2009 I=1,NYINP                           EPRI 463
C----- K-INF NU CRD -----                       EPRI 464
          READ(R,192) ANU1(I),ANU2(I),ANU3(I),ANU4(I)   EPRI 465
          WRITE(10,2008) FY(I),ANU1(I),ANU2(I),ANU3(I),ANU4(I) EPRI 466
2008 FORMAT(20X,1A6,4E16.6)                         EPRI 467
2009 CONTINUE                                       EPRI 468
C----- K-INF REMOVAL % FLUX RATIO CRD -----     EPRI 469
          READ (R,2012) (R(I),I=1,3), (FLXR(J,1),J=1,3) EPRI 470
2012 FORMAT(6E12.8)                                 EPRI 471
C----- K-INF CONST. CAPTURE, ETC., CRD -----   EPRI 472
          READ(R,3051) (AC(I),I=1,4),NGIP,NIFU         EPRI 473
3051 FORMAT(4E12.8,2I2)                             EPRI 474
          WRITE(10,2013) (R(I),I=1,3), (AC(J),J=1,4)   EPRI 475
2013 FORMAT(1H0.7X,8HSIGMA R1,6X,8HSIGMA R2,6X,8HSIGMA R3,8X,8HSIGMA C1EPRI 476
          1, 6X,8HSIGMA C2,6X,8HSIGMA C3,6X,8HSIGMA C4,/,2X,3E14.4,2X,4E14.4)EPRI 477
4600 IF(LSAME.NE.0) GO TO 989                        EPRI 478
3989 IF(INFG.EQ.0) GO TO 989                         EPRI 479
          DO 3070 I=1,NT                              EPRI 480
C----- DECAY ENERGY CARDS -----               EPRI 481
          READ(R,3069) (E(I,JF),JE=1,INEG)            EPRI 482
3069 FORMAT(6X,5E12.8)                              EPRI 483
3070 CONTINUE                                       EPRI 484
          WRITE(10,3100)                               EPRI 485
3100 FORMAT(1H0,50X,14HINPUT ENERGIES)             EPRI 486
          DO 3101 I=1,NT                              EPRI 487
          IF((IP1.EQ.1).AND.(I.GT.NETDP)) GO TO 4736 EPRI 488
          WRITE(10,685) SYMBOL(I),(E(I,JF),JF=1,INEG) EPRI 489
4736 CONTINUE                                       EPRI 490
3101 CONTINUE                                       EPRI 491
C***** SKIP TO 989 AFTER FIRST TS (FROM 1005) *****EPRI 492
          989 CONTINUE                                EPRI 493
          IF(ID1W.NE.1) GO TO 321                     EPRI 494
          F104(L)= FLXR(1,LTDO)                       EPRI 495
          F204(L)= FLXR(2,LTDO)                       EPRI 496
          F304(L)= FLXR(3,LTDO)                       EPRI 497

```

321	J=0	EPRI 498
	K4=0	EPRI 499
	IF(IT.NE.1) GO TO 213	EPRI 500
	NS=1	EPRI 501
	NET=NETDP	EPRI 502
	GO TO 129	EPRI 503
213	IT=IT+1	EPRI 504
129	DO 457 I=NS,NET	EPRI 505
	IF( INSF3(I).NE.0) GO TO 100	EPRI 506
	SPEC3=1.0	EPRI 507
	GO TO 766	EPRI 508
100	J=J+1	EPRI 509
	SPEC3=SFON3(J,L)	EPRI 510
766	IF(INSF4(I).NE.0) GO TO 764	EPRI 511
	S4= SPEC4(L)	EPRI 512
	GO TO 767	EPRI 513
764	K4 = K4+1	EPRI 514
	S4 = SFON4 (K4,L)	EPRI 515
767	IF(NPWR(I).NE.0) GO TO 291	EPRI 516
	IF(KOC(I).NE.4) GO TO 967	EPRI 517
291	CONTINUE	EPRI 518
	F(I)=( FSN1(I)*F104(L))+(FSN2(I)*F204(L))+ FSN3(I)* F304(L) * SPEE	EPRI 519
	103+ ( FSN4(I)*S4) ) * 1.0E-24	EPRI 520
	IF(NPWR(I).NE.0) FSOAE=(F(I)*OND(I)*1.0E24) +FSOAE	EPRI 521
967	ABN(I)=( (A1(I)*F104(L))+( A2(I)*F204(L))+( A3(I)*F304(L))*	EPRI 522
	1SPEC3) + ( A4(I) * S4) ) * 1.0E-24	EPRI 523
	A45(I)= A4(I)* S4	EPRI 524
457	A35(I)= A3(I) *SPEC3	EPRI 525
	IF(NOCFP.EQ.0) GO TO 107	EPRI 526
	IF(IT.FQ.2) GO TO 101	EPRI 527
	NS=NETDP+1	EPRI 528
	NET=NT	EPRI 529
	GO TO 213	EPRI 530
101	CONTINUE	EPRI 531
108	FORMAT(1H BE14.6)	EPRI 532
	C***** CALCULATE POWER OR GROUP 4 FLUX	EPRI 533

107	IF (KOP.EQ.0) GO TO 210	EPRI 534
	POWER=FOPIN(L)	EPRI 535
	F4 =POWER/(WFC*FSOAE)	EPRI 536
	GO TO 215	EPRI 537
210	F4 =FOPIN(L)	EPRI 538
	POWER=F4 *WFC*FSOAE	EPRI 539
215	F1 =F104(L)*F4	EPRI 540
	F2 =F204(L)*F4	EPRI 541
	F3 =F304(L)*F4	EPRI 542
	TPOWER = (POWER * DTS) + TPOWER	EPRI 543
	PCR(LTS)=POWER	EPRI 544
110	NPICK=0	EPRI 545
	NEIL=0	EPRI 546
	LUCY=0	EPRI 547
	LINUS=1	EPRI 548
	N=0	EPRI 549
111	IF (NPART.NE.1) GO TO 811	EPRI 550
	NOC= NOCDP	EPRI 551
	WRITE(10,443)	EPRI 552
	WRITE(10,235)	EPRI 553
	WRITE (10,525)LTS,DT(L),TIME(LTS)	EPRI 554
525	FORMAT (1H0,15X,10HTIME STEP ,I2,5X,11HDELTA T IS ,F14.4,6H HOURS,	EPRI 555
	15X,16H ELAPSED TIME IS ,F14.4,6H HOURS,/,1H0,/)	EPRI 556
	IF (ID1W.NE.1) GO TO 814	EPRI 557
	WRITE(10,2007) F104(L),F204(L),F304(L)	EPRI 558
2007	FORMAT(10X,8HPHI 1/4=F14.6,14X,8HPHI 2/4=E14.6,14X,8HPHI 3/4=E14.6	EPRI 559
	1 )	EPRI 560
	GO TO 814	EPRI 561
811	NOC=NOCFP	EPRI 562
814	DO 812 NC=1,NOC	EPRI 563
	LINUS=LINUS+N	EPRI 564
	IF (NPART.NE.1) GO TO 815	EPRI 565
	N=NEDP(NC)	EPRI 566
	GO TO 817	EPRI 567
815	N= NEFP(NC)	EPRI 568
817	IE=0	EPRI 569

```

      NES=NPICK+1
      NPICK=NPICK+N
      DO 8 I=NES, NPICK
      IE=IE+1
      ALAMDA(IE)=ALAMV(I)
      A(IE)=ABN(I)*F4
      M=KOC(I)
      GO TO (200,201,202,203),M
200  G(IE) = 1.0
      GO TO 12
201  G(IE) = ALAMV(I)
      GO TO 12
202  G(IE) = A(IE)
      GO TO 12
203  G(IE) = ( ABN(I) - F(I) ) * F4
      12 YS(IE)=YIELD(I)
C---- ADD FGAMA(IE)=FGAM(I), 11/10/71 -----
      FGAMA(IE) = FGAM(I)
      8 DAT(IE)=OND (I) * 1.0E24
C===== 3/76 =====
C      ROUNDOFF CONTROL MODIFIED
C
C      LAMDA+A VALUES (B(I)) EXAMINED AT EACH TIME STEP AND
C      MODIFIED ON BASIS OF CM AND CN VALUES AND TIME INCREMENT
C      TO PREVENT VALUES OR DIFFERENCES THAT ARE TOO SMALL FOR
C      COMPUTATION.
C      THIS ROUTINE IS BASED ON THE NUMBER OF DIGITS (BASE 10)
C      GUARANTEED BY ANY PARTICULAR COMPUTER. IF THE NUMBER
C      IS N (FOR CDC 60BIT WORDS N=16), THEN CM ON THE CONTROL
C      CARD SHOULD BE GREATER THAN 1.0E-N (THE VALUE CM=1.0E-13
C      IS RECOMMENDED FOR CDC COMPUTERS). CN ON THE CONTROL
C      CARD SHOULD BE SMALLER THAN CM/100. IF NOT, CN IS FORCED
C      TO EQUAL CM/100.
C
C      NOTE.---- IF CM AND CN ARE LEFT BLANK OR NEGATIVE, THE CODE
C      SETS THESE TO CM=1.0E-6

```

```

      EPRI 570
      EPRI 571
      EPRI 572
      EPRI 573
      EPRI 574
      EPRI 575
      EPRI 576
      EPRI 577
      EPRI 578
      EPRI 579
      EPRI 580
      EPRI 581
      EPRI 582
      EPRI 583
      EPRI 584
      EPRI 585
      EPRI 586
      EPRI 587
      EPRI 588
      EPRI 589
      EPRI 590
      EPRI 591
      EPRI 592
      EPRI 593
      EPRI 594
      EPRI 595
      EPRI 596
      EPRI 597
      EPRI 598
      EPRI 599
      EPRI 600
      EPRI 601
      EPRI 602
      EPRI 603
      EPRI 604
      EPRI 605

```

G-17

C		CN=1.0E-9	FPRI 606
C	IPRON	ON CONTROL CARD CONTROLS PRINT OF ROUND OFF INFO	FPRI 607
C	IF IPRON=0,	NO PRINT OF ROUND OFF INFO (RECOMMENDED)	FPRI 608
C		=1, PRINT CONTRIBUTION OF (NUC) FROM (NUC) ,ETC	FPRI 609
C		=2, PRINT CHANGE IN LAMDA+A VALUES	FPRI 610
C		=3, PRINT INFO ON DELTA (LAMDA+A)	FPRI 611
C	=====		FPRI 612
	DO 5136	I=1,N	FPRI 613
	CM1=I*2.0*CM		FPRI 614
	R(I)=ALAMDA(I)+A(I)		FPRI 615
	TRR=R(I)		FPRI 616
	TRRT=TRR		FPRI 617
	IF((TRR*DTS).LE.CM1) TRR=CM1/DTS		FPRI 618
	NAD=0		FPRI 619
	IF(I.EQ.1) GO TO 5828		FPRI 620
	II=I-1		FPRI 621
	DO 5829 J=1,II		FPRI 622
	TRJ=ABS(TRR-R(J))		FPRI 623
	CMM=CM1		FPRI 624
	IF(CMM.LT.(CM1/DTS)) CMM=CM1/DTS		FPRI 625
	IF(TRJ.GE.CMM) GO TO 5822		FPRI 626
	TRR=TRR+TRR*CMM		FPRI 627
	NAD=1		FPRI 628
5822	CONTINUE		FPRI 629
5829	CONTINUE		FPRI 630
5828	CONTINUE		FPRI 631
	WHIT=TRR-TRRT		FPRI 632
	B(I)=TRR		FPRI 633
	IF((WHIT*DTS).GE.CM) NAD=1		FPRI 634
	IF(NAD.EQ.0) GO TO 5131		FPRI 635
	IF(IPRON.LT.2) GO TO 5131		FPRI 636
	WRITE(10,5130) NPART,NC,I,TRRT,WHIT,B(I)		FPRI 637
5130	FORMAT(1H ,5HPART ,13.6H CHAIN,14,8H NUCLIDF,13.		FPRI 638
	19H LAMDA+A,(E12.5,16H) INCREMENTED BY,E12.5.		FPRI 639
	23H TC,F12.5)		FPRI 640
5131	CONTINUE		FPRI 641

5136 CONTINUE	EPRI 642
C ***** CALCULATE DELTA BETAS =R(I)-R(J)=ABAR(I,J)	EPRI 643
DO 5810 I=1,N	EPRI 644
DO 5135 J=1,N	EPRI 645
CMJ=0.999*CN	EPRI 646
IF(J.NF.I) GO TO 5132	EPRI 647
ABAR(I,J)=1.0	EPRI 648
GO TO 5134	EPRI 649
5132 CONTINUE	EPRI 650
ABAR(I,J)=R(I)-R(J)	EPRI 651
IF(ABS(ABAR(I,J)*DTS).GT.CMJ) GO TO 5134	EPRI 652
WRITE(10,5133)NPART,NC,I,J,ABAR(I,J)	EPRI 653
5133 FORMAT(1H ,8H*** PART,I2,6H CHAIN,I3,17H, DELTA BETA NUCS,I2,	EPRI 654
11H ,I2,2H =,E12.5,15H CHECK DENS ***)	EPRI 655
5134 CONTINUE	EPRI 656
IF(IPRON.LT.3) GO TO 5135	EPRI 657
C ***** TEST DELTA BETA	EPRI 658
WRITE(10,5842) NC,I,J,ABAR(I,J)	EPRI 659
5842 FORMAT(1H ,6H CHAIN,I3,5H NUCS,2I3,10H DIFFER BY,E12.5)	EPRI 660
5135 CONTINUE	EPRI 661
5810 CONTINUE	EPRI 662
922 IP=0	EPRI 663
NJ=0	EPRI 664
C ***** CALCULATE THE PRODUCTS OF THE DIFFERENCES IN	EPRI 665
C         DESTRUCTION RATES, PRODA(I,J,IV)	EPRI 666
DO 74 JP=1,N	EPRI 667
NIV=0	EPRI 668
NI=JP-1	EPRI 669
IVJ=NJ+1	EPRI 670
DO 72 J=IVJ,N	EPRI 671
PRFVP=1.0	EPRI 672
JE=NJ	EPRI 673
IVI=NI+1	EPRI 674
I=0+NIV	EPRI 675
DO 70 IV=IVI,N	EPRI 676
JE=JE+1	EPRI 677

I=I+1	EPRI 678
IF (JE.GT.1) GO TO 38	EPRI 679
PRODA(JE,JP,IV)= ABAP(I,J)	EPRI 680
PREVP=PRODA(JE,JP,IV)	EPRI 681
GO TO 70	EPRI 682
38 IF ((JP.LE.1).OR.(JE.NE.JP)) GO TO 41	EPRI 683
PREVP= PRODA(JE-1,JP-1,IV)	EPRI 684
41 PRODA(JE,JP,IV)=AHAR(I,J)*PREVP	EPRI 685
PREVP=PRODA(JE,JP,IV)	EPRI 686
IF (JE.EQ.JP) I=IV	EPRI 687
70 CONTINUE	EPRI 688
NIV=NIV+1	EPRI 689
NI=NI+1	EPRI 690
72 CONTINUE	EPRI 691
NJ=NJ+1	EPRI 692
74 CONTINUE	EPRI 693
C ***** CALCULATE THE PRODUCTS OF THE DFSTRUCTION RATFS.	EPRI 694
C PRODB(I,J)	EPRI 695
80 DO 90 JB=1,N	EPRI 696
JP=0	EPRI 697
PREVB=1.0	EPRI 698
JD=JB	EPRI 699
DO 85 JE=JD,N	EPRI 700
JP=JP+1	EPRI 701
PRODB(JE,JP)=B(JE)*PREVB	EPRI 702
PREVR=PRODB(JE,JP)	EPRI 703
421 FORMAT (1H ,2I2,8E14.6)	EPRI 704
85 CONTINUE	EPRI 705
90 CONTINUE	EPRI 706
C-----EXP SET TO 1400. IF GT, SET EXPONENTIAL TO 0.0 OTHERWISE.	EPRI 707
C IF EXPONENT GT CN CALCULATE VALUE AND IF LT CN SET	EPRI 708
C TO 1-EXPOENT. 6/76	EPRI 709
DO 106 I=1,N	EPRI 710
EXFLAM(I)=EXP(-DTS*B(I))	EPRI 711
IF ((-DTS*B(I)).GT.1400.0) EXFLAM(I)=0.0	EPRI 712
IF ((DTS*B(I)).LT.CN) EXFLAM(I)=1.0-DTS*B(I)	EPRI 713

106	CONTINUE	EPRI 714
C	DO 106 I=1,N	EPRI 715
C	IF (ABS(DTS*B(I)).LT.1400.) GO TO 105	EPRI 716
C	EXFLAM(I)=0.0	EPRI 717
C	GO TO 106	EPRI 718
C	105 EXFLAM(I)=EXP(-DTS*B(I))	EPRI 719
C	IF (ABS(DTS*B(I)).LT.1.0E-9) EXFLAM=1.0-DTS*B(I)	EPRI 720
C	106 CONTINUE	EPRI 721
C	--- LOOP ON DP OR FP CHAIN KE -----	EPRI 722
408	DO 250 KE=1,N	EPRI 723
	NEIL=NEIL+1	EPRI 724
	IF (NPART.EQ.1) FPE (NEIL)=0.0	EPRI 725
	DEN(NFIL)=0.0	EPRI 726
	PRGOG=1.0	EPRI 727
	PRFG=1.0	EPRI 728
	LCON1=0	EPRI 729
	LCON2=0	EPRI 730
	LCON3=0	EPRI 731
	LCON=0	EPRI 732
	DO 45 JS=1,KE	EPRI 733
	IF (JS.EQ.1) GO TO 530	EPRI 734
	NTKE=JS-1	EPRI 735
	KMN=KE-NTKE	EPRI 736
	LUCY=LINUS+JS-2	EPRI 737
C****	PRG CHNG 11/10/71, FGAMA(IE)=FGAM(LUCY),PRGOG =G*FGAMA*PRGOG	EPRI 738
C****	PRFG =FGAM(LUCY)*PRFG REMOVED	EPRI 739
	PRGOG = G(KMN)*FGAMA(KMN)*PRGOG	EPRI 740
C****	PRFG =FGAM(LUCY)*PRFG REMOVED (SET TO 1.0)	EPRI 741
	LPRINT=0	EPRI 742
	IF (PRGOG.NE.0.0) GO TO 530	EPRI 743
	IF (F4.EQ.0.0) GO TO 891	EPRI 744
	WRITE (10,481)KE,NC,NPART	EPRI 745
481	FORMAT(1)H0.17HERROR STOP,GAMMA(.I7,12H)=0.0,CHAIN .I3,6H PART .I2/EPRI 746	EPRI 746
	11X,87H EXCEPT FOR LAST NUC IN CHAIN ALL NUCS MUST HAVE A NON ZERO LEPRI 747	EPRI 747
	2AMDA OR XSEC AND A COUPLING)	EPRI 748
	GO TO 886	EPRI 749

891	PT1(NEIL) = 0.0	EPRI 750
	PT2(NEIL) = 0.0	EPRI 751
	GO TO 145	EPRI 752
530	PSM1=0.0	EPRI 753
	PSM2=0.0	EPRI 754
	PT1(NEIL)=0.0	EPRI 755
	PT2(NEIL)=0.0	EPRI 756
	PRVSM1=0.0	EPRI 757
	PRVSM2=0.0	EPRI 758
	IVS=KE-JS	EPRI 759
	IY=KE-JS+1	EPRI 760
	IF(YS(IY).EQ.0.0) GO TO 382	EPRI 761
	IF(PRODB(KE,JS).NE.0.0) GO TO 381	EPRI 762
	WRITE(10,920) JS,SYMBOL(NEIL)	EPRI 763
920	FORMAT(1H0,36HERROR STOP ON PRODUCT OF LAMDA + A S,5X,5H PART,I3,4	EPRI 764
	1H OF ,1A6)	EPRI 765
	GO TO 886	EPRI 766
381	SM1MAX=1.0/PRODB(KE,JS)	EPRI 767
382	SM2MAX=0.0	EPRI 768
	DO 140 JPS=1,JS	EPRI 769
	IVS=IVS+1	EPRI 770
	IF(JS.EQ.1) GO TO 6906	EPRI 771
	IF(PRODA(JS,JPS,KE).NE.0.0) GO TO 141	EPRI 772
	WRITE(10,873) JS,JPS,SYMBOL(NEIL)	EPRI 773
873	FORMAT(1H0,38HERROR STOP ON PRODUCT(DELTA LAMDA + A),5X,5HPART ,I3	EPRI 774
	1,2X,I3,4H OF ,1A6)	EPRI 775
	GO TO 886	EPRI 776
141	PSM2=EXFLAM(IVS)/PRODA(JS,JPS,KE)	EPRI 777
	IF(ABS(PSM2).GT.SM2MAX) SM2MAX=ABS(PSM2)	EPRI 778
	IF(ABS(PRVSM2).GT.SM2MAX) SM2MAX=ABS(PRVSM2)	EPRI 779
	SM2(JS,KE)=PRVSM2+ PSM2	EPRI 780
	IF(YS(IY).EQ.0.0) GO TO 116	EPRI 781
	SM1(JS,KE)= PSM2/H(IVS)	EPRI 782
	IF(ABS(SM1(JS,KE)).GT.SM1MAX) SM1MAX=ABS(SM1(JS,KE))	EPRI 783
	IF(ABS(PRVSM1).GT.SM1MAX) SM1MAX=ABS(PRVSM1)	EPRI 784
	PSM1= SM1(JS,KE) * PRVSM1	EPRI 785

116	CONTINUE	EPRI 786
130	PRVSM2=SM2(JS,KE)	EPRI 787
	PRVSM1= PSM1	EPRI 788
	SM1(JS,KE)=PRVSM1	EPRI 789
	GO TO 6907	EPRI 790
6906	PSM2=EXFLAM(IVS)	EPRI 791
	SM2MAX=PSM2	EPRI 792
	IF((B(IVS)*DTS).GT.1.0E-9) GO TO 6908	EPRI 793
	PSM1=DTS	EPRI 794
	GO TO 6909	EPRI 795
6908	PSM1=(1.0-EXFLAM(IVS))/B(IVS)	EPRI 796
6909	SM1MAX=ABS(PSM1)	EPRI 797
	SM1(JS,KE)=PSM1+PRVSM1	EPRI 798
	SM2(JS,KE)=PSM2+PRVSM2	EPRI 799
	PRVSM1=SM1(JS,KE)	EPRI 800
	PRVSM2=SM2(JS,KE)	EPRI 801
	PSM1=SM1(JS,KE)	EPRI 802
	PSM2=SM2(JS,KE)	EPRI 803
6907	CONTINUE	EPRI 804
140	CONTINUE	EPRI 805
	IF(YS(IY).NE.0.0) GO TO 410	EPRI 806
	PT1(NEIL)=0.0	EPRI 807
	SM1(JS,KE)=0.0	EPRI 808
	PSM1=0.0	EPRI 809
	GO TO 144	EPRI 810
410	PSM1=(1.0/PRODB(KE,JS))-PSM1	EPRI 811
	IF(JS.F0.1) PSM1=SM1(JS,KE)	EPRI 812
	SM1(JS,KE)=PSM1	EPRI 813
	IF((PSM1/SM1MAX).GE.CN)GO TO 143	EPRI 814
	PSM1=0.0	EPRI 815
	SM1(JS,KE)=0.0	EPRI 816
	LCON1=1	EPRI 817
	IF(IPRON.EQ.0)GO TO 143	EPRI 818
144	IF(JS.NE.1) GO TO 6904	EPRI 819
	PT2(NFIL)=PRGQG*DAT(IY)*SM2(JS,KE)*PRFG	EPRI 820
	LCON=0	EPRI 821

	GO TO 858	EPRI 822
6904	IF(SM2MAX.NE.0.0) GO TO 550	EPRI 823
	NSYM=KE-IY	EPRI 824
	NLMNS=NEIL-NSYM	EPRI 825
	WRITE (10,372)SYMBOL(NEIL), SYMBOL( NLMNS ) , NC	EPRI 826
372	FORMAT (1H ,20X,16HCONTRIBUTION TO ,1A6,6H FROM ,1A6,33H AND PRECFE	EPRI 827
	ADING ELEMENTS IN CHAIN ,I3,11H SET TO 0.0,3X,12HDIRECT YIELD)	EPRI 828
	LPRINT = 1	EPRI 829
143	PT1(NEIL)= PRGOG*YS(IY)*PSM1*PRFG	EPRI 830
	IF(JPS.NE.1) GO TO 551	EPRI 831
	IF(IPRC.LE.0) GO TO 551	EPRI 832
	WRITE (10,561) SYMBOL(NEIL),NC	EPRI 833
561	FORMAT (1H ,20X,62HROUND OFF CRITERION BYPASSED - ALL EXPONENTS IN	EPRI 834
	ICALCULATION OF ,1A6,10H IN CHAIN,I3,10H TOO LARGE)	EPRI 835
551	LCON3=1	EPRI 836
	GO TO 450	EPRI 837
550	IF((SM2(JS,KE)/SM2MAX).GE.CN) GO TO 450	EPRI 838
	SM2(JS,KE)=0.0	EPRI 839
	LCON2=1	EPRI 840
	PSM2=0.0	EPRI 841
	IF((IPRON.EQ.0).OR.(LPRINT.NF.0)) GO TO 450	EPRI 842
	NSYM=KE-IY	EPRI 843
	NLMNS=NEIL-NSYM	EPRI 844
	WRITE (10,346)SYMBOL(NEIL), SYMBOL( NLMNS ) , NC	EPRI 845
346	FORMAT (1H ,20X,16HCONTRIBUTION TO ,1A6,6H FROM ,1A6,33H AND PRECFE	EPRI 846
	ADING ELEMENTS IN CHAIN ,I3,11H SET TO 0.0)	EPRI 847
450	CONTINUE	EPRI 848
	IF((LCON1+LCON2).EQ.0) GO TO 858	EPRI 849
	PT1(NEIL)=0.0	EPRI 850
	PT2(NEIL)=0.0	EPRI 851
	PSM1=0.0	EPRI 852
	PSM2=0.0	EPRI 853
	PRVSM1=0.0	EPRI 854
	PRVSM2=0.0	EPRI 855
	GO TO 145	EPRI 856
858	CONTINUE	EPRI 857

PT2(NFIL)=PRGOG*(DAT(IY)*SM2(JS,KF))*PRFG	EPRI 858
FOND= DEN(NFIL)	EPRI 859
IF(NPART.EQ.1) PT1(NFIL)=0.0	EPRI 860
IF(YS(IY).EQ.0.0) PT1(NFIL)=0.0	EPRI 861
IF(F4.LE.0.0) PT1(NFIL)=0.0	EPRI 862
LCON=LCON1+LCON2	EPRI 863
IF(LCON3.EQ.1) LCON=0	EPRI 864
145 DEN(NFIL)= PT1(NFIL)+ PT2(NFIL)+ DFN(NFIL)	EPRI 865
650 IF(LCON.GT.0) GO TO 44	EPRI 866
45 CONTINUE	EPRI 867
44 LCON = 0	EPRI 868
LCON1=0	EPRI 869
LCON2=0	EPRI 870
LCON3=0	EPRI 871
46 PREVND =OND (NFIL) * 1.0E24	EPRI 872
148 CONTINUE	EPRI 873
IF(NPART.NE.1) GO TO 791	EPRI 874
IF(BND(NFIL).NE.0.0) ALPHA(NFIL)= DEN(NFIL)/ BND(NFIL)	EPRI 875
IF(NPWR(NFIL).EQ.0) GO TO 791	EPRI 876
NCP=NCP+1	EPRI 877
SP3= A3S(NFIL)/A3(NFIL)	EPRI 878
SP4= A4S(NFIL)/A4(NFIL)	EPRI 879
SFNU(1)= SFNU(1)+(DEN(NFIL)*1.0E-24*ANU1(NCP)*FSN1(NFIL))	EPRI 880
SFNU(2)= SFNU(2)+(DEN(NFIL)*1.0E-24*ANU2(NCP)*FSN2(NFIL))	EPRI 881
SFNU(3)= SFNU(3)+(DEN(NFIL)*1.0E-24*ANU3(NCP)*FSN3(NFIL)*SP3)	EPRI 882
SFNU(4)= SFNU(4)+(DEN(NFIL)*1.0E-24*ANU4(NCP)*FSN4(NFIL)*SP4)	EPRI 883
IF(NIFU.EQ.NCP) NSAVE=NFIL	EPRI 884
C=(DEN(NFIL)+PREVND)/2.0* F(NFIL)	EPRI 885
157 NE=NE+1	EPRI 886
D(NE)=C	EPRI 887
150 FPE(NFIL)= C*F4 *DTS*1.0E-24	EPRI 888
AFPE(NFIL)=FPE(NFIL)+AFPE(NFIL)	EPRI 889
FPTS(LTS)=FPE(NFIL)+FPTS(LTS)	EPRI 890
791 DEN(NFIL)=DEN(NFIL)*1.0E-24	EPRI 891
OND (NFIL)=DEN(NFIL)	EPRI 892
250 CONTINUE	EPRI 893

812	CONTINUE	EPRI	894
	IF( (NPART.NE.1).OR.(NOCFP.EQ.0)) GO TO 845	EPRI	895
	DO 337 LE=1,NETFP	EPRI	896
	YD=0.0	EPRI	897
	DO 336 K=1,NYINP	EPRI	898
336	YD=(Y(LE,K)*D(K))+YD	EPRI	899
	LEPNET=LE+NETOP	EPRI	900
337	YIELD(LEPNET )=YD*F4	EPRI	901
	NPART=2	EPRI	902
	GO TO 111	EPRI	903
845	FSMTS=FPTS(LTS)+FSMTS	EPRI	904
	AFD(LTS)=FSMTS	EPRI	905
	WRITE (10,473)	EPRI	906
473	FORMAT(1H0,10X,7HELEMENT,2X,15HFISSION DENSITY,2X,20HACC. FISSIION	EPRI	907
	IDENSITY)	EPRI	908
	DO 746 I=1,NT	EPRI	909
	IF(NPWR(I).NE.0) WRITE(10,475) SYMROL(I),FPE(I),AFPE(I)	EPRI	910
475	FORMAT(1H ,10X,1A6,2(5X,E14.6))	EPRI	911
	P1(I)=DEN(I)* A1(I)	EPRI	912
	P2(I)=DEN(I)* A2(I)	EPRI	913
	P3(I)=DEN(I)* A3S(I)	EPRI	914
	P4(I) = DEN(I) * A4S(I)	EPRI	915
	B1F(I)=P1(I)/ FSMTS	EPRI	916
	B2F(I)=P2(I)/ FSMTS	EPRI	917
	B3F(I)=P3(I)/ FSMTS	EPRI	918
	B4F(I)=P4(I)/ FSMTS	EPRI	919
	TOTE(I) = DEN(I) * ALAMV(I)*(1.0E+24)	EPRI	920
	IF(NSUM(I).NE.1) GO TO 746	EPRI	921
	TOTLP1(LTS)= P1(I) + TOTLP1(LTS)	EPRI	922
	TOTLP2(LTS) = P2(I) + TOTLP2(LTS)	EPRI	923
	TOTLP3(LTS) = P3(I) + TOTLP3(LTS)	EPRI	924
	TOTLP4(LTS) = P4(I) + TOTLP4(LTS)	EPRI	925
	TOTLB1 (LTS)=B1F(I) + TOTLB1(LTS)	EPRI	926
	TOTLB2 (LTS)=B2F(I) + TOTLB2(LTS)	EPRI	927
	TOTLB3 (LTS)=B3F(I) + TOTLB3(LTS)	EPRI	928
	TOTLB4 (LTS)=B4F(I) + TOTLB4(LTS)	EPRI	929

TOTAC(LTS) = TOTAC(LTS) + TOTE(I)	EPRI 930
TOTDEN(LTS)=TOTDEN(LTS)+DEN(I)	EPRI 931
746 CONTINUE	EPRI 932
C-----TEMPORARY INSERT FOR DEBUG OF EPRI CHAINS	EPRI 933
C WRITE(10,5600)	EPRI 934
C5600 FORMAT(1H1.14HMASS DENSITIES/1X.3HSEQ.1X.4HMASS.5X.9HDENSITIES,	EPRI 935
C 11X.10HNO OF NUCS)	EPRI 936
C DNST=0.0	EPRI 937
C KNT=0	EPRI 938
C M=0	EPRI 939
C DO 5610 I=70,172	EPRI 940
C DNS=0.0	EPRI 941
C KN=0	EPRI 942
C DO 5620 J=1,NT	EPRI 943
C M=MAS(J)	EPRI 944
C IF(M.NF.1) GO TO 5620	EPRI 945
C IF(NSUM(J).NE.1) GO TO 5620	EPRI 946
C KN=KN+1	EPRI 947
C DNS=DNS+DEN(J)	EPRI 948
C DNST=DNST+DEN(J)	EPRI 949
C MM=M	EPRI 950
C KNT=KNT+1	EPRI 951
C5620 CONTINUE	EPRI 952
C WRITE(10,5630) I,MM,DNS,KN	EPRI 953
C5630 FORMAT(1X,I3,I4,2X,E12.5,5X,I6)	EPRI 954
C5610 CONTINUE	EPRI 955
C WRITE(10,5640)LTS,KNT,DNST,FSMTS	EPRI 956
C5640 FORMAT(1H0.5HAT TS,I3,10H THERE ARE,I5,9HNUCS NSUM,E12.6,	EPRI 957
C 19H=TOT DENS/1X.3HFUR,E12.6,9H FISSIONS///)	EPRI 958
C-----END TEMPORARY INSEERT	EPRI 959
IF(ID1W.NF.1) GO TO 2015	EPRI 960
EA(1) = AC(1) + TOTLP1(LTS)	EPRI 961
EA(2) = AC(2) + TOTLP2(LTS)	EPRI 962
EA(3) = AC(3) + TOTLP3(LTS)	EPRI 963
EA(4) = AC(4) + TOTLP4(LTS)	EPRI 964
DO 3011 ICT=1,4	EPRI 965

```

3011 DA(ICT,LTS)= EA(ICT) EPRI 966
      IF(NGIP-3) 3014,3013,3012 EPRI 967
3012 FLXR(1,LTS)=(EA(2)+R(2))*(EA(3)+R(3))*EA(4)/(R(1)*R(2)*R(3)) EPRI 968
3013 FLXR(2,LTS)= (EA(3)+R(3))*EA(4)/(R(2)*R(3)) EPRI 969
3014 FLXR(3,LTS)= EA(4)/R(3) EPRI 970
      IF(NGIP-3) 3015,3016,3017 EPRI 971
3015 AKO(LTS)=(SFNU(3)*FLXR(3,LTS)+SFNU(4))/((EA(3)+R(3))*FLXR(3,LTS)) EPRI 972
      GO TO 3020 EPRI 973
3016 AKO(LTS)=(SFNU(2)*FLXR(2,LTS)+SFNU(3)*FLXR(3,LTS)+SFNU(4))/((EA(2) EPRI 974
      1+R(2))*FLXR(2,LTS)) EPRI 975
      GO TO 3020 EPRI 976
3017 AKO(LTS)=(SFNU(1)*FLXR(1,LTS)+SFNU(2)*FLXR(2,LTS)+SFNU(3) EPRI 977
      1*FLXR(3,LTS)+SFNU(4))/((EA(1)+R(1))*FLXR(1,LTS)) EPRI 978
3020 CONTINUE EPRI 979
      LTD0=LTS EPRI 980
      RHO(LTS)= (AKO(LTS)-1.0)/AKO(LTS) EPRI 981
      FFS(LTS)=ALPHA(NSAVE) EPRI 982
2015 CONTINUE EPRI 983
      TNUABS= (TOTLP1(LTS)* F1 + (TOTLP2(LTS) * F2 ) + (TOTLP3 EPRI 984
      1 (LTS) * F3 ) + F4 * TOTLP4(LTS)) * DTS EPRI 985
      ACNUAR= TNUABS + ACNUAR EPRI 986
      FLXTM = F4 * DTS EPRI 987
      IF(LTS,NE.1) GO TO 269 EPRI 988
      TLFXTM(LTS)= FLXTM + TFPREV EPRI 989
      GO TO 270 EPRI 990
269 LTSM1=LTS-1 EPRI 991
      TLFXTM(LTS) = FLXTM + TLFXTM(LTSM1) EPRI 992
270 WRITE(10,913) FPTS(LTS),FSMTS,TPOWER,ACNUAR,TLFXTM(LTS),F1,F2,F3 EPRI 993
      1,F4,POWER EPRI 994
913 FORMAT(1H0,11X,5HTOTAL,2(5X,F14.6),/,/,1H0,13X,28HINTEGRATED POWER EPRI 995
      1(WATTS-SEC),14X,29HINTEGRATED NEUTRON ABSORPTION,5X,28HINTEGRATED EPRI 996
      2THERMAL FLUX TIME,/,21X,E14.6,8X,2(20X,E14.6),/,1H0,19X,6HFLUX 1, EPRI 997
      3 13X,6HFLUX 2,13X,6HFLUX 3,13X,6HFLUX 4,13X,5HPOWER,/,16X,E14.6, EPRI 998
      4 4(5X,E14.6),/,1H0,/) EPRI 999
      IF(NPRINT.EQ.1) GO TO 1025 EPRI1000
      N00=1 EPRI1001

```

	GO TO 1026	EPR11002
1025	NDO=2	EPR11003
1026	IF (ID1W.EQ.1) GO TO 2017	EPR11004
	DO 253 IPR=1,NDO	EPR11005
	IF (IPR.NE.1) GO TO 245	EPR11006
931	FORMAT(1H0,45X,27HDEPLETION GROUP INFORMATION)	EPR11007
	KB=1	EPR11008
	KTF=NETDP	EPR11009
	GO TO 939	EPR11010
245	IF (NOCFP.EQ.0) GO TO 253	EPR11011
932	FORMAT(1H0,/,/,1H0,46X,27HFISSION PRODUCT INFORMATION)	EPR11012
	KB=NBFP	EPR11013
	KTE=NT	EPR11014
939	WRITE (10,944)	EPR11015
944	FORMAT(1H0,6AX,15HBARNS / FISSIION,/,6X,7HELEMENT,5X,14HNUMBER DENSEP ITY,14X,7HGROUP 1,11X,7HGROUP 2,12X,7HGROUP 3,12X,7HGROUP 4)	EPR11016
	DO 247 I=KB,KTE	EPR11018
	WRITE (10,941)(SYMBOL(I), DEN(I), B1F(I), B2F(I), B3F(I), BEP 4F(I))	EPR11019
941	FORMAT(1H ,5X,1A6,5X,F14.6,5X,4(5X,E14.6))	EPR11021
247	CONTINUE	EPR11022
	IF (IPR.EQ.2) WRITE (10,950)(TOTLB)(LTS),TOTLB2(LTS),TOTLB3(LTS)	EPR11023
	1. TOTLB4(LTS)	EPR11024
950	FORMAT(1H0,38HTOTAL - DEPLETION AND FISSION PRODUCTS,2X,E14.6,3(5X 1.E14.6),/,1H0,/) )	EPR11025
	IF (IPR.EQ.2) GO TO 633	EPR11027
	WRITE(10,945)	EPR11028
945	FORMAT(1H0,66X,18HMACROSCOPIC POISON,/,6X,7HELEMENT,4X,13HFUEL FRA CTION,15X,7HGROUP 1,12X,7HGROUP 2,12X,7HGROUP 3,12X,7HGROUP 4)	EPR11029
	GO TO 992	EPR11031
633	WRITE (10,634)	EPR11032
634	FORMAT(1H0,66X,18HMACROSCOPIC POISON,/,6X,7HELEMENT,5X,10HLAMBDA 1 N,17X,7HGROUP 1,12X,7HGROUP 2,12X,7HGROUP 3,12X,7HGROUP 4)	EPR11033
992	DO 935 I=KB,KTE	EPR11035
	IF (IPR.EQ.2) GO TO 635	EPR11036
	IF ( BND(I).EQ.0.0) GO TO 1999	EPR11037

	WRITE (10,943) SYMBOL(I),ALPHA(I),P1(I),P2(I),P3(I),P4(I)	EPRI1038
943	FORMAT(1H,5X,1A6,3X,F14.6,7X,4(5X,E14.6))	EPRI1039
	GO TO 935	EPRI1040
1999	WRITE(10,265) SYMBOL(I),P1(I),P2(I),P3(I),P4(I)	EPRI1041
265	FORMAT(1H,5X,1A6,24X,4(5X,E14.6))	EPRI1042
	GO TO 935	EPRI1043
635	WRITE(10,636) SYMHOI(I),TOTF(I),P1(I),P2(I),P3(I),P4(I)	EPRI1044
636	FORMAT(1H,5X,1A6,3X,E14.6,7X,4(5X,E14.6))	EPRI1045
935	CONTINUE	EPRI1046
	IF(IPR.NE.1) GO TO 253	EPRI1047
	WRITE (10,638)	EPRI1048
638	FORMAT (1H0,5X,7HELEMENT,7X,10HLAMBDA * N)	EPRI1049
	DO 639 I=KB,KTE	EPRI1050
639	WRITE (10,941) SYMBOL(I),TOTF(I)	EPRI1051
253	CONTINUE	EPRI1052
	WRITE (10,950)TOTLP1(LTS),TOTLP2(LTS),TOTLP3(LTS), TOTLP4(LTS)	EPRI1053
	WRITE (10,958)TOTAC(LTS)	EPRI1054
958	FORMAT(1H0,/,1H0,16HTOTAL LAMBDA * N,E14.6)	EPRI1055
	GO TO 3092	EPRI1056
2017	DO 2053 IPR=1,NDO	EPRI1057
	IF(IPR.NE.1) GO TO 2045	EPRI1058
	WRITE(10,931)	EPRI1059
	KB=1	EPRI1060
	KTF=NETDP	EPRI1061
	GO TO 2039	EPRI1062
2045	IF(NOCFP.EQ.0) GO TO 2053	EPRI1063
	WRITE(10,932)	EPRI1064
	KB=NBFP	EPRI1065
	KTE=NT	EPRI1066
2039	IF(IPR.EQ.1) GO TO 2066	EPRI1067
	WRITE(10,2027)	EPRI1068
2027	FORMAT(1H0,66X,18HMACROSCOPIC ABSORP,/,3X,8H ELEMENT,3X,14HNUMBER	EPRI1069
	10DENSITY,25X,7HGROUP 1,9X,7HGROUP 2,9X,7HGROUP 3,9X,7HGROUP 4)	EPRI1070
	GO TO 2068	EPRI1071
2066	WRITE(10,2067)	EPRI1072
2067	FORMAT(1H0,66X,18HMACROSCOPIC ABSORP,/,3X,8H ELEMENT,3X,14HNUMBER	EPRI1073

```

1DENSITY,5X,13HFUEL FRACTION,7X,7HGROUP 1,9X,7HGROUP 2,9X,7HGROUP 3EPR11074
2,9X,7HGROUP 4) EPR11075
2068 DO 2047 I=KB,KTE EPR11076
IF(IPR.NE.1) GO TO 2069 EPR11077
IF(BND(I).EQ.0.0) GO TO 2069 EPR11078
WRITE(10,2070) SYMBOL(I),DEN(I),ALPHA(I),P1(I),P2(I),P3(I),P4(I) EPR11079
2070 FORMAT(4X,1A6,E17.6,E18.6,4E16.6) EPR11080
GO TO 2047 EPR11081
2069 WRITE(10,2029) SYMBOL(I),DEN(I),P1(I),P2(I),P3(I),P4(I) EPR11082
2029 FORMAT(4X,1A6,E17.6,18X,4E16.6) EPR11083
2047 CONTINUE EPR11084
2053 CONTINUE EPR11085
WRITE(10,2031) TOTLP1(LTS),TOTLP2(LTS),TOTLP3(LTS),TOTLP4(LTS) EPR11086
2031 FORMAT(1H0,38HTOTAL - DEPLETION AND FISSION PRODUCTS,6X,4E16.6) EPR11087
3092 IF(INEG.EQ.0) GO TO 997 EPR11088
C***** IF NOT DECAY HEAT , BEGIN NEW TS ( A. 997)*****EPR11089
C*****FOLLOWING CRDS THRU STATEMENT 3090 INCLUDE THE NEW ENERGY PRINT EPR11090
INGP2=INEG+2 EPR11091
DO 3078 I=1,5 EPR11092
3078 TOTLR(I)=0.0 EPR11093
DO 3076 I=1,NT EPR11094
RT=0.0 EPR11095
DO 3077 JCT=1,INEG EPR11096
IF(JCT.EQ.1) GO TO 3080 EPR11097
LCT=JCT+2 EPR11098
GO TO 3081 EPR11099
3080 LCT=1 EPR11100
3081 RSL(I,LCT)=ALAMV(I)*DEN(I)*F(I,JCT)*(1.0E+24) EPR11101
IF(NSUM(I).EQ.0) GO TO 3077 EPR11102
TOTLR(LCT)=TOTLR(LCT)+RSL(I,LCT) EPR11103
3077 RT=RT+RSL(I,LCT) EPR11104
RSL(I,3)=RT EPR11105
RSL(I,2)=RT-RSL(I,1) EPR11106
IF(NSUM(I).EQ.0) GO TO 3076 EPR11107
TOTLR(2)=RSL(I,2) + TOTLR(2) EPR11108
TOTLR(3)= RT+ TOTLR(3) EPR11109

```

3076	CONTINUE	EPR11110
	NPEN=1	EPR11111
	IF (INGP2.GT.6) NPEN=2	EPR11112
	DO 3090 KE=1, NPEN	EPR11113
	IF (KE.EQ.2) GO TO 3087	EPR11114
	WRITE (10, 3082)	EPR11115
3082	FORMAT (4X, 6HSYMBOL, 8X, 6HE RFTA, 12X, 7HE GAMMA, 5X, 16HTOTAL BETA+GAMME	EPR11116
	1A, 3X, 9HE GAMMA 1, 7X, 9HE GAMMA 2, 7X, 9HE GAMMA 3)	EPR11117
	NB=1	EPR11118
	NE=6	EPR11119
	IF (NPEN.EQ.1) NE=INGP2	EPR11120
	GO TO 4300	EPR11121
3087	WRITE (10, 235)	EPR11122
	WRITE (10, 3083)	EPR11123
3083	FORMAT (4X, 6HSYMBOL, 7X, 9HE GAMMA 4, 9X, 9HE GAMMA 5, 7X, 9HE GAMMA 6, 7X	EPR11124
	1, 9HE GAMMA 7, 7X, 9HE GAMMA 8, 7X, 9HE GAMMA 9)	EPR11125
	NB=7	EPR11126
	NE=INGP2	EPR11127
4300	IF (NPRDH.NE.1) GO TO 4301	EPR11128
	IF (JPRINT.EQ.3) GO TO 4301	EPR11129
3089	DO 3085 I=1, NT	EPR11130
3085	WRITE (10, 2070) SYMBOL (I), (RSL (I, JPT), JPT=NB, NE)	EPR11131
4301	WRITE (10, 3086) (TOTLR (JPT), JPT=NB, NE)	EPR11132
3086	FORMAT (5X, 5HTOTAL, E17.6, E18.6, 4F16.6)	EPR11133
	IF ( KE.EQ.2) GO TO 3090	EPR11134
	TORBT (LTS) = TOTLR (1)	EPR11135
	TOGAM (LTS) = TOTLR (2)	EPR11136
	TORPG (LTS) = TOTLR (3)	EPR11137
	EMINUM = EMINCT * TORPG (LTS) / 100.	EPR11138
	IF (FPTS (LTS) .LE. 0.0) GO TO 4400	EPR11139
	FND0 = (FPTS (LTS) * 1.0E+24) / (SDT (LTS) * 3600.0)	EPR11140
4400	BETPF (LTS) = (TORBT (LTS)) / FND0	EPR11141
	GAMPF (LTS) = (TOGAM (LTS)) / FND0	EPR11142
	BPGPF (LTS) = (TORPG (LTS)) / FND0	EPR11143
	WRITE (10, 4525) BETPF (LTS), GAMPF (LTS), BPGPF (LTS)	EPR11144
4525	FORMAT (1H0, 9HTOT MEV/F, E17.6, E18.6, E16.6)	EPR11145

```

IF(JPRINT.NE.3) GO TO 3090
IF(NPRDH.NE.1) GO TO 3090
WRITE(10,4510) EMINUM,EMINCT
4510 FORMAT(1H1,1X,85H SELECTED DECAY ENERGIES...LISTING OF NUCLIDES IN
1 SUM HAVING TOTAL MEV/SEC EXCEEDING ,E14.6,2H (.F14.6,18H PERCENT
20F TOTAL),/)
WRITE(10, 81)(COMENT(I),I=1,16)
WRITE(10,4511) LTS,SDT(LTS),TIMF(LTS),FNDO
4511 FORMAT(1H0,10H TIME STEP ,I3,2X,8H DELTA T=,F14.7,7H HOURS ,2X,13H ELAPSED
1 APSED TIME=,F14.6,3X,28H AVE. FISS/S LAST TS AT PWR=,E14.6,/)
WRITE(10, 931)
WRITE(10,4512)
4512 FORMAT(1H0,8H NUCLIDE ,5H CHAIN,1X,12H NO. DENSITY,1X,14H N*LAME
1RDA,1X,14H E BETA,1X,14H E GAMMA,1X,14HTOT F BETA+GAMMA
2,1X,12H E GAMMA 1,1X,12H E GAMMA 2,/)
KNPICK= 0
KNFIL = 0
KLINUS= 1
NN = 0
KNCH = 1
4513 IF( KNCH.NE.1) GO TO 4514
NNCHN = NOCDP
GO TO 4515
4514 NNCHN = NOCFP
WRITE(10, 932)
WRITE(10,4512)
4515 DO 4522 NNC=1,NNCHN
KLINUS = KLINUS+NN
IF( KNCH.NE.1) GO TO 4516
NN = NEDP(NNC)
GO TO 4517
4516 NN = NEFP(NNC)
4517 KNES = KNPICK+1
KNPICK = KNPICK+NN
4518 DO 4521 NKE=1,NN
KNEIL = KNEIL+1

```

```

EPRI1146
EPRI1147
EPRI1148
EPRI1149
EPRI1150
EPRI1151
EPRI1152
EPRI1153
EPRI1154
EPRI1155
EPRI1156
EPRI1157
EPRI1158
EPRI1159
EPRI1160
EPRI1161
EPRI1162
EPRI1163
EPRI1164
EPRI1165
EPRI1166
EPRI1167
EPRI1168
EPRI1169
EPRI1170
EPRI1171
EPRI1172
EPRI1173
EPRI1174
EPRI1175
EPRI1176
EPRI1177
EPRI1178
EPRI1179
EPRI1180
EPRI1181

```

```

IF(NSUM(KNEIL).EQ.0) GO TO 4521
IF(EMINUM.EQ.0.0) GO TO 4519
IF(RSL(KNEIL,3).GT.EMINUM) GO TO 4519
GO TO 4521
4519 WRITE(10,4520) SYMBOL(KNEIL),NNC,DEN(KNEIL),TOTE(KNEIL),(RSL(KNEIL,3),
1,JPT),JPT=1,3),(RSL(KNEIL,KJPT),KJPT=4,5)
4520 FORMAT(1H,1X,1A6,3X,13,1X,F12.6,4(1X,E14.6),2(1X,E12.5))
4521 CONTINUE
4522 CONTINUE
IF((KNCH.NE.1).OR.(NOCFP.EQ.0)) GO TO 4523
KNCH = 2
GO TO 4513
4523 WRITE(10,4524) TOTAC(LTS),(TOTLR(JPT),JPT=1,3),(TOTLR(KJPT),KJPT=4
1,5)
4524 FORMAT(1H0,26HTOTALS OF ALL NUC. IN SUM,4(1X,F14.6),2(1X,E12.6))
WRITE(10,4526) BETPF(LTS),GAMPF(LTS),BPGPF(LTS)
4526 FORMAT(1H0,41HTOTAL MEV/FISSION,3(1X,E14.6)
1))
3090 CONTINUE
GO TO 997
C-----END OF TIMESTEP
C***** BEGIN OUTPUT SUMMARY*****
886 LTS=NTS
WRITE(10,541)
541 FORMAT(1H1/ 49X,25HSUMMARY OF PROBLEM OUTPUT)
WRITE(10,4000)(COMENT(I),I=1,16)
C ***** FOR DEBUG OF CHAINS USE NRILL=1
C NBILL=1
C IF(NBILL.EQ.0) GO TO 860
C WRITE(10,856)
C 856 FORMAT(1H0,3H TS,5X,8HTOT NUCS,1X,
C 125HPERCENT DEV FROM ACC FISS)
C DO 860 I=1,NTS
C PCFD=-100.0
C IF(AFD(I).LE.0.0) GO TO 861
C PCFD=100.0*(1.0-TOTDEN(I)/(2*AFD(I)))

```

```

EPR11182
EPR11183
EPR11184
EPR11185
EPR11186
EPR11187
EPR11188
EPR11189
EPR11190
EPR11191
EPR11192
EPR11193
EPR11194
EPR11195
EPR11196
EPR11197
EPR11198
EPR11199
EPR1200
EPR1201
EPR1202
EPR1203
EPR1204
EPR1205
EPR1206
EPR1207
EPR1208
EPR1209
EPR1210
EPR1211
EPR1212
EPR1213
EPR1214
EPR1215
EPR1216
EPR1217

```

C 861	WRITE(10,859) I,TOTDEN(I),PCFD	EPR11218
C 859	FORMAT(1X,I3,E12.5,14X,E12.4)	EPR11219
860	CONTINUE	EPR11220
	IF(IDIW=EQ.1) GO TO 2019	EPR11221
	WRITE(10,542)	EPR11222
542	FORMAT(1H0,33X,7HTHERMAL,26X,19HTOTAL BARN/FISSION)	EPR11223
	WRITE(10,543)	EPR11224
543	FORMAT(1H,9HTIME STEP,2X,12HELAPSED TIME,9X,9HFLUX TIME,14X,7HGRO	EPR11225
	UP 1,11X,7HGROUP 2,11X,7HGROUP 3,11X,7HGROUP 4)	EPR11226
	DO 491 I=1,NTS	EPR11227
	WRITE(10,545)( I ,TIME(I),TLFXTM(I),TOTLB1(I), TOTLB2(I),	EPR11228
	1 TOTLB3(I), TOTLB4(I))	EPR11229
545	FORMAT(1H,4X,I3,2X,F14.4,6X,E14.6,3X,4(4X,E14.6))	EPR11230
491	CONTINUE	EPR11231
2019	WRITE(10,544)	EPR11232
544	FORMAT(1H0,/,1H0,34X,7HTHERMAL,23X,24HTOTAL MACROSCOPIC POISON)	EPR11233
	WRITE(10,543)	EPR11234
	IF(IDIW=EQ.1) GO TO 2075	EPR11235
	DO 494 I=1,NTS	EPR11236
	WRITE(10,545)( I ,TIME(I),TLFXTM(I),TOTLP1(I), TOTLP2(I),	EPR11237
	1 TOTLP3(I), TOTLP4(I))	EPR11238
494	CONTINUE	EPR11239
	0 TO 2057	EPR11240
2075	DO 2078 I=1,NTS	EPR11241
	WRITE(10,545) I,TIME(I),TLFXTM(I),(DA(ICT,I),ICT=1,4)	EPR11242
2078	CONTINUE	EPR11243
	WRITE(10,2021)	EPR11244
2021	FORMAT(1H0,/,1H0,9H TIMESTEP,2X,12HELAPSED TIME, 8X,3HPH0, 6X,13HE	EPR11245
	IFUFL FRACTION,7X,1HK,10X,7HPHI 1/4,7X,7HPHI 2/4,7X,7HPHI 3/4)	EPR11246
	DO 2025 I=1,NTS	EPR11247
	WRITE(10,3050) 1,TIME(I),RH0(I),FFS(I),AKO(I),(FLXR(ICT,I),ICT=1,3	EPR11248
	1 )	EPR11249
3050	FORMAT(5X,I3,F16.4,6E14.4)	EPR11250
2025	CONTINUE	EPR11251
	GO TO 2060	EPR11252
2057	WRITE(10,541)	EPR11253

	WRITE(10,4002) (COMENT(I),I=1,16)	EPRI1254
	WRITE(10,682)	EPRI1255
682	FORMAT(1H0,/,1H0. 9H TIMESTEP,14H ELAPSED TIME,8X,	EPRI1256
	110HLAMBDA * N,18X,5HTOT B,13X,5HTOT G,6X,12HTOT B PLUS G)	EPRI1257
	DO 640 I=1,NTS	EPRI1258
640	WRITE(10,545) I,TIME(I),TOTAC(I),TORET(I),TOGAM(I),TORPG(I)	EPRI1259
	IF(INEG.EQ.0) GO TO 2060	EPRI1260
	DO 4402 JI=1,2	EPRI1261
	WRITE(10,541)	EPRI1262
	WRITE(10,4002) (COMENT(I),I=1,16)	EPRI1263
	WRITE(10,4401)	EPRI1264
4401	FORMAT(1H0,/,1H0,6HTS NO.,16H DELTA T (HRS), 16H TOTAL T (HRSEPR	EPRI1265
	1),17H TOTAL T (SEC),16H BETA MEV/FISS,16H GAMMA MEV/FISS,17HEPR	EPRI1266
	2 TOT B+G MEV/FISS,14H ACC FISS DENS)	EPRI1267
	DO 4402 I=1,NTS	EPRI1268
	STIME = TIME(I)*3600.0	EPRI1269
	WRITE(10,4403) I,SDT(I),TIMF(I),STIME,BETPF(I),GAMPF(I),BPGPF(I),AEPRI	EPRI1270
	1FD(I)	EPRI1271
4403	FORMAT(1H ,3X,I3,2X,F14.8,2X,F14.6,2X,E15.8,2(2X,E14.6),3X,E14.6,2EPRI	EPRI1272
	1X,F12.6)	EPRI1273
4402	CONTINUE	EPRI1274
C---	INSERT FOR PUNCHED CARD OUTPUT	EPRI1275
2060	IF(JPNCH.EQ.0) GO TO 2666	EPRI1276
	TR4=0.0	EPRI1277
	PUNCH 4002, (COMENT(I),I=1,16)	EPRI1278
4002	FORMAT(16A5)	EPRI1279
	PUNCH 4003	EPRI1280
4003	FORMAT(6X,3H TS,14X,2HDT,12X,4HTIME,6X,8HFIS DENS,2X,	EPRI1281
	112HACC FIS DENS)	EPRI1282
	DO 4005 I=1,NTS	EPRI1283
	PUNCH 4004,I,SDT(I),TIME(I),FPTS(I),AFD(I),I	EPRI1284
4004	FORMAT(6X,I3,2X,F14.8,2X,F14.6,2X,E12.6,2X,F12.6,3X,I8)	EPRI1285
4005	CONTINUE	EPRI1286
	IF( INFG.EQ.0) GO TO 2666	EPRI1287
	PUNCH 4006	EPRI1288
4006	FORMAT(6X,2HTS,12X,2HDT,10X,4HTIME,7X,5HTOT B,7X,5HTOT G,5X,	EPRI1289

17HTOT B+G)	EPR11290
DO 4008 I=1,NTS	EPR11291
NKRD= NTS+I	EPR11292
PUNCH 4007,I,SDT(I),TIME(I),TORBT(I),TOGAM(I),TORPG(I),NKRD	FPR11293
4007 FORMAT(6X,I2,F14.8,F14.6,3(F12.5),I8)	EPR11294
4008 CONTINUE	EPR11295
PUNCH 4404	FPR11296
4404 FORMAT(6X,2HTS,12X,2HDT,10X,4HTIME,12H RET MEV/FIS,	FPR11297
112H GAM MEV/FIS,12H B+G MEV/FIS)	EPR11298
DO 4405 I=1,NTS	EPR11299
NKRD=(? *NTS)+I	FPR11300
PUNCH 4007,I,SDT(I),TIME(I),RETPF(I),GAMPF(I),BPGPF(I),NKRD	EPR11301
4405 CONTINUE	EPR11302
WRITE(10,4333)	FPR11303
4333 FORMAT(1H0,14HPUNCHED OUTPUT)	FPR11304
2666 CONTINUE	EPR11305
C INSERT FOR ADDITIONAL SUMMARY	EPR11306
C (RESONANCE INTEGRAL CALCULATION ASSUMES FIRST THREE ABSORPTION	EPR11307
C GROUP LETHARGIES ARE 2.5, 5.0 AND 9.0880)	EPR11308
C (USE DECAY ENERGY STORAGE)	EPR11309
C	EPR11310
C ACCUMULATE EFFECTIVE CROSS THERMAL SECTION IN ARRAY RETPF	EPR11311
C RESONANCE INTEGRAL IN ARRAY GAMPF	EPR11312
C	EPR11313
L=1	EPR11314
DO 8010 I= 1, NTS	EPR11315
LTSC=LFDTO(L)	EPR11316
IF (I.GT.LTSC) L=L+1	EPR11317
RETPF(I)= TOTLH4(I)+ F104(L)*TOTLR1(I) + F204(L)*TOTLR2(I)	EPR11318
1 + F304(L)* TOTLR3(I)	EPR11319
8010 GAMPF(I)= 9.0880 *TOTLR3(I)+ 5.*TOTLR2(I) + 2.5*TOTLR1(I)	EPR11320
C PRINT ADDITIONAL SUMMARY	EPR11321
WRITE(10,8020)	EPR11322
8020 FORMAT(///,12X,24HELAPSED TIME THERMAL,8X, 9HEFFECTIVE,8X,	EPR11323
1 9HRESONANCE,/,1X,36HTIME STEP IN HOURS FLUX TIME,5X,	EPR11324
2 27HCROSS SECTION INTEGRAL,/) )	FPR11325

DO 8050 I=1,NTS	EPRI1326
8050 WRITE(10,8055) I, TIME(I), TLFXTM(I), BETPF(I), GAMPF(I)	EPRI1327
8055 FORMAT(6X,I2,2X,F14.4,3X,E12.5,3X,F14.7,3X,E14.7)	EPRI1328
C	FPRI1329
WRITE(10,241)	EPRI1330
241 FORMAT(1H0,30HEND OF OUTPUT FOR THIS PROBLEM)	EPRI1331
281 CONTINUE	EPRI1332
355 CONTINUE	EPRI1333
C----- JUMP CRD--IF 1 IN COL 10, BEGIN NEW CASE. IF 0 ALL CASES CMPLT*	EPRI1334
READ (8,583) JUMP	EPRI1335
583 FORMAT(9X,I1)	EPRI1336
IF (JUMP.NE.0) GO TO 7	EPRI1337
WRITE (10,691)	EPRI1338
691 FORMAT(/,18H PROBLEMS COMPLFTE)	EPRI1339
END	EPRI1340