A USER'S MANUAL FOR THE REACTOR BURNUP SYSTEM, REBUS

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ABSTRACT

A user's manual for the REBUS System (REactor BUrnup System) is presented in this document. The primary purpose is to provide sufficient information about the REBUS capability to the user to ensure its efficient utilization. The current REBUS System either solves for the infinite time (equilibrium) operating conditions of a recycle system under fixed conditions, or solves for operating conditions during a single time step (non-equilibrium). The capability of studying various in-reactor fuel management and ex-reactor fuel management schemes has been included. REBUS has been operated with one- and two-dimensional diffusion theory neutronics solutions up to the present time. The model was specifically designed for extension to other neutronics models such as three-dimensional diffusion or transport theory and direct or synthesis solutions.

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I. CAPABILITIES AND GENERAL DESCRIPTION

The REBUS System was developed to perform fuel cycle analysis of typical LMFBR reactors. The physical model, mathematical formulation, and solution techniques used in the REBUS System are presented in Ref. 1. Additional information about the model, formulation, and solution techniques has been published in preliminary form².

A brief description of the REBUS equilibrium cycle capability follows: Given one or more specified fuel supplies from outside the system, and with no fuel recycle, compute the equilibrium operating conditions with or without burn time adjustment to a given discharge burnup, with or without fresh charge enrichment adjustment to maintain criticality, and with or without control adjustment at each flux time node. Each subassembly may be specified to reside in the reactor for any number of burn steps, with fuel shuffling carried out in any pattern at the end of each burn step. With the addition of fuel recycle, this becomes a full equilibrium problem. REBUS includes models of both the in-reactor fuel management and the external cycle. The in-reactor fuel management model permits any physically realizable fuel management scheme.

Numerous assumptions are made in REBUS about the models chosen to represent the in-reactor cycle, and the external cycle. The principal assumptions are listed below.

During the operating phase of each burn step the following assumptions are made with respect to the in-reactor cycle model:

- The reactor operates at constant power;

- Quasistatic type equations govern the behavior of the reactor;

- i.e., the time derivative of flux equation is neglected;

Reaction rates which appear in the depletion equations are computed from region- and time-averaged group fluxes. All materials assigned to a given region are assumed to be irradiated in the same flux; The volume of each region in the reactor is equal to the sum of the volumes of all stages of each material type which are present in that region. Moreover the volume of any material type is constant in time;

Isotope multigroup cross sections are computed at reference compositions and temperatures, and therefore are time independent.

The assumptions for the external cycle model are:

Reprocessing plants are assumed to operate on a batch process.

The real continuous process can be simulated by splitting a single reprocessing plant input batch into several parts, then assigning a different reprocessing time to each part;

When an isotope which has been discharged as part of any material is fed into a reprocessing plant, the identification of that isotope with its particular self-shielded microscopic cross sections is lost, so that all atoms of that particular isotope from various materials are accounted together;

Associated with each material type is an enrichment. The enrichment is a volume fraction representing the fraction of the total fresh charge volume which is to be made up from the high-reactivity feed fuel stream (conventionally named "Class 1"). The fraction of the total volume of fuel required for each fresh material type which is not made up from Class 1 feed will be made up from the low-reactivity feed stream (conventionally named "Class 2").

In the external cycle, reprocessing and sale of the discharged fuel and refabrication with charged-fuel makeup from reprocessing plants and/or external feed supplies can be studied. The isotope chain matrix may contain β^- , β^+ , and α -decay terms as well as (n,γ) , (n,p) , (n,α) , $(n,2n)$, and (n,f) reactions.

In addition to the equilibrium capability, REBUS also permits solution of a non-equilibrium problem. For this case, given a fully loaded reactor at t_0 , REBUS computes the fuel burnup over a given time at constant power, with or without control adjustment to maintain criticality at each flux calculation time node.

Future code development for the non-equilibrium mode of operation will include a restart capability, automation of the fuel management strategy for a number of specified burn steps, and the ability to perform feed enrichment and burn-step time searches as are currently available for the equilibrium mode of operation.

The REBUS System is comprised of a neutronics model and a fuel cycle model. The fuel cycle model contains no geometric information so that any neutronics solution can be used (zero to three-dimensional, diffusion or transport theory, direct or synthesis solution). REBUS has been operated with one- and two-dimensional diffusion theory neutronics models up to the present time. The computer code was developed on the IBM-360/75 at Argonne, Illinois, within the framework of the ARC System³.

The procedure for execution of REBUS is presented in the next section. Input for two sample problems is discussed in Section III; output from these sample problems appears in Appendix 3. Rather extensive studies on the

effects of various convergence criteria on accuracy and computing time are reported in Section IV. Section V is devoted to listing all the error messages which may be produced by REBUS. Appendix 1 provides detailed descriptions of input card formats. Some special terminology is defined in a glossary.

II. Standard Path Use

A. Description of Modules

STP004 is a driver path of the ARC System which invokes ARC System modules to provide a complete one- or two-dimensional fuel cycle capability using diffusion theory. STP004 links to the modules FCC001⁴, FCI001⁴, NUC001⁵, NUC002⁶, NUC004⁶, NUC005⁷, NUC006⁷, NUC007⁵, and NUI002⁸.

FCC001 is the burnup model of the REBUS system. The REBUS system is comprised of a neutronics model and burnup model. The burnup model contains the search procedure and obtains the solution to the desired fuel cycle problem. This model obtains the infinite time (equilibrium) operating conditions of a recycle system under fixed conditions. The feed enrichments, the burn step time, and the control requirements are obtained. These parameters satisfy the constraint on fuel discharge burnup, give the desired unpoisoned multiplication constant for a specified time during reactor operation, and maintain criticality. Both the in-reactor fuel management and the external cycle fuel management are modeled. The in-reactor fuel management model permits any physically realizable fuel management scheme. In the external cycle, reprocessing and sale of the discharged fuel and refabrication with charge fuel makeup from reprocessing plants and/or external feed supplies can be studied. The isotope chain matrix may contain β^- , β^+ , and α -decay terms as well as (n,γ) , (n,p) , (n,α) , $(n,2n)$ and (n,f) reactions. REBUS may also solve non-equilibrium problems having a single burn step, with arbitrarily many sub-steps, and optional maintenance of criticality via control density searches.

FCI001 is the input processor for the fuel cycle capability REBUS. FCI001 reads and analyzes BCD card images and other data defining the fuel cycle problem. The BCD card images defining composition assignment are read and analyzed. In addition, the BCD card images defining the fuel management

scheme and the fuel cycle problem description are read and analyzed. Output data sets contain the input data which is necessary for execution of the fuel cycle computation module FCC001. Consistency and completeness checks are performed where appropriate; in general, processing continues after noting apparent inconsistencies until an obvious fatal error occurs.

NUC001 performs neutron cross section homogenization. Given isotopic cross-section data, isotopic fission spectrum fractions, isotopic delayed neutron data, material and composition specifications, the module computes the desired material cross-section data, material fission spectrum fractions, composition cross-section data, composition fission spectrum fractions, material delayed neutron data, and composition delayed neutron data.

NUC002 performs the solution of the 1-D finite difference approximation to the multigroup diffusion equations. Three basic types of calculations may be performed: k_{eff} , adjoint k_{eff} and, in the presence of external sources or inhomogeneous boundary conditions, a source calculation. These calculations can be performed in the three geometries slab, cylinder, and sphere, and the boundary conditions are required to be linear and homogenous in eigenvalue calculations or linear and homogeneous or inhomogeneous in source calculations. Interface conditions across regional boundaries can be specified by the logarithmic derivative condition in the case of black regions or the usual continuity of flux and current in all other cases. Full up and down scattering is permitted.

NUC004 is an extension of the calculation performed by NUC002 which includes the adjustment of certain parameters (material volume fractions, spatial mesh size or buckling) to achieve a specified value of k_{eff} . The module is invoked if search specifications are included in the general neutronics input data set A.NIP.

NUC005 performs the solution of the 2-D finite difference approximation to the multigroup diffusion equations. Three basic types of calculations may be performed: real k_{eff} , adjoint k_{eff} and, in the presence of external sources and/or inhomogeneous boundary conditions, a source calculation. The geometries allowed include xy, rz, zr, and r θ , and a triangular mesh is permitted in xy. Full up and down scattering is permitted, and a group ordered or channel ordered solution may be specified. Interface conditions across regional boundaries may be specified by the logarithmic derivative condition for black regions or the usual continuity conditions for all others.

NUC006 is an extension of the calculation performed by NUC005 which includes the adjustment of certain parameters (material volume fractions, spatial mesh size or buckling) to achieve a specified value of k_{eff} . The module is invoked if search specifications are included in the general neutronics input data set A.NIP.

NUC007 performs neutron cross section homogenization. Given macroscopic material cross sections and composition specifications the module computes the desired composition cross section data, composition fission spectrum fractions and composition delayed neutron data.

NUI002 reads and analyzes BCD card images defining reactor geometry and composition assignment and also reads and analyzes BCD card images defining boundary conditions, problem type, source and flux initial data, and external source data. Output data sets contain all input data which is explicit or implied. Consistency and completeness checks are performed where appropriate; in general, processing continues after noting apparent inconsistencies until an obvious fatal error occurs.

The flow through the standard path is illustrated in Fig. 1. Further detail may be obtained from Refs. 9 and 10.

B. Catalogued Procedure ARCSP004

A catalogued procedure which invokes the standard path STP004 is also provided for the user. This procedure reduces the amount of Job Control Language (JCL) required by the user for the execution of the fuel cycle capability in the ARC System. A listing of the catalogued procedure ARCSP004 is given in Appendix 4.

Fig. 1. Flowchart for Path STP004

Table I lists the symbolic parameters used in the procedure along with their meanings and default values. The correspondence between the JCL DDNAME and the ARC System data set glossary name is provided in Table II. This table also gives a brief description of the contents of the data sets, lists the associated symbolic parameters where applicable, and indicates which modules use each data set. All required standard ARC System data sets are listed in Appendix 1.

The minimal JCL required to execute a problem with the procedure ARCSP004 is illustrated in Fig. 2. Here the user need only supply the disk number (zz) which contains the two files of the microscopic cross section data set names ISOTOPE.XS.REFPROB and ISOTOPE.XS.REFPROB2. Some further illustrations of the use of this procedure and the symbolic parameters are included in the section "Sample Input". In Fig. 2 the //SYSABEND DD card may be left out if desired. This card is used to obtain a core dump in the event of an abnormal termination.

C. BCD (Alphanumeric) Input Data Sets

The input data deck for a fuel cycle path execution follows the general ARC System format⁹. A data set initialization block (DSIB) given the block name "OLD" defines the data sets required by the job which were generated in previous jobs, such as the isotopic cross section data set XS.ISO. The data set initialization block is followed in the input deck by a data block given the name STP004. This block may include

1. A path dependent data set (A.STP004)
2. The general neutronics input data set (A.NIP)
3. Module dependent data sets (e.g., A.BURN)

TABLE I. Symbolic Parameters for ARCSP004

Parameter Name	Definition	Default Value
BUFFER	Block size for data sets are defined in FT91F001-FT94F001	16000
BURNDSP	Disposition for burnup module user input data set	(,DELETE)
BURNINP	Data set name for burnup module user input data set A.BURN	&ABURN
BURNVOL	Volume serial designation for burnup module user input data set	SCRONE
DISKNO	Number of the disk containing the load modules to be executed	28
DUMP	Data set name for burnup module data set BRN (Files 1 and 2)	BRNDMP.F1 BRNDMP.F2
DUMPDSP	Disposition for data set DUMP	(,DELETE)
DUMPVOL	Volume serial designation for data set DUMP	SCRONE
FLX1D1	Data set name for real flux data set FR.D1	&FRD11
FLX1DSP	Disposition for data set FLX1D1	(,DELETE)
FLX1VOL	Volume serial designation for data set FLX1D1	SYSSCR
FLX2D1	Data set name for real flux data set FR.D2	&FRD21
FLX2DSP	Disposition for data set FLX2D1	(,DELETE)
FLX2VOL	Volume serial designation for data set FLX2D1	SYSSCR
MATCS	Data set name for material cross section data set XS.M.MIN	&XSMMIN
MATCDSP	Disposition for data set MATCS	(,DELETE)
MATCVOL	Volume serial designation for data set MATCS	SCRONE

TABLE I. (Contd.)

Parameter Name	Definition	Default Value
MCSP	Data set name for material and composition specifications data set B.HOMOG	&BHOMOG
MCSPDSP	Disposition for data set MCSP	(,DELETE)
MCSPVOL	Volume serial designation for data set MCSP	SCRTWO
MICRVOL	Volume serial designation for microscopic cross section data set XS.ISO	DISK20
MICRXS1	Data set name for file 1 of XS.ISO	&XSIS0
MICRXS2	Data set name for file 2 of XS.ISO	&XSIS2
NEUTDSP	Disposition for general neutronics input data set A.NIP	(,DELETE)
NEUTINP	Data set name for general neutronics input data set A.NIP	&ANIP
NEUTVOL	Volume serial designation for data set NEUTINP	SCRTWO
NFLX1	Data set name for power normalized region flux data set FR.PN	&FRPN1
NFL1DSP	Disposition for data set NFLX1	(,DELETE)
NFL1VOL	Volume serial designation for data set NFLX1	SCRONE

TABLE II. DDNAME and ARC System Glossary Name Correspondence in ARCSP004

DDNAME	ARC SYSTEM DATA SET GLOSSARY NAME	CONTENTS	SYMBOLIC PARAMETERS	MODULE(S) USING DATA SET
FT09F001	None	ARC-OS/360 correspondence		A11
FT11F001	A.BURN	Burnup module dependent data set	BURNINP BURNDSP BURNVOL	FCI001
FT13F001	A.DIF1D	1D diffusion module dependent data set		NUC002 and NUC004
FT14F001	A.DIF2D	2D diffusion module dependent data set		NUC005 and NUC006
FT15F001	A.STP004	Standard path STP004 path dependent data set		STP004
FT19F001	A.NIP	General neutronics input data set	NEUTINP NEUTDSP NEUTVOL	FCI001 and NUI002
FT21F001	FRI001	Power normalized region fluxes at second time point		FCC001 and FCI001
FT22F001	FRI002	Power normalized region fluxes at third time point		FCC001 and FCI001
FT27F001	B.HOMOG	Material and composition specifications	MCSP MCSPDSP MCSPVOL	FCC001, FCI001, NUC001, and NUC007

TABLE II. (Contd.)

DDNAME	ARC SYSTEM DATA SET GLOSSARY NAME	CONTENTS	SYMBOLIC PARAMETERS	MODULE(S) USING DATA SET
FT28F001	BC	Boundary condition specifications		NUC002, NUC004, NUC005, NUC006, and NUI002
FT31F001 FT31F002	BRN	Data dump for burnup module	DUMP DUMPDSP DUMPVOL	FCC001 and FCI001
FT43F001	FR.D1	1D real flux data set at first time point	FLX1D1 FLX1DSP FLX1VOL	FUCC001, FCI001, NUC002, NUC004, NUC005, NUC006, and NUI002
FT45F001	FR.D2	2D real flux data set at first time point	FLX2D1 FLX2DSP FLX2VOL	FCC001, FCI001, NUC005, NUC006, and NUI002
FT47F001	FR.PN	Power normalized region fluxes at first time point	NFLX1 NFL1DSP NFL1VOL	FCC001, FCI001, NUC002, NUC004, NUC005, and NUC006
FT50F001	FRI003	Power normalized region fluxes at fourth time point		FCC001 and FCI001
FT51F001	FRI004	Power normalized region fluxes at fifth time point		FCC001 and FCI001

TABLE II. (Contd.)

DDNAME	ARC SYSTEM DATA SET GLOSSARY NAME	CONTENTS	SYMBOLIC PARAMETERS	MODULE(S) USING DATA SET
FT54F001	GEOM	Geometry specification data set		FCI001, NUC002, NUC004, NUC005, NUC006, and NUI002
FT61F001	SCR001	Real flux data set at second time point		FCC001 and FCI001
FT62F001	SCR002	Real flux data set at third time point		FCC001 and FCI001
FT63F001	SCR003	Real flux data set at fourth time point		FCC001 and FCI001
FT64F001	SCR004	Real flux data set at fifth time point		FCC001 and FCI001
FT64F001	SP.CICN	Code independent constants specifica- tions data set		NUC002, NUC004, NUC005, NUC006, and NUI002
FT66F001	SP.CRIT	Search specifications data set		FCC001, FCI001, NUC004, NUC006, and NUI002
FT75F001 FT75F002	XS.C.MIN	"Composition" cross section data set		NUC001, NUC002, NUC004, NUC005, NUC006, and NUC007

TABLE II. (Contd.)

DDNAME	ARC SYSTEM DATA SET GLOSSARY NAME	CONTENTS	SYMBOLIC PARAMETERS	MODULE(S) USING DATA SET
FT78F001 FT78F002	XS.ISO	Isotope cross section data set	MICRXS1 MICRXS2 MICRVOL	FCI001, NUC001, NUC002, NUC004, NUC005, and NUC006
FT79F001	XS.IS02	An abbreviated form of XS.ISO containing only the isotopes used in the problem at hand		FCI001, NUC001, NUC002, NUC004, NUC005, and NUC006
FT85F001	XS.M.MIN	"Materials" cross section data set	MATCS MATCDSP MATCVOL	NUC001 and NUC007
FT88F001	NONE	Matrices A and B		FCC001
FT89F001	NONE	Average A matrix		FCC001
FT90F001	NONE	DN matrix		FCC001
FT91F001	NONE	N-1 (OR N-2) flux iterate	BUFFER	FCC001, NUC005, and NUC006
FT92F001	NONE	Nth iterate fluxes	BUFFER	NUC005 and NUC006
FT93F001	NONE	Finite difference coefficients	BUFFER	FCC001, NUC005, and NUC006
FT94F001	NONE	N-2 (OR N-1) flux iterate	BUFFER	FCC001, NUC005, NUC006

TABLE II. (Contd.)

DDNAME	ARC SYSTEM DATA SET GLOSSARY NAME	CONTENTS	SYMBOLIC PARAMETERS	MODULE(S) USING DATA SET
FT96F001	NONE	Stage densities at beginning of cycle		FCC001
FT97F001	NONE	Stage densities at current time node		FCC001
FT98F001	NONE	Scratch		FCC001
FT99F001	NONE	BHAT Matrix		FCC001

```
//REFPROB JOB (FXXXXX,50,,YY),'USER NAME',MSGLEVEL=(1,1),  
//          REGION=(760K),CLASS=A  
ACCOUNTING CARD  
/*SETUP DDNAME=FT78F001,DEVICE=2314,ID=DISKZZ  
//EXEC ARCSP004,MICRVOL=DISKZZ,MICRXS1='ISOTOPE.XS.REFPROB',  
//          MICRXS2='ISOTOPE.XS.REFPROB2'  
//SYSABEND DD UNIT=(CTC,,DEFER)  
//SYSIN DD *
```

Fig. 2. Reference Problem JCL Using Procedure ARCSP004.

The BCD input data sets which may be required by the path are listed in Table III. Any or all of these data sets could of course be saved from a previous run with appropriate override modifications of the catalogued procedure and appear in the data set initialization block "OLD".

In addition to the data sets required as shown in Table III, the binary data sets containing isotopic cross section information, XS.IS0 or XS.IS02, must appear in the data set initialization block.

TABLE III. BCD Input Data Sets* for STP004

<u>Data Set Name</u>	<u>Condition</u>
A.BURN	Must be present if the problem is not a restart.
A.DIF1D	Must be present if NUC002 (one-dimensional, diffusion theory neutronics solution) is invoked.
A.DIF2D	Must be present if NUC005 (two-dimensional, diffusion theory neutronics solution) is invoked.
A.NIP	Always present.
A.STP004	Always present.

*Descriptions of these Input Data Sets are contained in Appendix 1.

III. SAMPLE INPUT

Problem No. 1

The first problem is a fairly detailed geometrical representation of a typical large (≈ 3100 l core volume) LMFBR. The problem will be solved in R-Z geometry with a coarse mesh of 15×14 intervals to minimize computer time. About twice as many mesh intervals would be required in each dimension to eliminate errors due to mesh spacing. This problem runs with 2 neutron groups in 520k-bytes of main core storage on an IBM-360/75 in about 9.7 minutes CPU and 20.9 minutes of wait time.

The problem statement is: given a burnup limit of 0.075 (fraction of initial fissile atoms destroyed by fission) for the core, and given a desired k-effective of 1.002 ± 0.001 at the end of a burn cycle, find the burn time for a cycle that satisfies the burnup limit as well as the reactor charge enrichment for which this k is met. Also perform control rod smeared density searches at beginning and end of cycle for a k-effective of 1.000 ± 0.001 .

A map of the reactor model is shown in Fig. 3.

The core is fuelled in batches, $1/4$ of the inner part of the core (out to a radius of 58.727 cm) being renewed at each refuelling, and $1/5$ of the remainder of the core being renewed at each refuelling. The fuel is assumed to be added and discharged in a random fashion. The radial blanket is replaced at the end of a burn cycle in the same way, but in the fractions $1/2$, $1/4$, $1/3$, and $1/4$ for 4 radial zones. The discharged blanket elements are reinserted at a larger radius for further irradiation before being discharged from the reactor. For example, blanket elements from region BZ11 (Fig. 3) go to BZ31, while those from BZ21 go to BZ41. The axial blanket is renewed in the same way as the adjacent core.

Fig. 3. Geometrical Description of Sample Problem No. 1

The fuelling process begins with two external feeds, EFA and EFB, each being of unlimited supply. The A.BURN type-21 cards specify volumes of 10^{30} cm^3 for these feeds. The densities of uranium and plutonium isotopes in oxide form are all assumed to be 0.01933 atoms/b-cm, which is about 86.7% of theoretical density (see A.BURN type-13 cards). The atom density ratios of the feed materials are specified on A.BURN type-22 cards:

	<u>EFA</u>	<u>EFB</u>
U^{235}	0.0072	0.002
U^{238}	$\frac{0.9928}{1.0000}$	$\frac{0.998}{1.000}$
Pu^{239}	0.60	
Pu^{240}	0.24	
Pu^{241}	0.12	
Pu^{242}	$\frac{0.04}{1.00}$	

Approximate atomic weights are supplied on A.BURN type-24 cards. Fission products, LFPPS, are assumed to have an atomic weight of 120.

Feed supplies are assigned to reactor fuel management paths using A.BURN type-19 cards. This reactor core has two enrichment zones, which are specified on A.BURN type-12 cards. The initial feed enrichment coming from EFA is 0.1672 for paths CORE14 and CORE15, and is 0.2821 for paths CORE24 and CORE25. This enrichment ratio is defined as $N^{\text{Pu}}/(N^{\text{Pu}}+N^{\text{U}})$, where N^{Pu} is the total number of plutonium atoms per cm^3 and N^{U} is the total number of uranium atoms per cm^3 in the feed EFA. The blanket is supplied by fuel from feed EFB. It is strictly UO_2 , as the plutonium enrichment ratio is set to zero on the A.BURN type-12 cards.

The feed enrichment search process will take scale factors of 1.0 and 1.05 from the A.BURN type-04 card as first and second guesses. The converged

factor, X , is used as a constant multiplier, giving final enrichments of $0.1672 X$ and $0.2821 X$ for the two core zones.

The fuel management paths (defined on A.BURN type-11 cards) are easily interpreted. For example, path CORE14 simulates random scatter refuelling with 25% of fuel elements discharged, to be replaced by fresh fuel, in core regions CZ11, CZ12, CZ13, CZ21, CZ22, and CZ23 (see A.NIP type-15 cards for assignment of composition C1C4 to these regions). Another example is path BLKT15. Blanket elements in this path stay in region BZ11 for two burn cycles, then go to region BZ31 for three more burn cycles before being discharged to a spent fuel dump, COREDC. This fuel is not reprocessed for recycling back into the reactor, although the problem could be modified to do so.

The burnable isotope chains are defined using A.BURN types 09 and 25 cards. For economy and simplicity, the buildup of plutonium from uranium ignores the intermediate steps of neptunium formation and β -decay. The chains are:

buildup of Pu^{243} and U^{236} is dumped into molybdenum, as a convenient dump which will not affect the neutronics solution appreciably.

Control of criticality is made via insertion of a homogenized ring of control rods in region CONTR4. Composition CONT3, which is assigned to this region, gets modified by the addition of composition SHIMS. This actually corresponds to adding control rods, which add POISON (Ta^{181}) and STEEL and remove SODIUM coolant.

The BCD input is shown in Fig. 4. The multigroup cross section library used in this problem and in sample problem 2 is given in Appendix 2. Selected pages from the output listing from this problem are shown in Appendix 3.


```

BLOCK=DLD
DATASET=XS.ISD
BLOCK=SIPO04
DATASET=A.STP004
01      0      0      1      0
DATASET=A.DIF2D
01      SAMPLE FUEL CYCLE PROBLEM 9-22-71
01      0      0      0      1      1      3      50      1
02      0,0      1,221      E9
03      50      1      3      3      8      3 21000      0
04      2,0      E-31.0      E-31.0      E-3 0.0      ,01
05      50      1      3      3      8      3
06      1,0      E-50.0
DATASET=A.NIP
01      SAMPLE FUEL CYCLE PROBLEM 9-22-71
02      0      1 5000      0 5000      0      0      0      0
03      50      0      0
04      3      2      2      2
06      PLENUMO,0      208,737      0,0      345,89
06      SHIELD142,758      178,257      0,0      345,89
06      REFLR 125,956      142,758      0,0      345,89
06      UPLEN20,0      125,956      0,0      345,89
06      LPLEN 0,0      125,956      0,0      83,95
06      BZ11 97,308      101,1      83,95      122,43
06      BZ12 97,308      101,1      122,43      160,06
06      BZ13 97,308      101,1      160,06      197,69
06      BZ14 97,308      101,1      197,69      235,31
06      BZ15 97,308      101,1      235,31      243,06
06      BZ21 101,1      111,707      83,95      122,43
06      BZ22 101,1      111,707      122,43      160,06
06      BZ23 101,1      111,707      160,06      197,69
06      BZ24 101,1      111,707      197,69      235,31
06      BZ25 101,1      111,707      235,31      243,06
06      BZ31 111,707      116,65      83,95      122,43
06      BZ32 111,707      116,65      122,43      160,06
06      BZ33 111,707      116,65      160,06      197,69
06      BZ34 111,707      116,65      197,69      235,31
06      BZ35 111,707      116,65      235,31      243,06
06      BZ41 116,65      125,956      83,95      122,43
06      BZ42 116,65      125,956      122,43      160,06
06      BZ43 116,65      125,956      160,06      197,69
06      BZ44 116,65      125,956      197,69      235,31
06      BZ45 116,65      125,956      235,31      243,06
06      LB61 87,107      97,308      76,2      98,82
06      LB62 87,107      97,308      98,82      110,13
06      LB63 87,107      97,308      110,13      122,43
06      CZ61 87,107      97,308      122,43      160,06
06      CZ62 87,107      97,308      160,06      197,69
06      CZ63 87,107      97,308      197,69      235,31
06      UB61 87,107      97,308      235,31      250,67
06      UB62 87,107      97,308      250,67      266,03
06      LB51 79,338      87,107      76,2      98,82
06      LB52 79,338      87,107      98,82      110,13
06      LB53 79,338      87,107      110,13      122,43
06      CZ51 79,338      87,107      122,43      160,06
06      CZ52 79,338      87,107      160,06      197,69
06      CZ53 79,338      87,107      197,69      235,31
06      UB51 79,338      87,107      235,31      250,67
06      UB52 79,338      87,107      250,67      266,03
06      CUNTR374,445      79,338      76,2      178,87

```

Fig. 4. Sample Problem 1 BCD Input Data

06	CUNTR4	74.445	79.338	178.87	291.75	00000590				
06	LB41	73.008	74.445	76.2	98.82	00000600				
06	LB42	73.008	74.445	98.82	110.13	00000610				
06	LB43	73.008	74.445	110.13	122.43	00000620				
06	CZ41	73.008	74.445	122.43	160.06	00000630				
06	CZ42	73.008	74.445	160.06	197.69	00000640				
06	CZ43	73.008	74.445	197.69	235.31	00000650				
06	UB41	73.008	74.445	235.31	250.67	00000660				
06	UB42	73.008	74.445	250.67	266.03	00000670				
06	LB31	58.727	73.008	76.2	98.82	00000680				
06	LB32	58.727	73.008	98.82	110.13	00000690				
06	LB33	58.727	73.008	110.13	122.43	00000700				
06	CZ31	58.727	73.008	122.43	160.06	00000710				
06	CZ32	58.727	73.008	160.06	197.69	00000720				
06	CZ33	58.727	73.008	197.69	235.31	00000730				
06	UB31	58.727	73.008	235.31	250.67	00000740				
06	UB32	58.727	73.008	250.67	266.03	00000750				
06	LB21	42.262	58.727	76.2	98.82	00000760				
06	LB22	42.262	58.727	98.82	110.13	00000770				
06	LB23	42.262	58.727	110.13	122.43	00000780				
06	CZ21	42.262	58.727	122.43	160.06	00000790				
06	CZ22	42.262	58.727	160.06	197.69	00000800				
06	CZ23	42.262	58.727	197.69	235.31	00000810				
06	UB21	42.262	58.727	235.31	250.67	00000820				
06	UB22	42.262	58.727	250.67	266.03	00000830				
06	CUNTR1	37.547	42.262	76.2	266.03	00000840				
06	CUNTR2	37.547	42.262	266.03	345.89	00000850				
06	LB11	0.0	37.547	76.2	98.82	00000860				
06	LB12	0.0	37.547	98.82	110.13	00000870				
06	LB13	0.0	37.547	110.13	122.43	00000880				
06	CZ11	0.0	37.547	122.43	160.06	00000890				
06	CZ12	0.0	37.547	160.06	197.69	00000900				
06	CZ13	0.0	37.547	197.69	235.31	00000910				
06	UB11	0.0	37.547	235.31	250.67	00000920				
06	UB12	0.0	37.547	250.67	266.03	00000930				
06	UPLEN1	0.0	37.547	266.03	345.89	00000940				
07	CUREAVCZ11	CZ12	CZ13	CZ21	CZ22	CZ23	CZ31	CZ32	CZ33	CZ41
07	CUREAVCZ42	CZ43	CZ51	CZ52	CZ53	CZ61	CZ62	CZ63		
07	RBKTAVBZ11	BZ12	BZ13	BZ14	BZ15	BZ21	BZ22	BZ23	BZ24	BZ25
07	RBKTAVBZ31	BZ32	BZ33	BZ34	BZ35	BZ41	BZ42	BZ43	BZ44	BZ45
07	ABKTAVLB11	LB12	LB13	LB21	LB22	LB23	LB31	LB32	LB33	LB41
07	ABKTAVLB42	LB43	LB51	LB52	LB53	LB61	LB62	LB63	UB11	UB12
07	ABKTAVUB21	UB22	UB31	UB32	UB41	UB42	UB51	UB52	UB61	UB62
09	X	137.547		142.262			158.727			00000950
09	X	173.008		174.445			179.338			00000960
09	X	187.107		197.308			1101.1			00000970
09	X	1111.707		1116.65			1125.956			00000980
09	X	1142.758		1178.257			1208.737			00000990
09	Y	176.2		183.95			198.82			00001000
09	Y	1110.13		1122.43			1160.06			00001010
09	Y	1178.87		1197.69			1235.31			00001020
09	Y	1243.06		1250.67			1266.03			00001030
09	Y	1291.75		1345.89						00001035
13	FUEL	U238	1.0	PU239	1.0		PU240	1.0		00001040
13	FUEL	PU241	1.0	PU242	1.0		U235	1.0		00001050
13	FUEL	LFPPS	1.0	MD	0.					00001060
13	SODIUM	NA23	.0219							00001070
13	STEEL	SS	.085							00001080
13	QXY	Q16	.03789							00001090
13	POISON	TA181	.015							00001100

Fig. 4. Sample Problem 1 BCD Input Data (Contd.)

14	C1S1	FUEL	.3949	QXY	.3949	SODIUM.406	00001110					
14	C1S1	STEEL	.2067				00001120					
14	C2S1	FUEL	.3949	QXY	.3949	SODIUM.406	00001130					
14	C2S1	STEEL	.2067				00001140					
14	ABS1	FUEL	.434	QXY	.4429	SODIUM.406	00001150					
14	ABS1	STEEL	.2067				00001160					
14	RBS1	FUEL	.7227	QXY	.7377	SODIUM.2607	00001170					
14	RBS1	STEEL	.08982				00001180					
14	CON1	SODIUM	.9842	STEEL	.01581		00001190					
14	CON2	SODIUM	.6693	STEEL	.04882	POISON.5333	00001200					
14	CON3	SODIUM	.9842	STEEL	.01581		00001205					
14	SHIMS	SODIUM	.3986	STEEL	.00308	POISON1.0	00001210					
14	REF	SODIUM	.1	STEEL	.9		00001220					
14	SHL	SODIUM	.446	STEEL	.554		00001230					
14	SOD	SODIUM	1.0				00001240					
14	PLEN1	SODIUM	.922	STEEL	.1		00001250					
14	PLEN2	SODIUM	.4119	STEEL	.1928		00001260					
14	C1C4	C1S1	.25	C1S1	.25	C1S1 .25	00001270					
14	C1C4	C1S1	.25				00001280					
14	C1C5	C1S1	.2	C1S1	.2	C1S1 .2	00001290					
14	C1C5	C1S1	.2	C1S1	.2		00001300					
14	C2C4	C2S1	0.25	C2S1	0.25	C2S1 0.25						
14	C2C4	C2S1	0.25									
14	C2C5	C2S1	0.2	C2S1	0.2	C2S1 0.2						
14	C2C5	C2S1	0.2	C2S1	0.2							
14	ABC4	ABS1	.25	ABS1	.25	ABS1 .25	00001310					
14	ABC4	ABS1	.25				00001320					
14	ABC5	ABS1	.2	ABS1	.2	ABS1 .2	00001330					
14	ABC5	ABS1	.2	ABS1	.2		00001340					
14	RB1	RBS1	.5	RBS1	.5		00001350					
14	RB2	RBS1	.25	RBS1	.25	RBS1 .25	00001360					
14	RB2	RBS1	.25				00001370					
14	RB3	RBS1	.333333	RBS1	.333333	RBS1 .333333	00001380					
14	RB4	RBS1	.25	RBS1	.25	RBS1 .25	00001390					
14	RB4	RBS1	.25				00001400					
14	CONT1	CON1	1.0				00001410					
14	CONT2	CON2	1.0				00001420					
14	CONT3	CON3	1.0				00001430					
14	REFL	REF	1.0				00001440					
14	SHLD	SHL	1.0				00001450					
14	SODM	SOD	1.0				00001460					
14	PLENL	PLEN1	1.0				00001470					
14	PLENU	PLEN2	1.0				00001480					
15	C1C4	CZ11	CZ12	CZ13	CZ21	CZ22	CZ23	00001490				
15	C1C5	CZ31	CZ32	CZ33				00001500				
15	C2C4	CZ41	CZ42	CZ43	CZ51	CZ52	CZ53	00001510				
15	C2C5	CZ61	CZ62	CZ63				00001520				
15	ABC4	LB11	LB12	LB13	UB11	UB12	LB21	LB22	LB23	UB21	UB22	00001530
15	ABC4	LB41	LB42	LB43	UB41	UB42	LB51	LB52	LB53	UB51	UB52	00001540
15	ABC5	LB31	LB32	LB33	UB31	UB32	LB61	LB62	LB63	UB61	UB62	00001550
15	RB1	BZ11	BZ12	BZ13	BZ14	BZ15						00001560
15	RB2	BZ21	BZ22	BZ23	BZ24	BZ25						00001570
15	RB3	BZ31	BZ32	BZ33	BZ34	BZ35						00001580
15	RB4	BZ41	BZ42	BZ43	BZ44	BZ45						00001590
15	REFL	REFLR										00001600
15	SHLD	SHIELD										00001610
15	SODM	PLENUM										00001620
15	PLENU	UPLNU	UPLNU	UPLNU								00001630
15	PLENL	LPLEN										00001640
15	CUNT1	CONTR1	CONTR3									00001650

Fig. 4. Sample Problem 1 BCD Input Data (Contd.)

15	CUNT2	CONTR2							00001660
15	CUNT3	CONTR4							00001670
21		0	61.0	.001					00001680
22		1.0	.8	0.0	2.0				00001690
23	SHIMS	CONT3							
32			2.91E10						
DATASET=A,BURN									00001710
01	SAMPLE	FUEL CYCLE	PROBLEM 9-22-71						00001720
02		0 38000	0	0.001	0.001	0.001			00001730
03		0	0135.	.001	1.221	E9	1		00001740
04		1.002	.001	1.0	1.0	1.05			00001750
05	CURE	CORE14	CORE15	CORE24	CORE25				
06		CORE	.075						00001780
09	U238	1PU239							00001790
09	U238	2LFPPS							00001800
09	PU239	1PU240							00001810
09	PU239	2LFPPS							00001820
09	PU240	1PU241							00001830
09	PU240	2LFPPS							00001840
09	PU241	1PU242							00001850
09	PU241	2LFPPS							00001860
09	PU242	1MD							
09	PU242	2LFPPS							00001880
09	U235	1MD							
09	U235	2LFPPS							00001900
09	MU	0							
09	LFPPS	0							00001920
09	PU241	6MD							
11	CURE14	1	C1S1	C1C4	2	C1S1	C1C4		00001930
11	CURE14	3	C1S1	C1C4	4	C1S1	C1C4		00001940
11	CURE14	5	COREDC						00001950
11	CURE15	1	C1S1	C1C5	2	C1S1	C1C5		00001960
11	CURE15	3	C1S1	C1C5	4	C1S1	C1C5		00001970
11	CURE15	5	C1S1	C1C5	6	COREDC			00001980
11	CURE24	1	C2S1	C2C4	2	C2S1	C2C4		00001990
11	CURE24	3	C2S1	C2C4	4	C2S1	C2C4		00002000
11	CURE24	5	COREDC						00002010
11	CURE25	1	C2S1	C2C5	2	C2S1	C2C5		00002020
11	CURE25	3	C2S1	C2C5	4	C2S1	C2C5		00002030
11	CURE25	5	C2S1	C2C5	6	COREDC			00002040
11	ABLKT4	1	ABS1	ABC4	2	ABS1	ABC4		00002050
11	ABLKT4	3	ABS1	ABC4	4	ABS1	ABC4		00002060
11	ABLKT4	5	COREDC						00002070
11	ABLKT5	1	ABS1	ABC5	2	ABS1	ABC5		00002080
11	ABLKT5	3	ABS1	ABC5	4	ABS1	ABC5		00002090
11	ABLKT5	5	ABS1	ABC5	6	COREDC			00002100
11	BLKT15	1	RBS1	BZ11	2	RBS1	BZ11		00002110
11	BLKT15	3	RBS1	BZ31	4	RBS1	BZ31		00002120
11	BLKT15	5	RBS1	BZ31	6	COREDC			00002130
11	BLKT25	1	RBS1	BZ12	2	RBS1	BZ12		00002140
11	BLKT25	3	RBS1	BZ32	4	RBS1	BZ32		00002150
11	BLKT25	5	RBS1	BZ32	6	COREDC			00002160
11	BLKT35	1	RBS1	BZ13	2	RBS1	BZ13		00002170
11	BLKT35	3	RBS1	BZ33	4	RBS1	BZ33		00002180
11	BLKT35	5	RBS1	BZ33	6	COREDC			00002190
11	BLKT45	1	RBS1	BZ14	2	RBS1	BZ14		00002200
11	BLKT45	3	RBS1	BZ34	4	RBS1	BZ34		00002210
11	BLKT45	5	RBS1	BZ34	6	COREDC			00002220
11	BLKT55	1	RBS1	BZ15	2	RBS1	BZ15		00002230
11	BLKT55	3	RBS1	BZ35	4	RBS1	BZ35		00002240

Fig. 4. Sample Problem 1 BCD Input Data (Contd.)

11	BLKT55	5	RBS1	BZ35	6	CUREDQ	00002250
11	BLKT18	1	RBS1	BZ21	2	RBS1 BZ21	00002260
11	BLKT18	3	RBS1	BZ21	4	RBS1 BZ21	00002270
11	BLKT18	5	RBS1	BZ41	6	RBS1 BZ41	00002280
11	BLKT18	7	RBS1	BZ41	8	RBS1 BZ41	00002290
11	BLKT18	9	CUREDQ				00002300
11	BLKT28	1	RBS1	BZ22	2	RBS1 BZ22	00002310
11	BLKT28	3	RBS1	BZ22	4	RBS1 BZ22	00002320
11	BLKT28	5	RBS1	BZ42	6	RBS1 BZ42	00002330
11	BLKT28	7	RBS1	BZ42	8	RBS1 BZ42	00002340
11	BLKT28	9	CUREDQ				00002350
11	BLKT38	1	RBS1	BZ23	2	RBS1 BZ23	00002360
11	BLKT38	3	RBS1	BZ23	4	RBS1 BZ23	00002370
11	BLKT38	5	RBS1	BZ43	6	RBS1 BZ43	00002380
11	BLKT38	7	RBS1	BZ43	8	RBS1 BZ43	00002390
11	BLKT38	9	CUREDQ				00002400
11	BLKT48	1	RBS1	BZ24	2	RBS1 BZ24	00002410
11	BLKT48	3	RBS1	BZ24	4	RBS1 BZ24	00002420
11	BLKT48	5	RBS1	BZ44	6	RBS1 BZ44	00002430
11	BLKT48	7	RBS1	BZ44	8	RBS1 BZ44	00002440
11	BLKT48	9	CUREDQ				00002450
11	BLKT58	1	RBS1	BZ25	2	RBS1 BZ25	00002460
11	BLKT58	3	RBS1	BZ25	4	RBS1 BZ25	00002470
11	BLKT58	5	RBS1	BZ45	6	RBS1 BZ45	00002480
11	BLKT58	7	RBS1	BZ45	8	RBS1 BZ45	00002490
11	BLKT58	9	CUREDQ				00002500
12	CURE14	10XIDE	0.0	0.0	.1672		00002510
12	CURE15	10XIDE	0.0	0.0	.1672		00002520
12	CURE24	10XIDE	0.0	0.0	.2821		00002530
12	CURE25	10XIDE	0.0	0.0	.2821		00002540
12	ABLKT4	10XIDE	0.0	0.0	0.0		00002550
12	ABLKT5	10XIDE	0.0	0.0	0.0		00002560
12	BLKT15	10XIDE	0.0	0.0	0.0		00002570
12	BLKT25	10XIDE	0.0	0.0	0.0		00002580
12	BLKT35	10XIDE	0.0	0.0	0.0		00002590
12	BLKT45	10XIDE	0.0	0.0	0.0		00002600
12	BLKT55	10XIDE	0.0	0.0	0.0		00002610
12	BLKT18	10XIDE	0.0	0.0	0.0		00002620
12	BLKT28	10XIDE	0.0	0.0	0.0		00002630
12	BLKT38	10XIDE	0.0	0.0	0.0		00002640
12	BLKT48	10XIDE	0.0	0.0	0.0		00002650
12	BLKT58	10XIDE	0.0	0.0	0.0		00002660
13	OXIDE	U238	.01933	PU239 .01933	PU240 .01933		00002670
13	OXIDE	PU241	.01933	PU242 .01933	U235 .01933		00002680
14	CUREDQ0.0						00002690
18	SEPAR	PU239	1.0	PU240 1.0	PU241 1.0		00002700
18	SEPAR	PU242	1.0				00002710
19	CURE14	EFA	1				00002720
19	CURE15	EFA	1				00002730
19	CURE24	EFA	1				00002740
19	CURE25	EFA	1				00002750
19	ABLKT4	EFB	1				00002760
19	ABLKT5	EFB	1				00002770
19	BLKT15	EFB	1				00002780
19	BLKT25	EFB	1				00002790
19	BLKT35	EFB	1				00002800
19	BLKT45	EFB	1				00002810
19	BLKT55	EFB	1				00002820
19	BLKT18	EFB	1				00002830
19	BLKT28	EFB	1				00002840

Fig. 1. Sample Problem 1 BCD Input Data (Contd.)

19	BLKT38	EFB	1				00002850
19	BLKT48	EFB	1				00002860
19	BLKT58	EFB	1				00002870
20	CURE14	EFA	1				00002880
20	CURE15	EFA	1				00002890
20	CURE24	EFA	1				00002900
20	CURE25	EFA	1				00003000
20	ABLKT4	EFB	1				00003010
20	ABLKT5	EFB	1				00003020
20	BLKT15	EFB	1				00003030
20	BLKT25	EFB	1				00003040
20	BLKT35	EFB	1				00003050
20	BLKT45	EFB	1				00003060
20	BLKT55	EFB	1				00003070
20	BLKT18	EFB	1				00003080
20	BLKT28	EFB	1				00003090
20	BLKT38	EFB	1				00003100
20	BLKT48	EFB	1				00003110
20	BLKT58	EFB	1				00003120
21	EFA	SEPAR	1.0E+30				00003130
21	EFB	SEPAR	1.0E+30				00003140
22	EFA	U235	.0072	U238	.9928	PU239 .60	00003150
22	EFA	PU240	.24	PU241	.12	PU242 .04	00003160
22	EFB	U235	.002	U238	.998		00003170
24	U235	0	92235,	U238	0	92238,	00003180
24	PU239	1	94239,	PU240	0	94240,	00003190
24	PU241	1	94241,	PU242	0	94242,	00003200
24	LFPPS	0	54120,	MO	0	4296,	00003210
25	PU241	6MO	2.1	E-9			
/*							

Fig. 4. Sample Problem 1 BCD Input Data (Contd.)

Problem No. 2

This is a 1-dimensional radial representation in cylindrical geometry of the first sample problem. This problem runs with 2 neutron groups in 300k-bytes of main core storage on an IBM-360/75 in about 0.6 minutes CPU and 1.9 minutes wait time.

The problem statement is: burn over a cycle length of 135 days, with two sub-intervals of 67.5 days, while maintaining k -effective at 1.000 ± 0.001 with control rod smeared density searches.

A map of the reactor model is shown in Fig. 5. The BCD input is shown in Fig. 6.

Much of the commentary given previously in this section about problem No. 1 applies to this problem also. But the principal difference is that now we do not have any external feed supplies—instead the reactor compositions (and enrichments) are known and given on A.NIP types 13 and 14 cards. The fuel management paths are the ultimate in simplicity: just one stage each. This is the place in the reactor where each core or blanket element is initially loaded, and stays throughout the entire burn step of 135 days.

Fig. 5. Geometrical Description of Sample Problem No. 2


```

BLOCK=OLD
DATASET=XS.ISD
BLOCK=SIPO04
DATASET=A,STPO04
01      0      0      1      1
DATASET=A,DIF1D
01      SAMPLE FUEL CYCLE PROBLEM 8-19-71
01      0      0      0      3      50
02      0,0      1.221      E 09
03      50      1      3      8      3 10000      -1
04      2.0E-3      1.0E-3      1.0E-3      0,0      ,01
DATASET=A,NIP
01      SAMPLE FUEL CYCLE PROBLEM 8-19-71
02      0      1 5000      -1 10000      -1      0      1
03      21      0      0
04      3      2
06      C21      0,0      37,547      8
06      CUNTR1      42,262      2
06      C22      58,727      4
06      C23      73,008      4
06      C24      74,445      1
06      CUNTR2      79,338      2
06      C25      87,107      2
06      C26      97,308      3
06      B21      101,1      2
06      B22      111,707      3
06      B23      116,65      2
06      B24      125,956      3
06      REFLR      142,758      3
06      SHIELD      178,257      4
06      SUDIUM      208,737      3
12      56.44      19.8
13      FUEL1 U 238      0,00630122 PU239      0,00076440 PU240      0,00030576
13      FUEL1 PU241      0,00015288 PU242      0,00005096 U 235      0,00004442
13      FUEL1 LFPPS      0,0      MD      0,0
13      FUEL2 U 238      0,00543185 PU239      0,00128970 PU240      0,00051588
13      FUEL2 PU241      0,00025794 PU242      0,00008598 U 235      0,00003829
13      FUEL3 U 238      0,01265474 U 235      0,00002536
13      MCOOL NA 23      ,0219
13      MSTRC SS      ,0851
13      OXYFULD 16 ,0379
13      POISONA181 ,0045
14      COOLT MCOOL      1,0
14      STRUCTMSTRC      1,0
14      C1S1 FUEL1      1,0      MCOOL ,3986      MSTRC ,2065
14      C1S1 OXYFUL,3948
14      C2S1 FUEL2      1,0      MCOOL ,3986      MSTRC ,2065
14      C2S1 OXYFUL,3948
14      RBS1 FUEL3      1,0      MCOOL ,2541      MSTRC ,0889
14      RBS1 OXYFUL,657
14      SHIMS POISON 1,0      MCOOL -,372      MSTRC ,025
14      CONT1 COOLT ,949      STRUCT ,051
14      REFL STRUCT,9      COOLT ,1
14      SHLD STRUCT,554      COOLT ,446
14      SOD COOLT 1,0
14      C1C4 C1S1 1,
14      C1C5 C1S1 1,
14      C2C4 C2S1 1,
14      C2C5 C2S1 1,
14      RB1 RBS1 1,

```

Fig. 6. Sample Problem 2 BCD Input Data

```

14      RB2   RBS1  1.
14      RB3   RBS1  1.
14      RB4   RBS1  1.
14      CONT2  CQOLT .949          STRUCT.051
15      C1C4  CZ1   CZ2   CZ3
15      CUNT1  CNTR1
15      C2C4  CZ4   CZ5   CZ6
15      RB1   BZ1   BZ2   BZ3   BZ4
15      REFL  REFLR
15      SHLD  SHIELD
15      SUD   SODIUM
15      CUNT2  CNTR2
21      0      61.0      0.001
22      1.0      .8      0.0      2.5
23      SHIMS  CONT2
DATASET=A,BURN
01      NUNEQUILIBRIUM PROBLEM
02      0 9200      0      1.      1.      1.      2      1
03      135.0      1.0      1.0      1.05
04      1.002      .001      1.0      1.0
05      CURE   PATH1  PATH2  PATH3
09      U238   1PU239
09      U238   2LFPPS
09      PU239   1PU240
09      PU239   2LFPPS
09      PU240   1PU241
09      PU240   2LFPPS
09      PU241   1PU242
09      PU241   2LFPPS
09      PU242   2LFPPS
09      PU242   1MD
09      MU      0
09      LFPPS   0
09      U235   2LFPPS
09      U235   1MD
09      PU241   6MD
24      U235   0      92      235.
24      U238   0      92      238.
24      PU239   1      94      239.
24      PU240   0      94      240.
24      PU241   1      94      241.
24      PU242   0      94      242.
24      LFPPS   0      54      120.
24      MU      0      42      95.95
25      PU241   6MD      2.1E-9
11      PATH1   1      C1S1  C1C4
11      PATH2   1      C2S1  C2C4
11      PATH3   1      RBS1  RB1
/*

```

Fig. 6. Sample Problem 2 BCD Input Data (Contd.)

IV. TIMING CONSIDERATIONS

A calculational capability such as REBUS could be used with diverse objectives as various survey and parametric studies are done. Calculations with differing in-reactor and external cycle conditions would be done in seeking optimum conditions and in evaluating design alternatives. Efficient utilization of the REBUS system under these conditions necessitates reasonable estimation of the computation cost and selection of acceptable error limits. To assist the code user in meeting these objectives, timing studies were done to determine the sensitivity of the computation time to the convergence criteria and to obtain suggested values for the error limits. The results of these studies are presented below.

With REBUS more than 90 percent of the computation time is used in doing the neutronics solutions so that the computation time is directly proportional to the number of neutronics solutions. Therefore, timing studies were done using different convergence criteria and comparing the number of neutronics solutions.

Convergence Criteria for the Fuel Cycle Model

In REBUS, the convergence criteria divide into two classes, physics criteria and numerical criteria. The physics criteria are those criteria concerned with the physics constraints of an equilibrium fuel cycle problem. These are the obtaining of the desired unpoisoned multiplication constant and the specified fuel discharge burnup. The unpoisoned multiplication constant is converged if

$$\frac{|k_{\text{eff}} - k_d|}{k_d} < \text{epsf} \quad , \quad (1)$$

where

k_d is the desired unpoisoned multiplication constant
 k_{eff} is the unpoisoned multiplication constant obtained
 $epsf$ is a specified error limit.

The fuel discharge burnup b is converged if

$$\frac{|b - b_d|}{b_d} < epsg \quad , \quad (2)$$

where

b_d is the desired fuel discharge burnup
 $epsg$ is the specified tolerance.

The numerical criteria are concerned with the computational strategy chosen in REBUS to obtain the equilibrium solution. The numerical criteria are: the convergence of the region density vectors at each time node in the burn interval, the convergence of the cyclic mode iterations, and the convergence of the external cycle search. Following a neutronics calculation at a particular time node, the error for each region density vector is compared with the specified error limit. The neutronics solution is repeated with re-calculation of the density vectors until convergence. The convergence criterion for each region density vector is

$$\text{Max}_i \left(\frac{|n_{r,i}^{(q)} - n_{r,i}^{(q-1)}|}{n_{r,i}^{(q-1)}} \right) < epsn \quad , \quad (3)$$

where $n_{r,i}^{(q)}$ is the density of isotope i in region r after q neutronics solutions and $epsn$ is a specified error limit.

The number of cyclic mode iterations is determined by the convergence of the material-densities at the end-of-cycle condition. The convergence criterion for each stage of each material type (ℓ, τ) is

$$\max_i \left(\frac{|n_{\ell,\tau,i}^{(p)} - n_{\ell,\tau,i}^{(p-1)}|}{n_{\ell,\tau,i}^{(p-1)}} \right) < \text{epsc}, \quad (4)$$

where $n_{\ell,\tau,i}^{(p)}$ is the density of isotope i in stage τ of material type ℓ after p cyclic mode iterations and epsc is a specified tolerance.

In the external cycle iterations, the discharge distribution is passed through the external cycle and the in-reactor cycle, thereby generating a new discharge distribution. These steps are repeated until a converged charge distribution (stage 1 of each material type) is obtained. The convergence criterion is

$$\max_i \left(\frac{|n_{\ell,1,i}^{(v)} - n_{\ell,1,i}^{(v-1)}|}{n_{\ell,1,i}^{(v-1)}} \right) < \text{epse}, \quad (5)$$

where epse is a specified error limit.

Timing studies were done using various values for the above error limits. Some of the results are presented in Table IV. These results should serve as a guide in estimating the computation time. If the time required for each neutronics solution is known, then the total computation time can be estimated by multiplying this by the number of neutronics solutions.

The most significant parameter is the error limit for the convergence of the unpoisoned multiplication constant, epsf . Decreasing this error limit increases the number of neutronics solutions. The total computation time is most sensitive to this error limit. Decreasing the error limits epsc and epsn increases the number of neutronics solutions as more neutronics solutions are needed to obtain convergence to the cyclic mode and convergence of the

TABLE IV. Sensitivity Studies

Number of Neutronics Solution	epsf	epsc	epsn	epsg	epse
24	.001	.001	.001	.01	.001
24	.01	.001	.001	.01	.001
29	.0002	.001	.001	.01	.001
34	.0001	.001	.001	.01	.001
18	.01	.01	.01	.01	.01
22	.001	.01	.01	.01	.01
29	.001	.0005	.0005	.01	.0005
31	.001	.0001	.0001	.01	.0001
39	.001	.00001	.00001	.01	.00001
25	.001	.01	.001	.01	.001
24	.001	.001	.01	.01	.001
28	.001	.00001	.01	.01	.001
27	.001	.001	.00001	.01	.001
25	.001	.001	.001	.01	.01

region density vectors. Decreasing the error limit ϵ_{pse} for the unconstrained equilibrium mode does not increase the number of neutronics solutions.

Table V lists the suggested values for the error limits. These values should give acceptable accuracy for equilibrium fuel cycle calculations in the conceptual design analysis of Liquid Metal Fast Breeder Reactors. These error limits were chosen on the rather subjective basis of comparing the trade-off between accuracy and computation cost. In order to obtain the suggested values for the error limits, fuel cycle parameters which characterize the reactor performance were analyzed for the various values of the error limits in Table IV. The fuel cycle parameters examined were feed enrichment, breeding ratio, burn time, and fissile mass discharge. For the convergence criteria in Table V, the resulting errors in the fuel cycle parameters for some representative problems are shown in Table VI. The fissile mass discharge error was calculated separately for each core zone, the axial blanket above each core zone, and the radial blanket. The errors in Table VI refer to the maximum error in the above regions.

Convergence Criteria for the Neutronic Solution

In doing fuel cycle analysis with the REBUS system, most of the total computer time is used by the two-dimensional neutronics solution. Thus, the required computer time for REBUS is very sensitive to the convergence criteria used in the neutronics solution. The accuracy of the fuel cycle results was determined for the various convergence criteria in the neutronics solution. The objective is to reduce the computer time without significantly decreasing the accuracy.

TABLE V. Suggested Values for Error Limits

Error Limit	Suggested Value
epsf	.001
epsc	.001
epsn	.001
epsg	.01
epse	.0001

TABLE VI. Errors in Some Fuel Cycle Parameters

Fuel Cycle Parameter	Error %
Feed enrichment	.4
Breeding ratio	.4
Burn time	.7
Fissile mass discharge	1.0

The two-dimensional finite difference modules NUC005 and NUC006 (DARC2D⁷) use three convergence criteria to obtain the reactor multiplication constant and the two-dimensional multigroup flux distribution. The first convergence criterion deals with the difference in k_{eff} :

$$\left| k^{(n)} - k^{(n-1)} \right| \leq \epsilon_k , \quad (6)$$

where the index n refers to the n th outer iteration. The convergence criteria for the flux are

$$\sum_{ijg} \left(\frac{|\phi_{ijg}^{(n)} - \phi_{ijg}^{(n-1)}|}{\phi_{ijg}^{(n-1)}} \right) \leq \epsilon_p \quad (7)$$

and

$$\bar{\lambda}^{(n)} - \underline{\lambda}^{(n)} \leq \epsilon_\lambda , \quad (8)$$

where

$$\bar{\lambda}^{(n)} = \max_{ijg} \left(\frac{\phi_{ijg}^{(n)}}{\phi_{ijg}^{(n-1)}} \right) , \quad (9)$$

$$\underline{\lambda}^{(n)} = \min_{ijg} \left(\frac{\phi_{ijg}^{(n)}}{\phi_{ijg}^{(n-1)}} \right) \quad (10)$$

The indices i and j refer to the mesh point locations in the radial and axial direction. The index g is the neutron energy group. All three criteria must be satisfied in a converged problem.

In fuel cycle calculations, convergence of k_{eff} is needed to accurately determine the feed enrichments and control requirements. Accurate burnup and power distributions can be achieved only by convergence of the pointwise

flux distribution as specified by Eqs. (7) and (8). The iteration procedure used in DARC2D results in the rate of convergence of $k^{(n)}$ being greater than the rate of convergence of pointwise fluxes. Therefore, either Eq. (7) or Eq. (8) normally determines the number of outer iterations. Of these two, the max-min requirement, Eq. (8) is usually satisfied last. Equilibrium fuel cycle calculations were done with various values for the convergence limits ϵ_λ and ϵ_p . The accuracy of the results and the required computer time were studied.

The calculations were done with 8 neutron energy groups in r-z cylindrical geometry. The two-dimensional neutronics solution used 486 mesh points, 27 in the radial direction and 18 in the axial direction. Previous work has shown that the total computer time varies nearly linearly with the number of mesh points. Thus, extrapolation to large problems can be done.

The various convergence limits and the required computer time for REBUS are shown in Table VII. Most significant is the sensitivity of the computer time to these convergence limits. The results for some fuel cycle parameters are presented in Table VIII. For the various convergence criteria in Table VII the fuel cycle results agree quite well. Note the excellent conformity of the results for problems (1) and (6), which respectively used the largest and the smallest convergence limits. With the convergence limits of problem (1), the total fissile mass, the supplied fissile mass, and the discharged fissile mass can be calculated within 0.5 per cent, as compared to the results for problem (6). The error in the breeding ratio and the cycle time is insignificant for problem (1). It is important to note the large difference in the required computer time for problems (1) and (6).

TABLE VII

CONVERGENCE LIMITS AND CORRESPONDING COMPUTER TIME FOR REBUS
EQUILIBRIUM SOLUTION

Problem No.	Convergence Limit			Computer Time Min.
	ϵ_k	ϵ_p	ϵ_λ	
1	1.0×10^{-3}	4.0×10^{-3}	8.0×10^{-3}	13.4
2	1.0×10^{-3}	2.0×10^{-3}	4.0×10^{-3}	13.8
3	1.0×10^{-3}	4.0×10^{-4}	8.0×10^{-4}	21.0
4	1.0×10^{-3}	2.0×10^{-4}	4.0×10^{-4}	24.0
5	1.0×10^{-3}	2.0×10^{-5}	4.0×10^{-5}	29.4
6	1.0×10^{-3}	4.0×10^{-6}	8.0×10^{-6}	35.4

TABLE VIII
EQUILIBRIUM FUEL CYCLE RESULTS FOR VARIOUS CONVERGENCE CRITERIA

Problem:	1	2	3	4	5	6
Fissile Mass*						
Beginning of Cycle						
Core	723.8	723.9	724.6	724.6	724.9	724.9
Radial Blanket	173.1	173.1	172.6	172.6	172.4	172.4
Axial Blanket	77.0	77.0	76.9	76.9	76.8	76.8
End of Cycle						
Core	706.7	706.7	707.4	707.6	707.6	707.6
Radial Blanket	211.0	211.0	210.4	210.2	210.2	210.2
Axial Blanket	111.6	111.6	111.4	111.4	111.3	111.3
Breeding Ratio	1.355	1.355	1.354	1.354	1.354	1.354
Cycle Time	132.7	132.7	132.5	132.4	132.4	132.4
Supplied Fissile Mass						
Core Zone 1	78.0	78.0	78.1	78.1	78.1	78.1
Core Zone 2	89.3	89.3	89.4	89.4	89.4	89.4
Radial Blanket	3.6	3.6	3.6	3.6	3.6	3.6
Axial Blanket 1	1.8	1.8	1.8	1.8	1.8	1.8
Axial Blanket 2	1.4	1.4	1.4	1.4	1.4	1.4
Discharged Fissile Mass						
Core Zone 1	77.4	77.4	77.4	77.4	77.4	77.4
Core Zone 2	72.7	72.7	72.8	72.8	72.8	72.8
Radial Blanket	41.6	41.6	41.4	41.4	41.4	41.4
Axial Blanket 1	22.9	22.9	22.9	22.9	22.9	22.9
Axial Blanket 2	14.8	14.8	14.8	14.8	14.8	14.8

* kg of Pu²³⁹ + Pu²⁴¹ + U²³⁵

To determine the accuracy of the detailed burnup and flux calculations, the two-dimensional power distributions obtained with the various convergence limits were compared. The radial power distributions at the reactor midplane are presented in Table IX for problems (1) and (6). When compared to problem (6), the maximum error in the two-dimensional power distribution obtained in problem (1) is 0.5 per cent.

In conclusion, for fuel cycle calculations with the REBUS System the convergence limits on the flux can be approximately 1×10^{-3} without introducing significant errors. The total computer time is very sensitive to the convergence limits on the flux so that significant computer time can be saved by proper selection of these convergence limits.

Timing Studies

Representative running times for the REBUS System on the IBM-360/75 are presented in Table X. Equilibrium fuel cycle conditions for some typical 1000 Mwe, oxide-fueled reactors were computed using the two-dimensional neutronics capability, DARC2D. The burn time was divided into two subintervals; fluxes were computed, therefore, at three time nodes. The burn time was adjusted to achieve 100,000 MWD/T core average burnup at discharged. Feed enrichment was varied to obtain a critical system at the end of cycle. Control densities were fixed at cycle average values. The convergence criteria suggested in the preceding sections were used.

Computation times for two designs with different numbers of neutron energy groups are shown in Table X. Note the approximate linearity of the time with the number of neutron energy groups and the number of mesh points. Using 8 neutron groups, the sequence of calculations burnup $\rightarrow$ neutronics solution requires 1.5 minutes for the 18 in. core with 924 mesh points and .67 minutes for the 36 in. core with 486 mesh points. These are average times over the whole equilibrium computation.

TABLE IX.
RADIAL POWER DISTRIBUTION AT MIDPLANE FOR
END OF CYCLE CONDITIONS

Outer Radius cm	Relative Power, w/cm ³	
	Problem 1	Problem 6
3.67	8.691x10 ⁻⁷	8.696x10 ⁻⁷
11.02	8.647x10 ⁻⁷	8.652x10 ⁻⁷
18.37	8.559x10 ⁻⁷	8.563x10 ⁻⁷
25.72	8.427x10 ⁻⁷	8.431x10 ⁻⁷
33.06	8.253x10 ⁻⁷	8.256x10 ⁻⁷
40.41	8.037x10 ⁻⁷	8.039x10 ⁻⁷
47.76	7.780x10 ⁻⁷	7.783x10 ⁻⁷
55.11	7.482x10 ⁻⁷	7.484x10 ⁻⁷
62.46	7.141x10 ⁻⁷	7.143x10 ⁻⁷
69.81	6.751x10 ⁻⁷	6.753x10 ⁻⁷
76.52	7.705x10 ⁻⁷	7.711x10 ⁻⁷
82.61	7.075x10 ⁻⁷	7.080x10 ⁻⁷
88.69	6.297x10 ⁻⁷	6.301x10 ⁻⁷
94.78	5.399x10 ⁻⁷	5.402x10 ⁻⁷
100.87	4.424x10 ⁻⁷	4.426x10 ⁻⁷
106.03	1.616x10 ⁻⁷	1.612x10 ⁻⁷
110.28	1.268x10 ⁻⁷	1.265x10 ⁻⁷
114.52	9.897x10 ⁻⁸	9.865x10 ⁻⁸
118.56	5.758x10 ⁻⁸	5.737x10 ⁻⁸
122.39	4.508x10 ⁻⁸	4.491x10 ⁻⁸
126.21	3.526x10 ⁻⁸	3.511x10 ⁻⁸
129.88	2.056x10 ⁻⁸	2.047x10 ⁻⁸
133.39	1.637x10 ⁻⁸	1.630x10 ⁻⁸
136.90	1.327x10 ⁻⁸	1.321x10 ⁻⁸

TABLE X. REPRESENTATIVE COMPUTER TIMES*

Core Height in.	Core Radius in.	Mesh Points r-z	Neutron Energy Groups	Computation Time min.
18	55	42 x 22 (924)	6	30
			7	32
			8	35
			13	52
36	41	27 x 18 (486)	6	13
			7	13
			8	16
			13	20
30	49	39 x 13 (507)	8	20
35	60	50 x 22 (1100)	8	41

*On an IBM-360/75 Computer

V. ERROR MESSAGES

Error messages issued by various subroutines in the module FCI001 are listed on the following pages. The subroutines are presented alphabetically. The module FCC001 has no error messages. The error messages for the other modules in the REBUS capability can be found in references 5, 6, 7, and 8.

As a general rule, errors will not stop execution until the particular module involved has been completed. This will not be true in those cases in which the error results in some subsequent computer system error such as a division by zero, core region violation, etc.

Subroutine ARMAKE

ERROR - ZERO BURNUP MATRICES WILL BE STORED IN CORE BECAUSE INSUFFICIENT
POINTR CONTAINER ARRAY SPACE WAS SPECIFIED

Subroutine COMMAT

ERROR - THERE ARE NO TYPE 13 CARDS IN A.NIP.

Subroutine DIST

ERROR - 'aaaaaa' FROM CARD TYPE 19 OR CARD TYPE 20 DOES NOT CORRESPOND TO
A REPROCESSING PLANT LABEL NOR AN EXTERNAL FEED LABEL

Subroutine EDIT10

CARD TYPE 10 ERROR - 'aaaaaa' IS NOT AN ACTIVE ISOTOPE LABEL FROM TYPE
09 CARDS

Subroutine EDIT12

CARD TYPE 12 ERROR - 'aaaaaa' IS NOT A PATH LABEL ON TYPE 11 CARDS

Subroutine EDIT13

CARD TYPE 13 ERROR - 'aaaaaa' IS NOT A CHEMICAL COMPOSITION ON TYPE 12 CARDS
CARD TYPE 13 ERROR - 'aaaaaa' IS NOT A LIBRARY ISOTOPE ON TYPE 10 CARDS

Subroutine EDIT14

CARD TYPE 14 ERROR - 'aaaaaa' IS NOT A REACTOR DISCHARGE LABEL ON TYPE 11 CARDS

Subroutine EDIT15

CARD TYPE 15 ERROR - 'aaaaaa' IS NOT A REACTOR DISCHARGE LABEL ON TYPE 14 CARDS

Subroutine EDIT16

CARD TYPE 16 ERROR - 'aaaaaa' IS NOT A REPROCESSING PLANT LABEL ON TYPE 15
CARDS

Subroutine EDIT17

CARD TYPE 17 ERROR - 'aaaaaa' IS NOT A RECOVERY FACTOR SPECIFICATION LABEL
ON TYPE 16 CARDS

CARD TYPE 17 ERROR - 'aaaaaa' IS NOT AN ACTIVE ISOTOPE LABEL ON TYPE 09 CARDS

Subroutine EDIT18

CARD TYPE 18 ERROR - 'aaaaaa' IS NOT A CLASS SEPARATION LABEL ON TYPE 16 CARDS

CARD TYPE 18 ERROR - 'aaaaaa' IS NOT AN ACTIVE ISOTOPE LABEL ON TYPE 09 CARDS

Subroutine EDIT21

CARD TYPE 21 ERROR - 'aaaaaa' IS NOT A REPROCESSING PLANT LABEL NOR AN EXTERNAL
FEED LABEL ON TYPE 19 CARDS OR ON TYPE 20 CARDS

Subroutine EDIT22

CARD TYPE 22 ERROR - 'aaaaaa' IS NOT AN EXTERNAL FEED LABEL ON TYPE 21 CARDS

CARD TYPE 22 ERROR - 'aaaaaa' IS NOT AN ACTIVE ISOTOPE LABEL ON TYPE 09 CARDS

Subroutine EDIT23

CARD TYPE 23 ERROR - 'aaaaaa' IS NOT A REPROCESSING PLANT LABEL ON TYPE 16 CARDS

CARD TYPE 23 ERROR - 'aaaaaa' IS NOT AN ACTIVE ISOTOPE LABEL ON TYPE 09 CARDS

Subroutine FIVE

CARD TYPE 05 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 05 CARD

Subroutine FRTN15

ERROR - PRIMARY COMPOSITION LABEL 'aaaaaa' IS NOT ON TYPE 14 CARDS

ERROR - PRIMARY COMPOSITION LABEL 'aaaaaa' APPEARS IN SECONDARY COMPOSITION

ERROR - PRIMARY COMPOSITION 'aaaaaa' EITHER CONTAINS A MATERIAL OR THE SECONDARY COMPOSITION IS NOT GIVEN

ERROR - THE VOLUME FRACTION SUM OF PRIMARY COMPOSITION 'aaaaaa' DIFFERS FROM 1.0 BY GREATER THAN 0.001.

ERROR - SECONDARY COMPOSITION 'aaaaaa' CONTAINS NO MATERIALS

ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 'ii' CARD IN SUB-BLOCK A.NIP.

Subroutine GENHOM

THE SECONDARY COMPOSITION 'aaaaaa' HAS NOT BEEN SPECIFIED

Subroutine GEOMC

ERROR - A PRIMARY COMPOSITION HAS NOT BEEN ASSIGNED TO REGION LABEL 'aaaaaa'

Subroutine LDSDEN

ERROR - SECONDARY COMPOSITION 'aaaaaa' IS NOT FOUND IN THE INPUT DATA

Subroutine MAIN

DATA SET A.BURN IS NOT AVAILABLE

CARD TYPE 03 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 03 CARD

ERROR - CARD TYPE 03 IS REQUIRED

ERROR - CARD TYPE 04 IS REQUIRED

CARD TYPE 04 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 04 CARD

Subroutine MATRIX

ERROR - YOU SPECIFIED (N,2N) BUT THERE IS NO (N,2N) MATRIX IN THE DATA SET XS.ISO.

Subroutine PROACT

ISOTOPE 'aaaaaa' IS EQUIVALENT TO CHAIN NAMES 'aaaaaa' AND 'aaaaaa'

THE ACTIVE ISOTOPES 'aaaaaa' AND 'aaaaaa' APPEAR AS THE SAME MEMBER OF AN ACTIVE CHAIN IN A SINGLE COMPOSITION

Subroutine REACT

ERROR - 'aaaaaa' IS NOT DEFINED ON THE TYPE 24 CARDS

Subroutine SIX

CARD TYPE 06 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 06 CARD

Subroutine TRTENE

ISOTOPE STRING LENGTH IS EXCEEDED

THE FOLLOWING MAT-ISO STRING IS INCOMPATABLE

'aaaaaaaa' 'aaaaaaaa' 'aaaaaaaa' 'aaaaaaaa' 'aaaaaaaa' 'aaaaaaaa' 'aaaaaaaa'
'aaaaaaaa' 'aaaaaaaa' 'aaaaaaaa'

ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 13 CARD IN SUB-BLOCK A.NIP.

Subroutine TYPE09

CARD TYPE 09 ERROR - REACTION TYPE SPECIFIED FOR ISOTOPE 'aaaaaa' IS INCORRECT

CARD TYPE 09 ERROR - YIELD FRACTIONS FOR 'aaaaaa' TOTAL GREATER THAN 1.0.

Subroutine TYPE10

CARD TYPE 10 ERROR - 'aaaaaa' IS NOT AN ACTIVE ISOTOPE LABEL ON TYPE 09 CARDS

Subroutine TYPE12

CARD TYPE 12 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 12 CARD

Subroutine TYPE13

CARD TYPE 13 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 13 CARD

Subroutine TYPE14

CARD TYPE 14 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 14 CARD

Subroutine TYPE15

CARD TYPE 15 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 15 CARD

Subroutine TYPE16

CARD TYPE 16 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 16 CARD

Subroutine TYPE17

CARD TYPE 17 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 17 CARD

Subroutine TYPE18

CARD TYPE 18 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 18 CARD

Subroutine TYPE21

CARD TYPE 21 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 21 CARD

Subroutine TYPE22

CARD TYPE 22 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 22 CARD

Subroutine TYPE23

CARD TYPE 23 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 23 CARD

Subroutine TYPE24

CARD TYPE 24 ERROR - 'aaaaaa' IS NOT AN ACTIVE ISOTOPE LABEL ON TYPE 09 CARDS

CARD TYPE 24 ERROR - 'aaaaaa' HAS A LARGER ATOMIC NUMBER THAN ATOMIC MASS

Subroutine TYPE25

CARD TYPE 25 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 25 CARD

Subroutine T1920

CARD TYPE 19 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 19 CARD

CARD TYPE 20 ERROR - TYPE 'ii' CARD WAS ENCOUNTERED AS TYPE 20 CARD

APPENDIX 1. BCD DATA SET FORMATS

This Appendix lists the BCD input data sets A.BURN, A.DIF1D, A.DIF2D, A.NIP, and A.STP004 used for the REBUS capability.

Equilibrium problems require a non-standard usage of the A.NIP type-14 cards: a composition is made up of n fractions $\frac{1}{n}$ of the same composition, in order to provide the $\frac{1}{n}$ volume fractions which indicate the fraction of the fuel in a given region which is discharged after a burn cycle. The n -value is related simply to the A.BURN type 11 card, which specifies the reactor fuel management stages in each path. On this card, n is the maximum number of stages in the path.

```

MEMBER NAME  ABURN
C***** 000100
C - 000200
C          PREPARED 8/1/72 AT ANL - 000300
C - 000400
CF      A.BURN - 000500
CE      GENERAL INPUT FOR FUEL CYCLE MODULES. - 000600
C - 000700
CN          THIS IS A USER-SUPPLIED BCD DATA SET. - 000800
CN          THE LIST FOR EACH RECORD IS GIVEN IN TERMS OF - 000900
CN          THE BCD FORMAT OF THE DATA CARD. COLUMNS 1-2 - 001000
CN          NORMALLY CONTAIN THE CARD TYPE NUMBER. - 001100
C - 001200
C***** 001300
C          001400
C          001500
C----- 001600
CR      PROBLEM TITLE (TYPE 01) - 001700
C - 001800
CL      FORMAT-----(I2,4X,11A6) - 001900
C - 002000
CD      COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 002100
CD      ===== 002200
CD      1-2          01 - 002300
CD - 002400
CD      7-72          ANY ALPHANUMERIC CHARACTERS. - 002500
C - 002600
CN          AS MANY TYPE 01 CARDS MAY BE USED AS ARE NECESSARY. - 002700
C - 002800
C----- 002900
C          003000
C          003100
C----- 003200
CR      STORAGE, DUMP AND CONVERGENCE CRITERIA - 003300
CR      SPECIFICATIONS (TYPE 02) - 003400
C - 003500
CL      FORMAT-----(I2,4X,3I6,3E12.5,2I6) - 003600
C - 003700
CD      COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 003800
CD      ===== 003900
CD      1-2          02 - 004000
CD - 004100
CD      7-12          POINTR DEBUGGING EDIT. - 004200
CD          0...NO DEBUGGING PRINTOUT (DEFAULT). - 004300
CD          1...DEBUGGING DUMP PRINTOUT. - 004400
CD          2...DEBUGGING TRACE PRINTOUT. - 004500
CD          3...FULL DEBUGGING PRINTOUT. - 004600
CD - 004700
CD      13-18          POINTR CONTAINER ARRAY SIZE IN REAL*8 WORDS. - 004800
CD          (DEFAULT=35000). - 004900
CD - 005000
CD      19-24          PCINTR CONTAINER ARRAY SIZE IN LCS IN REAL*8 WORDS. - 005100
CD          (DEFAULT=0). - 005200
CD - 005300
CD      25-36          CONVERGENCE CRITERION: MAXIMUM ALLOWABLE ERROR IN - 005400
CD          REGION-ISOTOPE DENSITY (EPSN). (DEFAULT=0.001) - 005500
CD - 005600
CD      37-48          CONVERGENCE CRITERION: MAXIMUM ALLOWABLE ERROR IN - 005700
CD          ANY ISOTOPE DISCHARGE DENSITY, FOR CONVERGENCE - 005800

```

Fig. 7. Input Data Set A.BURN

MEMBER NAME ABURN

C-----		011700
		011800
		011900
C-----		012000
CR	CHARGE ENRICHMENT/CRITICALITY DATA (TYPE 04)	- 012100
C		- 012200
CL	FORMAT----- (I2,10X,5E12.5)	- 012300
C		- 012400
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY
CD	=====	=====
CD	1-2	04
CD		- 012700
CD		- 012800
CD	13-24	DESIRED UNPOISONED KEFF(0).
CD		- 012900
CD		- 013000
CD	25-36	ALLOWABLE RELATIVE ERROR IN KEFF(0), EPSILON(K),
CD		DURING CHARGE-ENRICHMENT SEARCHES. (DEFAULT=0.001).
CD		- 013100
CD		- 013200
CD		- 013300
CD	37-48	FRACTION OF BURN TIME AT WHICH KEFF(0) IS TO BE
CD		REACHED. THIS MUST BE ONE OF THE END POINTS OF A
CD		SUBINTERVAL OF THE BURN STEP.
CD		- 013400
CD		- 013500
CD		- 013600
CD		- 013700
CD	49-60	INITIAL VALUE FOR THE REACTOR CHARGE-ENRICHMENT SEARCH
CD		PARAMETER X.
CD		- 013800
CD		- 013900
CD		- 014000
CD	61-72	SECOND VALUE FOR THE REACTOR CHARGE-ENRICHMENT
CD		SEARCH PARAMETER X. (DEFAULT=INITIAL VALUE FROM
CD		COLS.49-60 PLUS 0.1).
CD		- 014100
CD		- 014200
CD		- 014300
C		- 014400
CN		- 014500
CN		THE ENRICHMENT OF A BATCH OF FRESH FUEL IDENTIFIED
CN		AS CHARGE TYPE M IS ADJUSTED ACCORDING TO THE FORMULA
CN		$E(M) = E(M)(0) (1 + (X-1.) * DELTA(M))$.
CN		- 014600
CN		- 014700
CN		WHERE X IS THE CHARGE-ENRICHMENT SEARCH PARAMETER
CN		WHOSE INITIAL VALUE IS GIVEN IN COLS. 49-60.
CN		- 014800
CN		- 014900
CN		THE E(M)(0) AND DELTA(M) FOR EACH CHARGE TYPE ARE
CN		SPECIFIED ON CARD TYPE 12.
CN		- 015000
CN		- 015100
CN		- 015200
CN		- 015300
CN		IN THE FOLLOWING CARDS, A "LABEL" WILL BE IDENTIFIED
CN		FROM THE CARD TYPE (E.G., CARD TYPE 21 INDICATES THAT
CN		EXTERNAL FEED DATA ARE TO FOLLOW). A LABEL IS DEFINED
CN		AS A SIX-CHARACTER IDENTIFIER THAT REFERENCES THE
CN		SPECIFIC OPERATIONS OR DATA THAT FOLLOW. FOR EXAMPLE,
CN		- 015400
CN		- 015500
CN		- 015600
CN		- 015700
CN		- 015800
CN		- 015900
CN		- 016000
CN		- 016100
CN		THE ISOTOPE LABELING SYSTEM ALLOWS DIFFERENT LIBRARY
CN		LABELS (I.E., DIFFERENT MICROSCOPIC CROSS SECTIONS) TO
CN		BE USED IN DIFFERENT FUEL BATCHES. THE INTERNAL, OR
CN		RUN-TIME, LABELS FOR "ACTIVE" ISOTOPES (THOSE THAT ARE
CN		- 016200
CN		- 016300
CN		- 016400
CN		- 016500
CN		- 016600
CN		INCLUDED IN THE TRANSMUTATION MATRIX) ARE DEFINED
CN		IN THE SPECIFICATION OF THE ISOTOPIIC CHAIN (CARD TYPE
CN		09). THESE RUN-TIME LABELS MAY COINCIDE WITH THE
CN		- 016700
CN		- 016800
CN		- 016900
CN		- 017000
CN		- 017100
CN		- 017200
CN		- 017300
CN		- 017400

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN		
CN	ARE EQUIVALENCED TO ONE OF THESE RUN-TIME LABELS ARE	-	017500
CN	CONSIDERED IDENTICAL IN THE EXTERNAL CYCLE.	-	017600
CN	APPROPRIATE MICROSCOPIC CROSS SECTIONS FOR THE FRESH	-	017700
CN	CHARGE BATCHES ARE SELECTED THROUGH THE CHEMICAL	-	017800
CN	COMPOSITION DATA ON CARD TYPE 13. ACTIVE ISOTOPE	-	017900
CN	LABELS APPEARING ON CARD TYPES OTHER THAN 10 OR 13	-	018000
CN	MUST BE THOSE THAT APPEAR IN COLS. 7-12 OF THE TYPE	-	018100
CN	09 CARDS.	-	018200
C		-	018300
C		-	018400
C		-	018500
C		-	018600
C		-	018700
CR	BURNUP TEST SPECIFICATIONS (TYPE 05)	-	018800
C		-	018900
CL	FORMAT----- (I2,4X,11A6)	-	019000
C		-	019100
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	-
CD	=====	=====	-
CD	1-2	05	-
CC			-
CD	7-12	LABEL OF BURNUP TEST GROUP (REPEATED ON ADDITIONAL	-
CD		CARDS).	-
CC			-
CD	13-18	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
CC			-
CD	19-24	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
CC			-
CD	25-30	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
CC			-
CD	31-36	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
CC			-
CD	37-42	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
CC			-
CD	43-48	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
CC			-
CD	49-54	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
CC			-
CD	55-60	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
CC			-
CD	61-66	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
CC			-
CD	67-72	PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST	-
CD		GROUP. SEE NOTE FOLLOWING CARD TYPE 08.	-
C		-	022800
C		-	022900
C		-	023000
C		-	023100
C		-	023200

Fig. 7. Input Data Set A.BURN (Contd.)

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MEMBER NAME  ABURN
CR          BURNUP LIMITS (TYPE 06)                - 023300
C                                                  - 023400
CL  FORMAT----- (I2,10X,3(A6,E12.5))           - 023500
C                                                  - 023600
CD  COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 023700
CD  =====          =====                     - 023800
CD  1-2              C6                             - 023900
CD                                                  - 024000
CD  13-18            TEST GROUP OR PATH LABEL.       - 024100
CD                                                  - 024200
CD  19-30            BURNUP LIMIT: RATIO OF TOTAL ATOMS DESTROYED IN - 024300
CD                    FISSION TO TOTAL ACCOUNTABLE ATOMS PRESENT INITIALLY. - 024400
CD                    UNLESS SPECIFIED OTHERWISE (SEE CARD TYPES 07 AND 08), - 024500
CD                    THE NUMERATOR INCLUDES ALL FISSION EVENTS, AND THE - 024600
CD                    DENOMINATOR INCLUDES ALL FISSIONABLE ATOMS PRESENT AT - 024700
CD                    THE START OF THE BURN.         - 024800
CD                                                  - 024900
CD  31-36            TEST GROUP OR PATH LABEL.       - 025000
CD                                                  - 025100
CD  37-48            BURNUP LIMIT.                   - 025200
CD                                                  - 025300
CD  49-54            TEST GROUP OR PATH LABEL.       - 025400
CD                                                  - 025500
CD  55-66            BURNUP LIMIT.                   - 025600
C                                                  - 025700
C-----
C                                                  025800
C                                                  025900
C                                                  026000
C-----
CR          BURNUP NUMERATOR DEFINITION (TYPE 07) - 026100
C                                                  - 026200
CL  FORMAT----- (I2,4X,11A6)                   - 026300
C                                                  - 026400
CD  COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 026500
CD  =====          =====                     - 026600
CD  1-2              C7                             - 026700
CD                                                  - 026800
CD  7-12            TEST GROUP OR PATH LABEL (REPEATED ON ADDITIONAL - 026900
CD                    CARDS).                        - 027000
CD                                                  - 027100
CD  13-18            LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN - 027200
CD                    NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED - 027300
CD                    TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM - 027400
CD                    COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD - 027500
CD                    TYPE 05.)                      - 027600
CD                                                  - 027700
CD  19-24            LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN - 027800
CD                    NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED - 027900
CD                    TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM - 028000
CD                    COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD - 028100
CD                    TYPE 05.)                      - 028200
CD  25-30            LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN - 028300
CD                    NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED - 028400
CD                    TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM - 028500
CD                    COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD - 028600
CD                    TYPE 05.)                      - 028700
CD                                                  - 028800
CD                                                  - 028900
CD                                                  - 029000

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Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN	
CD	31-36	LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD		NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD		TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD		COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD		TYPE 09.)
CD		
CD	37-42	LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD		NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD		TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD		COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD		TYPE 09.)
CD		
CD	43-48	LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD		NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD		TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD		COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD		TYPE 09.)
CD		
CD	49-54	LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD		NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD		TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD		COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD		TYPE 09.)
CD		
CD	55-60	LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD		NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD		TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD		COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD		TYPE 09.)
CD		
CD	61-66	LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD		NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD		TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD		COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD		TYPE 09.)
CD		
CD	67-72	LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD		NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD		TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD		COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD		TYPE 09.)
C		
CN		IF THIS CARD IS PRESENT, ONLY FISSION REACTIONS OF
CN		ISOTOPES APPEARING IN THIS LIST CONTRIBUTE TOWARD
CN		"BURNUP" OF THE TEST GROUP OR PATH.
C		
C		
C		
C		
CR		BURNUP DENOMINATOR DEFINITION (TYPE 08)
C		
CL		FORMAT----- (I2,4X,11A6)
C		
CD		COLUMNS CONTENTS...IMPLICATIONS, IF ANY
CD	=====	=====
CD	1-2	C8
CD		

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN	
CD	7-12	TEST GROUP OR PATH LABEL (REPEATED ON ADDITIONAL CARDS).
CD		
CD		
CD	13-18	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
CD		
CD	19-24	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
CD		
CD	25-30	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
CD		
CD	31-36	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
CD		
CD	37-42	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
CD		
CD	43-48	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
CD		
CD	49-54	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
CD		
CD	55-60	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
CD		
CD	61-66	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
CD		
CD	67-72	LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD		
CD		
C		
CN		FOR ANY ATOM VECTOR AT TIME T, THE BURNUP IS DEFINED AS THE QUOTIENT OF THE SUM OVER SPECIFIED ISOTOPES OF THE TOTAL FISSION REACTIONS IN EACH ISOTOPE FROM TIME ZERO TO TIME T, DIVIDED BY THE SUM OVER SPECIFIED ISOTOPES OF THE TOTAL ATOMS PRESENT AT TIME ZERO.
CN		
CN		
CN		

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN		
CN	(TIME ZERO IN THIS CONTEXT IS THE TIME AT WHICH THE	-	040700
CN	FUEL CHARGE WAS LOADED INTO THE CORE.) UNLESS CARD	-	040800
CN	TYPES 07 AND/OR 08 ARE PRESENT, THESE SUMS ARE TAKEN	-	040900
CN	OVER ALL ISOTOPES UNDERGOING FISSION.	-	041000
CN		-	041100
CN	ATCM VECTORS OF SEVERAL PATHS CAN BE COLLECTED INTO	-	041200
CN	A SINGLE TEST GROUP (CARD TYPE 05) FOR WHICH AN	-	041300
CN	AVERAGE BURNUP IS COMPUTED. A BURNUP LIMIT MAY BE	-	041400
CN	GIVEN ON CARD TYPE 06 FOR TEST GROUPS SPECIFIED ON	-	041500
CN	CARD TYPE 05. IF NO BURNUP LIMIT IS GIVEN, NO BURNUP	-	041600
CN	TEST IS MADE FOR THAT PATH OR TEST GROUP.	-	041700
CN		-	041800
CN	WE DEFINE THE RELATIVE BURNUP ERROR AS THE VALUE OF	-	041900
CN	THE DIFFERENCE BETWEEN ALLOWABLE AND ACHIEVED BURNUP	-	042000
CN	RELATIVE TO THE ALLOWABLE BURNUP FOR EACH PATH OR	-	042100
CN	TEST GROUP. THEN BURN TIME WILL BE ADJUSTED UNTIL THE	-	042200
CN	SMALLEST VALUE OF THIS DIFFERENCE BECOMES ZERO	-	042300
CN	WITHIN THE CONVERGENCE LIMIT ON CARD TYPE 03, COLS.	-	042400
CN	37-48.	-	042500
CN		-	042600
CN	THAT IS, ((BURNUP ALLOWED - BURNUP ACHIEVED)/	-	042700
CN	BURNUP ALLOWED) MIN OVER TEST GROUP = 0 PLUS OR	-	042800
CN	MINUS EPSILON.	-	042900
CN		-	043000
CN	THIS WILL BE THE SMALLEST TIME AT WHICH SOME PATH OR	-	043100
CN	TEST GROUP HAS A BURNUP ERROR OF PLUS OR MINUS EPSILON.	-	043200
C		-	043300
C		-	043400
			043500
			043600
C		-	043700
CR	ISOTOPIC CHAIN DATA (TYPE 09)	-	043800
C		-	043900
CL	FORMAT----- (I2,4X,A6,I6,3(A6,E12.5))	-	044000
C		-	044100
CD	COLUMNS CONTENTS...IMPLICATIONS, IF ANY	-	044200
CD	=====	-	044300
CD	1-2 09	-	044400
CD		-	044500
CD	7-12 LABEL OF ISOTOPE UNDERGOING REACTION (REPEATED ON ALL	-	044600
CD		-	044700
CD	CARDS THAT SPECIFY OTHER REACTIONS FOR THIS ISOTOPE).	-	044800
CD	13-18 REACTION TYPE (REPEATED ON ADDITIONAL CARDS).	-	044900
CD	0...NO REACTION.	-	045000
CD	1...(N,GAMMA) REACTION.	-	045100
CD	2...(N,F) REACTION.	-	045200
CD	3...(N,P) REACTION.	-	045300
CD	4...(N,ALPHA) REACTION.	-	045400
CD	5...(N,2N) REACTION.	-	045500
CD	6...BETA-MINUS DECAY.	-	045600
CD	7...BETA-PLUS DECAY.	-	045700
CD	8...ALPHA DECAY.	-	045800
CD		-	045900
CD	19-24 LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED	-	046000
CD		-	046100
CD	IN CCLS. 13-18.	-	046200
CD	25-36 YIELD FRACTION OR ISOMERIC STATE BRANCHING FRACTION	-	046300
CD		-	046400
CD	TO THE ISOTOPE SPECIFIED IN COLS. 19-24.	-	

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN		
CD			- 046500
CD	37-42	LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED	- 046600
CD		IN CCLS. 13-18.	- 046700
CD			- 046800
CD	43-54	YIELD FRACTION OR ISOMERIC STATE BRANCHING FRACTION	- 046900
CD		TO THE ISOTOPE SPECIFIED IN COLS. 37-42.	- 047000
CD			- 047100
CD	55-60	LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED	- 047200
CD		IN CCLS. 13-18.	- 047300
CD			- 047400
CD	61-72	YIELD FRACTION OR ISOMERIC STATE BRANCHING FRACTION	- 047500
CD		TO THE ISOTOPE SPECIFIED IN COLS. 37-42.	- 047600
C			- 047700
CN		ALL ISOTOPE LABELS APPEARING IN COLS. 7-12 OF ONE OR	- 047800
CN		MORE TYPE 09 CARDS ARE DEFINED AS "ACTIVE"; THAT IS,	- 047900
CN		THEY ARE CONSIDERED IN BURNUP/DECAY CALCULATIONS. ALL	- 048000
CN		OTHER ISOTOPES ARE "INACTIVE"; THAT IS, THEY ARE	- 048100
CN		ASSUMED TO UNDERGO NO TRANSMUTATIONS DURING THE	- 048200
CN		PROBLEM. ALL ACTIVE ISOTOPE LABELS MUST BE DEFINED	- 048300
CN		CN TYPE 24 CARDS.	- 048400
CN			- 048500
CN		IF NO TYPE 10 CARDS ARE GIVEN, THE ISOTOPE LABELS ON	- 048600
CN		THE TYPE 09 CARDS IN COLS. 7-12 MUST BE DEFINED IN THE	- 048700
CN		CROSS-SECTION LIBRARY. IF ANY TYPE 10 CARDS ARE GIVEN,	- 048800
CN		THE LABELS ON THE 09 CARDS MAY BE LOCAL; THE TYPE 10	- 048900
CN		CARDS WILL RELATE THE LOCAL LABELS TO SPECIFIC CROSS-	- 049000
CN		SECTION LIBRARY LABELS. IF THE FIRST PRODUCT-ISOTOPE	- 049100
CN		LABEL (COLS. 19-24) IS BLANK, IT IMPLIES A YIELD OR	- 049200
CN		BRANCHING FRACTION OF 1.0. THIS FURTHER IMPLIES THAT	- 049300
CN		THE PRODUCT ISOTOPE IS TO BE IDENTIFIED FROM THE PROTON-	- 049400
CN		AND MASS NUMBERS (Z,A) OF THE PARENT ISOTOPE (AS GIVEN	- 049500
CN		IN THE CROSS-SECTION LIBRARY), MODIFIED BY THE	- 049600
CN		SPECIFIED REACTION. FOR FISSION REACTIONS (N,F), AT	- 049700
CN		LEAST ONE PRODUCT-ISOTOPE LABEL MUST BE GIVEN (NO	- 049800
CN		LINKAGE THROUGH A AND Z IS POSSIBLE). IF ONLY ONE	- 049900
CN		PRODUCT ISOTOPE IS NAMED IN COLS. 19-24 FOR ANY	- 050000
CN		REACTION, NO YIELD FRACTION NEED BE ENTERED (1.0 IS	- 050100
CN		ASSUMED). IF MORE THAN ONE PRODUCT ISOTOPE IS LISTED,	- 050200
CN		THE YIELD FRACTIONS MUST BE GIVEN FOR EACH.	- 050300
CN			- 050400
CN		IF THE PRODUCT-ISOTOPE LABEL FIELDS ARE NONBLANK,	- 050500
CN		EACH LABEL MUST BE ENTERED IN COLS. 7-12 OF ONE TYPE	- 050600
CN		09 CARD.	- 050700
CN			- 050800
CN		ALL ISOTOPES UNDERGOING THE (N,F) REACTION ARE	- 050900
CN		INCLUDED IN THE CALCULATION OF BURNUP UNLESS TYPE	- 051000
CN		07 OR 08 CARDS ARE GIVEN. IN THAT CASE, ONLY THE	- 051100
CN		ISOTOPES LISTED ON 07 OR 08 CARDS WILL BE COUNTED IN	- 051200
CN		THE BURNUP CALCULATION.	- 051300
C			- 051400
C			- 051500
C			- 051600
C			- 051700
C			- 051800
CR		ACTIVE ISOTOPE-LABEL EQUIVALENCE LIST (TYPE 10)	- 051900
C			- 052000
CL		FORMAT----- (I2,4X,11A6)	- 052100
C			- 052200

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN	CONTENTS...IMPLICATIONS, IF ANY	
CD	COLUMNS		- 052300
CD	=====	=====	- 052400
CD	1-2	10	- 052500
CD			- 052600
CD	7-12	LOCAL ISOTOPE LABEL FROM COLS. 7-12 OF TYPE 09 CARDS	- 052700
CD		(REPEATED, IF NECESSARY, ON ADDITIONAL CARDS).	- 052800
CD			- 052900
CD	13-18	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 053000
CD		LABEL IN COLS. 7-12.	- 053100
CD			- 053200
CD	19-24	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 053300
CD		LABEL IN COLS. 7-12.	- 053400
CD			- 053500
CD	25-30	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 053600
CD		LABEL IN COLS. 7-12.	- 053700
CD			- 053800
CD	31-36	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 053900
CD		LABEL IN COLS. 7-12.	- 054000
CD			- 054100
CD	37-42	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 054200
CD		LABEL IN COLS. 7-12.	- 054300
CD			- 054400
CD	43-48	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 054500
CD		LABEL IN COLS. 7-12.	- 054600
CD			- 054700
CD	49-54	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 054800
CD		LABEL IN COLS. 7-12.	- 054900
CD			- 055000
CD	55-60	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 055100
CD		LABEL IN COLS. 7-12.	- 055200
CD			- 055300
CD	61-66	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 055400
CD		LABEL IN COLS. 7-12.	- 055500
CD			- 055600
CD	67-72	LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL	- 055700
CD		LABEL IN COLS. 7-12.	- 055800
C			- 055900
CN		CARD TYPE 10 IS REQUIRED ONLY IF DIFFERENT LIBRARY	- 056000
CN		ISOTOPE LABELS (I.E., DIFFERENT MICROSCOPIC CROSS-	- 056100
CN		SECTIONS) ARE REQUIRED FOR THE SAME ISOTOPE IN	- 056200
CN		DIFFERENT MATERIALS.	- 056300
C			- 056400
C			- 056500
			- 056600
			- 056700
C			- 056800
CR		REACTOR FUEL MANAGEMENT PATH (TYPE 11)	- 056900
C			- 057000
CL		FORMAT----- (I2,4X,A6,2(I6,6X,2A6))	- 057100
C			- 057200
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 057300
CD	=====	=====	- 057400
CD	1-2	11	- 057500
CD			- 057600
CD	7-12	PATH LABEL (REPEATED ON ADDITIONAL CARDS).	- 057700
CD			- 057800
CD	13-18	STAGE NUMBER	- 057900
CD			- 058000

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN		
CD	25-30	SECONDARY COMPOSITION LABEL.	- 058100
CC			- 058200
CD	31-36	PRIMARY COMPOSITION LABEL OR REGION LABEL.	- 058300
CD			- 058400
CD	37-42	STAGE NUMBER.	- 058500
CD			- 058600
CD	49-54	SECONDARY COMPOSITION LABEL.	- 058700
CD			- 058800
CD	55-60	PRIMARY COMPOSITION LABEL OR REGION LABEL.	- 058900
C			- 059000
CN		THE FUEL-SHUFFLING PATH IS DEFINED BY	- 059100
CN		STAGE NUMBERS IN ASCENDING NUMERICAL ORDER (1,2,3,	- 059200
CN		4,..., NOT NECESSARILY ORDERED ON THE CARDS); THE	- 059300
CN		FUEL TO BE MOVED IS IDENTIFIED BY THE PAIR OF LABELS	- 059400
CN		FOR SECONDARY COMPOSITION AND PRIMARY COMPOSITION OR	- 059500
CN		REGION. IN EQUILIBRIUM PROBLEMS THE VOLUMES OF ALL	- 059600
CN		SECONDARY COMPOSITIONS IN A GIVEN PATH MUST BE EQUAL.	- 059700
CN		IF THE PATH HAS K STAGES, THE DISCHARGE LABEL (SEE	- 059800
CN		CARD TYPES 14 AND 15) FOR THIS PATH IS ENTERED IN THE	- 059900
CN		(K+1) STAGE NUMBER OF THE PATH. NO REGION LABEL SHOULD	- 060000
CN		BE ENTERED FOR THIS STAGE.	- 060100
C			- 060200
C			- 060300
			- 060400
			- 060500
C			- 060600
CR		REACTOR-CHARGE SPECIFICATION (TYPE 12)	- 060700
C			- 060800
CL	FORMAT----	(I2,4X,A6,I6,A6,4E12.5)	- 060900
C			- 061000
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 061100
CD	=====	=====	- 061200
CC	1-2	12	- 061300
CD			- 061400
CD	7-12	PATH LABEL.	- 061500
CD			- 061600
CD	13-18	REPETITION FACTOR (MUST BE 1 FOR EQUILIBRIUM PROBLEMS).	- 061700
CC			- 061800
CD	19-24	CHEMICAL COMPOSITION LABEL (SEE CARD TYPE 13).	- 061900
CC			- 062000
CD	25-36	REFRACTIONATION TIME (DAYS).	- 062100
CC			- 062200
CD	37-48	PRELOADING STORAGE TIME (DAYS).	- 062300
CD			- 062400
CD	49-60	INITIAL ENRICHMENT (SEE CARD TYPE 04).	- 062500
CD			- 062600
CD	61-72	ENRICHMENT MODIFICATION FACTOR (SEE CARD TYPE 04).	- 062700
CC		(DEFAULT=1.0).	- 062800
C			- 062900
C			- 063000
			- 063100
			- 063200
C			- 063300
CR		CHEMICAL COMPOSITION DATA (TYPE 13)	- 063400
C			- 063500
CL	FORMAT----	(I2,4X,A6,6X,3(A6,E12.5))	- 063600
C			- 063700
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 063800

Fig. 7. Input Data Set A.BURN (Contd.)

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MEMBER NAME  ABURN
CD  =====
CD  1-2      13
CD
CD  7-12     CHEMICAL-COMPOSITION LABEL.
CD
CD  19-24    ACTIVE-ISOTOPE LABEL.
CD
CD  25-36    FULL ATOMIC DENSITY (ATOMS/CC * 1.E-24).
CD
CD  37-42    ACTIVE-ISOTOPE LABEL.
CD
CD  43-54    FULL ATOMIC DENSITY (ATOMS/CC * 1.E-24).
CD
CD  55-60    ACTIVE-ISOTOPE LABEL.
CD
CD  61-72    FULL ATOMIC DENSITY (ATOMS/CC * 1.E-24).
C
CN          ACTIVE ISOTOPES SPECIFIED HERE MUST APPEAR IN THE
CN          LIBRARY; THEY MAY OR MAY NOT BE NAMED ON A TYPE 09
CN          CARD. FULL ATOMIC DENSITY MEANS THE NUMBER OF ATOMS
CN          OF THE PURE ISOTOPE PER UNIT VOLUME IN THE GIVEN
CN          CHEMICAL COMBINATION AND STATE (E.G., OXIDE AT SOME
CN          PERCENTAGE OF THEORETICAL DENSITY).
C
C-----
C
C-----
CR          REACTOR-DISCHARGE COOLING TIMES (TYPE 14)
C
CL  FORMAT----(I2,4X,3(A6,E12.5))
C
CD  COLUMNS          CONTENTS...IMPLICATIONS, IF ANY
CD  =====
CD  1-2      14
CD
CD  7-12     REACTOR-DISCHARGE LABEL.
CD
CD  13-24    COOLING TIME (DAYS).
CD
CD  25-30    REACTOR-DISCHARGE LABEL.
CD
CD  31-42    COOLING TIME (DAYS).
CD
CD  43-48    REACTOR-DISCHARGE LABEL.
CD
CD  49-60    COOLING TIME (DAYS).
C
C-----
C
C-----
CR          REACTOR-DISCHARGE DESTINATION DATA (TYPE 15)
C
CL  FORMAT----(I2,4X,A6,6X,3(A6,E12.5))
C
CD  COLUMNS          CONTENTS...IMPLICATIONS, IF ANY
CD  =====

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063900
- 064000
- 064100
- 064200
- 064300
- 064400
- 064500
- 064600
- 064700
- 064800
- 064900
- 065000
- 065100
- 065200
- 065300
- 065400
- 065500
- 065600
- 065700
- 065800
- 065900
- 066000
- 066100
- 066200
066300
066400
066500
066600
- 066700
- 066800
- 066900
- 067000
- 067100
067200
- 067300
- 067400
- 067500
- 067600
- 067700
- 067800
- 067900
- 068000
- 068100
- 068200
- 068300
- 068400
- 068500
- 068600
068700
068800
068900
069000
- 069100
- 069200
- 069300
- 069400
- 069500
069600

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN		
CD	1-2	15	- 069700
CD			- 069800
CD	7-12	REACTOR-DISCHARGE LABEL (REPEATED ON ADDITIONAL CARDS).	- 069900
CD			- 070000
CD	19-24	REPRCESSING-PLANT LABEL.	- 070100
CD			- 070200
CD	25-36	FRACTION OF DISCHARGE TO BE DELIVERED TO REPROCESSING	- 070300
CD		PLANT.	- 070400
CD			- 070500
CD	37-42	REPRCESSING-PLANT LABEL.	- 070600
CD			- 070700
CD	43-54	FRACTION OF DISCHARGE TO BE DELIVERED TO REPROCESSING	- 070800
CD		PLANT.	- 070900
CD			- 071000
CD	55-60	REPRCESSING-PLANT LABEL.	- 071100
CD			- 071200
CD	61-72	FRACTION OF DISCHARGE TO BE DELIVERED TO REPROCESSING	- 071300
CD		PLANT.	- 071400
C			- 071500
CN		ALL REACTOR DISCHARGE NOT DELIVERED TO SCME	- 071600
CN		REPRCESSING PLANT WILL BE SCLD.	- 071700
C			- 071800
C			- 071900
			072000
			072100
C			072200
CR		REPROCESSING-PLANT SPECIFICATIONS (TYPE 16)	- 072300
C			- 072400
CL	FORMAT----	(I2,4X,3A6,2E12.5)	- 072500
C			- 072600
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 072700
CD	=====	=====	- 072800
CD	1-2	16	- 072900
CD			- 073000
CD	7-12	REPROCESSING-PLANT LABEL.	- 073100
CD			- 073200
CD	13-18	RECOVERY-FACTOR SPECIFICATION LABEL.	- 073300
CD			- 073400
CD	19-24	CLASS-SEPARATION SPECIFICATION LABEL.	- 073500
CD			- 073600
CD	25-36	REPRCESSING TIME (DAYS).	- 073700
CD		INITIAL BATCH	- 073800
CD	37-48	VOLUME OF REPROCESSING PLANT OUTPUT (CM**3).	- 073900
C			- 074000
CN		(COLS. 37-48 ARE PERTINENT ONLY IF CARD TYPE 23 IS	- 074100
CN		PROVIDED.)	- 074200
C			- 074300
C			- 074400
			074500
			074600
C			074700
CR		RECOVERY-FACTOR DATA (TYPE 17)	- 074800
C			- 074900
CL	FORMAT----	(I2,4X,A6,6X,3(A6,E12.5))	- 075000
C			- 075100
CD	COLUMNS	CONTENTS...IMPLICATION, IF ANY	- 075200
CD	=====	=====	- 075300
CD	1-2	17	- 075400

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN		
CC			- 075500
CD	7-12	RECOVERY-FACTOR SPECIFICATION LABEL (REPEATED ON	- 075600
CD		ADDITIONAL CARDS).	- 075700
CC			- 075800
CD	19-24	ACTIVE-ISOTOPE LABEL.	- 075900
CD			- 076000
CD	25-36	RECOVERY FRACTION.	- 076100
CD			- 076200
CD	37-42	ACTIVE-ISOTOPE LABEL.	- 076300
CD			- 076400
CD	43-54	RECOVERY FRACTION.	- 076500
CD			- 076600
CD	55-60	ACTIVE-ISOTOPE LABEL.	- 076700
CD			- 076800
CD	61-72	RECOVERY FRACTION.	- 076900
C			- 077000
CN		ALL ISCTOPE LABELS MUST BE DEFINED ON TYPE 09 CARDS.	- 077100
C			- 077200
C			- 077300
			077400
			077500
C			077600
CR		CLASS-SEPARATION DATA (TYPE 18)	- 077700
C			- 077800
CL	FORMAT----	(I2,4X,A6,6X,3(A6,E12.5))	- 077900
C			- 078000
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 078100
CD	=====	=====	- 078200
CC	1-2	18	- 078300
CD			- 078400
CD	7-12	CLASS-SEPARATION SPECIFICATION LABEL (REPEATED ON	- 078500
CD		ADDITIONAL CARDS).	- 078600
CD			- 078700
CD	19-24	ACTIVE-ISOTOPE LABEL.	- 078800
CD			- 078900
CD	25-36	FRACTION OF ISOTOPE ASSIGNED TO CLASS 1 FUEL.	- 079000
CD			- 079100
CD	37-42	ACTIVE-ISOTOPE LABEL.	- 079200
CD			- 079300
CD	43-54	FRACTION OF ISOTOPE ASSIGNED TO CLASS 1 FUEL.	- 079400
CD			- 079500
CD	55-60	ACTIVE-ISOTOPE LABEL.	- 079600
CD			- 079700
CD	61-72	FRACTION OF ISOTOPE ASSIGNED TO CLASS 1 FUEL.	- 079800
C			- 079900
CN		ALL ISCTOPE LABELS MUST BE DEFINED ON TYPE 09 CARDS.	- 080000
CN			- 080100
CN		CLASS 1 FUEL IS NORMALLY CONSIDERED TO BE FUEL THAT	- 080200
CN		ADDS GREATER REACTIVITY TO THE REACTOR THAN DOES CLASS	- 080300
CN		2 FUEL. THE COMPLEMENTS OF THE FRACTIONS GIVEN IN COLS.	- 080400
CN		25-36, 43-54, AND 61-72 ARE THE FRACTIONS ASSIGNED TO	- 080500
CN		CLASS 2 FUEL.	- 080600
CN			- 080700
CN		ANY ACTIVE ISOTOPE SPECIFIED ON CARD TYPE 09 THAT IS	- 080800
CN		NOT GIVEN ON CARD TYPE 18 WILL HAVE A FRACTION 0	- 080900
CN		ASSIGNED TO CLASS 1 FUEL.	- 081000
C			- 081100
C			- 081200

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME ABURN

			081300
			081400
C			081500
CR	CLASS 1 FABRICATION SPECIFICATIONS (TYPE 19)		- 081600
C			- 081700
CL	FORMAT----- (I2,4X,A6,6X,2(A6,I6,E12.5))		- 081800
C			- 081900
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 082000
CD	=====	=====	- 082100
CD	1-2	19	- 082200
CD			- 082300
CD	7-12	PATH LABEL OR SALE LABEL (REPEATED ON	- 082400
CD		ADDITICNAL CARDS).	- 082500
CD			- 082600
CD	19-24	REPRCESSING-PLANT LABEL OR EXTERNAL-FEED LABEL.	- 082700
CD			- 082800
CD	25-30	PRICRITY LEVEL.	- 082900
CD			- 083000
CD	31-42	DISTRIBLTION FRACTION (DEFAULT=1.0).	- 083100
CD			- 083200
CD	43-48	REPRCESSING-PLANT LABEL OR EXTERNAL-FEED LABEL.	- 083300
CD			- 083400
CD	49-54	PRICRITY LEVEL.	- 083500
CD			- 083600
CD	55-66	DISTRIBUTION FRACTION (DEFAULT=1.0).	- 083700
C			- 083800
CN	THE PRIORITY LEVEL ESTABLISHES THE ORDER OF PREFERENCE		- 083900
CN	FOR USE OF REPROCESSING-PLANT OUTPUT OR EXTERNAL-FEED		- 084000
CN	ATOMS IN FABRICATION OF THE VARIOUS BATCHES OF THE		- 084100
CN	REACTOR CHARGE. THE MOST STRAIGHTFORWARD SYSTEM IS ONE		- 084200
CN	IN WHICH ONLY ONE BATCH (SPECIFIED BY THE CHARGE		- 084300
CN	LABEL) REQUIRES ATOMS FROM A GIVEN PLANT OR FEED AT		- 084400
CN	EACH PRIORITY LEVEL. IN THIS CASE ALL ATOMS REQUIRED		- 084500
CN	FOR THE BATCH WITH PRIORITY 1 WILL BE TAKEN FIRST,		- 084600
CN	THEN THOSE REQUIRED FOR PRIORITY 2 (IF ANY REMAIN),		- 084700
CN	AND SO ON.		- 084800
CN			- 084900
CN	IF TWO OR MORE CHARGES SPECIFY THE SAME PLANT OUTPUT		- 085000
CN	OR FEED AT THE SAME PRIORITY LEVEL, THE AVAILABLE		- 085100
CN	ATOMS WILL FIRST BE DISTRIBUTED IN PROPORTION TO THE		- 085200
CN	DISTRIBUTION FRACTION OF EACH CHARGE. IF THE		- 085300
CN	REQUIREMENTS OF SOME OF THESE BATCHES ARE SATISFIED		- 085400
CN	WHILE OTHERS ARE NOT, FURTHER PROPORTIONAL		- 085500
CN	DISTRIBUTIONS ARE MADE TO THE REMAINING BATCHES UNTIL		- 085600
CN	EITHER ALL REQUIREMENTS ARE SATISFIED OR ALL AVAILABLE		- 085700
CN	ATOMS ARE USED.		- 085800
C			- 085900
C			- 086000
			086100
			086200
C			086300
CR	CLASS 2 FABRICATION SPECIFICATIONS (TYPE 20)		- 086400
C			- 086500
CL	FORMAT----- (I2,4X,A6,6X,2(A6,I6,E12.5))		- 086600
C			- 086700
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 086800
CD	=====	=====	- 086900
CD	1-2	20	- 087000

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN	
CD		- 087100
CD	7-12	- 087200
CD	PATH LABEL OR SALE LABEL (REPEATED ON	- 087300
CD	ADDITIONAL CARDS).	- 087400
CD	19-24	- 087500
CD	REPROCESSING-PLANT LABEL OR EXTERNAL-FEED LABEL.	- 087600
CD	25-30	- 087700
CD	PRIORITY LEVEL.	- 087800
CD	31-42	- 087900
CD	DISTRIBUTION FRACTION (DEFAULT=1.0).	- 088000
CD	43-48	- 088100
CD	REPROCESSING-PLANT LABEL OR EXTERNAL-FEED LABEL.	- 088200
CD	49-54	- 088300
CD	PRIORITY LEVEL.	- 088400
CD	55-66	- 088500
CD	DISTRIBUTION FRACTION (DEFAULT=1.0).	- 088600
C		- 088700
CN	THE PRIORITY SYSTEM IS IDENTICAL TO THAT DESCRIBED	- 088800
CN	FOR CLASS 1 MAKEUP ON CARD TYPE 19.	- 088900
C		- 089000
C		- 089100
C		- 089200
C		- 089300
CR	EXTERNAL-FEED SPECIFICATIONS (TYPE 21)	- 089400
C		- 089500
CL	FORMAT----- (I2,4X,2A6,E12.5)	- 089600
C		- 089700
CD	COLUMNS	- 089800
CD	CONTENTS...IMPLICATIONS, IF ANY	- 089900
CD	=====	- 090000
CD	1-2 21	- 090100
CD		- 090200
CD	7-12	- 090300
CD	EXTERNAL-FEED LABEL.	- 090400
CD	13-18	- 090500
CD	CLASS-SEPARATION SPECIFICATION LABEL.	- 090600
CD	19-30	- 090700
CD	VOLUME OF FEED (CM**3).	- 090800
C		- 090900
CN	THE VOLUME OF ONE OF THE EXTERNAL FEEDS MUST BE LARGE	- 091000
CN	TO ENSURE THAT THERE WILL ALWAYS BE ENOUGH FUEL TO	- 091100
CN	FABRICATE ALL CHARGES. AN INFINITE VOLUME WILL BE	- 091200
CN	ASSIGNED TO THE FEED IF COLS. 19-30 ARE BLANK.	- 091300
C		- 091400
C		- 091500
C		- 091600
CR	EXTERNAL-FEED COMPOSITION (TYPE 22)	- 091700
C		- 091800
CL	FORMAT----- (I2,4X,A6,6X,3(A6,E12.5))	- 091900
C		- 092000
CD	COLUMNS	- 092100
CD	CONTENTS...IMPLICATIONS, IF ANY	- 092200
CD	=====	- 092300
CD	1-2 22	- 092400
CD		- 092500
CD	7-12	- 092600
CD	EXTERNAL-FEED LABEL (REPEATED ON ADDITIONAL CARDS).	- 092700
CD	19-24	- 092800
CD	ISOTCPE LABEL.	- 092800

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN		
CD	25-36	ATOMIC DENSITY (ATOMS/CC * 1.E-24).	- 092900
CD			- 093000
CD	37-42	ISOTCPE LABEL.	- 093100
CD			- 093200
CD	43-54	ATOMIC DENSITY (ATOMS/CC * 1.E-24).	- 093300
CD			- 093400
CD	55-60	ISOTCPE LABEL.	- 093500
CD			- 093600
CD	61-72	ATOMIC DENSITY (ATOMS/CC * 1.E-24).	- 093700
C			- 093800
C	-----		- 093900
			094000
			094100
C	-----		094200
CR	REPROCESSING-PLANT OUTPUT INITIAL COMPOSITION (TYPE 23)		- 094300
C			- 094400
CL	FORMAT----- (I2,4X,A6,6X,3(A6,E12.5))		- 094500
C			- 094600
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 094700
CD	=====	=====	- 094800
CD	1-2	23	- 094900
CD			- 095000
CD	7-12	REPROCESSING-PLANT LABEL (REPEATED ON ADDITIONAL CARDS).	- 095100
CD			- 095200
CD			- 095300
CD	19-24	ISOTCPE LABEL.	- 095400
CD			- 095500
CD	25-36	ATOMIC DENSITY (ATOMS/CC * 1.E-24).	- 095600
CD			- 095700
CD	37-42	ISOTCPE LABEL.	- 095800
CD			- 095900
CD	43-54	ATOMIC DENSITY (ATOMS/CC * 1.E-24).	- 096000
CD			- 096100
CD	55-60	ISOTCPE LABEL.	- 096200
CD			- 096300
CD	61-72	ATOMIC DENSITY (ATOMS/CC * 1.E-24).	- 096400
C			- 096500
CN	ALL ISOTOPE LABELS MUST BE DEFINED ON TYPE 09 CARDS.		- 096600
CN			- 096700
CN	CARD TYPE 23 IS PROVIDED ONLY IF IT IS DESIRED TO SPECIFY THE COMPOSITION OF THE REPROCESSING-PLANT OUTPUT STORAGE AT THE START OF THE PROBLEM. IF CARD TYPE 23 IS GIVEN, COLS. 37-48 ON CARD TYPE 16 MUST SPECIFY THE VOLUME OF THE PROCESSING-PLANT OUTPUT.		- 096800
CN			- 096900
CN			- 097000
CN			- 097100
CN			- 097200
C			- 097300
C	-----		- 097400
			097500
			097600
C	-----		097700
CR	ACTIVE ISOTOPE DESCRIPTION (TYPE 24)		- 097800
C			- 097900
CL	FORMAT----- (I2,4X,2(A6,I6,I6,E12.5))		- 098000
C			- 098100
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 098200
CD	=====	=====	- 098300
CD	1-2	24	- 098400
CD			- 098500
CD	7-12	LOCAL ISOTCPE LABEL.	- 098600

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME	ABURN		
CD			- 098700
CD	13-18	FISSILE FLAG.	- 098800
CD			- 098900
CD	19-24	ATOMIC NUMBER.	- 099000
CD			- 099100
CD	25-36	ATOMIC MASS.	- 099200
CD			- 099300
CD	37-42	LOCAL ISOTOPE LABEL.	- 099400
CD			- 099500
CD	43-48	FISSILE FLAG.	- 099600
CD			- 099700
CD	49-54	ATOMIC NUMBER.	- 099800
CC			- 099900
CD	55-66	ATOMIC MASS.	- 100000
C			- 100100
CN		ISOTOPE LABELS USED ARE DEFINED ON TYPE 09 CARDS.	- 100200
CN		THE FISSILE FLAG MUST BE EQUAL TO "1" FOR ALL FISSILE	- 100300
CN		ISOTOPE AND "0" FOR ALL NON-FISSILE ISOTOPE.	- 100400
C			- 100500
C			- 100600
			- 100700
			- 100800
			- 100900
C			- 101000
CR		ACTIVE ISOTOPE DECAY CONSTANTS (TYPE 25)	- 101100
C			- 101200
CL		FORMAT----(I2,4X,A6,I6,3(A6,E12.5))	- 101300
C			- 101400
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 101500
CC	=====	=====	- 101600
CC	1-2	25	- 101700
CC			- 101800
CD	7-12	LABEL OF ISOTOPE UNDERGOING REACTION (REPEATED ON ALL	- 101900
CD		CARDS THAT SPECIFY OTHER REACTIONS FOR THIS ISOTOPE).	- 102000
CC			- 102100
CD	13-18	REACTION TYPE (REPEATED ON ADDITIONAL CARDS; THE SAME	- 102200
CD		AS ON CARD TYPE 09).	- 102300
CD		6...BETA-MINUS DECAY.	- 102400
CD		7...BETA-PLUS DECAY.	- 102500
CD		8...ALPHA DECAY.	- 102600
CD			- 102700
CD	19-24	LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED	- 102800
CD		IN CCLS. 13-18.	- 102900
CC			- 103000
CD	25-36	DECAY CONSTANT (1/SEC) FOR THE ISOTOPE SPECIFIED IN	- 103100
CD		COLS. 19-24.	- 103200
CC			- 103300
CD	37-42	LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED	- 103400
CD		IN CCLS. 13-18.	- 103500
CC			- 103600
CD	43-54	DECAY CONSTANT (1/SEC) FOR THE ISOTOPE SPECIFIED IN	- 103700
CD		COLS. 37-42.	- 103800
CC			- 103900
CD	55-60	LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED	- 104000
CC		IN CCLS. 13-18.	- 104100
CD			- 104200
CD	61-72	DECAY CONSTANT (1/SEC) FOR THE ISOTOPE SPECIFIED IN	- 104300
CD		COLS. 55-60.	- 104400
C			- 104400

Fig. 7. Input Data Set A.BURN (Contd.)

MEMBER NAME ABURN

C-----	104500
	104600
CECF	104700

Fig. 7. Input Data Set A.BURN (Contd.)

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MEMBER NAME  ACIF1D
C***** 000100
C - 000200
C          PREPARED 1/26/71 AT ANL - 000300
C - 000400
CF      A.DIF1D - 000500
CE      CNE-DIMENSIONAL DIFFUSION THEORY - 000600
CE      MCDULE-DEPENDENT BCD INPUT - 000700
C - 000800
CN          THIS IS A USER-SUPPLIED BCD DATA SET. - 000900
CN          THE LIST FOR EACH RECORD IS GIVEN IN TERMS - 001000
CN          OF THE BCD FORMAT OF THE DATA CARD. - 001100
CN          COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE - 001200
CN          NUMBER. - 001300
CN          CARD TYPES 01 THROUGH 04 ARE REQUIRED. - 001400
CN          THE TWO TYPE 01 CARDS MUST BE IN THE - 001500
CN          ORDER SHOWN. - 001600
CN          BLANK OR ZERO FIELDS PRODUCE DEFAULT VALUES. - 001700
C - 001800
C***** 001900
C          002000
C          002100
C----- 002200
CR      PROBLEM TITLE (TYPE 01) - 002300
C - 002400
CL      FORMAT----(I2,10X,10A6) - 002500
C - 002600
CD      COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 002700
CD      =====  ===== 002800
CD      1-2          01 - 002900
CD - 003000
CD      13-72      ANY ALPHANUMERIC CHARACTERS. - 003100
C - 003200
C----- 003300
C          003400
C          003500
C----- 003600
CR      PROBLEM OPTIONS (TYPE 01) - 003700
C - 003800
CL      FORMAT----(I2,10X,8I6) - 003900
C - 004000
CD      COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 004100
CD      =====  ===== 004200
CD      1-2          01 - 004300
CD - 004400
CD      13-18      KINETICS OPTION. - 004500
CD      0...KINETICS OPTION NOT DESIRED (DEFAULT). - 004600
CD      1...KINETICS OPTION 1 (DELAYED DATA FOR SOURCE - 004700
CD      CALCULATION) USED. - 004800
CD      2...KINETICS OPTION 2 (DELAYED DATA FOR ALPHA SEARCH) - 004900
CD      USED. - 005000
CD - 005100
CD      19-24      POINTN DEBUGGING EDIT. - 005200
CD      0...NO DEBUGGING PRINTOUT (DEFAULT). - 005300
CD      1...DEBUGGING DUMP PRINTOUT. - 005400
CD      2...DEBUGGING TRACE PRINTOUT. - 005500
CD      3...FULL DEBUGGING PRINTOUT. - 005600
CD - 005700
CD      25-30      MAXIMUM NUMBER OF UPSCATTER ITERATIONS (DEFAULT=0). - 005800

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Fig. 8. Input Data Set A.DIF1D

MEMBER NAME	ACIFID		
CD			- 005900
CD	31-36	DIFFUSION OUTPUT EDIT.	- 006000
CD		0...NO OUTPUT EDIT (DEFAULT).	- 006100
CD		1...INPUT CROSS SECTION AND GEOMETRY EDIT ONLY.	- 006200
CD		2...STANDARD OUTPUT EDIT (BALANCE CALCULATIONS AND	- 006300
CD		FLUX EDITS).	- 006400
CD		3...COMPLETE OUTPUT EDIT (ABOVE PLUS POWER	- 006500
CD		CALCULATIONS).	- 006600
CD			- 006700
CD	37-42	N, WHERE N OUTER ITERATIONS ARE PERFORMED BEFORE	- 006800
CD		INITIALLY WRITING THE FLUX DATA SET FR.D1 (FA.D1)	- 006900
CD		(DEFAULT=THE MAXIMUM NUMBER OF OUTER ITERATIONS AS	- 007000
CD		GIVEN CN CARD TYPE 03 (BELOW) +1).	- 007100
CD			- 007200
CD	43-48	M, WHERE AFTER INITIALLY WRITING FR.D1 (FA.D1) AS	- 007300
CD		SPECIFIED IN COLUMNS 37-42 ABOVE, FR.D1 (FA.D1) IS	- 007400
CD		REWRITTEN EVERY M ADDITIONAL OUTER ITERATIONS	- 007500
CD		(DEFAULT=10).	- 007600
CD			- 007700
CD	49-54	FISSION SOURCE DATA SETS.	- 007800
CD		0...FISSION SOURCE DATA SET IS NOT WRITTEN (DEFAULT).	- 007900
CD		1...FISSION SOURCE DATA SET FSR.D1 (FSA.D1) IS	- 008000
CD		WRITTEN.	- 008100
CD			- 008200
CD	55-60	SEARCH OUTPUT DATA SETS.	- 008300
CD		0...ALL DATA SETS DEPENDENT CN SEARCH PARAMETER ARE	- 008400
CD		REWRITTEN TO CORRESPOND TO CONVERGED VALUE OF	- 008500
CD		SEARCH PARAMETER (DEFAULT).	- 008600
CD		1...DATA SETS ARE NOT REWRITTEN.	- 008700
C			- 008800
C			- 008900
			009000
			009100
			009200
CR		UPSCATTER ITERATION AND NORMALIZATION CONTROL (TYPE 02)	- 009300
C			- 009400
CL		FORMAT-----(12,10X,2E12.5)	- 009500
C			- 009600
CD		COLUMNS CONTENTS...IMPLICATIONS, IF ANY	- 009700
CD	=====	=====	- 009800
CD	1-2	C2	- 009900
CD			- 010000
CD	13-24	CONVERGENCE CRITERION FOR UPSCATTER ITERATIONS	- 010100
CD		(DEFAULT=0.00001).	- 010200
CD			- 010300
CD	25-36	POWER IN WATTS TO WHICH PROBLEM IS NORMALIZED FOR	- 010400
CD		BURNUP CALCULATIONS (DEFAULT IS NO NORMALIZATION	- 010500
CD		OF FLUXES FOR BURNUP).	- 010600
C			- 010700
C			- 010800
			010900
			011000
C			- 011100
CR		ITERATION AND ARRAY CONTROL (TYPE 03)	- 011200
C			- 011300
CL		FORMAT-----(12,10X,8I6)	- 011400
C			- 011500
CD		COLUMNS CONTENTS...IMPLICATIONS, IF ANY	- 011600

Fig. 8. Input Data Set A.DIFID (Contd.)

MEMBER NAME	ADIFID		
CC	=====	=====	011700
CD	1-2	03	- 011800
CC			- 011900
CD	13-18	MAXIMUM NUMBER OF OUTER ITERATIONS (DEFAULT=100).	- 012000
CD			- 012100
CD	19-24	OUTER ITERATION EXTRAPOLATION.	- 012200
CD		0...NO EXTRAPOLATION (DEFAULT).	- 012300
CD		1...CHEBYSHEV EXTRAPOLATION.	- 012400
CD		2...CVERRELAXATION, FOR SOURCE CALCULATIONS ONLY.	- 012500
CD			- 012600
CD	25-30	NUMBER OF UNEXTRAPOLATED OUTER ITERATIONS BEFORE	- 012700
CD		EXTRAPOLATION (DEFAULT=5).	- 012800
CC			- 012900
CD	31-36	NUMBER OF EXTRAPOLATED OUTER ITERATIONS BEFORE	- 013000
CD		TESTING FOR EXTRAPOLATION PAYOFF (DEFAULT=3).	- 013100
CC			- 013200
CD	37-42	MAXIMUM NUMBER OF EXTRAPOLATED OUTER ITERATIONS IN	- 013300
CD		AN EXTRAPOLATION SEQUENCE (DEFAULT=8).	- 013400
CC			- 013500
CD	43-48	MINIMUM NUMBER OF UNEXTRAPOLATED OUTER ITERATIONS	- 013600
CD		BETWEEN EXTRAPOLATION SEQUENCES (DEFAULT=3).	- 013700
CD			- 013800
CD	49-54	SIZE OF FAST CORE STORAGE ARRAY IN REAL*8 WORDS	- 013900
CC		(DEFAULT=60000).	- 014000
CC			- 014100
CD	55-60	SIZE OF SLOW CORE STORAGE ARRAY IN REAL*8 WORDS	- 014200
CD		(DEFAULT=120000). IF LT.0, NO BULK CORE IS ALLOCATED.	- 014300
C			- 014400
C	-----		014500
			014600
			014700
C	-----		014800
CR		CONVERGENCE CRITERIA (TYPE 04)	- 014900
C			- 015000
CL	FORMAT-----	(I2,10X,5E12.5)	- 015100
C			- 015200
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 015300
CD	=====	=====	015400
CD	1-2	04	- 015500
CC			- 015600
CD	13-24	OUTER ITERATION CONVERGENCE CRITERION ON THE SUM	- 015700
CD		OF THE ABSOLUTE VALUE OF FLUX DIFFERENCES	- 015800
CD		(DEFAULT=0.00001).	- 015900
CD			- 016000
CD	25-36	OUTER ITERATION CONVERGENCE CRITERION ON THE	- 016100
CD		DIFFERENCE OF THE FLUX BOUNDS LAMBDA MAX AND	- 016200
CD		LAMBDA MIN (DEFAULT=0.00001).	- 016300
CD			- 016400
CD	37-48	OUTER ITERATION CONVERGENCE CRITERION ON THE	- 016500
CD		DIFFERENCE IN KEFF (DEFAULT=0.00001).	- 016600
CC			- 016700
CD	49-60	INTERVAL SHIFT FACTOR WHEN APPLYING CHEBYSHEV	- 016800
CD		EXTRAPOLATION TO OUTER ITERATIONS (DEFAULT=0.).	- 016900
CC			- 017000
CD	61-72	LAMBDA MONITOR (DEFAULT=0.). IF THE RATIO OF THE FLUX	- 017100
CD		AT ANY POINT TO THE ROOT MEAN SQUARE FLUX IS LESS THAN	- 017200
CD		THE LAMBDA MONITOR, THEN THE FLUX AT THAT POINT IS	- 017300
CD		ELIMINATED FROM THE CALCULATION OF LAMBDA MAX AND	- 017400

Fig. 8. Input Data Set A.DIFID (Contd.)

MEMBER NAME	ADIF1D		
CD	LAMBCA MIN.	-	017500
C		-	017600
C		-	017700
			017800
			017900
C		-	018000
CR	BLACK COMPOSITION CONTROL (TYPE 07)	-	018100
C		-	018200
CL	FORMAT----- (I2,I0X,A6,2I6)	-	018300
C		-	018400
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 018500
CD	=====	=====	- 018600
CC	1-2	07	- 018700
CC			- 018800
CD	13-18	NAME OF BLACK COMPOSITION	- 018900
CD			- 019000
CD	19-24	INITIAL (HIGHER ENERGY) GROUP NUMBER TREATED AS BLACK.	- 019100
CC			- 019200
CD	25-30	FINAL (LOWER ENERGY) GROUP NUMBER TREATED AS BLACK.	- 019300
CD			- 019400
CD		IF COLUMNS 19-24 ARE BLANK, THE COMPOSITION SPECIFIED	- 019500
CD		IN COLUMNS 13-18 IS TREATED AS BLACK FOR ALL ENERGY	- 019600
CD		GROUPS. IF COLUMNS 25-30 ARE BLANK, THE COMPOSITION	- 019700
CD		IS TREATED AS BLACK FOR THE ENERGY GROUP GIVEN	- 019800
CD		IN COLUMNS 19-24.	- 019900
C			- 020000
C			- 020100
			020200
CECF			020300

Fig. 8. Input Data Set A.DIF1D (Contd.)

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MEMBER NAME  ACIF2D
C*****000100
C-000200
C-000300
C-000400
CF      A.CIF2D-000500
CE      TWO-DIMENSIONAL DIFFUSION THEORY-000600
CE      MODULE-DEPENDENT BCD INPUT-000700
C-000800
CN      THIS IS A USER-SUPPLIED BCD DATA SET.-000900
CN      THE LIST FOR EACH RECORD IS GIVEN IN TERMS-001000
CN      OF THE BCD FORMAT OF THE DATA CARD.-001100
CN      COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE-001200
CN      NUMBER.-001300
CN      CARD TYPES 01 THROUGH 06 ARE REQUIRED.-001400
CN      THE TWO TYPE 01 CARDS MUST BE IN THE-001500
CN      ORDER SHOWN.-001600
CN      BLANK FIELDS PRODUCE DEFAULT VALUES.-001700
C-001800
C*****001900
002000
002100
C-----002200
CR      PROBLEM TITLE (TYPE 01)-002300
C-002400
CL      FORMAT----(I2,10X,10A6)-002500
C-002600
CD      COLUMNS      CONTENTS...IMPLICATIONS, IF ANY-002700
CD      =====
CC      1-2          C1-002900
CC-003000
CD      13-72        ANY ALPHANUMERIC CHARACTERS.-003100
C-003200
C-----003300
003400
003500
C-----003600
CR      PROBLEM OPTIONS (TYPE 01)-003700
C-003800
CL      FORMAT----(I2,10X,9I6)-003900
C-004000
CD      COLUMNS      CONTENTS...IMPLICATIONS, IF ANY-004100
CD      =====
CD      1-2          C1-004300
CD-004400
CD      13-18        KINETICS OPTION.-004500
CD      0...KINETICS OPTION NOT DESIRED (DEFAULT).-004600
CD      1...KINETICS OPTION 1 (DELAYED DATA FOR SOURCE-004700
CD      CALCULATION) USED.-004800
CD      2...KINETICS OPTION 2 (DELAYED DATA FOR ALPHA SEARCH)-004900
CD      USED.-005000
CD-005100
CD      19-24        POINTN DEBUGGIN EDIT.-005200
CD      0...NO DEBUGGING PRINTOUT (DEFAULT).-005300
CD      1...DEBUGGING DUMP PRINTOUT.-005400
CD      2...DEBUGGING TRACE PRINTOUT.-005500
CD      3...FULL DEBUGGING PRINTOUT.-005600
CC-005700
CD      25-30        MAXIMUM NUMBER OF UPSCATTER ITERATIONS (DEFAULT=0).-005800

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Fig. 9. Input Data Set A.DIF2D

MEMBER NAME ACIF2D		
CD		- 005900
CD	31-36	- 006000
CD	DIFFUSION OUTPUT EDIT.	- 006100
CD	0...NO OUTPUT EDIT (DEFAULT).	- 006200
CD	1...INPUT CROSS SECTION AND GEOMETRY EDIT ONLY.	- 006300
CD	2...STANDARD OUTPUT EDIT (BALANCE AND POWER	- 006400
CD	CALCULATIONS AND FLUX EDITS).	- 006500
CD	3...COMPLETE OUTPUT EDIT (ABCVE PLUS NEUTRON CURRENT	- 006600
CD	CALCULATIONS).	- 006700
CD		- 006800
CD	37-42	- 006900
CD	SOLUTION TYPE.	- 007000
CD	1...GRUP-ORDERED SOLUTION.	- 007100
CD	2...CHANNEL-ORDERED SOLUTION.	- 007200
CC		- 007300
CD	43-48	- 007400
CD	N, WHERE N OUTER ITERATIONS ARE PERFORMED BEFORE	- 007500
CD	INITIALLY WRITING THE FLUX DATA SET FR.D2 (FA.D2)	- 007600
CD	(DEFAULT=THE MAXIMUM NUMBER OF OUTER ITERATIONS AS	- 007700
CD	GIVEN CN CARD TYPE 03 BELOW + 1).	- 007800
CC		- 007900
CD	49-54	- 008000
CD	M, WHERE AFTER INITIALLY WRITING FR.D2 (FA.D2) AS	- 008100
CD	SPECIFIED IN COLUMNS 43-48 ABOVE, FR.D2 (FA.D2) IS	- 008200
CD	REWRITTEN EVERY M ADDITIONAL OUTER ITERATIONS	- 008300
CD	(DEFAULT=0).	- 008400
CD		- 008500
CD	55-60	- 008600
CD	MINIMUM NUMBER OF OUTER ITERATIONS (DEFAULT=1).	- 008700
CD		- 008800
CD	67-72	- 008900
CD	SEARCH OUTPUT DATA SETS.	- 009000
CD	0...ALL DATA SETS DEPENDENT ON SEARCH PARAMETER ARE	- 009100
CD	REWRITTEN TO CORRESPOND TO CONVERGED VALUE OF	- 009200
CD	SEARCH PARAMETER (DEFAULT).	- 009300
CD	1...DATA SETS ARE NOT REWRITTEN.	- 009400
C		- 009500
C		- 009600
C		- 009700
C		- 009800
C		- 009900
C		- 010000
C		- 010100
C		- 010200
C		- 010300
C		- 010400
C		- 010500
C		- 010600
C		- 010700
C		- 010800
C		- 010900
C		- 011000
C		- 011100
C		- 011200
C		- 011300
C		- 011400
C		- 011500
C		- 011600

CR	UPSCATTER ITERATION AND NORMALIZATION CONTROL (TYPE 02)		- 009400
C			- 009500
CL	FORMAT----	(I2,10X,2E12.5)	- 009600
C			- 009700
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 009800
CD	=====	=====	- 009900
CD	1-2	02	- 010000
CC			- 010100
CD	13-24	CONVERGENCE CRITERION FOR UPSCATTER ITERATIONS	- 010200
CD		(DEFAULT=0.00001).	- 010300
CC			- 010400
CD	25-36	POWER IN WATTS TO WHICH PROBLEM IS NORMALIZED FOR	- 010500
CD		BURNUP CALCULATIONS (DEFAULT=1.0).	- 010600
C			- 010700
C			- 010800
C			- 010900
C			- 011000
C			- 011100
C			- 011200
C			- 011300
C			- 011400
C			- 011500
C			- 011600

Fig. 9. Input Data Set A.DIF2D (Contd.)

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MEMBER NAME  ACIF2D
CD  =====  ===== 011700
CD  1-2      03 - 011800
CC - 011900
CD  13-18    MAXIMUM NUMBER OF OUTER ITERATIONS (DEFAULT=100). - 012000
CD - 012100
CD  19-24    OUTER ITERATION EXTRAPOLATION. - 012200
CD  0...NO EXTRAPOLATION (DEFAULT). - 012300
CD  1...CHEBYSHEV EXTRAPOLATION. - 012400
CD  2...CVERRELAXATION, FOR SOURCE CALCULATIONS ONLY. - 012500
CD - 012600
CD  25-30    NUMBER OF UNEXTRAPOLATED OUTER ITERATIONS BEFORE - 012700
CD  EXTRAPOLATION (DEFAULT=3 IF INPUT VALUE IS .LT.3). - 012800
CD - 012900
CD  31-36    NUMBER OF EXTRAPOLATED OUTER ITERATIONS BEFORE - 013000
CD  TESTING FOR EXTRAPOLATION PAYOFF (DEFAULT=5). - 013100
CD - 013200
CD  37-42    MAXIMUM NUMBER OF EXTRAPOLATED OUTER ITERATIONS IN - 013300
CD  AN EXTRAPOLATION SEQUENCE (DEFAULT WILL BE 3 + VALUE - 013400
CD  IN COLUMNS 31-36 ABOVE IF INPUT VALUE IS LESS - 013500
CD  THAN THE VALUE INPUT IN COLUMNS 31-36). - 013600
CD - 013700
CD  43-48    NUMBER OF UNEXTRAPOLATED OUTER ITERATIONS BETWEEN - 013800
CD  EXTRAPOLATION SEQUENCES (DEFAULT=3 IF INPUT VALUE IS - 013900
CD  .LT.3). - 014000
CD - 014100
CD  49-54    SIZE OF FAST CCORE STORAGE ARRAY IN REAL*8 WORDS - 014200
CD  (DEFAULT=60000). - 014300
CD - 014400
CD  55-60    SIZE OF SLOW CORE STORAGE ARRAY IN REAL*8 WORDS - 014500
CD  (DEFAULT=125000). IF LE.0, NO BULK CORE IS ALLOCATED. - 014600
C - 014700
C ----- 014800
C 014900
C 015000
C ----- 015100
CR CONVERGENCE CRITERIA (TYPE 04) - 015200
C - 015300
CL FORMAT----- (I2,10X,5E12.5) - 015400
C - 015500
CD COLUMNS CONTENTS...IMPLICATIONS, IF ANY - 015600
CD ===== 015700
CD 1-2      04 - 015800
CD - 015900
CD 13-24    OUTER ITERATION CONVERGENCE CRITERION ON THE SUM - 016000
CD  OF THE ABSOLUTE VALUE OF FLUX DIFFERENCES - 016100
CD  (DEFAULT=C.00001). - 016200
CD - 016300
CD 25-36    OUTER ITERATION CONVERGENCE CRITERION ON THE - 016400
CD  DIFFERENCE OF THE FLUX BOUNDS LAMBDA MAX AND - 016500
CD  LAMBDA MIN (DEFAULT=0.00001). - 016600
CD - 016700
CD 37-48    OUTER ITERATION CONVERGENCE CRITERION ON THE - 016800
CD  DIFFERENCE IN KEFF (DEFAULT=0.00001). - 016900
CD - 017000
CD 49-60    INTERVAL SHIFT FACTOR WHEN APPLYING CHEBYSHEV - 017100
CD  EXTRAPOLATION TO OUTER ITERATIONS (DEFAULT=0.). - 017200
CD - 017300
CD 61-72    LAMBDA MONITOR (DEFAULT=.01). IF THE RATIO OF THE FLUX - 017400

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Fig. 9. Input Data Set A.DIF2D (Contd.)

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MEMBER NAME  ACIF2D
CD          AT ANY POINT TO THE ROOT MEAN SQUARE FLUX IS LESS THAN - 017500
CD          THE LAMBDA MONITOR, THEN THE FLUX AT THAT POINT IS - 017600
CD          ELIMINATED FROM THE CALCULATION OF LAMBDA MAX AND - 017700
CD          LAMBDA MIN. - 017800
C - 017900
C----- 018000
C----- 018100
C----- 018200
C----- 018300
CR          INNER ITERATION CONTROL (TYPE 05) - 018400
C - 018500
CL          FORMAT----- (I2,10X,6I6) - 018600
C - 018700
CD          COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 018800
CD          ===== - 018900
CD          1-2          05 - 019000
CD - 019100
CD          13-18          MAXIMUM NUMBER OF INNER ITERATIONS PER OUTER ITERATION - 019200
CD          (DEFAULT=200). - 019300
CD - 019400
CD          19-24          INNER ITERATION EXTRAPOLATION. - 019500
CD          0...NO EXTRAPOLATION (DEFAULT). - 019600
CD          1...CHEBYSHEV EXTRAPOLATION. - 019700
CD          2...SUCCESSIVE OVERRELAXATION. - 019800
CD - 019900
CD          25-30          NUMBER OF UNEXTRAPOLATED INNER ITERATIONS BEFORE - 020000
CD          EXTRAPOLATING (DEFAULT=3 IF INPUT VALUE.LT.3). - 020100
CD - 020200
CD          31-36          NUMBER OF EXTRAPOLATED INNER ITERATIONS BEFORE - 020300
CD          TESTING FOR EXTRAPOLATION PAYOFF (IF GROUP-ORDERED - 020400
CD          SOLUTION, DEFAULT=3; IF CHANNEL-ORDERED SOLUTION, - 020500
CD          DEFAULT=5). - 020600
CD - 020700
CD          37-42          MAXIMUM NUMBER OF EXTRAPOLATED INNER ITERATIONS IN - 020800
CD          AN EXTRAPOLATED SEQUENCE (IF INPUT VALUE IS .LT. - 020900
CD          COLUMNS 31-36 ABOVE, DEFAULT VALUE IS 3+VALUE IN - 021000
CD          COLUMNS 31-36 ABOVE). - 021100
CD - 021200
CD          43-48          NUMBER OF UNEXTRAPOLATED INNER ITERATIONS BETWEEN - 021300
CD          EXTRAPOLATION SEQUENCES (DEFAULT=3 IF INPUT - 021400
CD          VALUE.LT.3). - 021500
C - 021600
C----- 021700
C----- 021800
C----- 021900
C----- 022000
CR          INNER ITERATION CONVERGENCE CRITERIA (TYPE 06) - 022100
C - 022200
CL          FORMAT----- (I2,10X,3E12.5) - 022300
C - 022400
CD          COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 022500
CD          ===== - 022600
CD          1-2          06 - 022700
CD - 022800
CD          13-24          INNER ITERATION CONVERGENCE CRITERION ON THE SUM - 022900
CD          OF THE ABSOLUTE VALUE OF FLUX DIFFERENCES - 023000
CD          (DEFAULT=0.000001). - 023100
CD - 023200

```

Fig. 9. Input Data Set A.DIF2D (Contd.)

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MEMBER NAME  ADIF2D
CD   25-36    INTERVAL SHIFT FACTOR WHEN APPLYING CHEBYSHEV      - 023300
CD                                     EXTRAPCLATION TO INNER ITERATIONS (DEFAULT=0.). - 023400
CD                                                     - 023500
CD   37-48    INITIAL ESTIMATE OF CONVERGENCE RATE OF INNER      - 023600
CD                                     ITERATIONS (IF GROUP-ORDERED, DEFAULT=0; IF      - 023700
CD                                     CHANNEL-ORDERED, DEFAULT=0.9). - 023800
C                                                     - 023900
C-----
C                                                     024000
C                                                     024100
C                                                     024200
C-----
CR          BLACK COMPCOSITION CONTROL (TYPE 07) - 024300
C                                                     - 024400
C                                                     - 024500
CL   FORMAT----- (I2,10X,A6,2I6) - 024600
C                                                     - 024700
CD   COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 024800
CD   =====          ===== - 024900
CD   1-2              C7 - 025000
CD                                                     - 025100
CD   13-18            NAME OF BLACK COMPCOSITION - 025200
CD                                                     - 025300
CD   19-24            INITIAL (HIGHER ENERGY) GROUP NUMBER TREATED AS BLACK. - 025400
CD                                                     - 025500
CD   25-30            FINAL (LOWER ENERGY) GROUP NUMBER TREATED AS BLACK. - 025600
CD                                                     - 025700
CD                                                     - 025800
CD   IF COLUMNS 19-24 ARE BLANK, THE COMPOSITION SPECIFIED - 025900
CD   IN COLUMNS 13-18 IS TREATED AS BLACK FOR ALL ENERGY - 026000
CD   GROUPS. IF COLUMNS 25-30 ARE BLANK, THE COMPOSITION - 026100
CD   IS TREATED AS BLACK FOR THE ENERGY GROUP GIVEN - 026200
CD   IN COLUMNS 19-24. - 026300
C                                                     - 026400
C-----
C                                                     026500
CEOF                                                     026600

```

Fig. 9. Input Data Set A.DIF2D (Contd.)

```

MEMBER NAME  ANIP
C***** 000100
C - 000200
C          PREPARED 12/1/71 AT ANL - 000300
C - 000400
CF        A.NIP - 000500
CE        GENERAL INPUT FOR NEUTRONICS CALCULATIONS - 000600
C - 000700
CN          THIS IS A USER-SUPPLIED BCD DATA SET. - 000800
CN          THE LIST FOR EACH RECORD IS GIVEN IN TERMS OF - 000900
CN          THE BCD FORMAT OF THE DATA CARD. - 001000
CN          COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE - 001100
CN          NUMBER. - 001200
CN - 001300
CN          BLANKS ARE NOT MEANINGFUL IN A6 LABEL FIELDS. - 001400
C - 001500
C***** 001600
C          001700
C          001800
C----- 001900
CR          PROBLEM TITLE (TYPE 01) - 002000
C - 002100
CL        FORMAT----(I2,4X,11A6) - 002200
C - 002300
CD        COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 002400
CD        ===== - 002500
CD        1-2          C1 - 002600
CD - 002700
CD        7-72          ANY ALPHANUMERIC CHARACTERS. - 002800
C - 002900
C----- 003000
C          003100
C          003200
C----- 003300
CR          INPUT PROCESSING SPECIFICATION (TYPE 02) - 003400
C - 003500
CL        FORMAT----(I2,10X,9I6) - 003600
C - 003700
CD        COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 003800
CD        ===== - 003900
CD        1-2          02 - 004000
CD - 004100
CD        13-18        POINTN DEBUGGING EDIT FOR MODULE NUI002. - 004200
CD        0...NO DEBUGGING PRINTOUT (DEFAULT). - 004300
CD        1...DEBUGGING DUMP PRINTOUT. - 004400
CD        2...DEBUGGING TRACE PRINTOUT. - 004500
CD        3...FULL DEBUGGING PRINTOUT. - 004600
CD - 004700
CD        19-24        NUI002 EDIT. - 004800
CD        0...NO NUI002 EDIT (DEFAULT). - 004900
CD        1...NUI002 EDIT. - 005000
CD - 005100
CD        25-30        SIZE OF MAIN CORE STORAGE ARRAY FOR MODULE NUI002 IN - 005200
CD        REAL*8 WORDS (DEFAULT=10000). - 005300
CD - 005400
CD        31-36        SIZE OF BULK CORE STORAGE ARRAY FOR MODULE NUI002 IN - 005500
CD        REAL*8 WORDS (DEFAULT=0). - 005600
CD - 005700
CD        37-42        SIZE OF MAIN CORE STORAGE ARRAY FOR MODULES NUI001 - 005800

```

Fig. 10. Input Data Set A.NIP

MEMBER NAME	ANIP		
CD		AND NUC001 IN REAL*8 WORDS (DEFAULT=10000).	- 005900
CD			- 006000
CD	43-48	SIZE OF BULK CORE STORAGE ARRAY FOR MODULES NUI001	- 006100
CD		AND NUC001 IN REAL*8 WORDS (DEFAULT=0).	- 006200
CD			- 006300
CD	49-54	PCINTR DEBUGGING EDIT FOR MODULES NUI001 AND NUC001.	- 006400
CD		0...NO DEBUGGING PRINTOUT (DEFAULT).	- 006500
CD		1...DEBUGGING DUMP PRINTOUT.	- 006600
CD		2...DEBUGGING TRACE PRINTOUT.	- 006700
CD		3...FULL DEBUGGING PRINTOUT.	- 006800
CD			- 006900
CD	55-60	NUI001 EDIT.	- 007000
CD		0...NO NUI001 EDIT (DEFAULT).	- 007100
CD		1...NUI001 EDIT.	- 007200
CD			- 007300
CD	61-66	PROMPT NEUTRON EMISSION SPECTRUM OPTION FOR	- 007400
CD		MODULE NUC001.	- 007500
CD		0...USE ISOTOPE EMISSION SPECTRA IF PRESENT IN XS.ISO	- 007600
CD		TO FORM MATERIAL SPECTRA (DEFAULT).	- 007700
CD		1...IGNORE ISOTOPE EMISSION SPECTRA AND USE SET	- 007800
CD		SPECTRUM FOR ALL MATERIALS.	- 007900
C			- 008000
C			- 008100
			- 008200
			- 008300
C			- 008400
CR		BASIC PROBLEM IDENTIFICATION (TYPE 03)	- 008500
C			- 008600
CL		FORMAT----- (I2,10X,3I6,18X,2E12.5)	- 008700
C			- 008800
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY.	- 008900
CD	=====	=====	- 009000
CD	1-2	C3	- 009100
CD			- 009200
CD	13-18	GEOMETRY TYPE.	- 009300
CD		10...SLAB, INFINITE.	- 009400
CD		11...SLAB, CYLINDRICAL.	- 009500
CD		12...SLAB, FINITE IN ONE TRANSVERSE DIRECTION.	- 009600
CD		13...SLAB, FINITE IN BOTH TRANSVERSE DIRECTIONS.	- 009700
CD		20...CYLINDER, INFINITE.	- 009800
CD		21...CYLINDER, FINITE.	- 009900
CD		30...SPHERE.	- 010000
CD		40...X-Y, INFINITE.	- 010100
CD		41...X-Y, FINITE.	- 010200
CD		42...X-Y, 45 DEGREE SYMMETRY, INFINITE.	- 010300
CD		43...X-Y, 45 SYMMETRY, INFINITE.	- 010400
CD		50...R-Z.	- 010500
CD		51...Z-R.	- 010600
CD		60...R-THETA, INFINITE.	- 010700
CD		61...R-THETA, FINITE.	- 010800
CD			- 010900
CD	19-24	PROBLEM TYPE.	- 011000
CD		0...REAL (DEFAULT).	- 011100
CD		1...ADJCINT.	- 011200
CD		2...BOTH REAL AND ADJOINT (MAY BE SELECTED ONLY IF	- 011300
CD		COLS. 25-30 BELOW ARE ZERO OR BLANK).	- 011400
CD		3...SYNTHESIS.	- 011500
CD			- 011600

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CD	25-30	CALCULATION TYPE	- 011700
CD		0...HOMOGENEOUS (DEFAULT).	- 011800
CD		1...INHOMOGENEOUS.	- 011900
CD			- 012000
CD	49-60	FIXED KEFF FOR THE PROBLEM.	- 012100
CD			- 012200
CD	61-72	INITIAL ALPHA, FOR AN ALPHA CRITICALITY SEARCH	- 012300
CD		PROBLEM, OR FIXED ALPHA FOR THE PROBLEM.	- 012400
C			- 012500
C			- 012600
			012700
			012800
C			012900
CR		EXTERNAL BOUNDARY CONDITIONS (TYPE 04)	- 013000
C			- 013100
CL		FORMAT----- (I2,I0X,4I6)	- 013200
C			- 013300
CD		COLUMNS CONTENTS...IMPLICATIONS, IF ANY	- 013400
CD	=====	=====	- 013500
CD	1-2	C4	- 013600
CD			- 013700
CD	13-18	BOUNDARY CONDITION AT LOWER "X" BOUNDARY OF REACTOR.	- 013800
CD			- 013900
CD	19-24	BOUNDARY CONDITION AT UPPER "X" BOUNDARY OF REACTOR.	- 014000
CD			- 014100
CD	25-30	BOUNDARY CONDITION AT LOWER "Y" BOUNDARY OF REACTOR.	- 014200
CD			- 014300
CD	31-36	BOUNDARY CONDITION AT UPPER "Y" BOUNDARY OF REACTOR.	- 014400
CD			- 014500
CD		1...PHI=A.	- 014600
CD		2...PHI=0.	- 014700
CD		3...PHI PRIME=0.	- 014800
CD		4...PHI PRIME + A/D * PHI=0.	- 014900
CD		5...PHI PRIME + A * PHI=0.	- 015000
CD		6...PERIODIC (R-THETA).	- 015100
CD		7...A * PHI PRIME + B * PHI=1.	- 015200
CD		8...A * PHI PRIME + B/D * PHI=1.	- 015300
CD		9...INCOMING ANGULAR FLUX ZERO.	- 015400
CD		10...REFLECTIVE.	- 015500
CD		11...PERIODIC.	- 015600
CD		12...WHITE.	- 015700
CD			- 015800
CN		PHI PRIME IS THE DERIVATIVE OF THE FLUX IN THE	- 015900
CN		DIRECTION OF THE REACTOR OUTWARD NORMAL. D IS THE	- 016000
CN		DIFFUSION COEFFICIENT IN THE MESH INTERVAL	- 016100
CN		IMMEDIATELY INSIDE THE REACTOR BOUNDARY.	- 016200
CN			- 016300
CN		CONDITIONS 1-8 APPLY TO DIFFUSION THEORY PROBLEMS,	- 016400
CN		AND 9-12 APPLY TO TRANSPORT THEORY PROBLEMS.	- 016500
C			- 016600
C			- 016700
			016800
			016900
C			017000
CR		EXTERNAL BOUNDARY CONDITION CONSTANTS (TYPE 05)	- 017100
C			- 017200
CL		FORMAT----- (I2,8X,A2,2E12.5,2I6,2E12.5)	- 017300
C			- 017400

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 017500
CD	=====	=====	- 017600
CD	1-2	C5	- 017700
CD			- 017800
CD	11-12	BOUNDARY DESIGNATOR.	- 017900
CD		XL..."X" LOWER.	- 018000
CD		XU..."X" UPPER.	- 018100
CD		YL..."Y" LOWER.	- 018200
CD		YU..."Y" UPPER.	- 018300
CD			- 018400
CD	13-24	VALUE OF CONSTANT A REFERRED TO ON CARD TYPE 04.	- 018500
CD			- 018600
CD	25-36	VALUE OF CONSTANT B REFERRED TO ON CARD TYPE 04.	- 018700
CD			- 018800
CD	37-42	HIGHER-ENERGY GROUP NUMBER FOR WHICH CONSTANTS APPLY.	- 018900
CD			- 019000
CD	43-48	LOWER-ENERGY GROUP NUMBER FOR WHICH CONSTANTS APPLY.	- 019100
CD			- 019200
CD	49-60	LOWER COORDINATE ON BOUNDARY FOR WHICH CONSTANTS APPLY.	- 019300
CD			- 019400
CD			- 019500
CD	61-72	UPPER COORDINATE ON BOUNDARY FOR WHICH CONSTANTS APPLY.	- 019600
CD			- 019700
CD			- 019800
CN		IF CCLS. 37-42 ARE BLANK, CONSTANTS GIVEN APPLY TO	- 019900
CN		ALL ENERGY GROUPS. IF COLS. 43-48 ARE BLANK,	- 020000
CN		CONSTANTS GIVEN APPLY TO GROUP SPECIFIED IN COLS.	- 020100
CN		37-42. IF COLS. 49-72 ARE BLANK, CONSTANTS GIVEN	- 020200
CN		APPLY TO THE ENTIRE EXTERNAL BOUNDARY CONCERNED.	- 020300
CN		LOWER AND UPPER COORDINATES MUST COINCIDE WITH MESH	- 020400
CN		LINE, WHICH BOUND MESH INTERVALS.	- 020500
C			- 020600
C			- 020700
			- 020800
			- 020900
C			- 021000
CR		REGION BOUNDARY COORDINATES AND CONSTANT MESH STRUCTURE	- 021100
CR		(TYPE 06)	- 021200
C			- 021300
CL		FORMAT----- (I2,4X,A6,2E12.5,2I6,2E12.5)	- 021400
C			- 021500
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 021600
CD	=====	=====	- 021700
CD	1-2	C6	- 021800
CD			- 021900
CD	7-12	REGION LABEL (REPEATED ON ADDITIONAL TYPE 06 CARDS).	- 022000
CD			- 022100
CD	13-24	"X"-DIRECTION LOWER-BOUNDARY COORDINATE.	- 022200
CD			- 022300
CD	25-36	"X"-DIRECTION UPPER-BOUNDARY COORDINATE.	- 022400
CD			- 022500
CD	37-42	NUMBER OF INTERVALS IN "X" DIRECTION.	- 022600
CD			- 022700
CD	43-48	NUMBER OF INTERVALS IN "Y" DIRECTION.	- 022800
CD			- 022900
CD	49-60	"Y"-DIRECTION LOWER-BOUNDARY COORDINATE.	- 023000
CD			- 023100
CD	61-72	"Y"-DIRECTION UPPER-BOUNDARY COORDINATE.	- 023200

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME ANIP			
CD			- 023300
CN	"X" REPRESENTS X, R, OR, IN THE CASE OF Z-R		- 023400
CN	GEOMETRY, Z. "Y" REPRESENTS Y, X, THETA, OR,		- 023500
CN	IN THE CASE OF Z-R GEOMETRY, R.		- 023600
CN			- 023700
CN	REGIONS MAY BE DEFINED USING THE OVERLAY PRECEDURE,		- 023800
CN	WITH THE LATEST REGION ASSIGNMENT OVERLAYING THE		- 023900
CN	PREVIOUS CONFIGURATION, OR USING THE USUAL PRECEDURE,		- 024000
CN	WITH EACH REGION'S BOUNDARIES GIVEN EXPLICITLY.		- 024100
CN	REGION LABELS MUST BE NON-BLANK.		- 024200
CN	THE MESH FOR A DIRECTION MUST BE COMPLETELY		- 024300
CN	SPECIFIED EITHER ON THE TYPE 06 OR 09 CARDS. IF MESH		- 024400
CN	DATA ARE SUPPLIED ON BOTH TYPE 06 AND 09 CARDS, THE		- 024500
CN	TYPE 09 DATA WILL BE USED. FOR ONE-DIMENSIONAL		- 024600
CN	PROBLEMS, ONLY THE "X"-DIRECTION UPPER BOUNDARIES NEED		- 024700
CN	BE GIVEN FOR REGIONS AFTER THE FIRST.		- 024800
C			- 024900
C			- 025000
			025100
			025200
C			- 025300
CR	AREA SPECIFICATIONS (TYPE 07)		- 025400
C			- 025500
CL	FORMAT----- (I2,4X,11A6)		- 025600
C			- 025700
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 025800
CD	=====	=====	- 025900
CD	1-2	07	- 026000
CC			- 026100
CD	7-12	AREA LABEL (REPEATED ON ADDITIONAL TYPE 07 CARDS).	- 026200
CC			- 026300
CD	13-18	LABEL OF REGION COMPRISING AREA.	- 026400
CC			- 026500
CD	19-24	LABEL OF REGION COMPRISING AREA.	- 026600
CC			- 026700
CD	25-30	LABEL OF REGION COMPRISING AREA.	- 026800
CC			- 026900
CD	31-36	LABEL OF REGION COMPRISING AREA.	- 027000
CC			- 027100
CD	37-42	LABEL OF REGION COMPRISING AREA.	- 027200
CC			- 027300
CD	43-48	LABEL OF REGION COMPRISING AREA.	- 027400
CC			- 027500
CD	49-54	LABEL OF REGION COMPRISING AREA.	- 027600
CC			- 027700
CD	55-60	LABEL OF REGION COMPRISING AREA.	- 027800
CC			- 027900
CD	61-66	LABEL OF REGION COMPRISING AREA.	- 028000
CC			- 028100
CD	67-72	LABEL OF REGION COMPRISING AREA.	- 028200
CC			- 028300
CN	AREA LABELS MUST BE NON-BLANK.		- 028400
C			- 028500
C			- 028600
			028700
			028800
C			- 028900
CR	ZCNE SPECIFICATIONS (TYPE 08)		- 029000

Fig. 10. Input Data Set A.NIP (Contd.)

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MEMBER NAME  ANIP
C                                                    - 029100
CL  FORMAT----- (I2,4X,A6,4E12.5)                - 029200
C                                                    - 029300
CD  COLUMNS          CCNTENTS...IMPLICATIONS, IF ANY - 029400
CD  =====          =====                      - 029500
CD  1-2              08                             - 029600
CD                                                    - 029700
CD  7-12             ZONE LABEL (REPEATED ON ADDITIONAL TYPE 08 CARDS). - 029800
CD                                                    - 029900
CD  13-24            LOWER "X" BOUNDARY OF SECTION.   - 030000
CC                                                    - 030100
CD  25-36            UPPER "X" BOUNDARY OF SECTION.   - 030200
CD                                                    - 030300
CC  37-48            LOWER "Y" BOUNDARY OF SECTION.   - 030400
CD                                                    - 030500
CD  49-60            UPPER "Y" BOUNDARY OF SECTION.   - 030600
CD                                                    - 030700
CN                  AS MANY SECTIONS MAY BE SPECIFIED AS NECESSARY TO - 030800
CN                  DEFINE THE ZONE. EACH ZONE BOUNDARY MUST COINCIDE WITH - 030900
CN                  SOME MESH LINE. ZONE LABELS MUST BE NON-BLANK.      - 031000
C                                                    - 031100
C-----                                              - 031200
C-----                                              - 031300
C-----                                              - 031400
C-----                                              - 031500
CR          VARIABLE-MESH STRUCTURE (TYPE 09)        - 031600
C                                                    - 031700
CL  FORMAT----- (I2,9X,A1,3(I6,E12.5))            - 031800
C                                                    - 031900
CD  COLUMNS          CONTENTS...IMPLICATIONS, IF ANY - 032000
CD  =====          =====                      - 032100
CD  1-2              09                             - 032200
CD                                                    - 032300
CD  12              COORDINATE DIRECTION.             - 032400
CD                  X..."X" COORDINATE DIRECTION.   - 032500
CD                  Y..."Y" COORDINATE DIRECTION.   - 032600
CD                                                    - 032700
CD  13-18            NUMBER OF INTERVALS.             - 032800
CD                                                    - 032900
CD  19-30            UPPER COORDINATE.                - 033000
CD                                                    - 033100
CD  31-36            NUMBER OF INTERVALS.             - 033200
CD                                                    - 033300
CD  37-48            UPPER COORDINATE.                - 033400
CD                                                    - 033500
CD  49-54            NUMBER OF INTERVALS.             - 033600
CD                                                    - 033700
CD  55-66            UPPER COORDINATE.                - 033800
CD                                                    - 033900
CN                  "X" REPRESENTS X, R, OR, IN THE CASE OF Z-R        - 034000
CN                  GEOMETRY, Z; "Y" REPRESENTS Y, X, THETA, OR,      - 034100
CN                  IN THE CASE OF Z-R GEOMETRY, R. EACH              - 034200
CN                  NUMBER PAIR IS OF THE FORM (N(I), X(I)). THERE ARE - 034300
CN                  N(I) INTERVALS BETWEEN X(I-1) AND X(I), WHERE X(0) IS - 034400
CN                  THE LOWER REACTOR BOUNDARY IN THIS DIRECTION. NUMBER - 034500
CN                  PAIRS MUST BE GIVEN IN ORDER OF INCREASING MESH    - 034600
CN                  COORDINATES. ALL REGION BOUNDARIES MUST COINCIDE WITH - 034700
CN                  THE MESH LINES THAT BOUND MESH INTERVALS.        - 034800

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Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME ANIP

C		-	034900
C		-	035000
C		-	035100
C		-	035200
C		-	035300
CR	INTERNAL BOUNDARY OR INTERFACE CONDITIONS (TYPE 10)	-	035400
C		-	035500
CL	FORMAT-----{I2,4X,A6,5X,A1,I6,3E12.5}	-	035600
C		-	035700
CD	COLUMNS CONTENTS...IMPLICATIONS, IF ANY	-	035800
CD	=====	-	035900
CC	1-2 10	-	036000
CD		-	036100
CD	7-12 INTERNAL INTERFACE LABEL.	-	036200
CD		-	036300
CD	18 COORDINATE DIRECTION OF INTERNAL BOUNDARY OR	-	036400
CD	INTERFACE.	-	036500
CD	X..."X" COORDINATE DIRECTION.	-	036600
CD	Y..."Y" COORDINATE DIRECTION.	-	036700
CD		-	036800
CD	19-24 INTERNAL CCNDITICN	-	036900
CD	0...PHI PRIME+(A/D)*PHI=B.	-	037000
CD	1...PHI PRIME+A*PHI=B.	-	037100
CD	2...PHI(I+1)=A*PHI(I)+B*PHI PRIME(I),	-	037200
CD	PHI PRIME(I+1)=C*PHI(I)+D*PHI PRIME(I).	-	037300
CD	3...A*PHI PRIME+B*PHI=0.	-	037400
CD	4...A*PHI PRIME+B/D*PHI=0	-	037500
CD	5...A*PHI PRIME+PHI=B.	-	037600
CD	6...A*PHI PRIME+1/D*PHI=B.	-	037700
CD		-	037800
CD	25-36 "Y" COORDINATE ALONG WHICH "X"-DIRECTION INTERFACE	-	037900
CD	LIES, OR "X" COORDINATE ALONG WHICH "Y"-DIRECTION	-	038000
CD	INTERFACE LIES.	-	038100
CD		-	038200
CD	37-48 COORDINATE OF LOWER END OF INTERFACE.	-	038300
CD		-	038400
CD	49-60 COORDINATE OF UPPER END OF INTERFACE.	-	038500
CD		-	038600
CN	EACH TYPE 10 CARD ABOVE MUST BE FOLLOWED BY ONE OR	-	038700
CN	MORE TYPE 11 CARDS WHICH CONTAIN THE NECESSARY	-	038800
CN	CONSTANTS FOR THE SPATIAL INTERVAL DEFINED ABOVE. THE	-	038900
CN	INTERNAL INTERFACE LABEL IS USED ON THE TYPE 11 CARDS	-	039000
CN	TO DESIGNATE THE INTERFACE DEFINED ON THE TYPE 10 CARD	-	039100
CN	WITH THE SAME LABEL.	-	039200
C		-	039300
C		-	039400
C		-	039500
C		-	039600
C		-	039700
CR	INTERNAL-BOUNDARY OR INTERFACE-CONDITION CONSTANTS	-	039800
CR	(TYPE 11)	-	039900
C		-	040000
CL	FORMAT-----{I2,4X,A6,4E12.5,2I6}	-	040100
C		-	040200
CD	COLUMNS CONTENTS...IMPLICATIONS, IF ANY	-	040300
CD	=====	-	040400
CC	1-2 11	-	040500
CD		-	040600

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CD	7-12	INTERNAL-INTERFACE LABEL.	- 040700
CD			- 040800
CD	13-24	CONSTANTS DEFINED BELOW.	- 040900
CD			- 041000
CD	25-36	CONSTANTS DEFINED BELOW.	- 041100
CD			- 041200
CD	37-48	CONSTANTS DEFINED BELOW.	- 041300
CD			- 041400
CD	49-60	CONSTANTS DEFINED BELOW.	- 041500
CD			- 041600
CD	61-66	HIGHER-ENERGY GROUP NUMBER FOR WHICH CONSTANTS APPLY.	- 041700
CD			- 041800
CD	67-72	LOWER-ENERGY GROUP NUMBER FOR WHICH CONSTANTS APPLY.	- 041900
CD			- 042000
CN		IF COLS. 61-66 ARE BLANK, CONSTANTS APPLY TO ALL	- 042100
CN		ENERGY GROUPS.	- 042200
CN		IF COLS. 67-72 ARE BLANK, CONSTANTS APPLY TO GROUP	- 042300
CN		SPECIFIED IN COLS. 61-66.	- 042400
CN			- 042500
CN		FOR THE LOGARITHMIC BOUNDARY CONDITIONS, OPTIONS 0, 1,	- 042600
CN		3-6: $\Phi' = (A/D) * \Phi = B$, $\Phi' = A * \Phi = B$,	- 042700
CN		ETC., ONE PAIR OF CONSTANTS, A AND B, IS GIVEN FOR	- 042800
CN		EACH SIDE OF THE BOUNDARY. THE CONSTANTS A AND B GIVEN	- 042900
CN		IN COLS. 13-24 AND 25-36, RESPECTIVELY, WILL BE	- 043000
CN		APPLIED AT THE SIDE OF THE BOUNDARY ENCOUNTERED FIRST	- 043100
CN		AS THE MESH IS SWEEPED, AND THE CONSTANTS A AND B IN	- 043200
CN		COLS. 37-48 AND 49-60 WILL BE APPLIED AT THE OTHER	- 043300
CN		SIDE OF THE BOUNDARY LINE. THE MESH IS SWEEPED IN THE	- 043400
CN		DIRECTION OF INCREASING DIMENSION. D IS THE DIFFUSION	- 043500
CN		COEFFICIENT IN THE CORRESPONDING REGION; Φ' IS	- 043600
CN		THE DERIVATIVE OF THE FLUX IN THE DIRECTION OF THE	- 043700
CN		OUTWARD NORMAL TO THE BOUNDARY. FOR THE GENERAL	- 043800
CN		INTERFACE CONDITION, OPTION 2,	- 043900
CN			- 044000
CN		$\Phi(I+1) = A * \Phi(I) + B * \Phi'(I)$,	- 044100
CN		$\Phi'(I+1) = C * \Phi(I) + D * \Phi'(I)$,	- 044200
CN			- 044300
CN		THE CONSTANTS A, B, C, AND D ARE GIVEN IN COLS. 13-24,	- 044400
CN		25-36, 37-48, AND 49-60, RESPECTIVELY. THE INDICES I	- 044500
CN		AND I+1 REFER TO MESH INTERVALS ON EITHER SIDE OF	- 044600
CN		THE INTERFACE, I BEING ENCOUNTERED BEFORE I+1 AS THE	- 044700
CN		MESH IS SWEEPED; Φ' IS THE DERIVATIVE OF THE FLUX	- 044800
CN		IN THE DIRECTION OF THE MESH SWEEP.	- 044900
C			- 045000
C			- 045100
C			- 045200
C			- 045300
C			- 045400
CR		FINITE-GEOMETRY TRANSVERSE DISTANCES (TYPE 12)	- 045500
C			- 045600
CL		FORMAT----- (I2,4X,A6,4E12.5)	- 045700
C			- 045800
CD		COLUMNS CONTENTS...IMPLICATIONS, IF ANY	- 045900
CD	=====	=====	- 046000
CD	1-2	12	- 046100
CD			- 046200
CD	7-12	REGION LABEL.	- 046300
CD			- 046400

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CD	13-24	ACTUAL TRANSVERSE HALF-HEIGHT OR RADIUS.	- 046500
CD			- 046600
CD	25-36	TRANSVERSE EXTRAPOLATION DISTANCE.	- 046700
CD			- 046800
CD	37-48	ACTUAL TRANSVERSE HALF-HEIGHT IN THE SECOND DIRECTION	- 046900
CD		FOR A FINITE ONE-DIMENSIONAL RECTANGULAR SLAB.	- 047000
CD			- 047100
CD	49-60	TRANSVERSE EXTRAPOLATION DISTANCE IN THE SECOND	- 047200
CD		DIRECTION FOR A FINITE ONE-DIMENSIONAL RECTANGULAR	- 047300
CD		SLAB.	- 047400
CD			- 047500
CN		IF COLS. 7-12 ARE BLANK, THE DATA IN COLS 13-60 APPLY	- 047600
CN		TO ALL REGIONS OF THE REACTOR.	- 047700
CN			- 047800
CN		IF COLS. 13-24 AND/OR 37-48 ARE BLANK, THE REACTOR IS	- 047900
CN		ASSUMED TO BE INFINITE IN THE CORRESPONDING TRANSVERSE	- 048000
CN		DIRECTION.	- 048100
C			- 048200
C			- 048300
			048400
			048500
C			048600
CR		MATERIAL SPECIFICATIONS (TYPE 13)	- 048700
C			- 048800
CL		FORMAT----- (I2,10X,A6,3(A6,E12.5))	- 048900
C			- 049000
CD		COLUMNS CONTENTS...IMPLICATIONS, IF ANY	- 049100
CD	=====	=====	- 049200
CD	1-2	13	- 049300
CD			- 049400
CD	13-18	MATERIAL LABEL (REPEATED ON ADDITIONAL TYPE 13 CARDS).	- 049500
CD			- 049600
CD	19-24	ISOTCPE LABEL.	- 049700
CD			- 049800
CD	25-36	ISOTCPE ATOM DENSITY (ATOMS/CC * 1.E-24).	- 049900
CD			- 050000
CD	37-42	ISOTCPE LABEL.	- 050100
CD			- 050200
CD	43-54	ISOTCPE ATOM DENSITY (ATOMS/CC * 1.E-24).	- 050300
CD			- 050400
CD	55-60	ISOTCPE LABEL.	- 050500
CD			- 050600
CD	61-72	ISOTCPE ATOM DENSITY (ATOMS/CC * 1.E-24).	- 050700
CD			- 050800
CN		MATERIAL LABELS MUST BE NON-BLANK.	- 050900
C			- 051000
C			- 051100
			051200
			051300
C			051400
CR		COMPOSITION SPECIFICATIONS (TYPE 14)	- 051500
C			- 051600
CL		FORMAT----- (I2,10X,A6,3(A6,E12.5))	- 051700
C			- 051800
CD		COLUMNS CONTENTS...IMPLICATIONS, IF ANY	- 051900
CD	=====	=====	- 052000
CD	1-2	14	- 052100
CD			- 052200

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CD	13-18	COMPOSITION LABEL (REPEATED ON ADDITIONAL TYPE 14 CARDS).	- 052300
CD			- 052400
CC			- 052500
CD	19-24	MATERIAL LABEL.	- 052600
CD			- 052700
CD	25-36	MATERIAL VOLUME FRACTION.	- 052800
CD			- 052900
CD	37-42	MATERIAL LABEL.	- 053000
CC			- 053100
CD	43-54	MATERIAL VOLUME FRACTION.	- 053200
CC			- 053300
CD	55-60	MATERIAL LABEL.	- 053400
CD			- 053500
CD	61-72	MATERIAL VOLUME FRACTION.	- 053600
CC			- 053700
CA		COMPOSITION LABELS MUST BE NON-BLANK.	- 053800
CN		IF CARD TYPE 13 IS NOT GIVEN, "MATERIAL" ON CARD TYPE	- 053900
CN		14 CORRESPONDS TO ISOTOPE, AND "VOLUME FRACTION"	- 054000
CN		CORRESPONDS TO ATOM DENSITY.	- 054100
C			- 054200
C			054300
			054400
			054500
C			054600
CR		COMPOSITION AND REGION ASSIGNMENTS (TYPE 15)	- 054700
C			- 054800
CL	FORMAT----- (I2,4X,11A6)		- 054900
C			- 055000
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 055100
CD	=====	=====	055200
CC	1-2	15	- 055300
CC			- 055400
CD	7-12	COMPOSITION LABEL (REPEATED ON ADDITIONAL TYPE 15 CARDS).	- 055500
CD			- 055600
CD			- 055700
CD	13-18	REGION LABEL OF REGION CONTAINING SPECIFIED COMPOSITION.	- 055800
CD			- 055900
CC			- 056000
CD	19-24	REGION LABEL OF REGION CONTAINING SPECIFIED COMPOSITION.	- 056100
CD			- 056200
CD			- 056300
CD	25-30	REGION LABEL OF REGION CONTAINING SPECIFIED COMPOSITION.	- 056400
CD			- 056500
CC			- 056600
CD	31-36	REGION LABEL OF REGION CONTAINING SPECIFIED COMPOSITION.	- 056700
CD			- 056800
CD			- 056900
CD	37-42	REGION LABEL OF REGION CONTAINING SPECIFIED COMPOSITION.	- 057000
CD			- 057100
CC			- 057200
CC	43-48	REGION LABEL OF REGION CONTAINING SPECIFIED COMPOSITION.	- 057300
CD			- 057400
CC			- 057500
CD	49-54	REGION LABEL OF REGION CONTAINING SPECIFIED COMPOSITION.	- 057600
CD			- 057700
CD			- 057800
CD	55-60	REGION LABEL OF REGION CONTAINING SPECIFIED COMPOSITION.	- 057900
CD			- 058000

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CD			- 058100
CD	61-66	REGION LABEL OF REGION CONTAINING SPECIFIED	- 058200
CD		COMPOSITION.	- 058300
CD			- 058400
CD	67-72	REGION LABEL OF REGION CONTAINING SPECIFIED	- 058500
CD		COMPOSITION.	- 058600
C			- 058700
C	-----		058800
			058900
			059000
C	-----		059100
CR	INITIAL FISSION SOURCE OR FLUX SPECIFICATIONS (TYPE 16)		- 059200
C			- 059300
CL	FORMAT-----(I2,10X,2I6,E12.5,2I6,E12.5)		- 059400
C			- 059500
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 059600
CD	=====	=====	059700
CD	1-2	16	- 059800
CD			- 059900
CD	13-18	TYPE OF QUANTITY BEING SPECIFIED FOR REAL PROBLEM.	- 060000
CD		0...FISSION SOURCE.	- 060100
CD		1...FLUX.	- 060200
CD			- 060300
CD	19-24	SPECTRUM DISTRIBUTION FOR REAL PROBLEM.	- 060400
CD		0...USE SPECIFIED QUANTITIES AS GIVEN.	- 060500
CD		1...DISTRIBUTE SPECIFIED QUANTITIES INTO THE ENERGY	- 060600
CD		GROUPS USING FISSION-SPECTRUM WEIGHTING AT EACH	- 060700
CD		MESH INTERVAL.	- 060800
CD			- 060900
CD	25-36	BASE VALUE FOR REAL PROBLEM.	- 061000
CD			- 061100
CD	37-42	TYPE OF QUANTITY BEING SPECIFIED FOR ADJOINT PROBLEM.	- 061200
CD		0...FISSION SOURCE.	- 061300
CD		1...FLUX.	- 061400
CD			- 061500
CD	43-48	SPECTRUM DISTRIBUTION FOR ADJOINT PROBLEM.	- 061600
CD		0...USE SPECIFIED QUANTITIES AS GIVEN.	- 061700
CD		1...DISTRIBUTE SPECIFIED QUANTITIES INTO ENERGY GROUPS	- 061800
CD		J USING (NU SIGMA FISSION) SUB J / SUMMATION OVER	- 061900
CD		J OF (NU SIGMA FISSION) SUB J FOR WEIGHTING AT	- 062000
CD		EACH MESH INTERVAL.	- 062100
CD			- 062200
CD	49-60	BASE VALUE FOR ADJOINT PROBLEM.	- 062300
CD			- 062400
CN	IF NO CARD TYPE 16 IS GIVEN, INITIAL REAL AND/OR		- 062500
CN	ADJOINT FLUX VALUES OF 1.0 WILL BE ASSUMED FOR ALL		- 062600
CN	ENERGY GROUPS AND FOR ALL MESH INTERVALS ACCORDING TO		- 062700
CN	THE PROBLEM TYPE GIVEN IN COLS. 19-24 ON CARD TYPE 03.		- 062800
CN			- 062900
CN	CARD TYPE 16 MUST BE USED IF CARD TYPES 17 AND/OR 18		- 063000
CN	ARE USED. THE BASE VALUES GIVEN IN COLS. 25-36 AND		- 063100
CN	49-60 WILL BE MODIFIED ACCORDING TO COLS. 19-24 AND		- 063200
CN	43-48 AND ASSIGNED TO EACH MESH INTERVAL IN THE		- 063300
CN	PROBLEM. QUANTITIES GIVEN ON CARD TYPES 17 AND/OR 18		- 063400
CN	WILL OVERRIDE THIS ORIGINAL ARRAY. COLUMNS 19-24 AND		- 063500
CN	43-48 ALSO INFLUENCE THE DATA FROM CARD TYPES 17 AND		- 063600
CN	18 EXCEPT FOR THE DATA ON CARD TYPES 17 OR 18 THAT ARE		- 063700
CN	GIVEN SPECIFICALLY AS A FUNCTION OF ENERGY GROUPS.		- 063800

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME ANIP		
C		069700
		069800
		069900
C		070000
CR	MESH-DISTRIBUTED INITIAL FISSION SOURCE OR FLUX DATA	- 070100
CR	(TYPE 18)	- 070200
C		- 070300
CL	FORMAT----- (I2,4X,3I6,4E12.5)	- 070400
C		- 070500
CD	COLUMNS CONTENTS...IMPLICATIONS, IF ANY	- 070600
CD	=====	- 070700
CD	1-2 18	- 070800
CC		- 070900
CD	7-12 TYPE OF PROBLEM FOR WHICH DATA ARE GIVEN.	- 071000
CD	0...QUANTITIES SPECIFIED APPLY TO BOTH REAL AND	- 071100
CD	ADJOINT PROBLEMS.	- 071200
CD	1...QUANTITIES SPECIFIED APPLY TO REAL PROBLEMS ONLY.	- 071300
CD	2...QUANTITIES SPECIFIED APPLY TO ADJOINT PROBLEMS	- 071400
CC	ONLY.	- 071500
CD		- 071600
CC	13-18 ENERGY GROUP NUMBER TO WHICH QUANTITIES SPECIFIED	- 071700
CD	APPLY (REPEATED ON ADDITIONAL TYPE 18 CARDS).	- 071800
CC		- 071900
CD	19-24 CARD NUMBER.	- 072000
CC		- 072100
CD	25-36 INITIAL FISSION SOURCE OR FLUX DATA BY MESH INTERVALS,	- 072200
CD	IN CRDER OF INCREASING "X" DIRECTION.	- 072300
CC		- 072400
CD	37-48 INITIAL FISSION SOURCE OR FLUX DATA BY MESH INTERVALS,	- 072500
CD	IN CRDER OF INCREASING "X" DIRECTION.	- 072600
CC		- 072700
CD	49-60 INITIAL FISSION SOURCE OR FLUX DATA BY MESH INTERVALS,	- 072800
CD	IN CRDER OF INCREASING "X" DIRECTION.	- 072900
CC		- 073000
CD	61-72 INITIAL FISSION SOURCE OR FLUX DATA BY MESH INTERVALS,	- 073100
CD	IN CRDER OF INCREASING "X" DIRECTION.	- 073200
CC		- 073300
CN	COLUMNS 7-12 ARE IGNORED UNLESS COLS. 19-24 OF CARD	- 073400
CN	TYPE 03 SPECIFY BOTH REAL AND ADJOINT PROBLEMS.	- 073500
CN		- 073600
CN	IF COLS. 13-18 ARE BLANK, THE DATA ARE ASSIGNED TO ALL	- 073700
CN	ENERGY GROUPS, AS MODIFIED BY COLS. 19-24 OR 43-48 ON	- 073800
CN	CARD TYPE 16.	- 073900
CN		- 074000
CN	THE DATA ON CARD TYPE 18 OVERRIDE INITIAL DATA ON CARD	- 074100
CN	TYPES 16 AND/OR 17. FOR EACH ENERGY GROUP OF DATA	- 074200
CN	BEING GIVEN ON CARD TYPE 18, THE ENTIRE SPACE MESH	- 074300
CN	MUST BE COVERED. THE SPACE MESH IS COVERED BY A SWEEP	- 074400
CN	IN THE DIRECTION OF INCREASING "X" VALUES. COLUMNS	- 074500
CN	19-24 OF THE FIRST CARD FOR EACH ENERGY GROUP MUST BE	- 074600
CN	1 TO INDICATE THE BEGINNING OF THE SWEEP. FOR	- 074700
CN	TWO-DIMENSIONAL GEOMETRIES, THE SWEEP PROCEEDS ACROSS	- 074800
CN	THE FIRST ROW, THEN BEGINS ON A NEW CARD, PROCEEDING	- 074900
CN	IN THE DIRECTION OF INCREASING "X" VALUES AGAIN, FOR	- 075000
CN	EACH NEW ROW. CARD NUMBERS, IN COLS. 19-24, INCREASE	- 075100
CN	CONSECUTIVELY UNTIL THE MESH SWEEP IS COMPLETED.	- 075200
C		- 075300
C		- 075400

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME ANIP

C			075500
C			075600
C			075700
CR	DISTRIBUTED ISCTROPIC INHOMOGENECUS SOURCE DATA (TYPE 19)	-	075800
C			075900
CL	FORMAT----- (I2,4X,I6,A6,3I6,3E12.5)	-	076000
C			076100
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	076200
CD	=====	=====	076300
CD	1-2	19	076400
CD			076500
CD	7-12	PORTION OF REACTOR FOR WHICH SOURCE IS GIVEN.	076600
CD		0...COLS 13-18 CONTAIN A REGION LABEL.	076700
CD		1...COLS 13-18 CCNTAIN AN AREA LABEL.	076800
CD		2...COLS 13-18 CONTAIN A ZONE LABEL.	076900
CD			077000
CD	13-18	LABEL CF REGION, AREA OR ZONE (BLANK IF DATA ARE GIVEN	077100
CD		BY MESH INTERVALS).	077200
CD			077300
CD	19-24	SPECTRUM DISTRIBUTION FOR DATA NOT GIVEN BY SPECIFIC	077400
CD		GROUP NUMBERS.	077500
CD		0...USE SPECIFIED SOURCE AS GIVEN.	077600
CD		1...DISTRIBUTE SPECIFIED SOURCE INTO THE ENERGY GROUPS	077700
CD		USING FISSION SPECTRUM WEIGHTING AT EACH MESH	077800
CD		POINT FOR A REAL PROBLEM, OR (NU SIGMA FISSION)	077900
CD		SUB J / SUMMATION OF J (NU SIGMA FISSION) SUB J	078000
CD		WEIGHTING FOR GROUP J IN AN ADJOINT PROBLEM.	078100
CD			078200
CD	25-30	HIGHER-ENERGY GROUP NUMBER.	078300
CD			078400
CD	31-36	LOWER-ENERGY GROUP NUMBER.	078500
CD			078600
CD	37-48	ISOTROPIC SOURCE VALUE IN THE SPECIFIED MESH INTERVAL	078700
CD		FOR THIS ENERGY RANGE.	078800
CD			078900
CD	49-60	LOWER "X" DIRECTION COORDINATE OF MESH INTERVAL	079000
CD		CONTAINING THIS SOURCE.	079100
CD			079200
CD	61-72	LOWER "Y" DIRECTION COORDINATE OF MESH INTERVAL	079300
CD		CONTAINING THIS SOURCE.	079400
CD			079500
CN		IF COLS. 13-18 ARE BLANK, THE DATA IN COLS. 37-48 ARE	079600
CN		PLACED IN THE ONE MESH INTERVAL REFERENCED BY COLS.	079700
CN		49-60 AND 61-72. IF COLS. 13-18 ARE NONBLANK, COLS.	079800
CN		49-72 ARE IGNORED AND THE VALUE GIVEN IN COLS. 37-48	079900
CN		IS USED EVERYWHERE IN THE REGION, AREA, OR ZONE NAMED	080000
CN		IN COLS. 13-18.	080100
CN			080200
CN		IF COLS. 25-30 ARE BLANK, THE SOURCE VALUE APPLIES TO	080300
CN		ALL ENERGY GROUPS. IF COLS. 31-36 ARE BLANK, THE	080400
CN		SOURCE VALUE APPLIES TO THE GROUP SPECIFIED IN COLS.	080500
CN		25-30.	080600
C			080700
C			080800
C			080900
C			081000
C			081100
CR	RUN-TIME CROSS SECTION MODIFIERS (TYPE 20)	-	081200

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
C			- 081300
CL	FORMAT-----	(I2,4X,A6,3I6,6X,2E12.5,2I6)	- 081400
C			- 081500
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 081600
CD	=====	=====	- 081700
CC	1-2	20	- 081800
CD			- 081900
CD	7-12	ISOTCPE LABEL.	- 082000
CC			- 082100
CD	13-18	CROSS SECTION TYPE BEING MODIFIED.	- 082200
CD		1...TRANSPORT CRSS SECTION.	- 082300
CD		2...RADIATIVE CAPTURE CROSS SECTION.	- 082400
CD		3...(N,ALPHA) CROSS SECTION.	- 082500
CD		4...(N,P) CROSS SECTION.	- 082600
CD		5...FISSION CRSS SECTION.	- 082700
CD		6...NUMBER OF FISSION NEUTRONS PER FISSION TIMES	- 082800
CD		FISSION CROSS SECTION.	- 082900
CD		7...ISCTROPIC ELASTIC SELF-SCATTERING CONSISTENT WITH	- 083000
CD		ANISOTROPIC TOTAL CROSS SECTION.	- 083100
CD		10...FISSION SPECTRUM FRACTION (CHI).	- 083200
CD		70...INELASTIC SCATTERING CRSS SECTION FOR ALL	- 083300
CD		LENDRE ORDERS.	- 083400
CD		71...INELASTIC SCATTERING CROSS SECTION FOR	- 083500
CD		ISCTROPIC SCATTERING.	- 083600
CD		72...INELASTIC SCATTERING CROSS SECTION FOR	- 083700
CD		LINEAR ANISCTROPIC SCATTERING.	- 083800
CD		80...ELASTIC SCATTERING CRSS SECTION FOR ALL	- 083900
CD		LENDRE ORDERS.	- 084000
CD		81...ELASTIC SCATTERING CROSS SECTION FOR ISOTROPIC	- 084100
CD		SCATTERING.	- 084200
CD		82...ELASTIC SCATTERING CROSS SECTION FOR LINEAR	- 084300
CD		ANISOTROPIC SCATTERING.	- 084400
CD		90...(N,2N) CROSS SECTION FOR ALL LENDRE ORDERS.	- 084500
CD		91...(N,2N) CRSS SECTION FOR ISOTROPIC SCATTERING.	- 084600
CD		92...(N,2N) CROSS SECTION FOR LINEAR ANISOTROPIC	- 084700
CD		SCATTERING.	- 084800
CD			- 084900
CD	19-24	GROUP NUMBER IF1.	- 085000
CD			- 085100
CD	25-30	GROUP NUMBER IF2 (IF2.GE.IF1).	- 085200
CC			- 085300
CD	37-48	CROSS SECTION MODIFIER CONSTANT A.	- 085400
CD			- 085500
CC	49-60	CROSS SECTION MODIFIER CONSTANT B.	- 085600
CD			- 085700
CD	61-66	GROUP NUMBER II1.	- 085800
CD			- 085900
CD	67-72	GROUP NUMBER II2 (II2.GE.II1).	- 086000
CN			- 086100
CN		IF THE CROSS SECTION TYPE NUMBER IN COLS. 13-18 IS	- 086200
CN		.LE.10, THEN COLS. 61-72 (II1, II2) ARE NEGLECTED AND	- 086300
CN		THE CROSS SECTION TYPE SIGMA INDICATED IN COLS. 13-18	- 086400
CN		WILL BE MODIFIED TO THE VALUE NEW SIGMA ACCORDING TO	- 086500
CN		THE FORMULA	- 086600
CN			- 086700
CN		NEW SIGMA(G) = B + A*SIGMA(G),	- 086800
CN		WHERE G IS THE GROUP INDEX.	- 086900
CN			- 087000

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP	
CN	COLS. 19-24: IF1 IS THE HIGHER-ENERGY GROUP NUMBER FOR	- 087100
CN	WHICH CONSTANTS APPLY.	- 087200
CN		- 087300
CN	COLS. 25-30: IF2 IS THE LOWER-ENERGY GROUP NUMBER FOR	- 087400
CN	WHICH CONSTANTS APPLY,	- 087500
CN		- 087600
CN	E.G., IF IF1 = 6, IF2 = 8,	- 087700
CN		- 087800
CN	THEN,	- 087900
CN		- 088000
CN	SIGMA FOR GROUPS 6,7,8 ARE MODIFIED USING THE	- 088100
CN	CONSTANTS A AND B.	- 088200
CN		- 088300
CN	IF COLS. 19-24 ARE BLANK, THE CONSTANTS GIVEN IN	- 088400
CN	COLS. 37-60 WILL BE APPLIED TO ALL ENERGY GROUPS.	- 088500
CN	IF COLS. 25-30 ARE BLANK, THE CONSTANTS WILL BE	- 088600
CN	APPLIED TO THE GROUP GIVEN IN COLS. 19-24.	- 088700
CN		- 088800
CN	IF THE CROSS SECTION TYPE NUMBER IN COLS. 13-18 IS	- 088900
CN	.GT.10, THEN THE SCATTERING MATRIX IS MODIFIED	- 089000
CN	ACCORDING TO THE SAME ALGORITHM,	- 089100
CN		- 089200
CN	NEW SIGMA(G TO G PRIME) = B + A*SIGMA(G TO G PRIME).	- 089300
CN		- 089400
CN	IN THIS CASE,	- 089500
CN	COLS. 19-24: IF1 IS THE HIGHER-ENERGY FINAL GROUP	- 089600
CN	NUMBER OF THE SCATTERED PARTICLES FOR WHICH CONSTANTS	- 089700
CN	APPLY.	- 089800
CN		- 089900
CN	COLS. 25-30: IF2 IS THE LOWER-ENERGY GROUP NUMBER OF	- 090000
CN	THE SCATTERED PARTICLES FOR WHICH CONSTANTS APPLY.	- 090100
CN		- 090200
CN	COLS. 61-66: I11 IS THE HIGHER-ENERGY INITIAL GROUP	- 090300
CN	NUMBER OF THE INCIDENT PARTICLES FOR WHICH CONSTANTS	- 090400
CN	APPLY.	- 090500
CN		- 090600
CN	COLS. 67-72: I12 IS THE LOWER-ENERGY INITIAL GROUP	- 090700
CN	NUMBER OF THE INCIDENT PARTICLES FOR WHICH CONSTANTS	- 090800
CN	APPLY,	- 090900
CN		- 091000
CN	E.G., IF IF1 = 3, IF2 = 5, I11 = 4, I12 = 5,	- 091100
CN		- 091200
CN	THEN,	- 091300
CN		- 091400
CN	SIGMA(4 TO 3), SIGMA(4 TO 4), SIGMA(4 TO 5),	- 091500
CN	SIGMA(5 TO 3), SIGMA(5 TO 4), SIGMA(5 TO 5)	- 091600
CN	ARE MODIFIED.	- 091700
CN		- 091800
CN	IF COLS. 61-66 ARE BLANK, THE CONSTANTS GIVEN IN COLS.	- 091900
CN	37-60 WILL BE APPLIED TO ALL GROUPS OF INCIDENT	- 092000
CN	PARTICLES. IF COLS. 67-72 ARE BLANK, THE CONSTANTS	- 092100
CN	WILL BE APPLIED TO THE GROUP GIVEN IN COLS. 61-66. IF	- 092200
CN	COLS. 19-24 ARE BLANK, THE CONSTANTS WILL BE APPLIED	- 092300
CN	FOR A SINGLE GROUP DOWNSCATTER FOR THE GROUPS AS	- 092400
CN	SPECIFIED IN COLS. 61-72,	- 092500
CN		- 092600
CN	SIGMA(I11 TO I11+1), SIGMA(I11+1 TO I11+2),..., SIGMA	- 092700
CN	(I12 TO I12+1).	- 092800

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CN			092900
CN	IF COLS. 25-30 ARE BLANK THE CONSTANTS WILL BE APPLIED	-	093000
CN	TO THE GROUP OF SCATTERED PARTICLES GIVEN IN COLS.	-	093100
CN	19-24.	-	093200
CN		-	093300
CN	IF THE FISSION SPECTRUM FRACTION CHI IS BEING	-	093400
CN	MODIFIED, X=10, THEN THE ALGORITHM USED WILL DEPEND	-	093500
CN	UPON WHETHER CHI IS A VECTOR OR MATRIX QUANTITY.	-	093600
CN	THE CHI VECTOR IS MODIFIED ACCORDING TO THE ALGORITHM	-	093700
CN		-	093800
CN	NEW CHI(G) = B + A*CHI(G),	-	093900
CN		-	094000
CN	WHERE G IS THE GROUP INDEX, B AND A ARE GIVEN BY COLS.	-	094100
CN	49-60 AND 37-48 RESPECTIVELY AND	-	094200
CN		-	094300
CN	COLS. 19-24: IF1 IS THE HIGHER-ENERGY GROUP NUMBER FOR	-	094400
CN	WHICH CONSTANTS APPLY.	-	094500
CN		-	094600
CN	COLS. 25-30: IF2 IS THE LOWER-ENERGY GROUP FOR WHICH	-	094700
CN	CONSTANTS APPLY.	-	094800
CN		-	094900
CN	IF COLS. 19-24 ARE BLANK, THE CONSTANTS GIVEN IN COLS.	-	095000
CN	37-60 WILL BE APPLIED TO ALL ENERGY GROUPS. IF COLS.	-	095100
CN	25-30 ARE BLANK, THE CONSTANTS WILL BE APPLIED TO THE	-	095200
CN	GROUP GIVEN IN COLS. 19-24.	-	095300
CN		-	095400
CN	THE CHI MATRIX IS MODIFIED ACCORDING TO THE ALGORITHM	-	095500
CN		-	095600
CN	NEW CHI(G PRIME TO G) = B + A*CHI(G PRIME TO G).	-	095700
CN		-	095800
CN	IN THIS CASE,	-	095900
CD		-	096000
CN	COLS. 19-24: IF1 IS THE HIGHER-ENERGY GROUP NUMBER OF	-	096100
CN	SOURCE NEUTRONS FOR WHICH CONSTANTS APPLY.	-	096200
CN		-	096300
CN	COLS. 25-30: IF2 IS THE LOWER-ENERGY GROUP NUMBER OF	-	096400
CN	SOURCE NEUTRONS FOR WHICH CONSTANTS APPLY.	-	096500
CN		-	096600
CN	COLS. 61-66: I11 IS THE HIGHER-ENERGY GROUP NUMBER OF	-	096700
CN	ABSORBED NEUTRONS FOR WHICH CONSTANTS APPLY.	-	096800
CN		-	096900
CN	COLS. 67-72: I12 IS THE LOWER-ENERGY GROUP NUMBER OF	-	097000
CN	ABSORBED NEUTRONS FOR WHICH CONSTANTS APPLY.	-	097100
CN		-	097200
CN	E.G., IF IF1 = 3, IF2 = 5, I11 = 4, I12 = 5,	-	097300
CN		-	097400
CN	THEN,	-	097500
CN		-	097600
CN	CHI(4 TO 3), CHI(4 TO 4), CHI(4 TO 5), CHI(5 TO 3),	-	097700
CN	CHI(5 TO 4), CHI(5 TO 5) ARE MODIFIED.	-	097800
CN		-	097900
CN	IF COLS 61-66 ARE BLANK, THE CONSTANTS GIVEN IN COLS.	-	098000
CN	37-60 WILL BE APPLIED TO ALL GROUPS OF ABSORBED	-	098100
CN	PARTICLES. IF COLS. 67-72 ARE BLANK, THE CONSTANTS	-	098200
CN	WILL BE APPLIED TO THE GROUP GIVEN IN COLS. 61-66. IF	-	098300
CN	COLS. 19-24 ARE BLANK, THE CONSTANTS WILL BE APPLIED	-	098400
CN	TO ALL GROUPS OF SOURCE NEUTRONS. IF COLS. 25-30 ARE	-	098500
CN	BLANK, THE CONSTANTS WILL BE APPLIED TO THE GROUP	-	098600

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP			
CN	GIVEN IN COLS. 19-24.	-	098700	
CN		-	098800	
CN	IN ORDER TO MODIFY THE CHI FISSION SPECTRUM FRACTION	-	098900	
CN	OF THE CROSS SECTION SET, THE ISOTOPE LABEL GIVEN IN	-	099000	
CN	COLS. 7-12 MUST READ SETCHI. THE SAME RULES AS GIVEN	-	099100	
CN	ABOVE APPLY DEPENDING UPON WHETHER THE SET CHI IS A	-	099200	
CN	VECTOR OR MATRIX.	-	099300	
CN		-	099400	
CN	IT IS NOT POSSIBLE TO MODIFY A NON-FISSIONABLE ISOTOPE	-	099500	
CN	WITH MODIFIER TYPES 5, 6 OR 10.	-	099600	
CN		-	099700	
CN	THE SCATTERING BAND WIDTH AT ANY ENERGY CANNOT BE	-	099800	
CN	MODIFIED.	-	099900	
CN		-	100000	
CN	THE TYPE 20 CARDS ARE PROCESSED SEQUENTIALLY AND	-	100100	
CN	MODIFICATIONS SPECIFIED ARE CUMULATIVE.	-	100200	
CN		-	100300	
CN	THE FISSION SPECTRUM STRUCTURE OF THE DATA SET MAY NOT	-	100400	
CN	BE MODIFIED. THUS IF A PARTICULAR ISOTOPE USES THE	-	100500	
CN	SET CHI, AN ISOTOPE CHI MAY NOT BE SPECIFIED FOR THIS	-	100600	
CN	ISOTOPE. SIMILARLY, A VECTOR MAY NOT BE EXPANDED INTO	-	100700	
CN	A MATRIX AND VICE VERSA.	-	100800	
C		-	100900	
C		-	101000	
			101100	
			101200	
C		-	101300	
C		-	101400	
CR	SEARCH MODIFIERS (TYPE 21)	-	101500	
C		-	101600	
CL	FORMAT----- (I2,10X,2I6,2E12.5)	-	101700	
C		-	101800	
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	-	101900
CD	=====	=====	-	102000
CD	1-2	21	-	102100
C			-	102200
CC	13-18	TYPE OF PRESCRIBED VARIABLE.	-	102300
CD		0...SEARCH TO OBTAIN A PRESCRIBED KEFF.	-	102400
CD		1...SEARCH TO OBTAIN A PRESCRIBED ALPHA.	-	102500
CD			-	102600
CD	19-24	MAXIMUM NUMBER OF SEARCH PASSES.	-	102700
CD			-	102800
CD	25-36	PRESCRIBED KEFF, KEFF(0) OR ALPHA, ALPHA(0).	-	102900
CD			-	103000
CD	37-48	CONVERGENCE CRITERION, EPSILON, FOR CURRENT VALUE OF	-	103100
CD		KEFF OR ALPHA:	-	103200
CD			-	103300
CD		ABSOLUTE VALUE OF ((KEFF-KEFF(0)) / KEFF(0)).LE.	-	103400
CD		EPSILON OR THE ABSOLUTE VALUE OF (ALPHA-ALPHA(0) /	-	103500
CD		ALPHA(0)).LE.EPSILON.	-	103600
CD			-	103700
CN		IF COLS. 13-18 ARE 0, A BLANK IN COLS. 25-36 IMPLIES	-	103800
CN		1.0 FOR THE PRESCRIBED KEFF.	-	103900
C			-	104000
C			-	104100
				104200
				104300
C			-	104400

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CR	SEARCH PARAMETERS (TYPE 22)	-	104500
C		-	104600
CL	FORMAT----- (I2,10X,4E12.5)	-	104700
C		-	104800
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 104900
CD	=====	=====	- 105000
CD	1-2	22	- 105100
CD			- 105200
CD	13-24	INITIAL VALUE OF X.	- 105300
CD			- 105400
CD	25-36	SECOND VALUE OF X (IGNORED IF COLS. 61-72 ARE	- 105500
CD		NON-ZERO).	- 105600
CD			- 105700
CD	37-48	LOWER BOUND FOR X.	- 105800
CD			- 105900
CD	49-60	UPPER BOUND FOR X.	- 106000
CD			- 106100
CD	61-72	DERIVATIVE OF KEFF WITH RESPECT TO X (OR ALPHA WITH	- 106200
CD		RESPECT TO X).	- 106300
CD			- 106400
CN		GENERAL SEARCH EXPRESSION:	- 106500
CN		$P(X) = P(0) + X * M,$	- 106600
CN		WHERE P IS THE QUANTITY BEING VARIED, X IS THE SEARCH	- 106700
CN		PARAMETER, AND M IS THE QUANTITY MODIFIER OBTAINED	- 106800
CN		FROM INFORMATION CONTAINED ON CARD TYPE 23, 24, 25 OR	- 106900
CN		26.	- 107000
C			- 107100
C			- 107200
C			- 107300
C			- 107400
C			- 107500
CR	COMPOSITION MODIFIERS FOR CRITICALITY SEARCH (TYPE 23)	-	107600
C		-	107700
CL	FORMAT----- (I2,4X,11A6)	-	107800
C		-	107900
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 108000
CD	=====	=====	- 108100
CD	1-2	23	- 108200
CD			- 108300
CD	7-12	COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)	- 108400
CD		TO BE USED AS THE MODIFIER M IN THE SEARCH FORMULA.	- 108500
CD			- 108600
CD	13-18	COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)	- 108700
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 108800
CD			- 108900
CD	19-24	COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)	- 109000
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 109100
CD			- 109200
CD	25-30	COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)	- 109300
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 109400
CD			- 109500
CD	31-36	COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)	- 109600
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 109700
CD			- 109800
CD	37-42	COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)	- 109900
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 110000
CD			- 110100
CD	43-48	COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)	- 110200

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 110300
CD			- 110400
CD	49-54	COMPCOSITION LABEL OF CCMPOSITION (FROM CARD TYPE 14)	- 110500
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 110600
CD			- 110700
CC	55-60	COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)	- 110800
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 110900
CD			- 111000
CD	61-66	CCMPCOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)	- 111100
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 111200
CC			- 111300
CD	67-72	COMPCOSITION LABEL CF CCMPOSITION (FROM CARD TYPE 14)	- 111400
CD		WITH WHICH MODIFIER COMPOSITION IS TO BE USED.	- 111500
CC			- 111600
CN		IN THE SEARCH FORMULA $P(X) = P(0) + X * M$, $P(X)$, $P(0)$,	- 111700
CN		AND M ARE MACROSCOPIC CROSS SECTIONS. $P(0)$ AND M ARE	- 111800
CN		OBTAINED FROM THE DATA ON CARD TYPE 14, WITH CARD TYPE	- 111900
CN		23 SELECTING THOSE COMPOSITIONS ON CARD TYPE 14 TO BE	- 112000
CN		USED IN PRODUCING THE M.	- 112100
C			- 112200
C			- 112300
			- 112400
			- 112500
C			- 112600
CR		MESH MODIFIERS FOR CRITICALITY SEARCH (TYPE 24)	- 112700
C			- 112800
CL	FORMAT----	(I2,9X,A1,3E12.5)	- 112900
C			- 113000
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 113100
CD	=====	=====	- 113200
CC	1-2	24	- 113300
CD			- 113400
CD	12	COORDINATE DIRECTION.	- 113500
CC		X..."X" COORDINATE DIRECTION.	- 113600
CD		Y..."Y" COORDINATE DIRECTION.	- 113700
CC			- 113800
CD	13-24	LOWER COORDINATE.	- 113900
CD			- 114000
CD	25-36	UPPER COORDINATE.	- 114100
CD			- 114200
CD	37-48	MESH MODIFIER, M, FOR EACH MESH INTERVAL BETWEEN	- 114300
CD		THE ABOVE COORDINATES.	- 114400
CD			- 114500
CN		IN THE SEARCH FORMULA, $P(X)$ IS THE RESULTING MESH	- 114600
CN		INTERVAL, $P(0)$ IS THE INITIAL MESH INTERVAL, AND	- 114700
CN		M IS THE MESH INTERVAL MODIFIER.	- 114800
C			- 114900
C			- 115000
			- 115100
			- 115200
C			- 115300
CR		BUCKLING MODIFIERS FOR CRITICALITY SEARCH (TYPE 25)	- 115400
C			- 115500
CL	FORMAT----	(I2,4X,A6,2E12.5)	- 115600
C			- 115700
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 115800
CD	=====	=====	- 115900
CD	1-2	25	- 116000

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME ANIP			
CD			- 116100
CD	7-12	REGION LABEL.	- 116200
CD			- 116300
CD	13-24	BUCKLING MODIFIER, M, IN FIRST TRANVERSE DIRECTION.	- 116400
CD			- 116500
CD	25-36	BUCKLING MODIFIER, M, IN SECND TRANVERSE DIRECTION.	- 116600
CD			- 116700
CN		IN THE SEARCH FORMULA, P(X) IS THE RESULTING BUCKLING,	- 116800
CN		P(0) IS THE INITIAL BUCKLING, AND M IS THE	- 116900
CN		BUCKLING MODIFIER. P(0) WILL BE EVALUATED FROM	- 117000
CN		THE TRANSVERSE HEIGHTS GIVEN ON CARD TYPE 12.	- 117100
CN			- 117200
CN		IF COLS. 7-12 ARE BLANK, THE DATA IN COLS. 13-36 APPLY	- 117300
CN		TO ALL REGIONS OF THE REACTOR.	- 117400
C			- 117500
C			- 117600
C			- 117700
C			- 117800
C			- 117900
CR		ALPHA MODIFIER FOR CRITICALITY SEARCH (TYPE 26)	- 118000
C			- 118100
CL	FORMAT----	(I2,I0X,E12.5)	- 118200
C			- 118300
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 118400
CD	=====	=====	- 118500
CC	1-2	26	- 118600
CD			- 118700
CD	13-24	ALPHA MODIFIER, M.	- 118800
CC			- 118900
CN		IN THE SEARCH FORMULA, P(X) IS THE RESULTING ALPHA,	- 119000
CN		P(0) IS THE INITITAL ALPHA, AND M IS THE ALPHA	- 119100
CN		MODIFIER. P(0) IS OBTAINED FROM COLS.	- 119200
CN		60-72 OF CARD TYPE 03.	- 119300
C			- 119400
C			- 119500
C			- 119600
C			- 119700
C			- 119800
CR		INHOMOGENEOUS SURFACE SOURCE SPECTRUM SPECIFICATION	- 119900
CR		(TYPE 27)	- 120000
C			- 120100
CL	FORMAT----	(I2,4X,A6,6X,2I6,3E12.5)	- 120200
C			- 120300
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 120400
CD	=====	=====	- 120500
CD	1-2	27	- 120600
CD			- 120700
CD	7-12	SURFACE SOURCE LABEL.	- 120800
CD			- 120900
CD	19-24	HIGHER ENERGY GROUP NUMBER.	- 121000
CC			- 121100
CD	25-30	LOWER ENERGY GROUP NUMBER.	- 121200
CD			- 121300
CD	37-48	ISOTROPIC COMPONENT OF SURFACE SOURCE.	- 121400
CD			- 121500
CD	49-60	ANISOTROPIC "X" DIRECTION COMPONENT OF SURFACE SOURCE.	- 121600
CD			- 121700
CD	61-72	ANISOTROPIC "Y" DIRECTION COMPONENT OF SURFACE SOURCE.	- 121800

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CD			- 121900
CN	CARD TYPE 27 IS PERTINENT ONLY FOR TRANSPORT		- 122000
CN	THEORY CALCULATIONS.		- 122100
CN			- 122200
CN	THE SURFACE SOURCE IS ASSUMED TO BE REPRESENTABLE BY		- 122300
CN	A LEGENDRE EXPANSION FOR SPHERICAL AND SLAB		- 122400
CN	GEOMETRY AND BY A SURFACE HARMONIC EXPANSION FOR		- 122500
CN	ALL OTHER GEOMETRIES. IN EACH CASE, THE		- 122600
CN	EXPANSION IS TRUNCATED AFTER THE FIRST ORDER TERMS.		- 122700
CN	FOR SPHERICAL AND SLAB GEOMETRY THE SURFACE SOURCE IS		- 122800
CN	TAKEN TO BE $S_0 + 3\mu S_1$ AND FOR ALL OTHER CASES		- 122900
CN	$S_0 + 3\mu S_1 + 3\eta S_2$, WHERE S_0 , S_1 , AND S_2 ARE GIVEN		- 123000
CN	RESPECTIVELY IN COLS. 37-48, 49-60, AND 61-72. μ AND		- 123100
CN	η ARE RESPECTIVELY THE DIRECTION COSINES IN THE		- 123200
CN	"X" AND "Y" DIRECTIONS OF THE DISCRETE ANGLE BEING		- 123300
CN	CONSIDERED.		- 123400
CN			- 123500
CN	IF COLS. 7-12 ARE BLANK, THE DATA ON THIS CARD WILL BE		- 123600
CN	APPLIED TO ALL SOURCES SPECIFIED ON TYPE 28 CARDS.		- 123700
CN			- 123800
CN	IF COLS. 19-24 ARE BLANK, THE SURFACE SOURCE VALUES		- 123900
CN	APPLY TO ALL ENERGY GROUPS. IF COLS. 25-30 ARE BLANK,		- 124000
CN	THE SURFACE SOURCE VALUES APPLY TO THE GROUP SPECIFIED		- 124100
CN	IN COLS. 19-24.		- 124200
CN			- 124300
CN	COLS. 61-72 ARE PERTINENT FOR TWO-DIMENSIONAL PROBLEMS		- 124400
CN	AND FOR ONE-DIMENSIONAL CYLINDRICAL PROBLEMS.		- 124500
CN			- 124600
CN	AS MANY TYPE 27 CARDS AS NECESSARY ARE USED.		- 124700
C			- 124800
C			- 124900
C			- 125000
C			- 125100
C			- 125200
CR	INHOMOGENEOUS SURFACE SOURCE GEOMETRY DATA (TYPE 28)		- 125300
C			- 125400
CL	FORMAT----- (I2,4X,A6,5X,A1,6X,3E12.5)		- 125500
C			- 125600
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 125700
CD	=====	=====	- 125800
CD	1-2	28	- 125900
CC			- 126000
CD	7-12	SURFACE SOURCE LABEL.	- 126100
CD			- 126200
CC	18	COORDINATE DIRECTION.	- 126300
CD		X..."X" COORDINATE DIRECTION.	- 126400
CD		Y..."Y" COORDINATE DIRECTION.	- 126500
CC			- 126600
CD	25-36	LOWER COORDINATE OF SPECIFIED COORDINATE DIRECTION.	- 126700
CD			- 126800
CD	37-48	UPPER COORDINATE OF SPECIFIED COORDINATE DIRECTION.	- 126900
CD			- 127000
CD	49-60	"Y" COORDINATE ALONG WHICH THE "X" COORDINATE	- 127100
CD		DIRECTION LIES.	- 127200
CD		"X" COORDINATE ALONG WHICH THE "Y" COORDINATE	- 127300
CD		DIRECTION LIES.	- 127400
CD		FOR ONE DIMENSIONAL PROBLEMS, "X" COORDINATE OF	- 127500
CD		THE SURFACE SOURCE.	- 127600

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP		
CD			- 127700
CN	CARD TYPE 28 IS PERTINENT ONLY FOR TRANSPORT		- 127800
CN	THEORY CALCULATIONS.		- 127900
CN			- 128000
CN	THE SURFACE SOURCE SPECIFIED BY THE CORRESPONDING		- 128100
CN	SURFACE SOURCE LABEL IN COLS. 7-12 OF CARD TYPE 27		- 128200
CN	WILL BE PLACED ON THE MESH LINE SPECIFIED.		- 128300
CN	FOR ONE-DIMENSIONAL PROBLEMS, COLS. 19-48 ARE		- 128400
CN	IRRELEVANT. IN THIS CASE COLS. 49-60 SPECIFY THE "X"		- 128500
CN	COORDINATE OF THE ONE-DIMENSIONAL SURFACE SOURCE AND		- 128600
CN	COL. 18 SHOULD CONTAIN Y. FOR TWO-DIMENSIONAL		- 128700
CN	PROBLEMS ALL COLUMNS ARE RELEVANT. THE COORDINATE		- 128800
CN	SPECIFIED MUST COINCIDE WITH A MESH LINE THAT BOUNDS		- 128900
CN	A MESH INTERVAL.		- 129000
CN			- 129100
CN	FOR TWO-DIMENSIONAL PROBLEMS, IF COLS. 25-36 ARE		- 129200
CN	BLANK, THE SPECIFIED SURFACE SOURCE IS PLACED ALONG		- 129300
CN	THE ENTIRE MESH LINE AS SPECIFIED IN COLS. 49-60. IF		- 129400
CN	COLS. 37-48 ARE BLANK, THE SURFACE SOURCE IS PLACED		- 129500
CN	ALONG THE SINGLE MESH INTERVAL LENGTH FOR WHICH COLS.		- 129600
CN	25-36 SPECIFY THE LOWER DIMENSION.		- 129700
CN			- 129800
CN	IF COLS. 49-60 ARE BLANK, THE SURFACE SOURCE IS PLACED		- 129900
CN	ALONG THE HIGHEST "X" OR "Y" COORDINATE OF THE SYSTEM		- 130000
CN	FOR TWO-DIMENSIONAL PROBLEMS OR AT THE HIGHEST		- 130100
CN	COORDINATE FOR ONE-DIMENSIONAL PROBLEMS.		- 130200
CN			- 130300
CN	AS MANY TYPE 28 CARDS AS NECESSARY ARE USED.		- 130400
C			- 130500
C			- 130600
C			- 130700
C			- 130800
C			- 130900
CR	ENERGY CONVERSION FACTOR DATA (TYPE 32)		- 131000
C			- 131100
CL	FORMAT----(I2,10X,3(A6,E12.5))		- 131200
C			- 131300
CD	COLUMNS	CONTENTS...IMPLICATIONS, IF ANY	- 131400
CD	=====	=====	- 131500
CC	1-2	32	- 131600
CC			- 131700
CD	13-18	REGION LABEL.	- 131800
CC			- 131900
CC	19-30	ENERGY CONVERSION FACTOR FOR THIS REGION	- 132000
CD		(FISSIONS/WATT-SEC.).	- 132100
CC			- 132200
CC	31-36	REGION LABEL.	- 132300
CD			- 132400
CC	37-48	ENERGY CONVERSION FACTOR FOR THIS REGION	- 132500
CD		(FISSIONS/WATT-SEC.).	- 132600
CC			- 132700
CC	49-54	REGION LABEL.	- 132800
CD			- 132900
CC	55-66	ENERGY CONVERSION FACTOR FOR THIS REGION	- 133000
CD		(FISSIONS/WATT-SEC.).	- 133100
CC			- 133200
CN	IF NO TYPE 32 CARDS ARE GIVEN, A DEFAULT VALUE OF		- 133300
CN	3.1 * 1.0E+10 FISSIONS/WATT-SEC. IS USED IN ALL		- 133400

Fig. 10. Input Data Set A.NIP (Contd.)

MEMBER NAME	ANIP	
CN	REGIONS.	- 133500
CN		- 133600
CN	IF THE FIRST REGION LABEL ON THE FIRST TYPE 32 CARD	- 133700
CN	IS BLANK, THE ASSOCIATED CONVERSION FACTOR WILL BE	- 133800
CN	ENTERED FOR ALL REGIONS. ENTRY OF A REGION LABEL	- 133900
CN	CORRESPONDING TO A LABEL ON THE TYPE 06 CARD CAUSES	- 134000
CN	THE ASSOCIATED CONVERSION FACTOR TO REPLACE THE	- 134100
CN	DEFAULT (OR INITIAL) CONVERSION FACTOR IN THE GIVEN	- 134200
CN	REGION ONLY.	- 134300
C		- 134400
C		134500
		134600
CEOF		134700

Fig. 10. Input Data Set A.NIP (Contd.)

```

MEMBER NAME  ASTP004
C*****
C                                                     - 000100
C                                                     - 000200
C               PREPARED 8/01/72 AT ANL                - 000300
C                                                     - 000400
CF           A.STP004                                  - 000500
CE           FUEL CYCLE STANDARD PATH BCD INPUT        - 000600
C                                                     - 000700
CN               THIS IS A USER SUPPLIED BCD DATA SET. THE - 000800
CN               LIST FOR EACH RECORD IS GIVEN IN TERMS OF THE - 000900
CN               BCD FORMAT OF THE DATA CARD. COLUMNS 1-2    - 001000
CN               NORMALLY CONTAIN THE CARD TYPE NUMBER.       - 001100
CN               CARD TYPE 01 IS REQUIRED.                  - 001200
C                                                     - 001300
C*****
C                                                     001400
C                                                     001500
C                                                     001600
C-----
C                                                     001700
CR           GENERAL PROBLEM SPECIFICATIONS              - 001800
C                                                     - 001900
CL           FORMAT----- (I2,4X,4I6)                  - 002000
C                                                     - 002100
CD           COLUMNS           CONTENTS...IMPLICATIONS, IF ANY - 002200
CD           =====
CC           1-2           01
CD                                                     - 002400
CD                                                     - 002500
CD                                                     - 002600
CD                                                     - 002700
CD                                                     - 002800
CD                                                     - 002900
CD                                                     - 003000
CD                                                     - 003100
CD           19-24           0...NO CRITICALITY SEARCH      - 003200
CD                           1...DO CRITICALITY SEARCH      - 003300
CD                                                     - 003400
CD           25-30           0...EQUILIBRIUM PROBLEM        - 003500
CD                           1...NONEQUILIBRIUM PROBLEM     - 003600
C-----
C                                                     003700
CECF                                                003800
                                                003900

```

Fig. 11. Input Data Set A.STP004

APPENDIX 2. MULTIGROUP CROSS SECTIONS

This Appendix lists the multigroup cross sections used for sample problem 1 and 2.

EDIT OF XS.ISO(XS.ISO2) DATA SET

NO. OF GROUPS = 2

NO. OF ISOTOPES = 12

ISONME

MO	TA181	NA23	PU242	016	PU241	U235	SS	LFPPS	U238
PU239	PU240								

LOCA

0	12	24	36	48	60	72	84	96	108
120	132	144							

SET FISSION FLAG = 1

ENERGY

0.100000000 08	0.111090000 06	0.226033000 02
----------------	----------------	----------------

LETHARGY

0.0	0.449999970 01	0.130000000 02
-----	----------------	----------------

VELOCITY

0.830292590 09	0.167364480 09
----------------	----------------

SETCHI

0.984087500 00	0.159135630-01
----------------	----------------

APPENDIX 2. Cross Section Library

EDIT OF ISOTOPE MO

FISSION FLAG = 0
 MAX. ORDER INEL. SCAT. = 0
 MAX. ORDER ELAS. SCAT. = 0
 MAX. ORDER N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	5.737663D 00	5.085440D-02	0.0	0.0	5.421998D 00		
2	7.419084D 00	4.518371D-01	0.0	0.0	6.734145D 00		

EDIT OF SCATTERING FOR ORDER 0

TYPE	G	G--G	(G-1)--G	(G-2)--G	.....	.....
INEL	1	4.0973703C-01				
ELAS	1	5.6599598C 00				
N2N	1	2.9264393D-04				
INEL	2	0.0	2.7477271D-02			
ELAS	2	7.0174788D 00	6.6549928D-02			
N2N	2	0.0	8.2306619D-06			

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE TA181

FISSION FLAG = 0
 MAX. ORDER INEL. SCAT. = 0
 MAX. ORDER ELAS. SCAT. = 0
 MAX. ORDER N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	5.551827D 00	2.142936D-01	0.0	0.0	3.809166D 00		
2	1.C28547D 01	1.587539D 00	0.0	0.0	9.446760D 00		

EDIT OF SCATTERING FOR ORDER 0

TYPE	G	G--G	(G-1)--G	(G-2)--G	.....	.....
INEL	1	1.4662147C 00				
ELAS	1	3.8697531C 00				
N2N	1	8.7953106D-04				
INEL	2	4.5605115D-01	1.6419035D-01			
ELAS	2	9.6299374D 0C	2.5056227D-02			
N2N	2	0.0	2.1961695D-05			

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE NA23

FISSION FLAG = C
 MAX. CRDER INEL. SCAT. = 0
 MAX. CRDER ELAS. SCAT. = 0
 MAX. ORDER N2N SCAT. = C

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	3.052879D 00	8.974475D-04	0.0	0.0	2.436755D 00		
2	4.698648D 00	2.872310D-03	0.0	0.0	4.573291D 00		

EDIT OF SCATTERING FOR CRDER 0

TYPE	G	G—G	(G-1)—G	(G-2)—G	.....	.....
INEL	1	1.6935474D-01				
ELAS	1	2.8810579D 00				
N2N	1	0.0				
INEL	2	0.0	2.3930377D-03			
ELAS	2	5.5745573D 00	1.2309539D-01			
N2N	2	0.0				

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE PU242

FISSION FLAG = -1
 MAX. ORDER INEL. SCAT. = 0
 MAX. ORDER ELAS. SCAT. = 0
 MAX. ORDER N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	6.205120D 00	1.039458D-01	0.0	0.0	4.764403D 00	4.754176D-01	1.455977D 00
2	1.381387D 01	6.462001D-01	0.0	0.0	1.367019D 01	3.375514D-02	9.498561D-02

EDIT OF SCATTERING FOR ORDER 0

TYPE	G	G—G	(G-1)—G	(G-2)—G	.....	.....
INEL	1	1.0053123D 00				
ELAS	1	4.8177075D 00				
N2N	1	1.1063410D-03				
INEL	2	1.1922047D-01	1.0647789D-01			
ELAS	2	1.3869086D 01	2.7430399D-02			
N2N	2	0.0	1.4151262D-04			

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE 016

FISSION FLAG = 0
 MAX. ORDER INEL. SCAT. = 0
 MAX. ORDER ELAS. SCAT. = 0
 MAX. ORDER N2N SCAT. = 0

GRUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	2.831214D 00	1.427085D-03	0.0	0.0	2.338287D 00		
2	3.473921C 00	0.0	0.0	0.0	2.628960D 00		

EDIT OF SCATTERING FOR ORDER 0

TYPE	G	G--G	(G-1)--G	(G-2)--G	.....	.....
INEL	1	7.33656C7D-04				
ELAS	1	3.045678C 00				
N2N	1	0.0				
INEL	2	0.0				
ELAS	2	3.4739833D 00	1.8291737D-01			
N2N	2	0.0				

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE PU241

FISSION FLAG = -1
 MAX. ORDER INEL. SCAT. = 0
 MAX. ORDER ELAS. SCAT. = 0
 MAX. ORDER N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	7.051918D 00	1.480157D-01	0.0	0.0	4.564505D 00	1.745686D 00	5.364490D 00
2	1.305462D 01	8.029402D-01	0.0	0.0	9.031995D 00	3.745295D 00	1.113465D 01

EDIT OF SCATTERING FOR CRDR 0

TYPE	G	G--G	(G-1)--G	(G-2)--G	.....	.....
INEL	1	5.0077372D-01				
ELAS	1	4.6172175D 00				
N2N	1	2.7302397D-03				
INEL	2	1.3748383D-01	4.3868121D-01			
ELAS	2	9.1608875D 00	2.4400253D-02			
N2N	2	0.0	1.1744440D-03			

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE U235

FISSION FLAG = -1
 MAX. CRDER INEL. SCAT. = 0
 MAX. CRDER ELAS. SCAT. = 0
 MAX. CRDER N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	6.521512D 00	2.015453D-01	0.0	0.0	4.332191D 00	1.328925D 00	3.320060D 00
2	1.371534D 01	1.095410D 00	0.0	0.0	1.002914D 01	2.929049D 00	7.121443D 00

EDIT OF SCATTERING FOR CRDER 0

TYPE	G	G--G	(G-1)--G	(G-2)--G	.....	.....
INEL	1	8.7455674D-01				
ELAS	1	4.3817582D 00				
N2N	1	1.8201435D-03				
INEL	2	7.3597487D-02	1.1995111D-01			
ELAS	2	1.0175801D 01	2.6102609D-02			
N2N	2	0.0	2.4783879D-04			

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE SS

FISSION FLAG = 0
 MAX. ORDER INEL. SCAT. = 0
 MAX. ORDER ELAS. SCAT. = 0
 MAX. ORDER N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	2.844200D 00	7.556338D-03	0.0	0.0	2.569142D 00		
2	6.116594D 00	2.982733D-02	0.0	0.0	5.966043D 00		

EDIT OF SCATTERING FOR ORDER 0

TYPE	G	G—G	(G-1)—G	(G-2)—G	.....	.....
INEL	1	1.46150740-01				
ELAS	1	2.7316184D 00				
N2N	1	5.1212705D-06				
INEL	2	0.0	4.3374186D-03			
ELAS	2	6.3722769D 00	5.5769830D-02			
N2N	2	0.0	1.4403649D-07			

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE LFPPS

FISSION FLAG = 0
 MAX. CRDR INEL. SCAT. = 0
 MAX. CRDR ELAS. SCAT. = 0
 MAX. CRDR N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	2.0850640-01	1.5361600-01	0.0	0.0	6.3051130-02		
2	7.0580350-01	8.9470730-01	0.0	0.0	2.2005480-01		

EDIT OF SCATTERING FOR CRDR 0

TYPE	G	G—G	(G-1)—G	(G-2)—G	.....	.....
INEL	1	2.39210920-02				
ELAS	1	6.42468260-02				
N2N	1	3.03357090-05				
INEL	2	2.52768720-03	2.75745470-03			
ELAS	2	2.24292300-01	5.35480290-04			
N2N	2	0.0	3.53803090-07			

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE U238

FISSION FLAG = -1
 MAX. ORDER INEL. SCAT. = 0
 MAX. ORDER ELAS. SCAT. = 0
 MAX. ORDER N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	6.796677D 00	1.370528D-01	0.0	0.0	5.336249D 00	7.751122D-02	2.183487D-01
2	1.228997D 01	5.288488D-01	0.0	0.0	1.170773D 01	0.0	0.0

EDIT OF SCATTERING FOR ORDER 0

TYPE	G	G--G	(G-1)--G	(G-2)--G	.....	.....
INEL	1	1.4506878D 00				
ELAS	1	5.3969574D 00				
N2N	1	2.5134901D-03				
INEL	2	1.1104357D-01	1.6077638D-01			
ELAS	2	1.1892493D 01	3.0765921D-02			
N2N	2	0.0	6.3750129D-04			

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE PU240

FISSION FLAG = -1
 MAX. ORDER INEL. SCAT. = 0
 MAX. ORDER ELAS. SCAT. = 0
 MAX. ORDER N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	6.547668D 00	1.662052D-01	0.0	0.0	5.487150D 00	5.760147D-01	1.770696D 00
2	1.372732D 01	7.919925D-01	0.0	0.0	1.294440D 01	9.252325D-02	2.660275D-01

EDIT OF SCATTERING FOR ORDER 0

TYPE	G	G—G	(G-1)—G	(G-2)—G	.....	.....
INEL	1	9.4752511D-01				
ELAS	1	5.5488794D 00				
N2N	1	9.4877454D-04				
INEL	2	6.5368450D-02	1.1001654D-01			
ELAS	2	1.3132049D 01	3.1799381D-02			
N2N	2	0.0	1.1545434D-04			

APPENDIX 2. Cross Section Library (Contd.)

EDIT OF ISOTOPE PU239

FISSION FLAG = -1
 MAX. CRDER INEL. SCAT. = 0
 MAX. CRDER ELAS. SCAT. = 0
 MAX. CRDER N2N SCAT. = 0

GROUP	TRANSPORT	N-GAMMA	N-ALPHA	N-P	ANISO	FISSION	NU-FISSION
1	6.889654D 00	1.249643D-01	0.0	0.0	4.848394D 00	1.611547D 00	4.809516D 00
2	1.379603D 01	8.193650D-01	0.0	0.0	1.093398D 01	2.114696D 00	6.077783D 00

EDIT OF SCATTERING FOR CRDER 0

TYPE	G	G--G	(G-1)--G	(G-2)--G	.....	.....
INEL	1	6.1427558D-01				
ELAS	1	4.9036673D 00				
N2N	1	4.2728051D-C4				
INEL	2	1.9078327D-01	3.5634423D-02			
ELAS	2	1.1091597D 01	2.7547547D-02			
N2N	2	0.0	7.7304518D-06			

APPENDIX 2. Cross Section Library (Contd.)

APPENDIX 3. SAMPLE OUTPUT

This Appendix lists selected pages from the output of sample problem 1 and 2 as presented in Section III.

BEGINNING OF PRELIMINARY SEARCH PROCEDURE

SAMPB1

THE MAXIMUM NUMBER OF ITERATIONS AT EACH TIME NODE IS 1

THE MAXIMUM NUMBER OF CYCLIC MODE ITERATIONS IS 1

THE NUMBER OF SUBINTERVALS IN THE OPERATION INTERVAL IS 1

NO EXTERNAL CYCLE ITERATIONS ARE DONE

NO CONTROL DENSITY SEARCHES ARE DONE

THE BURN STEP TIME IS 1.350000 02

THE ENRICHMENT MODIFICATION FACTOR IS 1.000000 00

TIME NODE 0 DIFFUSION THEORY NEUTRONICS SOLUTION AT 0.0 DAYS.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE FCC001

DATA SET NAME	DATA SET REFERENCE NUMBER
------------------	------------------------------

BRN	31
	6

THE TIME FOR THE FUEL CYCLE COMPUTATION IS 0.96 MINUTES.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NJC007

DATA SET NAME	DATA SET REFERENCE NUMBER
------------------	------------------------------

	6
--	---

*****MODULE NUC005*****

CORE STORAGE ALLOCATED FOR COMMON ARRAYS 21000
BULK (LCS) STORAGE ALLOCATED FOR COMMON ARRAYS 0

TIME FOR D2DIN= 0.06 MINUTES

MAXIMUM SCATTERING BAND = 2

FIRST DIMENSION OF FINITE DIFFERENCE CO-EFFTS. ARRAY= 42

STORAGE REQUIRED FOR MAXIMUM SCATTERING BAND WIDTH OF FLUXES AT EACH MESH POINT = 420

FULL SIZE OF FINITE DIFFERENCE CO-EFFTS. ARRAY = 1260

LENGTH OF CORE CONTAINER ARRAY = 21000

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 3747

FDC WILL BE HELD IN CORE DURING OUTER ITERATIONS

SCATTERING BAND FLUXES WILL BE HELD IN CORE

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 4797

FIRST UNUSED LOCATION IN BULK CONTAINER ARRAY = 0

FLUX NORMALIZATION FOR ERROR TERMS= 2.1000000D-02

FLUX GUESS READ FROM DATA SET REFERENCE NUMBER 91

NTH ITERATION WILL NOW BE DATA SET REFERENCE NUMBER 92

VALUE OF SMALL FLUXES= 1.0000000D-02

FLUX PUT OUT ON DATA SET REFERENCE NUMBER 45
AT OUTER ITERATION NUMBER 3

OUTER ITERATION NUMBER = 13 K-EFFECTIVE = 1.05662261

TIME FOR D2DCAL = 0.65 MINUTES

TIME FOR D2DOUT = 0.03 MINUTES

*****LEAVE MODULE NUC005*****

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC005

DATA SET NAME	DATA SET REFERENCE NUMBER
------------------	------------------------------

6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION IS 0.76 MINUTES.

TIME NODE 0 DIFFUSION THEORY NEUTRONICS SOLUTION AT 0.0 DAYS.

*****MODULE NUC005*****

CORE STORAGE ALLOCATED FOR COMMON ARRAYS 21000

BULK (LCS) STORAGE ALLOCATED FOR COMMON ARRAYS 0

TIME FOR D2DIN= 0.06 MINUTES

MAXIMUM SCATTERING BAND = 2

FIRST DIMENSION OF FINITE DIFFERENCE CO-EFFTS. ARRAY= 42

STORAGE REQUIRED FOR MAXIMUM SCATTERING BAND WIDTH OF FLUXES AT EACH MESH POINT = 420

FULL SIZE OF FINITE DIFFERENCE CO-EFFTS. ARRAY = 1260

LENGTH OF CORE CONTAINER ARRAY = 21000

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 3747

FDC WILL BE HELD IN CORE DURING OUTER ITERATIONS

SCATTERING BAND FLUXES WILL BE HELD IN CORE

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 4797

FIRST UNUSED LOCATION IN BULK CONTAINER ARRAY = 0

FLUX NORMALIZATION FOR ERROR TERMS= 3.4976066D-03

FLUX GUESS READ FROM DATA SET REFERENCE NUMBER 91

NTH ITERATION WILL NOW BE DATA SET REFERENCE NUMBER 92

VALUE OF SMALL FLUXES= 2.7557821D-07

FLUX PUT OUT ON DATA SET REFERENCE NUMBER 45

AT OUTER ITERATION NUMBER 3

OUTER ITERATION NUMBER = 6 K-EFFECTIVE = 1.03076689

TIME FOR D2DCAL = 0.28 MINUTES

TIME FOR D2DOUT = 0.03 MINUTES

*****LEAVE MODULE NUC005*****

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC005

DATA SET NAME	DATA SET REFERENCE NUMBER
------------------	------------------------------

6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION IS 0.38 MINUTES.

TIME NODE 1 DIFFUSION THEORY NEUTRONICS SOLUTION AT 1.35000D 02 DAYS.

*****MODULE NUC005*****

CORE STORAGE ALLOCATED FOR COMMON ARRAYS 21000
BULK (LCS) STORAGE ALLOCATED FOR COMMON ARRAYS 0

TIME FOR D2DIN= 0.06 MINUTES

MAXIMUM SCATTERING BAND = 2

FIRST DIMENSION OF FINITE DIFFERENCE CO-EFFTS. ARRAY= 42

STORAGE REQUIRED FOR MAXIMUM SCATTERING BAND WIDTH OF FLUXES AT EACH MESH POINT = 420

FULL SIZE OF FINITE DIFFERENCE CO-EFFTS. ARRAY = 1260

LENGTH OF CORE CONTAINER ARRAY = 21000

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 3747

FDC WILL BE HELD IN CORE DURING OUTER ITERATIONS

SCATTERING BAND FLUXES WILL BE HELD IN CORE

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 4797

FIRST UNUSED LOCATION IN BULK CONTAINER ARRAY = 0

FLUX NORMALIZATION FOR ERROR TERMS= 3.5979571D-03

FLUX GUESS READ FROM DATA SET REFERENCE NUMBER 91

NTH ITERATION WILL NOW BE DATA SET REFERENCE NUMBER 92

VALUE OF SMALL FLUXES= 2.7878218D-07

FLUX PUT OUT ON DATA SET REFERENCE NUMBER 61
AT OUTER ITERATION NUMBER 3

OUTER ITERATION NUMBER = 5 K-EFFECTIVE = 1.01668402

TIME FOR D2DCAL = 0.26 MINUTES

TIME FOR D2DOUT = 0.03 MINUTES

*****LEAVE MODULE NUC005*****

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC005

DATA SET NAME	DATA SET REFERENCE NUMBER
------------------	------------------------------

6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION IS 0.36 MINUTES.

BURNUP CALCULATION TO OBTAIN CONVERGENCE TO THE SPECIFIED BURNUP CONSTRAINTS

PATH OR TEST GROUP	BURNUP LIMIT	BURNUP VALUE
CORE	7.50000D-02	7.23284D-02

THE MINIMUM BURNUP OF 7.23284D-02 OCCURS IN CORE

BURNUP CALCULATION TO OBTAIN CONVERGENCE TO THE SPECIFIED BURNUP CONSTRAINTS

PATH OR TEST GROUP	BURNUP LIMIT	BURNUP VALUE
CORE	7.50000D-02	7.49947D-02

THE MINIMUM BURNUP OF 7.49947D-02 OCCURS IN CORE

THE BURN STEP TIME IS 1.40268D 02

THE ENRICHMENT MODIFICATION FACTOR IS 1.05000D 00

TIME NODE 0 DIFFUSION THEORY NEUTRONICS SOLUTION AT 0.0 DAYS.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE FCC001

DATA SET NAME	DATA SET REFERENCE NUMBER
BRN	31 6

THE TIME FOR THE FUEL CYCLE COMPUTATION IS 2.00 MINUTES.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC007

DATA SET NAME	DATA SET REFERENCE NUMBER
	6

*****MODULE NUC005*****

CORE STORAGE ALLOCATED FOR COMMON ARRAYS 21000

BULK (LCS) STORAGE ALLOCATED FOR COMMON ARRAYS 0

TIME FOR D2DIN= 0.06 MINUTES

MAXIMUM SCATTERING BAND = 2

FIRST DIMENSION OF FINITE DIFFERENCE CO-EFFTS. ARRAY= 42

STORAGE REQUIRED FOR MAXIMUM SCATTERING BAND WIDTH OF FLUXES AT EACH MESH POINT = 420

FULL SIZE OF FINITE DIFFERENCE CO-EFFTS. ARRAY = 1260

LENGTH OF CORE CONTAINER ARRAY = 21000

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 3747

FDC WILL BE HELD IN CORE DURING OUTER ITERATIONS

SCATTERING BAND FLUXES WILL BE HELD IN CORE

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 4797

FIRST UNUSED LOCATION IN BULK CONTAINER ARRAY = 0

FLUX NORMALIZATION FOR ERROR TERMS= 3.7399811D-03

FLUX GUESS READ FROM DATA SET REFERENCE NUMBER 91

NTH ITERATION WILL NOW BE DATA SET REFERENCE NUMBER 92

VALUE OF SMALL FLUXES= 2.8599016D-07

OUTER ITERATION NUMBER = 2

K-EFFECTIVE = 1.00201872

TIME FOR D2DCAL = 0.13 MINUTES

TIME FOR D2DOUT = 0.03 MINUTES

*****LEAVE MODULE NUC005*****

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC005

DATA SET NAME	DATA SET REFERENCE NUMBER
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6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION IS 0.23 MINUTES.

BURNUP CALCULATION TO OBTAIN CONVERGENCE TO THE SPECIFIED BURNUP CONSTRAINTS

ITH OR
TEST GROUP

BURNUP
LIMIT

BURNUP
VALUE

CORE

7.500000-02

7.465020-02

THE MINIMUM BURNUP OF 7.465020-02 OCCURS IN CORE

COMPLETION OF PRELIMINARY SEARCH PROCEDURE

THE ENRICHMENT MODIFICATION FACTOR IS 9.685640-01

THE BURN STEP TIME IS 1.402680 02

BEGINNING OF THE FINAL SEARCH PROCEDURE

THE MAXIMUM NUMBER OF ITERATIONS AT EACH TIME NODE IS 1

THE MAXIMUM NUMBER OF CYCLIC MODE ITERATIONS IS 1

THE NUMBER OF SUBINTERVALS IN THE OPERATING INTERVAL IS 1

CONTROL DENSITY SEARCHES ARE DONE IF SPECIFIED

TIME NODE 0 DIFFUSION THEORY NEUTRONICS SOLUTION AT 0.0 DAYS.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE FCC001

DATA SET NAME	DATA SET REFERENCE NUMBER
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BRN	31
	6

THE TIME FOR THE FUEL CYCLE COMPUTATION IS 0.84 MINUTES.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NJC007

DATA SET NAME	DATA SET REFERENCE NUMBER
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6

FUEL CYCLE REFERENCE 9-22-71

SEARCH DATA SET 4

NEW CONTROL PARAMETER = 3.0217579D-01

PREVIOUS REFERENCE = 1.0050600D 0

CHANGE IN CONTROL PARAMETER = 1.7335086D-01

COMPARISON OF CONTROL MODIFIED Y POSITION SHIFTS

MAXIMUM CONTROL CHANGE = 2

FIRST DIMENSION OF FINITE DIFFERENCE CO-EFFS. ARRAY = 42

STORAGE REQUIRED FOR FINITE DIFFERENCE BAND WIDTH OF FLUXES AT EACH MESH POINT = 420

FULL ZERO FINITE DIFFERENCE CO-EFFS. ARRAY = 1260

LENGTH OF CORE COEFFICIENT ARRAY = 21000

FIRST NUSET LOCATION IN CORE CONTAINER ARRAY = 3827

FOR WHICH BE HE IN CORE DURING OUTER ITERATIONS

SCATTERING FROM FLUXES WILL BE HELD IN CORE

FIRST NUSET LOCATION IN CORE CONTAINER ARRAY = 4877

FIRST NUSET LOCATION IN BULK CONTAINER ARRAY = 0

FLUX NORMALIZATION FOR ERROR TERMS = 3.5761238D-03

FLUX GUSS RESULTS FROM DATA SET REFERENCE NUMBER 95

NTH ITERATION WILL BE DATA SET REFERENCE NUMBER 91

VALUE OF SPALL FLUXES = 2.8019193D-07

FLUX PUT OUT BY DATA SET REFERENCE NUMBER 45
AT OUTER ITERATION NUMBER 3

OUTER ITERATION NUMBER = 3 K-EFFECTIVE = 0.99967510

BULK STORAGE HAS NOT BEEN ALLOCATED. ILASTB CANNOT BE INVOKED

SIZE OF POINTS CORE CONTAINER ARRAY REQUIRED FOR SEARCH DATA SET OUTPUT SECTION = 5531

SIZE OF POINTS BULK CONTAINER ARRAY REQUIRED FOR SEARCH DATA SET OUTPUT SECTION = 0

*****LEAVE MODULE NUC006

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC006

DATA SET DATA SET
NAME REFERENCE NUMBER

137

6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION WITH CONTROL SEARCHES IS 0.99 MINUTES.

BURNUP CALCULATION TO OBTAIN CONVERGENCE TO THE SPECIFIED BURNUP CONSTRAINTS

IN OR TEST GROUP	BURNUP LIMIT	BURNUP VALUE
CORE	7.500000-02	7.470460-02

THE MINIMUM BURNUP OF 7.470460-02 OCCURS IN CORE

A CALCULATION TO DETERMINE THE UNPOISONED MULTIPLICATION CONSTANT WILL BE DONE

THE ENRICHMENT MODIFICATION FACTOR IS 9.685640-01

THE BURN STEP TIME IS 1.402680 02

TIME NEEDED FOR ONE-DIFFUSION THEORY NEUTRONICS SOLUTION AT 1.402680 02 DAYS.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE FCC001

DATA SET DATA SET
NAME REFERENCE NUMBER

RRR	31
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THE TIME FOR THE FUEL CYCLE COMPUTATION IS 1.07 MINUTES.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NJC007

DATA SET DATA SET
NAME REFERENCE NUMBER

6

*****MODULE NJC005*****

CORE STORAGE ALLOCATED FOR COMMON ARRAYS 21000

BULK (LCS) STORAGE ALLOCATED FOR COMMON ARRAYS 0

TIME FOR D2BIN= 0.06 MINUTES

MAXIMUM SCATTERING BAND = 2

FIRST DIMENSION OF FINITE DIFFERENCE CO-EFFTS. ARRAY= 42

STORAGE REQUIRED FOR MAXIMUM SCATTERING BAND WIDTH OF FLUXES AT EACH MESH POINT = 420

FULL SIZE OF FINITE DIFFERENCE CO-EFFTS. ARRAY = 1260

LENGTH OF CORE CONTAINER ARRAY = 21000

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 3747

FDC WILL BE HELD IN CORE DURING OUTER ITERATIONS

SCATTERING BAND FLUXES WILL BE HELD IN CORE

FIRST UNUSED LOCATION IN CORE CONTAINER ARRAY = 4797

FIRST UNUSED LOCATION IN BULK CONTAINER ARRAY = 0

FLUX NORMALIZATION FOR ERROR TERMS= 3.7257103D-03

FLUX GUESS READ FROM DATA SET REFERENCE NUMBER 91

NTH ITERATION WILL NOW BE DATA SET REFERENCE NUMBER 92

VALUE OF SMALL FLUXES= 2.8561387D-07

FLUX PUT OUT ON DATA SET REFERENCE NUMBER 61

AT OUTER ITERATION NUMBER 3

OUTER ITERATION NUMBER = 6 K-EFFECTIVE = 1.00178517

TIME FOR D2DCAL = 0.30 MINUTES

TIME FOR D2DOUT = 0.03 MINUTES

*****LEAVE MODULE NJC005*****

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NJC005

DATA SET NAME	DATA SET REFERENCE NUMBER
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6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION IS 0.40 MINUTES.

THE BURN STEP TIME IS 1.40268D 02

THE ENRICHMENT MODIFICATION FACTOR IS 9.68564D-01

DENSITIES USED IN THE NEUTRONICS SOLUTION

COMPOSITION CZ11

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	6.12024D-03	PU239	7.63617D-04
PU240	3.06094D-04	PU241	1.21707D-04	PU242	5.19595D-05	U235	3.56051D-05	MO	4.27929D-06
LFPPS	2.29918D-04								

COMPOSITION CZ12

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	6.07597D-03	PU239	7.65221D-04
PU240	3.07697D-04	PU241	1.17817D-04	PU242	5.22061D-05	U235	3.40051D-05	MO	5.01758D-06
LFPPS	2.75484D-04								

COMPOSITION CZ13

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	6.12979D-03	PU239	7.63054D-04
PU240	3.05692D-04	PU241	1.22582D-04	PU242	5.18917D-05	U235	3.59660D-05	MO	4.11392D-06
LFPPS	2.20326D-04								

COMPOSITION CZ21

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	6.15527D-03	PU239	7.61901D-04
PU240	3.04799D-04	PU241	1.25033D-04	PU242	5.17218D-05	U235	3.69535D-05	MO	3.67994D-06
LFPPS	1.94057D-04								

COMPOSITION CZ22

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	6.12084D-03	PU239	7.63465D-04
PU240	3.06024D-04	PU241	1.21753D-04	PU242	5.19493D-05	U235	3.56282D-05	MO	4.26601D-06
LFPPS	2.29491D-04								

COMPOSITION CZ23

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	6.16831D-03	PU239	7.60859D-04
PU240	3.04204D-04	PU241	1.26311D-04	PU242	5.16083D-05	U235	3.74763D-05	MO	3.44622D-06
LFPPS	1.81200D-04								

COMPOSITION CZ31

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	6.12456D-03	PU239	7.63045D-04
PU240	3.05663D-04	PU241	1.21853D-04	PU242	5.19304D-05	U235	3.57056D-05	MO	4.19990D-06
LFPPS	2.26460D-04								

COMPOSITION CZ32

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	6.08900D-03	PU239	7.63913D-04
PU240	3.06712D-04	PU241	1.18573D-04	PU242	5.21152D-05	U235	3.43858D-05	MO	4.78393D-06
LFPPS	2.63929D-04								

COMPOSITION CZ33

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	6.14711D-03	PU239	7.61011D-04
PU240	3.04510D-04	PU241	1.23962D-04	PU242	5.17291D-05	U235	3.65859D-05	MO	3.79182D-06
LFPPS	2.04719D-04								

COMPOSITION CZ41

MX	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	5.37339D-03	PU239	1.17947D-03
PU240	5.08344D-04	PU241	2.17803D-04	PU242	8.65746D-05	U235	3.35040D-05	MO	3.55045D-06
LFPPS	2.30777D-04								

COMPOSITION C242

PHY	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	5.35499D-03	PU239	1.16891D-03
PII240	5.08419D-04	PU241	2.13935D-04	PU242	8.67839D-05	U235	3.27439D-05	MO	3.98731D-06
LFPPS	2.63642D-04								

COMPOSITION C243

PHY	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	5.39140D-03	PU239	1.18712D-03
PII240	5.06860D-04	PU241	2.21483D-04	PU242	8.61459D-05	U235	3.42830D-05	MO	3.04982D-06
LFPPS	2.03074D-04								

COMPOSITION C251

PHY	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	5.38636D-03	PU239	1.18396D-03
PII240	5.06816D-04	PU241	2.20348D-04	PU242	8.61996D-05	U235	3.40657D-05	MO	3.16597D-06
LFPPS	2.12498D-04								

COMPOSITION C252

PHY	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	5.36918D-03	PU239	1.17406D-03
PII240	5.06963D-04	PU241	2.16635D-04	PU242	8.64177D-05	U235	3.33375D-05	MO	3.57742D-06
LFPPS	2.43244D-04								

COMPOSITION C253

PHY	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	5.40230D-03	PU239	1.19134D-03
PII240	5.05723D-04	PU241	2.23745D-04	PU242	8.58426D-05	U235	3.47685D-05	MO	2.73492D-06
LFPPS	1.86958D-04								

COMPOSITION C261

PHY	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	5.37686D-03	PU239	1.17862D-03
PII240	5.07125D-04	PU241	2.18144D-04	PU242	8.63729D-05	U235	3.36328D-05	MO	3.40480D-06
LFPPS	2.29257D-04								

COMPOSITION C262

PHY	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	5.35627D-03	PU239	1.16738D-03
PII240	5.07538D-04	PU241	2.13802D-04	PU242	8.66637D-05	U235	3.27679D-05	MO	3.91033D-06
LFPPS	2.65075D-04								

COMPOSITION C263

PHY	3.94900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	5.39172D-03	PU239	1.18596D-03
PII240	5.06354D-04	PU241	2.21316D-04	PU242	8.60810D-05	U235	3.42798D-05	MO	3.01572D-06
LFPPS	2.04689D-04								

COMPOSITION LB11

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.31878D-03	PU239	4.90239D-05
PII240	3.42502D-07	PU241	1.70773D-09	PU242	6.93925D-12	U235	1.59943D-05	MO	1.96438D-07
LFPPS	4.87980D-06								

COMPOSITION LB12

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.27057D-03	PU239	8.92847D-05
PII240	1.16131D-06	PU241	1.06569D-08	PU242	8.11552D-11	U235	1.53352D-05	MO	3.54513D-07
LFPPS	1.25028D-05								

COMPOSITION LB13

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.21561D-03	PU239	1.31221D-04
PII240	2.57592D-06	PU241	3.52087D-08	PU242	4.07705D-10	U235	1.46319D-05	MO	5.16662D-07
LFPPS	2.46295D-05								

COMPOSITION UB11

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.22932D-03	PU239	1.20707D-04
PU240	2.15942D-06	PU241	2.70326D-08	PU242	2.85003D-10	U235	1.48037D-05	MO	4.75420D-07
LFPPS	2.17269D-05								

COMPOSITION UB12

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.29713D-03	PU239	6.74156D-05
PU240	6.53192D-07	PU241	4.49688D-09	PU242	2.54275D-11	U235	1.56934D-05	MO	2.68750D-07
LFPPS	8.05522D-06								

COMPOSITION LB21

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.32361D-03	PU239	4.47420D-05
PU240	2.84415D-07	PU241	1.29248D-09	PU242	4.77683D-12	U235	1.60628D-05	MO	1.79351D-07
LFPPS	4.33566D-06								

COMPOSITION LB22

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.28242D-03	PU239	7.94794D-05
PU240	9.13284D-07	PU241	7.43440D-09	PU242	4.99700D-11	U235	1.54939D-05	MO	3.13815D-07
LFPPS	1.05861D-05								

COMPOSITION LB23

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.23645D-03	PU239	1.15276D-04
PU240	1.96133D-06	PU241	2.34008D-08	PU242	2.34465D-10	U235	1.48940D-05	MO	4.54312D-07
LFPPS	2.01549D-05								

COMPOSITION UB21

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.25200D-03	PU239	1.02963D-04
PU240	1.54754D-06	PU241	1.64076D-08	PU242	1.45093D-10	U235	1.50941D-05	MO	4.05840D-07
LFPPS	1.71928D-05								

COMPOSITION UB22

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.30735D-03	PU239	5.85837D-05
PU240	4.89731D-07	PU241	2.92040D-09	PU242	1.42393D-11	U235	1.58350D-05	MO	2.33611D-07
LFPPS	6.72160D-06								

COMPOSITION LB41

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.33251D-03	PU239	3.67423D-05
PU240	1.90514D-07	PU241	7.08848D-10	PU242	2.13636D-12	U235	1.61901D-05	MO	1.47281D-07
LFPPS	3.44264D-06								

COMPOSITION LB42

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.30034D-03	PU239	6.41228D-05
PU240	5.85930D-07	PU241	3.82329D-09	PU242	2.04272D-11	U235	1.57390D-05	MO	2.54598D-07
LFPPS	8.17263D-06								

COMPOSITION LB43

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.26422D-03	PU239	9.27774D-05
PU240	1.24205D-06	PU241	1.18055D-08	PU242	9.30139D-11	U235	1.52549D-05	MO	3.65065D-07
LFPPS	1.53476D-05								

COMPOSITION UB41

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.28514D-03	PU239	7.33762D-05
PU240	8.04957D-07	PU241	6.16472D-09	PU242	3.87429D-11	U235	1.55350D-05	MO	2.95997D-07
LFPPS	1.20611D-05								

COMPOSITION UB42

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.32390D-03	PU239	4.38908D-05
PU240	2.70818D-07	PU241	1.20196D-09	PU242	4.32638D-12	U235	1.60684D-05	MO	1.74725D-07
LFPPS	4.90858D-06								

COMPOSITION LB51

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.33864D-03	PU239	3.12321D-05
PU240	1.37183D-07	PU241	4.33202D-10	PU242	1.10531D-12	U235	1.62786D-05	MO	1.25294D-07
LFPPS	2.80324D-06								

COMPOSITION LB52

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.31025D-03	PU239	5.56802D-05
PU240	4.39171D-07	PU241	2.48148D-09	PU242	1.14339D-11	U235	1.58764D-05	MO	2.21279D-07
LFPPS	6.74898D-06								

COMPOSITION LB53

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.27760D-03	PU239	8.19663D-05
PU240	9.60831D-07	PU241	8.03441D-09	PU242	5.53739D-11	U235	1.54326D-05	MO	3.22686D-07
LFPPS	1.29276D-05								

COMPOSITION UB51

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.29544D-03	PU239	6.70212D-05
PU240	6.32911D-07	PU241	4.29813D-09	PU242	2.38571D-11	U235	1.56746D-05	MO	2.63528D-07
LFPPS	1.01860D-05								

COMPOSITION UB52

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.32976D-03	PU239	3.88448D-05
PU240	2.11814D-07	PU241	8.31371D-10	PU242	2.64152D-12	U235	1.61516D-05	MO	1.54938D-07
LFPPS	4.09093D-06								

COMPOSITION LB31

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.31751D-03	PU239	5.01982D-05
PU240	3.46002D-07	PU241	1.71649D-09	PU242	6.96134D-12	U235	1.59754D-05	MO	2.01142D-07
LFPPS	4.98443D-06								

COMPOSITION LB32

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.27026D-03	PU239	8.96749D-05
PU240	1.12597D-06	PU241	1.00714D-08	PU242	7.49090D-11	U235	1.53280D-05	MO	3.56006D-07
LFPPS	1.24642D-05								

COMPOSITION LB33

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.21683D-03	PU239	1.30571D-04
PU240	2.44393D-06	PU241	3.22075D-08	PU242	3.59822D-10	U235	1.46403D-05	MO	5.13931D-07
LFPPS	2.41879D-05								

COMPOSITION UB31

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.24072D-03	PU239	1.11756D-04
PU240	1.75968D-06	PU241	1.96934D-08	PU242	1.84887D-10	U235	1.49444D-05	MO	4.39646D-07
LFPPS	1.95788D-05								

COMPOSITION UB32

PHY	4.42900D-01	SODIUM	4.06000D-01	STEEL	2.06700D-01	U238	8.30178D-03	PU239	6.33990D-05
PU240	5.53403D-07	PU241	3.47244D-09	PU242	1.78957D-11	U235	1.57563D-05	MO	2.52597D-07
LFPPS	7.47427D-06								

COMPOSITION LB61

ГХУ	4.429000-01	SODIUM	4.060000-01	STEEL	2.067000-01	U238	8.339450-03	PU239	3.057870-05
PII240	1.267950-07	PU241	3.810660-10	PU242	9.279160-13	U235	1.628970-05	MO	1.228040-07
LFPPS	2.654220-06								

COMPOSITION LB62

ГХУ	4.429000-01	SODIUM	4.060000-01	STEEL	2.067000-01	U238	8.310000-03	PU239	5.606310-05
PII240	4.291970-07	PU241	2.372980-09	PU242	1.073020-11	U235	1.587150-05	MO	2.230200-07
LFPPS	6.626160-06								

COMPOSITION LB63

ГХУ	4.429000-01	SODIUM	4.060000-01	STEEL	2.067000-01	U238	8.274780-03	PU239	8.456930-05
PII240	9.865180-07	PU241	8.272100-09	PU242	5.737830-11	U235	1.539170-05	MO	3.332000-07
LFPPS	1.314830-05								

COMPOSITION UB61

ГХУ	4.429000-01	SODIUM	4.060000-01	STEEL	2.067000-01	U238	8.290930-03	PU239	7.128230-05
PII240	6.939290-07	PU241	4.881720-09	PU242	2.822130-11	U235	1.561010-05	MO	2.810880-07
LFPPS	1.041740-05								

COMPOSITION UB62

ГХУ	4.429000-01	SODIUM	4.060000-01	STEEL	2.067000-01	U238	8.325550-03	PU239	4.288770-05
PII240	2.505550-07	PU241	1.058310-09	PU242	3.639230-12	U235	1.609010-05	MO	1.715980-07
LFPPS	4.271900-06								

COMPOSITION BZ11

ГХУ	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.392160-02	PU239	1.864210-05
PII240	3.685270-08	PU241	4.820060-11	PU242	4.757190-14	U235	2.763710-05	MO	7.423060-08
LFPPS	1.827060-06								

COMPOSITION BZ12

ГХУ	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.387700-02	PU239	5.601690-05
PII240	3.295280-07	PU241	1.293740-09	PU242	3.843290-12	U235	2.699770-05	MO	2.175240-07
LFPPS	9.271780-06								

COMPOSITION BZ13

ГХУ	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.386600-02	PU239	6.501030-05
PII240	4.459510-07	PU241	2.037810-09	PU242	7.064510-12	U235	2.684460-05	MO	2.521360-07
LFPPS	1.123330-05								

COMPOSITION BZ14

ГХУ	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.388390-02	PU239	5.011160-05
PII240	2.624430-07	PU241	9.193650-10	PU242	2.431790-12	U235	2.709640-05	MO	1.945150-07
LFPPS	8.188690-06								

COMPOSITION BZ15

ГХУ	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.391180-02	PU239	2.717080-05
PII240	7.802780-08	PU241	1.486130-10	PU242	2.135490-13	U235	2.749480-05	MO	1.075010-07
LFPPS	3.094940-06								

COMPOSITION BZ21

ГХУ	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.389920-02	PU239	3.923380-05
PII240	1.283510-07	PU241	3.040540-10	PU242	5.788440-13	U235	2.730660-05	MO	1.566900-07
LFPPS	3.765090-06								

COMPOSITION BZ22

PHY	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.380940-02	PU239	1.149990-04
PU240	1.119850-06	PU241	7.839650-09	PU242	4.489460-11	U235	2.604350-05	MO	4.518460-07
LFPPS	1.781450-05								

COMPOSITION BZ23

PHY	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.378550-02	PU239	1.342910-04
PU240	1.539650-06	PU241	1.263740-08	PU242	8.533540-11	U235	2.572170-05	MO	5.268960-07
LFPPS	2.220320-05								

COMPOSITION BZ24

PHY	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.382210-02	PU239	1.043640-04
PU240	9.174220-07	PU241	5.814000-09	PU242	3.004030-11	U235	2.621860-05	MO	4.101350-07
LFPPS	1.573370-05								

COMPOSITION BZ25

PHY	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.387490-02	PU239	6.074280-05
PU240	3.094580-07	PU241	1.138100-09	PU242	3.381690-12	U235	2.695580-05	MO	2.417570-07
LFPPS	6.615900-06								

COMPOSITION BZ31

PHY	7.376990-01	SODIUM	2.607000-01	STEEL	8.981990-02	U238	1.384020-02	PU239	9.237480-05
PU240	4.750670-07	PU241	1.638390-09	PU242	4.409350-12	U235	2.644510-05	MO	3.678320-07
LFPPS	9.935290-06								

COMPOSITION BZ32

PHY	7.376990-01	SODIUM	2.607000-01	STEEL	8.981990-02	U238	1.362270-02	PU239	2.651830-04
PU240	4.043780-06	PU241	4.064520-08	PU242	3.268710-10	U235	2.350950-05	MO	1.031200-06
LFPPS	5.321930-05								

COMPOSITION BZ33

PHY	7.376990-01	SODIUM	2.607000-01	STEEL	8.981990-02	U238	1.356810-02	PU239	3.059850-04
PU240	5.465700-06	PU241	6.397770-08	PU242	6.040220-10	U235	2.281900-05	MO	1.188230-06
LFPPS	6.612900-05								

COMPOSITION BZ34

PHY	7.376990-01	SODIUM	2.607000-01	STEEL	8.981990-02	U238	1.365550-02	PU239	2.396350-04
PU240	3.273440-06	PU241	2.963050-08	PU242	2.137480-10	U235	2.393430-05	MO	9.317920-07
LFPPS	4.645040-05								

COMPOSITION BZ35

PHY	7.376990-01	SODIUM	2.607000-01	STEEL	8.981990-02	U238	1.378730-02	PU239	1.375230-04
PU240	1.070140-06	PU241	5.585950-09	PU242	2.302110-11	U235	2.569940-05	MO	5.444240-07
LFPPS	1.766420-05								

COMPOSITION BZ41

PHY	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.380510-02	PU239	1.240160-04
PU240	8.585020-07	PU241	3.917630-09	PU242	1.391530-11	U235	2.594410-05	MO	4.930400-07
LFPPS	1.333270-05								

COMPOSITION BZ42

PHY	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.352650-02	PU239	3.447040-04
PU240	7.035430-06	PU241	9.189700-08	PU242	9.666320-10	U235	2.228120-05	MO	1.353030-06
LFPPS	6.782930-05								

COMPOSITION BZ43

7XY	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.345140-02	PU239	3.991400-04
PJ240	9.628100-06	PU241	1.473320-07	PJ242	1.834870-09	U235	2.137610-05	MO	1.564270-06
LEPPS	8.651460-05								

COMPOSITION BZ44

7XY	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.356470-02	PU239	3.157390-04
PJ240	5.842230-06	PU241	6.956920-08	PJ242	6.638990-10	U235	2.275630-05	MO	1.239820-06
LEPPS	5.941960-05								

COMPOSITION BZ45

7XY	7.377000-01	SODIUM	2.607000-01	STEEL	8.982000-02	U238	1.372200-02	PU239	1.948810-04
PJ240	2.174270-06	PU241	1.588690-08	PJ242	9.175850-11	U235	2.479580-05	MO	7.749180-07
LEPPS	2.514960-05								

COMPOSITION REFLR

SODIUM	1.000000-01	STEEL	9.000000-01						
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COMPOSITION SHIELD

SODIUM	4.460000-01	STEEL	5.540000-01						
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COMPOSITION PLENUM

SODIUM	1.000000 00								
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COMPOSITION UPLEN1

SODIUM	4.119000-01	STEEL	1.928000-01						
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COMPOSITION UPLEN2

SODIUM	4.119000-01	STEEL	1.928000-01						
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COMPOSITION LPLEN

SODIUM	9.220000-01	STEEL	1.000000-01						
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COMPOSITION CONTR1

SODIUM	9.342000-01	STEEL	1.581000-02						
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COMPOSITION CONTR3

SODIUM	9.342000-01	STEEL	1.581000-02						
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COMPOSITION CONTR2

SODIUM	6.693000-01	STEEL	4.882000-02	POISON	5.333000-01				
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COMPOSITION CONTR4

SODIUM	9.342000-01	STEEL	1.581000-02						
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COMPOSITION SHIMS

SODIUM	3.786000-01	STEEL	3.080000-03	POISON	1.000000 00				
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TIME NODE 0 DIFFUSION THEORY NEUTRONICS SOLUTION AT 0.0 DAYS.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE FCC001

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NJC005

DATA SET NAME	DATA SET REFERENCE NUMBER
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6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION WITH CONTROL SEARCHES IS 0.58 MINUTES.

REACTOR CONDITIONS AFTER 1 BURNUP SUBSTEPS AT TIME = 140.2682 DAYS

PATH CORE14
STAGE REGION

		U238	PU239	PU240	PU241	PU242	U235	MO	LFPPS
1	CZ11	6.1953D-03	7.6000D-04	3.0288D-04	1.2803D-04	5.1521D-05	3.8270D-05	3.0089D-06	1.5445D-04
2	CZ11	6.0426D-03	7.7252D-04	3.0922D-04	1.1177D-04	5.2960D-05	3.1776D-05	5.7698D-06	3.0681D-04
3	CZ11	5.8937D-03	7.8013D-04	3.1551D-04	9.8858D-05	5.3896D-05	2.6383D-05	8.3080D-06	4.5665D-04
4	CZ11	5.7484D-03	7.8363D-04	3.2162D-04	8.8634D-05	5.4441D-05	2.1905D-05	1.0655D-05	6.0408D-04

PATH CORE14
STAGE REGION

		U238	PU239	PU240	PU241	PU242	U235	MO	LFPPS
1	CZ12	6.1645D-03	7.6245D-04	3.0398D-04	1.2445D-04	5.1831D-05	3.6879D-05	3.5680D-06	1.8575D-04
2	CZ12	5.9829D-03	7.7521D-04	3.1140D-04	1.0621D-04	5.3341D-05	2.9513D-05	6.7830D-06	3.6807D-04
3	CZ12	5.8066D-03	7.8146D-04	3.1867D-04	9.2384D-05	5.4197D-05	2.3617D-05	9.6972D-06	5.4677D-04
4	CZ12	5.6355D-03	7.8247D-04	3.2559D-04	8.1952D-05	5.4573D-05	1.8900D-05	1.2361D-05	7.2202D-04

PATH CORE14
STAGE REGION

		U238	PU239	PU240	PU241	PU242	U235	MO	LFPPS
1	CZ13	6.2013D-03	7.5940D-04	3.0264D-04	1.2874D-04	5.1453D-05	3.8549D-05	2.8963D-06	1.4847D-04
2	CZ13	6.0549D-03	7.7169D-04	3.0871D-04	1.1296D-04	5.2863D-05	3.2261D-05	5.5535D-06	2.9450D-04
3	CZ13	5.9119D-03	7.7942D-04	3.1474D-04	1.0030D-04	5.3803D-05	2.6999D-05	8.0040D-06	4.3820D-04
4	CZ13	5.7724D-03	7.8330D-04	3.2062D-04	9.0174D-05	5.4373D-05	2.2595D-05	1.0276D-05	5.7970D-04

PATH CORE14
STAGE REGION

		U238	PU239	PU240	PU241	PU242	U235	MO	LFPPS
1	CZ21	6.2191D-03	7.5792D-04	3.0203D-04	1.3089D-04	5.1263D-05	3.9380D-05	2.5695D-06	1.3027D-04
2	CZ21	6.0894D-03	7.6985D-04	3.0749D-04	1.1645D-04	5.2606D-05	3.3655D-05	4.9560D-06	2.5900D-04

BURNUP (ATOM %) OF EACH STAGE OF EACH PATH					
STAGE/REGION	1/CZ11	2/CZ11	3/CZ11	4/CZ11	
	2.02340-02	1.98820-02	1.95520-02	1.92390-02	
STAGE/REGION	1/CZ12	2/CZ12	3/CZ12	4/CZ12	
	2.43340-02	2.38240-02	2.33510-02	2.29020-02	
STAGE/REGION	1/CZ13	2/CZ13	3/CZ13	4/CZ13	
	1.94500-02	1.91240-02	1.88200-02	1.85300-02	
STAGE/REGION	1/CZ21	2/CZ21	3/CZ21	4/CZ21	
	1.70660-02	1.68170-02	1.65820-02	1.63580-02	
STAGE/REGION	1/CZ22	2/CZ22	3/CZ22	4/CZ22	
	2.02670-02	1.99130-02	1.95830-02	1.92690-02	
STAGE/REGION	1/CZ23	2/CZ23	3/CZ23	4/CZ23	
	1.60050-02	1.57860-02	1.55780-02	1.53800-02	
STAGE/REGION	1/CZ31	2/CZ31	3/CZ31	4/CZ31	5/CZ31
	1.49930-02	1.47940-02	1.46050-02	1.44250-02	1.42520-02
STAGE/REGION	1/CZ32	2/CZ32	3/CZ32	4/CZ32	5/CZ32
	1.75700-02	1.72930-02	1.70330-02	1.67860-02	1.65480-02
STAGE/REGION	1/CZ33	2/CZ33	3/CZ33	4/CZ33	5/CZ33
	1.36270-02	1.34600-02	1.33010-02	1.31500-02	1.30030-02
STAGE/REGION	1/CZ41	2/CZ41	3/CZ41	4/CZ41	
	2.07390-02	1.97760-02	1.89070-02	1.81200-02	
STAGE/REGION	1/CZ42	2/CZ42	3/CZ42	4/CZ42	
	2.38720-02	2.26110-02	2.14890-02	2.04860-02	
STAGE/REGION	1/CZ43	2/CZ43	3/CZ43	4/CZ43	
	1.83110-02	1.75610-02	1.68750-02	1.62460-02	
STAGE/REGION	1/CZ51	2/CZ51	3/CZ51	4/CZ51	
	1.90510-02	1.82360-02	1.74930-02	1.68140-02	
STAGE/REGION	1/CZ52	2/CZ52	3/CZ52	4/CZ52	
	2.19780-02	2.09050-02	1.99400-02	1.90690-02	
STAGE/REGION	1/CZ53	2/CZ53	3/CZ53	4/CZ53	
	1.68370-02	1.62020-02	1.56160-02	1.50740-02	
STAGE/REGION	1/CZ61	2/CZ61	3/CZ61	4/CZ61	5/CZ61
	1.55140-02	1.49690-02	1.44630-02	1.39930-02	1.35560-02
STAGE/REGION	1/CZ62	2/CZ62	3/CZ62	4/CZ62	5/CZ62
	1.81020-02	1.73670-02	1.66940-02	1.60750-02	1.55060-02
STAGE/REGION	1/CZ63	2/CZ63	3/CZ63	4/CZ63	5/CZ63
	1.39100-02	1.34740-02	1.30650-02	1.26830-02	1.23240-02

STAGE/REGION	1/LB11	2/LB11	3/LB11	4/LB11	
	3.3969D-04	4.1405D-04	4.8625D-04	5.5634D-04	
STAGE/REGION	1/LB12	2/LB12	3/LB12	4/LB12	
	8.1998D-04	1.0857D-03	1.3366D-03	1.5735D-03	
STAGE/REGION	1/LB13	2/LB13	3/LB13	4/LB13	
	1.5501D-03	2.1717D-03	2.7397D-03	3.2583D-03	
STAGE/REGION	1/UB11	2/UB11	3/UB11	4/JB11	
	1.3859D-03	1.9070D-03	2.3870D-03	2.8289D-03	
STAGE/REGION	1/UB12	2/UB12	3/UB12	4/UB12	
	5.4341D-04	6.8948D-04	8.2957D-04	9.6389D-04	
STAGE/REGION	1/LB21	2/LB21	3/LB21	4/LB21	
	3.0445D-04	3.6609D-04	4.2609D-04	4.8451D-04	
STAGE/REGION	1/LB22	2/LB22	3/LB22	4/LB22	
	7.0475D-04	9.1302D-04	1.1110D-03	1.2993D-03	
STAGE/REGION	1/LB23	2/LB23	3/LB23	4/LB23	
	1.2926D-03	1.7635D-03	2.1992D-03	2.6020D-03	
STAGE/REGION	1/UB21	2/UB21	3/UB21	4/UB21	
	1.1226D-03	1.4951D-03	1.8428D-03	2.1673D-03	
STAGE/REGION	1/UB22	2/UB22	3/UB22	4/JB22	
	4.6091D-04	5.7046D-04	6.7612D-04	7.7802D-04	
STAGE/REGION	1/LB41	2/LB41	3/LB41	4/LB41	
	2.4649D-04	2.8786D-04	3.2834D-04	3.6794D-04	
STAGE/REGION	1/LB42	2/LB42	3/LB42	4/LB42	
	5.6061D-04	6.9533D-04	8.2472D-04	9.4897D-04	
STAGE/REGION	1/LB43	2/LB43	3/LB43	4/LB43	
	1.0201D-03	1.3223D-03	1.6063D-03	1.8732D-03	
STAGE/REGION	1/UB41	2/UB41	3/UB41	4/JB41	
	8.2887D-04	1.0284D-03	1.2181D-03	1.3986D-03	
STAGE/REGION	1/UB42	2/UB42	3/UB42	4/JB42	
	3.4877D-04	4.1031D-04	4.7021D-04	5.2852D-04	
STAGE/REGION	1/LB51	2/LB51	3/LB51	4/LB51	
	2.0336D-04	2.3304D-04	2.6218D-04	2.9079D-04	
STAGE/REGION	1/LB52	2/LB52	3/LB52	4/LB52	
	4.6999D-04	5.7052D-04	6.6762D-04	7.6140D-04	
STAGE/REGION	1/LB53	2/LB53	3/LB53	4/LB53	
	8.7306D-04	1.1063D-03	1.3272D-03	1.5365D-03	
STAGE/REGION	1/UB51	2/UB51	3/UB51	4/UB51	
	7.0837D-04	8.6405D-04	1.0130D-03	1.1556D-03	
STAGE/REGION	1/UB52	2/UB52	3/UB52	4/UB52	
	2.9301D-04	3.4059D-04	3.8705D-04	4.3243D-04	
STAGE/REGION	1/LB31	2/LB31	3/LB31	4/LB31	5/LB31
	2.5402D-04	2.9813D-04	3.4125D-04	3.8340D-04	4.2460D-04
STAGE/REGION	1/LB32	2/LB32	3/LB32	4/LB32	5/LB32
	5.9416D-04	7.4660D-04	8.9264D-04	1.0325D-03	1.1665D-03
STAGE/REGION	1/LB33	2/LB33	3/LB33	4/LB33	5/LB33
	1.1002D-03	1.4522D-03	1.7815D-03	2.0893D-03	2.3770D-03
STAGE/REGION	1/UB31	2/UB31	3/UB31	4/JB31	5/UB31
	9.1977D-04	1.1745D-03	1.4152D-03	1.6426D-03	1.8573D-03
STAGE/REGION	1/UB32	2/UB32	3/UB32	4/JB32	5/UB32
	3.7215D-04	4.4539D-04	5.1650D-04	5.8555D-04	6.5258D-04
STAGE/REGION	1/LB61	2/LB61	3/LB61	4/LB61	5/LB61
	1.4260D-04	1.5856D-04	1.7431D-04	1.8985D-04	2.0519D-04
STAGE/REGION	1/LB62	2/LB62	3/LB62	4/LB62	5/LB62
	3.3847D-04	3.9589D-04	4.5183D-04	5.0632D-04	5.5941D-04
STAGE/REGION	1/LB63	2/LB63	3/LB63	4/LB63	5/LB63
	6.4543D-04	7.8613D-04	9.2109D-04	1.0505D-03	1.1746D-03
STAGE/REGION	1/UB61	2/UB61	3/UB61	4/JB61	5/UB61
	5.2499D-04	6.2369D-04	7.1902D-04	8.1110D-04	9.0002D-04
STAGE/REGION	1/UB62	2/UB62	3/UB62	4/JB62	5/UB62
	2.2214D-04	2.5445D-04	2.8614D-04	3.1722D-04	3.4771D-04
STAGE/REGION	1/BZ11	2/BZ11	3/BZ11	4/BZ11	5/BZ11
	2.6177D-04	2.9666D-04	1.5066D-04	1.5950D-04	1.6825D-04
STAGE/REGION	1/BZ12	2/BZ12	3/BZ12	4/BZ12	5/BZ12
	1.3253D-03	1.6772D-03	7.8021D-04	8.5181D-04	9.2117D-04
STAGE/REGION	1/BZ13	2/BZ13	3/BZ13	4/BZ13	5/BZ13
	1.6117D-03	2.0894D-03	1.0079D-03	1.1065D-03	1.2016D-03

STAGE/REGION	1/8Z14	2/8Z14	3/8Z34	4/8Z34	5/8Z34			
	1.1791D-03	1.4629D-03	6.7674D-04	7.3751D-04	7.9656D-04			
STAGE/REGION	1/8Z15	2/8Z15	3/8Z35	4/8Z35	5/8Z35			
	4.4384D-04	5.2037D-04	2.9293D-04	3.1755D-04	3.4175D-04			
STAGE/REGION	1/8Z21	2/8Z21	3/8Z21	4/8Z21	5/8Z41	6/8Z41	7/8Z41	8/8Z41
	1.6855D-04	1.8577D-04	2.0276D-04	2.1950D-04	1.1666D-04	1.2154D-04	1.2638D-04	1.3119D-04
STAGE/REGION	1/8Z22	2/8Z22	3/8Z22	4/8Z22	5/8Z42	6/8Z42	7/8Z42	8/8Z42
	7.4116D-04	9.0682D-04	1.0651D-03	1.2164D-03	5.9736D-04	6.3159D-04	6.6506D-04	6.9779D-04
STAGE/REGION	1/8Z23	2/8Z23	3/8Z23	4/8Z23	5/8Z43	6/8Z43	7/8Z43	8/8Z43
	9.0959D-04	1.1397D-03	1.3577D-03	1.5642D-03	7.8732D-04	8.3457D-04	8.8057D-04	9.2535D-04
STAGE/REGION	1/8Z24	2/8Z24	3/8Z24	4/8Z24	5/8Z44	6/8Z44	7/8Z44	8/8Z44
	6.6271D-04	7.9876D-04	9.2934D-04	1.0547D-03	5.2157D-04	5.5144D-04	5.8070D-04	6.0936D-04
STAGE/REGION	1/8Z25	2/8Z25	3/8Z25	4/8Z25	5/8Z45	6/8Z45	7/8Z45	8/8Z45
	2.8748D-04	3.2986D-04	3.7130D-04	4.1183D-04	2.5480D-04	2.7029D-04	2.8556D-04	3.0062D-04

BURNUP (MWD/MT) OF EACH STAGE OF EACH PATH								
STAGE/REGION	1/CZ11	2/CZ11	3/CZ11	4/CZ11				
	2.0346D 04	1.9991D 04	1.9660D 04	1.9345D 04				
STAGE/REGION	1/CZ12	2/CZ12	3/CZ12	4/CZ12				
	2.4469D 04	2.3955D 04	2.3480D 04	2.3028D 04				
STAGE/REGION	1/CZ13	2/CZ13	3/CZ13	4/CZ13				
	1.9557D 04	1.9230D 04	1.8924D 04	1.8633D 04				
STAGE/REGION	1/CZ21	2/CZ21	3/CZ21	4/CZ21				
	1.7160D 04	1.6910D 04	1.6674D 04	1.6449D 04				
STAGE/REGION	1/CZ22	2/CZ22	3/CZ22	4/CZ22				
	2.0378D 04	2.0023D 04	1.9691D 04	1.9375D 04				
STAGE/REGION	1/CZ23	2/CZ23	3/CZ23	4/CZ23				
	1.6094D 04	1.5873D 04	1.5664D 04	1.5465D 04				
STAGE/REGION	1/CZ31	2/CZ31	3/CZ31	4/CZ31	5/CZ31			
	1.5076D 04	1.4875D 04	1.4686D 04	1.4505D 04	1.4330D 04			
STAGE/REGION	1/CZ32	2/CZ32	3/CZ32	4/CZ32	5/CZ32			
	1.7667D 04	1.7388D 04	1.7127D 04	1.6879D 04	1.6640D 04			
STAGE/REGION	1/CZ33	2/CZ33	3/CZ33	4/CZ33	5/CZ33			
	1.3702D 04	1.3534D 04	1.3375D 04	1.3222D 04	1.3075D 04			
STAGE/REGION	1/CZ41	2/CZ41	3/CZ41	4/CZ41				
	2.0837D 04	1.9870D 04	1.8997D 04	1.8207D 04				
STAGE/REGION	1/CZ42	2/CZ42	3/CZ42	4/CZ42				
	2.3985D 04	2.2719D 04	2.1591D 04	2.0583D 04				
STAGE/REGION	1/CZ43	2/CZ43	3/CZ43	4/CZ43				
	1.8398D 04	1.7645D 04	1.6955D 04	1.6324D 04				
STAGE/REGION	1/CZ51	2/CZ51	3/CZ51	4/CZ51				
	1.9142D 04	1.8323D 04	1.7576D 04	1.6894D 04				
STAGE/REGION	1/CZ52	2/CZ52	3/CZ52	4/CZ52				
	2.2083D 04	2.1005D 04	2.0035D 04	1.9159D 04				
STAGE/REGION	1/CZ53	2/CZ53	3/CZ53	4/CZ53				
	1.6917D 04	1.6279D 04	1.5690D 04	1.5146D 04				
STAGE/REGION	1/CZ61	2/CZ61	3/CZ61	4/CZ61	5/CZ61			
	1.5588D 04	1.5040D 04	1.4532D 04	1.4060D 04	1.3621D 04			
STAGE/REGION	1/CZ62	2/CZ62	3/CZ62	4/CZ62	5/CZ62			
	1.8188D 04	1.7450D 04	1.6773D 04	1.6152D 04	1.5580D 04			
STAGE/REGION	1/CZ63	2/CZ63	3/CZ63	4/CZ63	5/CZ63			
	1.3976D 04	1.3538D 04	1.3127D 04	1.2743D 04	1.2383D 04			
STAGE/REGION	1/LB11	2/LB11	3/LB11	4/LB11				
	3.4192D 02	4.1677D 02	4.8944D 02	5.5999D 02				
STAGE/REGION	1/LB12	2/LB12	3/LB12	4/LB12				
	8.2536D 02	1.0928D 03	1.3453D 03	1.5838D 03				
STAGE/REGION	1/LB13	2/LB13	3/LB13	4/LB13				
	1.5603D 03	2.1859D 03	2.7577D 03	3.2797D 03				
STAGE/REGION	1/UB11	2/UB11	3/UB11	4/UB11				
	1.3950D 03	1.9195D 03	2.4027D 03	2.8475D 03				
STAGE/REGION	1/UB12	2/UB12	3/UB12	4/UB12				
	5.4698D 02	6.9401D 02	8.3501D 02	9.7022D 02				
STAGE/REGION	1/LB21	2/LB21	3/LB21	4/LB21				
	3.0645D 02	3.6849D 02	4.2889D 02	4.8769D 02				
STAGE/REGION	1/LB22	2/LB22	3/LB22	4/LB22				

STAGE/REGION	7.0938D 02 1/LB23 1.3011D 03	9.1901D 02 2/LB23 1.7751D 03	1.1183D 03 3/LB23 2.2136D 03	1.3078D 03 4/LB23 2.5191D 03				
STAGE/REGION	1/UB21 1.1300D 03	2/UB21 1.5049D 03	3/UB21 1.8549D 03	4/UB21 2.1815D 03				
STAGE/REGION	1/UB22 4.6393D 02	2/UB22 5.7420D 02	3/UB22 6.8055D 02	4/UB22 7.8312D 02				
STAGE/REGION	1/LB41 2.4810D 02	2/LB41 2.8975D 02	3/LB41 3.3050D 02	4/LB41 3.7036D 02				
STAGE/REGION	1/LB42 5.6429D 02	2/LB42 6.9990D 02	3/LB42 8.3013D 02	4/LB42 9.5520D 02				
STAGE/REGION	1/LB43 1.0268D 03	2/LB43 1.3310D 03	3/LB43 1.6168D 03	4/LB43 1.8855D 03				
STAGE/REGION	1/UB41 8.3430D 02	2/UB41 1.0351D 03	3/UB41 1.2261D 03	4/UB41 1.4078D 03				
STAGE/REGION	1/UB42 3.5105D 02	2/UB42 4.1300D 02	3/UB42 4.7330D 02	4/UB42 5.3199D 02				
STAGE/REGION	1/LB51 2.0470D 02	2/LB51 2.3457D 02	3/LB51 2.6390D 02	4/LB51 2.9270D 02				
STAGE/REGION	1/LB52 4.7307D 02	2/LB52 5.7427D 02	3/LB52 6.7200D 02	4/LB52 7.6640D 02				
STAGE/REGION	1/LB53 8.7879D 02	2/LB53 1.1135D 03	3/LB53 1.3359D 03	4/LB53 1.5465D 03				
STAGE/REGION	1/UB51 7.1302D 02	2/UB51 8.6972D 02	3/UB51 1.0197D 03	4/UB51 1.1632D 03				
STAGE/REGION	1/UB52 2.9494D 02	2/UB52 3.4282D 02	3/UB52 3.8959D 02	4/UB52 4.3526D 02				
STAGE/REGION	1/LB31 2.5569D 02	2/LB31 3.0080D 02	3/LB31 3.4348D 02	4/LB31 3.8591D 02	5/LB31 4.2739D 02			
STAGE/REGION	1/LB32 5.9806D 02	2/LB32 7.5150D 02	3/LB32 8.9849D 02	4/LB32 1.0393D 03	5/LB32 1.1741D 03			
STAGE/REGION	1/LB33 1.1074D 03	2/LB33 1.4618D 03	3/LB33 1.7932D 03	4/LB33 2.1030D 03	5/LB33 2.3926D 03			
STAGE/REGION	1/UB31 9.2580D 02	2/UB31 1.1822D 03	3/UB31 1.4245D 03	4/UB31 1.6533D 03	5/UB31 1.8695D 03			
STAGE/REGION	1/UB32 3.7459D 02	2/UB32 4.4831D 02	3/UB32 5.1989D 02	4/UB32 5.8939D 02	5/UB32 6.5686D 02			
STAGE/REGION	1/LB61 1.4333D 02	2/LB61 1.5960D 02	3/LB61 1.7546D 02	4/LB61 1.9110D 02	5/LB61 2.0653D 02			
STAGE/REGION	1/LB62 3.4069D 02	2/LB62 3.9849D 02	3/LB62 4.5479D 02	4/LB62 5.0964D 02	5/LB62 5.6308D 02			
STAGE/REGION	1/LB63 6.4966D 02	2/LB63 7.9129D 02	3/LB63 9.2713D 02	4/LB63 1.0574D 03	5/LB63 1.1823D 03			
STAGE/REGION	1/UB61 5.2843D 02	2/UB61 6.2778D 02	3/UB61 7.2374D 02	4/UB61 8.1642D 02	5/UB61 9.0593D 02			
STAGE/REGION	1/UB62 2.2359D 02	2/UB62 2.5612D 02	3/UB62 2.8802D 02	4/UB62 3.1930D 02	5/UB62 3.4999D 02			
STAGE/REGION	1/BZ11 2.6348D 02	2/BZ11 2.9861D 02	3/BZ11 2.2752D 02	4/BZ11 2.4087D 02	5/BZ11 2.5408D 02			
STAGE/REGION	1/BZ12 1.2340D 03	2/BZ12 1.6882D 03	3/BZ12 1.1782D 03	4/BZ12 1.2864D 03	5/BZ12 1.3911D 03			
STAGE/REGION	1/BZ13 1.6222D 03	2/BZ13 2.1031D 03	3/BZ13 1.5220D 03	4/BZ13 1.6710D 03	5/BZ13 1.8145D 03			
STAGE/REGION	1/BZ14 1.1869D 03	2/BZ14 1.4725D 03	3/BZ14 1.0220D 03	4/BZ14 1.1138D 03	5/BZ14 1.2029D 03			
STAGE/REGION	1/BZ15 4.4675D 02	2/BZ15 5.2379D 02	3/BZ15 4.4236D 02	4/BZ15 4.7954D 02	5/BZ15 5.1608D 02			
STAGE/REGION	1/BZ21 1.6966D 02	2/BZ21 1.8699D 02	3/BZ21 2.0409D 02	4/BZ21 2.2094D 02	5/BZ21 1.1745D 02	6/BZ21 1.2236D 02	7/BZ21 1.2724D 02	8/BZ21 1.3207D 02
STAGE/REGION	1/BZ22 7.4602D 02	2/BZ22 9.1277D 02	3/BZ22 1.0721D 03	4/BZ22 1.2243D 03	5/BZ22 6.0140D 02	6/BZ22 6.3586D 02	7/BZ22 6.6955D 02	8/BZ22 7.0250D 02
STAGE/REGION	1/BZ23 9.1555D 02	2/BZ23 1.1471D 03	3/BZ23 1.3666D 03	4/BZ23 1.5744D 03	5/BZ23 8.4021D 02	6/BZ23 8.8652D 02	7/BZ23 9.3160D 02	8/BZ23 9.3160D 02
STAGE/REGION	1/BZ24 6.6706D 02	2/BZ24 8.0400D 02	3/BZ24 9.3544D 02	4/BZ24 1.0616D 03	5/BZ24 5.2509D 02	6/BZ24 5.5517D 02	7/BZ24 5.8462D 02	8/BZ24 6.1348D 02
STAGE/REGION	1/BZ25	2/BZ25	3/BZ25	4/BZ25	5/BZ25	6/BZ25	7/BZ25	8/BZ25

COMPLETION OF FINAL SEARCH PROCEDURE

THE ENRICHMENT MODIFICATION FACTOR IS 9.68564D-01

THE BURN STEP TIME IS 1.40268D 02

* THE PROBLEM IS CONVERGED *
*

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE FCC001

DATA SET NAME	DATA SET REFERENCE NUMBER
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ARN	31
	6

THE TIME FOR THE FUEL CYCLE COMPUTATION IS 0.19 MINUTES.

***** END OF PATH STP004 *****

 TIME IN GNIP WAS 0.0888 MINUTES
 GNIP MODULE HAS BEEN UTILIZED

SAMPB2

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUI002

DATA SET NAME	DATA SET REFERENCE NUMBER
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6

THE BURNUP MATRICES WILL BE STORED IN CORE.

THERE ARE 10 MATERIAL REGIONS SPECIFIED.

EACH MATERIAL REGION REQUIRES 320 WORDS OF STORAGE.

THE POINTR CONTAINER ARRAY SIZE IN INFUEL IS 5152.

THE FIRST UNUSED LOCATION IN THE MAIN CORE CCNTAINER IS 21039.

THE FIRST UNUSED LOCATION IN THE BULK CORE CCNTAINER IS-89343.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE FC1001

DATA SET NAME	DATA SET REFERENCE NUMBER
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BRN	31
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TIME= 0.32 MINUTES.

TIME= 0.28 MINUTES.

TIME= 0.39 MINUTES.

TIME= 0.98 MINUTES.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC001

DATA SET NAME	DATA SET REFERENCE NUMBER
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6

THE BURN STEP TIME IS 1.350000 02

THE ENRICHMENT MODIFICATION FACTOR IS 1.000000 00

DENSITIES USED IN THE NEUTRONICS SOLUTION

COMPOSITION C21

MC00L	3.986000-01	MSTRC	2.065000-01	OXYFUL	3.948000-01	U238	6.301220-03	PU239	7.644000-04
PU240	3.057600-04	PU241	1.528800-04	PU242	5.096000-05	MO	0.0	LFPPS	0.0
U235	4.442000-05								

COMPOSITION C22

MC00L	3.986CCD-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	6.30122D-03	PU239	7.64400D-04
PU240	3.05760D-04	PU241	1.52880D-04	PU242	5.09600D-05	MO	0.0	LFPPS	0.0
U235	4.44200C-05								

COMPOSITION CZ3

MC00L	3.986CCD-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	6.30122D-03	PU239	7.64400D-04
PU240	3.05760D-04	PU241	1.52880D-04	PU242	5.09600D-05	MO	0.0	LFPPS	0.0
U235	4.44200C-05								

COMPOSITION CONTR1

MC00L	9.49000D-01	MSTRC	5.10000D-02
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COMPOSITION CZ4

MC00L	3.986CCD-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	5.43185D-03	PU239	1.28970D-03
PU240	5.15880D-04	PU241	2.57940D-04	PU242	8.59800D-05	U235	3.82900D-05	MO	0.0
LFPPS	0.0								

COMPOSITION CZ5

MC00L	3.986CCD-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	5.43185D-03	PU239	1.28970D-03
PU240	5.15880D-04	PU241	2.57940D-04	PU242	8.59800D-05	U235	3.82900D-05	MO	0.0
LFPPS	0.0								

COMPOSITION CZ6

MC00L	3.986CCD-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	5.43185D-03	PU239	1.28970D-03
PU240	5.15880D-04	PU241	2.57940D-04	PU242	8.59800D-05	U235	3.82900D-05	MO	0.0
LFPPS	0.0								

COMPOSITION BZ1

MC00L	2.5410CD-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.26547D-02	U235	2.53600D-05
PU239	0.0	PU240	0.0	PU241	0.0	PU242	0.0	MO	0.0
LFPPS	0.0								

COMPOSITION BZ2

MC00L	2.5410CD-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.26547D-02	U235	2.53600D-05
PU239	0.0	PU240	0.0	PU241	0.0	PU242	0.0	MO	0.0
LFPPS	0.0								

COMPOSITION BZ3

MC00L	2.5410CD-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.26547D-02	U235	2.53600D-05
PU239	0.0	PU240	0.0	PU241	0.0	PU242	0.0	MO	0.0
LFPPS	0.0								

COMPOSITION BZ4

MC00L	2.5410CD-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.26547D-02	U235	2.53600D-05
PU239	0.0	PU240	0.0	PU241	0.0	PU242	0.0	MO	0.0
LFPPS	0.0								

COMPOSITION REFLR

MSTRC	9.00000D-01	MCOGL	1.00000D-01
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COMPOSITION SHIELD

MSTRC	5.540CCD-01	MCOOL	4.46000D-01
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COMPOSITION SODIUM

MCCOL 1.00000D 00

COMPOSITION CONTR2

MCOOL 9.49000D-01 MSTRC 5.10000D-02

COMPOSITION SHIMS

POISCN 1.00000D 00 MCOOL -3.72000D-01 MSTRC 2.50000D-02

TIME NODE 0 DIFFUSION THEORY NEUTRONICS SOLUTION AT 0.0 DAYS.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE FCC001

DATA SET NAME	DATA SET REFERENCE NUMBER
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BRN	31
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THE TIME FOR THE FUEL CYCLE COMPUTATION IS 0.16 MINUTES.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC007

DATA SET NAME	DATA SET REFERENCE NUMBER
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6

SAMPLE FUEL CYCLE PROBLEM 8-19-71

SEARCH CONTROL PASS 4

NEW CONTRL PARAMETER = 1.6878188D 00

PREVIOUS KEFF = 1.0011475D 00

CHANGE IN CONTROL PARAMETER = 6.2404908D-02

COMPOSITION CONTR2 MODIFIED BY COMPOSITION SHIMS

SIZE OF PCINTR CORE CONTAINER ARRAY REQUIRED FOR CALCULATION SECTION = 1320

SIZE OF PCINTR BULK CONTAINER ARRAY REQUIRED FOR CALCULATION SECTION = 0

SAMPLE FUEL CYCLE PROBLEM 8-19-71

ITERATION HISTORY

REAL CALCULATION

ITER NO P	KEFF SIGMA	DIF KEFF ENPM1	LAM UPPER SIGMA BAR	LAM LOWER LAM RATIO	DIF LAM ALPHA	DIF FLUX BETA	NGL FLUX
1	1.0004742C C0	-6.7339331D-04	9.9993429D-01	9.9042440D-01	9.5098909D-03	1.0397766D-03	8.4268592D-03
-2	0.0	0.0	1.0397766D-03	5.5098909D-03	0.0	0.0	
2	1.0002775D C0	-1.9664522D-04	1.0004486D 00	9.9835959D-01	2.0889727D-03	6.3742705D-04	8.4252010D-03
-1	0.0	0.0	6.1304228D-01	2.1966316D-01	0.0	0.0	
3	1.0001864D C0	-9.1092813D-05	1.0004385D 00	9.9889922D-01	1.5392972D-03	4.7859580D-04	8.4244328D-03
0	7.5082444C-01	0.0	7.5082444D-01	7.3686806D-01	0.0	0.0	
4	1.0001145D C0	-7.1945096D-05	1.0003352D 00	9.9912436D-01	1.2108819D-03	3.5583375D-04	8.4238263D-03
1	7.5082444C-01	1.0000000D 00	7.4349535D-01	7.8664592D-01	1.6010560D 00	0.0	
5	1.0000280D C0	-8.6511698D-05	1.0001546D 00	9.9942021D-01	7.3437487D-04	2.1890713D-04	8.4227335D-03

CCNVERGED KEFF = 1.0000280D 00

SIZE OF PCINTR CORE CONTAINER ARRAY REQUIRED FOR OUTPUT SECTION = 1441

SIZE OF POINTR BULK CONTAINER ARRAY REQUIRED FOR OUTPUT SECTION = 0

BULK STORAGE HAS NOT BEEN ALLOCATED. ILASTB CANNOT BE INVOKED

SIZE OF PCINTR CORE CONTAINER ARRAY REQUIRED FOR SEARCH DATA SET OUTPUT SECTION = 1570

SIZE OF POINTR BULK CONTAINER ARRAY REQUIRED FOR SEARCH DATA SET OUTPUT SECTION = 0

*** LEAVING MODULE DIOSCH (NUC004) TIME = 0.186 MINUTES ***

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC004

DATA SET DATA SET
NAME REFERENCE NUMBER

6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION WITH CONTROL SEARCHES IS 0.20 MINUTES.

BEGINNING OF CYCLE CONDITIONS

DENSITIES OF EACH STAGE OF EACH PATH

PATH PATH1
STAGE REGION

1	CZ1	U238 6.3012D-03	PU239 7.6440D-04	PU240 3.0576D-04	PU241 1.5288D-04	PU242 5.0960D-05	MO 0.0	LFPPS 0.0	U235 4.4420D-05
1	CZ1	6.3012D-03	7.6440D-04	3.0576D-04	1.5288D-04	5.0960D-05	0.0	0.0	4.4420D-05

PATH PATH1
STAGE REGION

1	CZ2	U238 6.3012D-03	PU239 7.6440D-04	PU240 3.0576D-04	PU241 1.5288D-04	PU242 5.0960D-05	MO 0.0	LFPPS 0.0	U235 4.4420D-05
1	CZ2	6.3012D-03	7.6440D-04	3.0576D-04	1.5288D-04	5.0960D-05	0.0	0.0	4.4420D-05

PATH PATH1
STAGE REGION

1	CZ3	U238 6.3012D-03	PU239 7.6440D-04	PU240 3.0576D-04	PU241 1.5288D-04	PU242 5.0960D-05	MO 0.0	LFPPS 0.0	U235 4.4420D-05
1	CZ3	6.3012D-03	7.6440D-04	3.0576D-04	1.5288D-04	5.0960D-05	0.0	0.0	4.4420D-05

PATH PATH2
STAGE REGION

1	CZ4	U238 5.4318D-03	PU239 1.2897D-03	PU240 5.1588D-04	PU241 2.5794D-04	PU242 8.5980D-05	MO 0.0	LFPPS 0.0	U235 3.8290D-05
1	CZ4	5.4318D-03	1.2897D-03	5.1588D-04	2.5794D-04	8.5980D-05	0.0	0.0	3.8290D-05

PATH PATH2
STAGE REGION

1	CZ5	U238 5.4318D-03	PU239 1.2897D-03	PU240 5.1588D-04	PU241 2.5794D-04	PU242 8.5980D-05	MO 0.0	LFPPS 0.0	U235 3.8290D-05
1	CZ5	5.4318D-03	1.2897D-03	5.1588D-04	2.5794D-04	8.5980D-05	0.0	0.0	3.8290D-05

PATH PATH2
STAGE REGION

1	CZ6	U238 5.4318D-03	PU239 1.2897D-03	PU240 5.1588D-04	PU241 2.5794D-04	PU242 8.5980D-05	MO 0.0	LFPPS 0.0	U235 3.8290D-05
1	CZ6	5.4318D-03	1.2897D-03	5.1588D-04	2.5794D-04	8.5980D-05	0.0	0.0	3.8290D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ1	1.2655D-02	0.0	0.0	0.0	0.0	0.0	0.0	2.5360D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ2	1.2655C-C2	0.0	0.0	0.0	0.0	0.0	0.0	2.5360D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ3	1.2655C-C2	0.0	0.0	0.0	0.0	0.0	0.0	2.5360D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ4	1.2655C-02	0.0	0.0	0.0	0.0	0.0	0.0	2.5360D-05

INSTANTANEOUS CONVERSION RATIOS

REGION CONVERSION RATIO FISSILE ATOMS FORMED FISSILE ATOMS DESTROYED

CZ1	9.5137CD-C1
CCNTR1	0.0
CZ2	9.49547D-C1
CZ3	9.31553D-C1
CZ4	4.94264D-C1
CCNTR2	0.0
CZ5	4.89985D-C1
CZ6	4.98435D-01
BZ1	0.0
BZ2	0.0
BZ3	0.0
BZ4	0.0
REFLR	0.0
SHIELD	0.0
SODIUM	0.0

AREA CONVERSION RATIO 0.0 , BREEDING RATIO 0.0

REACTOR BREEDING RATIO - 1.09944D 00

CONVERSION RATIO OF EACH STAGE OF EACH PATH

STAGE/REGION	1/CZ1
	9.5137C-C1
STAGE/REGION	1/CZ2
	9.4955C-C1
STAGE/REGION	1/CZ3
	9.3155C-C1
STAGE/REGION	1/CZ4
	4.9426C-C1
STAGE/REGION	1/CZ5
	4.8998C-C1
STAGE/REGION	1/CZ6
	4.9843C-01
STAGE/REGION	1/BZ1
	0.0
STAGE/REGION	1/BZ2

0.0
 STAGE/REGION 1/BZ3
 0.0
 STAGE/REGION 1/BZ4
 0.0

ISOTOPIC MASS (KG) OF EACH STAGE OF EACH PATH

PATH PATH1
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ1	1.2448C 03	1.5164D 02	6.0911D 01	3.0582D 01	1.0236D 01	0.0	0.0	8.6646D 00

PATH PATH1
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ2	1.4682D 03	1.7886D 02	7.1843D 01	3.6071D 01	1.2074D 01	0.0	0.0	1.0220D 01

PATH PATH1
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ3	1.6612C 03	2.0236D 02	8.1284D 01	4.0811D 01	1.3660D 01	0.0	0.0	1.1563D 01

PATH PATH2
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ4	1.6128D 02	3.8455D 01	1.5446D 01	7.7553D 00	2.5958D 00	0.0	0.0	1.1226D 00

PATH PATH2
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ5	9.8427C 02	2.3468D 02	9.4265D 01	4.7329D 01	1.5842D 01	0.0	0.0	6.8508D 00

PATH PATH2
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ6	1.4319C 03	3.4141D 02	1.3714D 02	6.8854D 01	2.3047D 01	0.0	0.0	9.9666D 00

PATH PATH3
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ1	1.3342D 03	0.0	0.0	0.0	0.0	0.0	0.0	2.6400D 00

PATH PATH3
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ2	4.0028D 03	0.0	0.0	0.0	0.0	0.0	0.0	7.9204D 00

PATH PATH3
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ3	2.0017D 03	0.0	0.0	0.0	0.0	0.0	0.0	3.9607D 00

PATH PATH3
 STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ4	4.0036D 03	0.0	0.0	0.0	0.0	0.0	0.0	7.9220D 00

FISSILE MASS OF EACH STAGE OF EACH PATH

STAGE/REGION	1/CZ1
	1.8223C C2
STAGE/REGION	1/CZ2
	2.1493C C2
STAGE/REGION	1/CZ3
	2.4317C 02
STAGE/REGION	1/CZ4
	4.6210C C1
STAGE/REGION	1/CZ5
	2.82C1C C2
STAGE/REGION	1/CZ6
	4.1027C 02
STAGE/REGION	1/BZ1
	0.0
STAGE/REGION	1/BZ2
	0.0
STAGE/REGION	1/BZ3
	0.0
STAGE/REGION	1/BZ4
	0.0

FISSILE MASS (KG) OF EACH PATH

PATH	MASS
PATH1	1.82226D 02
PATH1	2.14929D 02
PATH1	2.43175D 02
PATH2	4.62102D 01
PATH2	2.82C09C 02
PATH2	4.10266D 02
PATH3	0.0
PATH3	0.0
PATH3	0.0
PATH3	0.0

DENSITIES USED IN THE NEUTRONICS SOLUTION

COMPOSITION CZ1

MCOOL	3.9860CD-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	6.21141D-03	PU239	7.72632D-04
PU240	3.09232D-04	PU241	1.40183D-04	PU242	5.22596D-05	MO	1.74428D-06	LFPPS	9.22683D-05
U235	3.99147D-05								

COMPOSITION CZ2

MCOOL	3.9860CD-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	6.22724D-03	PU239	7.71184D-04
PU240	3.08574D-04	PU241	1.42309D-04	PU242	5.20417D-05	MO	1.43882D-06	LFPPS	7.61700D-05
U235	4.06797D-05								

COMPOSITION CZ3

MCOOL	3.9860CD-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	6.24278D-03	PU239	7.68874D-04
PU240	3.07666D-04	PU241	1.44387D-04	PU242	5.17810D-05	MO	1.11937D-06	LFPPS	6.15857D-05
U235	4.14466D-05								

COMPOSITION CONTR1

MC00L 9.49000D-01 MSTRC 5.10000D-02

COMPOSITION CZ4

MC00L	3.98600D-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	5.39028D-03	PU239	1.26116D-03
PU240	5.17887D-04	PU241	2.45941D-04	PU242	8.70607D-05	U235	3.61676D-05	MO	1.08386D-06
LFPPS	8.00643E-C5								

COMPOSITION CZ5

MC00L	3.98600D-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	5.39448D-03	PU239	1.26360D-03
PU240	5.17525D-04	PU241	2.47086D-04	PU242	8.69305D-05	U235	3.63787D-05	MO	9.66308D-07
LFPPS	7.26759E-C5								

COMPOSITION CZ6

MC00L	3.98600D-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	5.40063D-03	PU239	1.26851D-03
PU240	5.17552D-04	PU241	2.48888D-04	PU242	8.68238D-05	U235	3.66852D-05	MO	8.21819D-07
LFPPS	5.97330E-C5								

COMPOSITION BZ1

MC00L	2.54100D-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.25974D-02	U235	2.45161D-05
PU239	4.98369D-05	PU240	1.39872D-07	PU241	2.65396D-10	PU242	3.76852D-13	MO	1.92659D-07
LFPPS	7.99514E-C6								

COMPOSITION BZ2

MC00L	2.54100D-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.26136D-02	U235	2.47498D-05
PU239	3.67712D-05	PU240	7.73463D-08	PU241	1.08938D-10	PU242	1.15230D-13	MO	1.44193D-07
LFPPS	4.74064E-C6								

COMPOSITION BZ3

MC00L	2.54100D-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.26268D-02	U235	2.49427D-05
PU239	2.55454D-05	PU240	3.77670D-08	PU241	3.71255D-11	PU242	2.74526D-14	MO	1.01284D-07
LFPPS	2.67822E-C6								

COMPOSITION BZ4

MC00L	2.54100D-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.26345D-02	U235	2.50567D-05
PU239	1.87701D-05	PU240	2.05583D-08	PU241	1.48999D-11	PU242	8.13345D-15	MO	7.49792D-08
LFPPS	1.66928E-C6								

COMPOSITION REFLR

MSTRC 9.00000D-01 MC00L 1.00000D-01

COMPOSITION SHIELD

MSTRC 5.54000D-01 MC00L 4.46000D-01

COMPOSITION SODIUM

MC00L 1.00000D 00

COMPOSITION CONTR2

MCCOL 9.49000D-01 MSTRC 5.10000D-02

COMPOSITION SHIMS

POISON 1.00000D 00 MC00L -3.72000D-01 MSTRC 2.50000D-02

SAMPLE FUEL CYCLE PROBLEM 8-19-71

SEARCH CONTROL PASS 2

NEW CONTROL PARAMETER = 1.2060710D 00

PREVIOUS KEFF = 9.9019051D-01

CHANGE IN CONTROL PARAMETER = -4.8174782D-01

COMPOSITION CONTR2 MODIFIED BY COMPOSITION SHIMS

SIZE OF PCINTR CORE CONTAINER ARRAY REQUIRED FOR CALCULATION SECTION = 1320

SIZE OF PCINTR BULK CONTAINER ARRAY REQUIRED FOR CALCULATION SECTION = 0

SAMPLE FUEL CYCLE PROBLEM 8-19-71

ITERATION HISTORY

REAL CALCULATION

ITER NO P	KEFF SIGMA	DIF KEFF ENPM1	LAM UPPER SIGMA BAR	LAM LOWER LAM RATIO	DIF LAM ALPHA	DIF FLUX BETA	NGL FLUX
1 -2	9.9498162D-01 0.0	4.7911046D-03 0.0	1.0779994D 00 7.5494486D-03	1.0000349D 00 7.7964556D-02	7.7964556D-02 0.0	7.5494486D-03 0.0	7.1207064D-07
2 -1	9.9649407D-01 0.0	1.5124577D-03 0.0	1.0127753D 00 6.5600927D-01	9.9642083D-01 2.0976805D-01	1.6354473D-02 0.0	4.9525083D-03 0.0	7.1314377D-07
3 0	9.9723790D-01 7.5335959D-01	7.4382756D-04 0.0	1.0084287D 00 7.5335959D-01	9.9651901D-01 7.2821953D-01	1.1909646D-02 0.0	3.7310196D-03 0.0	7.1367115D-07
4 1	9.9781707D-01 7.5335959D-01	5.7916679D-04 1.0000000D 00	1.0066547D 00 7.4252716D-01	9.9731089D-01 7.8455492D-01	9.3437717D-03 1.6043119D 00	2.7703834D-03 0.0	7.1408296D-07
5 2	9.9850524D-01 7.5335959D-01	6.8817172D-04 6.1317130D-01	1.0044085D 00 6.1317130D-01	9.9874843D-01 6.0575810D-01	5.6600653D-03 1.9626925D 00	1.6987196D-03 2.2338587D-01	7.1482621D-07
6 -3	9.9913616D-01 7.7941691D-01	6.3092024D-04 0.0	1.0017340D 00 4.6860621D-01	1.0000462D 00 2.9820175D-01	1.6878414D-03 1.8060330D 00	7.9603054D-04 1.2573685D-01	7.1590543D-07
7	9.9934362D-01	2.0745686D-04	1.0003820D 00	1.0001053D 00	2.7674177D-04	2.3760033D-04	7.1656042D-07

CONVERGED KEFF = 9.9934362D-01

SIZE OF PCINTR CORE CONTAINER ARRAY REQUIRED FOR OUTPUT SECTION = 1441

SIZE OF PCINTR BULK CONTAINER ARRAY REQUIRED FOR OUTPUT SECTION = 0

BULK STORAGE HAS NOT BEEN ALLOCATED. ILASTB CANNOT BE INVOKED

SIZE OF PCINTR CORE CONTAINER ARRAY REQUIRED FOR SEARCH DATA SET OUTPUT SECTION = 1570

SIZE OF PCINTR BULK CONTAINER ARRAY REQUIRED FOR SEARCH DATA SET OUTPUT SECTION = 0

*** LEAVING MODULE DIDSCH (NUC004) TIME = 0.144 MINUTES ***

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC004

DATA SET DATA SET
NAME REFERENCE NUMBER

6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION WITH CONTROL SEARCHES IS 0.16 MINUTES.

REACTOR CONDITIONS AFTER 1 BURNUP SUBSTEPS AT TIME = 67.5000 DAYS

PATH PATH1
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ1	6.2128D-03	7.7255D-04	3.0919D-04	1.4037D-04	5.2243D-05	1.7189D-06	9.0831D-05	3.9980D-05

PATH PATH1
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ2	6.2276D-03	7.7119D-04	3.0857D-04	1.4236D-04	5.2039D-05	1.4332D-06	7.5781D-05	4.0696D-05

PATH PATH1
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ3	6.2422D-03	7.6902D-04	3.0772D-04	1.4431D-04	5.1794D-05	1.1329D-06	6.2075D-05	4.1416D-05

PATH PATH2
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ4	5.3892D-03	1.2607D-03	5.1804D-04	2.4567D-04	8.7102D-05	1.1158D-06	8.1625D-05	3.6116D-05

PATH PATH2
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ5	5.3935D-03	1.2632D-03	5.1765D-04	2.4684D-04	8.6966D-05	9.9465D-07	7.4165D-05	3.6331D-05

PATH PATH2
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ6	5.4000D-03	1.2682D-03	5.1762D-04	2.4872D-04	8.6846D-05	8.4015D-07	6.0799D-05	3.6653D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ1	1.2596D-02	5.0819D-05	1.4555D-07	2.8170D-10	4.0814D-13	1.9650D-07	8.1431D-06	2.4500D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ2	1.26130-02	3.75100-05	8.04990-08	1.15670-10	1.24830-13	1.47080-07	4.84780-06	2.47380-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ3	1.26260-02	2.60880-05	3.93840-08	3.95360-11	2.98560-14	1.03410-07	2.74970-06	2.49340-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ4	1.26340-02	1.91900-05	2.14840-08	1.59180-11	8.88280-15	7.66370-08	1.71750-06	2.50500-05

INTEGRATED CONVERSION RATIOS

REGION CONVERSION RATIO FISSILE ATOMS FORMED FISSILE ATOMS DESTROYED

CZ1	9.501170-01	4.158250 01	4.376570 01
CONTR1	0.0	0.0	0.0
CZ2	9.487750-C1	4.078820 01	4.299040 01
CZ3	9.327960-01	3.661810 01	3.925630 01
CZ4	5.020440-C1	3.124840 00	6.224230 00
CONTR2	0.0	0.0	0.0
CZ5	4.969660-C1	1.705520 01	3.431870 01
CZ6	5.035470-C1	2.081050 01	4.132790 01
BZ1	6.837480 C1	1.376020 01	2.012460-01
BZ2	9.726210 01	3.033740 01	3.119140-01
BZ3	1.454680 C2	1.051510 01	7.228470-02
BZ4	2.033160 02	1.544010 01	7.594130-02
REFLR	0.0	0.0	0.0
SHIELD	0.0	0.0	0.0
SOCIUM	0.0	0.0	0.0

AREA CONVERSION RATIO 0.0 , BREEDING RATIO 0.0

REACTOR BREEDING RATIO - 1.103040 00

CONVERSION RATIO OF EACH STAGE OF EACH PATH

STAGE/REGION	1/CZ1
	9.50120-C1
STAGE/REGION	1/CZ2
	9.48780-C1
STAGE/REGION	1/CZ3
	9.32800-C1
STAGE/REGION	1/CZ4
	5.02040-C1
STAGE/REGION	1/CZ5
	4.96970-C1
STAGE/REGION	1/CZ6
	5.03550-C1
STAGE/REGION	1/BZ1
	6.83750 01
STAGE/REGION	1/BZ2
	9.72620 01
STAGE/REGION	1/BZ3
	1.45470 C2
STAGE/REGION	1/BZ4
	2.03320 02

ISOTOPIIC MASS (KG) OF EACH STAGE OF EACH PATH

PATH PATH1
STAGE REGION

1	CZ1	U238 1.2273D 03	PU239 1.5326D 02	PU240 6.1594D 01	PU241 2.8079D 01	PU242 1.0494D 01	MO 1.3690D-01	LFPPS 9.0473D 00	U235 7.7985D 00
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PATH PATH1
STAGE REGION

1	CZ2	U238 1.4511D 03	PU239 1.8045D 02	PU240 7.2503D 01	PU241 3.3588D 01	PU242 1.2329D 01	MO 1.3463D-01	LFPPS 8.9029D 00	U235 9.3628D 00
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PATH PATH1
STAGE REGION

1	CZ3	U238 1.6456D 03	PU239 2.0359D 02	PU240 8.1805D 01	PU241 3.8523D 01	PU242 1.3884D 01	MO 1.2041D-01	LFPPS 8.2511D 00	U235 1.0781D 01
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PATH PATH2
STAGE REGION

1	CZ4	U238 1.60C2D 02	PU239 3.7591D 01	PU240 1.5511D 01	PU241 7.3865D 00	PU242 2.6297D 00	MO 1.3357D-02	LFPPS 1.2220D 00	U235 1.0588D 00
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PATH PATH2
STAGE REGION

1	CZ5	U238 9.7733D 02	PU239 2.2985D 02	PU240 9.4588D 01	PU241 4.5292D 01	PU242 1.6023D 01	MO 7.2662D-02	LFPPS 6.7759D 00	U235 6.5004D 00
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PATH PATH2
STAGE REGION

1	CZ6	U238 1.4235D 03	PU239 3.3571D 02	PU240 1.3760D 02	PU241 6.6392D 01	PU242 2.3279D 01	MO 8.9289D-02	LFPPS 8.0812D 00	U235 9.5405D 00
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PATH PATH3
STAGE REGION

1	BZ1	U238 1.3280D 03	PU239 5.3803D 00	PU240 1.5474D-02	PU241 3.0074D-05	PU242 4.3753D-08	MO 8.3521D-03	LFPPS 4.3286D-01	U235 2.5504D 00
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PATH PATH3
STAGE REGION

1	BZ2	U238 3.9895D 03	PU239 1.1914D 01	PU240 2.5676D-02	PU241 3.7048D-05	PU242 4.0150D-08	MO 1.8755D-02	LFPPS 7.7314D-01	U235 7.7260D 00
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PATH PATH3
STAGE REGION

1	BZ3	U238 1.9971D 03	PU239 4.1438D 00	PU240 6.2819D-03	PU241 6.3325D-06	PU242 4.8019D-09	MO 6.5944D-03	LFPPS 2.1930D-01	U235 3.8942D 00
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PATH PATH3
STAGE REGION

1	BZ4	U238 3.9970D 03	PU239 6.0967D 00	PU240 6.8540D-03	PU241 5.0994D-06	PU242 2.8575D-09	MO 9.7747D-03	LFPPS 2.7397D-01	U235 7.8251D 00
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FISSILE MASS OF EACH STAGE OF EACH PATH

STAGE/REGION 1/CZ1
 1.8134C 02
 STAGE/REGION 1/CZ2
 2.1403C 02
 STAGE/REGION 1/CZ3
 2.4211C 02
 STAGE/REGION 1/CZ4
 4.4977C 01
 STAGE/REGION 1/CZ5
 2.7514C 02
 STAGE/REGION 1/CZ6
 4.0210C 02
 STAGE/REGION 1/BZ1
 5.3803C 00
 STAGE/REGION 1/BZ2
 1.1914C 01
 STAGE/REGION 1/BZ3
 4.1438C 00
 STAGE/REGION 1/BZ4
 6.0967C 00

FISSILE MASS (KG) OF EACH PATH

PATH	MASS
PATH1	1.81339D 02
PATH1	2.14034C 02
PATH1	2.42109D 02
PATH2	4.49772D 01
PATH2	2.75142C 02
PATH2	4.02105D 02
PATH3	5.38034D 00
PATH3	1.19145D 01
PATH3	4.14384D 00
PATH3	6.09667D 00

BURNUP (ATOM %) OF EACH STAGE OF EACH PATH

STAGE/REGION 1/CZ1
 1.1537C-02
 STAGE/REGION 1/CZ2
 9.6236C-03
 STAGE/REGION 1/CZ3
 7.8866C-03
 STAGE/REGION 1/CZ4
 1.0543C-02
 STAGE/REGION 1/CZ5
 9.5805C-03
 STAGE/REGION 1/CZ6
 7.8514C-03
 STAGE/REGION 1/BZ1
 5.9103C-04
 STAGE/REGION 1/BZ2
 3.4552C-04
 STAGE/REGION 1/BZ3
 1.9178C-04
 STAGE/REGION 1/BZ4
 1.1726C-04

BURNUP (MWD/MT) OF EACH STAGE OF EACH PATH

STAGE/REGION 1/CZ1
 1.0889C 04
 STAGE/REGION 1/CZ2
 9.0825C 03

STAGE/REGION 1/CZ3
 7.44320 C3
 STAGE/REGION 1/CZ4
 9.94240 C3
 STAGE/REGION 1/CZ5
 9.03490 C3
 STAGE/REGION 1/CZ6
 7.40420 C3
 STAGE/REGION 1/BZ1
 5.58430 C2
 STAGE/REGION 1/BZ2
 3.26460 C2
 STAGE/REGION 1/BZ3
 1.81200 C2
 STAGE/REGION 1/BZ4
 1.10800 C2

DENSITIES USED IN THE NEUTRONICS SOLUTION

COMPOSITION CZ1

MCOOL	3.98600D-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	6.12824D-03	PU239	7.78826D-04
PU240	3.12542D-04	PU241	1.29679D-04	PU242	5.32644D-05	MO	3.30481D-06	LFPPS	1.77687D-04
U235	3.61000E-05								

COMPOSITION CZ2

MCOOL	3.98600D-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	6.15544D-03	PU239	7.76778D-04
PU240	3.11394E-04	PU241	1.32978D-04	PU242	5.29473D-05	MO	2.79616D-06	LFPPS	1.49991D-04
U235	3.73128E-05								

COMPOSITION CZ3

MCOOL	3.98600D-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	6.18249D-03	PU239	7.73167D-04
PU240	3.09786E-04	PU241	1.36289D-04	PU242	5.25433D-05	MO	2.25370D-06	LFPPS	1.24547E-04
U235	3.85595E-05								

COMPOSITION CONTR1

MCOOL	9.49000D-01	MSTRC	5.10000D-02						
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COMPOSITION CZ4

MCOOL	3.98600D-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	5.34494D-03	PU239	1.23207D-03
PU240	5.20190E-04	PU241	2.33746D-04	PU242	8.81740D-05	U235	3.39670D-05	MC	2.27502D-06
LFPPS	1.64271D-04								

COMPOSITION CZ5

MCOOL	3.98600D-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	5.35364D-03	PU239	1.23675D-03
PU240	5.19411E-04	PU241	2.35952D-04	PU242	8.79157D-05	U235	3.43828D-05	MC	2.02935D-06
LFPPS	1.49561E-04								

COMPOSITION CZ6

MCOOL	3.98600D-01	MSTRC	2.06500D-01	OXYFUL	3.94800D-01	U238	5.36707D-03	PU239	1.24663D-03
PU240	5.19319E-04	PU241	2.39639D-04	PU242	8.76795D-05	U235	3.50247D-05	MC	1.70563D-06
LFPPS	1.22564E-04								

COMPOSITION BZ1

MCOOL	2.54100D-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.25359D-02	U235	2.36372D-05
PU239	1.01824E-04	PU240	5.96351D-07	PU241	2.33869D-09	PU242	6.93035D-12	MO	3.93757D-07
LFPPS	1.77611E-05								

COMPOSITION BZ2									
MCOOL	2.54100D-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.25693D-02	U235	2.41064D-05
PU239	7.55674D-05	PU240	3.31315D-07	PU241	9.66455D-10	PU242	2.13006D-12	MO	2.96172D-07
LFPPS	1.05174C-C5								

COMPOSITION BZ3									
MCOOL	2.54100D-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.25965D-02	U235	2.44969D-05
PU239	5.28272C-05	PU240	1.62961D-07	PU241	3.32920D-10	PU242	5.13689D-13	MO	2.09269D-07
LFPPS	5.92348C-C6								

COMPOSITION BZ4									
MCOOL	2.54100D-01	MSTRC	8.89000D-02	OXYFUL	6.57000D-01	U238	1.26125D-02	U235	2.47297D-05
PU239	3.89899C-05	PU240	8.92545D-08	PU241	1.34833D-10	PU242	1.53856D-13	MO	1.55611C-07
LFPPS	3.67864C-C6								

COMPOSITION REFLR			
MSTRC	9.00000D-01	MCOOL	1.00000D-01

COMPOSITION SHIELD			
MSTRC	5.54000D-01	MCOOL	4.46000D-01

COMPOSITION SODIUM	
MCOOL	1.00000D 00

COMPOSITION CONTR2			
MCOOL	9.49000D-01	MSTRC	5.10000D-02

COMPOSITION SHIMS			
POISCN	1.00000D 00	MCOOL	-3.72000D-01
		MSTRC	2.50000D-02

TIME NODE 2 DIFFUSION THECRY NEUTRONICS SOLUTION AT 1.35000D 02 DAYS.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE FCC001

DATA SET NAME	DATA SET REFERENCE NUMBER
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BRN	31
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THE TIME FOR THE FUEL CYCLE COMPUTATION IS 0.15 MINUTES.

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC007

DATA SET NAME	DATA SET REFERENCE NUMBER
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SAMPLE FUEL CYCLE PROBLEM 8-19-71

SEARCH CONTROL PASS 2

NEW CONTROL PARAMETER = 7.1679397D-01

PREVIOUS KEFF = 9.9003720D-01

CHANGE IN CONTROL PARAMETER = -4.8927705D-01

COMPOSITION CONTR2 MODIFIED BY COMPOSITION SHIMS

SIZE OF PCINTR CORE CONTAINER ARRAY REQUIRED FOR CALCULATION SECTION = 1320

SIZE OF PCINTR BULK CONTAINER ARRAY REQUIRED FOR CALCULATION SECTION = 0

SAMPLE FUEL CYCLE PROBLEM 8-19-71

ITERATION HISTORY

REAL CALCULATION

ITER NO P	KEFF SIGMA	DIF KEFF ENPM1	LAM UPPER SIGMA BAR	LAM LOWER LAM RATIO	DIF LAM ALPHA	DIF FLUX BETA	NGL FLUX
1	9.9591056D-01	5.8733625D-03	1.0842185D 00	1.0000040D 00	8.4214422D-02	8.7465160D-03	7.0299481D-07
-2	0.0	0.0	8.7465160D-03	8.4214422D-02	0.0	0.0	
2	9.9756637D-01	1.6558068D-03	1.0138538D 00	9.9554363D-01	1.8310167D-02	5.6075256D-03	7.0415166D-07
-1	0.0	0.0	6.4111534D-01	2.1742318D-01	0.0	0.0	
3	9.9841534D-01	8.4897066D-04	1.0090151D 00	9.9580988D-01	1.3205188D-02	4.2010721D-03	7.0474463D-07
0	7.4918466D-01	0.0	7.4918466D-01	7.2119429D-01	0.0	0.0	
4	9.9907146D-01	6.5611901D-04	1.0070833D 00	9.9678127D-01	1.0301991D-02	3.1053782D-03	7.0520440D-07
1	7.4918466D-01	1.0000000D 00	7.3918709D-01	7.8014721D-01	1.5989570D 00	0.0	
5	9.9984203D-01	7.7056613D-04	1.0047308D 00	9.9849248D-01	6.2383324D-03	1.8861471D-03	7.0602606D-07
2	7.4918466D-01	6.0738079D-01	6.0738079D-01	6.0554631D-01	1.9484619D 00	2.1858305D-01	
6	1.0005361D 00	6.9402600D-04	1.0018717D 00	1.0000167D 00	1.8550412D-03	8.6282434D-04	7.0719980D-07
-3	7.7376911D-01	0.0	4.5745337D-01	2.9736171D-01	1.7951519D 00	1.2270179D-01	
7	1.0007604D 00	2.2430447D-04	1.0004063D 00	1.0001061D 00	3.0020800D-04	2.5466790D-04	7.0790036D-07

CONVERGED KEFF = 1.0007604D 00

SAMPLE FUEL CYCLE PROBLEM 8-19-71

REAL NORMALIZED FLUXES BY MESH INTERVAL AND GROUP

MESH INTERVAL NUMBER	MESH INTERVAL CENTER	GROUP 1	GROUP 2
1	2.347	1.316050D-04	1.030013D-04
2	7.040	1.308879D-04	1.025598D-04
3	11.733	1.294530D-04	1.016939D-04
4	16.427	1.272982D-04	1.004397D-04
5	21.120	1.244174D-04	9.885715D-05
6	25.814	1.207969D-04	9.703830D-05
7	30.507	1.164088D-04	9.512022D-05
8	35.200	1.112023D-04	9.330541D-05
9	38.726	1.074595D-04	9.244937D-05
10	41.083	1.067999D-04	9.179455D-05
11	44.320	1.068130D-04	8.925304D-05
12	48.436	1.056494D-04	8.560589D-05
13	52.553	1.035496D-04	8.204438D-05
14	56.669	1.006940D-04	7.833809D-05
15	60.512	9.745356D-05	7.459315D-05
16	64.082	9.405721D-05	7.078824D-05
17	67.653	9.035581D-05	6.658224D-05
18	71.223	8.643248D-05	6.188885D-05
19	73.727	8.359173D-05	5.817722D-05
20	75.668	8.174961D-05	5.629524D-05
21	78.115	8.077981D-05	5.498130D-05
22	81.280	8.006563D-05	5.284626D-05
23	85.165	7.613339D-05	4.940567D-05
24	88.807	7.009665D-05	4.595695D-05
25	92.208	6.269852D-05	4.263328D-05
26	95.608	5.371128D-05	3.937181D-05
27	98.256	4.515639D-05	3.703514D-05
28	100.152	3.935895D-05	3.504589D-05
29	102.868	3.213568D-05	3.200043D-05
30	106.404	2.490695D-05	2.795841D-05
31	109.939	1.934126D-05	2.416552D-05
32	112.943	1.569499D-05	2.130809D-05
33	115.414	1.320704D-05	1.919850D-05
34	118.201	1.088350D-05	1.711337D-05
35	121.303	8.856042D-06	1.521490D-05
36	124.405	7.277345D-06	1.374698D-05
37	128.756	5.406696D-06	1.181291D-05
38	134.357	3.669499D-06	9.282254D-06
39	139.958	2.465678D-06	7.124383D-06
40	147.195	1.553772D-06	5.238521D-06
41	156.070	9.416937D-07	3.635882D-06
42	164.945	5.509681D-07	2.346963D-06
43	173.820	2.905866D-07	1.288864D-06
44	183.337	1.516702D-07	6.722376D-07
45	193.497	8.292321D-08	3.852464D-07
46	203.657	2.586468D-08	1.230643D-07

NORMALIZATION FACTOR = 1.019168D 00

FLUXES NORMALIZED TO ONE FISSION IN REACTOR

NORMALIZED FLUXES WRITTEN OUT ON DATA SET REFERENCE NUMBER 43

SAMPLE FUEL CYCLE PROBLEM 8-19-71

POWER AND AVERAGE POWER BY REGION

REGION	POWER	AVERAGE POWER	FISSIONS/WATT-SEC.
CZ1	1.917902D-01	3.836268D-07	3.100000D 10
CONTR1	0.0	0.0	3.100000D 10
CZ2	1.957778D-01	3.320173D-07	3.100000D 10
CZ3	1.894304D-01	2.839377D-07	3.100000D 10
CZ4	2.837117D-02	3.775722D-07	3.100000D 10
CONTR2	0.0	0.0	3.100000D 10
CZ5	1.581125D-01	3.447970D-07	3.100000D 10
CZ6	1.880981D-01	2.819542D-07	3.100000D 10
BZ1	1.254406D-02	4.701579D-08	3.100000D 10
BZ2	2.212169D-02	2.763585D-08	3.100000D 10
BZ3	6.165073D-03	1.540162D-08	3.100000D 10
BZ4	7.588967D-03	9.478753D-09	3.100000D 10
REFLR	0.0	0.0	3.100000D 10
SHIELD	0.0	0.0	3.100000D 10
SODIUM	0.0	0.0	3.100000D 10

MAXIMUM POWER 1.957778D-01 OCCURS IN REGION CZ2

MINIMUM POWER 6.165073D-03 OCCURS IN REGION BZ3

TOTAL POWER = 1.000000D 00

*** LEAVING MODULE DIDSCH (NUC004) TIME = 0.170 MINUTES ***

THE FOLLOWING DATA SETS WERE OPEN AFTER MODULE NUC004

DATA SET DATA SET
NAME REFERENCE NUMBER

6

THE TIME FOR THE ONE- OR TWO-DIMENSIONAL DIFFUSION THEORY NEUTRONICS SOLUTION WITH CONTROL SEARCHES IS 0.18 MINUTES.

REACTOR CONDITIONS AFTER 2 BURNUP SUBSTEPS AT TIME = 135.0000 DAYS

PATH PATH1
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ1	6.1283D-03	7.7882D-04	3.1254D-04	1.2969D-04	5.3263D-05	3.3028D-06	1.7757D-04	3.6106D-05

PATH PATH1
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ2	6.1555D-03	7.7678D-04	3.1139D-04	1.3299D-04	5.2947D-05	2.7952D-06	1.4991D-04	3.7316D-05

PATH PATH1
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ3	6.1825D-03	7.7319D-04	3.0979D-04	1.3629D-04	5.2545D-05	2.2549D-06	1.2455D-04	3.8558D-05

PATH PATH2
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ4	5.3448D-03	1.2321D-03	5.2022D-04	2.3372D-04	8.8180D-05	2.2790D-06	1.6439D-04	3.3962D-05

PATH PATH2
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ5	5.3536D-03	1.2367D-03	5.1943D-04	2.3594D-04	8.7920D-05	2.0321D-06	1.4963D-04	3.4379D-05

PATH PATH2
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	CZ6	5.3671D-03	1.2466D-03	5.1933D-04	2.3963D-04	8.7681D-05	1.7066D-06	1.2257D-04	3.5024D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ1	1.2536D-02	1.0184D-04	5.9663D-07	2.3403D-09	6.9367D-12	3.9385D-07	1.7758D-05	2.3637D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ2	1.2569D-02	7.5577D-05	3.3141D-07	9.6686D-10	2.1312D-12	2.9621D-07	1.0518D-05	2.4106D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ3	1.2596D-02	5.2835D-05	1.6300D-07	3.3306D-10	5.1397D-13	2.0930D-07	5.9253D-06	2.4497D-05

PATH PATH3
STAGE REGION

		U238	PU239	PU240	PU241	PU242	MO	LFPPS	U235
1	BZ4	1.2612D-02	3.8997D-05	8.9285D-08	1.3490D-10	1.5396D-13	1.5564D-07	3.6804D-06	2.4730D-05

INTEGRATED CONVERSION RATIOS

REGION CONVERSION RATIO FISSILE ATOMS FORMED FISSILE ATOMS DESTROYED

CZ1	9.47587D-01	3.97679D 01	4.19675D 01
CONTR1	0.0	0.0	0.0
CZ2	9.47257D-01	3.99959D 01	4.22229D 01
CZ3	9.35409D-01	3.71682D 01	3.97348D 01
CZ4	5.18116D-01	3.28132D 00	6.33317D 00
CONTR2	0.0	0.0	0.0
CZ5	5.11366D-01	1.79092D 01	3.50222D 01
CZ6	5.14051D-01	2.16023D 01	4.20236D 01
BZ1	2.27759D 01	1.42396D 01	6.25202D-01
BZ2	3.22230D 01	3.14487D 01	9.75970D-01
BZ3	4.79830D 01	1.09342D 01	2.27877D-01
BZ4	6.69055D 01	1.60987D 01	2.40619D-01
REFLR	0.0	0.0	0.0
SHIELD	0.0	0.0	0.0
SODIUM	0.0	0.0	0.0

AREA CONVERSION RATIO 0.0 , BREEDING RATIO 0.0

REACTOR BREEDING RATIO - 1.11020D 00

CONVERSION RATIO OF EACH STAGE OF EACH PATH

STAGE/REGION	1/CZ1
	9.4759D-01
STAGE/REGION	1/CZ2
	9.4726D-01
STAGE/REGION	1/CZ3
	9.3541D-01
STAGE/REGION	1/CZ4
	5.1812D-01
STAGE/REGION	1/CZ5
	5.1137D-01
STAGE/REGION	1/CZ6
	5.1405D-01
STAGE/REGION	1/BZ1
	2.2776D 01
STAGE/REGION	1/BZ2
	3.2223D 01
STAGE/REGION	1/BZ3
	4.7983D 01
STAGE/REGION	1/BZ4
	6.6906D 01

ISOTOPIIC MASS (KG) OF EACH STAGE OF EACH PATH

PATH PATH-1
STAGE REGION

1	CZ1	U238 1.2107D 03	PU239 1.5450D 02	PU240 6.2261D 01	PU241 2.5944D 01	PU242 1.0699D 01	MO 2.6305D-01	LFPPS 1.7687D 01	U235 7.0428D 00
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PATH PATH1
STAGE REGION

1	CZ2	U238 1.4343D 03	PU239 1.8176D 02	PU240 7.3166D 01	PU241 3.1377D 01	PU242 1.2544D 01	MO 2.6257D-01	LFPPS 1.7612D 01	U235 8.5852D 00
---	-----	--------------------	---------------------	---------------------	---------------------	---------------------	------------------	---------------------	--------------------

PATH PATH-1
STAGE REGION

1	CZ3	U238 1.6299D 03	PU239 2.0469D 02	PU240 8.2357D 01	PU241 3.6382D 01	PU242 1.4085D 01	MO 2.3965D-01	LFPPS 1.6556D 01	U235 1.0037D 01
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PATH PATH2
STAGE REGION

1	CZ4	U238 1.5870D 02	PU239 3.6736D 01	PU240 1.5576D 01	PU241 7.0272D 00	PU242 2.6623D 00	MO 2.7281D-02	LFPPS 2.4611D 00	U235 9.9568D-01
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PATH PATH2
STAGE REGION

1	CZ5	U238 9.7069D 02	PU239 2.2504D 02	PU240 9.4914D 01	PU241 4.3251D 01	PU242 1.6199D 01	MO 1.4845D-01	LFPPS 1.3671D 01	U235 6.1511D 00
---	-----	--------------------	---------------------	---------------------	---------------------	---------------------	------------------	---------------------	--------------------

PATH PATH2
STAGE REGION

1	CZ6	U238 1.4148D 03	PU239 3.3001D 02	PU240 1.3805D 02	PU241 6.3968D 01	PU242 2.3503D 01	MO 1.8137D-01	LFPPS 1.6292D 01	U235 9.1164D 00
---	-----	--------------------	---------------------	---------------------	---------------------	---------------------	------------------	---------------------	--------------------

PATH PATH3
STAGE REGION

1	BZ1	U238 1.3216D 03	PU239 1.0782D 01	PU240 6.3431D-02	PU241 2.4984D-04	PU242 7.4362D-07	MO 1.6740D-02	LFPPS 9.4396D-01	U235 2.4606D 00
---	-----	--------------------	---------------------	---------------------	---------------------	---------------------	------------------	---------------------	--------------------

PATH PATH3
STAGE REGION

1	BZ2	U238 3.9758D 03	PU239 2.4006D 01	PU240 1.0571D-01	PU241 3.0968D-04	PU242 6.8546D-07	MO 3.7773D-02	LFPPS 1.6774D 00	U235 7.5289D 00
---	-----	--------------------	---------------------	---------------------	---------------------	---------------------	------------------	---------------------	--------------------

PATH PATH3
STAGE REGION

1	BZ3	U238 1.9924D 03	PU239 8.3922D 00	PU240 2.6000D-02	PU241 5.3345D-05	PU242 8.2663D-08	MO 1.3347D-02	LFPPS 4.7255D-01	U235 3.8259D 00
---	-----	--------------------	---------------------	---------------------	---------------------	---------------------	------------------	---------------------	--------------------

PATH PATH3
STAGE REGION

1	BZ4	U238 3.9902D 03	PU239 1.2389D 01	PU240 2.8484D-02	PU241 4.3217D-05	PU242 4.9528D-08	MO 1.9851D-02	LFPPS 5.8707D-01	U235 7.7251D 00
---	-----	--------------------	---------------------	---------------------	---------------------	---------------------	------------------	---------------------	--------------------

FISSILE MASS OF EACH STAGE OF EACH PATH

STAGE/REGION 1/CZ1
 1.8045C 02
 STAGE/REGION 1/CZ2
 2.1313C 02
 STAGE/REGION 1/CZ3
 2.41C7C C2
 STAGE/REGION 1/CZ4
 4.3763C 01
 STAGE/REGION 1/CZ5
 2.6833C 02
 STAGE/REGION 1/CZ6
 3.9398C C2
 STAGE/REGION 1/BZ1
 1.0783C C1
 STAGE/REGION 1/BZ2
 2.4006C 01
 STAGE/REGION 1/BZ3
 8.3923C 00
 STAGE/REGION 1/BZ4
 1.2389C C1

FISSILE MASS (KG) OF EACH PATH

PATH	MASS
PATH1	1.60448D 02
PATH1	2.13132C 02
PATH1	2.41C73D 02
PATH2	4.27632D 01
PATH2	2.68334C 02
PATH2	3.63981D 02
PATH3	1.07827D 01
PATH3	2.40064C 01
PATH3	8.39225D 00
PATH3	1.23894D 01

BURNUP (ATOM %) OF EACH STAGE OF EACH PATH

STAGE/REGION 1/CZ1
 1.1055C-C2
 STAGE/REGION 1/CZ2
 9.4414C-C3
 STAGE/REGION 1/CZ3
 7.9548C-C3
 STAGE/REGION 1/CZ4
 1.0696C-C2
 STAGE/REGION 1/CZ5
 9.7537C-C3
 STAGE/REGION 1/CZ6
 7.9810C-C3
 STAGE/REGION 1/BZ1
 7.0719C-C4
 STAGE/REGION 1/BZ2
 4.0996C-C4
 STAGE/REGION 1/BZ3
 2.2478C-C4
 STAGE/REGION 1/BZ4
 1.3605C-C4

BURNUP (MWD/MT) OF EACH STAGE OF EACH PATH

STAGE/REGION 1/CZ1
 1.0433C C4
 STAGE/REGION 1/CZ2
 8.91C6C C3

STAGE/REGION	1/CZ3
	7.5075C 03
STAGE/REGION	1/CZ4
	1.0087C 04
STAGE/REGION	1/CZ5
	9.1982C 03
STAGE/REGION	1/CZ6
	7.5264C 03
STAGE/REGION	1/BZ1
	6.6818C 02
STAGE/REGION	1/BZ2
	3.8735C 02
STAGE/REGION	1/BZ3
	2.1238C 02
STAGE/REGION	1/BZ4
	1.2855C 02

CUMULATIVE BURNUP AFTER 0 BURNUP SUBSTEPS AT TIME = 0.0 DAYS.

BURNUP (ATOM %) OF EACH STAGE OF EACH PATH

STAGE/REGION	1/CZ1
	0.0
STAGE/REGION	1/CZ2
	0.0
STAGE/REGION	1/CZ3
	0.0
STAGE/REGION	1/CZ4
	0.0
STAGE/REGION	1/CZ5
	0.0
STAGE/REGION	1/CZ6
	0.0
STAGE/REGION	1/BZ1
	0.0
STAGE/REGION	1/BZ2
	0.0
STAGE/REGION	1/BZ3
	0.0
STAGE/REGION	1/BZ4
	0.0

BURNUP (MWD/MT) OF EACH STAGE OF EACH PATH

STAGE/REGION	1/CZ1
	0.0
STAGE/REGION	1/CZ2
	0.0
STAGE/REGION	1/CZ3
	0.0
STAGE/REGION	1/CZ4
	0.0
STAGE/REGION	1/CZ5
	0.0
STAGE/REGION	1/CZ6
	0.0
STAGE/REGION	1/BZ1
	0.0
STAGE/REGION	1/BZ2
	0.0
STAGE/REGION	1/BZ3
	0.0
STAGE/REGION	1/BZ4
	0.0

APPENDIX 4. PROCEDURE ARCSP004

This Appendix lists the ARC Standard Procedure ARCSP004, which invokes the standard path STP004. This procedure is designed to reduce the amount of Job Control Language (JCL) required by the user for the execution of the fuel cycle analysis capability in the ARC System. Table I (Section II-B) lists the symbolic parameters used in the procedure along with their meanings and default values. The correspondence between the JCL DDNAME and the ARC System data set glossary name is provided in Table II (Section II-B). This table also gives a brief description of the contents of the datasets, lists associated symbolic parameters where applicable, and indicates which modules use each dataset. All standard ARC System data sets are listed and described in Reference 9.

The minimal JCL required to execute a problem with the procedure ARCSP004 is illustrated in Fig. 2 (Section II-B). Some further illustrations of the use of this procedure and the symbolic parameters are included in Section III.

```

//ARCSP004 PROC BUFFER=16000,DISKNO=28,BURNINP='&ABURNI', X
// BURNDSP='(,DELETE)',BURNVOL=SCRONE,DUMP='BRNDMP', X
// DUMPDSP='(,DELETE)',DUMPVOL=SCRONE,FLX1D1='&FRD11', X
// FLX1DSP='(,DELETE)',FLX1VOL=SYSSCR,FLX2D1='&FRD21', X
// FLX2DSP='(,DELETE)',FLX2VOL=SYSSCR,MATCS='&XSMMIN', X
// MATCDSP='(,DELETE)',MATCVOL=SCRONE,MCSP='&BHMOMG', X
// MCSPDSP='(,DELETE)',MCSPVOL=SCR TWO,MICRXS1='&XSIS0', X
// MICRXS2='&XSIS2',MICRVOL=DISK20,NEUTINP='&ANIP', X
// NEUTDSP='(,DELETE)',NEUTVOL=SCR TWO,NFLX1='&FRPN1', X
// NFL1DSP='(,DELETE)',NFL1VOL=SYSSCR
//STP004 EXEC PGM=STP004
//STEPLIB DD DSN=&DISKNO,MODLIB,DISP=(SHR,PASS),UNIT=DISK, X
// VOL=SER=DISK&DISKNO
//FT05FU01 DD DDNAME=SYSIN THIS CARD DEFINES INPUT DATA SET,
//FT06FU01 DD UNIT=(CTC,,DEFER), X
// DCB=(RECFM=VBSA,LRECL=137,BLKSIZE=1511) X
// THIS CARD DEFINES THE OUTPUT DATA SET,
//FT09FU01 DD UNIT=DISK,SPACE=(CYL,(1,1)), X
// DCB=(RECFM=VBS,LRECL=84,BLKSIZE=3364) X
// ARC SYSTEM OS360 CORRESPONDENCE.
//FT11FU01 DD DSN=&BURNINP,DISP=&BURNDSP,UNIT=DISK,VOL=SER=&BURNVOL, X
// SPACE=(TRK,(3,1),RLSE), X
// DCB=(RECFM=VBS,LRECL=84,BLKSIZE=7228) X
// BURNUP MODULE DEPENDENT DATA SET,
//FT12FU01 DD DSN=&ACOL,UNIT=DISK,SPACE=(TRK,(1,1)), X
// DCB=(RECFM=VBS,LRECL=84,BLKSIZE=844) X
// MICROSCOPIC OR MACROSCOPIC CROSS SECTION GROUP
// COLLAPSING INPUT DATA SET,
//FT13FU01 DD DSN=&ADIF1D,UNIT=DISK,SPACE=(TRK,(1,1)), X
// DCB=(RECFM=VBS,LRECL=84,BLKSIZE=508) X
// 1D DIFFUSION MODULE DEPENDENT DATA SET,
//FT14FU01 DD DSN=&ADIF2D,UNIT=DISK,SPACE=(TRK,(1,1)), X
// DCB=(RECFM=VBS,LRECL=84,BLKSIZE=676) X
// 2D DIFFUSION MODULE DEPENDENT DATA SET,
//FT15FU01 DD DSN=&ASTP004,UNIT=DISK,SPACE=(TRK,(1,1)), X
// DCB=(RECFM=VBS,LRECL=84,BLKSIZE=88) X
// STANDARD PATH STP004 PATH DEPENDENT DATA SET,
//FT19FU01 DD DSN=&NEUTINP,DISP=&NEUTDSP,UNIT=DISK,VOL=SER=&NEUTVOL, X
// SPACE=(TRK,(3,1),RLSE), X
// DCB=(RECFM=VBS,LRECL=84,BLKSIZE=7228) X
// GENERAL NEUTRONICS INPUT DATA SET,
//FT21FU01 DD DSN=&NFLX2,UNIT=DISK,VOL=SER=SCRONE,SPACE=(CYL,(1,1)), X
// DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
// POWER NORMALIZED REGION FLUXES AT SECOND TIME POINT,
//FT22FU01 DD DSN=&NFLX3,UNIT=DISK,VOL=SER=SCR TWO,SPACE=(CYL,(1,1)), X
// DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
// POWER NORMALIZED REGION FLUXES AT THIRD TIME POINT,
//FT27FU01 DD DSN=&MCSP,DISP=&MCSPDSP,UNIT=DISK,VOL=SER=&MCSPVOL, X
// SPACE=(CYL,(1,1)),DCB=(RECFM=VBS,LRECL=X,BLKSIZE=3460) X
// MATERIAL AND COMPOSITION SPECIFICATIONS DATA SET,
//FT28FU01 DD DSN=&BC,UNIT=DISK,SPACE=(TRK,(1,1)), X
// DCB=(RECFM=VBS,LRECL=X,BLKSIZE=304) X
// BOUNDARY CONDITION SPECIFICATIONS DATA SET,
//FT31FU01 DD DSN=&DUMP, F1,DISP=&DUMPDSP,UNIT=DISK,VOL=SER=&DUMPVOL, X
// SPACE=(CYL,(1,1)),DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
// FILE 1 OF DATA DUMP FOR BURNUP MODULE,
//FT31FU02 DD DSN=&DUMP, F2,DISP=&DUMPDSP,UNIT=DISK,VOL=SER=&DUMPVOL, X
// SPACE=(CYL,(1,1)),DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
// FILE 2 OF DATA DUMP FOR BURNUP MODULE,
//FT43FU01 DD DSN=&FLX1D1,DISP=&FLX1DSP,UNIT=DISK,VOL=SER=&FLX1VOL, X

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//          SPACE=(CYL,(1,1)),DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          1D REAL FLUX DATA SET AT FIRST TIME POINT,
//FT43FU01 DD DSN=&FLX2D1,DISP=&FLX2DSP,UNIT=DISK,VOL=SER=&FLX2VOL, X
//          SPACE=(CYL,(2,1),RLSE), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          2D REAL FLUX DATA SET AT FIRST TIME POINT,
//FT47FU01 DD DSN=&NFLX1,DISP=&NFL1DSP,UNIT=DISK,VOL=SER=&NFL1VOL, X
//          SPACE=(CYL,(1,1)),DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          POWER NORMALIZED REGION FLUXES AT FIRST TIME POINT,
//FT50FU01 DD DSN=&NFLX4,UNIT=DISK,VOL=SER=SYSSCR,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          POWER NORMALIZED REGION FLUXES AT FOURTH TIME POINT,
//FT51FU01 DD DSN=&NFLX5,UNIT=DISK,VOL=SER=SCRONE,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          POWER NORMALIZED REGION FLUXES AT FIFTH TIME POINT,
//FT54FU01 DD DSN=&GEDM,UNIT=DISK,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=3460) X
//          GEOMETRY SPECIFICATIONS DATA SET,
//FT61FU01 DD DSN=&FLX2,UNIT=DISK,VOL=SER=SCRONE, X
//          SPACE=(CYL,(2,1),RLSE), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          REAL FLUX DATA SET AT SECOND TIME POINT,
//FT62FU01 DD DSN=&FLX3,UNIT=DISK,VOL=SER=SCRTWO, X
//          SPACE=(CYL,(2,1),RLSE), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          REAL FLUX DATA SET AT THIRD TIME POINT,
//FT63FU01 DD DSN=&FLX4,UNIT=DISK,VOL=SER=SYSSCR, X
//          SPACE=(CYL,(2,1),RLSE), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          REAL FLUX DATA SET AT FOURTH TIME POINT,
//FT64FU01 DD DSN=&FLX5,UNIT=DISK,VOL=SER=SCRONE, X
//          SPACE=(CYL,(2,1),RLSE), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          REAL FLUX DATA SET AT FIFTH TIME POINT,
//FT65FU01 DD DSN=&SPCICN,UNIT=DISK,SPACE=(76,1), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=76) X
//          CODE INDEPENDENT CONSTANTS SPECIFICATIONS DATA SET,
//FT66FU01 DD DSN=&SPCRIT,UNIT=DISK,SPACE=(TRK,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=388) X
//          SEARCH SPECIFICATIONS DATA SET,
//FT75FU01 DD DSN=&XSCHMIN1,UNIT=DISK,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=1028) X
//          FILE 1 OF COMPOSITION CROSS SECTION DATA SET XS,C,MIN.
//FT75FU02 DD DSN=&XSCHMIN2,UNIT=DISK,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          FILE 2 OF COMPOSITION CROSS SECTION DATA SET XS,C,MIN.
//FT78FU01 DD DSN=&MICRXS1,DISP=SHR,UNIT=DISK,VOL=SER=&MICRVOL, X
//          FILE 1 OF ISOTOPE CROSS SECTION DATA SET XS,ISO,
//FT78FU02 DD DSN=&MICRXS2,DISP=SHR,UNIT=DISK,VOL=SER=&MICRVOL, X
//          FILE 2 OF ISOTOPE CROSS SECTION DATA SET XS,ISO,
//FT79FU01 DD DSN=&XSISQ2A,UNIT=DISK,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=644) X
//          FILE 1 OF DATA SET XS,ISQ2 CONTAINS A SHORTENED FORM OF X
//          THE DATA SET XS,ISO.
//FT79FU02 DD DSN=&XSISQ2B,UNIT=DISK,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          FILE 2 OF DATA SET XS,ISQ2.
//FT85FU01 DD DSN=&MATCS,DISP=&MATCDSP,UNIT=DISK,VOL=SER=&MATCVOL, X
//          SPACE=(CYL,(1,1)),DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          MATERIALS CROSS SECTION DATA SET,

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//FT88FU01 DD DSN=&NDS1,UNIT=DISK,VOL=SER=SCRONE,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          A MATRIX AND B MATRIX.
//FT89FU01 DD DSN=&NDS2,UNIT=DISK,VOL=SER=SCRTWO,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          AVERAGE A MATRIX.
//FT90FU01 DD DSN=&NDS3,UNIT=DISK,VOL=SER=SYSSCR,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          DN MATRIX.
//FT91FU01 DD UNIT=DISK,SPACE=(CYL,(6,1),RLSE), X
//          DCB=(RECFM=VBST,BLKSIZE=&BUFFER) X
//          N=1 (OR N=2) FLUX ITERATE.
//FT92FU01 DD UNIT=DISK,SPACE=(CYL,(6,1),RLSE), X
//          DCB=(RECFM=VBST,BLKSIZE=&BUFFER),SEP=FT91FU01 X
//          NITH ITERATE FLUXES.
//FT93FU01 DD UNIT=DISK,SPACE=(CYL,(6,1),RLSE), X
//          DCB=(RECFM=VBST,BLKSIZE=&BUFFER),SEP=FT92FU01 X
//          FINITE DIFFERENCE COEFFICIENTS.
//FT94FU01 DD UNIT=DISK,SPACE=(CYL,(6,1),RLSE), X
//          DCB=(RECFM=VBST,BLKSIZE=&BUFFER), X
//          SEP=(FT91FU01,FT92FU01) X
//          N=2 (OR N=1) FLUX ITERATE.
//FT95FU01 DD UNIT=DISK,SPACE=(CYL,(2,1),RLSE), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7172) X
//          EXTERNAL SOURCES.
//FT96FU01 DD DSN=&NDS4,UNIT=DISK,VOL=SER=SCRONE,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          STAGE DENSITIES AT THE BEGINNING OF CYCLE.
//FT97FU01 DD DSN=&NDS5,UNIT=DISK,VOL=SER=SCRTWO,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          STAGE DENSITIES AT THE CURRENT TIME NODE.
//FT98FU01 DD DSN=&NDSR,UNIT=DISK,VOL=SER=SYSSCR,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          SCRATCH DATA SET.
//FT99FU01 DD DSN=&NBHAT,UNIT=DISK,VOL=SER=SCRTWO,SPACE=(CYL,(1,1)), X
//          DCB=(RECFM=VBS,LRECL=X,BLKSIZE=7294) X
//          BHAT MATRIX.
//
//* *****
//*
//* ANYONE EXPERIENCING DIFFICULTY WITH THIS PROCEDURE SEE
//* J. P. REGIS      BLDG 208, ROOM E-227.
//*
//* *****
//*

```

GLOSSARY

1. Burnup ratio of total atoms destroyed in fission to total atoms initially present
2. Burn step time or cycle time full power days of reactor operation between successive refuellings
3. Charge material material made up by fabrication which is inserted in reactor at the refuelling time
4. Enrichment volume fraction of a charge material which is made up of high-reactivity fuel
5. Equilibrium conditions infinite time operating conditions of a recycle system in which the operating conditions are identical for sequential cycles
6. Material type identifies all these fuel bundles in a reactor which are linked by a single fuel management sequence
7. Process separation fraction fraction of the atoms of an isotope which is classified as high-reactivity or Class 1 fuel
8. Recovery fraction fraction of the atoms of an isotope recovered in a reprocessing plant
9. Region closed volume over which the average group fluxes are calculated for use in the burnup equations (a region may be one or more neutronics mesh intervals)
10. Stage identifies the in-reactor history of a material (i.e., the number of cycles it has resided in the reactor)
11. Time node time point during operating cycle at which neutronics solutions are done

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