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The Bold Venture Computation System for Nuclear Reactor Core Analysis, Version III

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ABSTRACT

This report is a condensed documentation for VERSION III of the BOLD VENTURE COMPUTATION SYSTEM for nuclear reactor core analysis. An experienced analyst should be able to use this system routinely for solving problems by referring to this document. Individual reports must be referenced for details. This report covers basic input instructions and describes recent extensions to the modules as well as to the interface data file specifications. Some application considerations are discussed and an elaborate sample problem is used as an instruction aid. Instructions for creating the system on IBM computers are also given.

I. INTRODUCTION

The BOLD VENTURE COMPUTATION SYSTEM^a for nuclear reactor core analysis is a modular system in which individual modules are accessed in a desired sequence by a CONTROL module. Each module reads interface data files which may have been written by other modules in the system, or supplied externally to the run. Except for the input data processor and special modules, no input data are read from cards. The input data processor reads free form card input in a one-to-one correspondence with the interface data file specifications and writes the files in binary form for use by the other modules. Special modules read fixed form card input data for direct use or to create additional files.

Individual reports documenting the modules¹⁻⁸ and the system have been published. With continuing extension of the modules to enhance the capability has come the need to extend the interface data file specifications. We have found increasing need for a compact set of user input data instructions and interface data file specifications. Basic data requirements are collected here for this computation system.

We do run the risk of inconsistencies with duplicate publication. The reader is to assume that the document having the most recent date is accurate and supersedes any earlier publication. We expect never to hear the end of any discrepancy that may have crept through.

The following sections address some of the application requirements, present input data requirements, define the interface data file contents, address control, show an elaborate sample problem, and describe recent extensions. Data storage requirements for the VENTURE neutronics and BURNER exposure codes are discussed in Appendix A. Creation of a computation system from compiled routines on an IBM or equivalent computer is discussed in Appendix B.

^aThis system of codes was previously referred to as VENTURE (versions I and II). The VENTURE neutronics module is but one of the many modules which comprise the system.

II. SOME APPLICATION CONSIDERATIONS

The experienced analyst needs no special instructions for application in a familiar area. The novice is beyond help. We try here to help the experienced user by pointing out certain requirements. That may not be obvious if the application is in a new area. We recommend that the novice be allowed or be instructed to solve a large number and wide variety of simple and inexpensive problems to gain familiarization.

If a high level of reliability is to be placed in calculated results, then attention must be paid to the following aspects: is the

1. Physical theory adequate
2. Mathematical representation of the theory adequate
3. Error associated with numerical approximations and discretizations acceptable
4. Modeling adequate
5. Problem description defining the intended problem
6. Problem solved the one intended
7. Data transmitted and processed properly
8. Proper selection made from among paralleled procedures
9. Error associated with termination of iterative procedures acceptable
10. Result realistic

We believe that the codes in this system can be used to produce results that have a high level of reliability. The system members have been subjected to extensive verification tests. Still this does not ensure either that they are entirely error free, especially when auxiliary results are produced, or that the user instructions may not be misinterpreted. You will be using that version of each code having the highest available level of quality assurance, along with others in the user community, not some other version.

The codes in this system individually and collectively have been qualified for nuclear reactor core analysis over a broad range of application. Still large voids can generally not be modeled

accurately with diffusion theory, and if you tell the exposure code not to consume U^{235} fuel, it won't and the results will not be correct.

The large amount of freedom allowed in describing core analysis problems was deemed necessary in the local environment of broad application. The result is a tremendous amount of capability. However, the impact on the analyst is quite severe. It is essential in a specific area of application for the user(s) to establish viable decks of input data. Special attention must be paid to the geometric description, to the coupled nuclide chain descriptions, to everything. Quite generally a viable data deck must evolve that is known to produce reliable results. It applies the proper boundary conditions, assigns materials correctly, describes such aspects as depletion and fuel management accurately, etc. Key results may be adjusted by bias factors developed from a comparison of calculated results with experimental results.

And then there is the cross section data. We note that expertise in this area comes only from experience. No advice is offered here deliberately to avoid creating the impression that the difficulties are less than they really are.

A. CONSISTENCY

To some extent many of these codes are forced to be consistent. They use and interpret most of the input data the same way. A notable exception is the correlation of microscopic cross sections on local temperature that must be specified in each of the instructions to the individual codes and is not available in the perturbation code (except in a macroscopic sense).

The continuous fueling model assumes that the fuel moves from zone n to $n + 1$ starting with $n = 1$, and subzone m to $m + 1$ starting with $m = 1$. Obviously a problem could be described that was physically impossible.

The available thermal hydraulics model assumes coolant flow along increasing mesh number ($j = 1$ at top to $j = j_{\max}$ at bottom). A vertical traverse of the reactor might go up or down without altering the neutronics, but the top and the bottom might be incorrectly reversed for the thermal hydraulics, their locations depending on the direction of coolant flow, down or up.

B. ACCURACY

Quite generally the accuracy of calculation has been carefully considered and factored into the development of these codes. Double precision arithmetic (rather than IBM half-precision) has been used extensively to avoid serious loss of significance, not everywhere and not in basic data interfacing, but in iterative and series calculations where hexadecimal rounding to less than six digit decimal accuracy can be serious.

The user is advised to heed warnings about reliability and become familiar with the available reliability tests and especially the implications of reported estimates of absolute accuracy. A part of the cost of a computer run is devoted to reliability testing that can not be avoided by the user, so he should see that this investment pays dividends.

C. BLACK BOXES

The major computer codes in this system must be used as black boxes. The FORTRAN listings are available, but the task of familiarization with the complicated procedures is so formidable that it could not be undertaken lightly. So the codes must be used without a detailed understanding of the contents. This does not free the user from the essential responsibility of satisfying himself that a reliable solution was obtained to the problem he intended to solve.

D. NEUTRONICS

There is the strange belief in the industry that the value of k_{eff} may be determined for a reactor core within at least 0.5 percent.

The fact is that the result of any calculation will be a value

$$0 < k_{\text{eff}} < \max \frac{\nu \Sigma_f}{\Sigma_a},$$

where usual properties are indicated. Many data errors have been eliminated because it is expected that $k_{\text{eff}} = 1$. Effort within a project must narrow down any discrepancy to an acceptable level. Only by careful and systematic analysis can the requirements for accurate analysis be established. There is no way that code developers can determine that the data presented is garbage. Oh, a reflected boundary condition at $r = 0$ may be required for the radial coordinate, but for the axial coordinate the appropriate boundaries may be extrapolated or reflected or a combination, and if a combination they may be improperly reversed.

It is not uncommon to find that a nuclide density or other datum as specified is in error by a factor of 10. How crucial are the exponents of input data! Cross sections are often in error by orders of magnitude. We recommend independent checking, and it should be a requirement when high reliability is needed.

In solving the usual core neutronics problem we generally use only equations and procedures that produce positive neutron flux values. This avoids the serious uncertainty associated with the results when some flux values are negative. For the unusual core neutronics problems that involve negative flux values, reliability of a solution is not so easy to test and a greater burden falls on the analyst in proving that the results are reliable.

E. EXPOSURE

The user is reminded that only the descriptions specified will be treated. If the iron is to be consumed and the transmutation products followed, then these nuclide chains must be described and the necessary data such as the (n, γ) capture cross section be made available.

Consider that Np^{237} is a product of U^{237} decay, and U^{237} is generated by U^{236} capture and the $(n, 2n)$ reaction in U^{238} . Quite generally the full set of contributing nuclides is not treated in core exposure calculations, usually only those that have significant reactivity effects plus any specific transmutation products of interest. We don't usually treat 1,000 fission product nuclides in 100,000 locations, but more likely 20 nuclides involving pseudo representations in perhaps 1,000 locations. Considerable data processing is required ahead of multi-dimensional analysis to constrain the computational costs to within reason. The capability for such processing may not be entirely adequate and essential compromises reduce the reliability of end results.

III. COMPUTATION SYSTEM

Components of the computational system are shown in Figure 1. The system includes a driver program which is resident in computer memory, a control module, an input data processor, a file editor, computational modules, and special modules that don't completely satisfy the system requirements for full membership. When the control module is first accessed by the driver, it reads input data as shown in Figure 2. Thereafter, the control module instructs the driver to access one or more modules in order before it re-accesses the control module for more instructions. Full control always returns to the control module.

None of the full member computational modules read input data. They read pre-defined interface data files that were written by other modules or made available from outside of the system. The input data processor reads free form card input in a one-to-one correspondence with the interface file specifications and writes binary files for use by the other modules. The special processors DVENTR, DCRSPR, DUTLIN, DMISLY, and DENMAN read fixed format card input data and write certain of the interface data files for use by the modules;^a these may be used

^a Any of the interface files can be produced directly with the input data processor, but in most cases these special modules read data in more straight forward manner and produce the needed interface files.

*OTHER MODULES MAY BE USED PRIOR TO OR AFTER THE USE OF THIS ONE

Figure 1. Components of the Computation System

initially before any calculation is done and may also be used during a calculation to modify the data or instructions between executions of computational modules.

The input data stream must contain a block of data for the input data processor each time it is called. Likewise each time one of the special processors (2 or 99 in the path instructions) is called, a block of data must be available for use. Each block of input data requires a special header card and a terminating END card. A look-ahead capability is incorporated in the control module procedure that causes termination if a readable block of input data is not available for the next requirement. Thus, there must be consistency between the ordered input data and the module execution path list. If a special processor is included in the nest of a repeating loop, then as many input data blocks must be supplied for it as there are entries in the expanded table. Note that an input data block defines the special processor to be executed by its header record. Those accessed by path entry 2 are fundamentally different from those accessed by path entry 99 because the former are high QA modules using confidential address names.

If the user is to add his own module(s) (with concatenation) to this system (path entry 99), special care must be exercised to protect the interface data files and any data files supplied if they are to be viable after executing the new module. The use of separate data sets for such special modules with concatenation is essential to insure high QA of the system. Anyone messing around with the data set containing these codes can expect to become a non-user, perhaps flying at half mast in the vicinity.

IV. CONTROL MODULE

The control module "CONTROL1" performs certain initialization and wrap up tasks and carries out the role of directing the resident driver to execute the code modules along a path prescribed by input data. Input instructions are shown in Figure 2.

Figure 2. User Input Instructions to
Control Module 'CONTROL1'

<u>Card Number</u>	<u>Columns (Format)</u>	<u>Reference Name</u>	<u>Typical Entry</u>	<u>Use</u>
1	1	-	=	Precedes control module name
1	2-9	-	CONTROL1	Control module name
2	(12A6)	TITLE		The run title card
3	1-6	IP1	090000	Primary memory allocation for data (040000) ^a
3	7-12	IP2	0	Reserved
3	13-18	IP3	0	Reserved
3	19-24	IP4	0	Override data block size for direct access files (4-byte words)
3	25-30	IP5	10	Processor time allowed to be used before wrap-up procedures are executed by the control module (min); must be less than allowed in the job control instructions, if > 0
3	31-36	IP6	50	Ditto 1000 Input/Output requests if > 0
3	37-42	IP7		Additional input is included to present inter- face data file information, if > 0
3	43-48	IP8		A module number. Data files will be saved after each access of module numbered IP8 (see footnote "h")
3	49-54	IP9		Reserved
3	55-57	IP10	0	
3	58-60	IP11	0	

Figure 2 (con't)

<u>Card Number</u>	<u>Columns (Format)</u>	<u>Reference Name</u>	<u>Typical Entry</u>	<u>Use</u>
3	61-63	IP12	1	Initial interface data file table initialization option 0 - Use SEEK default table (sets up 15 including CONTRL as the first) ^b >0 - Set up this many from the list of which CONTRL is the first
3	64-66	IP13	0	Option on reinitialization of interface data file tables for any subsequent access of the input processor after the first 0 - No action (leave as is) >0 - Retain this many (plus CONTRL)
3	67-69	IP14	0	Edit level for control module, primarily for debugging if > 0
3	70-72	IP15 ^c	0	Primary termination options 0 - No action 1 - Save data files only upon successful completion before termination, per instructions 2 - Save data files as possible before termination only if the first code module access completed successfully, per instructions
4	(2413)	IM(1)		String of integers presenting the code module numbers to define the calculational path, terminating with a blank entry, limited to 900 entries. These numbers and the corresponding modules are shown in Fig. 1. Any member special processor is accessed by the number 2 or others added in local application by 99. A loop over a substring of two or more code modules is defined by a negative entry which is the number of

Figure 2 (con't)

<u>Card Number</u>	<u>Columns (Format)</u>	<u>Reference Name</u>	<u>Typical Entry</u>	<u>Use</u>
				<p>previous entries included in the loop and the next entry is the number of passes through the loop; additional accesses may be specified in the path after these two entries which define the loop. Note that user input data must normally be processed requiring that the input processor or a special processor or both be accessed. Prior to accessing a code module. A loop may contain as the first module the input processor or a special processor to describe a basic multiple case run. Care must be taken in the arrangement of the user input data to satisfy input processor and special processor requirements consistent with these instructions and under restrictions defined elsewhere.</p>

(Note: Input to the control module ends here unless IP7 > 0)

5+ (9(2x,A6)) H(I)

This is a string of interface data file names presented in sets (sub-strings) of names for five different purposes. Termination of each set of names is with a blank 8 column field or an entry 'X' in the last column of a separating 8 column field, limited to 72 entries (8 cards). Purposes of each of the sets is as follows:

<u>Set^d</u>	<u>Use</u>
1	Names of files made available to be used as supplied from a previous run (normally on disk), reference data added to the data file management tables before any other action is taken.

Figure 2 (con't)

<u>Card Number</u>	<u>Columns (Format)</u>	<u>Reference Name</u>	<u>Typical Entry</u>	<u>Use</u>
				<p>2^e Names of files to be retrieved from the stacked files made available on a user data set, done before any module access, extends the data file management tables.</p> <p>3^f Names of existing files (after any retrieval) for which copies are to be made, thus creating new and therefore multiple versions, with the copies becoming the latest version available for use.</p> <p>4^g Names of files to be stacked on a user stack data set at wrap-up time at the end of a run, generally requires successful completion and wrap-up by the control module.</p> <p>5^h Names of files to be stacked on a user stack data set after each access of the module numbered IP8 .</p>
(next	(A3)	-	END	Normal data block terminator card required

(The user input data stream continues with data as required in order of access of modules requiring input data; generally each block of data requires a header card and a terminator END card).

^aNon-zero default values shown for entry of zero.

^bThese files are CONTRL(10), GRUPXS(11), GEODST(12), MDXSRF(13), ZNATDN(14), SEARCH(15), RSTRTR(16), RTFLUX(17), ATFLUX(18), RZFLUX(19), PMDINT(20), CXSPRR(30), ISOTXS(31), ISOTXS(32), and FIXSRC(33), where the numbers in parenthesis are the logical unit numbers assigned to the files.

^cNot implemented in the early version.

Footnotes (con't)

^dNote: For the first two sets of file names, IP1² should usually be 1; assignment of unit numbers is in increasing order starting with the first set beginning with unit 11 (unit 11-20, then 30-39, then 70+).

^eA user stack data set may be either a disk partitioned data set (PDS) or a tape. Data definition (DD) cards describing the stack data sets must be supplied having special ddnames. These special ddnames may be READSTKA, RITESTKA, READSTKB, and RITESTKB. The data control block (DCB) parameter of the DD cards should not be included.

The stack data set from which files are to be retrieved must have the special ddname READSTKA or READSTKB, and must contain all files listed. Retrieval of only one version of a file will be of the first file appearing on the data set having that name, and it will become the latest version for the run (unless a copy is made by additional instructions). If a file name appears more than once in the list, then more than one version is to be retrieved and all versions requested must exist on the stack data set. If the stack data set to be read has the ddname READSTKA, it is assumed that the first appearance of a particular file on the data set is to be the latest version for this run, the second appearance of that file the next-to-latest version, etc. (see footnote "g"), and the file versions will be set up in that order for the run. If the stack data set to be read has the ddname READSTKB, then it is assumed that the first appearance of a particular file on the data set is to be the oldest version, the second appearance of that file the next-to-oldest version, and the last appearance the version (see footnote "h"), and file versions will be set up in that order for the run.

Provision has been made for retrieving a particular file. If the 2X field of the list contains an I2 integer N, then the Nth appearance of that file name (not version number) is retrieved. Care should be exercised in specifying the order of appearance of files to be retrieved (from READSTKA or READSTKB) to effect the desired version number association for the run. For retrieving files from a user stack data set, the DCB parameters for the I/O units that will be written must be the same as the DCB parameters of the I/O units from which the files were saved on the user stack data set.

^fFiles listed here (latest version only) will be written on and then read from the stack data set having the special ddname RITESTKA if defined in the job control language (JCL), thus destroying any files that existed on this file. If this data set is not defined, then the data set with the ddname READSTKA will be used. Repeating a name causes another version of the same file to become available, etc.

^gFiles listed here will be written on the stack data set with ddname RITESTKA if it is defined, or READSTKA if not (see "f" above about destroying existing files). If a file name appears more than once in the list, a different version of the file must exist for each appearance of

Footnotes (con't)

that name. The latest version of the file will be written first, the next-to-latest version written next, etc. For later retrieval of files from this data set, it must be redefined as READSTKA to preserve the correct ordering of version numbers.

^h Files listed here (latest version only) will be written on the stack data set having ddname RITESTKB if it is defined, or READSTKB if not. If this data set is a disk PDS, the disposition parameter of the DD card must not be DISP=NEW (the data set should have previously been created). If IP8>0, this data set will be re-written after each access of the module numbered IP8 destroying the files previously written. If IP8<0, the files will be stacked one after the other, saving all files. Note that in this case, the oldest version of the files is written first, the next-oldest version written second, etc., and the latest version written last. This is in the reverse order to the way files are written at wrap-up. For later retrieval of files from this data set, it must be re-defined as READSTKB to preserve the correct ordering of version numbers.

V. INTERFACE DATA FILES

A. FILES REQUIRED BY THE MODULES

Figure 3 shows the files required by the modules in the computation system. These files are listed in Appendix C. The file CONTRL is unique in that it contains global information about an entire run and one record of control instructions that is read by each computational module. The association between the name of this record and the module is shown in the figure. The special processors DVENTR, DCRSPR, and DUTLIN write a record on the CONTRL file (see SPECIAL PROCESSORS below).

Figure 3. Interface Data Files Required

Module	Number	Name of Record in File CONTRL	Required	Required on Option	Written on Option	Reference
CONTROL		PROINS DVRINS		(Any)	(Any)	1
INPUT PROCESSOR	1			(Any)	(Any)	1,8
FILE EDITOR	3		FPRINT	(Any)		1,8

Figure 3. (con't)

Module	Number	Name as Record in File CONTRL	Required	Required on Option	Written on Option	Reference
CROSS SECTION PROCESSOR	6	XCPINS	CSXPRR ISOTXS	GRUPXS	GRUPXS ISOTXS	2
VENTURE NEUTRONICS	7	DTNINS	GEODST NDXSRF ZNATDN GRUPXS	RTFLUX ATFLUX RZFLUX FIXSRC RSTRTR SEARCH ZNTMP	RTFLUX ^a ATFLUX RZFLUX FIXSRC RSTRTR PNDINT PERTUB FISSOR ZNPOND GEODST	2
VALE NEUTRONICS	8	Same as VENTURE except TRIGOM is required instead of GEODST				10
REACTION RATE	9	RRTINS	NDXSRF ZNATDN GRUPXS RZFLUX	GEODST ^b TRIGOM ^b ZNTMP PERTUB		2
CONTROL ROD POSITIONING	12	RODINS	ROCSET GEODST NDXSRF ZNATDN YNATDN ^d		ZNATDN ^e YNATDN	6
EXPOSURE	13	EXPINS	EXPOSE NDXSRF ZNATDN GRUPXS RZFLUX	PTATDN ZNTMP GEODST ^b TRIGOM ^b EXPOHT CFHIST RTFLUX	PTATDN QNATDN ZNATDN ZNPOND EXPOHT ^a CFHIST ^a	3
PERTURBATION	15	PERINS	GEODST NDXSRF ZNATDN GRUPXS	PERTUB RTFLUX ATFLUX ZNTMP DLAYXS ^b	PERTUB	5
FUEL MANAG ^e ENT and ECONOMICS	19	REFINS	REFUEL NDXSRF ZNATDN	MASBAL FNATDN QNATDN	MASBAL	11

Figure 3 (con't)

Module	Number	Name as Record in File CONTRL	Required an Option	Written an Option	Reference
THERMAL HYDRAULICS	20	PBLINS			12
DVENTR	2	DTNINS		GEODST ^c NDXSRF ^c ZNATDN ^c SEARCH	4
DCRSPR	2	XCPINS		CXSPRR ^c	4
DUTLIN	2	(Any)			4
DCHACR	2				4
DMISLY	99		RTFLUX ATFLUX GEODST	RTFLUX ATFLUX GEODST	4
DENMAN	99		NDXSRF ZNATDN QNATDN	NDXSRF ZNATDN SEARCH	4

^aMay be created if it does not exist

^bWill be used if it exists

^cAlways written

^dWill be created if it does not exist

B. THE FILE 'CONTRL'

Figure C.1 describes the file 'CONTRL' with global information records and a record of information for each computational module. Each true member computational module reads its record of instructions from this file each time it is accessed and many of them also use the global data. Revised instructions may be supplied using the special processor DUTLIN at any predetermined point along the calculational path (between module access).^a Thus in solving the dominant harmonics problem, for example, it would be normal practice to instruct the

^a This file is created initially by the control module and generally the individual records for the modules are added by the special input modules.

VENTURE neutronics module to solve the regular and adjoint problems for a reference state, and then provide revised instruction (via OUTLIN) for a second access of VENTURE to solve the dominant harmonic problem.

Figure C.2 presents a correspondence list of data from the VENTURE neutronics record DTNINS and the special processor DVENTR input actions 001 and 002 (see Section VIII below), which writes this record on CONTRL. Some of the data have not yet been defined leaving it available for future use.

C. STANDARD FILES

Figure C.3 lists the standard interface data files.⁸ These are the files ISOTXS, GRUPXS, GEODST, NDXSRF, ZNATDN, RTFLUX, ATFLUX, RZFLUX, FIXSRC, SEARCH, DLAYXS, PWDINT, CXSPRR, and FPRINT. The files RTFLUX, ATFLUX, RZFLUX, FIXSRC, and SEARCH have been altered as indicated by an asterisk dash (*-) at the end of the card.

D. NEWLY DEFINED FILES

The files that have been defined locally expanding the set are shown in Figure C.4. These are the files EXPOSE, EXPOHT, CFHIST, PTATDN, QNATDN, ZNTEMP, ZNPOW, PERTUB, FISSOR, RODSET, RSTRTR, REFULE, TRIGOM, MASBAL, and REFUEL. Not listed are the files XNATDN, YNATDN, and FNATDN which are identical to ZNATDN except for the file names.

E. FILE VERSION NUMBERS

Clarification is offered here about interface data file version numbers as seen by the file management system. At the start of execution, the file management records are all initialized at zero version numbers. If a file is supplied (and the system is informed about this via the control module instructions), it becomes version 1 regardless of what is written on the file. If two versions are supplied, they are assigned version numbers 1 and 2 in the increasing order of the logical unit number. Note that these logical unit numbers are arbitrarily assigned in increasing order starting from the

largest known number reserved. The actual numbers must be consistent with what will be assigned. If a file is generated by a special Input Data Processor before any calculations are made, it normally is version 1; however, if N files were supplied and this is known to the Control Module, writing another one creates version N (replacing the Nth one supplied), except where special provision has been made otherwise and the option is exercised to generate a new $N + 1$ version. Such is not possible with most of the special Input Data Processors, as they generally destroy the latest version of any file (if it exists). To supply one and create yet another version with a special Input Data Processor would require supplying two initially, and the second could be a dummy, but it must contain the correct file name. The Control Module must be told there are two, and it checks for agreement with names in the files as a quality assurance step, and then the second one would be rewritten by the special Input Data Processor. (Here the copying capability within the Control Module is especially useful to create extra copies.) The two files would then be versions 1 and 2, version 1 being the first one supplied having the lowest version number. Note that only files which become assigned logical unit numbers for which special job control instructions are provided for the computer run can be made available from a previous calculation (or by special generation), and then these will be available at the end of the run. Often the original data file supplied or initially generated will be written over, destroying the initial contents. Such action by the codes in this system is necessary to avoid uncontrolled proliferation when global problems are solved involving the generation of many files, often many versions of a file having a common name.

Most of the codes in this system read the latest version (version having the highest version number assigned in the internal file management tables) of any file. The next-to-latest version may be read on demand by user option in some cases, especially where two versions are required for a calculation, but this can be done only if the latest version N and the next to latest version N-1 exist and are so labeled

in the file management tables. Special importance may be attached to a version 1 file as initial state, i. e. the nuclide concentrations, and this version may be used at a later point in the calculation. In some instances a copy is made of a file and it is assigned a new identification name to allow recovery of data at a later point in a calculation.

Consider a file used to interface data during a calculation. The first file will be version 1. A second file with the same name may be version 2 if written on a different unit, but usually it will be written over the first file leaving only a version 1 file in the set and in the file management tables.

The default option for writing most files in most of the computation Modules in this code system is to write over the existing latest version. Special Processors with few exceptions write over the existing file without increasing the version number. The user is referred to specific documentation.

When the neutronics code does a criticality search on nuclide density, it always leaves intact the available latest version N and writes a new version $N+1$ of the nuclide concentrations file, ZNATDN. If only one file existed, there now become two versions N and $N+1$. If there were more than one in the system, the version $N-1$ is deleted and the new file version $N+1$ is written leaving versions $N+1$ and N , and any lower version numbers existing. The new version $N+1$ would be located where the old $N-1$ was if it existed, unless a unit with a lower logical number in the set reserved for interface file is available (not revised). If a dimension search is done, new versions of both the geometry file GEODST and the nuclide concentration, cross section referencing file MDXSRF are always written on new logical units, extending the contents of the file management tables while preserving the original data.

The following actions are taken by the control rod positioning RODMOD code. For the reference data, YNATDN generation by request always produces a version $N+1$ given an existing latest version N , and deletion deletes version N . File ZNATDN generation always produces a version N given an existing latest version N . File GEODST generation always produces a version $N+1$.

F. COMMENTS ABOUT THE FILES

The following comments are offered about the data contents of specific interface data files regarding file processing and data use.

ISOTXS

- 1) NSBLOK - the scattering blocking factor must be evenly divisible into NGROUP.
- 2) JBAND - the scattering band width must be greater than 0.
- 3) IJJ - the scattering in-group term must fall within the band. Combinations of JBAND and IJJ which cause fictitious transfers for a given group are not allowed.
- 4) LTRN - must be greater than 0 and $\leq \text{MAXORD} + 1$.
- 5) LTOT - must be greater than 0 and $\leq \text{MAXORD} + 1$ for the P_1 calculation.
- 6) Group-to-group fission spectra are not allowed.

GRUPXS

- 1) NSBLOK - the scattering blocking factor must be evenly divisible into NISO.
- 2) JBAND - same as ISOTXS.
- 3) IJJ - same as ISOTXS.
- 4) Group-to-group fission spectra are not allowed.
- 5) The total scattering arrays must be present.

GEODST

- 1) IGOM - the following geometries are not implemented
 - 0 - point.
 - 11 - $R\theta$
 - 12 - $R\theta Z$
 - 13 - $R\theta\alpha$
 - 16 - $\theta R\alpha$

Triagonal geometry options assume equilateral triangles.
Hexagonal geometry options assume regular hexagons.
- 2) Boundary indicators for repeating conditions.

IMB1 = 3 first boundary of dimension 1 may repeat with second boundary of dimension 1.

IMB2 = 4 second boundary of dimension 1 may repeat with second boundary of dimension 2 (XY,XYZ,T,TZ only - mesh must be consistent for rotation).

IMB2 = 5 second boundary of dimension 1 may repeat with itself inverted (XY,XYZ,T,TZ only - mesh must be consistent for rotation).

3) Boundary constants

Default constants:

0.4692 for extrapolated and internal.

1.0 + 30 for zero flux.

0.0 for reflected.

If boundary constants are supplied, no check is made to assure consistency with boundary indicators.

4) NTRIAG - triangular geometry options 2, 3, and 4 are not implemented.

5) VOLR - the region volumes are not required except for use in the reaction rate module.

NDXSRF

- 1) NON, HNAME, HANAME and NCLN must be the same as NISO, HISONM, HABSID and KBR, respectively, on GRUPXS.
- 2) NZONE - must be the same as NZONE on GEODST.
- 3) VOLZ - the zone volumes are not required except for use in the reaction rate module. However, a case having subzones must have both the zone volumes and subzone volumes defined.
- 4) ATWT - is not used, atomic weights are always obtained from GRUPXS.

ZNATDM

- 1) NTZSZ - must be the same as NZONE + NXZ on NDXSRF.
- 2) NBLKAD - the density blocking factor must be evenly divisible into NTZSZ.

SEARCH

- 1) For concentration searches - nuclide names in search data not appearing in GRUPXS (NDXSRF) or are not assigned to the zone(s) specified will be eliminated from the calculation.

- 2) For dimension searches - NCINTI, NCINTJ, and NCINTK must have the same values as the same parameters on GEODST.

FIXSRC

- 1) Distributed sources for IDIST.EQ.1 and NDCOMP.GT.1 will cause termination.
- 2) Surface sources capability has not been used.

VI. INPUT DATA PROCESSOR

The input data processor in this system was developed at LASL⁸ to produce interface data files directly from user input. It has been modified locally for use on an IBM computer and to extend its capability. Additional work on it is anticipated to produce data files from user input instructions oriented toward requirements for typical problems with de-emphasis on the actual interface data file characteristics. Additional capability continues to be incorporated to produce new files needed by new code modules. The input processor is referred to in some circles as the 'standard user input processor'.

The following general comments are offered on the user input data:

1. Input for the control module must come first,
2. Requirements of the special processors must be met within the constraints of their actions and the actions of the input processor when it is used,
3. Care must be exercised to satisfy the requirements of the computational code modules, so that desired actions are taken regarding the reference tables of the interface data files and assigned logical unit numbers,
4. A header card must precede the block of input data for the input processor; an identifying note may be put on this card since the contents are not used for control.

Quite generally it is assumed that special processors use the file management tables to determine the logical unit numbers associated with the file names and generate the files without altering

these tables, except to add new files. Thus they play the game fairly. However, it is probable that some which don't will come into use, and their use must be carefully restricted. Any specific special processor can be used for some function, but a code module may carry out its assigned task after this point only if the actions taken allow continued communication of consistent data about the interface data files. Generally it is possible to use a special processor at the start of a run or at the end of a run successfully. Special processors are identified by the header record (see SPECIAL PROCESSORS below) of a block of data in the user input data file and access of a special processor is indicated by the number 2 in the calculational path presented to the control module; successive entries to special processors may be required in a path description. It may be practical to use the input processor after initial use of one or more of those special processors which generate interface data files from user input.^a

The input processor is summoned at each point in the calculational path where reference is made to module 1. As implemented, the input processor generates data files as follows with a 0V flag in front of the file name:

1. If the file is in the tables, the unit number associated with the latest version number is written destroying its old contents.
2. If the file name is not in the table, it is added and associated with the next higher unit number in the allowed set, and the new file is written.
3. If a file by this name was already generated in this access to the input processor, a new one and an associated next higher version number are added to the table, and a new file is written.

A 99V flag in front of the file name forces a new file to be created as a special option implemented locally.

^a For example DVNTR (see SPECIAL PROCESSORS below) might be used to create the files MDXSRF, ZNATDN, and the file GEODST with simple (slab) geometry. Then the input processor may be used to create a new GEODST with the desired geometry, i.e. triangular-Z, which in some cases is easier to generate using the input processor than using DEVNTR.

The input processor has the capability to update an existing file, useful capability not extensively tested locally. Care must be taken to count REAL*8 words as double entries, as when A6 names are involved, on short word machines. We consider that simple changes are possible, but complicated changes, as for data records in a loop structure, require special consideration; there are rather severe limitations such as the fact that record lengths cannot be changed. Thus we generally recommend against updating with new data lacking explicit description of the constraints, or only with careful testing prior to costly calculations.

A general discussion about the user input data requirements for the input processor to emphasize user considerations, is presented below. Example use of the input processor is shown under Super Sample Problem. A list of the files which can now be generated is given in Figure 4.

Figure 4. Files Which Can be Generated
By the Input Processor

File Name	Description	Capability Tested	Edit Capability
ISOTXS	Nuclide-ordered cross sections	x	x
DLAYXS	Delayed neutron data	x	x
BRKOXS	Bondarenko data		x
GRUPXS	Group-ordered cross sections	x	x
ISOGXS	Gamma reaction, transport data		x
GEODST	Geometry description	x	x
TRIGOM	Geometry description (mesh edge triangles)	x	No
NDXSRF	Nuclide referencing	x	x
ZNATDN	Nuclide concentrations	x	x
SEARCH	Criticality search data	x	x
SNCONS	S_n cosines, quadratures		x
FIXSRC	Fixed source	x	x

Figure 4 (con't)

File Name	Description	Capability Tested	Edit Capability
RTFLUX	Regular total point flux	x	x
ATFLUX	Adjoint total point flux	x	x
RAFLUX	Regular angular flux		x
AAFLUX	Adjoint angular flux		x
RZFLUX	Regular total zone flux	x	x
RCURNT	Regular current		x
ACURNT	Adjoint current		x
PWDINT	Point power density		x
CONTRL	Computation module control records	x	x
CXSPRR	Cross section processing data	x	x
PERTUB	Forward, adjoint integrals	x	x
FISSOR	Fission source	x	x
EXPOSE	Exposure data	x	No
ZCONCA	Local nuclide concentrations	x	No
RODSET	Control rod positioning data	x	No
FPRINT	File editor instructions	x	No
ZNTEMP	Zone temperatures	x	No
ZNPOWD	Zone power density	x	No
EXPOHT	Exposure history	x	No
PTATDN	Point nuclide concentrations	x	No
REFUEL	Fuel Management Specifications	x	No

The primary function of the input processor is to create interface files entirely from card input. The data can be read directly from cards as free-format data blocked by file record. Interface file specifications are the input specifications.

The card format specifications define rules for entering data on cards. The card format is free form in the sense that data items may be entered freely on a card without regard to card columns. However, certain rules for ordering data into groups and entering data on cards are specified.

The card format has two distinct categories for entries on a card. These are (a) the file and record control words, and (b) the datum field for the actual data items to be loaded into a given array. The rules governing usage of these entries are given below.

A. FILE AND RECORD CONTROL CARDS FOR INPUT PROCESSOR

There are four types of control cards governing the input of data which are addressed in the following discussion.

1. File Control Cards - nV FILEID

The unsigned integer n immediately followed by the character V denotes that version n of the file named FILEID is to be overlaid by the data on the cards that follow the nV card. If $n=0$ the file FILEID is to be created entirely from the cards that follow, destroying an old file if one exists. If n is 99, a new file is created. Data or comments following nV FILEID on the file control card are ignored. When the data for two files having the same name are supplied in a block, each with a OV control field, an existing old file (the latest version) will always be rewritten with the first set of data and second set creates the new file with a next higher version number.

A file control card is the first card read by the processor. Processing of the named file continues until a new file control card or a STOP card (see below) is encountered. Any number of files may be processed in any order.

As currently implemented, when $n=0$, the latest version of the file, if known by the file management system to exist, will be rewritten; otherwise a new file will be created with a version number one higher than the highest number found, version one if there is no entry of that name in the tables. When the overlay option (n greater than 0) is used, the old file is purged and is not available for further use, and the new file has the version number of the old one, but it is placed on a new logical unit.

2. Record Type Control Card - mD

An unsigned integer immediately followed by the alphabetic character "D" denotes a "Data" card. The first word on a card following a file control card must be an mD. Thereafter, if a card is encountered without the first word being an identifier, then the last read identifier is used. The data on this card may be integer, floating point, Hollerith, etc., with any mixture being possible, but the actual requirements set out in the data specifications for the specific file must be satisfied.

The mD are associated with the record types appearing in the interface file specifications. Each unique data list in the specifications is assigned a specific record type. The record types are numbered consecutively beginning with the first record following the file identification record. Data for the file identification record are supplied on the file identifier card, identifying the record type of the data following. If the list for record type m is repeated in the file, mD must precede each repetition of the list. In overlay applications the defined ordering of records is followed; records to be left intact may be skipped as desired. Skipped records are copied unmodified from the reference file onto the new file. For the overlay option, any parameter that controls the length or number of records in the file may not be changed.

3. STOP Card

Input processing is terminated when a card containing STOP as the first entry is encountered.

4. FLAG Card

This is a new option card that can be used to change the normal input unit number and/or control the card image printout. Cards of the form

FLAG IUNIT IPRINT ISTART IEND

can be inserted anywhere in the input stream (preferably before OV cards). FLAG is a keyword identifying the special instructions to the processor. IUNIT, IPRINT, ISTART, and IEND are integers. IUNIT

identifies a secondary unit from which the input processor will immediately begin processing. Processing on the secondary unit continues until a STOP card (no additional cards will be processed) or end-of-file (processing will then revert to the normal input unit) is encountered. A zero value for IUNIT instructs the processor to continue on the normal input unit. IPRINT controls card image printing. If IPRINT is zero, all card images will be printed. If IPRINT is one, no card images will be printed. If IPRINT is two, only the cards between and including the numbers specified by ISTART and IEND will be printed. For example, the card

FLAG 90 2 1 4000

specifies that card images will be read from logical unit 90 and that only cards 1 through 4000 will be printed.

B. DATA FIELDS

The data field contains words which may be data along with control parameters and allowed comments. This section describes the allowable data forms, the structure of data entries and the various control options available to simplify data entries.

1. Allowable Data Forms

The allowable data forms are integers, single precision floating point numbers, and Hollerith words. Any combination of these forms is allowed within the data field. For files containing double precision numbers, each number is first constructed in single precision on a short word machine and then converted to a double word for the file. When the overlay option is used, a double precision number is converted to single precision before overlay occurs. After the overlay, reconversion is done to double precision for the file. Card input specifications determine the allowable combinations of data forms.

a. Numeric Words. Numeric entries are integers if they contain no decimal point or exponent. Otherwise, numerics are taken to be real (floating-point) numbers. An exponent is an expression containing an optionally signed integer preceded optionally by the letter E.

The sign or the E may be absent but not both. An exponent in a numeric word must always be preceded by at least one digit, otherwise, forms En or E+n delimited by blanks or commas are interpreted as Hollerith words. To allow data written by the computer to be read, a blank after the E is treated as a plus sign. Also, a D (not the same as mD) will be treated as if it were an E. Examples of allowed forms are:

<u>Numeric</u>	<u>Equivalent Value</u>	<u>Type</u>
10	10	Integer
-10	-10	Integer
1E1	10.	Real
1+1	10.	Real
-1.0E+01	-10.	Real
1.0E 01	10.	Real
1.000 01	10.	Real

b. Hollerith Words. Hollerith data are specified in three different ways:

1. by enclosing the data in asterisks,
2. by using the mH specifications, or
3. by beginning a single word entry, containing no more than six characters, with a letter.

In all cases, Hollerith data are stored at the rate of six characters per word. On IBM machines each six-character word is stored in a double precision word. Input words of less than six characters are stored left adjusted with blank fill. Imbedded blanks in words are allowed only on options (1) and (2); in option (3) blanks delimit words.

For example, the following are all equivalent:

*U238A * *PU239B* *IRON *

*U238A PU239BIRON *

16HU238A PU239BIRON

U238A PU239B IRON

The requirements for a 12-word (72-character) title may easily be satisfied by putting an asterisk (*) in columns 1 and 72 and limiting the actual title to columns 2 through 71.

It is recommended that Hollerith always be delimited using the asterisk notation. In any event, if the Hollerith includes the character D in any position of the word or the character E in the last position of a word, the Hollerith must be delimited for proper interpretation.

Note: FILEID, STOP, and FLAG must never be delimited. For example:

OV ISOTXS is correct

OV *ISOTXS* is incorrect.

2. Card Structure

The card field has no fixed structure except that data items must be separated by blanks (or a comma, not recommended), and a single datum item may not be split between two cards. The data field on a card may be terminated by a slash (/) after which comments may be supplied on that card. The trailing comments, however, will appear in the listing, since all card images are printed, but will not be included in the data file.

Comments enclosed in dollar signs (\$)

\$COMMENT\$

may also be inserted freely between datum entries. Except for listing the card images, such comments are ignored by the processor. The initial \$ terminates an immediately preceding data entry.

Card fields for data entries are limited to 72 columns.

3. Control Options

Control options available in the data field are repeat, skip, interpolation, and section repeat.

a. Repeat Option. The repeat option is an unsigned integer immediately followed by the letter "R". Use of this option permits repeating the previously entered data item an integer number of times. The specification nR means n total entries of the previous entry, for example

1 2R = 1 1, and

2.0 3R = 2.0 2.0 2.0

b. Skip Option. The skip option is an unsigned integer immediately followed by the letter "S". This means that the integer number of locations will be skipped when determining the index of a value to be loaded. The skip option is applicable only in overlay applications. Skipping one Hollerith word must be counted as 2 single precision positions having format A6. For example:

1 10R 5S 2 10R = The integer 1 is stored into ten consecutive locations. Then 5 locations are skipped and the integer 2 is stored into the 16th through 25th locations.

c. Interpolation Option. The interpolate (nI) specification provides for linear interpolation between two REAL constants. The previously processed word is the initial end-point, n is the number of equally spaced points to be inserted between the initial and terminal end-points, and the terminal end-point follows the nI specification. Integer interpolation is not available. For example:

1.0 3I 5.0 = 1.0 2.0 3.0 4.0 5.0

d. Section Repeat Option. A section is a group of entries enclosed in parentheses. The entries may consist of numeric or Hollerith data; repeat, interpolate, and skip specifications; or section repeats. The section is always used in conjunction with the repeat option in the form

(entries) nR.

The entries are expanded to obtain n identical data sets.

The end of an interpolation section entry must lie within the section. The initial point may immediately precede the section, although this is seldom useful. The skip option as a section entry must be used cautiously since items skipped are taken from the array being overlayed and the overlayed array is the entity repeated in the section repeat operation. Sections may be continued over more than one card, and section repeats may be nested within section repeats up to 10 levels of nesting. An example of nesting is:

(1(5.0 2I 20.0) 2R WORD1) 2R

which is equivalent to

(1 5.0 10.0 15.0 20.0 5.0 10.0 15.0 20.0 WORD1) 2R.

When repeating a Hollerith word, the section repeat must be used.

For example:

(*PU2388*) 2R.

C. COMMENTS

The following comments should be heeded:

1. A header card is required.
2. The standard input processor will only accept cards or card-images written in the EBCDIC character set. The following characters are different from the BCD characters:
 - (is 12-5-8 punch
 -) is 11-5-8 punch
 - + is 12-6-8 punch
 - = is 6-8 punch
3. Interface file CONTRL is written initially by the driver. Local special processors which use data from the input stream add or replace records in this file (unless in a stand-alone mode). The standard processor will write a completely new file. All records on this file are designated 10. The records may be in any order except as noted below:

PROINS	always first
DVRINS	always present
(others)	optional
* * or BLANK	always last, more than four characters required.
4. The block of data for the input processor is terminated with a card containing STOP and another card containing END.
5. As much of the input data block is processed as possible; any error causes abnormal termination at the end preventing continuing access of code modules and calculation as implemented.

VII. FILE EDITOR

The file editor was developed at LASL and modified extensively for local use. It may be used to print in card-image form the contents of interface data files, or to generate a file containing stacked interface data files, formatted for direct recovery by the input processor. The file editor requires instructions from the interface data file FPRINT when summoned in the calculational path, which must have previously been generated by the input processor. The contents of FPRINT describe the action to be taken by the file editor and were shown in Figure 6. A unit which is to be written for future reading by the input processor must have compatible job control instructions including formatted records of 80 byte length. Files which can be edited were shown in Figure 8.

The maximum record length which can be processed by the file editor is 30,000 short words (15,000 long words). Also, only 10 different record types are now allowed, limiting use in a few instances.

The instruction file FPRINT is deleted^a from the file management table after use. Therefore a new file must be generated by use of the input processor and user input data for each access of the file editor. Of course, once a file is generated, it is available for use until it has been used and deleted.

When data is written on a file for recovery, writing begins at the start of the file and destroys the original contents.

An example of use of the file editor is shown in Section X. A sophisticated control module may use the file editor directly (by generating the required instructions in the file FPRINT without input data), but this is not now done by the control module CONTROL1.

VIII. SPECIAL PROCESSORS

Special processors are allowed in this computational system. All true system member processors are assigned the path access number 2 and each has a unique eight-character name associated with it (six characters ending with two blank characters allowing identification

^a Now Optional - See FPRINT file specifications.

at the user level with six characters). Other special processors may be added which are assigned the path access number 99.

Additional special processors will be added with development effort and reliability testing to ensure proper performance in this system. The special processors named above are frozen members of the system and cannot be overridden by the user supplying his own modules with the names indicated.

Provision has been made to allow use of other special processors. Five additional special processor names have been designated and may be used. They are USERXA, USERXB, USERXC, USERXD, and USERXE. Future extension of these names is obvious. The special processor must be a module, previously loaded, assigned one of these names. At run time, the data set containing that module would be concatenated with the code system data set by overriding the //STEPLIB card in the catalog procedure.

For each special processor module referenced by path access number 2 or 99 in the computational path IM(I) Figure 2, the reference module name followed by any required input data must appear in the input stream, with an END card termination.

When all of the calculations specified on the computational path card have been completed, the user may execute any other modules outside the system that were previously loaded as desired by including cards with =NAME punched beginning in column 1, where NAME is the name of the module to be accessed. Care must be taken to access the necessary data files proper logical units; this may require that special action be taken for the run. Likely these logical units must be specified as input to the module, and input data requirements must be satisfied.

One or more special processors can be added to the system for local use. The module must be put in a data set with the eight-character name (six characters plus two blanks recommended) to be used for access (path access number 99).

Special care should be taken if one or more data sets are concatenated onto the set containing codes used routinely; do not destroy the production codes, as by improper disposition. All the data sets

used should be considered to be permanent (don't DELETE anything, thus avoiding accidental destruction of production codes). Avoid action which prevents quality assurance of the production codes. Make load modules in computer runs separate from runs using the production code.

The fixed format input data read by each of the special processors is described here. This is essentially the same information as given in reference 4.

Each block of user input data must start with a header card which identifies the special processor, and must terminate with an END card. No distinction is made between a zero and a blank field. Data elements are usually named herein, followed by fixed field columns of a keypunched input data card in parentheses. A non-zero default value is shown in [] after the discussion about the datum, overridden by non-zero input. Undefined data is reserved for future use. Some of the data is blocked into individual sections; except where indicated, data must be supplied for each section, and in the order of increasing section number.

A reasonable amount of error checking is done to identify evident user blunders and to effect abortion to avoid wasted calculation by return of a non-zero stop number. Still, unreasonable data may be supplied inadvertently, so careful checking of the edits from the codes and of the results is in order to avoid drawing incorrect conclusions in analysis.

A summary is presented below of the access names and path identification for the special processors covered and the names of the files generated. Files which are generated only on option have been shown in parentheses. Also shown are the names of records added to the file CONTRL; these are accessed by the computation modules for their control.

Processor Access Name	Access Path Module Number	Record Generated in file CONTRL	Files Generated
DVENTR	2	DTNINS	GEODST, NDXSFR, ZNATDN, (SEARCH)
DCRSPR	2	XCPINS	(CXSPRR)
DUTLIN	2	(optional)	-
DCMACR	2	-	See discussion
DENMAN	99	-	(ZNATDN),(QNATDN), (NDXSFR),(SEARCH)
DMISLY	99	-	RTFLUX, ATFLUX, GEODST

A. DVENTR

This code processes data to generate the essential files required by the VENTURE neutronics code. The files generated are consistent regarding the zone volumes which are calculated from the geometric mesh description and the nuclide cross section, concentration, and referencing tables. Reference data is accessed from the group ordered microscopic cross section file GRUPXS which must that it be available.

Header card: DVENTR in columns (1-6).

Section 001: General Control

Card 1: 001 in Columns 1-3.

Card 2: Control Data (6E12.0).

RXX1(1-12)

RXX2(13-24)

Machine central processor time limit for any eigenvalue problem (min) if >0.

RXX3(25-36)

If > 0, the restart I/O data file RSTRTR will be written (rewritten) every RXX3 minutes during the iterative calculation, and also at termination [0.0].

Unless noted, defaulting has been moved into VENTURE for this section of data.

- RXX4(37-48) Power level (watts thermal). (Normalization of the flux is to source neutrons produced lacking energy generation data with the cross sections).
- RXX5(49-60) Conversion factor, ratio of thermal energy to fission + capture energy as calculated from the data presented with the cross sections [1.0].
- RXX6(61-72) Fraction of reactor considered, applied to the power level RXX4 (accounts for the actual geometry treating less than the whole core). RXX6 would be 1.0 in R-Z geometry if Z spanned the whole core, 0.5 if only half was treated; in X-Y geometry, this could be the reciprocal of the Z dimension. Considering unit dimensions in untreated coordinates, this is the volume actually treated divided by the actual core volume. Power generation in untreated regions requires special consideration. Note that the flux level will be normalized to cause a fission + capture energy level of $RXX4 \cdot RXX6 / RXX5$. (If RXX4 is perchance electrical energy, then RXX5 should contain the plant efficiency).

Card 3: Control Data, cont. (6E12.0).

- RXX7(1-12)
- RXX8(13-24) Chebyshev parameter μ_2 upper bound (overrides that calculated by the code).
- RXX9(25-36) Chebyshev parameter μ_1 lower bound, usually zero, (overrides that calculated by the code).
- RXX10(37-48) Specified overrelaxation coefficient (overrides automated procedure).
- RXX11(49-60) Convergence criterion on integral quantities (K) on outer iterations [0.000005].
- RXX12(61-72) Convergence criterion on local, point quantities (maximum relative flux change) [0.00005].

Card 4: Control Data cont. (6E12.0)

- RXX13(1-12) Input Buckling to override that on the GEODST interface file.
- RXX14(13-24)
- RXX15(25-36)
- RXX16(37-48) Search k_{eff} to be satisfied. Required if ICX2=4 or 5. May be used to override search k_{eff} on search interface if ICX2=1.

Card 5: Control Options (2413).

- ICX1(1-3) Transport theory approximation to be applied [1].
- VENTURE - Mesh Centered Finite - Difference.
- 1 - Diffusion theory fundamental flux problem.
 - 2 - P_1 approximation fundamental flux problem.
 - 1 - Diffusion theory solution for the dominant allowed first harmonic (see Section XI) requiring the fundamental regular and adjoint flux files RTFLUX and ATFLUX. The first iterate source distribution will be skewed to excite all spacial flux harmonics so that the dominant one will surface
 - 2 - Same as -1 but the first iterate source will not be skewed. Usually for this option the RTFLUX file must either be a uniform flux distribution (in which case the solution may or may not be for the dominant harmonic) or an initial estimate of the dominant harmonic flux distribution (for example, a cosine from -1 to +1 along a coordinate while perhaps uniform in other directions) that will cause the desired harmonic to surface. This may especially be useful to accelerate convergence when two of the spacial harmonic eigenvalues are nearly equal.
 - 10 - Special dominant azimuthal harmonic solution only applicable for RZ geometry. The total loss term is adjusted to account for the azimuthal harmonic (a D/R loss contribution is added).

- VALE - Mesh Edge Triangular Geometry.**
- 1 - Diffusion theory fundamental flux problem.
 - 1 - Diffusion theory dominant harmonic flux problem.
 - 2 - Diffusion theory dominant harmonic but the first iterate source will not be skewed.
 - 3 - Higher order approximation fundamental flux problem (see RXXN2 Section 002).
 - 3 - Higher order approximation dominant harmonic flux problem.
 - 4 - Higher order approximation dominant harmonic but the first iterate source will not be skewed.
- ICX2(4-6) Type of problem.**
- 0 - Determine k_{eff} .
 - 1 - Search (requires search file be supplied, see ICX3).
 - 2 - Fixed source (requires source file be supplied).
 - 3 - Adjoint only (see ICX4 option to do the adjoint problem directly following a regular problem, which is generally recommended).
 - 4 - B^2 search.
 - 5 - $1/v$ search, prompt mode (requires velocity data in cross section file).
- ICX3(7-9) Search data identifier, see section 028 which is required if ICX3 > 0, or if ICX2 = 1 and ICX3 $\geq$ 0**
- ICX4(10-12) Adjoint problem option.**
- 0 - Not to be done.
 - 1 - Adjoint eigenvalue problem.
 - 2 - Adjoint fixed source problem (requires source file be supplied or generated).
- ICX5(13-15) Flux initialization option.**
- 0 - Automated procedure, (recommended unless a good guess is available).
 - 1 - Set all values equal.
 - 1 - Make space-energy dependent.

- 2 - Use data from the latest version interface data file supplied.
- 3 - Use data from next-to-latest interface data file supplied.

ICX6(16-18)^a

Force data handling mode.

- 0 - Automated procedure, (recommended to minimize data input/output).
- 1 - Core contained.
- 2 - Space problem contained.
- 3 - One row contained.
- 4 - Multiple planes stored.
- 5 - Multiple rows stored.
- 6 - Multi-level transfer mode (special coding for a machine having a large slow extended memory).

ICX7(19-21)

If > 0, a previously written restart data file, RSTRTR (which must be supplied), will be read to continue a calculation. This option continues the flux-eigenvalue calculation with no changes in the problem parameters such as overrelaxation coefficients, number of inner iterations, etc. To restart a problem where changes are desired, use ICX5 option = 2 or 3 (see above).

ICX8(22-24)

Extrapolation options on outer iterations.

- 0 - Automated procedure which may do either single error or double error mode extrapolation.
- 1 - Single error mode using successive iterate flux sets.
- 1 - Single error mode using alternate iterate flux sets
- 2 - Extrapolation not allowed.

^a A "-1" option has recently been added to allow the user to cause termination if the amount of memory allocated is insufficient for efficient execution (cannot store space problem in two-dimensions or enough planes to avoid excess data transfer in three-dimensions). Also see ICX11.

- 3 - Set to 0, but when single error mode extrapolation is done, successive iterate flux sets are used.

ICX9(25-27) Options for initialization procedure.

- 2 - Do not solve a 1-D problem
- 1 - Do not use results from a 1-D problem for inner iterative procedure data.
- 0 - Automated.
- 1 - No Chebyshev or overrelaxation coefficients on outer iterations.
- 2 - Fix the number of inner iterations.
- 3 - Fix the number of inner iterations, no Chebyshev.
- 4 - Fix overrelaxation factors and the number of inner iterations.
- 5 - Same as 4, but no Chebyshev.
- 6 - Same as 4, but do not use results from a 1-D problem.
- 7 - Same as 5, but do not use results from a 1-D problem.

ICX10(28-30) Recalculate overrelaxation coefficients and number of inner iterations at outer iteration number ICX10. (Leave blank and let the code decide this).

ICX11(31-33) Number of inner iterations, leave blank and let the code decide this. (For many fast reactor problems we find 4 inner iterations are near optimum without Chebyshev acceleration; however, for some problems the code automated procedure may be superior provided adequate memory is allocated for the inner iteration process to be done efficiently). For efficient data transfer for three-dimensional problems, we recommend that the container array size (see IP1 Figure 2) be large enough to store as many planes of data as the number of inner iterations.

- ICX12(34-36) Maximum number of outer iterations. If set = 969, preliminary data processing from interface files is done to check data, storage requirements, etc., and no calculations are done unless ICX5 > 1 in which case the residues pass is made to calculate k-effective [50 in input processor].
- ICX13(37-39)^a Extrapolation not allowed before ICX13 outer iterations. If < 0, forced extrapolation is allowed.
- ICX14(40-42) Outer iteration Chebyshev acceleration (flux) options.
 <0 - Start at iteration number | ICX14 | .
 0 - Use automated procedure.
 1 - Start after first extrapolation.
 2 - Force after initial delay.
 3 - Do not allow.
 100 + N - Start at iteration N > 3 with forced extrapolation to obtain the L₁ norm eigenvalue.
- ICX15(43-45) Options on mesh point sweep.
 -1 - Force normal ordering.
 0 - Automated procedure.
 1 - s₁ ordering when data handling procedures allow it.
- ICX16(46-48) Plane (or row) number of a 3-D (or 2-D) problem which is to be run as a 2-D (or 1-D) problem.
- ICX17(49-51) Options on k-effective calculation.
 0 - Automated procedure.
 1 - Calculate k-effective by the source ratio.
- ICX18(52-54) Fission spectrum option.
 0 - Apply set values.
 1 - Determine zone-dependent data from data for the individual nuclides, often desirable for fast reactor problem.
- ICX19(55-57) Fission spectrum normalization.
 0 - Not to be done.
 1 - Normalize individually to unity.

^a Generally used for testing only.

ICX20(58-60)

ICX21(61-63) This order (1, 2, or 3) of the coordinate direction dependent cross section data in the library is to be used for the first dimension.

ICX22(64-66) Ditto, second dimension.

ICX23(67-69) Ditto, third dimension.

ICX24(70-72) Force data transfer of the region assignments in processing (only used to check procedures).

Card 6: Edit options and instruction to generate interface data files (2413).

Note: Indicated action generally to be taken if the value is $\neq 0$, no action if 0.

IXE1(1-3) Print overall neutron balance, highly recommended.

IXE2(4-6) Print neutron balance by zone (macroscopic composition).

IXE3(7-9) Print space-energy point flux values (recommended only when really essential).

IXE4(10-12) Print space point map of power density (not usually needed, especially when zone peaks are edited).

IXE5(13-15) Print power density traverse through peak along each coordinate.

IXE6(16-18) Print space point map of neutron density. This requires velocity data with the cross sections, and is useful only in some situations (d/v is $1/v$ response).

IXE7(19-21) Print neutron density traverse through peak along each coordinate.

IXE8(22-24) Print space-energy point adjoint flux values (when calculated). Seldom needed.

IXE9(25-27) Print zone average flux values by energy group (already available if the zone neutron balance is obtained by option IXE2); if >1 , also print zone average adjoint flux values if the adjoint problem is solved.

- IXE10(28-30)** Print information about the iterative progress.
 - - No
 0,1 - One line of iteration edit per outer iteration.
 2 - Also inner iteration data.
 3 - Also more inner iteration data.
- IXE11(31-33)** Print principal macroscopic cross sections and other data, useful for checking data.
 1 - Only macroscopic cross sections.
 2 - Also boundary conditions and buckling, and overrelaxation coefficients.
 3 - Also extensive information about initialization and recalculation of overrelaxation coefficients.
- IXE12(34-36)** Print scattering macroscopic cross sections.
- IXE13(37-39)** A plane number for which the zone and group bucklings are to be calculated.
- IXE14(40-42)** A second plane number for the buckling calculation.
- IXE15(43-45)** Write regular total flux interface data file RTFLUX.
 1 - Replace old file; if none exists, create one.
 2 - Write a new file.
- IXE16(46-48)** Write adjoint total flux (if calculated) interface data file ATFLUX.
 1 - Replace old file; if none exists, create one.
 2 - Write a new file.
- IXE17(49-51)** Write regular zone flux interface data file RZFLUX.
 1 - Replace old file; if none exists, create one.
 2 - Write a new file.
- IXE18(52-54)** Write power density interface data file PWDINT.
 1 - Replace old file; if none exists, create one.
 2 - Write a new file.
- IXE19(55-57)** Write fission source interface data file FISSOR.
 1 - Replace old file; if none exists, create one.
 2 - Write a new file.
- IXE20(58-60)** Print option when input data is processed.
 1 - Edit interface data files NDXSRF and ZNATDN.

- 2 - Also edit interface data file GEODST.
- IXE21(61-63) Additional print option when data is processed.
- 1 - No mesh point zone number edit.
 - 0 - Edit zone number at each mesh interval only after overlay input Section 006.
 - 1 - Edit zone number at each mesh interval after input Sections 005 and 006.
- IXE22(64-66)^a Perturbation edits. Positive values for this number indicate that the neutronics regular-flux or adjoint-flux or both regular followed by adjoint calculations are to be run prior to the perturbation calculation to write the interface data files RTFLUX and ATFLUX which must be available for perturbation calculations. Negative values indicate that these two interface data files already exist and no neutronics calculation will be done.
- 1 - Edit basic integrals.
 - 2 - Also edit transport integrals.
 - 3 - Also edit absorption cross-section space point importance map.
 - 4 - Also edit production and production-absorption cross-section space point importance maps.
 - 5 - Also edit 1/v space point importance map.
- IXE23(67-69) Write perturbation interface data file PERTUB (IXE22 not zero).
- 1 - Replace old file; if none exists create one.
 - 2 - Write a new file.
- IXE24(70-72) Save results as formatted data (see Section 704, of the VENTURE report) at the end of a case.
- 1 - Yes.
 - 2 - Also print this data.

^aA new option 6 allows file PERTUB to be written with edit suppressed.

Section 002: Optional General Control

This section of input is optional.

Card 1: 002 in columns 1-3.

Card 2: Control options (2413).

IXCN1(1-3)	Identifies secondary search data in the SEARCH interface file to be used if the constraints of the first set are not satisfied, and a second search is to be done (see SEARCH file specifications).
IXCN2(4-6)	
IXCN3(7-9)	Option for testing to prevent default of files to memory.
IXCN4(10-12)	Space-energy rebalance will be done occasionally if > 0.
IXCN5(13-15)	The number of blocks (left-right) for space-energy rebalance if > 0.
IXCN6(16-18)	The number of blocks (top-bottom) for space-energy rebalance if > 0.
IXCN7(19-21)	The number of blocks (fore-aft) for space-energy rebalance if > 0.
IXCN8(22-24)	
IXCN9(25-27)	
IXCN10(28-30)	Option to account for the dependence of the cross sections on the local temperature requires two GRUPXS cross section interface files, a ZNTEMP interface file, and reference temperatures (see RXXN7, RXXN8, and RXXN9 below).
	0 - No.
	1 - Yes.
IXCN11(31-33)	
IXCN12(34-36)	
IXCN13(37-39)	
IXCN14(40-42)	
IXCN15(43-45)	
IXCN16(46-48)	

IXCN17(49-51)

IXCN18(52-54)

IXCN19(55-57)

IXCN20(58-60)

IXCN21(61-63)

IXCN22(64-66)

IXCN23(67-69)

IXCN24(70-72)

Card 3: Control options (cont.)(2413).

- IXEN1(1-3) Calculate and edit perturbation results for a 100 percent change in macroscopic cross sections and uncertainty (sensitivity) information if IXE22 (Section 001) is not zero.
- IXEN2(4-6) Option to write point flux values (used for auxiliary exposure calculations), if IXE17>0.
- >0 - write flux data for this zone.
 - 1 - write data for only the point where the power density is a maximum for the initial neutronics problem.
 - 2 - write flux data for points in the zone where the power density is a maximum for the initial neutronics problem.
 - 3 - write flux data for the point where the first group flux is a maximum for the initial neutronics problem.
 - 4 - write flux data for the points in the zone where the first group flux is a maximum for the initial neutronics problem.
 - <-4 - write flux data for this mesh point count in the mesh.
- IXEN3(7-9) A second zone number for the same purpose, only >0 allowed.

- IXEN4(10-12)** Option to calculate the conversion ratio adjoint importance fixed source and write a new interface file FIXSRC from the results of this forward eigenvalue problem: $F(\text{zone, group}) = \frac{\Sigma_c}{C} - \frac{\Sigma_a}{A}$
 Σ_c is the fertile macroscopic capture cross section, Σ_a is the fuel macroscopic absorption cross section, and C and A are integrated fertile capture and fuel absorption (C/A = primitive conversion ratio). If < 0 write two fixed source files: $\frac{\Sigma_c}{C}$, and $\frac{\Sigma_a}{A}$.
- IXEN5(13-15)**
- IXEN6(16-18)**
- IXEN7(19-21)**
- IXEN8(22-24)** The maximum zone number for which the zone and group dependent diffusion coefficients will be changed by RXXN2 and RXXN3 below, if not zero.
- IXEN9(25-27)**
- IXEN10(28-30)** Option to calculate and edit the relative change in conversion ratio for a 100% change in the macroscopic fertile capture cross section and finite absorption.
- IXEN11(31-33)** Write an adjoint total flux file ATFLUX with the product of the regular and adjoint fluxes.
 1 - Write over old file; if none exists create a new one.
 2 - Write a new file version.
- IXEN12(34-36)** Write zone power density file ZNPWD.
 1 - Replace old file; if none exists, create one.
 2 - Write a new file.
- IXEN13(37-39)** Write a point fixed source file as DB²φ.
 1 - Replace old file; if none exists, create one.
 2 - Write a new file.
- IXEN14(40-42)** Write the adjoint zone average flux file AZFLUX.
 1 - Replace old file; if none exists, create one.
 2 - Write a new file.

IXEN15(43-45) Option to calculate a point power density adjoint importance fixed source and write a new interface file FIXSRC. This file is by mesh point and

group

$$FS(i,k) = \left[\frac{W(i,k)}{(PD)_N} \right]^* - \frac{W(i,k)}{P F} V(i)$$

where

i = mesh point index

k = energy group index

W = power per unit flux

(PD)_N = power density at mesh point N

P = total power

F = fraction of core

V = volume

[]* zero except at point N

1 - N is the meshpoint where the power density is the peak

-M - N is the meshpoint in zone | M | where the power density is the peak.

2 - N is the mesh point defined by IXEN16, IXEN17, and IXEN18 below.

IXEN16(46-48) Column number for IXEN15 = 2 (point number on a plane for VALE)

IXEN17(49-51) Row number for IXEN15 = 2 (set to 1 for VALE)

IXEN18(52-54) Plane number for IXEN15 = 2

IXEN19(55-57)

IXEN20(58-60) If > 0, this is the order number in the nuclide name set 1 of Section 013 of Xenon, and equilibrium Xenon will be accounted for in the flux calculation (see RXXN5 and RXXN12 below and Section XI).

IXEN21(61-63)

IXEN22(64-66)

IXEN23(67-69)

IXEN24(70-72)

Card 4: Control options (cont.) (24I3).

IXNU1 (1-3)

Card 5: Control Data (6E12.0).

RXXN1(1-12) Limiting value of the diffusion coefficient^a
(100 cm)

RXXN2(13-24) Parameter for higher order VALE formulation
|IXC1| > 2.
1/6 - Taylor Series.
7/36 - Linear Flux.
1/4 - Linear Finite Element
If made negative, the fission and scattering
source will not be calculated using the higher
order approximation.

RXXN3(25-36) The zone (see IXEN8) and group dependent dif-
fusion coefficients are multiplied by RXXN3
[1.0].

RXXN4(37-48) This number is added to the diffusion coef-
ficients after RXXN3 is applied [0.0].

RXXN5(49-60) $X_{e^{135}} + I^{135}$ yield fraction for equilibrium Xenon
(see IXEN19).

RXXN6(61-72) Factor Q in equation (9) Section XI.

Card 6: Control Data (cont.) (6E12.0).

RXXN7(1-12) Reference temperature (degrees C) at the next-to-
latest version GRUPXS cross section file.

RXXN8(13-24) Reference temperature (degrees C) at the latest
GRUPXS file.

RXXN9(25-36) Correlation parameter for the arctangent depen-
dence of cross sections on zone temperatures
(linear correlation if 0.0).

RXXN10(37-48) Factor applied to space interpolation slope (see
section XI) for space-energy rebalance. If zero,
no space interpolation will be done.

RXXN11(49-60) Factor applied to final rebalance factors for
space-energy rebalance (1.0).

^aIf a larger value is calculated, the limiting value is used
(essential to avoid poor convergence characteristics), defaulted in
VENTURE proper.

RXXN12

Xenon decay constant λ_{Xe} for equilibrium Xenon
(sec^{-1}) (see IXEN19).

Section 003: Geometric Description

Card 1: 003 in Columns 1-3.

Card 2: Data (13I3)

IGOM(1-3)

Reference Geometry.

1 - Slab (X) one-dimensional.

2 - Cylinder (R).

3 - Sphere (S).

6 - X-Y, two-dimensional.

7 - R-Z.

8 - θ -R.

9 - T (equilateral triangle).

10 - H (equilateral hexagon).

14 - X-Y-Z, three dimensional.

15 - θ -R-Z.

17 - T-Z.

18 - H-Z.

IMBL(4-6)

Boundary condition at start of rows (left).

0 - Zero flux.

1 - Reflected.

2 - Extrapolated.

3 - Repeating with opposite end.

IMBR(7-9)^a

Boundary condition at end of rows (right).

0 - Zero flux.

1 - Reflected.

2 - Extrapolated.

3 - Automatically if IMBL=3.

4 - Repeating with next adjacent face (rotational symmetry with boundary JMBB).

5 - Inverted repeating this face (180° rotational symmetry).

^a Note interchange of IMBR and JMBT from old ORNL codes; only those boundaries required for the geometry need values.

- JMBT(10-12)** Boundary condition at start of columns (top).
0, 1, 2, options above.
- JMBB(13-15)** Boundary condition at end of columns (bottom)
0, 1, 2, options above (set = 4 if IMBR = 4).
- KMBF(16-18)** Boundary condition face of planes (front)
0, 1, 2, options above.
- KMBR(19-21)** Boundary condition back of planes (back)
0, 1, 2, options above.
- NBS(22-24)** Number of buckling specifications: remember that buckling is normally used only to approximate leakage in those coordinate directions untreated, and not for S, R-Z and three-dimensional problems.
0 - None, code uses $B_1^2 = 0.0$.
1 - Single value of B_1^2 applies everywhere.
= NZONE $\equiv$ number of zones, zone dependent.
= N*NZONE, data is given over all zones for the first energy group, then for the next group, and so on through N groups. If there are more than N groups, data for group N is used for the other groups. If NBS > 0, additional data will be required.
- NBCS(25-27)** Number of constants for external boundaries non-return boundary constants, applied only where the "extrapolated" boundary condition is specified.
0 - Default value of C = 0.4692 is used;

$$C = - \frac{D}{\phi} \frac{\partial \phi}{\partial x} \bigg|_b$$

- 1 - Single value to be used everywhere.
- 6 - Individual values for each of the faces of a J-D problem (left, right, top, bottom, front, back).

N*6 - Values for the six faces are given for the first energy group, then the next, through N groups; data for group N is used for any additional groups. If NBCS > 0, additional data will be required.

NIBCS(28-30) Number of constants for internal extrapolated boundaries.
 0 - None, default value C = 0.4692.
 1 - Single value given will be used.
 N - Values given in increasing group number order, last value used for any additional groups. If NIBCS > 0, additional data will be required.

NZMBB(31-33) Number of zones which are black absorbers (no return current from these).
 If NZMBB > 0, additional data will be required.

NTRIAG(34-36) Orientation of triangular geometry.
 0 - 120° between X and Y axes (required for 120° rotational symmetry which is about opposite corner from 0,0).
 1 - 60° between X and Y axes (required for 60° rotational symmetry which is about opposite corner from 0.0).

NRASS(37-39)

Card(s) 3: NBS values of buckling required (6E12.0).

Card(s) 4: NBCS values of boundary constants required (6E12.0).

Card(s) 5: NIBCS values of internal boundary constants required (6E12.0).

Card(s) 6: NZMBB identifiers of black zones required (24I3).

Section 004: Geometric Mesh Description

Card 1: 004 in Columns 1-3.

Card(s) 2: (6(I3,E9.0)).

Specify the number of mesh points and the region width for each vertical region going from left to right. For a two- or three-dimensional problem next specify the number of mesh points and the region width for each horizontal region going from the top to bottom starting with a new card. For a three-dimensional problem then specify the number of mesh points and the region width for each region going from front to back starting with a new card. In referring to the geometric mesh, rows of mesh points go from top to bottom, columns of mesh points go from left to right, and planes of mesh points go from front to back. In R and R-Z geometry, a row is a radial traverse. In θ -R and θ -R-Z geometries, columns radiate downward from a center at the top and a row has constant radius. In hexagonal geometry, the X and Y axes are assumed to be at 60° (upper left-hand corner), and dimensions are on external boundaries. In triangular geometry, the X and Y axes are located at 120° (except 60° when NTRIAG in Section 003 is made 1). Distances are given along these coordinates (not at 90° for the special orientations). Data must be ended for each traverse by a blank entry; if the last card of data is filled for any traverse, another card is required (blank).

Section 005: Zone Placement

Card 1: 005 in Columns 1-3.

Card(s) 2: (2413).

Specify the zone identification numbers (i.e., location of uniform composition) of each region of a traverse along the first horizontal row of regions going from left to right, one number for each interval entry in Section 004. Beginning with a new card, specify the zone numbers of each region in the second horizontal row of regions. Continue these specifications going from top to bottom. For a one-dimensional problem, the zone numbers are specified for only one traverse. For a three-dimensional problem, give the two-dimensional grid for the front plane of regions and continue these to map the material through to the back plane. The cross section set later to be associated with the zone numbered 1 will be used as a reference, so

zone 1 might be located within a core rather than in a blanket or reflector. Also it will prove convenient to number consecutively zones which will contain the same material (will have the same nuclides and use the same microscopic cross section tape). Note that each specification in this block of data is for a traverse along a row and requires the same number of entries.

Section 006: Mesh Overlay (Optional)

New zones may be superimposed within a mesh already described with this data.

Card 1: 006 in Columns 1-3.

Card 2: (14).

Specify a zone number in the first field; data is read to a blank zone number.

Card(s) 3: (3(6I4)).

Specify blocks of points by left column number and then right column number to give limits along rows, top and bottom row numbers for column limits, and front and back plane numbers for depth limits in that order. If only one row is involved, for example, then that row number is repeated. Only 4 entries are needed for each specification in 2-D geometry. Data is read to blank left column entry. The entry 000600060005001500020002 places the new material along column 6 from rows 5 through 15 and on only plane 2. Remember that each mesh point has an associated volume around it - mesh points do not lie on material interfaces; specifying a single mesh point here, say 000600060005000500020002 does involve the associated volume.

Section 012: Assignment of Nuclide Name Sets to Zones

This data is used to block the nuclide concentrations.

Card 1: 012 in Columns 1-3.

Card 2: Number of subzones in Columns 1-3, NSZ.

Card 3: Referencing data (4I3,E12.0).

M1(1-3) First zone number of a consecutively numbered set of zones.

M2(4-6) Last zone number of the set.

NS(7-9) Nuclide set reference number (out of the integers from 1 to the number of sets).

NC(10-12) Zone classification number.

VF(13-24) Volume fraction associated with zone concentrations in these zones. [1.0]
Cards 3 are read until a blank or zero M1 number is encountered.

Card(s) 4: Subzone data (4I3,E12.0,I3) required if NSZ > 0.

MM1(1-3) First subzone number of a consecutively numbered set of subzones.

MM2(4-6) Last subzone number of the set.

NMS(7-9) Nuclide set reference number.

NMC(10-12) Zone number containing these subzones.

VMC(13-24) Fraction of the zone volume applying to each of these subzones.

NMCOPT(25-27) If = 1, the first subzone is assigned to zone NMC, the next subzone is assigned to the next zone, etc., indexing upward through the subzone set, one subzone assigned to a zone.
Cards 4 are read to a blank (zero MM1).

Section 013: Nuclide Names in Sets

This data is necessary to relate concentration assignments by nuclide name.

Card 1: 013 in Columns 1-3.

Card 2: NNS maximum number of nuclides in any set in Columns 1-3.

Card 3: NDXS number of nuclides in this set in Columns 1-3.

Card(s) 4: Names of nuclides (alphanumeric characters) in the set

The names must correspond with user identification names (not absolute labels) in the cross-section library, NDXS six-character names (12A6) required.

Cards 3 and 4 are repeated for each set specified in Section 012 through the maximum set number.

Section 020: Nuclide Concentration Assignments

In this assignment of nuclide concentrations for some initial condition, overlay is permitted; that is the last assignment to a zone overrides any previous ones.

Card 1: (I3, 3X, 2I3, E12.0) Section Card.

Columns (1-3)	Must contain the section identification 020.
NDO(7-9)	Option that no concentrations are supplied if <0 which assumes that the file ZNATDN exists and is not to be written, and no more cards are supplied in this section.
MCN(10-12)	Cycle reference (count) for documentation.
TIME(13-24)	Reference time (days) for documentation.

Card 2: Zone set (3I3).

MZ1(1-3)	First zone number of a consecutively numbered set.
MZ2(4-6)	Last zone number of the set.
MZI(7-9) ^a	Reserved

Card(s) 3: Concentration assignments 4(A6,E12.0).

Specify a six character alphanumeric name of a nuclide and then its concentration, and continue with sets of these to a blank name.

Cards 2 and 3 are read until a blank card (zero MZ1) is encountered.

Note: Names must correspond precisely with those given in Section 013 and with those in the cross-section library.

Card(s) 4: Subzone set (3I3), required if NSZ > 0.

MSZ1(1-3)	First subzone number of a consecutively numbered set of subzones.
MSZ2(4-6)	Last subzone number of the set.
MSZI(7-9) ^a	Option on input.

^aFor processing with the special processor DENMAN, a -1 here causes the nuclide densities in these locations to be set to zero before the additions are made.

- 0 - Input concentrations.
- +1 - Use the concentrations from the corresponding zone (the nuclide set for the zone and sub-zone must be the same for this option).

Card(s) 5: Subzone concentrations 4(A6,E12.0), required if MSZ1 = ≤ 0 .
Cards 4 and 5 are read until a blank card (zero MSZ1) is encountered.

Section 028: Criticality Search Data for Search Problems (Required if ICX3 > 0 or if ICX2 = 1 and ICX3 > 0)

Card 1: (I3) 028 in Columns (1-3)

Card 2: (I3)

NSP(1-3) Search set identifier, set equal to ICX3 in DVENTR.

Card 3: (6E12.0) Search specifications.

XSH1(1-12) Desired multiplication factor (1.0).

XSH2(13-24) Multiplication factor slope, $\partial k / \partial \lambda$ where λ is the search problem eigenvalue.

XSH3(25-36) Convergence criterion to be met by k , $\epsilon_n = (k_n - k_{n-1}) / k_n$ where n refers to the n th outer iteration [5.0E-5].

XSH4(37-48) Convergence criterion to be met by eigenvalue of the search problem [1.0E-3].

XSH5(49-60) Modifier applied to nuclide concentration varied specially (for NSH1 = 7 only see card 4).

XSH6(61-72)

Card 4: (24I3) Search specifications.

NSH1(1-3) Type of search.

0 - Not defined.

1 - Buckling.

2 - 1/V.

5 - Dimension.

7 - Nuclide concentration search by proportional adjustments of selected initial concentration.

9 - Nuclide concentration search by adding weighted eigenvalue adjustments to selected initial concentration.

- NSH2(4-6) Subzone option when NSH1 = 7 or 9.
 0 - Search data by zone.
 1 - Search data by subzone.
- NSH3(7-9) Maximum number of neutronic eigenvalue problems allowed for the search (a zero specifies a direct search).
- NSH4(10-12) Number of first dimension coarse mesh intervals (data required only for a dimension search, NSH1 = 5).
- NSH5(13-15) Number of second dimension coarse mesh intervals.
- NSH6(16-18) Number of third dimension coarse mesh intervals.
- NSH7(19-21) Maximum number of isotopes or nuclides defined in a set for a concentration search (NSH1 = 7 or 9 only).
- NSH8(22-24) Number of sets specified for concentration search (NSH1 = 7 or 9 only).
- NSH9(25-27) Search problem eigenvalue range allowed for an acceptable solution.
 -1 - $\lambda > 0$.
 0 - No restriction.
 1 - $0 < \lambda < 1$.
 2 - $\lambda < 1$.
- NSH10(28-30) State of the iterative procedure allowed for an acceptable solution.
 0 - No restraint.
 1 - Convergence criteria not met.
 2 - Convergence criteria not met and problem not converging.
- NSH11(31-33) Conditions allowed in the solution for it to be acceptable.
 0 - All nuclide concentrations > 0 during calculation.
 1 - All nuclide concentrations > 0 at solution.
 2 - Allow nuclide concentrations < 0 .

NSH12(34-36) If > 0, update the macroscopic cross sections during a direct nuclide search (NSH3 = 0).

Additional input is required if NSH1 = 5 or 7 or 9.

For NSH1 = 5

Card(s) 5: (6E12.0)

SRHDJ(J) NSH4 values to be used as first dimension coarse mesh modifiers; coarse mesh intervals are adjusted in proportion to these modifiers.

Card(s) 6: (6E12.0)

SRHDI(I) NSH5 values to be used as second dimension coarse mesh modifiers.

Card(s) 7: (6E12.0)

.RHDK(K) NSH6 values to be used as third dimension coarse mesh modifiers.

For NSH1 = 7 There must be NSH8 sets of Card 5 and Card(s) 6.

Card 5: (2I3)

NSHZ1(1-3) First number of a consecutively numbered set of zones (or subzones).

NSHZ2(4-6) Second number of a consecutively numbered set of zones (or subzones).

Card(s) 6: (12(A6))

HNNAMS(N) NSH7 nuclide names whose concentrations are to be adjusted proportionately in the specified zones (subzones); blanks are allowed.

Concentrations are adjusted by the equation $C_2 = \lambda C_1$ where λ is a common multiplier.

Card 7: (10(A6))

HNSHN(N) The names of up to 10 nuclides to have concentrations adjusted inversely (concentration changes are of opposite sign to those of the other nuclides) in all search zones $C_2 = C_1 + C_1*(1-\lambda)*XSH5$.

For NSH1 = 9

Card 5: (2I3)

NSHZ1(1-3) (See above)

NSHZ2(4-6)

Card(s) 6: [4(A6,E12.0)]

(HNNAMS(N), NSH7 pairs of nuclide names and relative con-
CHZDN(N)) centration changes to be made in the specified
zones (subzones). Concentrations are adjusted by
the equation $C_2 = C_1 + \lambda \Delta C$.

B. DCRSPR

This code processes data for the cross section processor code. Since a number of tasks have been programmed in the latter, the necessary instructions and data must be supplied as required by the various options. A primary role is the conversion from a nuclide ordered cross section file ISOTXS, as usually available from cross section preparation codes, to a group ordered GRUPXS file required by many of the computation modules in this system. Also, extraneous data in an ISOTXS file may be eliminated, such as the higher moments of scattering and data for nuclides not of interest, important to hold down the computer memory and possibly the data transfer requirements for a calculation.

Header card: DCRSPR in columns (1-6)

Card 1: Control Options (24I3)

ICD1(1-3)

ICD2(4-6)

ICD3(7-9)

Option on input cross-section file processing

0 - No processing required.

1 - Generate a new nuclide-ordered file.

(ISOTXS) from the file or files having format

ICD5 (requires additional input data)

ICD4(10-12)

Option to generate a new group-ordered file

(GRUPXS) from a nuclide-ordered file.

0 - No.

1 - Yes.

ICD5(13-15)

Format of input cross section for ICD3=1.

0 - Nuclide-ordered file (ISOTXS)

- 1 - CITATION cross-section sets.
 - 2 - Merge two nuclide-ordered files (ISOTXS); the file control parameters NGROUP, MAXORD, ICHIST, NSCMAX, and NSBLOK must be the same for both files.
- ICD6(16-18) Option on principal cross-section data for ICD4=1.
- 0 - Retain all data.
 - 1 - Redefine (n,γ) cross section to be the capture cross section = $(n,\gamma) + (n,\alpha) + (n,p) + (n,d) + (n,t) - (n,2n)$.
- ICD7(19-21) Option on scattering data for ICD4=1.
- 0 - Retain all data.
 - 1 - Retain the total scattering only.
- ICD8(22-24) Option on scattering order for ICD4=1.
- 0 - Retain all data.
 - N - Retain orders up to (N-1) only.
- ICD9(25-27) Option on scattering record blocking factor for ICD4=1.
- 0 - NSBLOK=1
 - N - NSBLOK=N, if $(NISO/N)*N=NISO$, otherwise NSBLOK=NISO where NISO is the number of nuclides.
- ICD10(28-30) Option to compute the total scattering matrix from the components for ICD4=1: TOTAL=ELASTIC + INELASTIC + N2N (This must be done if the GRUPXS file is to be used by VENTURE and there is no total scattering data present).
- 0 - No.
 - 1 - Yes.
 - 2 - Yes, but multiply N2N by 2.0.
- ICD11(31-33) Option to create isotope mixtures after processing specified by ICD3 and ICD5, if any. A new nuclide-ordered file (ISOTXS) will be written.
- 0 - No.
 - 1 - Yes (requires additional input data).

ICD23(67-69)

1 - Yes.

1 - Yes.

Card 2: (2413) Control instructions (required if ICD3=1 or ICD11=1).

N - Yes (N should be equal to the number of energy groups on the cross section file). If NOP3>0 card(s) 4 required.

- NOP4(10-12) Option to create pseudo direction dependent transport data.
 0 - No.
 1 - Yes, if NOP4>0, card 5 required.
- NOP5(13-15) Option to input override data for isotopes.
 0 - No.
 N - Yes (N is the number of card(s) 6).
- NOP6(16-18) Number of mixtures (required if ICD11=1).
 Card(s) 7, 8, and 9 are required if NOP6>0.
- NOP7(19-21) Maximum number of isotopes in any mixture (required if ICD11=1).
- NOP8(22-24)
- NOP9(25-27)
- NOP10(28-30) Option on use of the override data for isotopes when NOP5>0 (applicable only when ICD3=1 and ICD5=0).
 0 - Data corresponds with the order of isotopes in the file.
 1 - Data identifies isotopes to be selected by unique isotope label.
- NOP11(31-33)
- NOP12(34-36)
- NOP13(37-39)
- NOP14(40-42)
- NOP15(43-45)
- NOP16(46-48)
- NOP17(49-51)
- NOP18(52-54)
- NOP19(55-57)
- NOP20(58-60)
- NOP21(61-63)
- NOP22(64-66)
- NOP23(67-69)
- NOP24(70-72) Option on edit during CITATION cross section processing.

0 - No.

1 - Yes.

Note: Any subsequent data causes file CXSPRR to be generated.

Card(s) 3: (24I3) CITATION set numbers to process (required if NOP1>0).
(ISET(I),I=1,NOP1) Set numbers in ascending order of appearance in library.

Card(s) 4: (6E12.0) Neutron energy spectrum (required if NOP3>0).

(WGT(I),I=1,NOP3) Spectrum for weighting in mixture calculation.

Card 5: (3E12.0) Multipliers for transport cross section (required if NOP4>0).

(TRMOD(I),I=1,3) Multiplier for each coordinate direction

STRPD(I)=TRMOD(I)*STRPL(1) for each energy.

Card 6: (3A6,6X,3E12.0,4I3) Isotope override data, required if NOP5>0 and there must be NOP5 card(s) 6.

HISONM(1-6) Hollerith isotope label (unique).

HABSID(7-12) Hollerith isotope label (absolute).

HMAT(13-18) Hollerith isotope label (reference).

AMASS(25-36) Gram atomic weight.

EFISS(37-48) Total thermal energy yield/fission (watt-sec/fission).

ECAPT(49-60) Total thermal energy yield/capture (n, γ)(watt-sec/capture).

KBR(61-63) Isotope classification.

IDP1(61-63)

IDP2(67-69)

IDP3(70-72)

When NOP10=0 and ICD3=1, the contents of these cards control the processing of the cross sections. The order of these cards must be one-to-one with the order of the isotopes in the old data file(s). One card is read for each isotope. If for the label HISONM the word 'DELETE' is specified, the data for this isotope are not written on the new nuclide-ordered file; otherwise, the data will be included and non-blank names and non-zero data on the card will replace the old data. The new file is completed when NOP5 isotopes have been processed (copied or deleted); NOPS may be less than the number on the old file.

When NOP10=1 and ICD3=1 and ICD5=0, this data may be used to control the content of the new ISOTXS file. The order of the cards is not specified since the unique label (HISONM) is used to identify isotopes to be copied to the new file. Non-blank or non-zero values for the rest of the data will be put on the new file. The unique label may not be changed when using this option. If NOP5=0, data for all isotopes in the old file will be copied to the new file.

Card(s) 7 and 8 are required for creating mixtures if NOP6>0.

Card 7: (2I3)

M1(1-3) First mixture number of a consecutive set of mixtures.^a

M2(4-6) Last mixture of a consecutive set of mixtures.

Card(s) 8: 4(A6,E12.0)

Specify sets of (1) a character unique isotope label and (2) the concentration (Atoms/b-cm). A blank label ends this data for these mixtures. Any isotope appearing in a mixture will be deleted from the new file.

Sets of card(s) 7 and 8 are read until a value of M1=0 is encountered.

Card(s) 9: (3A6,6X,3E12.0,4I3)

Reference data for the mixtures, required if NOP6>0 and there must be NOP6 card(s). Card format is the same as Card 6. Non-blank data should be supplied for labels and non-zero data for KBR. AMASS, EFISS, and ECAPT are calculated for the mixture, but are replaced by non-zero entries.

C. DUTLIN

This special input processor is used to add or replace records on the interface file CONTRL which is initially created by the control module. For example, the Reaction Rate module reads the record RRTINS to obtain the instructions for calculating reaction rates, the exposure module reads the record EXPINS for the instructions for exposure and shutdown calculations. This processor may be used to add the RRTINS and EXPINS and other records to the CONTROL file.

^a Normally M1 is a mixture number, running from 1 up, and M2 is left blank.

Each record of the file CONTRL consists of a REAL*8 six character identifier, 100 REAL*8 words and 100 INTEGER*4 words. The 100 REAL*8 words may contain Hollerith information, but the Hollerith will always be in the first locations and each Hollerith word will consist of six characters.

Header card: OUTLIN in columns (1-6).

Card 1: (A6,6X,4I3).

HXCTL(1-6)	Record identifier (see Figure 4. Interface File CONTRL).
NH(13-15)	Number of REAL*8 six-character Hollerith words to be input in (12A6) format.
NR(16-18)	Number of REAL*8 floating point numbers to be input in (6E12.0) format.
NI6(19-21)	Number of integers to be input in (12I6) format.
NI3(22-24)	Number of integers to be input in (24I3) format.
IPR(25-27)	Edit data if > 0.

Note: $NH + NR \neq 100$, and $NI6 + NI3 \neq 100$.

Card(s) 2: (12A6) Required if $NH > 0$.

(XCD(I), I=1,NH) REAL*8 Hollerith data.

Card(s) 3: (6E12.0) Required if $NR > 0$.

(XCD(NH+I), I=1,NR) REAL*8 floating point data.

Card(s) 4: (12I6) Required if $NI6 > 0$.

(IXD(I), I=1,NI6) Integer data.

Card(s) 5: (24I3) Required if $NI3 > 0$.

(IXD(NI6+I), I=1,NI3) Integer data.

Note: Unassigned values of XCD or IXD will be zero.

Data for additional records will be processed until HXCTL on card 1 equals 6H_____ or 6HBLANK__ (or end-of-file is read).

D. DCMACR

This code reads macroscopic cross section data in the section 008 format of the CITATION code^a and writes a pseudo CITATION format

^a ORNL/TM-2496; note that certain assumptions are made in converting the data to a pseudo microscopic file which includes values of the fission cross section, and the full capability implied in the specifications for file ISOTXS or GRUPXS is of course not possible.

microscopic cross section file on logical unit 8. This file may then be converted to the standard interface file GRUPXS by the cross section processor code in this system.

Header card: DCMACR in Columns (1-6).

Card 1: (I3)

MVX(1-3) The number of zones (pseudo nuclides) in the CITATION format macroscopic data below.

Card 2: (12A6)

TITLE(1-72) Descriptive title.

Card(s) 3: The data for a complete CITATION input section 008 including the 008 card.

E. DENMAN

This code is accessed by a module number 99 in the calculational path instruction to the control module. On option, the user may:

- (1) Change the cross section reference
 - (a) change zone and/or subzone nuclide set reference
 - (b) change nuclide set definition
- (2) Change (overlay) the nuclide concentrations in file ZNATDN (or QNATDN)
- (3) Produce a deck of nuclide concentrations in the Section 020 format of the special processor DVENTR
- (4) Edit the contents of file ZNATDN (or QNATDN)
- (5) Create file SEARCH with multiple sets of search data.

The interface file NDXSRF, which contains referencing information, is always required.

If no data is specified (the code finds an end-of-file or the first card after the header card contains a 999 in Columns 1-3) the default task of option NOPN2=1 below is performed (a deck of nuclide concentrations in the section 020 format is produced).

Header card: DENMAN in Columns 1-6.

Section 010: Nuclide Set Reference Instructions (optional)

Card 1: 010 in Columns 1-3.

Card 2: Instructions (24I3)

Card 2: Instructions (24I3)

JOPN1(1-3) Option to change nuclide set reference

0 - no change

1 - change nuclide set number assigned to zone and/or subzone
 (requires additional input in form of Section 012)

2 - change nuclide set definitions (requires additional input
 in form of Section 013)

JOPN2(4-6) Reserved

JOPN3(7-9) Reserved

JOPN4(10-12) Reserved

JOPN5(13-15) Reserved

JOPN6(16-18) Option on the version of the referencing file
 NDXSRF to be written.

0 - rewrite old version

1 - write new version

JOPN7-JOPN24 Reserved

Note: When nuclide sets are changed the absolute nuclide name associated with each position in the old set and the new set must agree. Also a change in nuclide sets may require redefining the file SEARCH.

Section 012: Assignment of Nuclide Sets to Zones and/or Subzones
(Conditional - Required if JOPN1 = 1)

Card 1: 012 in columns 1-3.

Card 2: NSZ(1-3) Number of subzones (not used but is obtained from file NDXSRF)

Cards 3: Zone referencing data (4I3, E12.0)

M1(1-3) First zone number of a consecutively numbered set of zones

M2(4-6) Last zone number of the set

NS(7-9) Nuclide set reference number (out of the integers from 1 to the number of sets defined in file NDXSRF, zero is allowed if the zone contains subzones)

NC(10-12) Not used

VF(13-24) Not used

Cards 3 are read until a blank or zero MI number is encountered
 Cards 4: Subzone referencing data (4I3, E12.0, I3) (required if subzones are present)

MM1(1-3)	First subzone number of a consecutively numbered set of subzones
MM2(4-6)	Last subzone number of the set
NMS(7-9)	Nuclide set reference number (out of the integers from 1 to the number of sets defined in file NDXSRF)
NMC(10-12)	Not used
VMC(13-24)	Not used
NMCOPT(25-27)	Not used

Cards 4 are read until a blank or zero MM1 is encountered.

Section 013: Nuclide set Definition (Conditional - Required if JOPN1 = 2)

Card 1: 013 in Columns 1-3

Card 2: NNS(1-3) Maximum number of nuclides in any set (not used but is obtained from file NDXSRF)

Card 3: NDXS(1-3) Number of nuclides in this set (enter zero if no change in this set)

Cards 4: Names of nuclides (alphanumeric characters) in the replacement set which must correspond with user identification (unique) names (not absolute names) in the cross section library, there must be NDXS six-character names (12A6).

Cards 3 and 4 are repeated for each nuclide set specified in NDXSRF file.

Section 018: Nuclide Concentration Instructions (Optional)

Card 1: 018 in Columns 1-3

Card 2: Instructions (24I3)

NOPN1(1-3) Option to change (overlay) the nuclide concentrations in the latest version interface file.

0 - No

1 - Yes (requires additional input in form of Section (020)

NOPN2(4-6) Option to produce a deck of the nuclide concentrations in the format of Section 020 of the

DVENTR special input processor from the latest version interface file. The deck is written on unit 7 and may be punched or saved on an external device according to the job control instructions.

0 - No

1 - Yes

NOPN3(7-9) Option to edit the nuclide concentrations from the latest version interface file.

0 - No

1 - Yes

NOPN4(10-12) Option on nuclide concentration interface file name.

-1 - Read QNATDN, write QNATDN

0 - Read ZNATDN, write ZNATDN

1 - Read QNATDN, write ZNATDN

Note: A file is written only when NOPN1 = 1

NOPN5(13-15) Reserved

NOPN6(16-18) Option on version of nuclide concentration file to be written

0 - rewrite old version

1 - write new version

NOPN7-NOPN24 Reserved

Section 020: Nuclide Concentrations (Conditional - Required if NOPN1 = 1)

The form of the data is as described for Section 020 of the DVENTR special input processor except the NDO on Card 1 has no affect. Note that existing concentrations are not altered unless new concentrations are assigned. If a zero concentration is desired for a nuclide in one or more zones where it is non-zero in the file, then such must be specified. There is provision to set nuclide densities to zero by option before adding new values. Following the identification of a series of zones (MZ1, MZ2), MZ1 (Col. 7-9) set to -1 causes all nuclide densities in zones MZ1 through MZ2 to be set to zero, and for a set of subzones (MSZ1, MSZ2), MSZ1 (Col. 7-9) set to -1 effects the same for this set of subzones. Full overlay capability

of data by blocks of zones or subzones is implemented allowing redundant specifications; the last assignment in such event overrides any earlier ones.

Note: If nuclide sets have been changed, reference to nuclides must be made with the new unique names.

Section 026: Search Data Instructions (Optional)

Card 1: 026 in Columns 1-3

Card 2: Instructions (2413)

LPHN1(1-3) Option to create a SEARCH interface file

0 - No

1 - Yes (requires additional input in form of Section 028)

LOPN2(4-6) Reserved

LOPN3(7-9) Reserved

LOPN4(10-12) Reserved

LOPN5(13-15) Reserved

LOPN(16-18) Option on the version of the SEARCH file
to be written

0 - rewrite old version

1 - write new version

LOPN7-LOPN24 Reserved

Section 028: Criticality Search Data (Conditional - Required if LOPN1 = 1)

The form of the data is as described for Section 028 of the DVENTR special input processor except that multiple sets of search data may be input. Data is processed until NSP on Card 2 is less than or equal to zero.

Section 999: Terminator

A card containing 999 in Columns 1-3 is recommended for termination of this data.

END Card

The block of data for this processor requires a final card with END in Columns 1-3.

F. DMISLY

This code is accessed by a module number 99 and performs miscellaneous tasks described by the input options given below:

Head Card: DMISLY in Columns (1-6).

Card 1: Control Options (24I3). Always required.

- IOP1(1-3) 1 - Expand an RTFLUX file by adding a dimension (controlled by IOP4 below) and write over the old file. The permitted expansions are:
 X to XY (last dimension),
 R to RZ or θ R (last or first dimension),
 XY to XYZ (1st dimension),
 RZ to θ RZ (first dimension),
 θ R to θ RZ (last dimension),
 T to TZ (last dimension),
 H to HZ (last dimension).
- 2 - Same as IOP1=1 but write a new version of the file.
- IOP2(4-6) Same as IOP1 but for an ATFLUX file.
- IOP3(7-9) Same as IOP1 but for a GEODST file. (Requires additional input).
- IOP4(10-12) 0 - Add a last dimension.
 1 - Add a first dimension.
- IOP5(13-15) The number of fine mesh intervals for the added dimension. If IOP5 = 1, the only change to the GEODST file (IOP3>0) will be new buckling or outer boundary conditions, if specified, (see cards 3, 4, and 5). If IOP5 = 1 and IOP4 = 0, no change will be made to the R(A)TFLUX files.
- IOP6(16-18) 0 - Cosine flux distribution for IOP1 and/or IOP2>0. The expanded flux distribution will be:
 ϕ (expanded) = ϕ (input) $\times Z_I$, where $Z_I = \cos(X_I)$,
 $X_I = \frac{I-1/2}{IOP5} \times (\pi \times XOP1)$. (XOP1 input on card 2).
- 1 - Same as IOP6=0 but with a sine flux distribution.
- IOP7(19-21) 1 - Fold fluxes from a one-dimensional RTFLUX file and a one- or two-dimensional RTFLUX file (two latest versions) to produce a two- or three-dimensional RTFLUX file and write over the old one- or two-dimensional file.

See IOP9 option if both files are one-dimensional. The possible geometries are:

Y, X (X,Y see IOP9) to XY
 Z, R (R,Z see IOP9) to RZ
 Z, T to TZ
 Z, H to HZ
 Z, XY to XYZ
 Z, θR to θRZ

The fluxes from the one-dimensional file will be normalized by dividing by ϕ_N in each group where N is the point where the first group flux is the maximum.

2 - Same as IOP7=1 but write a new version of the file.

IOP8(22-24)

Same as IOP7 but for ATFLUX files.

IOP9(25-27)

0 - The next-to-latest version of the file is the Y or Z file and the latest version is the X or R file. The latest version will be written over for IOP7=1 or IOP8=1

1 - The latest version of the file is the Y or Z file and the next-to-latest version is the X or R file. The next-to-latest version will be written over for IOP7=1 or IOP8=1.

IOP10(28-30)

IOP11(31-33)

IOP12(34-36)

IOP13(37-39)

IOP14(40-42)

IOP15(43-46)

IOP16(47-49)

IOP17(50-51)

IOP18(52-54)

IOP19(55-57)

IOP20(58-60)

IOP21(61-63)

IOP22(64-66) Print contents of input files (if >0).

IOP23(67-69) Print content of output files (if >0).

IOP24(70-72) 0 - Minimum debug edit.

1 - Medium debug edit.

2 - Maximum debug edit.

Card 2: Control Options (6E12.0). Always required.

See IOP6 card 1.

XOP1(1-12) 0.0 - $Z_I = 1.0$

1.0 - Z_I ranges from +1.0 to -1.0 (IOP6=0, cosine distribution).

0.5 - Z_I ranges from +1.0 to 0.0 (IOP6=0, cosine distribution).

1.0 - Z_I ranges from 0.0 to 0.0 (IOP6=1, sine distribution).

0.5 - Z_I ranges from 0.0 to +1.0 (IOP6=1, sine distribution).

XOP2(13-24) Width of added dimension for GEODST expansion (cm or radians).

Card 3: GEODST Data (24I3). Required only if IOP3>0.

IG01(1-3) First boundary condition of added dimension (IMB1, JMB1, or KMB1).

IG02(4-6) Last boundary condition of added dimension (IMB2, JMB2, or KMB2).

IG03(7-9) The number of buckling specifications (NBS) (if >0 requires additional input).

IG04(10-12) The number of constants for external boundaries (NBCS) (if >0 requires additional input).
2 - The first and last surface constants for the added dimension will be given. NBCS on the GEODST file must be 6 for this option.

J 2 See NBCS on GEODST file.

Card 4: Buckling Data (6E12.0). Required only if IG03>0.

IG03 numbers required.

Card 5: Boundary Constants (6E12.0). Required only if IG04>0.

IG04 numbers required.

IX. JOB CONTROL INSTRUCTIONS

A. THE CATALOG PROCEDURE

To run a job on the local IBM computers the computer operating system must have available the job control instructions for that job. Most of the job control instructions for executing the code modules in this computational system are cataloged and stored in a library which is accessed at run time. This catalog is shown in Figure 5.

The information in the cataloged job control instructions is parameterized and actual values of these parameters must be supplied by the user. These parameters have values which are problem-dependent and include core region size, CPU time, and space, buffer size, and blocking factors for each auxiliary storage I/O data file.

Figure 6 shows a typical set of job control instructions which the user supplies to supplement or override the instructions in the catalog. Only a brief description of these instructions will be given here. For information about the use of the local computers, refer to the local report "Programmers Notebook" issued by the Computer Sciences Division of the Nuclear Division of Union Carbide.

B. USER SUPPLIED JOB CONTROL INSTRUCTIONS

The parameters NB1, NB2, B1, B2, NX, NS, and N1 through N16 shown in Figure 10 are described under Problem Dependent Data File Parameters below. The core storage region size (in k=1024 bytes), specified on the "// GOSIZE =" card must be approximately 300 plus the primary data allocation size (IP1, Figure 2.) divided by 250. Any cards present between the "// GOSIZE=" card and the "//GO.SYSIN DD *" card override the corresponding cards in the catalog, and must be given in the same order as those in the catalog - unit numbers increasing. Note that when overriding cards in the catalog, a "GO." should be punched following the // in column 1-2: i.e. "//GO."

The catalog identifies three individual data files for printed output. The file PRINT receives output from the driver and consists of all user input card images, the file FT06F001 receives output from the calculational or special code modules, and the file FT99F001

receives output from the control module CONTROL1 (a history of the run) and selected output from the calculation modules. If none of these files are overridden, the output is printed locally, with PRINT first, followed by FT06F001, and FT99F001 last. A card "//GO.PRINT DD DUMMY" causes the file PRINT to be null and no DRIVER output will be printed. The card "//GO.FT99F001 DD SYSOUT=(J,RM01)" causes the output from the control module to be printed at a remote printer identified as RM01.

A card such as "//GO.FT32F001" makes a special assignment overriding the catalog specification. It identifies logical unit 32 as a standard labeled tape. The parameter NNNNNN should be replaced by the actual tape number. DDD should be replaced by NEW if the tape is to be written, or OLD if the tape is to be protected from being written, and SOME.NAME should be replaced by an identifying name. Labeled tapes are recommended in general. If an overriding data set identifies a disk other than a scratch disk (SYSDA), the DSN parameter must also be included.

All cards between "//GO.SYSIN DD *" card and the "/*" card are data cards for the run. The first four are the control module instructions described in Figure 2. The fourth card describes the calculational path as follows: (1) The Input Processor module is accessed, for example, to read cards and write the nuclide ordered cross section file ISOTXS on the tape unit 32, (2) The special input processor DCRSPR is accessed to read input data and write the necessary interface files for the Cross Section Processor Module, (3) Then the module for processing cross sections is accessed, to convert the nuclide ordered file ISOTXS to the group ordered file GRUPXS, (4) The special input processor DVENTR is then accessed to read input data and write the necessary interface files for the VENTURE Neutronics module, (5) The VENTURE Neutronics module is then accessed, (6) The special processor DUTLIN is accessed to read data and write the instructions for the Reaction Rate module, and (7) The Reaction Rate module is accessed.

Calculations may be done without using the input processor as shown, but data must be made available as required.

FIGURE 5. THE CATALOG PROCEDURE.

```

//BOLDVENT PROC GOSIZE=540%,GOTIME=,MODULE=SCALE,
// NB1=1,NB2=1,B1=3520,B2=32000,NX=2,NS=50,N1=100,
// N2=1,N3=1,N4=1,N5=1,N6=1,N7=1,N8=1,N9=1,N10=1,N11=1,N12=1,N13=1,
// N14=1,N15=1,N16=1
//GO      EXEC  PGM=&MODULE,
//          REGION=&GOSIZE,TIME=&GOTIME
//STEPLIB DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
//          DSN=BOLD.VENTURE
//PRINT   DD SYSOUT=A,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=1100)
//PT01P001 DD UNIT=SYSDA,SPACE=(&B1,(&NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT02P001 DD UNIT=SYSDA,SPACE=(&B1,(&NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT03P001 DD UNIT=SYSDA,SPACE=(80,(10)),
//          DCB=(RECFM=F,BLKSIZE=80)
//PT04P001 DD UNIT=SYSDA,SPACE=(3200,(&N1,&NX)),
//          DCB=(RECFM=FBS,LRECL=80,BLKSIZE=3200)
//PT05P001 DD UNIT=SYSDA,SPACE=(3120,(200,100)),
//          DCB=(RECFM=FB,BUFNO=1,LRECL=80,BLKSIZE=3120)
//PT06P001 DD SYSOUT=A,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=1100)
//PT07P001 DD SYSOUT=B,DCB=(RECFM=F,BLKSIZE=80)
//PT08P001 DD UNIT=SYSDA,SPACE=(&B1,(&N1,2)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT09P001 DD UNIT=SYSDA,SPACE=(&B1,(&NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT10P001 DD UNIT=SYSDA,SPACE=(&B1,(&NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT11P001 DD UNIT=SYSDA,SPACE=(&B1,(&N1,&NX)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT12P001 DD UNIT=SYSDA,SPACE=(&B1,(&N1,&NX)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT13P001 DD UNIT=SYSDA,SPACE=(&B1,(&N1,2)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT14P001 DD UNIT=SYSDA,SPACE=(&B1,(&NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT15P001 DD UNIT=SYSDA,SPACE=(&B1,(&NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT16P001 DD UNIT=SYSDA,SPACE=(&B1,(&N1,&NX)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT17P001 DD UNIT=SYSDA,SPACE=(&B1,(&N16)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT18P001 DD UNIT=SYSDA,SPACE=(&B1,(&N16)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT19P001 DD UNIT=SYSDA,SPACE=(&B1,(&NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT20P001 DD UNIT=SYSDA,SPACE=(&B1,(&N13)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)
//PT21P001 DD UNIT=SYSDA,SPACE=(&B1,(&N1,2)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=&NB1,BLKSIZE=&B1)

```

(CONT)

```

//PT22F001 DD UNIT=SYSDA, SPACE=(&B1, (&FS, 1)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT23F001 DD UNIT=SYSDA, SPACE=(&B1, (&N3)),
//          DCB=(RECFM=PT, BUFNO=&NB1)
//PT24F001 DD UNIT=SYSDA, SPACE=(&B1, (&N2)),
//          DCB=(RECFM=PT, BUFNO=&NB2)
//PT25F001 DD UNIT=SYSDA, SPACE=(&B1, (&N12)),
//          DCB=(RECFM=PT, BUFNO=&NB1)
//PT26F001 DD UNIT=SYSDA, SPACE=(&B1, (&N12)),
//          DCB=(RECFM=PT, BUFNO=&NB1)
//PT27F001 DD UNIT=SYSDA, SPACE=(&B1, (&N2)),
//          DCB=(RECFM=PT, BUFNO=&NB2)
//PT28F001 DD UNIT=SYSDA, SPACE=(&B1, (&N2)),
//          DCB=(RECFM=PT, BUFNO=&NB2)
//PT29F001 DD UNIT=SYSDA, SPACE=(&B1, (&N14)),
//          DCB=(RECFM=PT, BUFNO=&NB2)
//PT30F001 DD UNIT=SYSDA, SPACE=(&B1, (&N1, 2)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT31F001 DD UNIT=SYSDA, SPACE=(&B1, (&N1, &NX)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT32F001 DD UNIT=SYSDA, SPACE=(&B1, (&N1, 2)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT33F001 DD UNIT=SYSDA, SPACE=(&B1, (&N4)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT34F001 DD UNIT=SYSDA, SPACE=(&B1, (&N1, &NX)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT35F001 DD UNIT=SYSDA, SPACE=(&B1, (&N1, 2)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT36F001 DD UNIT=SYSDA, SPACE=(&B1, (&N6, 2)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT37F001 DD UNIT=SYSDA, SPACE=(&B1, (&N15, 2)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT38F001 DD UNIT=SYSDA, SPACE=(&B1, (&N15, 2)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT39F001 DD UNIT=SYSDA, SPACE=(&B1, (&N15, 2)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT40F001 DD UNIT=SYSDA, SPACE=(&B2, (&N5)),
//          DCB=(RECFM=PT, BUFNO=&NB2)
//PT41F001 DD UNIT=SYSDA, SPACE=(&B1, (&N4)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT42F001 DD UNIT=SYSDA, SPACE=(&B2, (&N7)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB2, BLKSIZE=&B2)
//PT43F001 DD UNIT=SYSDA, SPACE=(&B2, (&N8)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB2, BLKSIZE=&B2)
//PT44F001 DD UNIT=SYSDA, SPACE=(&B1, (&NS, 1)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT45F001 DD UNIT=SYSDA, SPACE=(&B1, (&N9)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT46F001 DD UNIT=SYSDA, SPACE=(&B1, (&N10)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT47F001 DD UNIT=SYSDA, SPACE=(&B1, (&NS, 1)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)
//PT48F001 DD UNIT=SYSDA, SPACE=(&B1, (&N1, 2)),
//          DCB=(RECFM=VBST, LRECL=X, BUFNO=&NB1, BLKSIZE=&B1)

```

(CONT)

```

//FT49F001 DD UNIT=SYSDA,SPACE=(8B1,(8N11)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT50F001 DD UNIT=SYSDA,SPACE=(8B1,(8N1,2)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT51F001 DD UNIT=SYSDA,SPACE=(8B1,(8NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT52F001 DD UNIT=SYSDA,SPACE=(8B1,(8NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT53F001 DD UNIT=SYSDA,SPACE=(8B1,(8NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT54F001 DD UNIT=SYSDA,SPACE=(8B1,(8N1,2)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT55F001 DD UNIT=SYSDA,SPACE=(8B1,(8NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT56F001 DD UNIT=SYSDA,SPACE=(8B1,(8NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT96F001 DD UNIT=SYSDA,SPACE=(8B1,(8NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT97F001 DD UNIT=SYSDA,SPACE=(8B1,(8NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT98F001 DD UNIT=SYSDA,SPACE=(8B1,(8NS,1)),
//          DCB=(RECFM=VBST,LRECL=X,BUFNO=8NB1,BLKSIZE=8B1)
//FT99F001 DE  SYSOUT=A,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=1100)
//BOLDVENT PEND

```

FIGURE 6. USER SUPPLIED JOB CONTROL INSTRUCTIONS.

```
//UIDXXXXX JOB (CHRG), 'ADRES, NAME COL 25-44', MSGLEVEL=(1, 1)
//*CLASS CPU91=10H, IO=50, REGION=600K, LINES=19, CARDS=0
//STEP EXEC BOLDVENT,
// NB1=1, NB2=1, B1=3520, B2=3520, NI=2, NS=50, N1=100,
// N2=1, N3=1, N4=1, N5=1, N6=1, N7=1, N8=1, N9=1, N10=1, N11=1, N12=1, N13=1,
// N14=1, N15=1, N16=1,
// GOSIZE=600K
//GO.FT32F001 DD UNIT=TAPE8, VOLUME=SER=NNNNNN, LABEL=(1, SL, , IN) ,
// DCB=(RECFM=VBS, LRECL=1, BLKSIZE=3520, DEN=2), DISP=DDD, DSN=SCN1.NAME
//GO.SYSIN DD *
=CONTROL1
*****TITLE CARD FOR THE RUN*****
90000          10      50      1          1
 1  2  6  2  7 13  7 13  2  9  0
RTFLUX
END

INPUT PROCESSOR
COMMENT*****DATA FOR THE INPUT PROCESSOR GOES HERE
END

DCRSPR
COMMENT*****DATA FOR THE SPECIAL INPUT PROCESSOR DCRSPR GOES HERE
END

DVENTR
COMMENT*****DATA FOR THE SPECIAL INPUT PROCESSOR DVENTR GOES HERE
END

DUTLIN
COMMENT*****DATA FOR THE SPECIAL INPUT PROCESSOR DUTLIN GOES HERE
END
/*
//
```

C. PROBLEM DEPENDENT DATA FILE PARAMETERS

Often the data file requirements are governed by those of the neutronics codes, so these parameters have been tailored to satisfy the basic needs of the VENTURE and VALE neutronics code modules. However, there are situations where the requirements are governed by other modules in the system. The user should refer to specific documentation about these requirements. Information about specifying these parameters is given here and Figure 7. presents reference information. (See also APPENDIX A.)

When a file has special requirements, such as for an unusually large amount of disk space, it may be most practical to include override instructions for this unit rather than use the parameters.

B1 and B2 are the sizes in bytes (4 bytes per short word) of core memory blocks into which data are read, limited to 32000. The larger this block size the fewer are the I/O requests required to read a particular data set. B2 defines the block size of the data sets which are read most often during the iterative part of the calculation. NB1 and NB2 (permissible values of 1 or 2) specify the number of buffers (number of blocks of size B1 or B2) of core memory into which data will be stored.

We recommend specifying NB1 = 1, NB2 = 1, B1 = 3520, and B2 = 32000, NX = 2, NS = 50, and N1 = 100. These values will be adequate for most practical problems. We find advantage in using only one buffer as this minimizes core memory requirements. For small problems, it may be desirable to set B2 to something smaller than 32000 to minimize core memory. It is recommended that B1 and B2 not be set smaller than 3520. Values for parameters N2 through N16 are calculated as follows where reference is to the multi-dimensional problem to be solved by the neutronics code:^a

^a Space requirements are shown for "track overflow"; they increase by a factor equal to the reciprocal of the fraction utilization without this.

Figure 7. Determining the Values of L, N, and B

For	L	N	B	Remarks
N2	8CR 8C	PG RPG	B1	Normally For the "row-stored" mode.
N3	--- $36C+4$ $44C+12$	RPG	B1	Set N3=1 except for the "row-stored" mode. Non-hexagonal geometry. Hexagonal geometry.
N4	--- 8CR 4Z	PG G	B1	Set N4=1 except for fixed source problems. Fixed source by point and group. Fixed source by zone and group.
N5	--- $4(8CR+C+R)$ $4(9CR+2C+2R)$	PG	B2	Set N5=1 for the "row-stored" mode only. Non-hexagonal geometry. Hexagonal geometry.
N6				Set N6=10
N7	8CR	P	B2	
N8	8CR	P	B2	
N9	8CR	P	B1	
N10	8CR	P PG	B1	Normally. If initial flux guess is to be read from RTFLUX interface and to be expanded.
N11	8C	RP	B1	
N12				Set N12=1.
N13	--- 8CR	P	B1	Set N13=1 unless the power density interface PWDINT will be written. For writing the interface PWDINT.
N14	--- 8CR	PG	B1	Set N14=1 unless the P_1 calculation is to be done. For the P_1
N15				Set N15=10.
N16	--- 8CR	PG	B1	Normally N16=1. If the standard flux interfaces RTFLUX and/or ATFLUX are to be written on scratch disc.

Let C = number of columns in the mesh

R = number of rows in the mesh

P = number of planes in the mesh

G = number of energy groups

Z = number of zones

and $NN = [(110 + 1.1L)N]/B + 1$

where NN is the value assigned to N2 through N16, and L, N, and B are calculated from the above parameters as shown in Fig. 11 or have set values.

For a non-hexagonal problem running in the "plane stored" mode, with 48 columns, 22 rows, 16 planes, and 6 groups, N2=257, N3=1, N4=1, N5=113, N6=10, N7=5, N8=5, N9=43, N10=43, N11=54, N12=1, N13=1, N14=1, N15=10, and N16=1. Larger values for these parameters waste computer resources and likely increase cost.

As a user aid major space requirements for data files are edited by the more sophisticated codes such as VENTURE in this system (see APPENDIX A.).

X. SUPER SAMPLE PROBLEM

The source of this problem is the Large Core Code Evaluation Working Group (LCCEWG) Third Benchmark Problem. It has been changed somewhat from the original specifications for use as a sample problem. The hexagonal three-dimensional geometry and zone placement are shown in Figures 8 and 9, and the depletion transmutation scheme is shown in Figure 10. A description of the module accesses is given in Figure 11. The job control instruction and input are shown in Figure 12, and selected output is shown in Figure 13. The complete output for this problem is included in the source package for the BOLD VENTURE computation system available from the National Energy Software Center (ANL).

The calculational path was chosen to demonstrate the flexibility of calculations that may be done with the BOLD VENTURE system.

The control module is initially accessed by the resident driver in order to read input data and create the file CONTRL and write the records PROINS and DVRINS on this file. After this initial access the control module instructs the driver to access the modules in order.

NOTE: SEE FIGURE 13 FOR ZONE PLACEMENT AND DIMENSIONS.

Figure 8. Cross Section Through Core Assemblies

ZONES 1-12 INTERNAL AND RADIAL BLANKET ASSEMBLIES

13-18 FUELED DRIVER ASSEMBLIES

19-21 AXIAL BLANKETS

22 RADIAL SHIELD

23 GAS PLENUM / STRUCTURE

Figure 9. Zone Placement

NOTE: NO TRANSMUTATION OF COOLANT OR STRUCTURAL MATERIALS

FIGURE 10. TRANSMUTATION SCHEME

Figure 11. Module Accesses and Results.

Module Access	Results
1	Reads interface files GRUPXS, RODSET, EXPOSE, and REFUEL
2	Reads neutronics instruction and data for files GEODST, NDXSRF, and ZNATDN.
2	Reads control rod positioning and exposure instructions, and fuel management instructions.
12	Inserts control rod material in primary control rod zones 24 through 39.
7	Regular flux-eigenvalue neutronics.
19	Fuel management initialization.
13	Exposure (255.5 days).
2	Reads control rod positioning instructions.
12	Replaces rod material with rod-follower material in control rod zones 24 through 35.
7	Regular flux-eigenvalue neutronics.
13	Exposure (255.5 days).
2	Reads control rod positioning instructions, neutronics instructions, and perturbation instructions.
12	Removes control rod material from control rod zones 36 through 39 and replaces it with rod-follower material. This is the all-rods-out configuration.
7	Regular and adjoint flux-eigenvalue calculation.
9	Reaction rate calculation.
15	Perturbation calculation.
2	Reads neutronics instructions.

Figure 11. (con't)

Module Access	Results
7	Dominant harmonic adjoint fixed source (peak power density) calculation.
2	Reads control rod positioning and neutronics instructions.
12	Inserts control rod material in all primary control rod zones 24 through 39 and special shutdown rod material in secondary control rod zones 40 through 51. This is the all-rods-in configuration.
7	Regular flux-eigenvalue calculation.
2	Reads control rod positioning instructions and fuel management instructions.
12	Restores all control rod zones 24 through 51 to their original configuration (after the first access to module 12).
19	Refuels the core.
7	Regular flux-eigenvalue calculation.

FIGURE 12. INPUT FOR SUPER SAMPLE PROBLEM.

```

//USERID          JOB (CHARG),'USER ADDRESS          *,MSCLEVEL=(1,1)
//*CLASS CPU91=20H,IO=015,REGION=1500K,LINES=12,CARDS=0
//STEP EXEC BOLDVENT,
// NB1=1,NB2=1,B1=3520,B2=32000,WX=50,YS=136,H1=136,
// N2=135,N3=10,W4=136,W5=60,W6=10,W7=4,W8=4,W9=34,W10=34,W11=41,W12=1,
// N13=136,W14=20,W15=10,W16=136,
// GOSIZE=1500K
//GO.SYSIN DD *
=CONTROL1
  SUPER SAMPLE PROBLEM.
220000
  1 2 2 12 7 19 13 2 12 7 13 2 12 7 9 15 2 7 2 12 7 2 12 19
  7 0
END
INPUT DATA PROCESSOR.
OV GRUPIXS          SORNL N ADE          S
1D          4          49          0          3          0          1          343          0          3R
2D /
*LCCEVG METHODS BENCHMARK PROBLEM 3 LIBRARY - R PROTSIK (GE-A*
*BSD)          A0816 A1123 A2400 A2555 A2600 A2800 A4200 A9235 *
*A9236 A9238 A9439 A9440 A9441 A9442 A9999 B0816 B1123 B2400 *
*B2555 B2600 B2800 B4200 B9235 B9236 B9238 B9439 B9440 B9441 *
*B9442 B9999 I0510I10511I10600I11230I24000I25550I26000I28000*
*I42000Q1123 Q2400 Q2555 Q2600 Q2800 Q4200 U23X PU24X AH24X *
*CUFISS*
7.68547E-01 2.24484E-01 6.93373E-03 3.54065E-05 1.79858E 09 6.27404E 08
1.84270E 08 4.27109E 07 2.00000E 07 8.20850E 05 6.73794E 04 2.03468E 03
1.06770E 01
4D /
*O16 WA23 CR HW55 FE WI HO U235 U236 U238 *
*PU239 PU240 PU241 PU242 PP O16 WA23 CR HW55 FE *
*WI HO U235 U236 U238 PU239 PU240 PU241 PU242 PP *
*B10 B11 C WA23 CR HW55 FE WI HO WA23 *
*CR HW55 FE WI HO U23X PU24X AH24X CUFISSSENEFPB5*
*SENEFPB5SENEFPB5SENEFPB5SENEFPB5SENEFPB5SENEFPB5SENEFPB5SENEFPB5*
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2.41060E 02 2.42060E 02 2.36000E 02 1.59950E 01 2.29900E 01 5.19960E 01
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 1.90289E 01 1.21727E-02 2.94078E-06 3.18392E-05 2.08370E 01 4.22432E-02
 0.0 2E 9.45946E-01 4.94540E-03 2.42349E-09 1.78763E-07
 4.72455E 00 1.16187E-02 0.0 1.27401E-07 4.46691E 00 1.03767E-02
 0.0 5.69301E-08 4.65092E 00 1.73046E-01 3.81898E-07 1.72673E-06
 5.12802E 00 2.57482E-02 8.55972E-08 1.95784E-05 5.11300E 01 7.04889E-01
 7.77639E-06 3.33695E-05 9.10679E 00 2.65403E-02 0.0 8.59732E-05
 1.68749E 01 5.40047E-02 3.02511E-06 1.77346E-05 8.61124E 00 2.01417E-02
 0.0 2E 3.83418E 00 2.64830E-01 3.53197E-07 1.51817E-06
 4.86138E 00 4.02034E-02 3.15073E-08 2.41874E-05 4.24788E 01 1.08098E 00
 1.07388E-05 3.75005E-05 9.88072E 00 4.15554E-02 0.0 7.89677E-05
 1.72882E 01 8.47089E-02 5.65693E-06 1.87621E-05 8.90944E 00 3.08242E-02
 0.0 18E
 OV MODSET
 1D
 SSCRN WFRN MCR DEFT WSRPS WCYD WSE NOE ISV HWV WRI WSH IIS
 3 6 7 35 4 1 0 0 0 0 0 12 0 83
 2D SSCRN, WFR, MCR, ADPS
 I0510I *I0511I* *I0600I*
 I11230 *I24000* *I25550* *I26000* *I28000* *I42000*
 2.9110-2 2.5310-3 8.2700-3
 1.8420-2 1.3980-3 1.3240-4 4.8170-3 9.5520-4 1.0820-4
 3D SSCRN
 27 26 25 24 0 31 30 29 28 0 35 34 33 32 0 39 38 37 36 0

(CONT)

(CONT)

```

SPQ(NNR),NQ(NNR)$ 0.0 19R 0 19R
4D
SNPN(NNPF),NPPD)$
  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
SADB(NNPF,NPPD)$
  2.146-2 8.2217-3 2.8111-3 2.6609-4
  9.6814-3 1.9207-3 2.1764-4 2.7953-5
  0.0 1.2673-2 0.0 9R
  2.146-2 8.2217-3 2.8111-3 2.6609-4
  9.6814-3 1.9207-3 2.1764-4 1.9168-5
  0.0 8.6912-3 1.3591-3 4.0739-4
  2.0392-4 4.8481-5 0.0 5R
  2.146-2 8.2217-3 2.8111-3 2.6609-4
  9.6814-3 1.9207-3 2.1764-4 1.9168-5
  0.0 8.6912-3 1.3591-3 4.0789-4
  2.0392-4 4.8481-5 0.0 5R
5D
SNSPN(NNPS,NPSE)$
  1 2 3 4 5 6 7 8 9 10 11 12 12 14 15 16 17 18 19
SNDR(NNPD,NPDB)$
  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
6D
SRVF(NPSE,NPDB)$ 1.0
SNEHO(NPDB)$ 0
7D
SNPSY NLS ISN NPHO JI(16)$
  3 3 0 0 0 16R
8D
SNPB(NPST)$ 1 2 3
SNPR(NPST)$ 0 0 0
SNPB(NPST)$ 0 0 0
SNDR(NPST)$ 1 1 1
SNPD(NPST)$ 0 0 0
SNZ(NLS,NPST)$ 21 20 19 18 17 16 15 14 13
STOP
END
DVENTR
001
0.0
0.0
1
1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
003
17 1 2 1 2 2 1 1 1
52
004
50 235.7032
25 235.7032
1 134.62 1 35.56 1 30.48 1 30.48
005
52
52

```

(CONT)

52
52
006

1	1	7	1	1	4	4	1	6	2	2	4	4	1	5	3	3	4	4
1	1	1	4	4	4	4	0											
2	16	16	1	1	4	4	13	15	2	2	4	4	12	14	3	3	4	4
11	13	4	4	4	4	4	6	8	6	6	4	4	2	7	7	7	4	4
1	3	8	8	4	4	4	0											
3	23	28	1	1	4	4	22	27	2	2	4	4	21	26	3	3	4	4
20	25	4	4	4	4	4	19	24	5	5	4	4	18	23	6	6	4	4
17	19	7	7	4	4	4	12	14	9	9	4	4	8	13	10	10	4	4
4	12	11	11	4	4	4	1	11	12	12	4	4	1	7	13	13	4	4
1	3	14	14	4	4	4	0											
4	38	43	1	1	4	4	37	42	2	2	4	4	36	41	3	3	4	4
35	40	4	4	4	4	4	34	39	5	5	4	4	30	35	6	6	4	4
29	34	7	7	4	4	4	28	33	8	8	4	4	27	32	9	9	4	4
26	31	10	10	4	4	4	22	27	11	11	4	4	21	26	12	12	4	4
20	25	13	13	4	4	4	16	21	14	14	4	4	12	20	15	15	4	4
11	19	16	16	4	4	4	10	15	17	17	4	4	6	11	18	18	4	4
2	10	19	19	4	4	4	1	9	20	20	4	4	1	5	21	21	4	4
1	1	22	22	4	4	4	0											
5	1	7	1	1	3	3	1	6	2	2	3	3	1	5	3	3	3	3
1	1	1	4	4	3	3	0											
6	14	16	1	1	3	3	13	15	2	2	3	3	12	14	3	3	3	3
11	13	4	4	3	3	3	6	8	6	6	3	3	2	7	7	7	3	3
1	3	8	8	3	3	3	0											
7	23	28	1	1	3	3	22	27	2	2	3	3	21	26	3	3	3	3
20	25	4	4	3	3	3	19	24	5	5	3	3	18	23	6	6	3	3
17	19	7	7	3	3	3	12	14	9	9	3	3	8	13	10	10	3	3
4	12	11	11	3	3	3	1	11	12	12	3	3	1	7	13	13	3	3
1	3	14	14	3	3	3	0											
8	38	43	1	1	3	3	37	42	2	2	3	3	36	41	3	3	3	3
35	40	4	4	3	3	3	34	39	5	5	3	3	30	35	6	6	3	3
29	34	7	7	3	3	3	28	33	8	8	3	3	27	32	9	9	3	3
26	31	10	10	3	3	3	22	27	11	11	3	3	21	26	12	12	3	3
20	25	13	13	3	3	3	16	21	14	14	3	3	12	20	15	15	3	3
11	19	16	16	3	3	3	10	15	17	17	3	3	6	11	18	18	3	3
2	10	19	19	3	3	3	1	9	20	20	3	3	1	5	21	21	3	3
1	1	22	22	3	3	3	0											
9	1	7	1	1	2	2	1	6	2	2	2	2	1	5	3	3	2	2
1	1	1	4	4	2	2	0											
10	14	16	1	1	2	2	13	15	2	2	2	2	12	14	3	3	2	2
11	13	4	4	2	2	2	6	8	6	6	2	2	2	7	7	7	2	2
1	3	8	8	2	2	2	0											

(CONT)

11																	
23	28	1	1	2	2	22	27	2	2	2	2	21	26	3	3	2	2
20	25	4	4	2	2	19	24	5	5	2	2	18	23	6	6	2	2
17	19	7	7	2	2	12	14	9	9	2	2	8	13	10	10	2	2
4	12	11	11	2	2	1	11	12	12	2	2	1	7	13	13	2	2
1	3	14	14	2	2	0											
12																	
38	43	1	1	2	2	37	42	2	2	2	2	36	41	3	3	2	2
35	40	4	4	2	2	34	39	5	5	2	2	30	35	6	6	2	2
29	34	7	7	2	2	28	33	8	8	2	2	27	32	9	9	2	2
26	31	10	10	2	2	22	27	11	11	2	2	21	26	12	12	2	2
20	25	13	13	2	2	16	21	14	14	2	2	12	20	15	15	2	2
11	19	16	16	2	2	10	15	17	17	2	2	6	11	18	18	2	2
2	10	19	19	2	2	1	9	20	20	2	2	1	5	21	21	2	2
1	1	22	22	2	2	0											
13																	
8	13	1	1	4	4	7	12	2	2	4	4	6	11	3	3	4	4
2	7	4	4	4	4	1	6	5	5	4	4	1	5	6	6	4	4
1	1	7	7	4	4	0											
14																	
20	22	1	1	4	4	16	21	2	2	4	4	15	20	3	3	4	4
14	19	4	4	4	4	10	18	5	5	4	4	9	17	6	6	4	4
8	13	7	7	4	4	4	12	8	8	4	4	3	11	9	9	4	4
2	7	10	10	4	4	1	3	11	11	4	4	0					
15																	
32	37	1	1	4	4	28	36	2	2	4	4	27	35	3	3	4	4
26	34	4	4	4	4	25	33	5	5	4	4	24	29	6	6	4	4
20	28	7	7	4	4	16	27	8	8	4	4	15	26	9	9	4	4
14	19	10	10	4	4	23	25	10	10	4	4	13	18	11	11	4	4
12	20	12	12	4	4	8	19	13	13	4	4	4	15	14	14	4	4
3	11	15	15	4	4	2	10	16	16	4	4	1	9	17	17	4	4
1	5	18	18	4	4	1	1	19	19	4	4	0					
16																	
8	13	1	1	3	3	7	12	2	2	3	3	6	11	3	3	3	3
2	7	4	4	3	3	1	6	5	5	3	3	1	5	6	6	3	3
1	1	7	7	3	3	0											
17																	
20	22	1	1	3	3	16	21	2	2	3	3	15	20	3	3	3	3
14	19	4	4	3	3	10	18	5	5	3	3	9	17	6	6	3	3
8	13	7	7	3	3	4	12	8	8	3	3	3	11	9	9	3	3
2	7	10	10	3	3	1	3	11	11	3	3	0					
18																	
32	37	1	1	3	3	28	36	2	2	3	3	27	35	3	3	3	3
26	34	4	4	3	3	25	33	5	5	3	3	24	29	6	6	3	3
20	28	7	7	3	3	16	27	8	8	3	3	15	26	9	9	3	3
14	19	10	10	3	3	23	25	10	10	3	3	13	18	11	11	3	3
12	20	12	12	3	3	8	19	13	13	3	3	4	15	14	14	3	3
3	11	15	15	3	3	2	10	16	16	3	3	1	9	17	17	3	3
1	5	18	18	3	3	1	1	19	19	3	3	0					
19																	
8	13	1	1	2	2	7	12	2	2	2	2	6	11	3	3	2	2
2	7	4	4	2	2	1	6	5	5	2	2	1	5	6	6	2	2
1	1	7	7	2	2	0											
20																	

(CONT)

20	22	1	1	2	2	16	21	2	2	2	2	15	20	3	3	2	2
14	19	4	4	2	2	10	18	5	5	2	2	9	17	6	6	2	2
8	13	7	7	2	2	4	12	8	8	2	2	3	11	9	9	2	2
2	7	10	10	2	2	1	3	11	11	2	2	0					
21																	
32	37	1	1	2	2	28	36	2	2	2	2	27	35	3	3	2	2
26	34	4	4	2	2	25	33	5	5	2	2	24	29	6	6	2	2
20	28	7	7	2	2	16	27	8	8	2	2	15	26	9	9	2	2
14	19	10	10	2	2	23	25	10	10	2	2	13	18	11	11	2	2
12	20	12	12	2	2	8	19	13	13	2	2	4	15	14	14	2	2
3	11	15	15	2	2	2	10	16	16	2	2	1	9	17	17	2	2
1	5	18	18	2	2	1	1	19	19	2	2	0					
22																	
44	49	1	1	1	4	43	48	2	2	1	4	42	47	3	3	1	4
41	46	4	4	1	4	40	45	5	5	1	4	36	44	6	6	1	4
35	43	7	7	1	4	34	39	8	8	1	4	33	38	9	9	1	4
32	37	10	10	1	4	28	36	11	11	1	4	27	35	12	12	1	4
26	31	13	13	1	4	22	30	14	14	1	4	21	29	15	15	1	4
20	25	16	16	1	4	16	24	17	17	1	4	12	23	18	18	1	4
11	19	19	19	1	4	10	15	20	20	1	4	6	14	21	21	1	4
2	13	22	22	1	4	1	9	23	23	1	4	1	5	24	24	1	4
1	1	25	25	1	4	0											
23																	
1	16	1	1	1	1	20	28	1	1	1	1	32	43	1	1	1	1
1	42	2	2	1	1	1	41	3	3	1	1	1	7	4	4	1	1
11	40	4	4	1	1	1	6	5	5	1	1	10	39	5	5	1	1
1	35	6	6	1	1	1	13	7	7	1	1	17	34	7	7	1	1
1	12	8	8	1	1	16	33	8	8	1	1	3	32	9	9	1	1
2	19	10	10	1	1	23	31	10	10	1	1	1	18	11	11	1	1
22	27	11	11	1	1	1	26	12	12	1	1	1	25	13	13	1	1
1	21	14	14	1	1	3	20	15	15	1	1	2	19	16	16	1	1
1	15	17	17	1	1	1	11	18	18	1	1	1	10	19	19	1	1
1	9	20	20	1	1	1	5	21	21	1	1	1	1	22	22	1	1
0																	
24																	
1	2	9	9	4	4	1	1	10	10	4	4	0					
25																	
1	2	9	9	3	3	1	1	10	10	3	3	0					
26																	
1	2	9	9	2	2	1	1	10	12	2	2	0					
27																	
1	2	9	9	1	1	1	1	10	10	1	1	0					
28																	
8	10	4	4	4	4	7	9	5	5	4	4	0					
29																	
8	10	4	4	3	3	7	9	5	5	3	3	0					
30																	
8	10	4	4	2	2	7	9	5	5	2	2	0					
31																	
8	10	4	4	1	1	7	9	5	5	1	1	0					
32																	
17	19	1	1	4	4	0											
33																	
17	19	1	1	3	3	0											

(CONT)

34												
17	19	1	1	2	2	0						
35												
17	19	1	1	1	1	0						
36												
14	16	7	7	4	4	13	15	8	8	4	4	0
37												
14	16	7	7	3	3	13	15	8	8	3	3	0
38												
14	16	7	7	2	2	13	15	8	8	2	2	0
39												
14	16	7	7	1	1	13	15	8	8	1	1	0
40												
1	2	15	15	4	4	1	1	16	16	4	4	0
41												
1	2	15	15	3	3	1	1	16	16	3	3	0
42												
1	2	15	15	2	2	1	1	16	16	2	2	0
43												
1	2	15	15	1	1	1	1	16	16	1	1	0
44												
29	31	1	1	4	4	0						
45												
29	31	1	1	3	3	0						
46												
29	31	1	1	2	2	0						
47												
29	31	1	1	1	1	0						
48												
20	22	10	10	4	4	19	21	11	11	4	4	0
49												
20	22	10	10	3	3	19	21	11	11	3	3	0
50												
20	22	10	10	2	2	19	21	11	11	2	2	0
51												
20	22	10	10	1	1	19	21	11	11	1	1	0

012												
0												
1	12	1	1	1.0								
19	21	1	1	1.0								
13	18	2	2	1.0								
22	23	3	3	1.0								
24	51	4	4	1.0								

013												
19												
19												
A0016	A1123	A2400	A2555	A2600	A2800	A4200	A9235	A9236	A9238	A9439	A9440	
A9441	A9442	A9999	U23X	PU24X	AN24X	CUPISS						
19												
B0016	B1123	B2400	B2555	B2600	B2800	B4200	B9235	B9236	B9238	B9439	B9440	
B9441	B9442	B9999	U23X	PU24X	AN24X	CUPISS						

6

(CONT)

Q1123 Q2400 Q2555 Q2600 Q2800 Q4200

9
 I0510I I0511I I0600I I11230I I24000I I25550I I26000I I28000I I42000
 020

1 12
 A0816 2.7176 -2A1123 6.2401 -3A2400 2.3756 -3A2555 2.2528 -8
 A2600 8.1994 -3A2800 1.6266 -3A4200 1.8431 -4A9235 2.9907 -5
 A9236 0.0 A9238 1.3558 -2A9439 0.0 A9440 0.0
 A9441 0.0 A9442 0.0 A9999 0.0 U23X 0.0
 PU24X 0.0 AM24X 0.0 CUFFISS 0.0

13 18
 B0816 2.1460 -2B1123 8.2217 -3B2400 2.8111 -3B2555 2.6609 -4
 B2600 9.6814 -3B2800 1.9207 -3B4200 2.1764 -4B9235 1.9168 -5
 B9236 0.0 B9238 8.6912 -3B9439 1.3591 -3B9440 4.0789 -4
 B9441 2.0392 -4B9442 4.8481 -5B9999 0.0 U23X 0.0
 PU24X 0.0 AM24X 0.0 CUFFISS 0.0

19 21
 A0816 2.1460 -2A1123 8.2217 -3A2400 2.8111 -3A2555 2.6609 -4
 A2600 9.6814 -3A2800 1.9207 -3A4200 2.1764 -4A9235 2.7953 -5
 A9236 0.0 A9238 1.2673 -2A9439 0.0 A9440 0.0
 A9441 0.0 A9442 0.0 A9999 0.0 U23X 0.0
 PU24X 0.0 AM24X 0.0 CUFFISS 0.0

22 22
 Q1123 2.2370 -3Q2400 1.3180 -2Q2555 1.2480 -3Q2600 4.5410 -2
 Q2800 9.0060 -3Q4200 1.0210 -3

23 23
 Q1123 5.9220 -3Q2400 7.4068 -3Q2555 7.0100 -4Q2600 2.5512 -2
 Q2800 5.0613 -3Q4200 5.7352 -4

24 39
 I0510I 2.9110 -2I0511I 2.5310 -3I0600I 8.2700 -3

40 51
 I11230 1.8420 -2I24000 1.3980 -3I25550 1.3240 -4I26000 4.8170 -3
 I28000 9.5520 -4I42000 1.0820 -4

0
 END
 DUTLIN

RODINS 0 6 0 24

0.0
 0 0 1 0 0 0 0 1 0 0 0 0 0 0

EXPIRS 0 06 0 30

255.5
 0 0 0 0 3 3 0 1 0 0 0 0 0 1

0 0 0 0 0 0

REFINS 0 6 0 24

0.0 0.08333333 8.52067E+08 0.333333 1.3 B-09

-1 1

END
 DUTLIN

RODINS 0 6 0 24

0.0
 0 0 1 0 0 0 0 2 0 0 0 0 0 0

END

(CONT)

```

END
DOTLIN
RODINS      0 6 0 24
0.0
0 0 1 0 0 0 0 3 0 0 0 0 0 0
DTWINS      0 6 0 72
                1      1      2
                1 1      1
                1      1
PERINS      0 0 0 24
0 0 0 0 0 0 0 4
END
DOTLIN
RODINS      0 6 0 48
                -2 3 2      -1
                1 1      0
                2.55620+9  1.0      0.08333333
                75
END
DOTLIN
RODINS      0 6 0 24
0.0
0 0 1 0 0 0 0 4 0 1 1 0 0 0
DTWINS      0 6 0 48
                1      2
                1 1
                2.55620+9  1.0      0.08333333
END
DOTLIN
RODINS      0 6 0 24
0.0
0 0 1 0 0 0 0 0 0 -4 0 0 0 0
REFINS      0 24 0 24
0.0      0.08333333  8.52067E+08  0.333333  1.3  E-09
0.0
0.0
0.0
0.0
0 0 1 0 0 0 0 0 0 0 0 0 0 0 1
END
/*
//

```

Figure 13. Selected Output From Super Sample Problem.

BOLD VERTON VERS-4 RUN ON THE IER-360/400. CONTROL MOD=CONTROL1, DATE=00-01-81, TIME=10.10.57, JOBNAME=TDPA

INITIALIZATION, REFERENCE - REMAINING I/O= 10.99, CPU EIM= 19.06

FOR TITLE AND CONTROL MODULE DATA

SUPER SAMPLE PROBLEM.

200000 0 0 0 0 0 0 0 0 0 1 0 0 0
1 2 2 12 7 19 13 2 12 7 13 2 12 7 9 15 2 7 2 12 7 2 12 19
7

INITIAL I/O FILE MANAGEMENT TABLES
FILE NAME SUPPLIED 11

FILE NUMBER	SECT	USER-EXIST	USER-STACK	VERSION	WRITTEN	USER IDENTIFICATION
10	CONTROL			1	1	TDPA 00-01-81

MODULES TO BE ACCESSED IN ORDER

1 2 2 12 7 19 13 2 12 7 13 2 12 7 9 15 2 7 2 12
7 2 12 19 7

READ DATA AND ACCESS MODULE 1 - REMAINING I/O= 10.97, CPU EIM= 19.06

READ DATA FOR A SPECIAL PROCESSOR - REMAINING I/O= 10.03, CPU EIM= 19.01

ACCESS PROCESSOR 'DUTLIN' - REMAINING I/O= 10.01, CPU EIM= 19.01

READ DATA FOR A SPECIAL PROCESSOR - REMAINING I/O= 10.77, CPU EIM= 10.99

ACCESS PROCESSOR 'DUTLIN' - REMAINING I/O= 10.76, CPU EIM= 10.99

READ INPUT DATA ONLY (LOOK-HEAD) - REMAINING I/O= 10.70, CPU EIM= 10.99

ACCESS MODULES 12 7 19 13 0 - REMAINING I/O= 10.72, CPU EIM= 10.99

CYCLE, OPT, PT. IN HIST, CYCLE TIME, TIME IN CYCLE, FRAC. IN CYCLE- 1 0 1 0.0 0.0 0.0
ITERATIONS, CONVERGENCE, SEARCH, PEAK POWER DENSITY, K - 32 -3.229900-C5 0.0 0.009938 02 0.9935011
PRIMITIVE CONVERSION RATIO, ALSO FOR CRITICAL SYSTEM, FUEL CONSUMPTION(ATONS/WATT-SEC) - 1.47192 1.45235 2.03732E 10
FUEL MANAGEMENT, TIME= 0.0 DAYS, CYCLE= 0, INITIAL CORE FISSION INVENTORY (KWE) 0.961175 03
TIME AFTER EXPOSURE 255.500 DAYS, ESTIMATED K 0.985126, FISSION INVENTORY 5.233101E 03 KG, CONVERSION RATIO(MD) 1.42573

ACCESS PROCESSOR 'DUTLIN' - REMAINING I/O= 13.56, CPU EIM= 17.25

READ INPUT DATA ONLY (LOOK-HEAD) - REMAINING I/O= 13.54, CPU EIM= 17.24

ACCESS MODULES 12 7 13 0 0 - REMAINING I/O= 13.50, CPU EIM= 17.24

CYCLE, OPT, PT. IN HIST, CYCLE TIME, TIME IN CYCLE, FRAC. IN CYCLE- 1 0 1 0.0 2.35500E 02 0.0
ITERATIONS, CONVERGENCE, SEARCH, PEAK POWER DENSITY, K - 30 -1.069530-C5 0.0 5.00619E 02 0.9890390
PRIMITIVE CONVERSION RATIO, ALSO FOR CRITICAL SYSTEM, FUEL CONSUMPTION(ATONS/WATT-SEC) - 1.06997 1.43931 2.27501E 10
TIME AFTER EXPOSURE 511.000 DAYS, ESTIMATED K 0.989995, FISSION INVENTORY 5.502852E 03 KG, CONVERSION RATIO(MD) 1.41552

ACCESS PROCESSOR 'DUTLIN' - REMAINING I/O= 12.03, CPU EIM= 15.07

READ INPUT DATA ONLY (LOOK-HEAD) - REMAINING I/O= 12.00, CPU EIM= 15.06

ACCESS MODULES 12 7 9 15 0 - REMAINING I/O= 12.30, CPU EIM= 15.06

CYCLE, OPT, PT. IN HIST, CYCLE TIME, TIME IN CYCLE, FRAC. IN CYCLE- 1 0 1 0.0 5.11000E 02 0.0
ITERATIONS, CONVERGENCE, SEARCH, PEAK POWER DENSITY, K - 30 0.00210-05 0.0 5.07200E 02 1.0100367
PRIMITIVE CONVERSION RATIO, ALSO FOR CRITICAL SYSTEM, FUEL CONSUMPTION(ATONS/WATT-SEC) - 1.42956 1.47240 2.94213E 10
ADJOINT - ITERATIONS, CONVERGENCE, K - 20 -1.125400-05 1.0100340
FISSION INVENTORY 5.502959E 03 KG, CONVERSION RATIO(MD) 1.41662, FISSION CONSUMPTION RATE 1.162201E-14 KG/H-SEC
FWD ADJ K 1.010035 1.010036, LIFTTIME 3.41004E-07, B.D. NCIF. 1.03762E-13, SWR (K DELTA K)/(K DELTA W) 2.253940-01

VENTURE - TETRONICS MODULE -VERS 3- JANUARY 1, 1981 --- QUALITY ASSURANCE LEVEL 1

NOT TITLE - SUPER SAMPLE PROBLEM.

STATUS REQUIRED FOR CROSS SECTION CHECK 898 WORDS

TITLE OF THE LATEST VERSION CROSS SECTI FILE
LCCNC METHOD3 BENCHMARK PROBLEM 3 LIBRARY - - PROTSEK (G2-ABSD)

CROSS SECTION CHECK COMPLETED NORMALLY

REFERENCE REAL TIME FROM STARTD INTERFACE FILE = 0.0 DAYS

SECTION BY WHITE-DIFFERENCE DIFFUSION THEORY
SIGNATURE PROBLEM

THEORETICAL NO. 17 3-D TRIANGULAR-2

TRIANGULAR OPTION 1 PARALLOGRAM - 40 DEGREE

NUMBER OF REFLECT GROUPS (NAT) 8

NUMBER OF REFLECT GROUPS (NAT) 0

NUMBER OF REFLECT GROUPS (NAT) 1

NUMBER OF REFLECT GROUPS (NAT) 50

NUMBER OF REFLECT GROUPS (NAT) 25

NUMBER OF REFLECT GROUPS (NAT) 5

NUMBER OF REFLECT GROUPS (NAT) 52

NUMBER OF REFLECT GROUPS (NAT) 123

NUMBER OF REFLECT GROUPS (NAT) 1

NUMBER OF REFLECT GROUPS (NAT) 1

NUMBER OF REFLECT GROUPS (NAT) 1

NUMBER OF REFLECT GROUPS (NAT) 1

NUMBER OF REFLECT GROUPS (NAT) 1

MEMORY REQUIREMENTS FOR DATA STORAGE

	TOTAL	A	B	C	D
STORAGE AVAILABLE	MINIMUM				
16000	MAXIMUM				
16000	3050				
LOCATION CONSTANT CALCULATION					
CODE CONTAINED OR SPACE STORED	32304				
PLANE STORED	15879				
ROW STORED	6019				
MULTI-LEVEL PLANE STORED	17053				
INITIAL FILE					
CODE CONTAINED OR SPACE STORED	16331				
OTHER CODES	8331				
ITERATIVE PROCESS					
CODE CONTAINED	307238	174202	2195	3200	26551
SPACE STORED	44499	44551	2195	320	0
PLANE STORED	70433	67804	2195	320	0
PLANE STORED	35605	32576	2195	320	0
PLANE STORED	19424	16600	2195	320	0
PLANE STORED	3029	0	2195	320	0
PLANE STORED	83729	7500	2195	320	70200
PERFORMANCE CALCULATION	8540				

NOTE WILL BE STORED FOR ALL GROUPS, ALL SPACE

1. TOTAL LOCATIONS REQUIRED FOR DATA STORAGE --- 220000

2. MEMORY LOCATIONS REQUIRED FOR THIS PROBLEM --- 707216

12764

SPECIAL SCRATCH, DATASET REQUIREMENTS

PHYSICAL RECORD IS 7200 WORDS

SITE CONTAINER ARRAYS, CONTROL		36 DATA	12716
3199CT	ACCESS FILE 34	REQUIRES	4 RECORDS
3199CT	ACCESS FILE 37	REQUIRES	10000 WORDS IN LENGTH
3199LT	ACCESS FILE 38	REQUIRES	10000 WORDS IN LENGTH
3199CT	ACCESS FILE 60	REQUIRES	26550 WORDS IN LENGTH

NO PARAMETERS FOLLOW FOR B1 = 3520 AND B2 = 32000

22= 51 H3= 10 H4= 1 H5= 23 H6= 10 H7= 2 H8= 2 H9= 13 H10= 13 H11= 10 H12= 1 H13= 1 H14= 1 H15= 10
H16= 51 (NOTE THAT IF THE PLATES ARE TO BE EXPANDED FROM EXISTING RFLUX, H10= 51)

REQUIRES DISK STORAGE SPACE FOR PLUR(UNITS 24,27,28) IS 179520 BYTES.

FOR CONSTANTS (UNIT 40) IS-- 736000 BYTES.

FOR CONSTANTS (UNIT 23) IS-- 35200 MTTTS.

REQUIRED TOTAL DISK STORAGE SPACE IS----- 7417920 BYTES.

FOR THE ASSIGNED DATA STORAGE, THE REQUIRED REGION SIZE IS APPROXIMATELY 1210K BYTES

MAXIMUM STORAGE USED FOR MACROSCOPIC CROSS SECTION CALCULATION 3050 WORDS

THE MAXIMUM AND MINIMUM DIFFUSION COEFFICIENTS ARE 6.44536E 00 4.46438E-01

FINT MESH DESCRIPTION - POINT IS LOCATED AT THE CENTROID OF THE VOLUME ELEMENT

SCYLATERAL TRIANGLES - SIDE = 9.42M1

DISTANCE TO POINT - DIMENSION 3 (FRONT TO REAR)

1	2	3	4
67,1109	152,4000	105,0200	215,9000

DETERMINE INITIAL PARAMETERS FOR ITERATIVE PROCEDURE

REFERENCE POINT FOR INITIALIZATION WILL BE AT COLUMN = 36 ROW = 2 PLANE = 3 ZONE = 10

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INITIAL 217TH ITERATION EIGENVALUE      0.948511  OPTION  -99
```

INITIAL OVERRELAXATION COEFFICIENTS MAX. 1.410419 MIN. 1.250364 INNER ITERATIONS MAX. 0 MIN.

YESX POINT SWEEP OPTION 1

OUTER ITERATION LIMIT TO BE USED 50 ESTIMATED 53

MAXIMUM STORAGE USED FOR CALCULATING INITIAL PARAMETERS WAS 27976

INTERNAL FLUX IS $P_{H2}(J,K) \cdot \Phi_{F1}(I) \cdot P_{F2}(M,N)$

TOTAL CORE REQUIRED FOR DATA STORAGE IS 207232 WORDS

SLAPSED CPM AND CLOCK MINUTES ARE 0.049 0.776

107

LEAKAGE 5.91710E 15 TOTAL LOSSES 1.84200E 19 TOTAL PRODUCTIONS 1.83105E 19 REACTOR POWER (WATTS) 2.556200 09

108

OVERALL NEUTRON BALANCE

ZONE VOLUMES FOLLOW. TOTAL VOLUME 1.11203E 07

20MB AVERAGE FLUX INTERFACE FILE REFLUX (VERSION 1) HAS BEEN WRITTEN ON UNIT NUMBER 19

POINT REGULAR FLUX INTERFACE FILE RTPLUX (VERSION 1) HAS BEEN WRITTEN ON UNIT NUMBER 20

SALESTERS FIRST GROUP FLIES BY ZONE

THE MAXIMUM POWER DENSITY IS AT PLANE 4, ROW 3, AND COLUMN 31 AND IS 6.40995045D 02 WATTS/CC.

THE VARIATION NEUTRON DENSITY IS AT PLANE 4, ROW 1, AND COLUMN 31 AND IS 1.70286287D 07 NEUTRONS/CC.

THE FOLLOWING POWER DENSITY (WATTS/CC) IN EACH ZONE IS

6.755197 00	1.737452 01	0.894072 00	0.339952 01	1.500191 00	1.198432 01	6.153602 01	5.687902 01	4.926182-01	0.000000-00
1.226602 00	7.821052 00	7.927502 00	5.071072 01	1.651352 02	0.809952 02	3.466242 01	1.136622 02	4.395162 02	0.000000-00
6.736735-01	2.311802 01	0.829002 00	7.326612 00	6.433112-02	2.900002 01	1.770252 01	0.079952 00	2.608882 00	0.000000-00
2.183432 01	1.441882 01	2.574472 00	1.832472-01	2.904912 01	1.992452 01	3.685332 00	2.744952-01	0.188512 01	0.000000-00
5.404622 01	9.950842 00	5.318182-00	1.156382 00	0.808062-01	2.272782-01	1.563872-02	1.194882 00	0.814482-01	0.000000-00
2.283852-01	1.975212-02	1.119192 00	7.771242-01	2.235272-01	1.476792-02	0.0	0.0	0.0	0.0

TOTAL CPU MINUTES USED 1,697 TOTAL CLOCK MINUTES USED 9,990 TOTAL I/O USED 1037

JOURNAN DIRECT ACCESS UNIT USED (LIMIT 10)

TOTAL CPU TIME USED 0.004 MINUTES

TOTAL CLOCK TIME USED 0.093 MINUTES

TOTAL I/O USED 34

BURNER - EXPOSURE MODULE - PRE-RELEASE VERSION 10 - AUGUST 20, 1979 - QUALITY ASSURANCE LEVEL 0

CASE TITLE - SUPER SAMPLE PROBLEM.

SITE CONTAINED ARRAYS, CONTROL & DATA 1

TITLE OF THE LATEST VERSION CROSS SECTION FILE
LCCSAR NETWORK BENCHMARK PROBLEM 3 LIBRARY - R PROBLEM (02-ARSD)

METHOD OF SOLUTION - NATPIX EXPONENTIAL

MAXIMUM ARRAY SIZE USED FOR INITIAL PROCESSING IS 2034

STORAGE REQUIRED FOR BASIC DATA IS 1023

STORAGE SUPPLIED IS 220000
MAXIMUM STORAGE REQUIRED IS 8574
MINIMUM STORAGE REQUIRED IS 3729

NUMBER = 0 NUMBER = -1

MEMORY ACTUALLY USED WILL BE 8574

NEXT-TO-LATEST VERSION EXACTLY NOT AVAILABLE

EXPOSURE TIME STEP STARTS AT 0.0 DAYS

EXPOSURE TIME STEP IS 2.553000E 02 DAYS (2.207520E 07 SECONDS) THE NUMBER OF SUBSTEPS IS 3

POWER	2.554190E 09 WATTS, MAXIMUM POWER DENSITY	5.399536E 02 WATTS/CC IN ZONE	15	AT START OF SUBSTEP	1
POWER	2.553037E 09 WATTS, MAXIMUM POWER DENSITY	5.284716E 02 WATTS/CC IN ZONE	15	AT END OF SUBSTEP	1
AVERAGE POWER AT END OF SUBSTEP				2.554625E 09 WATTS	
INITIAL REACTION RATES WILL BE MULTIPLIED BY				1.002457E 00 FOR NEXT SUBSTEP	1.001322E 00
POWER	2.559329E 09 WATTS, MAXIMUM POWER DENSITY	5.299705E 02 WATTS/CC IN ZONE	15	AT START OF SUBSTEP	2
POWER	2.557091E 09 WATTS, MAXIMUM POWER DENSITY	5.193735E 02 WATTS/CC IN ZONE	15	AT END OF SUBSTEP	2
AVERAGE POWER AT END OF SUBSTEP				2.556410E 09 WATTS	
INITIAL REACTION RATES WILL BE MULTIPLIED BY				1.002370E 00 FOR NEXT SUBSTEP	9.999135E-01 1.000264E 00
POWER	2.554940E 09 WATTS, MAXIMUM POWER DENSITY	5.193204E 02 WATTS/CC IN ZONE	15	AT START OF SUBSTEP	3
POWER	2.553390E 09 WATTS, MAXIMUM POWER DENSITY	5.094063E 02 WATTS/CC IN ZONE	15	AT END OF SUBSTEP	3
AVERAGE POWER AT END OF SUBSTEP				2.556323E 09 WATTS	

END OF EXPOSURE STEP AFTER DENSITIES AT TIME 2.553000E 02 DAYS

ICR NUMBER 1

INVENTORY AND REACTION RATES BY ABSOLUTE NUCLEIDE

		***** START OF STEP TIME				0.0 DAYS		***** END OF STEP TIME				255.500 DAYS		*****	
NO.	NAME	INVENTORY	ABSORPTION	FISSION	PRODUCTION	CAPTURE	INVENTORY	ABSORPTION	FISSION	PRODUCTION	CAPTURE				
		(KG)				(H,G)	(KG)				(H,G)				
1	O16	1.51727E-04	3.24743E-01	0.0	0.0	3.24743E-03	1.51727E-04	3.22937E-03	0.0	0.0	3.22937E-03				
2	HA23	1.65508E-04	2.43080E-03	0.0	0.0	2.42991E-03	1.65508E-04	2.41728E-03	0.0	0.0	2.41649E-03				
3	CP	4.96648E-04	1.18223E-02	0.0	0.0	1.18088E-02	4.96648E-04	1.09610E-02	0.0	0.0	1.09476E-02				
4	W55	4.96798E-03	6.42290E-03	0.0	0.0	6.42164E-03	4.96798E-03	6.38720E-03	0.0	0.0	6.38597E-03				
5	FE	1.81554E-05	2.08514E-02	0.0	0.0	2.08362E-02	1.81554E-05	2.07355E-02	0.0	0.0	2.07284E-02				
6	NI	3.78532E-04	1.07651E-02	0.0	0.0	1.07637E-02	3.78532E-04	1.07053E-02	0.0	0.0	1.07019E-02				
7	TO	7.01208E-03	9.71440E-03	0.0	0.0	9.69988E-03	7.01208E-03	9.66040E-03	0.0	0.0	9.64597E-03				
8	U235	2.39648E-02	9.27946E-03	7.00102E-03	1.72475E-02	2.27588E-02	2.39732E-02	8.88782E-03	6.09354E-03	1.50087E-02	1.97005E-03				
9	U236	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
10	U238	1.18036E-05	3.28473E-01	6.03675E-02	1.67967E-01	4.65171E-01	1.09024E-05	3.16080E-01	5.87295E-02	1.63438E-01	4.54497E-01				
11	PU239	4.18103E-03	2.68133E-01	2.12479E-01	6.29451E-01	5.50846E-02	4.46404E-03	2.77769E-01	2.18492E-01	6.45314E-01	5.92110E-02				
12	PU240	1.23494E-03	3.15199E-02	1.54725E-02	4.78205E-02	1.80376E-02	1.28082E-03	3.49084E-02	1.60812E-02	4.88644E-02	1.89171E-02				
13	PU241	6.20494E-02	5.08714E-02	4.30901E-02	1.28448E-01	7.71797E-03	5.46029E-02	4.27946E-02	3.62478E-02	1.08135E-01	6.49354E-03				
14	PU242	1.48131E-02	3.04434E-03	1.34941E-03	4.11883E-03	1.74893E-03	1.53754E-02	3.29580E-03	1.42788E-03	4.38762E-03	1.86260E-03				
15	PP	0.0	0.0	0.0	0.0	0.0	6.49903E-02	1.10295E-02	0.0	0.0	1.04910E-02				
16	P10	4.44451E-02	4.18494E-02	0.0	0.0	4.18498E-02	9.45951E-02	4.16171E-02	0.0	0.0	4.16171E-02				
17	B71	9.04279E-01	7.42401E-08	0.0	0.0	7.28041E-08	9.04279E-01	7.38273E-08	0.0	0.0	7.23994E-08				
18	C	3.22869E-02	2.23975E-06	0.0	0.0	2.23975E-06	3.22869E-02	2.22730E-06	0.0	0.0	2.22730E-06				
19	U232	0.0	0.0	0.0	0.0	0.0	4.08714E-06	0.0	0.0	0.0	0.0				
20	PU243	0.0	0.0	0.0	0.0	0.0	3.57753E-00	0.0	0.0	0.0	0.0				
21	A724X	0.0	0.0	0.0	0.0	0.0	1.91662E-01	0.0	0.0	0.0	0.0				
22	CWPI35	0.0	0.0	0.0	0.0	0.0	3.16689E-02	0.0	0.0	0.0	0.0				
TOTALS		4.39854E-05	9.99678E-01	3.40250E-01	9.94553E-01	6.56298E-01	4.30163E-05	9.99679E-01	3.37872E-01	9.85126E-01	6.59539E-01				
OTHER LOSS RATE			3.22342E-04					3.20733E-04							
TOTAL LOSS RATE			1.00000E-00					1.00000E-00							
SYSTEM LOSS RATE (H/HWC)			2.20929E-20					2.22691E-20							
RELATIVE FLOW LEVEL			1.00000E-00					1.00237E-00							

**SUMMARY TABLES FOR EXPOSURE ENDING AT TIME 2.555000E 02 DAYS
FOR CASE SUPER SAMPLE PROBLEM.**

AVERAGE NEUTRON LOSSES BY NUCLEIDE CLASS AND ZONE CLASS - SYSTEM LOSS RATE 2.210094E 20 N/SEC

ZONE CLASS	FISSILE	FERTILE	O. ACTINIDE	FISSION PROD	STRUCTURAL	COOLANT	CONTROL ROD	OTHER
ID.	1	2	3	4	5	6	7	8
1	0.0159847	0.2759144	0.0000000	0.0003379	0.0173254	0.0000742	0.0	0.0
2	0.3124873	0.2405344	0.0031955	0.0051907	0.0254840	0.0012490	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0101784	0.0000000	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0009394	0.0003117	0.0417350	0.0
SR	0.3204440	0.5564400	0.0031955	0.0055346	0.0610345	0.0024240	0.0417350	0.0

ZONE CLASS	ABSORPTION	FISSION INVENTORY (KG)	EFFECTIVE CONVERSION RATIO	POWER (WATTS)
ID.	LOSS	0.0 DAYS 255.500 DAYS	REACTION RATE MASS BALANCE	
1	0.3104325	1.427722E 02 6.325747E 02	16.12030 16.20676	2.463494E 08
2	0.4240916	4.770383E 03 4.500546E 03	0.70963 0.67464	2.209310E 09
3	0.0102676	0.0 0.0	0.0 0.0	5.367407E 06
4	0.0428043	0.0 0.0	0.0 0.0	1.735499E 07
OVERALL	0.9954782	4.961152E 03 5.233141E 03	1.45590 1.42573	2.556324E 09
OTHER LOSSES	0.0003210			
TOTAL LOSSES	1.0000000			

FISSION CONSUMPTION PER UNIT ENERGY GENERATION IS 1.132127E-14 KG/WATT-SEC
FISSION CONSUMPTION RATE IS 2.094005E-05 KG/SEC

INTERFACE FILE SWATH VERSION 1 (OLD) HAS BEEN WRITTEN ON UNIT 17 WITH DENSITIES AT TIME 2.555000E 02 DAYS

SUMMARY OF CALCULATION

NATPIX EXPONENTIAL - EXPOSURE
MAX. STEPS (INTERVALS) USED 1
MIN. STEPS (INTERVALS) USED 1
EQUILIBRIUM CHANGED TO NO EQUILIBRIUM 03

MAX ARRAY SIZE USED 0573 WORDS - FOR ZONE CALCULATION

MAX ARRAY SIZE USED 0573 WORDS

TOTAL CPU TIME USED 0.010 MINUTES TOTAL CLOCK TIME USED 0.094 MINUTES TOTAL I/O USED 37

NORMAL END OF EXPOSURE MODULE

DATA HAS BEEN RETRIEVED SUCCESSFULLY FROM INTERPACE FILES CONTROL ROBBERT MURRAY BRAYTON AND GIBSON (VERSION 1)
THE FOLLOWING RECORDS ON FILE CONTROL HAVE BEEN PROCESSED BYRINS PHOIMS ROBINS
CONTENTS OF ROAMS RECORD OF FILE CONTROL

$\pi(1)$	$\pi(2)$	$\pi(3)$	$\pi(4)$	$\pi(5)$	$\pi(6)$	$\pi(7)$	$\pi(8)$	$\pi(9)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(2)$	$\pi(3)$	$\pi(4)$	$\pi(5)$	$\pi(6)$	$\pi(7)$	$\pi(8)$	$\pi(9)$	$\pi(10)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(3)$	$\pi(4)$	$\pi(5)$	$\pi(6)$	$\pi(7)$	$\pi(8)$	$\pi(9)$	$\pi(10)$	$\pi(11)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(4)$	$\pi(5)$	$\pi(6)$	$\pi(7)$	$\pi(8)$	$\pi(9)$	$\pi(10)$	$\pi(11)$	$\pi(12)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(5)$	$\pi(6)$	$\pi(7)$	$\pi(8)$	$\pi(9)$	$\pi(10)$	$\pi(11)$	$\pi(12)$	$\pi(13)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(6)$	$\pi(7)$	$\pi(8)$	$\pi(9)$	$\pi(10)$	$\pi(11)$	$\pi(12)$	$\pi(13)$	$\pi(14)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(7)$	$\pi(8)$	$\pi(9)$	$\pi(10)$	$\pi(11)$	$\pi(12)$	$\pi(13)$	$\pi(14)$	$\pi(15)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(8)$	$\pi(9)$	$\pi(10)$	$\pi(11)$	$\pi(12)$	$\pi(13)$	$\pi(14)$	$\pi(15)$	$\pi(16)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(9)$	$\pi(10)$	$\pi(11)$	$\pi(12)$	$\pi(13)$	$\pi(14)$	$\pi(15)$	$\pi(16)$	$\pi(17)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(10)$	$\pi(11)$	$\pi(12)$	$\pi(13)$	$\pi(14)$	$\pi(15)$	$\pi(16)$	$\pi(17)$	$\pi(18)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(11)$	$\pi(12)$	$\pi(13)$	$\pi(14)$	$\pi(15)$	$\pi(16)$	$\pi(17)$	$\pi(18)$	$\pi(19)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(12)$	$\pi(13)$	$\pi(14)$	$\pi(15)$	$\pi(16)$	$\pi(17)$	$\pi(18)$	$\pi(19)$	$\pi(20)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(13)$	$\pi(14)$	$\pi(15)$	$\pi(16)$	$\pi(17)$	$\pi(18)$	$\pi(19)$	$\pi(20)$	$\pi(21)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(14)$	$\pi(15)$	$\pi(16)$	$\pi(17)$	$\pi(18)$	$\pi(19)$	$\pi(20)$	$\pi(21)$	$\pi(22)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(15)$	$\pi(16)$	$\pi(17)$	$\pi(18)$	$\pi(19)$	$\pi(20)$	$\pi(21)$	$\pi(22)$	$\pi(23)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(16)$	$\pi(17)$	$\pi(18)$	$\pi(19)$	$\pi(20)$	$\pi(21)$	$\pi(22)$	$\pi(23)$	$\pi(24)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(17)$	$\pi(18)$	$\pi(19)$	$\pi(20)$	$\pi(21)$	$\pi(22)$	$\pi(23)$	$\pi(24)$	$\pi(25)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(18)$	$\pi(19)$	$\pi(20)$	$\pi(21)$	$\pi(22)$	$\pi(23)$	$\pi(24)$	$\pi(25)$	$\pi(26)$
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$\pi(19)$	$\pi(20)$	$\pi(21)$	$\pi(22)$	$\pi(23)$	$\pi(24)$	$\pi(25)$	$\pi(26)$	$\pi(27)$
0.0								

LAST ACCESS THIS ACCESS	ACCESS NO. 1 2	CYCLE NO. 1 1	C.O.P. OPT. 0 0	ST. IN DIST. 1 1	INTERCHANGES 0 0	INTERCHANGES 0 0	INTERCHANGES 0 0	RECORD NO. 2303 2303
LAST ACCESS THIS ACCESS	0.0 0.0	TIME IN CYCL 0.0 0.0	PAC IN CYCL 0.0 0.0	INTERCHANGES 0.0 0.0	INTERCHANGES 0.0 0.0	INTERCHANGES 0.0 0.0	INTERCHANGES 0.0 0.0	0.0 0.0
POSITIONING FOR	NZ SET - 1	NUMBER OF ZONES = 1	FIRST ZONE = 1	LAST ZONE = 24	NUMBER OF INTERCHANGES = 4			
POSITIONING FOR	NZ SET - 2	NUMBER OF ZONES = 4	FIRST ZONE = 1	LAST ZONE = 28	NUMBER OF INTERCHANGES = 4			
POSITIONING FOR	NZ SET - 3	NUMBER OF ZONES = 4	FIRST ZONE = 35	LAST ZONE = 32	NUMBER OF INTERCHANGES = 4			
POSITIONING FOR	NZ SET - 4	NUMBER OF ZONES = 4	FIRST ZONE = 39	LAST ZONE = 36	NUMBER OF INTERCHANGES = 0			
POSITIONING FOR	NZ SET - 5	NUMBER OF ZONES = 4	FIRST ZONE = 43	LAST ZONE = 40	NUMBER OF INTERCHANGES = 0			
POSITIONING FOR	NZ SET - 6	NUMBER OF ZONES = 4	FIRST ZONE = 47	LAST ZONE = 44	NUMBER OF INTERCHANGES = 0			
POSITIONING FOR	NZ SET - 7	NUMBER OF ZONES = 4	FIRST ZONE = 51	LAST ZONE = 48	NUMBER OF INTERCHANGES = 0			

STANDARD FORM NO. 64

DATE	27	IN	HSE	SET	ENTRT	1	ENTRT	2	ENTRT	3	ENTRT	4	ENTRT	5	ENTRT	6	ENTRT	7	ENTRT	8	ENTRT	9	ENTRT	10	ENTRT	11	ENTRT	12	ENTRT	13	ENTRT	14	ENTRT	15	ENTRT	16	ENTRT	17	ENTRT	18	ENTRT	19	ENTRT	20	ENTRT	21	ENTRT	22	ENTRT	23	ENTRT	24	ENTRT	25	ENTRT	26	ENTRT	27	ENTRT	28	ENTRT	29	ENTRT	30	ENTRT	31	ENTRT	32	ENTRT	33	ENTRT	34	ENTRT	35	ENTRT	36	ENTRT	37	ENTRT	38	ENTRT	39	ENTRT	40	ENTRT	41	ENTRT	42	ENTRT	43	ENTRT	44	ENTRT	45	ENTRT	46	ENTRT	47	ENTRT	48	ENTRT	49	ENTRT	50	ENTRT	51	ENTRT	52	ENTRT	53	ENTRT	54	ENTRT	55	ENTRT	56	ENTRT	57	ENTRT	58	ENTRT	59	ENTRT	60	ENTRT	61	ENTRT	62	ENTRT	63	ENTRT	64	ENTRT	65	ENTRT	66	ENTRT	67	ENTRT	68	ENTRT	69	ENTRT	70	ENTRT	71	ENTRT	72	ENTRT	73	ENTRT	74	ENTRT	75	ENTRT	76	ENTRT	77	ENTRT	78	ENTRT	79	ENTRT	80	ENTRT	81	ENTRT	82	ENTRT	83	ENTRT	84	ENTRT	85	ENTRT	86	ENTRT	87	ENTRT	88	ENTRT	89	ENTRT	90	ENTRT	91	ENTRT	92	ENTRT	93	ENTRT	94	ENTRT	95	ENTRT	96	ENTRT	97	ENTRT	98	ENTRT	99	ENTRT	100	ENTRT	101	ENTRT	102	ENTRT	103	ENTRT	104	ENTRT	105	ENTRT	106	ENTRT	107	ENTRT	108	ENTRT	109	ENTRT	110	ENTRT	111	ENTRT	112	ENTRT	113	ENTRT	114	ENTRT	115	ENTRT	116	ENTRT	117	ENTRT	118	ENTRT	119	ENTRT	120	ENTRT	121	ENTRT	122	ENTRT	123	ENTRT	124	ENTRT	125	ENTRT	126	ENTRT	127	ENTRT	128	ENTRT	129	ENTRT	130	ENTRT	131	ENTRT	132	ENTRT	133	ENTRT	134	ENTRT	135	ENTRT	136	ENTRT	137	ENTRT	138	ENTRT	139	ENTRT	140	ENTRT	141	ENTRT	142	ENTRT	143	ENTRT	144	ENTRT	145	ENTRT	146	ENTRT	147	ENTRT	148	ENTRT	149	ENTRT	150	ENTRT	151	ENTRT	152	ENTRT	153	ENTRT	154	ENTRT	155	ENTRT	156	ENTRT	157	ENTRT	158	ENTRT	159	ENTRT	160	ENTRT	161	ENTRT	162	ENTRT	163	ENTRT	164	ENTRT	165	ENTRT	166	ENTRT	167	ENTRT	168	ENTRT	169	ENTRT	170	ENTRT	171	ENTRT	172	ENTRT	173	ENTRT	174	ENTRT	175	ENTRT	176	ENTRT	177	ENTRT	178	ENTRT	179	ENTRT	180	ENTRT	181	ENTRT	182	ENTRT	183	ENTRT	184	ENTRT	185	ENTRT	186	ENTRT	187	ENTRT	188	ENTRT	189	ENTRT	190	ENTRT	191	ENTRT	192	ENTRT	193	ENTRT	194	ENTRT	195	ENTRT	196	ENTRT	197	ENTRT	198	ENTRT	199	ENTRT	200	ENTRT	201	ENTRT	202	ENTRT	203	ENTRT	204	ENTRT	205	ENTRT	206	ENTRT	207	ENTRT	208	ENTRT	209	ENTRT	210	ENTRT	211	ENTRT	212	ENTRT	213	ENTRT	214	ENTRT	215	ENTRT	216	ENTRT	217	ENTRT	218	ENTRT	219	ENTRT	220	ENTRT	221	ENTRT	222	ENTRT	223	ENTRT	224	ENTRT	225	ENTRT	226	ENTRT	227	ENTRT	228	ENTRT	229	ENTRT	230	ENTRT	231	ENTRT	232	ENTRT	233	ENTRT	234	ENTRT	235	ENTRT	236	ENTRT	237	ENTRT	238	ENTRT	239	ENTRT	240	ENTRT	241	ENTRT	242	ENTRT	243	ENTRT	244	ENTRT
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[illegible]

 NAME - REACTION RATE MODEL - AUGUST 23, 1979 - QUALITY ASSURANCE LEVEL 0

CASE TITLE - SUPER SAMPLE PROBLEM.

REACTION RATE MODEL INSTRUCTIONS (UNIT) ARE NOT ON CONTROL - DEFECT TO MINIMUM OUTPUT
 WITH CONTAINED ANALYT, CONTROL 6 DATA 1

TITLE OF THE LAST VERSION CROSS SECTION FILE
 LCCRD NETWORKS BENCHMARK PROBLEM) (ANALYT - 2 PROBLEM (DE-ANALYT)

ANALYT ANALYT SIZE 880 FOR INITIAL PROCESSING IS 3030

STORAGE REQUIRED FOR ANALYT DATA IS 1593

STORAGE SUPPLIED IS 220000

MAXIMUM STORAGE REQUIRED IS 23370

MINIMUM STORAGE PROVIDED IS 4202

MODEL 1 = 0 MODEL 2 = 0 MODEL 3 = 0

VERSION 1.11000002 02

PCY = 0

MSZ = 19

UNIT 19

UNIT 19

UNIT 19

UNIT 19

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UNIT 19

UNIT 19

TOTAL REACTION RATE BY ISOTOPE FOR WHOLE REACTOR
NORMALIZED WITH 2.2105E-20

IS.	RATE	AUSTRON	FUSION	PRODUCTION	CAPTURE (R.0) (H.2M)
1	10816	0.070599E-04	0.0	0.0	0.670599E-04
2	11123	0.011502E-04	0.0	0.0	0.011502E-04
3	12550	3.346910E-03	0.0	0.0	3.362401E-03
4	12550	1.711302E-03	0.0	0.0	1.711302E-03
5	12550	6.532121E-03	0.0	0.0	6.524607E-03
6	12550	1.025052E-03	0.0	0.0	1.022651E-03
7	12550	2.415408E-03	0.0	0.0	2.413214E-03
8	12550	5.78825E-03	1.390115E-03	8.223652E-03	1.187901E-03
9	12550	0.0	0.0	0.0	0.0
10	12550	2.02385E-01	1.975001E-02	5.480910E-02	2.611701E-01
11	12550	2.46331E-02	2.78702E-02	0.13518E-02	1.55058E-02
12	12550	9.72366E-04	1.14036E-04	3.53318E-04	3.54234E-04
13	12550	3.16022E-05	2.42230E-05	7.77638E-05	3.56263E-05
14	12550	1.01361E-07	2.32306E-08	7.07650E-08	7.80539E-08
15	12550	1.45540E-03	0.0	0.0	1.05719E-03
16	12550	2.36934E-03	0.0	0.0	2.26918E-03
17	12550	1.25271E-03	0.0	0.0	1.25205E-03
18	12550	0.72292E-01	0.0	0.0	0.71204E-01
19	12550	1.17993E-03	0.0	0.0	1.17897E-03
20	12550	9.07190E-03	0.0	0.0	9.05998E-03
21	12550	5.16733E-03	0.0	0.0	5.15672E-03
22	12550	2.52666E-01	0.0	0.0	2.51495E-01
23	12550	3.05601E-03	2.34284E-03	5.40518E-03	6.90333E-03
24	12550	0.0	0.0	0.0	0.0
25	12550	2.40501E-01	2.91974E-02	1.09120E-01	1.99397E-01
26	12550	2.54512E-01	1.99342E-01	5.40091E-01	5.31546E-02
27	12550	2.52316E-02	1.57971E-02	8.78718E-02	1.48244E-02
28	12550	3.96409E-02	3.35617E-02	1.00570E-01	6.09104E-02
29	12550	3.56693E-03	1.40238E-03	8.50710E-03	1.32942E-03
30	12550	1.46990E-02	0.0	0.0	1.46595E-02
31	12550	0.0	0.0	0.0	0.0
32	12550	0.0	0.0	0.0	0.0
33	12550	0.0	0.0	0.0	0.0
34	12550	3.04674E-04	0.0	0.0	3.04674E-04
35	12550	3.21125E-04	0.0	0.0	3.20718E-04
36	12550	1.01402E-04	0.0	0.0	1.01405E-04
37	12550	5.84546E-04	0.0	0.0	5.84532E-04
38	12550	2.987810E-04	0.0	0.0	2.987820E-04
39	12550	2.00113E-04	0.0	0.0	2.00277E-04
40	12550	8.55103E-05	0.0	0.0	8.55121E-05
41	12550	2.12706E-01	0.0	0.0	2.12485E-01
42	12550	2.63567E-03	0.0	0.0	2.63566E-03
43	12550	1.81033E-03	0.0	0.0	1.81033E-03
44	12550	1.56512E-03	0.0	0.0	1.56512E-03
45	12550	3.56500E-03	0.0	0.0	3.56484E-03
46	12550	0.0	0.0	0.0	0.0
47	12550	0.0	0.0	0.0	0.0
48	12550	0.0	0.0	0.0	0.0
49	12550	0.0	0.0	0.0	0.0
TOTALS	9.789530E-01	3.42904E-01	1.00135E-00	6.32976E-01	3.07090E-03

TOTAL REACTION RATE AND POWER PRODUCTION BY ABSOLUTE ISOTOPE FOR WHOLE REACTOR
REACTION RATES HAVE UNITS OF EVENTS/SEC

POS.	IDENTIFIER ABSOLUTE	INVENTORY (KGS)	ABSORPTION	FISSION	PRODUCTION	CAPTURE(N,0)	FISSION POWER (WATTS)	CAPT. POWER (WATTS)
1	O16	1.51726E 04	7.17984E 17	0.0	0.0	7.17984E 17	0.0	4.76489E 05
2	HA23	1.79251E 04	5.74933E 17	0.0	0.0	5.74731E 17	0.0	1.07279E 06
3	CR	4.93007E 04	2.33684E 18	0.0	0.0	2.33386E 18	0.0	3.45435E 06
4	HA55	4.63160E 03	1.25728E 18	0.0	0.0	1.25701E 18	0.0	1.46442E 06
5	FE	1.42424E 04	4.43594E 18	0.0	0.0	4.43263E 18	0.0	5.54699E 06
6	HI	3.80351E 04	2.30761E 18	0.0	0.0	2.30731E 18	0.0	3.43150E 06
7	HO	7.04571E 03	1.93132E 18	0.0	0.0	1.92612E 18	0.0	2.62822E 06
8	U235	2.67704E 02	1.49318E 18	1.27603E 18	3.14274E 18	4.16604E 17	3.96643E 07	4.36184E 05
9	U236	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	U238	1.04010E 05	1.15988E 20	1.30740E 19	3.63715E 19	1.02280E 20	4.14981E 08	9.43231E 07
11	PO240	4.41074E 03	4.47427E 19	5.04172E 19	1.44706E 20	1.43604E 19	1.61589E 07	1.50355E 07
12	PO240	1.33403E 03	7.91967E 18	3.53042E 18	1.07188E 19	4.34706E 18	1.13005E 08	3.68337E 06
13	PO241	4.84409E 02	8.41143E 18	7.44477E 18	2.22104E 19	1.35226E 18	2.41325E 08	1.36443E 06
14	PO242	1.62024E 02	7.42405E 17	3.11062E 17	9.55357E 17	4.30192E 17	9.99753E 06	3.40270E 05
15	FP	1.30024E 03	3.62830E 18	0.0	0.0	3.61914E 18	0.0	4.93324E 06
16	B10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	B11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	C	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	U238	7.47925E 00	0.0	0.0	0.0	0.0	0.0	0.0
20	PO242	7.31115E 00	0.0	0.0	0.0	0.0	0.0	0.0
21	HA242	3.61032E 01	0.0	0.0	0.0	0.0	0.0	0.0
22	CURISS	6.33594E 02	0.0	0.0	0.0	0.0	0.0	0.0
TOTALS			2.17137E 20	7.40582E 19	2.22103E 20	1.40390E 20	2.43487E 09	1.38233E 08
			(N,2R)					
1	O16		0.0					
2	HA23		2.01445E 14					
3	CR		2.97594E 15					
4	HA55		2.71981E 14					
5	FE		3.33182E 14					
6	HI		3.05357E 14					
7	HO		3.19875E 15					
8	U235		5.42890E 14					
9	U236		0.0					
10	U238		4.33257E 17					
11	PO234		1.41740E 16					
12	PO240		2.18187E 15					
13	PO241		1.03972E 16					
14	PO242		1.15037E 15					
15	FP		4.15924E 15					
16	B10		0.0					
17	B11		0.0					
18	C		0.0					
19	U238		0.0					
20	PO242		0.0					
21	HA242		0.0					
22	CURISS		0.0					
TOTALS			6.81153E 17					

SUPER SAMPLE PROBLEM.

SUMMARY TABLE OF NEUTRON LOSSES FLUX WEIGHTED
NORMALIZED WITH 2.218050E 20 K-EFFECTIVE IS 0.969839

ZONE CLASS	FISSILE	FERTILE	O. ACTINIDE	FISSION PROD	STRUCTURAL	COOLANT	CONTROL ROD	OTHER
ID.	1	2	3	4	5	6	7	8
1	0.0000741	0.2020579	0.0000001	0.0016506	0.0179141	0.0000002	0.0	0.0
2	0.2954000	0.2757731	0.0033470	0.0106990	0.0233870	0.0012537	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0137032	0.0000000	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0019470	0.0003487	0.0	0.0
SUM	0.3394741	0.5306110	0.0033471	0.0163506	0.0585513	0.0025921	0.0	0.0

SUMMARY TABLE OF OTHER INFORMATION

ZONE CLASS	ABSORPTION	FISSILE	CONVERSION	FISSION	TOTAL
ID.	LOSSES	INVENTORY (K3B)	RATIO	POWER (WATTS)	POWER (WATTS)
1	0.3014048	1.090504E 03	5.94645	3.615736E 08	6.262117E 08
2	0.4154141	0.006273E 03	0.74076	3.073290E 09	2.186196E 09
3	0.0117807	0.0	0.0	0.0	0.0
4	0.0010417	0.0	0.0	0.0	0.0
SUM	0.7789432	5.502859E 03	1.01042	2.434070E 09	2.673103E 09
OTHER LOSSES	0.0210464				
TOTAL LOSSES	1.0000000				

A BETTER ESTIMATE OF THE FUEL CONVERSION RATIO FOR A CRITICAL SYSTEM IS 1.30630
(NOT MADE CRITICAL BY CHANGING CONTROL ABSORPTIONS OR LEAKAGE)

FISSILE CONSUMPTION/UNIT ENERGY GENERATION IS 1.162201E-14 KGB/WATT-SEC
FISSILE CONSUMPTION RATE IS 2.990866E-05 KGB/SEC

INITIATIVE DOUBLING TIME (YRS) OF THE ABOVE FISSILE INVENTORY (ONE PLANT) IS 15.00240

NOTE - CONVERSION RATIO = (CAPTURE IN FERTILE)/(ABSORPTION IN FISSILE)

***** PERTURBATION MODULE - VERSION 1 - APRIL 1, 1978 - QUALITY ASSURANCE LEVEL 0

RUN TITLE - SUPER SAMPLE PROBLEM.

***** CALCULATED DERIVATIVES (DELTA K)/(K DELTA X) AND THE CHANGES FOR PERTURBATIONS (DELTA K)/K ARE REACTIVITY EFFECTS
 ESTIMATED BY APPLICATION OF FIRST ORDER PERTURBATION THEORY, NORMALLY PRECISE ONLY IN THE LIMIT OF NO CHANGE. IT
 IS ASSUMED THAT APPLICABLE, CONSISTENT REGULAR AND ADJOINT FLOW DISTRIBUTIONS, GEOMETRIC DESCRIPTION, CROSS
 SECTIONS, AND NUCLEONIC CONCENTRATIONS AND ASSOCIATIONS ARE SUPPLIED FOR A PROBLEM. OTHERWISE THE RESULTS MAY NOT
 HAVE A SERIOUS INTERPRETATION, OR PERHAPS HAVE A SPECIAL INTERPRETATION WHICH INVALIDATES THE LABELS.

*****INTERFACE FILE SLATES DOES NOT EXIST - WILL NOT DO BETA-EFFECTIVE CALCULATION SLATES SLATES

REFERENCE REAL TIME FROM KNOWN INTERFACE FILE = 8.110000E 02 DAYS

GEOMETRY NO. 17 3-D TRIANGULAR-1
 TRIANGULAR OPTION 1 PARALLELOGRAM - 60 DEGREE
 NUMBER OF ENERGY GROUPS 4
 NUMBER OF UPSCATTER GROUPS (MAX) 0
 NUMBER OF DOWNSCATTER GROUPS (MAX) 3
 NUMBER OF INTERVALS IN DIMENSION 1 (COLUMNS) 50
 NUMBER OF INTERVALS IN DIMENSION 2 (ROWS) 25
 NUMBER OF INTERVALS IN DIMENSION 3 (PLANES) 4
 NUMBER OF TOWERS 52
 NUMBER OF REMOVAL 123
 NUMBER OF BLACK ASSIGNED ZONES 1
 BOUNDARY INDICATORS- LEFT 1 RIGHT 2
 TOP 1 BOTTOM 2
 FRONT 2 REAR 1

MEMORY REQUIREMENTS FOR DATA STORAGE

	MINIMUM	MAXIMUM
STORAGE AVAILABLE	320000	
TAPE CALCULATION	9094	
EQUATION CONSTANTS CALCULATION		
CODE CONTAINED ON TAPE STORED	32304	33554
PLANS STORED	14029	17079
FOR STORED	6019	7249
PERTURBATION CALCULATION	7420	47725

DATA WILL BE STORED FOR 1 GROUP, ALL SPACE

MEMORY LOCATIONS RESERVED FOR DATA STORAGE--- 320000
 THE MEMORY LOCATIONS REQUIRED FOR THIS PROB--- 47725
 MEMORY LOCATIONS NOT USED----- 172275

SPECIAL SCRATCH DATASET REQUIREMENTS
 MINIMUM PHYSICAL RECORD IS 7300 WORDS

FILE	CONTAINED	ARRAYS,	CONTROL	36 DATA	172229
FILE 27	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 28	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 29	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 30	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 31	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 32	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 33	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 34	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 35	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 36	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 37	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 38	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 39	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 40	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 41	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 42	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 43	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 44	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 45	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 46	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 47	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 48	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 49	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 50	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 51	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 52	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 53	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 54	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 55	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 56	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 57	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 58	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 59	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 60	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 61	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 62	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 63	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 64	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 65	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 66	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 67	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 68	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 69	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 70	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 71	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 72	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 73	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 74	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 75	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 76	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 77	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 78	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 79	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 80	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 81	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 82	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 83	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 84	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 85	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 86	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 87	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 88	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 89	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 90	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 91	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 92	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 93	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 94	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 95	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 96	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 97	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 98	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 99	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,
FILE 100	DEFINITS	TO CORE	- NO. RECS,	REC. LETH,	TOT. LETH,

INITIAL NETTOW BALANCE (REACTION RATE) INFORMATION FOR FLUX, ADJOINT WEIGHTING CONDITIONS.

	PRODUCTION	ABSORPTION	BLACK ABS.	LEAKAGE	REFLECTIVE
FORWARD FLUX/	1.036220 19/	1.000950 19/	7.535900 16/	0.007500 15/	1.0140359/
ADJOINT FLUX/	1.036220 19/	1.000010 19/	2.992000 16/	3.713600 15/	1.0140360/
POW RTFLUX/	/	/	/	/	1.0140363/
POW RTFLUX/	/	/	/	/	1.0140363/

REGULAR, ADJOINT FLUX INTEGRALS---(DELTA 4)/(K*DELTA 3) WHERE K REPRESENTS MACRO. CROSS SECTIONS. BIG DADDY = 1.0376200-13

ZONE	GRP	AREA, SIGMA, DENSITY	WGT	WGT*SIGMA	DIFF. CORR.
1	1	-3.401967E-01	-5.135061E-01	2.200072E-01	-7.320936E-04
	2	-0.175779E-01	-9.615229E-01	1.050700E 00	-1.692573E-03
	3	-0.002770E-01	-3.770091E-01	0.000050E-01	-0.904026E-04
	4	-0.309313E-02	-5.005500E-02	1.205370E-01	5.305695E-05
2	1	-9.750700E-01	-2.050002E 00	9.053759E-01	-0.000700E-04
	2	-2.070010E 00	-2.615000E 00	3.790525E 00	-7.030050E-04
	3	-1.705053E 00	-1.371011E 00	2.002216E 00	2.672760E-04
	4	-2.335570E-01	-1.035500E-01	3.000612E-01	1.079051E-04
3	1	-1.227001E 00	-2.570311E 00	1.131970E 00	-1.004203E-03
	2	-3.952255E 00	-0.600130E 00	0.999003E 00	-3.190553E-03
	3	-2.270612E 00	-1.025670E 00	0.055900E 00	-0.707000E-04
	4	-3.129000E-01	-2.000000E-01	5.070100E-01	1.207000E-04
4	1	-2.170533E-01	-0.573190E-01	2.002000E-01	-1.292900E-03
	2	-7.319010E-01	-0.007770E-01	9.300310E-01	-3.333000E-03
	3	-0.130070E-01	-3.320397E-01	1.000250E-01	-1.300070E-03
	4	-0.722160E-02	-0.532901E-02	1.150015E-01	-5.130070E-05
5	1	-1.000030E-01	-2.292701E-01	1.000000E-01	-0.150370E-04
	2	-2.720000E-01	-0.370550E-01	0.000197E-01	-9.900000E-04
	3	-2.131000E-01	-1.710000E-01	0.220020E-01	-3.322193E-04
	4	-2.050250E-02	-2.200000E-02	0.217000E-02	2.102290E-05
6	1	-0.000000E-01	-0.307000E-01	0.110000E-01	-0.190000E-04
	2	-1.030370E 00	-1.601030E 00	1.772171E 00	-9.502230E-04
	3	-7.900720E-01	-0.000000E-01	1.302000E 00	-1.015000E-04
	4	-1.100000E-01	-0.707000E-02	1.000000E-01	0.000000E-05
7	1	-5.300000E-01	-1.120700E 00	0.903000E-01	-1.010000E-03
	2	-1.700000E 00	-2.050700E 00	2.371200E 00	-2.303720E-03
	3	-1.000000E 00	-0.250500E-01	1.000000E 00	-0.200000E-04
	4	-1.030000E-01	-1.120250E-01	2.700550E-01	0.022700E-05
8	1	-1.010000E-01	-2.100100E-01	9.301055E-02	-7.025171E-04
	2	-2.000000E-01	-0.100000E-01	0.073012E-01	-1.023717E-03
	3	-1.970072E-01	-1.505102E-01	3.010125E-01	-7.522610E-04
	4	-2.700000E-02	-2.150000E-02	5.015310E-02	-3.103731E-05
9	1	-2.155577E-03	-0.500770E-03	1.020000E-03	-0.632270E-05
	2	-1.000000E-02	-1.202107E-02	1.630000E-02	-1.500000E-04
	3	-0.300000E-03	-5.130000E-03	2.000000E-02	-0.000000E-05
	4	-9.723000E-04	-7.701000E-04	0.010000E-03	-1.013370E-05
10	1	-1.000000E-02	-2.273015E-02	9.732000E-03	-1.750777E-04
	2	-5.123702E-02	-0.000170E-02	7.200000E-02	-5.000000E-04
	3	-2.905500E-02	-2.300130E-02	7.003100E-02	-2.000000E-04
	4	-5.173000E-03	-0.130000E-03	1.050000E-02	-3.901100E-05
11	1	-1.203312E-02	-2.000770E-02	1.132210E-02	-2.110200E-04
	2	-0.070000E-02	-7.153100E-02	0.023000E-02	-0.900000E-04
	3	-1.500000E-02	-2.033700E-02	1.037100E-01	-1.797377E-04
	4	-0.002100E-03	-0.020000E-03	2.270150E-02	-0.000000E-05
12	1	-2.105500E-03	-0.620000E-03	1.000000E-03	-0.900000E-05

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ADJUSTED RESIDUALS WITH PLATE RELATIVE ERROR 2.433500-05

MULTIPLICATION RELIABILITY ESTIMATORS

BY THE SUM OF THE SQUARES OF THE RESIDUALS----- 1.0168364
 UPPER AND LOWER BOUNDS ESTIMATES BY MAX REL PLATE CHANGE----- 1.0168364
 1PERS AND LOWER BOUNDS ESTIMATES OVER ALL SIGNIFICANT POINTS----- 1.0168365

NUMBER OF INNER ITERATIONS, OVER ITERATION ERROR EIGENVALUE, AND OVERRELAXATION COEFFICIENTS 0 0.165330-01

7 4 4

1.42404 1.33166 1.32277 1.34990

CPU AND CLOCK MINUTES REQUIRED FOR THIS EIGENVALUE PROBLEM ARE 3.456 21.563

ADJOINT PLATE ENERGY SPECTRUM BY GROUP, 1 TO MAX, (SUMMED OVER SPACE)

-2.413300-20 -2.097000-20 -1.978770-20 -1.418750-20

ADJOINT PLATE SPACE FUNCTION BY ZONE (SUMMED OVER ENERGY)

8.376510-19 2.480900-18 -5.433900-19 -8.507300-19 7.265920-19 -6.942370-19 -6.470270-19 -4.399700-21
 8.344470-20 -1.780220-19 -1.865550-19 2.236000-18 3.152990-18 -2.511510-18 8.464330-19 5.092890-19 -2.040000-18
 4.384470-20 -1.225570-20 -2.957210-19 -4.418740-20 -2.492010-20 1.567870-18 4.936210-19 -2.320000-21 -2.264090-20
 1.178440-18 1.041710-18 1.197090-19 -2.037190-20 1.568070-18 4.951040-19 3.309220-20 -2.364490-20 1.168130-18
 -7.751960-20 -4.417070-20 -2.704960-20 -2.233000-18 -1.767410-18 -3.745030-19 -3.282330-20 -2.353960-18 -1.767500-18
 -3.751070-19 -3.284410-20 -2.197380-18 -1.755470-18 -3.460940-19 -3.215590-20 0.0

*****NOTE - A NEW VERSION OF APLXIS IS BEING WRITTEN

PCINT ADJOINT PLATE INTERPAC FILE APLXIS (VERSION 2) HAS BEEN WRITTEN ON UNIT NUMBER 35

TOTAL CPU MINUTES USED 3.500 TOTAL CLOCK MINUTES USED 23.496 TOTAL I/O USED 3966

FUEL.MG -- FUEL MANAGEMENT -- POSITIONING AND ACCOUNTING MODULE VERSION Y 1.9 3/24/81 QA LEVEL 0

INIT: REFUEL INSTRUCTIONS FROM "REFUEL" RECORD IN FILE "CONTROL"

TASK OPTION, TASK	0
REFUEL OPTION, REFUEL	1
EXHAUST FILE REFUEL OPTION, REFUEL	0
EXHAUST BACKUP FILE OPTION, REFUEL	0
CONTINUOUS FUELING FILE OPTION, REFUEL	0
NORMAL F.L. DELETE OPTION, REFUEL	0
VOLUME RESTART FACTOR, REFUEL	1.00000E-02
INSTRUCTION SETS TO EXECUTE, REFUEL	1 0 0 0
FRACTION OF WHOLE REACTOR TYPED, REFUEL	0.33333E-02
THERMAL POWER OF REACTOR, POWER1	0.42067E-08
THERMAL CONVERSION FACTOR, THERM1	3.33333E-01
FUEL CONSUMPTION RATE PER UNIT THERMAL ENERGY, CHERM1	1.30000E-09

CASE TITLE - SUPER SAMPLE PROBLEM.

INIT: THE MAXIMUM VALUES ARE -- REFUEL = 3 RESTART = 3

WRITING OLD ZONE ATOM DENSITY BACKUP FILE, EXHAUST VERSION 3, ON UNIT 30 FOR BACKUP OF EXHAUST FILE

TAKE BALANCE FILE, NORMAL VERSION 1, HAS BEEN OPENED ON UNIT 31

DATA FROM REFUEL FILE FOLLOWS (REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF) --

DATA FROM REFUEL FILE FOLLOWS (REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF) --

DATA FROM EXHAUST FILE FOLLOWS (TIME,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF,REF) --

INIT:

REFUEL TO UNIT 0 IS 14 VERSION 1
 REFUEL TO UNIT 0 IS 16 VERSION 1
 EXHAUST TO UNIT 0 IS 17 VERSION 1
 EXHAUST TO UNIT 0 IS 30 VERSION 2

REFUEL: MEMORY POINTERS FOR REFUEL. 352 WORDS ALLOCATED.

REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL	REFUEL
1	1	33	33	110	137	150	175	175	175	175	175	175	175	175
232	249	269	304	327	337	338	339	339	339	339	339	339	339	339
341	344													

REFUEL: WARNING - CONTROL WORDS IN REFUEL INTERFACE FILE SPECIFY "TRANSITION DATA FOR FUEL RECYCLE" IS NOT PRESENT

REFUEL: MEMORY POINTERS FOR EXHAUST. 908 WORDS ALLOCATED.

REFUEL	REFUEL
1101	1101

ZONE ATOM DENSITY DATA READ FROM FILE EXHAUST VERSION 1 ON UNIT 17 - TIME= 5.11000E-02 DAYS, CYCLE= 0

WARNING: NO NAMES WERE FOUND TO BUILD THE DEFAULT NUC (NOT ACCOUNTED FOR) NUCLEON REFERENCE NAME LIST. EITHER ALL LIBRARY MATERIALS ARE PRESENT IN THE NUC (ACCOUNTED FOR) NUCLEON REFERENCE NAME LIST OR THE LIBRARY MATERIALS ARE NOT PRESENT

ESTIMATED INSOLUBLE POINT FLUX RELATIVE ERROR 2.69704D-04

MULTIPLICATION RELIABILITY ESTIMATOR					

SUBSTANTIAL BALANCE EFFECTIVE-----					
BY THE SUM OF THE SQUARES OF THE RESIDUES-----					
				1.0201883	
				1.0201883	
				1.0201921	1.0201047
				1.0214350	1.0165860

UPPER AND LOWER BOUNDS ESTIMATES OVER ALL SIGNIFICANT POINTS-----					

UPPER AND LOWER BOUNDS ESTIMATES OVER ALL SIGNIFICANT POINTS-----					

NUMBER OF INNER ITERATIONS, OUTER ITERATION ERROR EIGENVALUE, AND OVERRELAXATION COEFFICIENTS					
					* 8.42877D-01
	1.30035	1.47157	1.32806	1.36648	

TIME AND CLOCK RANGES REQUIRED FOR THIS EIGENVALUE PROBLEM ARE 1.268 3.517					
				24	6
				27	6

LEAKAGE 5.70895E 14 TOTAL LOSSES 1.79819E 19 TOTAL PRODUCTIONS 1.83882E 19 REACTOR POWER (WATTS) 2.55420E 09					

ESTIMATE FISSILE CONVERSION RATIO IS 1.26755D 00. ESTIMATE FOR CRITICAL SYSTEM IS 1.40605D 00					

FISSILE DISTRIBUTION AND HEAT ENERGY (MW/MW-THERM) IS 2.90743D 10					

TWO-DAY MEASUREMENT		LEAKAGE		TOP		BOTTOM		FRONT		BACK	
LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	2.28	2.28	14	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.70	2.70	14	0.0

XI. RECENT EXTENSIONS

Described here are extensions to some of the modules in the system.

A. VENTURE NEUTRONICS, VERSION III

Numerous changes have been made to the VENTURE neutronics module² since the release of Version II. The major extensions are described below.

1. The Uncommon Reactor Core Neutronics Problem

The common reactor core neutronics problems have fundamental neutron space energy spectrum solutions. In a typical problem, one finds the most positive eigenvalue associated with an all-positive flux for the pseudo-steady-state condition (k_{eff}), or one achieves the critical state by selective adjustment of some variable such as the fuel concentration. With sophistication in reactor analysis has come the demand for solutions of other, uncommon neutronics problems. Importance functions are needed for sensitivity and uncertainty analyses, as for ratios of integral reaction rates such as the fuel conversion (breeding) ratio. The dominant higher harmonic solution is needed in stability analysis. Typically the desired neutronics solution must contain negative values to qualify as a higher harmonic or to satisfy a fixed source containing negative values. Both regular and adjoint solutions as well as special integrals of the solutions are of interest to support analysis.

A general procedure has been implemented for removing the fundamental contribution to the iterate estimate of the harmonic source each outer iteration. Instead of a flux correction, source correction based orthogonality properties is done⁹ during iteration to avoid cost of processing group dependent data. Given the local fission source associated with meshpoint i and harmonic n , the sum over energy groups g ,

$$S_{i,n} = \sum_g \nu \Sigma_{f,g,i} \phi_{g,i,n} \quad (1)$$

and the importance,

$$I_{i,n}^* = \sum_g \chi_{g,i} \phi_{g,i,n}^* \quad (2)$$

the source correction to remove any fundamental contribution is

$$S_{i,1} = S_{i,1} - S_{i,0} \frac{\sum_i S_{i,1} I_{i,0}^* V_i}{\sum_i S_{i,0} I_{i,0} V_i} \quad (3)$$

where index $n = 0$ is used for the fundamental, and $n = 1$ for the harmonic, because

$$\sum_i I_{i,n}^* S_{i,m} V_i = 0, n \neq m, \quad (4)$$

and for the adjoint,

$$I_{i,1}^* = I_{i,1}^* - I_{i,0}^* \frac{\sum_i I_{i,1}^* S_{i,0} V_i}{\sum_i I_{i,0}^* S_{i,0} V_i}$$

So for either the regular or adjoint (transposed) harmonic problem, be it eigenvalue or fixed source, a source correction is made at the start of each outer iteration. Usual acceleration procedures with small changes are used to drive the iterate estimate to a solution. Note that since the integral fission source tends to be near zero for the harmonic, a special procedure is necessary to produce accurate eigenvalue estimates. We sum absolute values. For the fixed source sensitivity importance problem, this procedure avoids the difficulty experienced without removal of the fundamental contribution where the contamination is so severe that reliability of the solution is questionable. In principle, any harmonic may be solved by successive removal of the contamination from each of the higher harmonics. Other procedures used for solving simple problems are not attractive for the multi-dimensional problems.

Another efficient procedure has been implemented. Consider that the transport term for an untreated simple coordinate is simply

$$-\frac{\partial^2 \phi_n}{\partial x^2} = D B_n^2 \phi_n, \quad (6)$$

but for the azimuthal coordinate,

$$-\frac{D}{r^2} \frac{\partial^2 \phi_n}{\partial \theta^2} = D \frac{B_n^2}{r^2} \phi_n \quad (7)$$

For the azimuthal fundamental, $B_0^2 = 0$ and for the first harmonic $B_1^2 = 1$. Thus by including a space dependent loss term of D/r^2 , the solution for the azimuthal symmetry (or when so approximated) may be computed using two-dimensional (RZ) geometry rather than treating three-dimensional (ØRZ) geometry. This harmonic is of special importance in stability analysis since it is often dominant.

Shown in Fig. 14 is the dependence of the eigenvalue separation ($1/k_1 - 1$) on the core height of a large gas-cooled high-temperature thermal reactor core modeled as a bare homogeneous problem.

There are a number of aspects that impact the ability to produce reliable solutions. For example, given eigenvalues ordered $k_0 > k_1 > k_2 > k_3 \dots$, there tends to be a large separation between k_0 and k_1 , but not between k_1 and k_2 , making the harmonic more difficult to solve by iteration than the fundamental.

Fig. 14. Eigenvalue Separation for the Dominant Harmonics (Bare Homogeneous Pebble Bed Reactor Model).

2. Space-Energy Rebalance

Space-energy rebalance has been implemented to try to accelerate outer iteration convergence. It is available only for one-dimensional slab (X), cylindrical(R), or spherical(S) geometry; two-dimensional slab (X-Y), or cylindrical(R-Z) geometry; and three-dimensional slab (X-Y-Z) geometry. Problems to be rebalanced must not contain internal black absorber zones or have zone dependent fission spectrum. They must be forced to run in the "space stored" mode, since the procedure of calculation was not implemented in the other modes.

If a problem is to be rebalanced in space and energy, the user specifies the number of coarse mesh intervals in each dimension. Then after any asymptotic flux extrapolation, the fluxes contained in each rebalance block are multiplied by a rebalance factor for that block.

The block rebalance factors are calculated as

$$F(B,K)_n = \frac{\sum_{KK} S(B,K,KK)F(B,KK) + \frac{1}{k_n} X(K)X(B)_n + \sum_P L(F,B',K)F(B',K)}{A(B,K) + \sum_P L(P,B,K)} \quad (8)$$

where:

$$X(B)_n = \sum_K Q(B,K)F(B,K),$$

$$Q(B,K) = \sum_{i \in B} v \Sigma f(i,K) V(i) \phi(i,K),$$

$$k_n = \frac{k_{n-1} \sum_B X(B)_n}{\sum_B X(B)_{n-1}}$$

$$S(B,K,KK) = \sum_{KK} \sum_{i \in B} \Sigma S(i, KK \rightarrow K) V(i) \phi(i, KK),$$

$$A(B,K) = \sum_{i \in B} [\Sigma A + \Sigma R + DB^2](i,K) V(i) \phi(i,K),$$

$$L(P,B,K) = \sum_{i \in B} LCON(i,K) \phi(i,K),$$

$\chi(K)$ = group dependent fission spectrum

B = block index

B' = adjoining block index

K, KK = energy group index

i = mesh point index

P = block boundary mesh points index

$\phi(i,K)$ = flux

n = iteration number.

Equation (E) is iterated until for some input convergence criterion, ϵ ,

$$\max \left| \frac{F(B,K)_n - F(B,K)_{n-1}}{F(B,K)_{n-1}} \right| < \epsilon$$

The iteration process is accelerated by overrelaxation

$$F(B,K)_n = F(B,K)_{n-1} + \beta_k [F^*(B,K)_n - F(B,K)_{n-1}]$$

where β_k = calculated overrelaxation factor for the rebalance process at each group.

The final values of $F(B,K)$ are then adjusted by the linear formulation

$$F(B,k) = 1.0 + \alpha_1 [F(B,K) - 1.0]$$

where α_1 is input (defaulted to 1.0, no adjustment).

A linear space interpolation of the final rebalance factors is then done on rows or two-dimensional planes with a second free parameter, for example at meshpoint i ,

$$F_i = F_{i-1} + \alpha_2 \left(\frac{\Delta F}{\Delta X} \right),$$

where α_2 is input (defaulted to 1.0) and $\Delta F/\Delta X$ is the derivative obtained by assuming that the calculated block rebalance factors apply at block centers. Note that α_2 may be < 1 , while $\alpha_1 > 1$.

Our experience with this procedure has shown that indeed those problems having slow spacial convergence properties may be accelerated, and the rebalance procedure would be especially impressive if we were not using asymptotic extrapolation procedures. Given effective outer iteration extrapolation, rebalancing appears to be of marginal benefit and often not worth its cost, especially on typical problems. Typically, we found a specific procedure (linear interpolation or not, for example) and a specific blocking (arrangement of spacial rebalance zones involving internal meshpoint assignments) to be remarkably effective. But a guide to selecting all of these factors is unknown. When 6 meshpoints per block along one coordinate is much more effective than either 5 or 7, we don't know how to predict this. Typically one needs many blocks and the rebalance cost becomes significant. Incidentally these procedures work with one meshpoint per block producing the solution in one iteration, but generally not at a cost competitive with the usual iterative solution procedures.

3. Other Extensions

A number of other extensions are noted briefly here. Generally these were found to be needed in application and they were simple in application and they were simple to implement.

- a. The diffusion coefficients are adjusted in all zones up to a specified number by

$$D'_{K,Z} = \alpha_1 + \alpha_2 D_{K,Z}$$

where α_1 and α_2 are input values and $D_{K,Z}$ is the value calculated for group K and zone Z. One may want to know the effect of changing the values or might have correlating data to adjust for heterogeneous effects which tend to increase D.

- b. Instead of writing the adjoint flux on the interface data file, an option was implemented to write the space, energy point values of the product of the regular and the adjoint flux, $\phi_o^* \phi_o$ instead of ϕ_o^* . Thus subsequent integrals that usually involve $\phi_o^* \phi_o$ become $\phi_1 \phi_o^* \phi_o$ if ϕ_1 is available, typically a desired harmonic ϕ_1 weighting as for stability. Generally some attention must be paid to the normalization factors to produce absolute values from the integrals.
- c. Using the above option, the integral

$$I_1 = \sum_i \frac{\phi_1 \phi_o^* \phi_o E \Delta V_i}{\gamma + Q \phi_1},$$

where E is the energy per unit flux (not a constant), is done for only the bottom energy group (assumed to be thermal) producing information useful for assessing stability against xenon driven oscillation, where Q is input $[(\sigma/\lambda) \times 10^{-24}$ for Xe^{135} in the thermal range] and γ is 1.0 for reference conditions, 2.0 for half the reference power level and is 0.5 for twice the power level. Also the integral over space and energy is obtained

$$I_2 = \sum_i \phi_o^* \phi_o E \Delta V_i,$$

where $\phi_o^* \phi_o$ can be one $\phi_1 \phi_o^* \phi_o$.

- d. The fixed source over space may now be calculated for the power density importance,

$$S_i = \frac{-E_i \Delta V_i}{P f} + \delta_j \frac{E_j}{d_j}$$

where P is the reactor power level, d_j is the local power density, f is the core fraction treated, and the delta function δ_j means a local value applies at only a selected point.

Several options are implemented for selecting the reference point including location of the peak power density. Note that there are special considerations when the point falls on one or more symmetry boundaries. Subsequent calculations are required to generate the importance function (a fixed source neutronics problem often solved by VENTURE) free from fundamental contamination, and then special space, energy integrals must usually be obtained.

4. Equilibrium Xenon

For some thermal reactor cores, the flux distribution is sensitive to the Xe^{135} distribution. This can make it difficult to obtain an accurate history calculation without using very short exposure periods that may cause the computer cost to be prohibitively high. A gross macroscopic equilibrium xenon calculation has been programmed. Incidentally, the implementation is general so that any other situation satisfying the equations may be treated. Consider the local Xe^{135} concentration to be given by

$$\frac{dN}{dt} = - \left(\lambda \times 10^{24} + \int \sigma(E) \phi(E) \right) N + yF = 0,$$

where F is the fission rate, N is the nuclide concentration, σ its cross section. The user must identify the data to be used and supply effective values for the yield fraction y and decay constant λ . The capture loss is included as sink during iterative solution of the non-linear equations.

B. PERTUBAT PERTURBATION ANALYSIS

Delayed neutron behavior calculations have been added to the PERTUBAT perturbation analysis module.⁵ These calculations are done if the microscopic group delayed neutron precursor data interface file DLAYXS is available for use by the module. The equations solved are described below.

Definitions

f = delayed neutron family subscript

g, gg = energy group subscripts

- i = space point subscript
 m = material zone subscript
 n = nuclide subscript associated with delayed neutrons
 $A_{g,f}$ = fraction of delayed neutrons emitted into group g from precursor family f
 B_f = delayed neutron precursor decay constant for family f
 $C_{n,m}$ = nuclide concentration
 $D_{gg,f,n}$ = number of delayed neutron precursors produced in family f per fission in group gg and nuclide n
 $\sigma_{n,gg}$ = microscopic fission cross section
 $\phi_{i,gg}$ = regular flux
 $\phi_{i,g}^*$ = adjoint flux
 $\nu\Sigma_{m,gg}$ = macroscopic production cross section
 $\chi_{m,g}$ = fission spectrum
 V_i = element volume
 $S_{m,gg,g} = \sum_{i \in m} \phi_{i,gg} \phi_{i,g}^* V_i$
 $T = \sum_{i \in m} V_i \sum_g \chi_{m,g} \phi_{i,g} \sum_{gg} \nu\Sigma_{m,gg} \phi_{i,gg}^{-1}$
 $U_{n,f,g} = \sum_{gg} D_{gg,f,n} \sum_m \sigma_{n,gg} C_{n,m} S_{m,gg,g}$
 $W_{n,f} = T \sum_g A_{g,f} U_{n,f,g}$

Reported for Output

1. Delayed neutron contribution

$$\text{by nuclide} - \beta_n = \sum_f W_{n,f}$$

$$\text{by family} - \beta_f = \sum_n W_{n,f}$$

$$\text{total} - \beta_{eff} = \sum_n \sum_f W_{n,f}$$

2. Distribution by group

$$x_g = \frac{I}{\beta_{eff}} \sum_n \sum_f A_{g,f} U_{n,f,g}$$

3. Delayed neutron source after clean shutdown

$$y_{f,t} = \beta_f e^{-\beta_f t}$$

4. Delayed neutron source

$$z_{f,t} = y_{f,t} \frac{\alpha + \beta_f e^{(\alpha + \beta_f)t}}{\alpha + \beta_f t}$$

where for 3. and 4.,

$$t = 0.0, 0.001, 0.01, 0.1, 1.0, 10.0, \text{ and } 100.0$$

and where for 4.

$$\alpha = X(7) \text{ and } XX(8) \text{ from the PERINS record of the file}$$

CONTRL. If not specified, α values are -0.05 and +0.05.

C. TEMPERATURE CORRELATION

The VENTURE neutronics module,² the REACTION RATE module,² and the EXPOSURE module³ have been extended so that a temperature correlation of the microscopic cross sections may be applied. An inconvenience to the user is that each module must be informed to apply the correlation and no proof testing is done to see that the instructions are consistent. The equation is applied to all microscopic cross sections,

$$\sigma(T) = \sigma(T_1) + \frac{\tan^{-1} \left[\frac{\alpha(T-T_1)}{T_2-T_1} \right]}{\tan^{-1}(\alpha)} \left[\sigma(T_2) - \sigma(T_1) \right]$$

where α and the reference temperatures T_1 and T_2 must be specified.

D. SPECIAL MODULES

A special module has been added recently to the system to perform such tasks as expanding a flux file or combine two to increase the number of geometric dimensions. This new capability is discussed in Section 8.

REFERENCES

1. D. R. Vondy, T. B. Fowler, G. W. Cunningham, and L. M. Petrie, "A Computation System for Nuclear Reactor Core Analysis," ORNL-5158 (April 1977).
2. D. R. Vondy, T. B. Fowler, and G. W. Cunningham, "VENTURE: A Code Block for Solving Multigroup Neutronics Problems Applying the Finite-Difference Diffusion-Theory Approximation to Neutron Transport--Version II," ORNL-5062/R1 (November 1977).
3. D. R. Vondy and G. W. Cunningham, "Exposure Calculation Code Module: BURNER," ORNL-5180 (February 1979).
4. D. R. Vondy, T. B. Fowler, and G. W. Cunningham, "Input Data Requirements for Special Processors in the Computation System Containing the VENTURE Neutronics Code," ORNL-5229/R1 (July 1979).
5. D. R. Vondy and T. B. Fowler, "The Code PERTUBAT for Processing Neutron Diffusion Theory Neutronics Results for Perturbation Analysis," ORNL-5376 (March 1978).
6. D. R. Vondy and T. B. Fowler, "RODMOD-A Code for Control Rod Positioning," ORNL-5466 (November 1978).
7. D. R. Vondy and T. B. Fowler, "Reference Test Problems for the VENTURE Neutronics and Related Computer Codes," ERDA Report ORNL/TM-5887 (August 1977).
8. G. E. Bosler, R. D. O'Dell, and W. M. Resnik, "LASIP-III, A Generalized Processor for Standard Interface Files," LA-6280-MS (April 1976).
9. R. L. Childs, "Generalized Perturbation Theory Using Two-Dimensional Discrete Ordinates Transport Theory," ORNL/CSD/TM-127 (June 1980).
10. VALE, Advanced Triangular Neutronics to be documented.
11. Fuel management to be documented.
12. Thermal hydraulics to be documented.

APPENDIX A

DATA STORAGE REQUIREMENTS FOR THE VENTURE NEUTRONICS
AND BURNER CODES

The equations that determine the memory and scratch data file storage requirements for VENTURE neutronics and BURNER depletion problems as dependent on the mode of calculation have been programmed to produce specific information. These programs are being distributed with the code for use at other installations. They are available for use on the ORNL computers. Documentation of local use is shown by requirements in Figures A.1 and A.3 and edit in Figures A.2 and A.4.

For large problems for VENTURE we strongly recommend that the data storage be determined. Usually, for three-dimensional problems the multi-plane stored mode must be used, and usually, enough memory must be allocated to store as many planes of data as the maximum number of inner iterations to minimize data transfer. The requirements depend on the number of inner iterations (which should be determined by the code unless known). See special input processor (DVENTR) section 001. $ICX11 = 0$, $ICX12 = 969$ for a special run to determine the number of inners (and also storage); or in the DTNINS record of the CONTRL file, $IX(20) = 969$, $IX(21) = 0$.

The authors do believe that documentation for a code should present the information required by users to determine storage requirements. When a code attempts to cover a very broad range of problem type and provides great flexibility in data handling to balance storage and transfer, the equations become extremely involved and not practical to use routinely. Fortran listings of coding used to calculate storage could be included here, but the many lines would waste many pages and serve little utility. We recommend using these codes, using the VENTURE code proper, and relying on past experience.

FIGURE A.1. INPUT FOR VENTURE STORAGE REQUIREMENTS.

```

                                JOB CONTROL INSTRUCTIONS
//USERID  JOB (CHARG), 'USER ADDRESS      ', HSGLEVEL= (1,1)
//CLASS CPU91=105, IO=1, REGION=270K, LINES=1, CARDS=0
//STEP EXEC LINKGO,
// REGION.GO=270K
//LKED. VENTSTOR DD UNIT=3330, VOLUME=SER=ZX1111, DISP=SHR,
// DSN=HRE=X.TBP14650. VENTSTOR
//LKED. SYSIN DD *
// INCLUDE VENTSTOR
//
//GO. PT05F001 DD *
//
//

```

INPUT DESCRIPTION

```

C-----C
C      INPUT FORMAT IS W1((10A4)/*(12I6)/W2(I6)). W1 AND W2 ARE C
C      VARIABLES. C
C      C
C      CARD 1 - HOLLERITH TITLE. C
C      C
C      CARDS 2-5 ARE INTEGERS IN THE STANDARD INTERFACES C
C      GEODST, GRUPIX, NDXSHF, AND SEARCH (EXCEPT THE C
C      LAST THREE INTEGERS). THE FIRST SEVEN NUMBERS C
C      (IGON THRU NGROUP) ARE NECESSARY TO COMPUTE C
C      REQUIREMENTS FOR THE ITERATIVE PROCEDURE. IF THE C
C      REST OF THE NUMBERS ARE INPUT ZERO, THE REQUIREMENTS C
C      FOR THE MACRO., CNSTS., AND INITIALIZATION PROCEDURES C
C      WILL BE INCORRECT. C
C      C
C      COLUMNS  NAME  INTERFACE C
C      -----  ----  - C
C      CARD 2 - ( 1- 6)  IGON  (GEODST) C
C      ( 7-12)  NZONE  (GEODST) C
C      (13-18)  NINTI  (GEODST) C
C      (19-24)  NINTJ  (GEODST) C
C      (25-30)  NINTK  (GEODST) C
C      (31-36)  NZWBB  (GEODST) C
C      (37-42)  NGROUP  (GRUPIX) C
C      (43-48)  NISO  (GRUPIX) C
C      (49-54)  NAXUP  (GRUPIX) C
C      (55-60)  NAXDN  (GRUPIX) C
C      (61-66)  NAXORD  (GRUPIX) C
C      (67-72)  NPSCS  (GRUPIX) C
C      CARD 3 - ( 1- 6)  NSTRPD  (GRUPIX) C
C      ( 7-12)  NSCHAX  (GRUPIX) C
C      (13-18)  NSBLOK  (GRUPIX) C
C      (19-24)  NREG  (GEODST) C
C      (25-30)  NCINTI  (GEODST) C
C      (31-36)  NCINTJ  (GEODST) C
C      (37-42)  NCINTK  (GEODST) C
C      (43-48)  INB1  (GEODST) C

```

(CONT)

```

C          (49-54)  INB2      (GEODST)
C          (55-60)  JNB1      (GEODST)
C          (60-66)  JNB2      (GEODST)
C          (67-72)  KNB1      (GEODST)
C  CARD 4 - ( 1- 6)  KNB2      (GEODST)
C          ( 7-12)  WBS       (GEODST)
C          (13-18)  WBCS      (GEODST)
C          (19-24)  WBCS      (GEODST)
C          (25-30)  WTRIAG    (GEODST)
C          (31-36)  WRASS     (GEODST)
C          (37-42)  WSH       (NDXSRF)
C          (43-48)  WWS       (NDXSRF)
C          (49-54)  WAN       (NDXSRF)
C          (55-60)  WSZ       (NDXSRF)
C          (61-66)  ISRCH     (SEARCH)
C          (67-72)  WHAKHP    (SEARCH)
C  CARD 5 - ( 1- 6)  WISOR    (SEARCH)
C          ( 7-12)  WSETS     (SEARCH)
C          (13-18)  WPS       GT.0 FOR FIXED SOURCE PROBLEMS.
C          (19-24)  WPI       GT.0 FOR CONSISTANT P1 PROBLEMS.
C          (25-30)  WADJ      GT.0 FOR ADJOINT AND/OR PERTUBATIONS.
C          (31-36)  WPRIT     GT.0 FOR WRITING RTPLUX OR ATPLUX.
C          (37-42)  WPRAT     GT.0 FOR WRITING PWDINT.
C          (43-48)  UNDEFINED.
C          (49-54)  UNDEFINED.
C          (55-60)  UNDEFINED.
C          (61-66)  UNDEFINED.
C          (67-72)  UNDEFINED.
C
C  THE NEXT INPUT CARDS GIVE THE DATA ARRAY SIZE (COLUMNS 1-6) FOR
C  AS MANY DIFFERENT ARRAY SIZES AS DESIRED, ENDING WITH A BLANK CARD.
C  THE CODE THEN LOOPS TO READ A NEW TITLE CARD. A BLANK TITLE CARD
C  ENDS THE RUN.
C-----C

```

```

              SAMPLE INPUT
PROBLEM TITLE = SUPER SAMPLE PROBLEM.
  17   52   50   25   4    1    4   49    0    3    0   343
   0    1    1  123   1    1    4    1    2    1    2    2
   1    0    0    0    1    0    4   19   19    0    0    0
   0    0    0    0    1    1    1    0    0    0    0    0

```

500C3

100000

0

COMMENT - A BLANK CARD OR NEW PROBLEM TITLE CARD GOES HERE.

Figure A.2. Edit for Sample Calculation-Venture Storage Requirements

MEMORY REQUIREMENTS FOR DATA STORAGE				
TOTAL	A	B	C	D
MINIMUM				
50000				
3673				
STORAGE AVAILABLE				
FACTORY CALCULATION				
EQUATION CONSTANTS CALCULATION				
CORE CONTAINED ON SPACE STORED	32306	33554		
PLANE STORED	15029	17079		
FOR STORED	6019	7269		
INITIAL PLAT	17053	18303		
CORE CONTAINED ON SPACE STORED	14531	18281		
OTHER MODES	4531	8281		
ITERATIVE PROCESS				
CORE CONTAINED	207214	176202	2171	2290
SPACE STORED	69556	66551	2171	0
2 PLANE STORED	40657	37652	2171	0
1 PLANE STORED	25581	22576	2171	0
25 ROWS STORED	19605	16600	2171	0
1 ROW STORED	3005	0	834	0
2 MULTI-LEVEL PLANE STORED	48105	7500	834	37600
PERMUTATION CALCULATION	31250			

DATA WILL BE STORED FOR 1 GROUP, 2 PLANES

MEMORY LOCATIONS RESERVED FOR DATA STORAGE--- 50000
 MAX MEMORY LOCATIONS REQUIRED FOR THIS PROB-- 40657
 REMOIT LOCATIONS NOT USED----- 9343

SPECIAL SCRAMBLE DATASET REQUIREMENTS
 MAXIMUM PHYSICAL RECORD IS 7200 WORDS
 DIRECT ACCESS FILE 24 REQUIRES 16 RECORDS 2500 WORDS IN LENGTH
 DIRECT ACCESS FILE 27 REQUIRES 16 RECORDS 2500 WORDS IN LENGTH
 DIRECT ACCESS FILE 28 REQUIRES 16 RECORDS 2500 WORDS IN LENGTH
 DIRECT ACCESS FILE 40 REQUIRES 16 RECORDS 10075 WORDS IN LENGTH

DO PARAMETERS FOLLOW FOR B1 = 3520 AND B2 = 32000

N12= 51 N4= 10 N4= 1 N5= 23 N6= 10 N7= 2 N8= 2 N9= 13 N10= 13 N11= 16 N12= 1 N13= 13 N14= 1 N15= 10
 (NOTE THAT IF THE VALUES ARE TO BE EXPANDED FROM EXISTING REPLY, N10= 51)

REQUIRED DISK STORAGE SPACE FOR PLUX(UNITS 24,27,28) IS 179520 BYTES.
 FOR CONSTANTS(UNIT 40) IS-- 736000 BYTES.
 FOR CONSTANTS(UNIT 23) IS-- 35200 BYTES.
 REQUIRED TOTAL DISK STORAGE SPACE IS----- 7460160 BYTES.

FOR THE ASSIGNED DATA STORAGE, THE REQUIRED REGION SIZE IS APPROXIMATELY 530K BYTES

MEMORY REQUIREMENTS FOR DATA STORAGE

	TOTAL		A	B	C	D
	MINIMUM	MAXIMUM				
STORAGE AVAILABLE	75000					
MACRO CALCULATION	3673					
EQUATION CONSTANTS CALCULATION						
CORE CONTAINED OR SPACE STORED	32304	33554				
PLANE STORED	15829	17079				
ROW STORED	6019	7269				
MULTI-LEVEL PLANE STORED	17053	18303				
INITIAL FLUX						
CORE CONTAINED OR SPACE STORED	14531	18281				
OTHER MODES	4531	8281				
ITERATIVE PROCESS						
CORE CONTAINED	207214	176202	2171	2290	26551	
SPACE STORED	69556	66551	2171	834	0	
4 PLANES STORED	70809	67804	2171	834	0	
1 PLANE STORED	25581	22576	2171	834	0	
25 ROWS STORED	19605	16600	2171	834	0	
1 ROW STORED	3005	0	2171	834	0	
3 MULTI-LEVEL PLANES STORED	64405	7500	2171	834	53900	
PERTURBATION CALCULATION	47725					

DATA WILL BE STORED FOR 1 GROUP, ALL SPACE

MEMORY LOCATIONS RESERVED FOR DATA STORAGE--- 75000
 MAX MEMORY LOCATIONS REQUIRED FOR THIS PROB-- 64556
 MEMORY LOCATIONS NOT USED----- 5444

SPECIAL SCRATCH DATASET REQUIREMENTS
 MAXIMUM PHYSICAL RECORD IS 7200 WORDS
 DIRECT ACCESS FILE 24 REQUIRES 4 RECORDS 10000 WORDS IN LENGTH
 DIRECT ACCESS FILE 27 REQUIRES 4 RECORDS 10000 WORDS IN LENGTH
 DIRECT ACCESS FILE 28 REQUIRES 4 RECORDS 10000 WORDS IN LENGTH
 DIRECT ACCESS FILE 40 REQUIRES 4 RECORDS 26550 WORDS IN LENGTH

DD PARAMETERS FOLLOW FOR B1 = 3520 AND B2 = 32000
 N2= 51 N3= 10 N4= 1 N5= 23 N6= 10 N7= 2 N8= 2 N9= 13 N10= 13 N11= 16 N12= 1 N13= 13 N14= 1 N15= 10
 N16= 51 (NOTE THAT IF THE FLUXES ARE TO BE EXPANDED FROM EXISTING REFLUX, N10= 51)

REQUIRED DISK STORAGE SPACE FOR FLUX(UNITS 24,27,28) IS 179520 BYTES.
 FOR CONSTANTS(UNIT 40) IS-- 736000 BYTES.
 FOR CONSTANTS(UNIT 23) IS-- 35200 BYTES.
 REQUIRED TOTAL DISK STORAGE SPACE IS----- 7460160 BYTES.

FOR THE ASSIGNED DATA STORAGE, THE REQUIRED REGION SIZE IS APPROXIMATELY 630K BYTES

MEMORY REQUIREMENTS FOR DATA STORAGE

	TOTAL		A	B	C	D
	MINIMUM	MAXIMUM				
STORAGE AVAILABLE	100000					
MACRO CALCULATION	3673					
EQUATION CONSTANTS CALCULATION						
CORE CONTAINED OR SPACE STORED	32304	33554				
PLANE STORED	15829	17079				
ROW STORED	6019	7269				
MULTI-LEVEL PLANE STORED	17053	18303				
INITIAL FLUX						
CORE CONTAINED OR SPACE STORED	14531	18281				
OTHER NODES	4531	8281				
ITERATIVE PROCESS						
CORE CONTAINED	207214	176202	2171	2290	26551	
SPACE STORED	69556	66551	2171	834	0	
4 PLANES STORED	70809	67804	2171	834	0	
1 PLANE STORED	25581	22576	2171	834	0	
25 ROWS STORED	19605	16600	2171	834	0	
1 ROW STORED	3005	0	2171	834	0	
4 MULTI-LEVEL PLANES STORED	80705	7500	2171	834	70200	
PERTURBATION CALCULATION	47725					

DATA WILL BE STORED FOR 1 GROUP, ALL SPACE

MEMORY LOCATIONS RESERVED FOR DATA STORAGE--- 100000
 MAX MEMORY LOCATIONS REQUIRED FOR THIS PROB--- 69556
 MEMORY LOCATIONS NOT USED----- 30444

SPECIAL SCRATCH DATASET REQUIREMENTS
 MAXIMUM PHYSICAL RECORD IS 7200 WORDS
 DIRECT ACCESS FILE 24 REQUIRES 4 RECORDS 10000 WORDS IN LENGTH
 DIRECT ACCESS FILE 27 REQUIRES 4 RECORDS 10000 WORDS IN LENGTH
 DIRECT ACCESS FILE 28 REQUIRES 4 RECORDS 10000 WORDS IN LENGTH
 DIRECT ACCESS FILE 40 REQUIRES 4 RECORDS 26550 WORDS IN LENGTH

DD PARAMETERS FOLLOW FOR B1 = 3520 AND B2 = 32000
 N2= 51 N3= 10 N4= 1 N5= 23 N6= 10 N7= 2 N8= 2 N9= 13 N10= 13 N11= 16 N12= 1 N13= 13 N14= 1 N15= 10
 N16= 51 (NOTE THAT IF THE FLUXES ARE TO BE EXPANDED FROM EXISTING REFLUX, N10= 51)

REQUIRED DISK STORAGE SPACE FOR FLUX(UNITS 24,27,28) IS 179520 BYTES.
 FOR CONSTANTS(UNIT 40) IS-- 736000 BYTES.
 FOR CONSTANTS(UNIT 23) IS-- 35200 BYTES.
 REQUIRED TOTAL DISK STORAGE SPACE IS----- 7460160 BYTES.

FOR THE ASSIGNED DATA STORAGE, THE REQUIRED REGION SIZE IS APPROXIMATELY 730K BYTES

INC0021 STOP 0

FIGURE A.3. INPUT FOR RATER AND BURNER STORAGE REQUIREMENTS.

C	INPUT REQUIREMENTS	-
C		-
C	CARD 1 (12A6 FORMAT)	-
C	COL (1-72) TITLE	-
C		-
C	CARD(S) 2+ (NAMELIST PARAM)	-
C		-
C	NISO NO. OF NUCLIDES IN CROSS SECTION FILE	-
C	NGROUP NO. OF ENERGY GROUPS	-
C	NZONE NO. OF ZONES	-
C	NSZ NO. OF SUBZONES	-
C	NSH NO. OF NUCLIDE SETS	-
C	NNS MAX. NO. OF NUCLIDES IN ANY SET	-
C	NREG NO. OF REGIONS	-
C	NISOU NO. OF UNIQUE NUCLIDES APPEARING IN SYSTEM	-
C	NISOA NO. OF DIFFERENT ABSOLUTE NUCLIDE NAMES IN SYSTEM	-
C	NUCLAS NO. OF DIFFERENT NUCLIDE CLASSIFICATIONS	-
C	NZCLAS NO. OF DIFFERENT ZONE CLASSES	-
C	IRSON NO. OF OPTIONAL PRINCIPAL CROSS SECTIONS IN CROSS	-
C	SECTION FILE (IALF + INP + IE2N + IND + INT)	-
C	HAWORD MAX. SCATTERING ORDER	-
C	NSTRPD NO. OF COORDINATE DEPENDENT TRANSPORT CROSS	-
C	SECTIONS IN CROSS SECTION FILE	-
C	NSCHAX NO. OF SCATTERING BLOCKS	-
C	NBS NO. OF BUCKLING SPECIFICATIONS	-
C	NBCS NO. OF EXTERNAL BOUNDARY CONSTANTS	-
C	NIBCS NO. OF INTERNAL BOUNDARY CONSTANTS	-
C	NZWBB NO. OF ZONES WHICH ARE BLACK ABSORBERS	-
C	NZTO CROSS SECTION - TEMPERATURE CORRELATION OPTION	-
C	0 - NOT DONE	-
C	1 - ZONE TEMPERATURES	-
C	2 - ZONE AND SUBZONE TEMPERATURES	-
C	NZT NO. OF TEMPERATURES PER ZONE(SUBZONE)	-
C	IEDIT EDIT OPTION	-
C	0 - BASIC	-
C	1 - EXTRA	-
C	IGEOM OPTION ON GEOMETRY INTERFACE	-
C	0 - USE GEODST	-
C	1 - USE TRIGON	-
C	NULLO1 RESERVED	-
C	NISO2 NO. OF NUCLIDES IN EXPOSE FILE	-
C	NIER NO. OF ENERGY RANGES FOR YIELD DATA	-
C	NGER NO. OF ENERGY RANGES FOR GAMMA DATA	-
C	NPSLR NO. OF FISSION NUCLIDES WHICH YIELD FISSION PRODUCTS	-
C	NPPR NO. OF FISSION PRODUCTS HAVING YIELD	-
C	NDCYR NO. OF NUCLIDES WHICH DECAY	-
C	NEXP9 RESERVED	-
C	NEXP10 RESERVED	-
C	NEXP11 RESERVED	-

(CONT)

C	MMATTE	NO. OF SOURCE-PRODUCT-PROCESS SPECIFICATIONS FOR	-
C		MATRIX EXPONENTIAL OR AVERAGE GENERATION RATE	-
C	LSEXCH	NO. OF SUPPLEMENTAL EXPLICIT CHAIN SPECIFICATIONS FOR	-
C		MATRIX EXPONENTIAL OR AVERAGE GENERATION RATE	-
C	LBEXCH	NO. OF BASIC EXPLICIT CHAIN SPECIFICATIONS	-
C	METHOD	SOLUTION METHOD FOR EXPOSURE/SHUTDOWN	-
C		0 - MATRIX EXPONENTIAL	-
C		1 - EXPLICIT CHAIN	-
C		2 - AVERAGE GENERATION RATE	-
C	IYER	YIELD OPTION	-
C		0 - NORMAL	-
C		1 - IF IYER EQ 1 AND ENERGY RANGE OF YIELD DATA	-
C		DOES NOT COVER REACTION ENERGY RANGE	-
C	LNICTI	MAXIMUM EXPLICIT CHAIN LENGTH (MUST BE EVEN)	-
C	MAODX	NO. OF ADDITIONAL COUPLING TERMS FOR MATRIX METHODS	-
C	NSTEPE	NO. OF EXPOSURE SUBSTEPS	-
C	NSTEPS	NO. OF SHUTDOWN SUBSTEPS	-
C	MNODE	EXPOSURE OPTION	-
C		0 - NORMAL	-
C		1 - CONTINUOUS FUELING	-
C	MRTZ	NO. OF ZONE PASSES	-
C	MRTSZ	NO. OF SUBZONE PASSES	-
C	INIST	OPTION TO WRITE EXPOSURE HISTORY INTERFACE	-
C		0 - NOT DONE	-
C		1 - DONE	-
C	MPLU	NO. OF FLUENCE RANGES TO BE SAVED	-
C	MRRN	NO. OF REACTION RATE TYPE DATA TO BE SAVED	-
C	IZPD	OPTION ON ZONE(SUBZONE) POWER DENSITY	-
C		0 - NOT USED	-
C		1 - MUST BE CALCULATED	-
C	ISED	SECONDARY ENERGY DEPOSITION OPTION	-
C		0 - NOT DONE	-
C		1 - DONE	-
C	IPTC	OPTION FOR POINT CALCULATION	-
C		0 - NOT DONE	-
C		1 - METHOD 1 (GEODST AND RTFLUX)	-
C		2 - METHOD 2 (RZFLUX-MODIFIED)	-
C	IPTCDB	POINT CALCULATION DEBUG EDIT	-
C		0 - NONE	-
C		1 - EXTENSIVE	-
C	MPT	NO. OF POINTS	-
C	MZPT	NO. OF ZONES SPECIFIED FOR POINT CALCULATION	-
C	MCINTI	NO. OF COARSE MESH INTERVALS - DIMENSION 1	-
C	MCINTJ	NO. OF COARSE MESH INTERVALS - DIMENSION 2	-
C	MCINTK	NO. OF COARSE MESH INTERVALS - DIMENSION 3	-
C	MINTI	NO. OF FINE MESH INTERVALS - DIMENSION 1	-
C	MINTJ	NO. OF FINE MESH INTERVALS - DIMENSION 2	-
C	MINTK	NO. OF FINE MESH INTERVALS - DIMENSION 3	-
C	IGON	GEOMETRY OPTION	-
C	MTRIAG	TRIANGONAL GEOMETRY OPTION	-

(CONT)

SAMPLE INPUT

[illegible]

A.4. Edit For Sample Calculation-VENTURE Storage Requirements

PROBLEM PARAMETERS

CASE TITLE SUPER SAMPLE PROBLEM.

NI 0 =	49	NGROUP=	4	NZONT =	52	NSE =	0	NBN =	0	NBS =	4	19
NR =	123	NISOU =	49	NISOA =	22	NUCLAS=	8	NICLAS=	8	INISOU=	4	1
HALORD=	0	NSTP0=	0	NSTRAX=	1	NBS =	1	NBCS =	1	NIRCS =	6	1
NISBB =	1	NSTO =	0	NST =	0	NEDIT =	0	IGRON =	0	NULLO1=	0	0
NISOB =	11	NVER =	1	NGER =	0	NFSLR =	6	NPPR =	6	NDCYN =	2	1
NKPP9 =	0	NKPP10=	0	NKPP11=	0	NKPP12=	0	NKPP13=	0	NKPP14=	0	0
NKPP15=	0	NYER =	0	NKPP16=	0	NKPP17=	0	NKPP18=	0	NKPP19=	0	0
NKPP20=	0	NYER =	0	NKPP21=	0	NKPP22=	0	NKPP23=	0	NKPP24=	0	0
NKPP25=	0	NYER =	0	NKPP26=	0	NKPP27=	0	NKPP28=	0	NKPP29=	0	0
NKPP30=	0	NYER =	0	NKPP31=	0	NKPP32=	0	NKPP33=	0	NKPP34=	0	0
NKPP35=	0	NYER =	0	NKPP36=	0	NKPP37=	0	NKPP38=	0	NKPP39=	0	0
NKPP40=	0	NYER =	0	NKPP41=	0	NKPP42=	0	NKPP43=	0	NKPP44=	0	0
NKPP45=	0	NYER =	0	NKPP46=	0	NKPP47=	0	NKPP48=	0	NKPP49=	0	0
NKPP50=	0	NYER =	0	NKPP51=	0	NKPP52=	0	NKPP53=	0	NKPP54=	0	0
NKPP55=	0	NYER =	0	NKPP56=	0	NKPP57=	0	NKPP58=	0	NKPP59=	0	0
NKPP60=	0	NYER =	0	NKPP61=	0	NKPP62=	0	NKPP63=	0	NKPP64=	0	0
NKPP65=	0	NYER =	0	NKPP66=	0	NKPP67=	0	NKPP68=	0	NKPP69=	0	0
NKPP70=	0	NYER =	0	NKPP71=	0	NKPP72=	0	NKPP73=	0	NKPP74=	0	0
NKPP75=	0	NYER =	0	NKPP76=	0	NKPP77=	0	NKPP78=	0	NKPP79=	0	0
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NKPP85=	0	NYER =	0	NKPP86=	0	NKPP87=	0	NKPP88=	0	NKPP89=	0	0
NKPP90=	0	NYER =	0	NKPP91=	0	NKPP92=	0	NKPP93=	0	NKPP94=	0	0
NKPP95=	0	NYER =	0	NKPP96=	0	NKPP97=	0	NKPP98=	0	NKPP99=	0	0
NKPP100=	0	NYER =	0	NKPP101=	0	NKPP102=	0	NKPP103=	0	NKPP104=	0	0
NKPP105=	0	NYER =	0	NKPP106=	0	NKPP107=	0	NKPP108=	0	NKPP109=	0	0
NKPP110=	0	NYER =	0	NKPP111=	0	NKPP112=	0	NKPP113=	0	NKPP114=	0	0
NKPP115=	0	NYER =	0	NKPP116=	0	NKPP117=	0	NKPP118=	0	NKPP119=	0	0
NKPP120=	0	NYER =	0	NKPP121=	0	NKPP122=	0	NKPP123=	0	NKPP124=	0	0
NKPP125=	0	NYER =	0	NKPP126=	0	NKPP127=	0	NKPP128=	0	NKPP129=	0	0
NKPP130=	0	NYER =	0	NKPP131=	0	NKPP132=	0	NKPP133=	0	NKPP134=	0	0
NKPP135=	0	NYER =	0	NKPP136=	0	NKPP137=	0	NKPP138=	0	NKPP139=	0	0
NKPP140=	0	NYER =	0	NKPP141=	0	NKPP142=	0	NKPP143=	0	NKPP144=	0	0
NKPP145=	0	NYER =	0	NKPP146=	0	NKPP147=	0	NKPP148=	0	NKPP149=	0	0
NKPP150=	0	NYER =	0	NKPP151=	0	NKPP152=	0	NKPP153=	0	NKPP154=	0	0
NKPP155=	0	NYER =	0	NKPP156=	0	NKPP157=	0	NKPP158=	0	NKPP159=	0	0
NKPP160=	0	NYER =	0	NKPP161=	0	NKPP162=	0	NKPP163=	0	NKPP164=	0	0
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NKPP180=	0	NYER =	0	NKPP181=	0	NKPP182=	0	NKPP183=	0	NKPP184=	0	0
NKPP185=	0	NYER =	0	NKPP186=	0	NKPP187=	0	NKPP188=	0	NKPP189=	0	0
NKPP190=	0	NYER =	0	NKPP191=	0	NKPP192=	0	NKPP193=	0	NKPP194=	0	0
NKPP195=	0	NYER =	0	NKPP196=	0	NKPP197=	0	NKPP198=	0	NKPP199=	0	0
NKPP200=	0	NYER =	0	NKPP201=	0	NKPP202=	0	NKPP203=	0	NKPP204=	0	0
NKPP205=	0	NYER =	0	NKPP206=	0	NKPP207=	0	NKPP208=	0	NKPP209=	0	0
NKPP210=	0	NYER =	0	NKPP211=	0	NKPP212=	0	NKPP213=	0	NKPP214=	0	0
NKPP215=	0	NYER =	0	NKPP216=	0	NKPP217=	0	NKPP218=	0	NKPP219=	0	0
NKPP220=	0	NYER =	0	NKPP221=	0	NKPP222=	0	NKPP223=	0	NKPP224=	0	0
NKPP225=	0	NYER =	0	NKPP226=	0	NKPP227=	0	NKPP228=	0	NKPP229=	0	0
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NKPP235=	0	NYER =	0	NKPP236=	0	NKPP237=	0	NKPP238=	0	NKPP239=	0	0
NKPP240=	0	NYER =	0	NKPP241=	0	NKPP242=	0	NKPP243=	0	NKPP244=	0	0
NKPP245=	0	NYER =	0	NKPP246=	0	NKPP247=	0	NKPP248=	0	NKPP249=	0	0
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NKPP255=	0	NYER =	0	NKPP256=	0	NKPP257=	0	NKPP258=	0	NKPP259=	0	0
NKPP260=	0	NYER =	0	NKPP261=	0	NKPP262=	0	NKPP263=	0	NKPP264=	0	0
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NKPP285=	0	NYER =	0	NKPP286=	0	NKPP287=	0	NKPP288=	0	NKPP289=	0	0
NKPP290=	0	NYER =	0	NKPP291=	0	NKPP292=	0	NKPP293=	0	NKPP294=	0	0
NKPP295=	0	NYER =	0	NKPP296=	0	NKPP297=	0	NKPP298=	0	NKPP299=	0	0
NKPP300=	0	NYER =	0	NKPP301=	0	NKPP302=	0	NKPP303=	0	NKPP304=	0	0
NKPP305=	0	NYER =	0	NKPP306=	0	NKPP307=	0	NKPP308=	0	NKPP309=	0	0
NKPP310=	0	NYER =	0	NKPP311=	0	NKPP312=	0	NKPP313=	0	NKPP314=	0	0
NKPP315=	0	NYER =	0	NKPP316=	0	NKPP317=	0	NKPP318=	0	NKPP319=	0	0
NKPP320=	0	NYER =	0	NKPP321=	0	NKPP322=	0	NKPP323=	0	NKPP324=	0	0
NKPP325=	0	NYER =	0	NKPP326=	0	NKPP327=	0	NKPP328=	0	NKPP329=	0	0
NKPP330=	0	NYER =	0	NKPP331=	0	NKPP332=	0	NKPP333=	0	NKPP334=	0	0
NKPP335=	0	NYER =	0	NKPP336=	0	NKPP337=	0	NKPP338=	0	NKPP339=	0	0
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NKPP345=	0	NYER =	0	NKPP346=	0	NKPP347=	0	NKPP348=	0	NKPP349=	0	0
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NKPP395=	0	NYER =	0	NKPP396=	0	NKPP397=	0	NKPP398=	0	NKPP399=	0	0
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NKPP405=	0	NYER =	0	NKPP406=	0	NKPP407=	0	NKPP408=	0	NKPP409=	0	0
NKPP410=	0	NYER =	0	NKPP411=	0	NKPP412=	0	NKPP413=	0	NKPP414=	0	0
NKPP415=	0	NYER =	0	NKPP416=	0	NKPP417=	0	NKPP418=	0	NKPP419=	0	0
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NKPP425=	0	NYER =	0	NKPP426=	0	NKPP427=	0	NKPP428=	0	NKPP429=	0	0
NKPP430=	0	NYER =	0	NKPP431=	0	NKPP432=	0	NKPP433=	0	NKPP434=	0	0
NKPP435=	0	NYER =	0	NKPP436=	0	NKPP437=	0	NKPP438=	0	NKPP439=	0	0
NKPP440=	0	NYER =	0	NKPP441=	0	NKPP442=	0	NKPP443=	0	NKPP444=	0	0
NKPP445=	0	NYER =	0	NKPP446=	0	NKPP447=	0	NKPP448=	0	NKPP449=	0	0
NKPP450=	0	NYER =	0	NKPP451=	0	NKPP452=	0	NKPP453=	0	NKPP454=	0	0
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NKPP465=	0	NYER =	0	NKPP466=	0	NKPP467=	0	NKPP468=	0	NKPP469=	0	0
NKPP470=	0	NYER =	0	NKPP471=	0	NKPP472=	0	NKPP473=	0	NKPP474=	0	0
NKPP475=	0	NYER =	0	NKPP476=	0	NKPP477=	0	NKPP478=	0	NKPP479=</		

PROBLEM PARAMETERS

CASE TITLE SUPER SAMPLE PROBLEM.

NISO =	49	NGROUP =	4	NEONE =	52	MSZ =	0	MSN =	0	MS =	19
NREG =	123	NISOU =	49	NISOA =	22	NUCLAS =	0	NECLAS =	0	NECLAS =	1
NAKORD =	0	NSTRPO =	0	NSCHAX =	1	NBS =	0	NBCS =	0	NBCS =	1
NHBB =	1	NHIO =	0	NHT =	0	IEDIE =	0	IGSON =	0	IGSON =	0
NISOE =	11	NHER =	1	NGER =	0	WFLR =	0	WPPR =	0	WPPR =	1
NEXP9 =	0	NEXP10 =	0	NEXP11 =	0	WRAKKE =	0	LSRICH =	0	LSRICH =	0
NEHOD =	0	IYER =	0	LNICTX =	0	WADOK =	0	WSTEP =	0	WSTEP =	0
NHODE =	0	NRTX =	0	NRTSZ =	0	INISF =	0	WPLU =	0	WPLU =	0
I2PD =	0	ISED =	0	IPFC =	0	XPTCDB =	0	WPT =	0	WPT =	0
WCINTI =	1	WCINTJ =	1	WCINTK =	1	WINTI =	1	WINTJ =	1	WINTK =	1
IGON =	0	NTRING =	0	YEND =	0	WRASS =	0	WULLO2 =	0	WULLO3 =	0

STORAGE REQUIRED FOR REACTION RATE MODULE

STORAGE SUPPLIED IS 25000
 BASE STORAGE REQUIRED IS 2035
 MAXIMUM STORAGE REQUIRED IS 23371
 MINIMUM STORAGE REQUIRED IS 4203

LSTART 1594 LYS 2582

NOD32 = 0 NODZ = 0 NODC = 1

DIRECT ACCESS REQUIREMENTS
 UNIT RECORDS LENGTH (WORDS)
 27 4 392

MEMORY ACTUALLY USED WILL BE 28195

STORAGE REQUIRED FOR DEPLETION MODULE

STORAGE SUPPLIED IS 25000
 BASE STORAGE REQUIRED IS 2035
 MAXIMUM STORAGE REQUIRED IS 8575
 MINIMUM STORAGE REQUIRED IS 3730

NODR = 0 NODRP = -1

MEMORY ACTUALLY USED WILL BE 8575

PROBLEM PARAMETERS

CASE TITLE SUPER SAMPLE PROBLEM.

WISO =	49	WGROUP=	4	WZONE =	52	WSZ =	0	WSN =	0	WNS =	4	WNS	19
WREG =	123	WISOU =	49	WISOA =	22	WUCLAS=	0	WUCLAS=	0	WIRSUM =	4	WIRSUM =	1
WAKORD=	0	WSTRPD=	0	WSCMAX=	1	WBS =	1	WBCS =	1	WIBCS =	6	WIBCS =	1
WREBB =	1	WETO =	0	WET =	0	WIDIF =	0	WIDOR =	0	WULLO1=	0	WULLO1=	0
WISOR =	11	WYER =	1	WGER =	0	WPSLR =	0	WPSR =	6	WDCYR =	2	WDCYR =	1
WEXP9 =	0	WEXP10=	0	WEXP11=	0	WNAATKE=	0	WSEACH=	8	WLBEXCH=	0	WLBEXCH=	0
WETMOD=	0	WYER =	0	WLNICTX=	0	WMAODK =	0	WSTEPS=	0	WSTEPS=	3	WSTEPS=	0
WMODE =	0	WRTZ =	0	WRTSZ =	0	WHSZ =	0	WPLU =	0	WBRN =	0	WBRN =	0
WIPD =	0	WSED =	0	WPTC =	0	WHSZ =	0	WPT =	0	WZPT =	0	WZPT =	0
WCINTI=	1	WCINTJ=	1	WCINTK=	1	WINTJ =	1	WINTJ =	1	WINTK =	1	WINTK =	1
WGOR =	0	WTRIAG=	0	WIND =	0	WTRASS =	0	WULLO2=	0	WULLO3=	0	WULLO3=	0

STORAGE REQUIRED FOR REACTION RATE MODULE

STORAGE SUPPLIED IS	10000
BASE STORAGE REQUIRED IS	2035
MAXIMUM STORAGE REQUIRED IS	25371
MINIMUM STORAGE REQUIRED IS	4203

LSTART 1594 LXS 2582

MODESE = 1 MODE = 1 MODEC = 0

DIRECT ACCESS REQUIREMENTS	
UNIT RECORDS	LENGTH (WORDS)
24	152
52	392
40	

MEMORY ACTUALLY USED WILL BE 5379

STORAGE REQUIRED FOR DEPLETION MODULE

STORAGE SUPPLIED IS	10000
BASE STORAGE REQUIRED IS	2035
MAXIMUM STORAGE REQUIRED IS	8575
MINIMUM STORAGE REQUIRED IS	3730

MODRR = 0 MODRRP = -1

MEMORY ACTUALLY USED WILL BE 8575

PROBLEM PARAMETERS

CASE TITLE SUPER SAMPLE PROBLEM.

WISO = 49 WGROUP = 4 WZORZ = 52 NSZ = 0 NNS = 4 NNS = 19
 WREG = 123 WISOA = 49 WISOA = 22 NOCLAS = 8 NOCLAS = 4 INSUN = 1
 MAXORD = 0 WSTRPD = 0 MSCMAX = 1 HBS = 1 HBS = 6 HBS = 1
 WZBB = 1 WZTU = 0 WZT = 0 WZT = 0 WZT = 0 WZT = 0 WZT = 0
 WISOR = 11 WYER = 1 WYER = 0 WYER = 0 WYER = 0 WYER = 0 WYER = 0
 WEXP9 = 0 WEXP10 = 0 WEXP11 = 0 WEXP11 = 0 WEXP11 = 0 WEXP11 = 0
 METHOD = 0 IYER = 0 LNUCTX = 0 LNUCTX = 0 LNUCTX = 0 LNUCTX = 0
 WNODE = 0 WRTZ = 0 WRTZ = 0 WRTZ = 0 WRTZ = 0 WRTZ = 0
 IZPD = 0 ISED = 0 IPTC = 0 IPTC = 0 IPTC = 0 IPTC = 0
 NCINT1 = 1 NCINTJ = 1 NCINTK = 1 NCINTK = 1 NCINTK = 1 NCINTK = 1
 IZON = 0 WTRIAG = 0 WTRIAG = 0 WTRIAG = 0 WTRIAG = 0 WTRIAG = 0

STORAGE REQUIRED FOR REACTION RATE MODULE

STORAGE SUPPLIED IS 5000
 BASE STORAGE REQUIRED IS 2035
 MAXIMUM STORAGE REQUIRED IS 25371
 MINIMUM STORAGE REQUIRED IS 4203

LSTART 1594 LXS 2582

MODSZ = 1 MODZ = 1 MODEC = 1

DIRECT ACCESS REQUIREMENTS

UNIT RECORDS LENGTH(WORDS)
 24 52 152
 40 52 392
 27 4 392

MEMORY ACTUALLY USED WILL BE 4203

STORAGE REQUIRED FOR DEPLETION MODULE

STORAGE SUPPLIED IS 5000
 BASE STORAGE REQUIRED IS 2035
 MAXIMUM STORAGE REQUIRED IS 8575
 MINIMUM STORAGE REQUIRED IS 3730

MODRR = 1 MODRR = -1

DIRECT ACCESS REQUIREMENTS

UNIT RECORDS LENGTH(WORDS)
 24 52 95

MEMORY ACTUALLY USED WILL BE 3730

PROBLEM PARAMETERS

CASE TITLE SUPER SAMPLE PROBLEM.

NISO =	49	NGROUP=	4	NZONE =	52	NSZ =	0	NSN =	0	NBS =	4	19
NREG =	123	NISOB =	49	NISOA =	22	NUCLAS=	8	NZCLAS=	8	IRSUB =	4	1
NXORD =	0	NSIRPD=	0	NSCHAX=	1	NBS =	1	NBGS =	6	NBGS =	6	1
NZBBB =	1	NZTO =	0	NZT =	0	IEDIT =	0	IGEOR =	0	NULLO1=	0	0
NISOE =	11	NZER =	1	NZER =	0	NPSLR =	0	NPPR =	2	NDCIR =	2	1
NEXP9 =	0	NEXP10=	0	NEXP11=	0	NRAIIE=	0	LSXICH=	0	LBXICH=	0	0
METHOD=	0	IYER =	0	LNICTX=	0	NAODX =	0	NSTEP=	3	NSTEPS=	3	0
NMODE =	0	NRTZ =	0	NRTSZ =	0	IHISI =	0	NPLU =	0	NBAN =	0	0
IYPD =	0	ISEB =	0	IPTC =	0	IPTCDB=	0	NPT =	0	NZPT =	0	0
NCINTI=	1	NCINTJ=	1	NCINIK=	1	NINTI =	1	NINTJ =	1	NINTK =	1	1
IGOR =	0	NTRIAG=	0	IBND =	0	NRASS =	0	NULLO2=	0	NULLO3=	0	0

STORAGE REQUIRED FOR REACTION RATE MODULE

STORAGE SUPPLIED IS	3000
BASE STORAGE REQUIRED IS	2035
MAXIMUM STORAGE REQUIRED IS	25371
MINIMUM STORAGE REQUIRED IS	4203

LSTART 1594 LXS 2582

NODESZ = -1 NODZ = -1 NODZC = -1

CAN NOT SOLVE PROBLEM

STORAGE REQUIRED FOR DEPLETION MODULE

STORAGE SUPPLIED IS	3000
BASE STORAGE REQUIRED IS	2035
MAXIMUM STORAGE REQUIRED IS	8575
MINIMUM STORAGE REQUIRED IS	3730

MODRR = -1 MODRRP = -1

CAN NOT SOLVE PROBLEM

INCO02I STOP 0

APPENDIX B

The attached figure shows the Job Control Language (JCL) that is required to create the BOLD VENTURE computation system on the local IBM computers as a partitioned data set. This data set has the name BOLD.VENTURE.

The subroutines that are required for each module are stored in hexadecimal form as sequential data sets on a 3330 disk (XXXXXX). For example, the data set CONTROL1.HEX.PGM contains the hexadecimal routines for the control module. The four modules SCALE, LPGETMDL, LPREADER, and LPGETPRM comprise the driver for the system.

The recommended overlay structure for each module is documented by Figure B.1.

FIGURE B.1. JCL REQUIRED TO CREATE THE SYSTEM.

```

//STEP EXEC LKED,
// REGION.LKED=270K,
// PARM.LKED='OVLY,LIST,MAP,SIZE=(266K,100K)'
//LKED.SYSLIB DD DSN=SYS1.PORTLIB,DISP=SHR
// DD DSN=SYS1.LOGLIB,DISP=SHR
//LKED.SYSUT1 DD SPACE=(6000,(300,50))

//LKED.SYSLMOD DD UNIT=3330,VOL=SER=XXXXXX,
// DISP=(NEW,KEEP),
// SPACE=(TRK,(500,10,10),RLSE),
// DSN=NAME=BOLD.VENTURE

//LKED.SCALEHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=SCALE.HEX.PGM
//LKED.LPGETHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=LPGETMDL.HEX.PGM
//LKED.LPREAHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=LPREADER.HEX.PGM
//LKED.LPGPRHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=LPGETPRM.HEX.PGM
//LKED.CONTRHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=CONTROL1.HEX.PGM
//LKED.INPROHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=INPROSER.HEX.PGM
//LKED.INDVEHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=INDVENTR.HEX.PGM
//LKED.INDCRHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=INDCRSPR.HEX.PGM
//LKED.INDUTHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=INDUTLIN.HEX.PGM
//LKED.INDCHHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=INDCHACR.HEX.PGM
//LKED.FILEDHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=FILEDTOR.HEX.PGM
//LKED.CROSPHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=CROSPROS.HEX.PGM
//LKED.VENTNHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=VENTNEUT.HEX.PGM
//LKED.RZACRHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=REACRATE.HEX.PGM
//LKED.CNTROHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=CNTRDPO.HEX.PGM
//LKED.EXPOSHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=EXPOSURE.HEX.PGM
//LKED.PERTUHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=PERTUBAT.HEX.PGM
//LKED.DMISLHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=DMISLY.HEX.PGM
//LKED.DENMAHEX DD UNIT=3330,VOL=SER=XXXXXX,DISP=SHR,
// DSN=NAME=DENMAN.HEX.PGM
//LKED.SYSIN DD *

```

(CONT)

INCLUDE SCALEHEX
ENTRY LPCNTROL
NAME SCALE

INCLUDE LPGETHEX
ENTRY LPGETMDL
NAME LPGETMDL

INCLUDE LPREAHEX
ENTRY LPREADER
NAME LPREADER

INCLUDE LPGPRHEX
ENTRY LPGETPRM
NAME LPGETPRM

INCLUDE CONTRHEX
ENTRY GABY
NAME CONTROL1

INCLUDE INPROHEX
OVERLAY INPUT
INSERT CGEODS,CNDXSR,CZNATD
OVERLAY INPUT
INSERT CISOTX
OVERLAY INPUT
INSERT CGRPXS
OVERLAY INPUT
INSERT CISOGX
OVERLAY INPUT
INSERT CFXSRC,CSERCH,CSMCON
OVERLAY INPUT
INSERT CCKSPR,CVENTR,CPRINT,CISOGP
OVERLAY INPUT
INSERT CTFLUX,CCURNT,CAPLUX
OVERLAY INPUT
INSERT CRZFLX,CPERTU,CPWDNT,CFISOR
OVERLAY INPUT
INSERT CDLYXS,CERKXS,CWORTH,CANSIN,CDACIN
OVERLAY INPUT
INSERT CEXPOS,CZCONC,CRODST
OVERLAY INPUT
INSERT CZNTMP,CZNPOW,CEXPOH,CPTATD
OVERLAY INPUT
INSERT CRFUEL,CTRIGH
ENTRY MAIN
NAME INPROSER

INCLUDE INDVEHEX
OVERLAY LEVELD
INSERT GEOM,GOMN
OVERLAY LEVELD
INSERT REGD
OVERLAY LEVELD

(CONT)


```

INSERT TRIF,HEXF
OVERLAY LEVELD
INSERT THKD,VOLS,MSHP
OVERLAY LEVELD
INSERT KOMP,KNOT
OVERLAY LEVELD
INSERT OVLY,MOSH,OVL P
OVERLAY LEVELD
INSERT SSET
OVERLAY LEVELD
INSERT GOMA
OVERLAY LEVELD
INSERT DENS
OVERLAY LEVELD
INSERT GDNA
OVERLAY LEVELD
INSERT SETS
OVERLAY LEVELD
INSERT SEAR
OVERLAY LEVELD
INSERT GOM1,GOM2
OVERLAY LEVELD
INSERT ZND1,ZND2
OVERLAY LEVELD
INSERT NDR1,NDR2
OVERLAY LEVELD
INSERT CTL1
ENTRY MAIN
NAME INDVENTR

```

```

INCLUDE INDCRHEX
ENTRY MAIN
NAME INDCRSPR

```

```

INCLUDE INDUTHEX
ENTRY MAIN
NAME INDUTLIN

```

```

INCLUDE INDCMHEX
ENTRY MAIN
NAME INDCMACR

```

```

INCLUDE FILEDHEX
OVERLAY PRINT
INSERT PVENTR
OVERLAY PRINT
INSERT PCXSPR,PPEPTU,PFISOR
OVERLAY PRINT
INSERT PANSIN,PDACIN,PWORTH,PSNCON,PISOG
OVERLAY PRINT
INSERT PTFLUX,PCURNT,PAFLUX,PPWDNT,PRZFLX
OVERLAY PRINT
INSERT PNDXSR,PZNATD,PGEODS
OVERLAY PRINT

```

(CONT)

```

INSERT PFXSRC,PSEFCH
OVERLAY PRINT
INSERT PISOGX,PDLYXS,PBRKXS
OVERLAY PRINT
INSERT PGRPXS,PISOTX
OVERLAY PRINT
INSERT PPTATD,PEXPOH,PZNPOW,PZNTMP
ENTRY MAIN
NAME FILEDTOF

```

```

INCLUDE CROSPHEX
OVERLAY LEVELQ
INSERT ITI1,ITI2
OVERLAY LEVELQ
INSERT CTI1,CTI2,CTI3,CHOL
OVERLAY LEVELQ
INSERT M2I1,M2I2
OVERLAY LEVELQ
INSERT MIX1,MIX2,MIX3,MIX4,MIX5,MIXC
OVERLAY LEVELQ
INSERT IXS1,IXS2
OVERLAY LEVELQ
INSERT XSC1,XSC2,XSC3,XSC4,XSC5
OVERLAY LEVELQ
INSERT GXS1,GXS2
ENTRY MAIN
NAME CROSPROS

```

```

INCLUDE VENTNHX
OVERLAY LEVELD
INSERT IONO,VENT
OVERLAY LEVELD
INSERT GETCOR,PRECOR
OVERLAY LEVELD
INSERT SGX0,SGX1,SGX2,SGX3,SCAL
OVERLAY LEVELD
INSERT CORE,CORI,CORP,GNAM,CORD,CORB,DDSP,DASU,JPRT
INSERT RELA,RBLB
OVERLAY LEVELD
INSERT MAC1,VZT2,MACA,MACB,MAC2,MAC3,MAC5,CHDM,MAC4,MAC6
OVERLAY LEVELD
INSERT CON1,MSH0,NRCF,MSH1,CON2,CON3,CKCT,CON4,CON5,CON7,CON9,BNDY
INSERT MSH3,GEOQ
OVERLAY LEVELD
INSERT ORLX,ORLA,HUCK,ORLB,ORLC,ORLD,ORLE,ORLF,LAXR,LAXP,BAT3,LUCK
INSERT ORLR,CON6,RCOV
OVERLAY LEVELD
INSERT PHIA,PHI1,PHI2,PHI3,PHI4,PHI5,PHI6,PBND,PC2D,PC3D,EDBN,SDBN
INSERT PHI7,TOIP,QDBN,RDBN,GRXP,PAN1,PAN2
OVERLAY LEVELD
INSERT ADN1,ADN2,ADN3,DCID,DSDF,DIMS,AJDS,DIM1,DIM2,CMES,CHVL,DIM3
INSERT ZVRV,CRGV,FLRD,FLMH
OVERLAY LEVELD
INSERT COMC,LCAL,FLXR,FXSR,BSQV,AJNT,REV1,PROS,ZI03,FEFS

```

```

INSERT CORR,IFTD,ONES,TWOS,TRES,HST1,HST2,HST3
OVERLAY LEVELD
INSERT OUTR,BALC,ZINS,CHBF,CHEV,ROAD,XTRP,JUT3,ATED,PPGG,RDUE,RELX
INSERT PSOR,SSOR,PSOR,PLUX,LTRG,BHAV,OELX,NEWB
OVERLAY LEVELE
INSERT MUEX,ETR1,ETR2,SGDA
OVERLAY LEVELE
INSERT DCIN,RRES,WRRES,PREC
OVERLAY LEVELE
INSERT POU1,SOU1,POU1,INR1,LOU1,LEK1
OVERLAY LEVELE
INSERT POU2,SOU2,POU2,INR2,LOU2,LEK2
OVERLAY LEVELE
INSERT POU3,SOU3,POU3,INR3,LOU3,LEK3
INSERT RBL1,RBL2,RBL3,RBL4,RBL5
OVERLAY LEVELE
INSERT POU4,SOU4,POU4,INR4,LOU4,LEK4,QDUE,QELX,SOUX,J1C4
OVERLAY LEVELE
INSERT POU5,SOU5,POU5,INR5,LOU5,LEK5,J1C5
OVERLAY LEVELE
INSERT POU6,SOU6,INR6,DELX
OVERLAY LEVELE
INSERT POUX,SOUY,POUX,INRX,LOUX,LEKX,SOUZ,J1CX
OVERLAY LEVELD
INSERT EDIT,POUT,NBAL,SOBL,FISS,FLXW,BSQS,PNDN,PTVL,PTZF,JINT
INSERT PND1,PND2,PND3,PND4,PND5
OVERLAY LEVELD
INSERT SAV1,SAV2,SAV3,SAV4,SAV5,SAV6,SAV7
OVERLAY LEVELD
INSERT PERO,RTUB,MPPT,QOUT,BBB1,BBB2,ZASU
OVERLAY LEVELE
INSERT PRET,TUPY,LIFE,DAPA,MAPS,PMAP
OVERLAY LEVELE
INSERT JERT,JUPY,JIFE,JAPA,JAPS,JMAP,JGET
ENTRY MAIN
NAME VENTNEUT

```

```

INCLUDE REACRHEX
ENTRY MAIN
NAME REACRATE

```

```

INCLUDE CNTROHEX
OVERLAY ONE
INSERT INTL
OVERLAY ONE
INSERT CCR
OVERLAY TWO
INSERT GDST,A89D,REDR,GETL,IDIT,CHEK
OVERLAY TWO
INSERT POS1
OVERLAY TWO
INSERT POS2
OVERLAY TWO
INSERT POSH

```

OVERLAY TWO
 INSERT POS4
 OVERLAY THREE
 INSERT NOP0
 OVERLAY THREE
 INSERT NOP1
 OVERLAY THREE
 INSERT NOP2
 OVERLAY TWO
 INSERT SAVE,GDSW
 ENTRY MAIN
 NAME3 CNTRODPO

INCLUDE EXPOSHEX
 OVERLAY LEVELQ
 INSERT BINP,GNZC,BRN7,BRN4,BGXS,BZT1,BRNF,BRNW,ZUCZ,ZUCY,ZIGY
 INSERT EPPD,BRNK,HQOE,SKNO
 OVERLAY LEVELQ
 INSERT BZIN,DEEP,CHOV,BRNS,BRN3,BRNZ,BRNT,BZT2,BRNA,BRND,BRRF
 INSERT PRPF
 OVERLAY LEVELQ
 INSERT BURN,BRNY,ZNAW,ZZPD,AUXE,TPNE
 OVERLAY LEVELR
 INSERT OEXP,POWL,ARRI,ZCRI,PARI,BRNO
 OVERLAY LEVELS
 INSERT OFIX,BFIX
 OVERLAY LEVELS
 INSERT OMOV,BMOV
 OVERLAY LEVELT
 INSERT ZOND,ZZPF,ZONI,POWP
 OVERLAY LEVELT
 INSERT PONI,PPOE,QNAW,QNAT
 OVERLAY LEVELR
 INSERT OXPH,CPH1,ECHK,ESET,FLUE
 OVERLAY LEVELS
 INSERT EXPH,FLUC,REHT,CPH2,EPH2
 OVERLAY LEVELS
 INSERT QXPH,QPTD,QFLU,QEHT,CPH3,EPH3
 OVERLAY LEVELR
 INSERT EDEP,EDED,ETAB
 OVERLAY LEVELR
 INSERT OCWN,DOWN
 OVERLAY LEVELQ
 INSERT FOUL
 OVERLAY LEVELQ
 INSERT BPIN,PTNS
 OVERLAY LEVELR
 INSERT BPIA,PTAT,PGeo,GCHK,MSH0,MSHK,MSH1,MSH3,NRCF,VOLP
 INSERT PLOC,PRN3,PEOR,CHEK
 OVERLAY LEVELR
 INSERT BPIB,ZFMP,ZPH3,ZFNV
 OVERLAY LEVELR
 INSERT BPIC,PRNS,PRNZ,PRNT,PZT2,PRNA,PRND,BRPF,PRPF
 OVERLAY LEVELQ

(CONT)

INSERT PURN,PRNY,PPIX,POWN,PNAW,PDST
 ENTRY MAIN
 NAME EXPOSURE

INCLUDE PERTUHEX
 OVERLAY LEVELD
 INSERT UENT,UONO,UORE,UORI,UNAH,UORD,UORB,UDSP,UASU,UPET,DLY1,DLY2
 OVERLAY LEVELD
 INSERT GETCOR,FRECOR
 OVERLAY LEVELD
 INSERT MCON,NCON
 OVERLAY LEVELE
 INSERT UAC1,UAC2,UAC3,UAC5,UAC6,UACA,UACB,UCAL,IONS
 OVERLAY LEVELE
 INSERT UON1,USH0,URCF,USH1,UON2,UON3,UKCT,UON4,UON5,UON7,UON9,BNDY
 INSERT USH3,WDFL,WEFL
 OVERLAY LEVELE
 INSERT URLX,UON6,UJNT,SCAT,OSIG,UEV1
 OVERLAY LEVELE
 INSERT VAC1,GNEQ,VAC2,VAC3,VACA,VCAL,DKOH,WNEK,DKDN,TEMP,TANS,TENS
 INSERT UNEK,KANS,KENS
 OVERLAY LEVELD
 INSERT PERO,RTUB,MRPT,QOUT,BBB1,8BB2,BEFF
 OVERLAY LEVELE
 INSERT PERT,TUFY,LIFE,DAPA,MAPS,PHAP
 OVERLAY LEVELE
 INSERT JERT,JUFY,JIFE,JAPA,JAPS,JMAP,JGET,INLK,KEFF,KEFA
 OVERLAY LEVELD
 INSERT DKOK,DLK1
 ENTRY MAIN
 NAME PERTUBAT

INCLUDE DMISLHEX
 ENTRY MAIN
 NAME DMISLY

INCLUDE DENMAHEX
 ENTRY MAIN
 NAME DENMAN

/*
 //

APPENDIX C

Listed here are the interface data files required by the modules of the system. Figure C.1 lists the file CONTRL and Figure C.2 shows the correspondence of data from the DTNINS record of CONTRL and the special input processor DVENTR. The standard files are listed in Figure C.3, and newly defined files are listed in Figure C.4.

Figure C.1. INTERFACE FILE CONTROL

REVISED 04/01/80

CONTROL

BOLD VENTURE SYSTEM CONTROL

FILE STRUCTURE

OV FILE IDENTIFICATION

RECORD NAME

CODE BLOCK (MODULE)

REQUIREMENT

1D PROINS
1D DVRIINS
1D ICPINS
1D DTWINS
1D RRTINS
1D RODINS
1D EXPINS
1D PERINS
1D REPINS
1D PBLINS
1D BLANK

(PROBLEM INFORMATION)
(MODULE DRIVING INFORMATION)
CROSS SECTION PROCESSOR (CIGAR)
NEUTRONICS (VENTUR?)
REACTION RATE (RATER)
CONTROL ROD POSITIONING (RODMOD)
EXPOSURE (BURNER)
PERTURBATION (PERTUBAT)
FUEL MANAGEMENT
THERMAL HYDRAULICS
(CLOSURE)

ALWAYS FIRST
ALWAYS
AS NEEDED
AS NEEDED
AS NEEDED
AS NEEDED
AS NEEDED
AS NEEDED
AS NEEDED
AS NEEDED
ALWAYS LAST

FILE IDENTIFICATION

RNAME, (HUSE(I), I=1,2), IVERS
3*MULT + 1

RNAME
HUSE(I)
IVERS

FILE NAME (A6) 'CONTROL'
USER IDENTIFICATION (A6)
FILE VERSION NUMBER

1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES

MULT

(CONT)

SPECIFICATIONS FOR PROINS RECORD IN INTERFACE FILE CONTROL

C	-----		
CR	PROBLEM INFORMATION		-
C			-
CL	PROINS, (IX(I),I=1,100), (IX(I),I=1,100)		-
C			-
CW	101*HULT + 100		-
C			-
CD	PROINS	PROBLEM INFORMATION DATA IDENTIFIER (6HPROINS)	-
C			-
CD	IX(1-24)	PROBLEM OR CASE TITLE (A6)	-
C			-
CD	IX(25)	USER LABEL (JOBNAME) FOR INTERFACE DATA FILES (A6)	-
C			-
CD	IX(26)	USER LABEL (DATE) FOR INTERFACE DATA FILES (A6)	-
C			-
CD	IX(27-100)	RESERVED	-
C			-
CD	IX(1-100)	RESERVED	-
C			-
C	-----		

(CONT)

SPECIFICATIONS FOR DVRINS RECORD IN INTERPACE FILE CONTROL

C	-----		
CR		MODULE DRIVING INFORMATION	-
C			-
CL	DVRINS, (IX(I), I=1,100), (IX(I), I=1,100)		-
C			-
CW	101*MULT + 100		-
C			-
CD	DVRINS	MODULE DRIVING INFORMATION IDENTIFIER (6HDVRINS)	-
C			-
CD	IX(1-100)	RESERVED	-
C			-
CD	IX(1)	PRIMARY MEMORY ALLOCATION, WORDS	-
C			-
CD	IX(2)	RESERVED	-
C			-
CD	IX(3)	RESERVED	-
C			-
CD	IX(4)	MAXIMUM BLOCK SIZE FOR DIRECT ACCESS DATA FILES, WORDS, BEST VALUE DEPENDS ON SEVERAL THINGS INCLUDING DISK TRACK LENGTH, OVERRIDE THE AUTOMATED PROCEDURE ASSIGNMENT IF NON-ZERO	-
C			-
CD	IX(5)	TOTAL PROCESSOR TIME ALLOWED FOR THE RUN, MINUTES	-
C			-
CD	IX(6-10)	RESERVED	-
C			-
CD	IX(11)	STAND-ALONE FLAG - 0 - MODULES ARE ACCESSED IN A TRUE MODULAR SENSE- 1 - MODULES ARE ACCESSED AS IF EACH IS A STAND-ALONE CODE (NOT RECOMMENDED)	-
C			-
CD	IX(12-100)	RESERVED	-
C			-
C	-----		-

(CONT)

SPECIFICATIONS FOR XCPINS RECORD IN INTERFACE FILE CONTROL

```

C-----
CP      CROSS SECTION PROCESSOR INSTRUCTIONS
C
CN      THIS DATA REQUIRED BY THE CROSS SECTION PROCESSOR
C
CL      XCPINS, (IX(I),I=1,100), (IX(I),I=1,100)
C
CW      101*MULT + 100
C
CD      XCPINS      CROSS SECTION PROCESSOR DATA IDENTIFIER (6HXCPINS)
C
CD      IX(1-100)    RESERVED
C
CD      IX(1-2)      RESERVED
C
CD      IX(3)        OPTION ON INPUT CROSS SECTION FILE PROCESSING
CD                      0 - NO PROCESSING REQUIRED
CD                      1 - GENERATE NEW NUCLIDE-ORDERED FILE FROM
CD                        THE FILE OR FILES HAVING FORMAT IX(5)
CD                        (REQUIRES INTERFACE FILE CXSPRR FOR
CD                        ADDITIONAL INFORMATION)
C
CD      IX(4)        OPTION TO GENERATE A GROUP-ORDERED FILE FROM
CD                      A NUCLIDE-ORDERED FILE
CD                      0 - NO
CD                      1 - YES
C
CD      IX(5)        FORMAT OF INPUT CROSS SECTIONS FOR IX(3) EQ 1
CD                      0 - NUCLIDE-ORDERED FILE
CD                      1 - CITATION CROSS SECTION SETS
CD                      2 - MERGE TWO NUCLIDE-ORDERED FILES
C
CD      IX(6)        OPTION ON PRINCIPAL CROSS SECTION DATA
CD                      FOR IX(4) EQ 1
CD                      0 - RETAIN ALL DATA
CD                      1 - REDEFINE (N,GAMMA) CROSS SECTION TO BE
CD                        THE CAPTURE CROSS SECTION = (N,GAMMA) +
CD                        (N,ALPHA) + (N,P) + (N,D) + (N,T) - (N,2N)
C
CD      IX(7)        OPTION ON SCATTERING DATA FOR IX(4) EQ 1
CD                      0 - RETAIN ALL DATA
CD                      1 - RETAIN THE TOTAL SCATTERING ONLY
C
CD      IX(8)        OPTION ON SCATTERING ORDER FOR IX(4) EQ 1
CD                      0 - RETAIN ALL DATA
CD                      N - RETAIN ORDERS UP TO (N-1) ONLY
C

```

(CONT)

CD	IX(9)	OPTION ON SCATTERING RECORD BLOCKING FACTOR	-
CD		FOR IX(4) EQ 1	-
CD		0 - NSBLOK = 1	-
CD		N - NSBLOK = N, IF (NISO/N)*N EQ NISO,	-
CD		OTHERWISE NSBLOK = NISO	-
CD		WHERE NISO IS THE NUMBER OF NUCLIDES	-
C			-
CD	IX(10)	OPTION TO COMPUTE THE TOTAL SCATTERING MATRIX	-
CD		FROM THE COMPONENTS FOR IX(4) EQ 1	-
CD		TOTAL = ELASTIC + INELASTIC + N2N	-
CD		(THIS MUST BE DONE IF THE GROUPS FILE IS TO BE	-
CD		USED BY VENTURE AND THERE IS NO TOTAL	-
CD		SCATTERING DATA PRESENT)	-
CD		0 - NO	-
CD		1 - YES	-
CD		2 - YES AND MULTIPLY N2N SOURCE BY 2.0	-
C			-
CD	IX(11)	OPTION TO CREATE ISOTOPE MIXTURES AFTER PROCESSING	-
CD		SPECIFIED BY IX(3) AND IX(5), IF ANY	-
CD		0 - NO	-
CD		1 - YES (REQUIRES INTERFACE FILE CISPFR FOR	-
CD		ADDITIONAL INFORMATION)	-
C			-
CD	IX(12-22)	RESERVED	-
C			-
CD	IX(23)	OPTION TO EDIT LATEST NUCLIDE-ORDERED FILE	-
CD		0 - NO	-
CD		1 - YES	-
C			-
CD	IX(24)	OPTION TO EDIT GROUP-ORDERED FILE	-
CD		0 - NO	-
CD		1 - YES	-
C			-
CD	IX(25-100)	RESERVED	-
C			-
C			-

(CONT)

SPECIFICATIONS FOR DTWINS RECORD IN INTERFACE FILE CONTROL

```

C-----
CN      NEUTRONICS INSTRUCTIONS
C
CL      DTWINS, (XX(I),I=1,100), (IX(I),I=1,100)
C
CN      101*HULT + 100
C
CD      DTWINS      NEUTRONICS CONTROL IDENTIFIER, A(6)
CD      IX(1)       REFERENCE REAL TIME, DAYS
CD      IX(2)       MACHINE TIME ALLOWED FOR SOLUTION, MIN
CD                  (ITERATION TERMINATED IF TIME EXCEEDED)
CD      IX(3)       CYCLE TIME IN MINUTES TO WRITE RESTART DATA
CD                  NOT DONE IF 0, ALWAYS DONE AT END IF NON-ZERO
C
CN      NOTE THAT VARIABLES NOT DEFINED ARE RESERVED FOR LATER USE
C
CD      IX(4)       POWER LEVEL OF REACTOR, WATTS THERMAL
CD                  IF 0, NORMALIZATION IS TO ONE SOURCE NEUTRON
CD                  (WATT-SEC/FISS DEFAULTED TO 3.2E-11 IF ZERO)
CD      IX(5)       ENERGY CONVERSION FACTOR, FISSION TO THERMAL
CD      IX(6)       FRACTION OF REACTOR TREATED
CD      IX(7)       SPECIFIED MULTIPLICATION FACTOR FOR SEARCH IF
CD                  NON-ZERO
CD      IX(8)       SPECIFIED OVERRELAXATION COEFFICIENT IF NON-ZERO
CD      IX(9)       ESTIMATE OF THE EIGENVALUE FOR CHEBYCHEV
CD                  ACCELERATION ON OUTER ITERATIONS
CD      IX(10)      ESTIMATE OF THE LOWER LIMIT OF THE SPECTRUM OF
CD                  EIGENVALUES FOR CHEBYCHEV ACCELERATION
CD      IX(11)      CONVERGENCE CRITERIA ON INTEGRAL QUANTITIES
CD                  MAXIMUM RELATIVE CHANGE ON OUTER ITERATION
CD      IX(12)      CONVERGENCE CRITERIA ON LOCAL OR POINT VARIABLES-
CD                  MAXIMUM RELATIVE POINT FLUX CHANGE ON OUTER
CD                  ITERATION (.00005)
CD      IX(13)      CONSTANT DUCKLING VALUE WHICH OVERRIDES THE DATA-
CD                  IN GEODST FILE IF NON-ZERO
CD      IX(14)      RESERVED
CD      IX(15)      RESERVED
CD      IX(16)      RESERVED
CD      IX(17)      RESERVED
CD      IX(18)      RESERVED
CD      IX(19)      LIMITING VALUE OF ANY DIFFUSION COEFFICIENT
CD                  IF NOT ZERO - DEFAULT 100.0
CD      IX(20)      PARAMETER FOR HIGHER ORDER VALE SOLUTION
CD                  1/6 = 0.1666666 - TAYLOR SERIES
CD                  7/36 = 0.194444 - LINEAR FLUX
CD                  1/4 = 0.25 - LINEAR FINITE ELEMENT
CD                  IF MADE NEGATIVE, THE HIGHER ORDER APPROXIMATION-
CD                  IS NOT APPLIED TO THE SOURCE

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(CONT)

CD	IX(21)	THE ZONE AND GROUP DIFFUSION COEFFICIENTS	-
CD		THROUGH ZONE IX(43) (SEE BELOW) WILL BE	-
CD		MULTIPLIED BY THIS NUMBER IF NOT ZERO	-
CD	IX(22)	THIS NUMBER WILL BE ADDED TO THE ZONE AND	-
CD		GROUP DIFFUSION COEFFICIENTS THROUGH ZONE	-
CD		IX(43) AFTER IX(21) IS APPLIED IF NOT ZERO	-
CD	IX(23)	XENON+IODINE YIELD FRACTION FOR EQUILIBRIUM	-
CD		XENON - IF IX(69) GT 0	-
CD	IX(24)	'Q' FACTOR FOR POWER WEIGHTED REGULAR TIMES	-
CD		ADJOINT FLUX	-
CD	IX(25)	REFERENCE TEMPERATURE (DEGREES C) OF THE	-
CD		NEXT-TO-LATEST VERSION 'GROUPXS' CROSS SECTION	-
CD		INTERFACE FILE	-
CD	IX(26)	REFERENCE TEMPERATURE (DEGREES C) OF THE	-
CD		LATEST VERSION 'GROUPXS' CROSS SECTION INTERFACE	-
CD		FILE	-
CD	IX(27)	CORRELATION PARAMETER FOR THE ARCTANGENT	-
CD		DEPENDENCE OF CROSS SECTIONS ON ZONE	-
CD		TEMPERATURES (LINEAR CORRELATION IF 0.0)	-
CD	IX(28)	FACTOR APPLIED TO SPACE INTERPOLATION SLOPE	-
CD		FOR SPACE-ENERGY REBALANCE. IF ZERO, NO	-
CD		SPACE INTERPOLATION IS DONE	-
CD	IX(29)	FACTOR APPLIED TO THE FINAL REBALANCE FACTORS	-
CD		FOR SPACE-ENERGY REBALANCE - DEFAULT 1.0	-
CD	IX(30)	XENON DECAY CONSTANT FOR EQUILIBRIUM XENON -	-
CD		IF IX(69) GT 0	-
CD	IX(31) - IX(100)	RESERVED	-
C			-
CD	IX(1)	INDICATOR THAT THE CODE BLOCK HAS INPUT DATA	-
CD		NOT CONTAINED IN THE STANDARD INTERFACE FILES-	-
CD		OTHER THAN THIS BLOCK OF DATA IF .GT.0	-
CD	IX(2)	RESTART OPTIONS- RESTART USING DATA FROM AN	-
CD		OLD CASE IF .GT. 0, REQUIRES SPECIAL RESTART	-
CD		DATA FILE	-
CD	IX(3)	REFERENCE COUNT ON PROBLEMS (CYCLE NUMBER)	-
CD	IX(4)	FORMULATION OPTIONS	-
C			-
CD		VENTURE, MESH CENTERED FINITE-DIFFERENCE	-
CD		1 - DIFFUSION THEORY (FUNDAMENTAL)	-
CD		2 - SIMPLE P1 APPROXIMATELY (FUNDAMENTAL)	-
CD		-1 - DIFFUSION THEORY SOLUTION FOR THE DOMINANT-	-
CD		ALLOWED FIRST HARMONIC REQUIRING THE	-
CD		FUNDAMENTAL REGULAR AND ADJOINT FLUX FILES-	-
CD		'RTFLUX' AND 'ATFLUX'. THE FIRST ITERATE	-
CD		SOURCE DISTRIBUTION WILL BE SKEWED TO	-
CD		EXCISE ALL SPACIAL FLUX HARMONICS SO	-
CD		THAT THE DOMINANT WILL SURFACE.	-
CD		-2 - SAME AS -1 BUT THE FIRST ITERATE SOURCE	-
CD		WILL NOT BE SKEWED. USUALLY FOR THIS	-
CD		OPTION THE 'RTFLUX' FILE MUST EITHER BE A	-
CD		UNIFORM FLUX DISTRIBUTION (IN WHICH CASE	-
CD		THE SOLUTION MAY OR MAY NOT BE FOR THE	-

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CD      DOMINANT HARMONIC) OR AN INITIAL ESTIMATE -
CD      OF THE DOMINANT HARMONIC FLUX DISTRIBUTION-
CD      (FOR EXAMPLE, A COSINE FROM -1 TO +1 -
CD      ALONG A COORDINATE WHILE PERHAPS UNIFORM -
CD      IN OTHER DIRECTIONS) THAT WILL CAUSE THE -
CD      DESIRED HARMONIC TO SURFACE. THIS MAY -
CD      ESPECIALLY BE USEFUL TO ACCELERATE -
CD      CONVERGENCE WHEN TWO OF THE SPACIAL -
CD      HARMONIC EIGENVALUES ARE NEARLY EQUAL. -
CD      -10 - SPECIAL DOMINANT HARMONIC SOLUTION (R2) -
CD      ADJUSTING THE TOTAL LOSS TERM TO ACCOUNT -
CD      FOR THE AZIMUTHAL HARMONIC -
C      -
CD      VALE, MESH EDGE TRIANGULAR -
CD      1 - DIFFUSION THEORY (FUNDAMENTAL) -
CD      -1 - DIFFUSION THEORY (DOMINANT HARMONIC) -
CD      -2 - SAME AS -1 BUT THE FIRST ITERATE SOURCE -
CD      WILL NOT BE SKEWED -
CD      3 - HIGHER ORDER (FUNDAMENTAL) - SEE IX(20) -
CD      -3 - HIGHER ORDER (DOMINANT HARMONIC) -
CD      -4 - SAME AS -3 BUT THE FIRST ITERATE SOURCE -
CD      WILL NOT BE SKEWED -
C      -
CD      VANCER, MESH EDGE (2- AND 3-D SLAB INFO SHOWN) -
CD      1 - FINITE DIFFERENCE -
CD      2 - LINEAR FINITE DIFFERENCE (8, 10 NEIGHBORS) -
CD      3 - EXTENDED TAYLOR SERIES (8, 10 NEIGHBORS) -
CD      4 - LINEAR FINITE ELEMENT (8, 10 NEIGHBORS) -
CD      5 - SIMPLE TAYLOR SERIES (8, 10 NEIGHBORS) -
CD      6 - USUAL FINITE DIFFERENCE (4, 6 NEIGHBORS) -
CD      7 - COMPROMISE (8, 10 NEIGHBORS) -
CD      8 - COMPROMISE (4, 6 NEIGHBORS) -
CD      9 - COMPENSATED DIFFERENCE (4, 6 NEIGHBORS) -
C      -
CD      IX(5)      TYPE OF PROBLEM -
CD      0- DETERMINE SOURCE MULTIPLICATION FACTOR -
CD      1- SEARCH PROBLEM (FILE OF SEARCH DATA IS -
CD      REQUIRED, SEE OPTION IX(10)) -
CD      2- FIXED SOURCE PROBLEM -
CD      3- ADJOINT PROBLEM ONLY -
CD      4- BUCKLING SEARCH -
CD      5- PROMPT MODE ALPHA CALCULATION, 1/V SEARCH-
CD      ADJOINT PROBLEM OPTIONS -
CD      IX(6)      0 - NO ADJOINT PROBLEM TO BE DONE -
CD      1 - EIGENVALUE TYPE PROBLEM -
CD      (NORMALLY FOLLOWING A FORWARD PROBLEM) -
CD      2 - FIXED SOURCE TYPE PROBLEM -
CD      IX(7)      RESERVED -

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CD      IX(8)      OPTION TO FORCE DATA HANDLING MODE (FOR TESTING) -
CD      -1  OPTION TO TERMINATE IF MEMORY ALLOCATION -
CD      IS TOO SMALL FOR EFFICIENT EXECUTION (THE -
CD      SPACE PROBLEM CANNOT BE STORED IN TWO- -
CD      DIMENSIONS OR ENOUGH PLANES OF DATA CAN -
CD      NOT BE STORED TO AVOID EXCESS TRANSFER -
CD      IN THREE-DIMENSIONS) -
CD      0- AUTOMATED TO MINIMIZE INPUT/OUTPUT -
CD      1- BASE PROBLEM CORE CONTAINED -
CD      2- SPACE PROBLEM AT EACH ENERGY CONTAINED -
CD      3- ONE ROW CONTAINED IN CORE -
CD      4- ONE OR MORE SPACE PLANES CONTAINED IN CORE -
CD      5- MULTIPLE ROWS STORED FOR TWO DIMENSIONAL -
CD      6- MULTI-LEVEL DATA TRANSFER -
CD      IX(9)      OPTIONS ON FLUX INITIALIZATION -
CD      -1 SET ALL FLUX VALUES EQUAL -
CD      0 AUTOMATED PROCEDURE -
CD      1 POINT ENERGY MODEL, COSINE IN SPACE -
CD      2 USE LATEST VERSION OF AVAILABLE SCALAR -
CD      FLUX FILE -
CD      3 USE NEXT-TO-LATEST VERSION OF AVAILABLE -
CD      SCALAR FLUX FILE -
CD      IX(10)     IDENTIFIES SEARCH DATA IN SEARCH FILE, IX(5)=1 -
CD      IX(11)     IDENTIFIES SECONDARY SEARCH DATA IN SEARCH FILE -
CD      TO BE USED IF CONSTRAINTS FOR FIRST SET ARE -
CD      NOT SATISFIED, AND SECOND SEARCH IS TO BE DONE -
CD      IX(12)     SPECIFIES THAT A 2-D (OR 1-D) PROBLEM IS TO BE -
CD      SOLVED FOR THIS PLANE (OR ROW) OF A 3-D -
CD      (OR 2-D) DESCRIPTION IF NON-ZERO -
CD      IX(13)     ORDER IN THE CROSS SECTION FILE OF THE DIRECTION- -
CD      DEPENDENT TRANSPORT CROSS SECTION TO BE USED -
CD      FOR THE FIRST COORDINATE DIRECTION (USUALLY 0) -
CD      IX(14)     DITTO, SECOND COORDINATE DIRECTION -
CD      IX(15)     DITTO, THIRD COORDINATE DIRECTION -
CD      IX(16)     INSTRUCTION NORMALLY EXERCISED BY CONTROL MODULE -
CD      TO INFORM THE NEUTRONICS MODULE TO RECOVER -
CD      DATA FOR INITIALIZATION FROM FILES RZPLUX AND -
CD      RTPLUX -
CD      IX(17)     FORCE KEFF. CALC. BY SOURCE RATIO IF GT 0 -
CD      IX(18)     FISSION SOURCE DISTRIBUTION FUNCTION OPTION -
CD      0- SET VALUES TO BE USED (SAME IN EACH ZONE) -
CD      1- REGION DEPENDENT VALUES TO BE USED -
CD      IX(19)     FISSION SOURCE DISTRIBUTION NORMALIZATION OPTION -
CD      0- LEAVE UNNORMALIZED -
CD      1- NORMALIZE EACH SET TO SUM TO UNITY -
CD      IX(20)     CONSTRAINT ON OUTER ITERATIONS (MAX ALLOWED) -
CD      (SET BY THE CODE IF NOT SPECIFIED) -
CD      IF SET = 969 INITIAL DATA PROCESSING IS DONE -
CD      FOR CHECKING INTERFACE DATA FILES, MEMORY -
CD      REQUIREMENTS, ETC. AND NO CALCULATIONS -
CD      ARE DONE - EXCEPT IF IX(9) IS GREATER -
CD      THAN 1, THE RESIDUES PASS IS MADE TO -
CD      CALCULATE KEFFECTIVE ONLY -

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CD      IX(21)      INNER ITERATION OPTION -
CD                  0- USE AUTOMATED PROCEDURE (RECOMMENDED) -
CD                  N- REFERENCE NUMBER OF INNERS = N -
CD                  SET BY THE CODE IF NOT SPECIFIED -
CD                  (IF 1 .LE. N .LE. 4, CHEBYSHEV ACCELERATION-
CD                  WILL NOT BE DONE ON OUTER ITERATIONS -
CD                  AS THE AUTOMATED PROCEDURE) -
CD      IX(22)      OPTION TO PREESTIMATE OVERRELAXATION FACTORS BY -
CD                  L1 NORM FOR ZERO SOURCE PROBLEM, SPECIAL INNER -
CD                  ITERATIONS ARE DONE (MAKE LARGE TO OVERRIDE -
CD                  THE AUTOMATED PROCEDURE WHICH EMPLOYS THIS) -
CD      IX(23)      INITIALIZATION OPTIONS FOR PROCEDURES, CHOICE OF -
CD                  OVERRELAXATION COEFFICIENTS AND ITERATIONS -
CD                  -2 DONT DO ONE-DIMENSIONAL CALCULATION -
CD                  FOR INITIALIZATION -
CD                  -1 DONT USE 1-D OVERRELAXATION COEFFICIENTS -
CD                  0- USE AUTOMATED PROCEDURE, SOLVES 1-D PROBLEMS -
CD                  CHEBYSHEV COEFFICIENTS ON OUTER ITERATIONS -
CD                  IF THE NUMBER OF INNERS IS .LT. 5 -
CD                  EXCEPT WHEN CHEBYSHEV FLUX ON OUTERS -
CD                  1- SAME AS 0 BUT DO NOT CHEBYSHEV -
CD                  OVERRELAXATION COEFFICIENTS -
CD                  2- FIX THE NUMBER OF INNER ITERATIONS -
CD                  3- FIX NUMBER OF INNERS, NO CHEBYSHEV -
CD                  4- FIXED INNERS AND INITIAL COEFFICIENTS -
CD                  5- FIXED INNERS AND COEFFICIENTS, NO CHEBYSHEV -
CD                  6- SAME AS 4 BUT DONT USE 1-D COEFFICIENTS -
CD                  7- SAME AS 5 BUT DONT USE 1-D COEFFICIENTS -
CD      IX(24)      INNER ITERATION SWEEP ORDER -
CD                  -1 NORMAL ORDERED -
CD                  0 AUTOMATED (SIGNA-1 IF AVAILABLE, USUALLY) -
CD                  1 SIGNA-1 ORDERED IF AVAILABLE -
CD      IX(25)      OUTER ITERATION CHEBYSHEV ACCELERATION OPTIONS -
CD                  .LT. 0 START AT THIS ITERATION -
CD                  0- USE AUTOMATED PROCEDURE -
CD                  1- APPLY ONLY AFTER THE FIRST EXTRAPOLATION -
CD                  2- APPLY CONTINUOUSLY FROM THE START -
CD                  3- DONT APPLY THE PROCESS -
CD                  .GT. 100- THE PROCESS IS STARTED AT ITERATION -
CD                  IX(25)-100 USING AN L1 NORM EIGENVALUE -
CD      IX(26)      ASYMPTOTIC OUTER ITERATION EXTRAPOLATION OPTIONS -
CD                  -1 SINGLE ERROR MODE ONLY -
CD                  0- USE AUTOMATED PROCEDURE -
CD                  1- SINGLE ERROR MODE USING DATA FOR ALTERNATE -
CD                  ITERATIONS -
CD                  2- NOT ALLOWED -
CD                  3- WE ARE TRYING TO FIGURE OUT WHAT THIS DOES -

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CD	IX(27)	FORCED DELAY IN ASYMPTOTIC EXTRAPOLATION	-
CD		N- NOT ALLOWED FOR THIS MANY OUTER ITERATIONS-	-
CD		(IF NEGATIVE, A FORCED PROCEDURE MAY BE	-
CD		EXECUTED EARLIER)	-
C			-
CN		EDITS GENERALLY ARE NOT DONE WHEN FLAG IS ZERO	-
C			-
CD	IX(28)	OPTION FOR CONDENSED EDIT (TERMINAL) IF .GT. 1	-
CD	IX(29)	OPTION TO EDIT THE PRINCIPAL MACROSCOPIC	-
CD		CROSS SECTIONS BY ZONE	-
CD	IX(30)	OPTION TO EDIT THE MACROSCOPIC SCATTERING	-
CD		CROSS SECTIONS BY ZONE	-
CD	IX(31)	OPTIONS ON ITERATION DATA EDITS	-
CD		-1- NO EDITS DURING ITERATION	-
CD		0, OR 1- PRIMARY OUTER ITERATION DATA ONLY	-
CD		2- GETS DETAILS EDITED FOR TESTING	-
CD		3- REQUESTS EXTENDED EDIT FOR DEBUGGING	-
CD	IX(32)	OPTION TO EDIT OVERALL NEUTRON BALANCE BY GROUP	-
CD	IX(33)	OPTION TO EDIT NEUTRON BALANCE BY ZONE	-
CD	IX(34)	RESERVED	-
CD	IX(35)	OPTION TO EDIT SCALAR NEUTRON FLUX BY POINT	-
CD	IX(36)	RESERVED	-
CD	IX(37)	OPTION TO EDIT ZONE-AVERAGE FLUX BY GROUP	-
CD		IF .GT. 1, ALSO EDIT THE ZONE, GROUP ADJOINT FLUX-	-
CD	IX(38)	OPTION TO EDIT POWER DENSITY MAP BY INTERVAL	-
CD	IX(39)	OPTION TO EDIT POWER DENSITY TRAVERSES THRU PEAK-	-
CD	IX(40)	OPTION TO EDIT NEUTRON DENSITY MAP (1/V FLUX	-
CD		WEIGHTING)	-
CD	IX(41)	OPTION TO EDIT NEUTRON DENSITY TRAVERSES	-
CD	IX(42)	OPTION TO EDIT SCALAR ADJOINT FLUX	-
CD	IX(43)	MAXIMUM ZONE NUMBER FOR WHICH IX(21) AND IX(22)	-
CD		ARE TO BE APPLIED TO THE ZONE AND GROUP	-
CD		DIFFUSION COEFFICIENTS IF NOT ZERO	-
CD	IX(44)	OPTION TO EDIT ATOMIC DENSITIES WHEN SEARCHING	-
CD		0- NO EDIT	-
CD		1- MINIMUM EDIT AT END	-
CD		2- MAXIMUM EDIT DURING CALCULATION	-
CD	IX(45)	PERTURBATION OPTIONS - IF NEGATIVE, FILES RTFLUX-	-
CD		AND ATFLUX ARE SUPPLIED AND NO NEUTRONICS	-
CD		CALCULATION IS DONE - OTHERWISE THE REGULAR	-
CD		AND/OR ADJOINT SOLUTION IS OBTAINED AS	-
CD		SPECIFIED ABOVE AND EITHER FLUX FILE NOT	-
CD		GENERATED MUST BE SUPPLIED	-
CD		0- NO PERTURBATION CALCULATION	-
CD		1- CALCULATE AND EDIT BASIC REGULAR*ADJOINT	-
CD		FLUX INTEGRALS EXCEPT TRANSPORT	-
CD		2- ALSO CALCULATE AND EDIT TRANSPORT INTEGRALS-	-
CD		(REQUIRED FOR COMPLETE PERTURBATION EFFECT)-	-
CD		3- ALSO EDIT MACROSCOPIC ABSORPTION CROSS	-
CD		SECTION SPACE POINT IMPORTANCE MAP	-
CD		4- ALSO EDIT MACROSCOPIC PRODUCTION CROSS	-
CD		SECTION SPACE POINT IMPORTANCE MAP	-
CD		PLUS ABS-PROD MAP	-
CD		5- ALSO EDIT 1/V SPACE POINT IMPORTANCE MAP	-

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CD IX(46) EDIT RESULTS FOR A 100 PERCENT CHANGE IN MACRO -
CD CROSS SECTIONS, ONLY IF IX(45).NE.0 -
CD IX(47) OPTION TO WRITE POINT FLUX VALUES FOR EXPOSURE -
CD (EXERCISED ONLY IF IX(53) .GT. 0) -
CD .GT. 0 WRITE DATA FOR POINTS IN THIS ZONE -
CD -1 WRITE ONLY THE SPECTRUM FOR THE POINT WHERE -
CD THE POWER DENSITY IS A MAXIMUM INITIALLY -
CD -2 WRITE DATA FOR THE POINTS IN THE ZONE WHERE -
CD THE POWER DENSITY IS A MAXIMUM INITIALLY -
CD -3 WRITE ONLY THE SPECTRUM FOR THE POINT WHERE -
CD THE FIRST GROUP FLUX IS A MAXIMUM INITIALLY -
CD -4 WRITE DATA FOR THE POINTS IN THE ZONE WHERE -
CD THE FIRST GROUP FLUX IS A MAXIMUM INITIALLY -
CD .LT.-4 WRITE SPECTRUM FOR THIS MESH POINT -
C: ANOTHER ZONE NUMBER FOR WHICH THE POINT FLUX -
CD IX(48) VALUES ARE TO BE WRITTEN FOR EXPOSURE IF .GT. -
CD IX(49) OPTION TO EDIT THE DIRECT CONTRIBUTION TO CHANGE-
CD IN CONVERSION RATIO FROM UNIT CHANGE IN FERTILE -
CD CAPTURE AND FISSION ABSORPTION (MACROSCOPIC) -
CD IX(50) OPTION TO WRITE SCALAR ADJOINT FLUX FILE AS -
CD THE PRODUCT OF THE REGULAR AND ADJOINT FLUX -
CD 0- NO -
CD 1- REWRITE THE LATEST VERSION OF AN OLD FILE -
CD (IF THERE IS NONE, WRITE A NEW ONE) -
CD 2- WRITE NEW FILE -
C -
C OPTIONS ABOVE ARE TYPICAL FOR EACH FILE COVERED BELOW -
C -
CD IX(51) OPTION TO WRITE THE POINT SCALAR FLUX FILE -
CD IX(52) OPTION TO WRITE THE POINT FISSION SOURCE FILE -
CD IX(53) OPTION TO WRITE ZONE-AVERAGE SCALAR FLUX FILE -
CD IX(54) OPTION TO WRITE POINT POWER DENSITY FILE -
CD IX(55) WRITE THE CONVERSION RATIO ADJOINT IMPORTANCE -
CD FIXED SOURCE FILE (ALWAYS ADDS A FILE OR TWO) -
CD .GT.0- WRITE COMBINED FILE (HAS NEGATIVE DATA) -
CD .LT.0- WRITE TWO FILES, ALL POSITIVE -
CD IX(56) OPTION TO WRITE THE ZONE POWER DENSITY FILE -
CD IX(57) OPTION TO WRITE THE ADJOINT ZONE AVERAGE FLUX -
CD FILE AZPLIX -
CD IX(58) OPTION TO WRITE SCALAR ADJOINT FLUX FILE -
CD APPLICABLE ONLY IF AN ADJOINT PROBLEM WAS DONE -
CD IX(59) OPTION TO WRITE PERTURBATION INTEGRALS ON FILE -
CD PERTURB. IX(45) MUST BE NON-ZERO. TRANSPORT -
CD INTEGRALS ARE INCLUDED IF ABS(IX(45)) GT 2. -
CD IX(60) OPTION TO WRITE SPECIAL FORMATTED DATA FILE -
CD (LOGICAL 4) AT THE END OF A CASE - SEE SECTION -
CD OF THE VENTURE REPORT -
CD IX(61) A PLANE NUMBER AT WHICH ZONE AND GROUP BUCKLINGS -
CD ARE TO BE CALCULATED -
CD IX(62) A SECOND PLANE NUMBER FOR THE BUCKLING CALCULATI-

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CD    IX(63)          OPTION TO WRITE A POINTWISE FIXED SOURCE FILE -
CD                      AS (DB**2) TIMES FLUX -
CD    IX(64)          WRITE A POINT POWER DENSITY ADJOINT IMPORTANCE -
CD                      FIXED SOURCE FILE (ALWAYS ADDS A FILE) -
CD                      1 POINT WHERE POWER DENSITY IS MAX -
CD                      -M POINT IN ZONE ARS (M) WHERE POWER DENSITY -
CD                      IS MAX -
CD                      2 POINT GIVEN BY IX(65-67) BELOW -
CD    IX(65)          COLUMN NUMBER FOR IX(64)=2 -
CD    IX(66)          POW  NUMBER FOR IX(64)=2 -
CD    IX(67)          PLANE NUMBER FOR IX(64)=2 -
CD    IX(68)          RESERVED -
CD    IX(69)          IF GT 0 EQUILIBRIUM XENON WILL BE ACCOUNTED FOR -
CD                      AND THIS IS THE ORDER NUMBER OF XENON IN THE -
CD                      NUCLIDE LIST (SET 1) IN SECTION 013 DVENTR -
CD    IX(70)          FORCE DATA TRANSFER IN INITIALIZATION (TO TEST -
CD                      PROCEDURES) -
CD    IX(71)          RESERVED -
CD    IX(72)          RESERVED -
CD    IX(73)          OVERRIDE DEFAULT OF FILES TO MEMORY (TO TEST -
CD                      PROCEDURES) -
CD    IX(74)          SPACE-ENERGY REBALANCE WILL BE DONE OCCASIONALLY -
CD                      IF GT 0 -
CD    IX(75)          THE NUMBER OF BOLCKS ALONG ROWS (LEFT-RIGHT) -
CD                      FOR REBALANCE - IX(74) .GT. 0 -
CD    IX(76)          THE NUMBER OF BOLCKS ALONG COLS (TOP-BOTTOM) -
CD                      FOR REBALANCE - IX(74) .GT. 0 -
CD    IX(77)          THE NUMBER OF BOLCKS ALONG PLANES (FORE-AFT) -
CD                      FOR REBALANCE - IX(74) .GT. 0 -
CD    IX(78) - IX(79) RESERVED -
CD    IX(80)          OPTION TO ACCOUNT FOR THE DEPENDENCE OF THE -
CD                      CROSS SECTIONS ON THE LOCAL TEMPERATURE, REQUIRES -
CD                      TWO 'GROSSAS' FILES, A 'ZTEMP' FILE, AND REFERENCE -
CD                      TEMPERATURES (SEE IX(25), IX(26), AND IX(27)) -
CD                      0- NO -
CD                      1- YES -
CD    IX(81) - IX(100) RESERVED -
C
C-----

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(CONT)

SPECIFICATIONS FOR RRTINS RECORD IN INTERFACE FILE CONTROL

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C-----
CR      REACTION RATE MODULE INSTRUCTIONS
C
C      REFERENCE 11/01/77 ORNL-5062/R1
C      MODIFIED 09/17/79
C
CL      RRTINS, (IX(I),I=1,100), (IX(I),I=1,100)
C
CW      101*MULT + 100
C
CD      RRTINS      REACTION RATE MODULE DATA IDENTIFIER (6HRRTINS)
C
CC      NOTE- UNDEFINED DATA ARE RESERVED FOR FUTURE USE.
CC      NOTE- THE VALUE OF ZERO IS A DEFAULT MEANING THAT THE OPTION TO
CC      PERFORM THE TASK IS NOT EXERCISED. CONSIDERABLE DATA
CC      HANDLING MAY BE INVOLVED AND MUCH PAPER PRINTED, SO CARE
CC      SHOULD BE TAKEN TO OBTAIN ONLY THOSE RESULTS NEEDED.
CC      NOTE- QUITE GENERALLY THE FILES -WDXSRF- AND -ZNATDM- ARE NEEDED
CC      AND USUALLY -GRUPXS-
C
CD      XX(1)      DESIRED POWER LEVEL IF NON-ZERO (USUALLY MW)
C
CD      XX(2)      RESERVED
C
CD      XX(3)      WEIGHTING FACTOR DISCUSSED BELOW
C
C!      XX(4)      WEIGHTING FACTOR DISCUSSED BELOW
C
CD      XX(5-24)   RESERVED
C
CD      XX(25)     REFERENCE TEMPERATURE (DEGREES C) OF THE
CD                NEXT-TO-LATEST VERSION 'GRUPXS' CROSS SECTION
CD                INTERFACE FILE
C
CD      XX(26)     REFERENCE TEMPERATURE (DEGREES C) OF THE
CD                LATEST VERSION 'GRUPXS' CROSS SECTION INTERFACE
CD                FILE
C
CD      XX(27)     CORRELATION PARAMETER FOR THE ARCTANGENT
CD                DEPENDENCE OF CROSS SECTIONS ON ZONE
CD                TEMPERATURES (LINEAR CORRELATION IF 0.0)
C
CD      XX(28-30)  RESERVED
C
CD      XX(31-100) RESERVED - SEE IX(41)
C
CD      IX(1)      RESERVED
C
CD      IX(2)      CONDENSED EDIT OPTION
CD                  0- YES
CD                  1- NO
C

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CD	IX(3)	OPTION TO EDIT PROGRAMMER INFORMATION FOR DEBUGGING	-
C			-
CD	IX(4)	RESERVED	-
C			-
CD	IX(5)	OPTION TO ACCOUNT FOR THE DEPENDENCE OF THE	-
CD		CROSS SECTIONS ON THE LOCAL TEMPERATURE, REQUIRES	-
CD		TWO 'GRUPIS' FILES, A 'ZNTMP' FILE, AND REFERENCE	-
CD		TEMPERATURES (SEE IX(25), IX(26), AND IX(27))	-
CD		0- NO	-
CD		1- YES	-
C			-
CD	IX(6)	OPTION TO COMPUTE AND EDIT REACTION RATES,	-
CD		INVENTORIES, AND POWER PRODUCTION	-
CC	NOTE-	INDEPENDENT OF THE OPTIONS WHICH FOLLOW, SUMMARY TABLES	-
CC		ARE ALWAYS EDITED ON THIS OPTION	-
C			-
CD	IX(7)	RESERVED	-
C			-
CD	IX(8)	RESEVED	-
C			-
CD	IX(9)	OPTION TO EDIT BY ZONE AND SUBZONE FOR EACH UNIQUE	-
CD		NUCLIDE NAME	-
CD		1 - YES (WILL BE DONE ONLY IF THERE ARE	-
CD		SUBZONES)	-
CC	NOTE-	IN THIS EDIT, ZONE RESULTS EXCLUDE SUBZONE CONTRIBUTIONS	-
C			-
CD	IX(10)	OPTION TO EDIT BY ZONE FOR EACH UNIQUE NUCLIDE NAME	-
CD		NOTE - ZONES WILL INCLUDE SUBZONE CONTRIBUTIONS	-
C			-
CD	IX(11)	OPTION TO EDIT BY ZONE CLASS FOR EACH UNIQUE	-
CD		NUCLIDE NAME	-
C			-
CD	IX(12)	RESERVED	-
C			-
CD	IX(13)	RESERVED	-
C			-
CD	IX(14)	OPTION TO WEIGHT SUMMARY REACTION RATES BY NUCLIDE	-
CD		ENERGY GENERATION	-
CD		1- FISSION ENERGY ONLY	-
CD		2- FISSION PLUS CAPTURE ENERGY	-
C			-
CD	IX(15)	OPTION FOR ADDITIONAL RESULTS WITH ALTERNATIVE	-
CD		WEIGHTINGS (SUMMARY TABLES ONLY)	-
CD		1- BY NET NEUTRON PRODUCTION (GENERATION MINUS	-
CD		ABSORPTION)	-
CD		2- BY CAPTURE RATE IF FERTILE AND ABSORPTION	-
CD		RATE IF FISSILE	-
C			-
CD	IX(16)	REPEAT THE CALCULATIONS OF REACTION RATES INDICATED	-
CD		ABOVE (IX(5).GT.0) USING FLUX, ADJOINT WEIGHTING-	-
CD		REQUIRING FILE -PERTUB-	-
C			-

(CONT)

CN	THE FOLLOWING ARE PRELIMINARY, NOT IMPLEMENTED		-
C			-
CD	IX(17-20)	RESERVED	-
C			-
CD	IX(21)	OPTION TO EDIT REACTION RATE MAPS USING FILE -RTFLUX-	-
CD		.GP.0- SPECIFIES A PLANE OF A 3-D PROBLEM OR	-
CD		A ROW OF A 2-D PROBLEM	-
CJ		-1- THE PLANE OR ROW IS TO CONTAIN THE	-
CD		LOCATION OF MAXIMUM POWER DENSITY	-
C			-
CD	IX(22)	MAP PRINCIPAL REACTION RATES FOR FISSILE NUCLIDES	-
CD		1- ABSORPTION	-
CD		2- ABSORPTION AND PRODUCTION	-
CD		3- CAPTURE AND FISSION	-
CD		4- CAPTURE, FISSION AND PRODUCTION PER	-
CD		ABSORPTION	-
C			-
CD	IX(23)	MAP PRINCIPAL REACTION RATES FOR FERTILE NUCLIDES	-
CD		1- CAPTURE	-
CD		2- ABSORPTION ONLY	-
C			-
CD	IX(24)	MAP ABSORPTION RATES FOR NUCLIDES OF THIS CLASS	-
C			-
CD	IX(25)	RESERVED	-
C			-
CD	IX(26)	REPEAT THE MAPPING WITH WEIGHTING ON ADJOINT FLUX	-
CD		USING FILE -PERTUB	-
C			-
CD	IX(27-30)	RESERVED	-
C			-
CD	IX(31)	OPTION TO EDIT REACTIVITY COEFFICIENTS FOR UNIT	-
CD		CHANGES IN FISSILE NUCLIDE CONCENTRATIONS	-
C			-
CD	IX(32)	OPTION TO EDIT REACTIVITY COEFFICIENTS FOR UNIT	-
CD		CHANGES IN FERTILE NUCLIDE CONCENTRATIONS	-
C			-
CD	IX(33)	OPTION TO EDIT REACTIVITY COEFFICIENTS FOR UNIT	-
CD		CHANGES IN NUCLIDE CONCENTRATIONS OF THIS CLASS	-
C			-
CD	IX(34-36)	RESERVED	-
C			-
CD	IX(37)	OPTION TO PRODUCE DELAYED NEUTRON PROPERTIES WITH	-
CD		FLUX, ADJOINT WEIGHTING USING FILE -PERTUB- AND	-
CD		-D'AYXS-	-
C			-
CD	IX(38-40)	RESERVED	-
C			-

(CONT)

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CD      IX(41)      OPTION TO COLLAPSE CROSS SECTIONS IN ENERGY, FILE -
CD                  -ISOTXS-10-ISOTXS- USING THE ENERGY STRUCTURE -
CD                  GIVEN AS GROUP LOWER BOUNDS DESCENDING EV, DATA -
CD                  IN ARRAY XI STARTING AT XI(31) TERMINATING WITH -
CD                  A ZERO ENTRY FOR THE LAST GROUP -
CD                  1- PRODUCE MACROSCOPIC CROSS SECTIONS FOR PSEUDO-
CD                      DENSITY UNITY FOR EACH ZONE, FLUX WEIGHTED -
CD                  2- PRODUCE ONE-TO-ONE NUCLIDE DATA ONLY FOR THE -
CD                      ONES HAVING NON-ZERO CONCENTRATIONS WITH FLUX-
CD                      WEICHTING USING FILE -RZFLUX- -
CD                  3- SAME AS 2 EXCEPT FLUX, ADJOINT WEIGHTING -
CD                      REQUIRING FILE -PERTUB- -
C
CD      IX(42-50)    RESERVED -
C
CD      IX(51)      OPTION TO GENERATE A DISTRIBUTED NEUTRON SOURCE FILE-
CD                  -FIXSRC- USING FLUX FROM -RTFLUX- -
CD                  1- TOTAL PRODUCTIONS FROM FISSION MULTIPLIED BY -
CD                      XI(3) NORMALIZED TO A TOTAL OF XI(3)*XI(4) -
CD                      IF XI(4) IS NON ZERO, XI(3) SET TO UNITY IF 0-
CD                  2- TOTAL DELAYED NEUTRON SOURCE USING FILE -
CD                      -DLAYXS- -
CD                  3- ASYMPTOTIC DELAYED NEUTRON SOURCE USING THE -
CD                      FAMILY OF LONGEST HALF LIFE (ASSUMES DISTINCT-
CD                      ONE APPLIES) USING FILE -DLAYXS- -
C
CD      IX(52)      OPTION TO GENERATE A ZONE-GROUP DISTRIBUTED SOURCE -
CD                  FILE -FIXSRC- USING ZONE AVERAGE FLUX FILE -
CD                  -RZFLUX- (SEE OPTIONS IMMEDIATELY ABOVE) -
C
CD      IX(53-100)   RESERVED -
C
C-----

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(CONT)

SPECIFICATIONS FOR RODINS RECORD IN INTERFACE FILE CONTRL

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C-----
CR      CONTROL ROD POSITIONING INSTRUCTIONS
C
CL      RODINS, (IX(1),I=1,100),(IX(1),I=1,100)
C
CW      101*MULT + 100
C
CD      RODINS      ROD POSITIONING MODULE DATA IDENTIFIER (6HRODINS).
C
CC      NOTE - THE INTERFACE FILES 'CONTRL' 'RODSET' 'NDISRP' 'ZNATDN'
CC      AND 'GEODST' ARE REQUIRED.
C
CD      XX(1)      REFERENCE HISTORY TIME (CYCLE TIME), DAYS, BETWEEN
CD                  FUELINGS DURING WHICH A SUCCESSION OF CONTROL ROD
CD                  POSITIONINGS ARE TO BE DONE (SEE IX(10)=0 BELOW) -
CD                  USED FOR THE FIRST NSRPS SET (IX(8)=1).
C
CD      XX(2)      REFERENCE HISTORY TIME TO BE USED FOR ALL BUT THE
CD                  FIRST NSRPS SET (IX(8).GT.1) - DEFAULTED TO XX(1)
CD                  IF 0.
C
CD      IX(3)      EDIT OPTIONS.
CD                  0- NO SPECIAL EDITS.
CD                  1- ROD-FOLLOWER ZONE DENSITIES AFTER POSITIONING.
CD                  2- PLUS SOME INFORMATION ABOUT ROD POSITIONING.
CD                  3- PLUS MORE INFORMATION ABOUT ROD POSITIONING.
CD                  4- PLUS CONTENTS OF THE COMMON DATA BLOCK.
CD                  5- PLUS THE CONTENTS OF FILES 'NDISRP', 'ZNATDN',
CD                  AND THIS RECORD 'RODINS' OF FILE 'CONTRL'.
C
CD      IX(8)      THE SET NUMBER OF THE ROD POSITIONING SPECIFICATIONS-
CD                  (OUT OF NSRPS SETS ON FILE 'RODSET') THAT IS TO BE
CD                  USED THIS ACCESS. DEFAULTED TO 1 IF 0. (APPLICABLE
CD                  FOR IX(10) =0, OR =1 BELOW).
C
CD      IX(9)      ANOTHER SET NUMBER OF THE ROD POSITIONING
CD                  SPECIFICATIONS THAT IS TO BE USED THIS ACCESS
CD                  (IF.GT.0) AFTER USING THE IX(8) SET.
C
CD      IX(10)     OPTIONS ON ROD POSITIONING.
CD                  -4- RECOVER ALL ROD AND FOLLOWER CONCENTRATIONS
CD                      FROM THE NEXT-TO-LATEST VERSION OF THE ZONE
CD                      DENSITY FILE 'ZNATDN' (SEE IX(11) AND IX(12)
CD                      BELOW). IF NEXT-TO-LATEST VERSION DOES NOT
CD                      EXIST, USE LATEST VERSION.
CD                  -3- RECOVER ALL ROD AND FOLLOWER CONCENTRATIONS
CD                      FROM THE LATEST VERSION OF FILE 'ZNATDN'.
CD                  -2- INSERT RODS FULLY AS SPECIFIED BY OPTION NSR
CD                      IN THE FILE 'RODSET'.
CD                  -1- WITHDRAW RODS FULLY AS SPECIFIED BY OPTION NSR
CD                      IN THE FILE 'RODSET'.

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(CONT)

IX (11)

(CONT)

CD	IX(12)	OPTION ON SAVING THE ZONE DENSITY INTERFACE FILE	-
CD		'YNATDN', ONLY IF IX(11)=0.	-
CD		-1- NO.	-
CD		0- IF NO FILE EXISTS, CREATE IT WITH DENSITIES -	-
CD		A) AFTER PULL ROD INSERTION (IX(10)=-2)	-
CD		IF SPECIFIED, OR	-
CD		B) RECOVERED FROM LATEST 'ZNATDN' FILE.	-
CD		IF A FILE EXISTS, NONE IS WRITTEN.	-
CD		1- WRITE IT AFTER PULL ROD INSERTION (IX(10)=-2).	-
CD		2- WRITE IT AFTER ANY ROD POSITIONING	-
CD		SPECIFICATION.	-
C			-
CD	IX(13)	OPTION ON DELETING THE LATEST VERSION OF THE ZONE	-
CD		DENSITY FILE 'YNATDN' AFTER APPLYING SPECIFICATIONS,	-
CD		PROVIDED IT WAS NOT CREATED THIS ACCESS.	-
CD		0- NO.	-
CD		1- DELETE THE LATEST VERSION OF 'YNATDN' BUT	-
CD		ONLY IF MORE THAN 1 VERSION EXISTS.	-
C			-
CD	IX(14)	BLACK ABSORBER OPTION FOR ROD ZONES.	-
CD		0- NO.	-
CD		1- YES (GENERALLY REQUIRED FOR THERMAL REACTORS	-
CD		WITH RODS REPRESENTED EXPLICITLY).	-
CD		NORMALLY THE LATEST VERSION OF 'GEODST' IS	-
CD		READ TO OBTAIN THE BLACK ABSORBER ZONES AND	-
CD		A NEW VERSION IS WRITTEN IF ONLY ONE EXISTS,	-
CD		OTHERWISE THE LATEST VERSION IS RE-WRITTEN.	-
CD		IF IX(10)=-4, THE NEXT-TO-LATEST VERSION OF	-
CD		'GEODST' IS READ TO OBTAIN THE BLACK ABSORBER	-
CD		ZONES.	-
CD		WHEN CONTROL ROD INTERCHANGES ARE APPLIED,	-
CD		BLACK ABSORBER CONDITIONS ARE MOVED WITH THE	-
CD		INTERCHANGES. SOME ROD ZONES MAY NOT BE BLACK	-
CD		AND NEVER BECOME BLACK IF ONLY THE ROD	-
CD		INTERCHANGE SPECIFICATIONS ARE USED (NO	-
CD		INSERTION SPECIFICATIONS). WHEN INSERTION	-
CD		SPECIFICATIONS ARE APPLIED, ALL ZONES	-
CD		CONTAINING CONTROL ROD ARE ASSIGNED THE BLACK	-
CD		ABSORBER CONDITION, LIMITING APPLICATION TO	-
CD		ONLY FULLY EXPLICIT CONTROL ROD	-
CD		REPRESENTATION.	-
C			-

(CONT)

SPECIFICATIONS FOR EXPINS RECORD IN INTERFACE FILE CONTROL

```

C-----
CX      EXPOSURE MODULE INSTRUCTIONS
C
C      REFERENCE 92/01/79 ORNL-5180
C      MODIFIED 05/01/79
C
CL      EXPINS, (XX(I), I=1, 100), (IX(I), I=1, 100)
C
CW      101*HOLT + 100
C
CD      EXPINS      EXPOSURE MODULE DATA IDENTIFIER (6*EXPINS)
C
C*      OPTION NOT IMPLEMENTED
C**     OPTION NOT RECOMMENDED
C
CD      XX(1)        EXPOSURE TIME STEP (DAYS)
C**     (A NEGATIVE TIME IS USED FOR SPECIAL SITUATIONS)
C
CD      IX(2)        SHUTDOWN TIME STEP AFTER EXPOSURE (DAYS AT ZERO
C                   FLUX)
C
CD      IX(3)        THE RATIO OF EACH SHUTDOWN SUBSTEP TIME INTERVAL
C                   TO THAT OF THE PREVIOUS SUBSTEP (APPLICABLE
C                   ONLY IF IX(7) .GT. 1)
C                   (DEFAULT TO 1.0)
C
CD      IX(4)        RESERVED
C
CD      IX(5)        RESERVED
C
CD      IX(6)        RELATIVE POWER LEVEL (ALL REACTION RATES ARE
C                   MULTIPLIED BY THIS FACTOR IF NONZERO - PROPER
C                   NORMALIZATION OF THE FLUX LEVEL BY THE NEUTRONICS
C                   CODE TO EFFECT SOME POWER LEVEL IS PRESUMED)
C
CD      IX(7)        RESERVED
C
CD      IX(8)        RESERVED
C
CD      IX(9)        RESERVED
C
CD      IX(10)       WEIGHTING FACTOR FOR USE WITH TWO PLEX INTERFACE
C                   FILES (IF IX(13) .EQ. -2)
C
C                   PHI(USED) = PHI(LV) + IX(10)*(PHI(NLV) - PHI(LV))
C                   WHERE PHI(LV) IS LATEST VERSION (IN TIME) FLUX
C                   WHERE PHI(NLV) IS NEXT-TO-LATEST VERSION 'IN
C                   TIME' FLUX
C                   (DEFAULT TO 0.5)
C

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(CONT)

CD	XX(11)	FLUENCE LOWER BOUND FOR FIRST ENERGY RANGE (EV)	-
C			-
CD	XX(12)	FLUENCE LOWER BOUND FOR SECOND ENERGY RANGE (EV)	-
C			-
CD	XX(13)	CONVERGENCE LEVEL FOR MATRIX EXPONENTIAL METHOD	-
CD		(DEFAULT TO 1.0E-8)	-
C			-
CD	XX(14)	LIMITING VALUE OF DIAGONAL TERM FOR MATRIX	-
CD		EXPONENTIAL METHOD (EACH SUBSTEP IS SUBDIVIDED	-
CD		INTO AS MANY FINE INCREMENTS AS NEEDED TO REDUCE	-
CD		THE LARGEST DIAGONAL TERM TO THIS LEVEL)	-
CD		(DEFAULT TO 12.0)	-
C			-
CD	XX(15)	MATRIX EXPONENTIAL TRANSFORM, FRACTION OF LARGEST	-
CD		DIAGONAL TERM	-
CD		(DEFAULT TO 0.5)	-
C			-
CD	XX(16)	MINIMUM NUCLIDE DENSITY ALLOWED	-
CD		(DEFAULT TO 1.0E-50)	-
C			-
CD	XX(17)	MAGNITUDE OF DIAGONAL TERM USED AS CRITERIA FOR	-
CD		APPLYING THE EQUILIBRIUM APPROXIMATION TO A	-
CD		NUCLIDE WITH THE MATRIX EXPONENTIAL METHOD	-
CD		(DEFAULT TO 2.0*XX(14))	-
C			-
CD	XX(18)	WEIGHTING FACTOR FOR EXPOSURE NUCLIDE DENSITIES	-
CD		WRITTEN ON INTERFACE FILE (IF IX(31) .NE. 0)	-
CD		'ZNATDN' FOR ZONE CALCULATION	-
CD		'PTATDN' FOR POINT CALCULATION	-
C			-
CD		$N(WRITTEN) = N(E) + XX(18) * (N(S) - N(E))$	-
CD		WHERE N(E) ARE DENSITIES AT END OF EXPOSURE	-
CD		WHERE N(S) ARE DENSITIES AT START OF EXPOSURE	-
CD		(DEFAULT TO 0.5)	-
C			-
CD	XX(19)	AVERAGE GENERATION RATE WEIGHTING FACTOR FOR	-
CD		SOURCE TERM	-
C			-
CD		PRECURSOR DENSITY IS	-
CD		$XX(19) * N(T) + (1.0 - XX(19)) * N(T+DT)$	-
CD		(DEFAULT TO 0.5)	-
C			-
CD	XX(20)	CONVERGENCE CRITERIA ON POWER LEVEL FOR CONTINUOUS	-
CD		FUELING MODEL TO DISCONTINUE POWER LEVEL	-
CD		INITIALIZATION PASSES (APPLICABLE IF IX(51) .GT. 0	-
CD		AND/OR IX(52) .GT. 0 AND IX(61) .GT. 1)	-
CD		(DEFAULT TO 0.005)	-
C			-
CD	XX(21)	RESERVED	-
C			-

(CONT)

CD	IX(22)	RESERVED	-
C			-
CD	IX(23)	RESERVED	-
C			-
CD	IX(24)	RESERVED	-
C			-
CD	IX(25)	REFERENCE TEMPERATURE (DEGREES C) OF THE	-
CD		NEXT-TO-LATEST VERSION 'GRUPIS' CROSS SECTION	-
CD		INTERFACE FILE	-
C			-
CD	IX(26)	REFERENCE TEMPERATURE (DEGREES C) OF THE	-
CD		LATEST VERSION 'GRUPIS' CROSS SECTION INTERFACE	-
CD		FILE	-
C			-
CD	IX(27)	CORRELATION PARAMETER FOR THE ARCTANGENT	-
CD		DEPENDENCE OF CROSS SECTIONS ON ZONE	-
CD		TEMPERATURES (LINEAR CORRELATION IF 0.0)	-
C			-
CD	IX(28)	RESERVED	-
C			-
CD	IX(29)	RESERVED	-
C			-
CD	IX(30)	RESERVED	-
C			-
CD	IX(31-100)	CORE RESIDENCE TIME (DAYS) FOR EACH ZONE PATH	-
CD		FOLLOWED BY THE CORE RESIDENCE TIME (DAYS) FOR	-
CD		EACH SUBZONE PATH (IF ANY) - SEE IX(51)	-
CD		(DEFAULT TO IX(1))	-
C			-
CN		USUAL VALUES OF SOME OF THE PARAMETERS ARE SHOWN HERE IN ()	-
C			-
CD	IX(1)	RESERVED	-
C			-
CD	IX(2)	CONDENSED EDIT OPTION	-
CD		0- YES	-
CD		1- NO	-
C			-
CD	IX(3)	DEBUG EDIT OPTION (0)	-
CD		0- NO SPECIAL EDITS	-
CD		1- CROSS REFERENCE TABLES, EXPOSURE DATA,	-
CD		CHECK AND EDIT DATA FROM 'EXPOSE' INTERFACE	-
CD		FILE, AND EDIT INTERFACE FILE PARAMETERS	-
CD		2- HIGHER LEVEL DATA EDIT	-
CD		3- PLUS STARTING NUCLIDE DENSITIES	-
CD		4- PLUS INTERMEDIATE LEVEL DATA	-
CD		5- PLUS STARTING REACTION RATES	-
CD		6- PLUS ALL EDIT OPTIONS ARE TURNED ON	-
CD		7- PLUS MATRIX EXPONENTIAL AND AVERAGE GENERATION	-
CD		RATE DEBUG EDITS	-
CD		8- PLUS ADDITIONAL MATRIX EXPONENTIAL DEBUG EDITS	-
C			-
CN		NOTE- USE OF 6,7, OR 8 WILL PRODUCE REAMS OF PAPER	-
C			-

(CONT)

CD	IX(4)	RESERVED	-
C			-
CD	IX(5)	OPTION ON BASIC CHAIN EQUATION SOLUTION METHOD	-
CD		(CONSISTENT CHAIN DATA MUST BE PRESENT ON	-
CD		INTERFACE FILE 'EXPOSE')	-
CD		0- MATRIX EXPONENTIAL	-
CD		1- EXPLICIT CHAIN	-
CD		2- AVERAGE GENERATION RATE	-
CD		3- MATRIX EXPONENTIAL (NO COUPLING)	-
CD		5- AVERAGE GENERATION RATE (NO COUPLING)	-
C			-
CN		(IF IX(5) .EQ. 0 AND NHATKE('EXPOSE') .EQ. 0 AND	-
CN		LBEXCH('EXPOSE') .GT. 0, DEFAULT TO 1)	-
CN			-
CN		(IF IX(5) .EQ. 2 AND NHATKE('EXPOSE') .EQ. 0 AND	-
CN		LBEXCH('EXPOSE') .GT. 0, DEFAULT TO 1)	-
CN			-
CN		(IF IX(5) .EQ. 1 AND LBEXCH('EXPOSE') .EQ. 0 AND	-
CN		NHATKE('EXPOSE') .GT. 0, DEFAULT TO 0)	-
C			-
CD	IX(6)	NUMBER OF SUBSTEP EXPOSURE INTERVALS	-
CD		IX(6) .GT. 1 IS NORMALLY USED ONLY WHEN THE FLUX	-
CD		LEVEL IS TO BE ADJUSTED (SEE IX(12))	-
CD		(DEFAULT TO 1 IF XX(1) .NE. 0.0)	-
C			-
CN		EXPOSURE NOT CALCULATED IF XX(1) .EQ. 0.0	-
C			-
CN		FOR CONTINUOUS FUELING MODEL SET IX(6) .EQ. 1	-
C			-
CD	IX(7)	NUMBER OF SUBSTEP SHUTDOWN INTERVALS	-
CD		IX(7) .GT. 1 IS NORMALLY USED ONLY TO PRODUCE	-
CD		EDITS AT POINTS ALONG SHUTDOWN STEP	-
CD		(DEFAULT TO 1 IF XX(2) .GT. 0.0)	-
C			-
CN		SHUTDOWN NOT CALCULATED IF IX(2) .LE. 0.0	-
C			-
CD	IX(8)	OPTION ON VERSION OF NUCLIDE DENSITIES AT START	-
CD		'ZNATDN' FOR ZONE CALCULATION	-
CD		'PTATDN' FOR POINT CALCULATION (IF NOT AVAILABLE	-
CD		DENSITIES WILL BE EXTRACTED FROM INITIAL ZONE	-
CD		DENSITIES)	-
CD		-1- USE VERSION WITH THE SAME TIME AS THE ZONE	-
CD		FLUX FILE	-
CD		0- USE LATEST VERSION (USUAL)	-
CD		1- USE NEXT-TO-LATEST VERSION IF IT EXISTS	-
C			-
CD	IX(9)	OPTION TO ACCOUNT FOR THE DEPENDENCE OF THE	-
CD		CROSS SECTIONS ON THE LOCAL TEMPERATURE, REQUIRES	-
CD		TWO 'GRUPXS' FILES, A 'ZNTENP' FILE, AND REFERENCE	-
CD		TEMPERATURES (SEE IX(25), XX(26), AND XX(27))	-
CD		0- NO	-
CD		1- YES	-

(CONT)

C			
CD	IX(10)	RESERVED	-
C			-
CD	IX(11)	NUMBER OF SUBDIVISIONS OF EACH SUBSTEP FOR THE	-
CD		AVERAGE GENERATION RATE METHOD (IF ZERO, THE	-
CD		CHOICE IS AUTOMATED)	-
C			-
CD	IX(12)	OPTION ON POWER RENORMALIZATION (SUBSTEPS)	-
CD		0- ATTEMPT TO SATISFY DESIRED POWER LEVEL BY	-
CD		ADJUSTING FLUX LEVEL AT THE START OF EACH	-
CD		SUBSTEP AFTER THE FIRST	-
CD		1- DO NOT ADJUST THE FLUX LEVEL	-
CD		2- NORMALIZE TO THE INITIAL POWER LEVEL AT THE	-
CD		START OF EACH SUBSTEP	-
C			-
CD	IX(13)	OPTION ON FLUX VALUES	-
CD		'RZFLUX' FOR ZONE CALCULATION	-
CD		'RTFLUX' FOR POINT CALCULATION (IF IX(73) .EQ. 1)	-
CD		'RZFLUX' (MODIFIED) FOR POINT CALCULATION	-
CD		(IF IX(73) .EQ. 2)	-
CD		-2- WEIGHT LATEST VERSION AND NEXT-TO-LATEST	-
CD		VERSION (SEE IX(10))	-
CD		-1- USE A LINEAR FLUX APPROXIMATION WITH TIME FROM	-
CD		THE NEXT-TO-LATEST VERSION FILE TO THE LATEST	-
CD		VERSION FILE (IF ONLY ONE EXISTS, USE IT)	-
CD		0- USE LATEST VERSION (USUAL)	-
CD		1- USE NEXT-TO-LATEST VERSION IF IT EXISTS	-
C			-
CD	IX(14)	OPTION ON ZONE(SUBZONE) NUCLIDE DENSITY EDITS	-
CD		(EXPOSURE)	-
CD		0- NONE	-
CD		1- END OF EXPOSURE STEP	-
CD		2- END OF EACH EXPOSURE SUBSTEP	-
C			-
CD	IX(15)	RESERVED	-
C			-
CD	IX(16)	RESERVED	-
C			-
CD	IX(17)	RESERVED	-
C			-
CD	IX(18)	OPTION ON SECONDARY ENERGY DEPOSITION EDITS	-
CD		0- NONE	-
CD		1- DECAY ENERGY RELEASE ONLY	-
CD		2- FISSION ENERGY RELEASE ONLY	-
CD		3- CAPTURE ENERGY RELEASE ONLY	-
CD		4- DECAY + FISSION + CAPTURE ENERGY RELEASE	-
C			-
CN		IF .GT. 0, EDITS BY ZONE AND SUBZONE	-
CN		IF .LT. 0, EDIT TOTALS ONLY	-
C			-

(CONT)

CD	IX(19)	RESERVED	-
C			-
CD	IX(20)	OPTION ON ZONE(SUBZONE) NUCLIDE DENSITY EDITS	-
CD		(SHUTDOWN)	-
CD		0- NONE	-
CD		1- END OF SHUTDOWN STEP	-
CD		2- END OF EACH SHUTDOWN SUBSTEP	-
C			-
CD	IX(21)	SPECIAL NUCLIDE DENSITY EDIT OPTION FOR A SINGLE	-
CD		ZONE PROBLEM	-
CD		-1- COLUMN EDIT IN OPE15.6 FORMAT	-
CD		0- NORMAL EDIT	-
CD		1- COLUMN EDIT IN IPE15.6 FORMAT	-
C			-
CD	IX(22)	RESERVED	-
C			-
CD	IX(23)	RESERVED	-
C			-
CD	IX(24)	RESERVED	-
C			-
CD	IX(25)	OPTION ON WRITING EXPOSURE HISTORY INTERFACE FILE	-
CD		'EXPONT' FOR NORMAL EXPOSURE	-
CD		'CFRIST' FOR CONTINUOUS FUELING EXPOSURE	-
CD		(FLUENCE AND REACTION RATE TYPE DATA)	-
CD		0- DO NOT WRITE	-
CD		1- YES - SAVE LATEST AND NEXT-TO-LATEST DATA	-
CD		2- YES - SAVE ALL DATA	-
CD		3- YES - SAVE LATEST DATA ONLY	-
CD		4- YES - START OVER AGAIN	-
C			-
CN		IF .GT. 0, NO EDIT	-
CN		IF .LT. 0, EDITS OF CUMULATIVE DATA BY ZONE AND	-
CN		SUBZONE	-
C			-
CN		OPTIONS IX(26), IX(27), XX(11), AND XX(12) APPLY ONLY	-
CN		WHEN FILE IS INITIALLY WRITTEN	-
CN		IF THE FILE EXISTS THE OPTIONS SPECIFIED	-
CN		ON THE FILE ARE USED	-
C			-
CD	IX(26)	FLUENCE DATA TO BE SAVED ON EXPOSURE HISTORY	-
CD		INTERFACE FILE	-
CD		0- NONE	-
CD		1- TOTAL FLUENCE (AND FIRST AND SECOND	-
CD		FLUENCE RANGES IF XX(11) AND XX(12) ARE	-
CD		PROPERLY DEFINED)	-
C			-
CD	IX(27)	REACTION RATE TYPE DATA TO BE SAVED ON EXPOSURE	-
CD		HISTORY INTERFACE FILE	-
CD		0- NONE	-
CD		1- FISSIONS AND EXPOSURE	-
CD		2- PLUS ENERGY	-
CD		3- PLUS UNDEFINED	-

(CONT)

OPTION TO EDIT EXPOSURE STEP AVERAGE ZONE(SUBZONE)
POWER DENSITIES
0- NO
1- YES

OPTION TO WRITE INTERFACE FILE 'ZWPOND' WITH
FEASURE STEP AVERAGE ZONE(ZWSZONE) POWER
RUMSRIES
0- DO NOT WRITE
1- REPLACE THE LATEST VERSION OF AN OLD FILE,
IF SOME EXISTS WRITE NEW FILE
2- WRITE NEW FILE

```

OPTION ON NUCLEAR DENSITY FILE WRITING
'EXPOS' FOR ZONE CALCULATION
'SHUTDN' FOR POINT CALCULATION
0- WRITE OVER LATEST EXISTING FILE WITH END OF
  EXPOSURE DENSITIES
1- WRITE NEW FILE WITH END OF EXPOSURE DENSITIES
2- WRITE OVER LATEST EXISTING FILE WITH END OF
  SHUTDOWN DENSITIES
3- WRITE NEW FILE WITH END OF SHUTDOWN DENSITIES
4- WRITE OVER LATEST EXISTING FILE WITH END OF
  EXPOSURE DENSITIES AND WRITE NEW FILE WITH
  END OF SHUTDOWN DENSITIES
5- WRITE NEW FILE WITH END OF EXPOSURE DENSITIES
  AND WRITE NEW FILE WITH END OF SHUTDOWN
  DENSITIES

```

OPTION TO WRITE WEIGHTED AVERAGE EXPOSURE SENSITIVITIES
(SEE IX(10))
'ZMATH' FOR ZONE CALCULATION
'PMATH' FOR POINT CALCULATION
-1- REPORT NORMAL END OF EXPOSURE TIME
0- NO
1- REPORT WEIGHTED TIME

OPTION TO CHECK AND EDIT B..SA FROM INTERFACE FILE
'EXPOSE'
0- NO
1- YES

OPTION TO EDIT INITIAL SOME (SUBZONE) SPECIFIC
REACTION RATES
0- NO
1- YES

IX(34)	OPTION TO EDIT INITIAL SOURCE(SUBSOURCE) SPECTROSC REACTION RATE FOR PSEUDO IN YIELD DATA ENERGY RANGES 0- NO 1- YES
IX(35)	OPTION TO EDIT INITIAL SOURCE(SUBSOURCE) SOURCE DENSITIES 0- NO 1- YES
IX(36)	OPTION TO FORCE CALCULATION INTO I/O SOURCE (USUALLY DETERMINED BY CODE BASED ON MEMORY AVAILABLE) 0- NO (AUTOMATIC) 1- YES
IX(37)	OPTION TO INCREASE STORAGE FOR COUPLING TERMS FOR MATRIX EXPONENTIAL METHOD (IN THE EVENT STOP 4321 OCCURS) (DEFAULT - NUMBER OF NUCLIDES IN EXPOSURE DATA)
IX(38)	OPTION TO SOLVE THE TRANSPOSE OF THE MATRIX FOR THE MATRIX EXPONENTIAL METHOD (THIS IS A SPECIAL FEATURE - NOT APPLICABLE TO A REACTOR CALCULATION) 0- NO 1- YES
IX(39)	MATRIX EXPONENTIAL EQUILIBRIUM OPTION 0- DEFAULT, SAME AS 1 1- APPLY EQUILIBRIUM ASSUMPTION TO HIGH LOSS NUCLIDES 2- DO NOT APPLY EQUILIBRIUM ASSUMPTION (REQUIRED FOR HIGH ACCURACY (BENCHMARKING) BUT IS EXPENSIVE IN TERMS OF RUNNING TIME)
IX(40)	MATRIX EXPONENTIAL FORMULATION OPTION 0- DEFAULT, SAME AS 4 1- NO TRANSFORMATION, ONE TERM 2- TRANSFORMATION, ONE TERM 3- NO TRANSFORMATION, TWO TERM 4- TRANSFORMATION, TWO TERM
IX(41)	MATRIX EXPONENTIAL REFERENCE NUMBER OF TERMS IN EXPANSION (DEFAULT TO 60)
IX(42)	NUMBER OF SUBDIVISIONS OF EACH SUBSTEP FOR THE MATRIX EXPONENTIAL METHOD (IF ZERO, THE CHOICE IS AUTOMATIC)

CD	IX(43)	UPPER BOUND ON NUMBER OF SUBDIVISIONS OF EACH	-
CD		SUBSTEP FOR THE HAPPIX EXPONENTIAL METHOD.	-
CD		(IF IX(39) .EQ. 2 AND THE NUMBER OF SUBDIVISIONS	-
C		COMPUTED BY THE CODE EXCEEDS IX(43) THEN THE	-
CD		EQUILIBRIUM ASSUMPTION WILL BE USED)	-
CD		(DEFAULT TO 10000)	-
C			-
CD	IX(44)	RESERVED	-
C			-
CD	IX(45)	EXPLICIT CHAIN MISSING NUCLIDE OPTION (C)	-
CD		0- TREAT SUBCHAINS	-
CD		1- TREAT FIRST SUBCHAIN ONLY	-
CD		2- SKIP CHAIN	-
C			-
CD	IX(46)	RESERVED	-
C			-
CD	IX(47)	RESERVED	-
C			-
CD	IX(48)	RESERVED	-
C			-
CD	IX(49)	OPTION TO ALLOW EXPOSURE WITH ZERO FLUX AND/OR	-
CD		ZERO ZONE VOLUME	-
CD		0- DO NOT TREAT THE ZONE(SUBZONE)	-
CD		1- ALLOW (FOR TREATING OUT-OF-CORE DECAY IN	-
CD		FALSE ZONES(SUBZONES))	-
C			-
CD	IX(50)	RESERVED	-
C			-
CD	IX(51)	FALSE ZONE NUMBER CONTAINING FEED MATERIAL	-
CD		COMPOSITION FOR ZONE PATHS (OR THE FIRST IN A	-
CD		SEQUENCE OF FALSE ZONE NUMBERS IF IX(57) .EQ. 1)	-
C			-
CN		IF IX(51) .GT. 0 AND/OR IX(52) .GT. 0 THE STEADY STATE,	-
CN		CONTINUOUS FUELING MODEL IS TO BE APPLIED.	-
C			-
CN		THIS ZONE IS THE FEED BOX (OR THE FIRST OF A SET OF BOXES)	-
CN		WHERE FEED MATERIAL FOR EACH FLOW PATH ORIGINATES.	-
CN		THESE ARE FALSE ZONES WHICH MUST BE WITHIN THE DATA	-
CN		DESCRIPTION OF THE PROBLEM, THAT ARE NOT ASSIGNED	-
CN		TO GEOMETRIC LOCATIONS FOR THE NEUTRONICS CALCULATION (THE	-
CN		FLUX WILL NOT BE CALCULATED), AND HAVE ASSIGNED NUMBERS	-
CN		LESS THAN THE MAXIMUM ZONE NUMBER IN THE PROBLEM IF	-
CN		THE 'DVENTR' SPECIAL INPUT PROCESSOR IS USED.	-
CN		THE NUCLIDE DENSITIES ALONG A FLOW PATH CALCULATED IN	-
CN		THIS MODEL DEPEND ONLY ON THE FEED MATERIAL, THE	-
CN		NEUTRON FLUX, AND THE RESIDENCE TIME, SO ALL MATERIALS	-
CN		IN THESE ZONES INCLUDING STRUCTURE, MODERATOR, ETC.	-
CN		MUST BE GIVEN IN THE FEED BOX ZONE (ZONES). IF THE	-
CN		DENSITIES OF THE NUCLIDES REPRESENTING STRUCTURAL	-
CN		MATERIAL WERE NOT SPECIFIED FOR THE FEED BOX (OR BOXES),	-
CN		NONE WOULD APPEAR IN THE REACTOR AFTER THE EXPOSURE	-
CN		CALCULATION EVEN THOUGH VALUES WERE ASSIGNED INITIALLY.	-

(CONT)

CN FOR SOME SIMPLE SITUATIONS IT IS POSSIBLE TO SEPARATE -
 CN OUT SELECTED MATERIALS USING THE SUBZONE REPRESENTATION -
 CN (THOSE MATERIALS ACCOUNTED FOR WOULD NOT BE ASSIGNED -
 CN CONCENTRATIONS IN THE FEED BOX(ES)). IT IS DESIRABLE -
 CN TO CARRY AT LEAST ONE NON-DEPLETING NUCLIDE CONCENTRATION -
 CN ALONG THE PATHS TO PROVIDE A MASS BALANCE CHECK. -
 CN MATERIAL ENTERING A ZONE IS THAT LEAVING THE PREVIOUS -
 CN ZONE ALONG A PATH, WHILE THE AVERAGE BETWEEN ENTERING -
 CN AND LEAVING NUCLIDE DENSITIES IN EACH ZONE ARE WRITTEN -
 CN IN THE NEW NUCLIDE DENSITY FILE 'ZWATCH' FOR USE BY -
 CN THE NEUTRONICS CODE TO ESTIMATE THE FLUX DISTRIBUTION. -
 CN THE SPECIAL INPUT DATA FOR THIS MODEL ARE THE RESIDENCE -
 CN TIMES ALONG FLOW PATHS (XX(31) UP TO XX(100)), -
 CN XX(20), IX(49), IX(51), IX(52), IX(53), IX(54), IX(55), -
 CN IX(56), IX(57), IX(58), IX(59), IX(60), IX(61), -
 CN AND IX(62). THE EXPOSURE TIME XX(1) MUST BE -
 CN SPECIFIED - IT WILL BE USED FOR RECORD KEEPING AND IT -
 CN WILL BE USED FOR EXPOSURE OF ANY ZONES NOT IN THE FLOW -
 CN PATHS, EXCLUDING THE FEED BOX ZONE(S), AS MIGHT BE USED -
 CN TO REPRESENT A FIXED BLANKET, AND THE FINAL NUCLIDE -
 CN DENSITIES IN THESE ZONES WILL BE PLACED IN THE NEW -
 CN NUCLIDE DENSITY FILE (WHICH REQUIRES ACTION TO BE TAKEN -
 CN TO PREVENT CONTINUING BUILDUP FROM EXPOSURE IN AN -
 CN ITERATION PROCESS. -
 CN QUITE GENERALLY AN ITERATION PROCESS IS NECESSARY -
 CN (NEUTRONICS, EXPOSURE) TO ESTABLISH A NEUTRON FLUX -
 CN DISTRIBUTION WHICH DEPENDS ON THE NUCLIDE DENSITIES -
 CN AFTER EXPOSURE, THE COMPOSITION IN THE FEED BOX(ES) MUST -
 CN BE ALTERED TO EFFECT A CRITICAL STATE, AND THE ITERATIVE -
 CN PROCESS MUST CONVERGE TO A SOLUTION FOR RELIABLE -
 CN ANALYSIS. IF THE FEED BOX COMPOSITIONS ARE NOT ALTERED, -
 CN A PSEUDO STEADY STATE CONDITION RESULTS FOR A REACTOR -
 CN WHICH IS NOT JUST CRITICAL. A CAPABILITY EXISTS TO -
 CN EFFECT THE CRITICAL STATE BY APPLYING THE CRITICALITY -
 CN SEARCH OPTION WHEN THE NEUTRONICS PROBLEM IS SOLVED. -
 CN MATERIALS IN THE REACTOR MUST BE CHANGED AS WELL AS THE -
 CN CONTENTS OF THE FEED BOXES. AFTER EXPOSURE THE REACTOR -
 CN CONTENTS DEPEND ON THE FEED, SO THE FEED MUST BE -
 CN DETERMINED (CHARGING ONLY THE FEED DURING A -
 CN NEUTRONICS CALCULATION WILL NOT CHANGE THE CURRENT -
 CN ESTIMATE OF THE REACTOR CONTENTS SINCE THE FEED BOX -
 CN LIES OUTSIDE OF THE REACTOR AND THE NEUTRONICS SEARCH -
 CN PROBLEM COULD NOT CONVERGE). -
 CN MORE THAN ONE PASS MAY BE MADE THROUGH THE REACTOR. -
 CN HOLD-UP OUT-OF-CORE MAY BE ALLOWED WITH FALSE ZONES -
 CN NOT IN THE ACTUAL GEOMETRY (IX(49) MUST BE SET .EQ. 1). -
 CN NOTE THAT THE ASSIGNMENT OF ZONES AND SUBZONES TO THE -
 CN GEOMETRY MUST START WITH 1 FOR LOCATIONS RECEIVING -
 CN FEED AND INDEX UP ALONG FLOW PATHS. -
 CN ONLY ONE EXPOSURE SUBSTEP MAY BE REQUESTED FOR THIS -
 CN OPTION. -

(CONT)

(EXC)

CD	IX(61)	NUMBER OF PASSES TO ESTABLISH POWER LEVEL REPORTED	-
CD		BY THE NEUTRONICS CALCULATION	-
CD		(DEFAULT TO 1)	-
C			-
CD		THE CALCULATION IS DONE THIS MANY TIMES (OR UNTIL THE	-
CD		CONVERGENCE CRITERIA (SEE IX(20)) IS SATISFIED) WITH	-
CD		THE FLUX LEVEL ADJUSTED AFTER EACH PASS WHICH IMPROVES	-
CD		THE POWER LEVEL AND MAY ACCELERATE THE CONVERGENCE RATE	-
CD		OF A USUAL FEED SEARCH ITERATION PROCEDURE.	-
C			-
CD*	IX(62)	OPTION TO WRITE INTERFACE FILE 'QWATON' WITH	-
CD*		DISCHARGE DENSITIES (FOR CONTINUOUS FUELING MODEL	-
CD*		ONLY)	-
CD*		0- DO NOT WRITE	-
CD*		1- REPLACE THE LATEST VERSION OF AN OLD FILE,	-
CD*		IF NONE EXISTS WRITE NEW FILE	-
CD*		2- WRITE NEW FILE	-
C			-
CD	IX(63)	RESERVED	-
C			-
CD	IX(64)	RESERVED	-
C			-
CD	IX(65)	RESERVED	-
C			-
CD	IX(66)	RESERVED	-
C			-
CD	IX(67)	RESERVED	-
C			-
CD	IX(68)	RESERVED	-
C			-
CD	IX(69)	RESERVED	-
C			-
CD	IX(70)	RESERVED	-
C			-
CD	IX(71)	RESERVED	-
C			-
CD	IX(72)	RESERVED	-
C			-
CD	IX(73)	OPTION TO PERFORM AUXILIARY POINT CALCULATION	-
CD		OVER SELECTED ZONES	-
CD		0- NO	-
CD		1- YES - THE ZONE NUMBERS SPECIFIED IN	-
CD		IX(64)-IX(93), MAXIMUM OF 10, ARE TREATED IF	-
CD		THE POINT NUCLIDE DENSITY FILE 'PTATEN' DOES	-
CD		NOT EXIST; IF THIS FILE EXISTS THE REFERENCE	-
CD		DATA IN THE FILE IS USED TO CONTINUE THE	-
CD		CALCULATION FOR THE SAME ZONES TREATED	-
CD		PREVIOUSLY. FILE 'GEOST' IS ACCESSED FOR	-
CD		IDENTIFYING LOCATIONS OF POINTS IN THE ZONES	-
CD		AND POINT FLUX VALUES ARE OBTAINED FROM FILE	-
CD		'RTFLUX'.	-

(CONT)

CD		2- YES - THE REFERENCE DATA IS INITIALLY TAKEN	-
CD		FROM THE FILE 'REFLUX' (MODIFIED) AND THE	-
CD		POINT FLUX VALUES ARE ALWAYS USED FROM THIS	-
CD		FILE (AS MADE AVAILABLE FROM A COMPATIBLE	-
CD		NEUTRONICS CODE). IF THE POINTS DO NOT	-
CD		AGREE WITH AN EXISTING 'PTATDN' FILE THE	-
CD		CALCULATION WILL NOT BE DONE.	-
C			-
CN		IN AN ATTEMPT TO PARALLEL THE ZONE CALCULATION	-
CN		OPTIONS IX(6), IX(10), IX(18), IX(8), IX(12),	-
CN		IX(13), IX(30), AND IX(31) APPLY TO BOTH ZONE	-
CN		AND POINT CALCULATIONS	-
C			-
CN		THE PROCEDURE SHOULD MAINTAIN A SET OF POINT	-
CN		DENSITIES CONSISTENT WITH THE ZONE DENSITIES	-
CN		BUT CAN NOT ACCOUNT FOR EXTERNAL CHANGES IN	-
CN		THE ZONE DENSITIES (FROM A NEUTRONICS SEARCH,	-
CN		OR AFTER REFUELING, OR REPOSITIONING, FOR EXAMPLE)	-
C			-
CN		NOT DONE IF IX(51) .GT. 0 OR IX(52) .GT. 0	-
C			-
CD	IX(74)	OPTION ON POINT NUCLIDE DENSITY EDITS (EXPOSURE)	-
CD		0- NONE	-
CD		1- END OF EXPOSURE STEP	-
CD		2- END OF EACH EXPOSURE SUBSTEP	-
C			-
CD	IX(75)	OPTION ON POINT NUCLIDE DENSITY EDITS (SHUTDOWN)	-
CD		0- NONE	-
CD		1- END OF SHUTDOWN STEP	-
CD		2- END OF EACH SHUTDOWN SUBSTEP	-
C			-
CD	IX(76)	OPTION TO EDIT INITIAL POINT SPECIFIC REACTION	-
CD		RATES	-
CD		0- NO	-
CD		1- YES	-
C			-
CD	IX(77)	OPTION TO EDIT INITIAL POINT SPECIFIC REACTION	-
CD		RATE FOR FISSION IN YIELD DATA ENERGY RANGES	-
CD		0- NO	-
CD		1- YES	-
C			-
CD	IX(78)	OPTION TO EDIT INITIAL POINT NUCLIDE DENSITIES	-
CD		0- NO	-
CD		1- YES	-
C			-

(CONT)

CD	IX(79)	DEBUG EDIT OPTION FOR POINT CALCULATION	-
CD		(IN ADDITION TO THOSE REQUESTED WITH IX(3))	-
CD		0- NONE	-
CD		1- MINIMAL EDITS	-
CD		2- PLUS FLUX INFORMATION	-
CD		3- PLUS VOLUME INFORMATION	-
C			-
CH		2,3 MAY INCREASE STORAGE REQUIREMENTS FOR	-
CH		IX(73) .EQ. 1	-
C			-
CD	IX(80)	RESERVED	-
C			-
CD	IX(81)	RESERVED	-
C			-
CD	IX(82)	RESERVED	-
C			-
CD	IX(83)	RESERVED	-
C			-
CD	IX(84-93)	UP TO 10 ZONE NUMBERS SPECIFYING THE LOCATIONS WHERE-	-
CD		THE POINT CALCULATION IS TO BE DONE	-
CD		(IF IX(73) .EQ. 1)	-
CD		IF THERE ARE LESS THAN 10 ENTRIES , THE FIRST 0	-
CD		TERMINATES THE LIST OF ZONE NUMBERS	-
C			-
CD	IX(94-103)	RESERVED	-
C			-
C			-

(CONT)

SPECIFICATIONS FOR PERINS RECORD IN INTERFACE FILE CONTROL

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C-----
CR      PERTURBATION MODULE INSTRUCTIONS
C
CL      PERINS, (IX(I),I=1,100), (IX(I),I=1,100)
C
CW      101*HULT + 100
C
CD      PERINS      PERTURBATION MODULE DATA IDENTIFIER (CONTINUED)
CC
CC      NOTE- UNDEFINED DATA ARE RESERVED FOR FUTURE USE.
CC      NOTE- THE VALUE OF ZERO IS A DEFAULT MEANING THAT THE OPTION TO
CC      PERFORM THE TASK IS NOT EXERCISED.
CC      NOTE- THE INTERFACE FILES -XIS- -GHOST- -HDSST- -SWTGN-
CC      -RTPLX- AND -ATPLX- ARE NEEDED.
CC      IF THE FILE -PLAYIS- EXISTS, INFORMATION ABOUT THE DELAYED
CC      NEUTRON BEHAVIOR IS CALCULATED IN ADDITION TO THE
CC      OTHER PERTURBATION CALCULATIONS.
C
C
C      XX( 1) - REFERENCE TEMPERATURE T1, DEGREES C (SEE IX(7) BELOW).
C
C      XX( 2) - CHANGED TEMPERATURE T2, DEGREES C.
C      XX( 3) - TEMPERATURE CORRELATING PARAMETER 'ALPHA'
C
C      XX( 4)
C      XX( 5)
C      XX( 6)
C      XX(7) - 'ALPHA' FOR THE DELAYED NEUTRON SOURCE - DEFAULT -0.05.
C      XX(8) - 'ALPHA' FOR THE DELAYED NEUTRON SOURCE - DEFAULT +0.05.
C      XX( 9)
C      XX(10)
C      XX(11)
C      XX(12)
C
C      XX(13) - CONSTANT BUCKLING, OVERRIDES DATA ON GHOST.
C
C      XX(14)
C      XX(15)
C      XX(16)
C      XX(17)
C      XX(18)
C      XX(19)
C      XX(20)
C      XX(21)
C      XX(22)
C      XX(23)
C      XX(24)
C
C      XX(25) - FRACTION CHANGE IN MACRO. CROSS SECTIONS FOR IX(2)=1.
C

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(CONT)

THE FOLLOWING TABLE SHOWS THE INTERFACE FILES REQUIRED FOR OPTIONS IX(1) AND IX(2), AND THE FILE VERSIONS USED TO OBTAIN THE PERTURBATION (DELTA MACRO = SIGB-SIGA). ADDITIONAL FILES ARE ALSO REQUIRED.

IX(2)	IX(1) -	-1	0	1	2	3
0		EXCLUDED	N1,N2,S1, S2,X	N1,N2,S,X	N,S1,S2,X	N,S,X
1	SIGA	N,S,X	N1,S1,X	N1,S,X	N,S1,X	N,S,X
			N2,S2	N2	S2	
2	SIGA	N1,S,X	N1,S1,X	N1,S,X	N1,S1,X	N1,S,X
	SIGB	N2,S,X	N2,S2,X	N2,S,X	N2,S2,X	N2,S,X
3	SIGA	N,S1,X	N1,S1,X	N1,S1,X	N,S1,X	N,S1,X
	SIGB	N,S2,X	N2,S2,X	N2,S2,X	N,S2,X	N,S2,X
4	SIGA	N1,S1,X	N1,S1,X	N1,S1,X	N1,S1,X	N1,S1,X
	SIGB	N2,S2,X	N2,S2,X	N2,S2,X	N2,S2,X	N2,S2,X
5	SIGA	N,S,X1	N1,S1,X1	N1,S,X1	N,S1,X1	N,S,X1
	SIGB	N,S,X2	N2,S2,X2	N2,S,X2	N,S2,X2	N,S,X2
6	SIGA	N1,S,X1	N1,S1,X1	N1,S,X1	N1,S1,X1	N1,S,X1
	SIGB	N2,S,X2	N2,S2,X2	N2,S,X2	N2,S2,X2	N2,S,X2
7	SIGA	N1,S1,X1	N1,S1,X1	N1,S1,X1	N1,S1,X1	N1,S1,X1
	SIGB	N2,S2,X2	N2,S2,X2	N2,S2,X2	N2,S2,X2	N2,S2,X2

WHERE -- N1 = NEXT-TO-LATEST VERSION (UNPERTURBED) ZNATDN FILE.
 N2 = LATEST VERSION (PERTURBED) ZNATDN FILE.
 S1 = NEXT-TO-LATEST VERSION (UNPERTURBED) GROUPXS FILE.
 S2 = LATEST VERSION (PERTURBED) GROUPXS FILE.
 X1 = NEXT-TO-LATEST VERSION (UNPERTURBED) NDXSHY FILE.
 X2 = LATEST VERSION (PERTURBED) NDXSHY FILE.
 N, S, X = LATEST (MAY BE ONLY ONE) VERSION OF ZNATDN, GROUPXS, AND NDXSHY FILES.

(CONT)

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CC IF FILES DO NOT EXIST FOR IX(1) OPTIONS 0, 1, OR 2, IX(1) IS -
CC DEFAULTED TO 3 AND THE ATTEMPT IS MADE TO PROCEED USING A SINGLE -
CC EXISTING FILE AS NEXT-TO-LATEST VERSION UNLESS IX(6) GT 0. -
CC NOTE -- DIFFERENT GROUPS FILES MUST HAVE THE SAME GROUP STRUCTURE -
CC THE FILES GEODST, RIFLUX, AND ATFLOX MUST HAVE THE SAME -
CC NUMBER OF GROUPS AND THE SAME MESH. -
CC THE FILES GEODST AND NDXSRF MUST HAVE THE SAME NUMBER -
CC OF ZONES. -
CC THE FILES GROUPS AND NDXSRF MUST HAVE THE SAME TOTAL -
CC NUMBER OF NUCLIDES. -
CC THE FILES ZHATDN AND NDXSRF MUST HAVE THE SAME MAXIMUM -
CC NUMBER OF NUCLIDES IN ANY SET, AND THE SAME NUMBER OF -
CC ZONES PLUS SUB-ZONES. -
C -
C -
C -
CD IX( 1) - OPTIONS FOR CALCULATING BASIC INTEGRALS. -
CD -1 - NO CALCULATION (PERTURB ALREADY EXISTS). -
CD 0 - CALCULATE INTEGRALS USING FILES W1, S1. -
CD 1 - CALCULATE INTEGRALS USING FILES W1, S2 (USUALLY NOT -
CD DONE). -
CD 2 - CALCULATE INTEGRALS USING FILES W2, S1 (USUALLY NOT -
CD DONE). -
CD 3 - CALCULATE INTEGRALS USING FILES W2, S2 (OR W, S). -
C -
CD IX( 2) - OPTIONS FOR CALCULATING  $(\Delta K)/K = (\text{PERTURBATION}$  -
CD  $\text{INTEGRALS}) * (\text{SIGB-SIGA})$ . -
CD 0 - ONLY CALCULATE BASIC INTEGRALS. -
CD 1 - CHANGE MACROSCOPIC CROSS SECTIONS BY MULTIPLYING -
CD THEN BY XX(25). -
CD 2 - CHANGE ONLY DENSITIES. -
CD 3 - CHANGE ONLY CROSS SECTIONS. -
CD 4 - CHANGE BOTH DENSITIES AND CROSS SECTIONS. -
CD 5 - CHANGE ONLY REFERENCING. -
CD 6 - CHANGE DENSITIES AND REFERENCING. -
CD 7 - CHANGE DENSITIES, CROSS SECTIONS, AND REFERENCING. -
C -
CD IX( 3) - PERTURBATION CALCULATION OPTIONS FOR IX(1) GE 0. -
CD -1 - DO NOT CALCULATE TRANSPORT INTEGRALS. -
CD 0 - CALCULATE ALL INTEGRALS. -
CD 1 - ALSO CALCULATE RESULTS FOR 100 PERCENT CHANGE IN -
CD MACROSCOPIC CROSS SECTIONS AND UNCERTAINTY -
CD (SENSITIVITY) RESULTS. -
CD 6 - SAME AS 0 BUT NO EDITS ARE PRINTED. -
C -
CD IX( 4) - EDIT OPTIONS FOR IMPORTANCE MAPPING FOR IX(1) GE 0. -
CD 1 - ABSORPTION CROSS SECTION SPACE POINT IMPORTANCE MAP. -
CD 2 - ALSO PRODUCTION AND PRODUCTION-ABSORPTION SPACE -
CD POINT IMPORTANCE MAPS. -
CD 3 - ALSO 1/V SPACE POINT IMPORTANCE MAP. -
C

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(CONT)

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CD IX( 5) - OPTION TO WRITE INTERFACE FILE PERTUB FOR IX(1) GE 0. -
CD 0 - REPLACE OLD FILE, IF NONE EXISTS SET UP NEW ONE. -
CD 1 - WRITE NEW FILE. -
CD IX( 6) - OPTION TO DEFAULT FILES FOR IX(1) = 0, 1, OR 2. -
CD 0 - DEFAULT IX(1) TO 3 IF FILES FOR IX(1) = 0, 1, OR 2 -
CD DO NOT EXIST. -
CD 1 - STOP CALCULATION IF FILES DO NOT EXIST. -
C -
CD IX( 7) - OPTIONS TO CONSIDER A CORRELATION OF MACROSCOPIC -
CD CROSS SECTIONS OF ZONE TEMPERATURE IF GT 0, REQUIRES -
CD ZONE TEMPERATURE DATA IN INTERFACE FILE(S). -
CD 0 - NO TEMPERATURE DEPENDENCE, SEE DISCUSSION ABOUT -
CD OPTIONS ABOVE. -
CD 1 - SIGA = SIGAT1, AND -
CD SIGB = SIGBT1+F1*(SIGBT2-SIGBT1). -
CD 2 - SIGA = SIGAT1+F1*(SIGAT2-SIGAT1), AND -
CD SIGB = SIGBT1+F1*(SIGBT2-SIGBT1). -
CD 3 - SIGA = SIGAT1+F1*(SIGAT2-SIGAT1), AND -
CD SIGB = SIGBT1+F2*(SIGBT2-SIGBT1). -
C -
CC WHERE -- SIGA = STATE A MACROS. -
CC SIGB = STATE B MACROS. -
CC SIGAT1 = MACROS CALCULATED USING FILE N1 (OR N) AND -
CC FILE S1 (REFERENCE TEMPERATURE) OR I1. -
CC SIGAT2 = MACROS CALCULATED USING FILE N1 (OR N) AND -
CC FILE S2 (CHANGED TEMPERATURE) OR I2. -
CC SIGBT1 = MACROS CALCULATED USING FILE N2 (OR N) AND -
CC FILE S1 (REFERENCE TEMPERATURE) OR I1. -
CC SIGBT2 = MACROS CALCULATED USING FILE N2 (OR N) AND -
CC FILE S2 (CHANGED TEMPERATURE) OR I2. -
CC A1 = (Z1-T1)/(T2-T1). -
CC A2 = (Z2-T1)/(T2-T1). -
CC T1 = REFERENCE TEMPERATURE (IX(1) ABOVE). -
CC T2 = CHANGED TEMPERATURE (IX(2) ABOVE). -
CC Z1 = ZONE DEPENDENT REFERENCE TEMPERATURES -
CC (FROM FILE ZWTEMP). -
CC Z2 = ZONE DEPENDENT CHANGED TEMPERATURES -
CC (FROM FILE ZWTEMP). -
CC IF ALPHA= 0, F1=A1, -
CC OTHERWISE F1=TAN-1(ALPHA*A1)/TAN-1(ALPHA) -
CC IF ALPHA= 0, F2=A2, -
CC OTHERWISE F2=TAN-1(ALPHA*A2)/TAN-1(ALPHA) -
C -
CC NOTE -- FOR IX(7) = 0, ALL IX(1) AND IX(2) OPTIONS APPLY. -
CC FOR IX(7) GT 0, IX(1) OPTIONS -1, 0, OR 3 APPLY, AND -
CC IX(2) OPTIONS 3, 4, 5, 6, AND 7 APPLY. -
C -

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(CONT)

CD IX(8) - OPTION TO CALCULATE IMPORTANCE BY UNIQUE (USER) NUCLIDE NAME IN EACH ZONE. -
 CD 0 - NO. -
 CD 1 - CALCULATE $(\Delta K)/(K \cdot \Delta W)$ FOR NUCLIDES HAVING CLASSIFICATION 1, 2, AND 3 (ACTINIDES). DEFAULT TO ALL NUCLIDES IF NO 1, 2, OR 3 CLASSIFICATION. -
 CD 2 - ALSO CALCULATE $(W \cdot \Delta K)/(K \cdot \Delta W)$. -
 CD 3 - SAME AS 1 BUT FOR ALL NUCLIDES. -
 CD 4 - SAME AS 2 BUT FOR ALL NUCLIDES. -
 CC NOTE -- THE ZNATHM, GROUPXS, AND WDISRY FILES USED FOR THIS OPTION WILL BE THE ONES LAST USED AS REQUIRED BY OPTIONS IX(1), IX(2), AND IX(7). -
 CC
 C
 CD IX(9) -
 C
 CD IX(10) - OPTION TO USE LOCAL I/O ROUTINES IF GT 0. -
 C
 CD IX(11) - OPTION TO PREVENT FILES FROM DEFAULTING TO CORE IF GT 0. -
 C
 CD IX(12) -
 C
 CD IX(13) - 0 OR 1 = NORMAL RTFLUX. 2 = FIXED SOURCE RTFLUX. -
 C
 CD IX(14) - 0 OR 1 = NORMAL ATFLUX. 2 = FIXED SOURCE ATFLUX. -
 CD IX(15) - EDIT MACROSCOPIC CROSS SECTIONS IF GT 0. -
 C
 CD IX(16) - EDIT MACROSCOPIC SCATTERING CROSS SECTIONS IF GT 0. -
 C
 CD IX(17) -
 C
 CD IX(18) - FISSION SOURCE DISTRIBUTION FUNCTION OPTION. -
 CD 0 - SET VALUES TO BE USED (SAME IN EACH ZONE). -
 CD 1 - REGION DEPENDENT VALUES TO BE USED. -
 C
 CD IX(19) - FISSION SOURCE DISTRIBUTION NORMALIZATION OPTION. -
 CD 0 - LEAVE UNNORMALIZED. -
 CD 1 - NORMALIZE EACH SET TO SUM TO UNITY. -
 C
 CD IX(20) - OPTION TO FORCE DATA HANDLING MODE. -
 CD 1 - 1-PW STORED MODE. -
 CD 2 - SPACE STORED MODE. -
 CD 3 - PLANE STORED MODE. -
 C
 CD IX(21) - ORDER IN THE CROSS SECTION FILE OF THE DIRECTION DEPENDENT TRANSPORT CROSS SECTION TO BE USED FOR THE FIRST COORDINATE DIRECTION (USUALLY 0). -
 CD
 C
 CD IX(22) - DITTO, SECOND COORDINATE DIRECTION. -
 C
 CD IX(23) - DITTO, THIRD COORDINATE DIRECTION. -

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C
CD IX(24) - FORCE DATA TRANSFER IN INITIALIZATION (FOR TESTING ONLY). -
C
CD IX(25) - DEBUG OUTPUT OPTION. -
CD 0 - NO DEBUG EDIT. -
CD 1 - EDIT NUCLIDE IMPORTANCE (SEE IX(8)) BY REACTION -
CD TYPE (SIGA, NOSIGP, SIGTR, DB**2, SIGR, AND SIGS) -
CD AND FOR EACH ZONE CLASS. ALSO EDIT CONTENTS OF I/O -
CD ISIGNA. -
CD 2 - PLUS EDIT CONTENTS OF I/O ISIGS AND OTHER SIGNAS. -
CD 3 - PLUS EDIT CONTENTS OF I/O 23 AND/OR 40. -
C
C-----

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(CONT)

SPECIFICATIONS FOR REFINS RECORD IN INTERFACE FILE CONTROL

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C-----
CR          FUEL MANAGEMENT INFORMATION
C
CL          REFINS, (XX(I), I=1,100), (IX(I), I=1,100)
C
C          101*MULT = 100
C
CD          REFINS          REQUIRED INFO IDENTIFIER = 'REFINS' (A6)
CD          XX(1)          *** RESERVED ***
CD          XX(2)          FRACTION OF THE WHOLE REACTOR TREATED
CD                          (DEFAULT VALUE = 1.0)
CD          XX(3)          ELECTRICAL POWER LEVEL OF THE REACTOR (WATTS)
CD                          (DEFAULT VALUE = 0.0)
CD          XX(4)          THERMAL CONVERSION FACTOR FOR THE REACTOR
CD                          (ELECTRICAL POWER/THERMAL POWER)
CD          XX(5)          RATE OF FUEL CONSUMPTION PER UNIT THERMAL
CD                          ENERGY GENERATED (KG FISSILE/WATT-DAY)
CD                          (DEFAULT VALUE=1.3E-9 KGH/WATT-DAY ASSUMING
CD                          3.1E-11 WATTS/FISSION)
CD          XX(7)          REFERENCE FUEL COST DISCOUNT RATE
CD                          (DEFAULT VALUE = 0.10)
CD          XX(8)          SECONDARY FUEL COST DISCOUNT RATE FOR
CD                          AUXILIARY CALCULATIONS
CD                          (DEFAULT VALUE = 0.15)
CD          XX(20)         PROGRAMMABLE SIGNIFICANCE VALUE.
CD                          1. THIS VALUE IS THE FRACTIONAL VOLUME
CD                          MISMATCH TO ALLOW BEFORE REPORTING ERRORS
CD                          FOR FUEL MOVEMENT. FUEL MOVEMENT IS ALLOWED
CD                          FROM ZONE 1 TO ZONE 2 IF, FOR VOLUMES
CD                          V1 AND V2, ABS((V1-V2)/V1) .LE. MAXIMUM
CD                          MISMATCH.
CD                          2. FOR ANY RECYCLE PROCESSING (TRANSFER TO
CD                          SUPPLY FROM DISCHARGE, FABRICATION AND
CD                          PROCESSING, OR TRANSITIONS), IF THE RELATIVE
CD                          MASS BEFORE AND AFTER PROCESSING IS LESS
CD                          THAN THE SIGNIFICANCE VALUE, THE MASS IS
CD                          FORCED TO 0.
CD                          (DEFAULT VALUE= 1.0E-04)
C
CD          IX(1)          PRIMARY TASK ASSIGNMENT OPTIONS
CD                          -1 INITIALIZATION OPTION TO START THE MASS
CD                          BALANCE HISTORY. NO REFUELING/FUEL
CD                          MOVEMENT IS PERFORMED; THE MASS BALANCE
CD                          HISTORY FILE IS CREATED FOR THE INITIAL
CD                          REACTOR INVENTORY. IF INITIALIZATION IS
CD                          NOT THE FIRST OPTION USED, THE MASS
CD                          BALANCE HISTORY FILE IS CREATED BUT MASS
CD                          BALANCES MAY NOT BE COMPLETE.
CD                          0 PERFORM NORMAL TASKS (NORMAL FUEL
CD                          MOVEMENT WITH MASS BALANCE ACCOUNTING
CD                          OR FUEL RELOCATION) (DEFAULT)

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CD      1 REEVALUATE MASS BALANCE WITH OTHER      -
CD      TASKS AS IN A NEUTRONICS CONCENTRATION    -
CD      ADJUSTMENT. THIS OPTION IS NOT AVAILABLE.  -
CD      2 HISTORY END; OUTPUT MASS BALANCE         -
CD      IX(3) DEBUG EDIT OPTION FOR PROGRAM MAINTENANCE -
CD      0 NO SPECIAL EDITS (DEFAULT)               -
CD      1 FIRST LEVEL EDITS                         -
CD      2 ELABORATE DEBUG EDIT                     -
CD      IX(4) ZNATDN UPDATE OPTION                  -
CD      0 REWRITE NEW DATA ON EXISTING FILE (DEFAULT) -
CD      1 GENERATE A NEW FILE FOR EACH CYCLE        -
CD      IX(5) ZONE ATOM DENSITY (ZNATDN) BACKUP FILE OPTION -
CD      0 WRITE BACKUP FILE FNATDN (DEFAULT)        -
CD      1 DO NOT WRITE BACKUP FILE FNATDN           -
CD      -1 RECOVER ZONE ATOM DENSITY DATA FROM BACKUP -
CD      FILE FNATDN RATHER THAN FROM FILE ZNATDN    -
CD      IX(6) CONTINUOUS FUELING FILE OPTION        -
CD      0 READ ZONE CONCENTRATIONS FROM FILE ZNATDN -
CD      AND UPDATE ZONE CONCENTRATIONS IN FILE     -
CD      ZNATDN (DEFAULT)                           -
CD      1 READ ZONE CONCENTRATIONS FROM FILE QNATDN -
CD      AND UPDATE ZONE CONCENTRATIONS IN FILE     -
CD      ZNATDN                                       -
CD      IX(7) MASS BALANCE FILE (HASBAL) DELETE OPTION -
CD      0 RETAIN CURRENT VERSION OF HASBAL FILE ONLY; -
CD      DELETE ALL OLDER VERSIONS (DEFAULT)         -
CD      1 RETAIN CURRENT VERSION OF HASBAL FILE AND -
CD      PREVIOUS VERSION ONLY; DELETE ALL OLDER    -
CD      VERSIONS                                    -
C
CN      NOTE: THIS OPTION IS NOT USED IF FUEL RELOCATION IS -
CN      THE ONLY TASK PERFORMED SINCE NO MASS BALANCE -
CN      ACCOUNTING IS PERFORMED.                    -
C
CD      IX(11) FUEL COST CALCULATION OPTION          -
CD      0 NO FUEL COST CALCULATIONS                 -
CD      1 OBTAIN LEVELIZED COST FOR ENTIRE HISTORY -
CD      WITH COST BREAKDOWN INTO COMPONENTS AT     -
CD      END OF HISTORY ONLY.                        -
CD      (FABRICATION, PROCESSING, SHIPPING, ETC.)   -
CD      2 OBTAIN LEVELIZED COST FOR HISTORY WITH    -
CD      BREAKDOWN, COST BETWEEN SUCCESSIVE FUELINGS -
CD      AND RUNNING LEVELIZED COST. (EACH CYCLE IS -
CD      TREATED AS A COMPLETE HISTORY FOR REPORTING -
CD      PURPOSES)                                    -
CD      IX(12) PLANT LIFE OPTION                     -
CD      <0 LIFE IN YEARS ESTIMATED PRECISELY (USE THE -
CD      HISTORY TO THE TIME ESTIMATED, REGARDLESS   -
CD      OF ITS POINT IN THE CYCLE.)                -

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CD		0 USE AVAILIABLE HISTORY	-
CD		>0 LIFE IN YEARS ROUNDED TO THE NEAREST FUELIN	-
CD		TIME (TRUNCATE OR EXTRAPOLATE THE DATA AS	-
CD		NEEDED)	-
CD	IX(13)	LOAD FACTOR VARIATION	-
CD		0 FIXED LOAD FACTOR	-
CD		1 EXPONENTIAL LOAD FACTOR DECREASE	-
CD	IX(16)	ORDER NUMBER OF FUEL MANAGEMENT SPECIFICATION	-
CD		SET IN REFUEL (RECORDS 7D AND 8D) APPLIED ON	-
CD		REQUEST	-
CD	IX(17)	ORDER NUMBER OF FUEL MANAGEMENT SPECIFICATION	-
CD		SET IN REFUEL (RECORDS 7D AND 8D) APPLIED ON	-
CD		REQUEST	-
CD	IX(18)	ORDER NUMBER OF FUEL MANAGEMENT SPECIFICATION	-
CD		SET IN REFUEL (RECORDS 7D AND 8D) APPLIED ON	-
CD		REQUEST	-
CD	IX(19)	ORDER NUMBER OF FUEL MANAGEMENT SPECIFICATION	-
CD		SET IN REFUEL (RECORDS 7D AND 8D) APPLIED ON	-
CD		REQUEST	-
C			-
CH		NOTE: THE FUEL MANAGEMENT SPECIFICATIONS GIVEN IN	-
CH		IX(16)-IX(19) ARE APPLIED ON REQUEST (I.E. IF	-
CH		.GT. 0) IN THE ORDER PRESENTED.	-
C			-

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SPECIFICATIONS FOR PBLINS RECORD IN INTERFACE FILE CONTROL

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C-----
CR      PEBBLE THERMAL HYDRAULICS MODULE INSTRUCTIONS, FILE 'CONTROL'
C
CN      (THERMAL PEBBLE BED IN RZ OR Z GEOMETRY)
C
CN      DATE OF THESE USE INSTRUCTIONS, OCTOBER, 1980  --D VONDY, ORNL
C
CL      PBLINS, (XX(I),I=1,100), (IX(I),I=1,100)
C
CN      101*MULT + 100
C
CD      PBLINS  PEBBLE THERMAL HYDRAULICS DATA IDENTIFIER (6HPBLINS)
C
CN*      A * IS PLACED IN COLUMN 3 TO INDICATE THAT THAT DATA MUST
CN*      NORMALLY BE SUPPLIED -- HEED NOTES AND CHECK OLD DECKS
CN*      FLAG TO INDICATE THAT DATA IS USUALLY REQUIRED FOR FLOW THRU
CN*      HOLES IN A SOLID MATRIX
CD
CD      XX(1)    VOID FRACTION IF TO BE CONSTANT
CD               (DEFAULT VALUE 0.39 LACKING OTHER DATA - THE ZONE
CD               FRACTIONS MAY BE USED AS SOLID FRACTIONS IF .02 <X< .98)
CDX      SPECIAL CONSIDERATIONS WITH FLOW THROUGH HOLES
CD*      XX(2)    INLET TEMPERATURE OF COOLANT, DEG C (DEFAULT 350.35)
CD*      XX(3)    INLET PRESSURE OF COOLANT, ATM (DEFAULT 40)
CD      XX(4)    COOLANT MASS FLOW RATE FOR REACTOR, KG/SEC,
CD               NORMALLY CALCULATED GIVEN INLET AND OUTLET TEMPS
CD*      XX(5)    PEBBLE DIAMETER OR COOLANT HOLE DIAMETER, CM
CDN      THIS IS THE COOLANT FLOW CHARACTERISTIC DIAMETER
CD      XX(6)    REFERENCE HIGH ENERGY NEUTRON FLUX FLUENCE, N/CM**2
CD               APPLIED ONLY IF IX(3) < 0
CD      XX(7)    RECOVERABLE ENERGY FRACTION (DEFAULT 1.0)
CD      XX(8)    REACTOR POWER LEVEL DESIRED, W-TM, USUALLY NOT SET
CDX      XX(9)    EFFECTIVE DIAMETER OF UNIT CELL ABOUT FUEL (INSIDE
CDX      A SHELL OF MATERIAL OUTSIDE, LOCATION OF COOLANT FLOW), CM
CDX      SET EQUAL TO XX(5) IF 0
CD*      XX(10)   RADIUS OF THE ZONE PEBBLE HEAT OR HEAVY METAL CORE
CD               (DEFAULT HALF OF PEBBLE DIAMETER - NO SHELL)
CD*      XX(11)   RADIUS OF THE SUBZONE PEBBLE HEAT OR HEAVY METAL CORE
CD               (DEFAULT HALF OF PEBBLE DIAMETER - NO SHELL)
CD      XX(12)   OUTLET TEMPERATURE OF COOLANT, DEG C (DEFAULT 850.35 IF
CD               XX(4)=0)
CD               (NOT USED IF XX(4) IS NON-ZERO)
CD      XX(13)   FLUENCE MULTIPLIER ON DATA AVAILABLE (DEFAULT 1.0)
CD      XX(14)   RELATIVE PEBBLE GRAPHITE THERMAL CONDUCTIVITY, A
CD               MULTIPLIER ON BUILT IN DATA (DEFAULT 1.0)
CD      XX(15)   ITERATION CONVERGENCE CRITERIA, MAXIMUM RELATIVE ITERATE
CD               CHANGE FOR TERMINATION (DEFAULT 0.00005)
CN      THE OPTION ON BLOCKED FLOW AREA FOLLOWS, USE WITH CAUTION
CD      XX(16)   INSIDE RADIUS (MUST BE ZERO TO BE REALISTIC)
CD      XX(17)   OUTSIDE RADIUS OF BLOCKAGE, CM

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CD XX(18)  DISTANCE BLOCKAGE STARTS FROM COOLANT INLET, CM -
CD XX(19)  HEIGHT OF BLOCKAGE, CM -
CD XX(20)  SOLID BLOCKAGE FRACTION (DEFAULT 0.85 -- USE LARGE VALUES-
CD          WITH DISCRETION) -
CD          THE OPTION OF DEFINING CORE BOUNDARIES FOLLOWS -
CD          WITHOUT DATA, THE NON-ZERO POWER DENSITY EXTREMES DEFINE CORE-
CD XX(21)  INSIDE RADIUS (IF NON-ZERO WILL REQUIRE ADDING THE -
CD          ANNULAR INTERNAL SOLID BOUNDARY PLANNED) -
CD XX(22)  OUTSIDE RADIUS OF CORE, CM -
CD XX(23)  DISTANCE FROM START OF GEOMETRY, TYPICALLY FROM TOP, CM -
CD XX(24)  HEIGHT OF CORE, CM -
C -
CD          ADDITIONAL OPTIONS AND OVERRIDE DATA VALUES FOLLOW -
CD XX(25)  LIMITING PROCESSOR TIME, SECONDS (DEFAULT 120) -
C -
CD          INITIAL ACCELERATION COEFFICIENTS ARE MADE PROBLEM DEPENDENT -
CD          AND MAY BE ALTERED DURING THE PROBLEM SOLUTION IF DEEMED TO BE -
CD          DESIRABLE BY THE AUTOMATED MONITORING PROCEDURES -
C -
CD          IT IS QUITE POSSIBLE THAT THE ROUGH ITERATIVE BEHAVIOR EARLY IN -
CD          THE HISTORY WILL CAUSE INITIAL COEFFICIENTS TO BE DECREASED -
CD          WHICH WOULD REQUIRE INPUT OF SOMEWHAT LARGER VALUES THAN THOSE -
CD          EXPECTED TO BE OPTIMUM ASYMPTOTICALLY -
C -
CD XX(26)  STREAM FUNCTION OVERRELAXATION COEFFICIENT -
CD XX(27)  BULK TEMPERATURE, DITTO, SEE FOLLOWING NOTE -
CD          THIS COEFFICIENT MAY BE OF UTMOST IMPORTANCE, AND AN EFFECTIVE-
CD          VALUE SHOULD BE SUPPLIED IF KNOWN (TEST PROVEN FOR AT LEAST A -
CD          SYMILAR PROBLEM). TYPICALLY THE VALUE IS MUCH LESS THAN 1. -
CD XX(28)  SURFACE TEMPERATURE, DITTO -
CD          IT IS DIFFICULT TO SEE HOW A VALUE OTHER THAN UNITY WOULD BE -
CD          EFFECTIVE HERE -
CD XX(29)  PRESSURE, DITTO -
CD XX(30)  SPECIFIC HEAT VALUE (5193.) -
C -
CD          DATA FOR A SECOND AND THIRD CALCULATION FOLLOW (3 DATA EACH) -
CD XX(31)  NEW INLET COOLANT TEMPERATURE, DEG C (DEFAULT XX(2)) -
CD XX(32)  NEW OUTLET COOLANT TEMPERATURE, DEG C (DEFAULT XX(12)) -
CD XX(33)  RELATIVE POWER LEVEL FOR SUBSEQUENT CALCULATION -
CD XX(34)  NEW INLET COOLANT TEMPERATURE, DEG C (DEFAULT XX(31)) -
CD XX(35)  NEW OUTLET COOLANT TEMPERATURE, DEG C (DEFAULT XX(32)) -
CD XX(36)  RELATIVE POWER LEVEL FOR THIRD CASE (DEFAULT (XX(33)) -
CD          (RELATIVE TO THAT FOR THE SECOND CASE) -
C -
CD XX(37)  MOLECULAR WEIGHT (8.0026) -
CD XX(38)  AZERO (0.0216) -
CD XX(39)  AGAS (0.49849) -
CD XX(40)  B (0.) -
CD XX(41)  C (40.) -
CD XX(42)  RGAS (0.08206) -

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CD XX(43) BZERO (0.014)
CD XX(44) PCONA (17.)
CD XX(45) PCONB (20.5)
CD XX(46) PCONC (-15.37)
CD XX(47) BETAK (0.95)
CD XX(48) GASHAK (2./3. SPHERE, PI/4. CYLINDER)
CD XX(49) PC (3.674E-07)
CD XX(50) PD (0.7)
CD XX(51) PE (0.71)
CD XX(52) PF (2.682E-03)
CD XX(53) PG (0.0011379)
CD XX(54) PH (1.4389E-4)
CD XX(55) BPRIC (4.1666) HYDRAULIC EQUATION, FIRST COEFFICIENT
CDX NOT USED IF IX(13) > 0
CD XX(56) BPRIC (.1754)
CDX (1.0 IF IX(13) > 0)
CD XX(57) P1 (2.2679E-07)
CD XX(58) P2 (3.)
CD XX(59) P3 (.1293)
CD XX(60) P4 (.3292)
CD XX(61) P5 (.277)
CD XX(62) P6 (.2426)
CD XX(63) P7 (.26)
CD XX(64) P8 (.476)
CD XX(65) P9 (.41)
CD XX(66) P10 (1.176E-04)
CD XX(67) P11 (311.)
CD XX(68) FOR ONE-DIMENSIONAL CALCULATIONS, RADIAL PEAKING FACTOR
CD FOR AUXILIARY CALCULATION (DEFAULT 1.2)
CD XX(69) P12 (.005)
CD XX(70) P14 (2.)
C XX(71) - XX(83) REFERENCE THERMAL CONDUCTIVITY DATA
C USED IF XX(71) .NE. 0
CN AT NO EXPOSURE, CORRESPONDING TO TEMPERATURES (K) --
CN 300. 350. 400. 500. 600. 700. 800. 900. 1000. 1100. 1200. 1300. 1600.
CN REFERENCE POINT C(2) AT T = 350. IS 1.05 WATTS/CM-DEG DELTA T
CN TO CONVERT CM-CAL TO WATT-SEC, MULTIPLY BY 4.186
CD XX(84) P15 (0.1905)
CD XX(85) P16 (2./3.)
CD XX(86) EOVR (0.1*DP)
CD XX(87) EOVA (0.5*DP)
CD XX(88)-XX(100) RESERVED
C
CD XX(1) OPTION ON COOLANT FLOW
CD -1 NO GRAVITY TERM
CD 0- DOWNWARD FLOW
CD 1- UPWARD FLOW
C

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CN IT MAY BE USEFUL TO CONSIDER THAT AS THE PROBLEMS ARE DESCRIBED -
 CN FOR THE NEUTRONICS, FLOW IS FROM THE TOP TO THE BOTTOM -
 CN (LEFT TO RIGHT IF ONE DIMENSIONAL) -
 CN AND THE COOLANT FLOW MUST BE IN THIS DIRECTION, REASONABLE IT -
 CN SEEMS FOR DOWN FLOW OF COOLANT AND PEBBLES, BUT IF THE COOLANT IS -
 CN TO FLOW UP AND THE PEBBLES DOWN, THEN THE PROBLEM MUST BE SET UP -
 CN QUITE DIFFERENTLY (ZONE NUMBERS RUN UP INSTEAD OF DOWN) -
 C -
 CD IX(2) OPTION ON PRESSURE DROP AND FILM COEFFICIENT -
 CD 0- GEREAN -
 CD 1- US CORRELATIONS (OLD) -
 CD IX(3) OPTION ON FLUENCE, <0- DON'T READ DATA (SEE IX(6)) -
 CD 0,1- CPNIST FILE, CONTINUOUS FUELING -
 CN NOTE THAT THIS FLAG MUST BE SET FOR FIXED FUEL EXPOSURE -
 CD 2- EXPORT FILE, FIXED FUEL EXPOSURE -
 CD IX(4) FLUENCE SELECTION, 0,1- USE FIRST RANGE IF AVAILABLE -
 CD 2- USE SECOND RANGE IF AVAILABLE -
 CD 3- USE TOTAL IF IT IS AVAILABLE -
 CN IF DESIRED DATA IS NOT AVAILABLE, NO DATA IS USED -
 CD IX(5) MEMORY AVAILABLE FOR DATA IN 1000 WORDS -
 CD (DEFAULT 20000 ADDED TO RECORD 'DRVINS' CONTENT) -
 CD WHICH IS THE NUMBER SUPPLIED TO THE CONTROL MODULE) -
 CD UNDER VIRTUAL MEMORY, ASSUME FULL CORE CONTAINED -
 CD AND ALLOCATE SPACE ACCORDINGLY -
 CD IX(6) THERMAL CONDUCTIVITY TREATMENT (FOR GROSS HEAT TRANSFER -
 CD ACROSS CORE), OPTIONS -
 CD <0- NO SOLID PHASE HEAT TRANSFER -
 CD 0- USE ZONE EXPOSURE DATA AND SURFACE TEMPERATURE -
 CD 1- USE SUBZONE EXPOSURE DATA AND SURFACE TEMPERATURE -
 CD 2- DITTO, BUT VOLUME FRACTION WEIGHT INSTEAD OF AVERAGE -
 CD 3- USE BUILT IN AXIAL FUNCTION -
 CD IX(7) DEBUG EDIT LEVEL (0,1,2,3) -
 CD IX(8) EDIT LEVEL OF RESULTS (-1,0,1,2) -
 CD EDIT LEVEL IS INDEXED UP IF RESULTS SEEM UNUSUAL -
 CD IX(9) HEAT REMOVAL OPTIONS -
 CD 0- NORMAL -
 CD 1- EXCLUDE SOLID CONDUCTION -
 CD IX(10) FUEL ELEMENT GEOMETRY (GRAPHITE, NOW USED ONLY FOR THE -
 CD TEMPERATURE CALCULATION IN THE ELEMENT AND AT THE -
 CD SURFACE, NOT FOR FLOW) -
 CD 0- SPHERICAL -
 CD 1- CYLINDRICAL (INFINITE LENGTH) -
 CD IX(11) ITERATION COUNT TERMINATION (DEFAULT ESTIMATED BY CODE) -
 CD -NO ITERATION IF <0 -
 CD IX(12) OPTION TO ELIMINATE RADIAL (CROSS) FLOW -
 CD 0- NORMAL (INCLUDE) -
 CD 1- EXCLUDE -
 CD 2- EXCLUDE, AND FIX THE AXIAL FLOW RATE PROPORTIONAL -
 CD TO THE AXIAL HEAT LOAD (IDEAL ORIFICING) -
 CD 3- SAME AS 2 BUT ORIFICE AT INLET INSTEAD OF OUTLET -
 CN NOTE THAT THE ABOVE NON-ZERO OPTIONS APPLY TO FIXED TRAVERSE -
 CN COOLANT FLOW REQUIRING ADJUSTMENT IN THE DEFAULT COEFFICIENTS -
 CD IX(13) OPTION FOR FLOW THROUGH HOLES IN SOLID IF > 0 -
 CD IX(14) ITERATION PROCEDURE OPTION, -
 CD -1- DO NOT INCREASE OVERRELAXATION COEFFICIENTS -
 CD 0- ADJUST OVERRELAXATION COEFFICIENTS DURING ITERATION -
 CD 1- DO NOT INCREASE NOR DECREASE COEFFICIENTS -

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CD      IX(15)  EQUATION SWEET ORDER, -
CD          0- SIGNA-1 (ODD POINTS, THEN EVEN POINTS) -
CD          1- NORMAL ORDERED (ONE POINT AFTER THE OTHER, 2 THEN 2) -
CD      IX(16)  ASYMPTOTIC EXTRAPOLATION PROCEDURE OPTION, -
CD          0- NORMAL (ALLOW) -
CD          1- DO NOT ALLOW -
CD          >1- MINIMUM CYCLE DELAY -
CD      IX(17)  OPTION ON ASYMPTOTIC EXTRAPOLATION, DATA LEVEL -
CD          0- STREAM FUNCTION, TEMPERATURES, PRESSURE -
CD          1- STREAM FUNCTION, PRESSURE -
CD          2- PRESSURE -
CD      IX(18)  OPTION ON THE CALCULATION OF THE LOCAL VOID FRACTION -
CD          (OVERRIDDEN BY IX(1), APPLICABLE ONLY WHEN THERE ARE SUBZONES) -
CD          0- SUMS ZONE AND SUBZONE VOLUME FRACTIONS -
CD          1- USES ONLY ZONE VOLUME FRACTION -
CD          2- SUMS ONLY SUBZONE VOLUME FRACTIONS -
CD      IX(19)  INITIALIZATION OPTIONS -
CD          -1 ONLY FOR SUBSEQUENT CASE THE SOLUTION IS KEPT -
CD          0- AUTOMATED PROCEDURE (AXIAL FLUID HEATING) -
CD          1- SOMETHING DIFFERENT FOR HE WHO HAS TRIED EVERYTHING -
CD      IX(20)  WRITE ZONE TEMPERATURE FILE 'ZTEMP' OPTIONS -
CD          -1- NO -
CD          0,1- WRITE OVER EXISTING ONE IF ONE EXISTS -
CD                OTHERWISE WRITE NEW ONE -
CD          2- WRITE OVER NEXT TO LATEST VERSION IF IT EXISTS, -
CD                OTHERWISE WRITE NEW ONE -
CD          3- GENERATE NEW FILE -
CD      IX(21)  SAVE DATA ON AN INTERFACE FILE FOR RECOVERY -
CD          -1 SAVE DATA IF CONVERGENCE CRITERIA IS NOT SATISFIED -
CD          0 DO NOT SAVE DATA -
CD          1 SAVE THE THERMAL HYDRAULICS DATA FOR RECOVERY -
CD          2 ALSO SAVE THE PEBBLE THERMAL CONDUCTIVITY DATA -
CD      DATA IS SAVED FOR ONLY THE FIRST PROBLEM SOLVED IN A CODE ACCESS-
CD      IX(22)  RECOVER DATA FROM AN INTERFACE FILE TO CONTINUE ITERATION-
CD                OR TO INITIALIZE WITH (PROBLEM MUST BE SIMILAR) -
CD          1- RECOVER ALL DATA (NO REPLACEMENT) -
CD          2- DO NOT USE VOID FRACTION, POWER DENSITY, NOR -
CD                EXPOSURE DATA FROM FILE (USE NEW DATA) -
CD      IX(23)  OPTION TO RECOVER THE PEBBLE THERMAL CONDUCTIVITY DATA -
CD          0- DO NOT -
CD          1- RECOVER AND USE THE IRRADIATION TEMPERATURE AND -
CD                NEUTRON FLUX EXPOSURE FUNCTION DATA -
CD                (THIS OPTION REQUIRED TO OBTAIN ONLY EFFECTS OF -
CD                SHORT TIME TEMPERATURE CHANGES) -
CD          2- RECOVER AND USE DIRECTLY THE THERMAL CONDUCTIVITY -
CD      PEBBLE THERMAL DATA MAY BE SAVED OR RECOVERED, BUT NOT BOTH. -
CD      DEFAULT PROCEDURES GIVE PREFERENCE TO DATA RECOVERY OVER SAVING-
CD      (USED FIRST PROBLEM ONLY) -
CD      IX(24)-IX(100) RESERVED -
C
C-----

```

(CONT)

SPECIFICATIONS FOR BLANK RECORD IN INTERFACE FILE CONTROL

```

C-----
C      CLOSURE
C-----
C      BLANK1, (IX(I),I=1,100), (IX(I),I=1,100)
C-----
C      101*HULT + 100
C-----
C      BLANK1      END OF FILE IDENTIFIER (6H      ) OR (6HBLANK )
C-----
C*****
C      COTEL
C*****

```

Figure C.2. Correspondence of Data: DVENTR-DTNINS

DVENTR Input Section 001	DTNINS Record	DVENTR Input Section 001	DTNINS Record	DVENTR Input Section 001	DTNINS Record
RXX1	XX(1)	ICX1	IX(4)	IXE1	IX(32)
RXX2	XX(2)	ICX2	IX(5)	IXE2	IX(33)
RXX3	XX(3)	ICX3	IX(10)	IXE3	IX(35)
RXX4	XX(4)	ICX4	IX(6)	IXE4	IX(38)
RXX5	XX(5)	ICX5	IX(9)	IXE5	IX(39)
RXX6	XX(6)	ICX6	IX(8)	IXE6	IX(40)
RXX7	XX(14)	ICX7	IX(2)	IXE7	IX(41)
RXX8	XX(9)	ICX8	IX(26)	IXE8	IX(42)
RXX9	XX(10)	ICX9	IX(23)	IXE9	IX(37)
RXX10	XX(8)	ICX10	IX(22)	IXE10	IX(31)
RXX11	XX(11)	ICX11	IX(21)	IXE11	IX(29)
RXX12	XX(12)	ICX12	IX(20)	IXE12	IX(30)
RXX13	XX(13)	ICX13	IX(27)	IXE13	IX(61)
RXX14	XX(15)	ICX14	IX(25)	IXE14	IX(62)
RXX15	XX(16)	ICX15	IX(24)	IXE15	IX(51)
RXX16	XX(7)	ICX16	IX(12)	IXE16	IX(58)
RXX17		ICX17	IX(17)	IXE17	IX(53)
RXX18		ICX18	IX(18)	IXE18	IX(54)
		ICX19	IX(19)	IXE19	IX(52)
		ICX20	IX(16)	IXE20	No
		ICX21	IX(13)	IXE21	No
		ICX22	IX(14)	IXE22	IX(45)
		ICX23	IX(15)	IXE23	IX(59)
		ICX24	IX(70)	IXE24	IX(60)

Figure C.2. (con't)

DVENTR Input Section 002	DTNINS Record	DVENTR Input Section 002	DTNINS Record	DVENTR Input Section 002	DTNINS Record
RXXN1	XX(19)	IXCN1	IX(11)	IXEN1	IX(46)
RXXN2	XX(20)	IXCN2	IX(7)	IXEN2	IX(47)
RXXN3	XX(21)	IXCN3	IX(73)	IXEN3	IX(48)
RXXN4	XX(22)	IXCN4	IX(74)	IXEN4	IX(55)
RXXN5	XX(23)	IXCN5	IX(75)	IXEN5	IX(28)
RXXN6	XX(24)	IXCN5	IX(76)	IXEN6	IX(34)
RXXN7	XX(25)	IXCN7	IX(77)	IXEN7	IX(36)
RXXN8	XX(26)	IXCN8	IX(78)	IXEN8	IX(43)
RXXN9	XX(27)	IXCN9	IX(79)	IXEN9	IX(44)
RXXN10	XX(28)	IXCN10	IX(80)	IXEN10	IX(49)
RXXN11	XX(29)	IXCN11	IX(81)	IXEN11	IX(50)
RXXN12	XX(30)	IXCN12	IX(82)	IXEN12	IX(56)
		IXCN13	IX(83)	IXEN13	IX(57)
		IXCN14	IX(84)	IXEN14	IX(63)
		IXCN15	IX(85)	IXEN15	IX(64)
		IXCN16	IX(86)	IXEN16	IX(65)
		IXCN17	IX(87)	IXEN17	IX(66)
		IXCN18	IX(88)	IXEN18	IX(67)
		IXCN19	IX(89)	IXEN19	IX(68)
		IXCN20	IX(90)	IXEN20	IX(69)
		IXCN21		IXEN21	
		IXCN22		IXEN22	
		IXCN23		IXEN23	
		IXCN24		IXEN24	

Figure C.3. Standard Files

```

SPECIFICATIONS FOR INTERFACE FILE ISOTXS
C-----
C                                     REVISED 07/23/75
C
C      ISOTXS-IIIA
C
C      MICROSCOPIC GROUP NEUTRON CROSS SECTIONS
C
C      THIS FILE PROVIDES A BASIC BROAD GROUP
C      LIBRARY, ORDERED BY ISOTOPE
C-----

C-----
C      FILE STRUCTURE
C
C      RECORD TYPE                                PRESENT IF
C      -----
C      FILE IDENTIFICATION                        ALWAYS
C      FILE CONTROL                              ALWAYS
C      FILE DATA                                ALWAYS
C      FILE-WIDE CHI DATA                       ICHI.GT.1
C
C      ***** (REPEAT FOR ALL ISOTOPES)
C      *      ISOTOPE CONTROL AND GROUP
C      *      INDEPENDENT DATA                  ALWAYS
C      *      PRINCIPAL CROSS SECTIONS           ALWAYS
C      *      ISOTOPE CHI DATA                  ICHI.GT.1
C      *
C      *      ***** (REPEAT TO NSCHX SCATTERING BLOCKS)
C      *      *      ***** (REPEAT FROM 1 TO NSBLOK)
C      *      *      SCATTERING SUB-BLOCK        LORD(N).GT.0
C      *      *****
C-----

C-----
C      FILE IDENTIFICATION
C
C      NNAME, (NUSE(I), I=1,2), IVERS
C
C      1+3*NULT=NUMBER OF WORDS
C
C      NNAME      HOLLERITH FILE NAME - ISOTXS - (A6)
C      NUSE(I)    HOLLERITH USER IDENTIFICATION (A6)
C      IVERS      FILE VERSION NUMBER
C      NULT       DOUBLE PRECISION PARAMETER
C      1- A6 WORD IS SINGLE WORD
C      2- A6 WORD IS DOUBLE PRECISION WORD
C-----

```

(CONT)

```

C-----
CR          FILE CONTROL      (1D RECORD)
C
CL  NGROUP,NISO, NAXUP,NAXDP,NAXDPD, ICHIST, WSCNAX, WSBLOK
C
CW  8=NUMBER OF WORDS
C
CD  NGROUP      NUMBER OF ENERGY GROUPS IN FILE
CD  NISO        NUMBER OF ISOTOPES IN FILE
CD  NAXUP       MAXIMUM NUMBER OF UP-SCATTER GROUPS
CD  NAXDN       MAXIMUM NUMBER OF DOWNSCATTER GROUPS
CD  NAXDPD      MAXIMUM SCATTERING ORDER (MAXIMUM VALUE OF
CD              LEGENDRE EXPANSION INDEX USED IN FILE) .
CD  ICHIST      FILE-WIDE FISSION SPECTRUM FLAG
CD              ICHIST.EQ.0, NO FILE-WIDE SPECTRUM
CD              ICHIST.EQ.1, FILE-WIDE CHI VECTOR
CD              ICHIST.GT.1, FILE-WIDE CHI MATRIX
CD  WSCNAX      MAXIMUM NUMBER OF BLOCKS OF SCATTERING DATA
CD  WSBLOK      SUBBLOCKING CONTROL FOR SCATTER MATRICES. THE
CD              SCATTERING DATA ARE SUBBLOCKED INTO WSBLOK
CD              RECORDS (SUBBLOCKS) PER SCATTERING BLOCK.
C-----

```

```

C-----
CR          FILE DATA      (2D RECORD)
C
CL  (NSETID(I), I=1,12), (NISON(I), I=1,NISO),
CL  1 (CHI(J), J=1,NGROUP), (VEL(J), J=1,NGROUP),
CL  2 (ENAX(J), J=1,NGROUP), ENIN, LOCA(I), I=1,NISO)
C
CW  (NISO+12)*MULT+1+NISO
CW  +NGROUP*(2+ICHIST*(2/(ICHIST+1)))=NUMBER OF WORDS
C
CD  NSETID(I)    NOLLERITH IDENTIFICATION OF FILE (A6)
CD  NISON(I)     NOLLERITH ISOTOPE LABEL FOR ISOTOPE I (A6)
CD  CHI(J)       FILE-WIDE FISSION SPECTRUM (PRESENT IF ICHIST.EQ.1)
CD  VEL(J)       MEAN NEUTRON VELOCITY IN GROUP J (CM/SEC)
CD  ENAX(J)      MAXIMUM ENERGY BOUND OF GROUP J (EV)
CD  ENIN         MINIMUM ENERGY BOUND OF SET (EV)
CD  LOCA(I)      NUMBER OF RECORDS TO BE SKIPPED TO READ DATA FOR
CD              ISOTOPE I. LOCA(1)=0
C-----

```

```

C-----
CR          FILE-WIDE CHI DATA      (3D RECORD)
C
CC  PRESENT OF ICHIST.GT.1
C
CL  ((CHI(K,J), K=1, ICHIST), J=1,NGROUP), (ISSPEC(I), I=1,NGROUP)
C
CW  NGROUP*(ICHIST+1)=NUMBER OF WORDS
C

```

(CONT)

```

CD CHI(K,J) FRACTION OF NEUTRONS EMITTED INTO GROUP J AS A
CD RESULT OF FISSION IN ANY GROUP, USING SPECTRUM K
CD ISSPEC(I) ISSPEC(I)=K IMPLIES THAT SPECTRUM K IS USED
CD TO CALCULATE EMISSION SPECTRUM FROM FISSION
CD IN GROUP I
C
C-----

```

```

C-----
CR ISOTOPE CONTROL AND GROUP INDEPENDENT DATA (40 RECORD)
C
CL HABSID,HIDENT,HMAT,ANASS,EPISS,ECAPT,TEMP,SIGPOT,ADENS,KBR,ICHI,
CL 1IPIS,IALP,INP,IN2N,IND,INT,LTOT,LTRN,ISTRPD,
CL 2(IDSCT(N),N=1,NSCHAX),(LORD(N),N=1,NSCHAX),
CL 3((JBAND(J,N),J=1,NGROUP),N=1,NSCHAX),
CL 4((IJJ(J,N),J=1,NGROUP),N=1,NSCHAX)
C
CW 3*NULT+17+NSCHAX*(2*NGROUP+2)=NUMBER OF WORDS
C
CD HABSID HOLLERITH ABSOLUTE ISOTOPE LABEL - SAME FOR ALL
CD VERSIONS OF THE SAME ISOTOPE IN FILE (A6)
CD HIDENT IDENTIFIER OF LIBRARY FROM WHICH BASIC DATA
CD CAME (E.G. ENDF/B) (A6)
CD HMAT ISOTOPE IDENTIFICATION (E.G. ENDF/B MAT NO.) (A6)
CD ANASS GRAM ATOMIC WEIGHT
CD EPISS TOTAL THERMAL ENERGY YIELD/FISSION (W.SEC/FISS)
CD ECAPT TOTAL THERMAL ENERGY YIELD/FISSION (W.SEC/CAPT)
CD TEMP ISOTOPE TEMPERATURE (DEGREES KELVIN)
CD SIGPOT AVERAGE EFFECTIVE POTENTIAL SCATTERING IN
CD RESONANCE RANGE (BARN5/ATON)
CD ADENS DENSITY OF ISOTOPE IN MIXTURE IN WHICH ISOTOPE
CD CROSS SECTIONS WERE GENERATED (A/BARN-CM)
CD KBR ISOTOPE CLASSIFICATION
CD 0=UNDEFINED
CD 1=FISSILE
CD 2=PERTILE
CD 3=OTHER ACTINIDE
CD 4=FISSION PRODUCT
CD 5=STRUCTURE
CD 6=COOLANT
CD 7=CONTROL
CD ICHI ISOTOPE FISSION SPECTRUM FLAG
CD ICHI.EQ.0, USE FILE-WIDE CHI
CD ICHI.EQ.1, ISOTOPE CHI VECTOR
CD ICHI.GT.1, ISOTOPE CHI MATRIX
CD IPIS (N,F) CROSS SECTION FLAG
CD IPIS=0, NO FISSION DATA IN PRINCIPAL CROSS
CD SECTION RECORD
CD =1, FISSION DATA PRESENT IN PRINCIPAL
CD CROSS SECTION RECORD
CD IALP (N,ALPHA) CROSS SECTION FLAG
CD SAME OPTIONS AS IPIS

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(CONT)

```

CD INP      (N,P) CROSS SECTION FLAG
CD          SAME OPTIONS AS IPIS
CD IN2N     (N,2N) CROSS SECTION FLAG
CD          SAME OPTIONS AS IPIS
CD IND      (N,D) CROSS SECTION FLAG
CD          SAME OPTIONS AS IPIS
CD INT      (N,T) CROSS SECTION FLAG
CD          SAME OPTIONS AS IPIS
CD LTOT     NUMBER OF MOMENTS OF TOTAL CROSS SECTION PROVIDED
CD          IN PRINCIPAL CROSS SECTIONS RECORD
CD LTRN     NUMBER OF MOMENTS OF TRANSPORT CROSS SECTION
CD          PROVIDED IN PRINCIPAL CROSS SECTIONS RECORD
CD ISTRPD   NUMBER OF COORDINATE DIRECTIONS FOR WHICH
CD          COORDINATE DEPENDENT TRANSPORT CROSS SECTIONS
CD          ARE GIVEN. IF ISTRPD=0, NO COORDINATE DEPENDENT
CD          TRANSPORT CROSS SECTIONS ARE GIVEN.
CD IDSCT(N) SCATTERING MATRIX TYPE IDENTIFICATION FOR
CD          SCATTERING BLOCK N. SIGNIFICANT ONLY IF
CD          LORD(N).GT.0
CD          IDSCT(N)=000 + NN, TOTAL SCATTERING
CD          =100 + NN, ELASTIC SCATTERING
CD          =200 + NN, INELASTIC SCATTERING
CD          =300 + NN, (N,2N) SCATTERING,
CD          WHERE NN IS THE LEGENDRE EXPANSION INDEX OF THE
CD          FIRST MATRIX IN BLOCK N
CD LORD(N)  NUMBER OF SCATTERING ORDERS IN BLOCK N. IF
CD          LORD(N)=0, THIS BLOCK IS NOT PRESENT FOR THIS
CD          ISOTOPE. IF NN IS THE VALUE TAKEN FROM
CD          IDSCT(N), THEN THE MATRICES IN THIS BLOCK
CD          HAVE LEGENDRE EXPANSION INDICES OF NN.NN+1,
CD          NN+2,...,NN+LORD(N)-1
CD JBAND(J,N) SCATTERING BANDWIDTH FOR GROUP J, SCATTERING
CD          BLOCK N
CD IJJ(J,N)  POSITION OF IN-GROUP SCATTERING CROSS SECTION IN
CD          SCATTERING DATA FOR GROUP J, SCATTERING BLOCK
CD          N,COUNTED FROM THE FIRST WORD OF GROUP J DATA.
C
C-----

```

```

C-----
C          PRINCIPAL CROSS SECTIONS (50 RECORD)
C
CL ((STRPL(J,L),J=1,NGROUP),L=1,LTRN),
CL 1((STOTPL(J,L),J=1,NGROUP),L=1,LTOT), (SNGAN(J),J=1,NGROUP),
CL 2(SFIS(J),J=1,NGROUP), (SNUTOF(J),J=1,NGROUP),
CL 3(CHISO(J),J=1,NGROUP), (SNALP(J),J=1,NGROUP),
CL 4(SNP(J),J=1,NGROUP), (SN2N(J),J=1,NGROUP),
CL 5(SVD(J),J=1,NGROUP), (SNT(J),J=1,NGROUP)
CL 6((ISTRPD(J,I),J=1,NGROUP),I=1,ISTRPD)
C
CW (1+LTRN+LTOT+IALP+INP+IN2N+IPD+INT+ISTRPD+2*IFIS+
CW ICHI*(2/(ICHI+1)))*NGROUP=NUMBER OF WORDS

```

(CONT)

```

C
CD STRPL(J,L) PL WEIGHTED TRANSPORT CROSS SECTION
CD THE FIRST ELEMENT OF ARRAY STRPL IS THE
CD CUPRENT (P1) WEIGHTED TRANSPORT CROSS SECTION
CD STOTPL(J,L) PL WEIGHTED TOTAL CROSS SECTION
CD THE FIRST ELEMENT OF ARRAY STOTPL IS THE
CD FLUX (P0) WEIGHTED TOTAL CROSS SECTION
CD SNGAN(J) (W,GAMMA)
CD SPIS(J) (W,P) (PRESENT IF IPIS.GT.0)
CD SNUOT(J) TOTAL NEUTRON YIELD/FISSION (PRESENT IF IPIS.GT.0)
CD CHISO(J) ISOTOPE CHI (PRESENT IF ICHI.EQ.1)
CD SHALF(J) (W,ALPHA) (PRESENT IF IALF.GT.0)
CD SWP(J) (W,P) (PRESENT IF IMP.GT.0)
CD SN2H(J) (W,2H) (PRESENT IF IN2H.GT.0)
CD SWD(J) (W,D) (PRESENT IF IND.GT.0)
CD SWT(J) (W,T) (PRESENT IF INT.GT.0)
CD STRPD(J,I) COORDINATE DIRECTION I TRANSPORT CROSS SECTION
CD (PRESENT IF ISTRPD.GT.0)
C

```

```

C-----
CR ISOTOPE CHI DATA (6D RECORD)
C
CC PRESENT IF ICHI.GT.1
C
CL ((CHIISO(K,J),K=1,ICHI),J=1,NGROUP),(ISOPEC(I),I=1,NGROUP)
C
CW NGROUP*(ICHI+1)=NUMBER OF WORDS
C
CD CHIISO(K,J) FRACTION OF NEUTRONS EMITTED INTO GROUP J AS A
CD RESULT OF FISSION IN ANY GROUP, USING SPECTRUM K
CD ISOPEC(I) ISOPEC(I)=K IMPLIES THAT SPECTRUM K IS USED
CD TO CALCULATE EMISSION SPECTRUM FROM FISSION
CD IN GROUP I
C
C
C-----

```

```

C-----
CR SCATTERING SUB-BLOCK (7D RECORD)
C
CC PRESENT IF LOR3(W).GT.0
C
CL ((SCAT(K,L),K=1,KMAX),L=1,LCPDN)
C
CC KMAX=SUM OVER J OF JBAND(J,W) WITHIN THE J-GROUP RANGE OF THIS
CC SUB-BLOCK. IF W IS THE INDEX OF THE SUB-BLOCK, THE J-GROUP
CC RANGE CONTAINED WITHIN THIS SUB-BLOCK IS
CC JL=(W-1)*((NGROUP-1)/NSBLOK+1)+1 TO JU=W*((NGROUP-1)/NSBLOK+1)
CC IF (JU.GT.NGROUP) JU = NGROUP
C

```

(CONT)

```

CC      LORDN=LORD(J)
CC      N IS THE INDEX FOR THE LOOP OVER NSCHAX (SEE FILE STRUCTURE)
C
C0      KNAT=LORDN=NUMBER OF WORDS
C
C0      SCAT(K,L) SCATTERING MATRIX OF SCATTERING ORDER L, FOR
C0              REACTION TYPE IDENTIFIED BY IDSCT(N) FOR THIS
C0              BLOCK. JBAND(J,N) VALUES FOR SCATTERING INTO
C0              GROUP J ARE STORED AT LOCATIONS K=SUM FROM 1
C0              TO (J-1) OF JBAND(J,N) PLUS 1 TO K-1+JBAND(J,N).
C0              THE SUM IS ZERO WHEN J=1. J-TO-J SCATTER IS
C0              THE IJJ(J,N)-TH ENTRY IN THE RANGE JBAND(J,N).
C0              VALUES ARE STORED IN THE ORDER (J+JUP),
C0              (J+JUP-1), ..., (J+1), J, (J-1), ..., (J-JDN),
C0              WHEN: JUP=IJJ(J,N)-1 AND JDN=JBAND(J,N)-IJJ(J,N)
C
C-----

```

```

C*****
C
C00F      ISOTXS
C
C*****

```

SPECIFICATIONS FOR INTERFACE FILE GROUPXS

```

C*****
C                      REVISED 07/23/75
C
C
C  CP      GROUPXS-III
C
C  CE      MICROSCOPIC GROUP NEUTRON CROSS SECTIONS
C
C
C  CN      THIS FILE PROVIDES A BASIC BROAD GROUP
C  CN      LIBRARY, ORDERED BY GROUP
C
C*****

```

```

C-----
C  CS      FILE STRUCTURE
C
C  CS      RECORD TYPE                      PRESENT IF
C  CS      *****
C  CS      FILE IDENTIFICATION              ALWAYS
C  CS      FILE CONTROL                     ALWAYS
C  CS      FILE DATA                       ALWAYS
C  CS      SET CHI DATA                    ICHIST.GT.1
C  CS      ISOTOPE CONTROL AND GROUP
C  CS      INDEPENDENT DATA                ALWAYS
C  CS      ***** (REPEAT OVER ALL ENERGY GROUPS)
C  CS      * PRINCIPAL CROSS SECTIONS        ALWAYS
C  CS      *****
C  CS      ***** (REPEAT OVER NISO ISOTOPES)  NCHIN.GT.0
C  CS      * ISOTOPE CHI DATA                ICHI(I).GT.1
C  CS      *****
C  CS      ***** (REPEAT OVER ALL ENERGY GROUPS)
C  CS      * SCATTERING CONTROL              ALWAYS
C  CS      * ***** (REPEAT TO NSCHNAX SCATTERING BLOCKS)
C  CS      * * ***** (REPEAT FROM 1 TO NSBLOK)
C  CS      * * * SCATTERING SUB-BLOCK        LORD(N).GT.0
C  CS      *****
C
C-----

```

```

C-----
C  CP      FILE IDENTIFICATION
C
C  CL      HNAME, (HUSE(I), I=1,2), IVERS
C
C  CN      1+3*NULT=NUMBER OF WORDS
C
C  CD      HNAME      HOLLERITH FILE NAME - GROUPXS - (A6)
C  CD      HUSE(I)     HOLLERITH USER IDENTIFICATION (A6)
C  CD      IVERS       FILE VERSION NUMBER
C  CD      NULT        DOUBLE PRECISION PARAMETER
C  CD                  1- A6 WORD IS SINGLE WORD
C  CD                  2- A6 WORD IS DOUBLE PRECISION WORD
C
C-----

```

(CONT)


```

C-----
CR          FILE CONTROL (1D RECORD)
C
CL  NGROUP,NISO,NAXUP,NAXDN,NAXORD,ICHIST,NPSCS,NSTRPD,MCHIN,WICHI,
CL  NSCHAX,NSBLOK,NPG,NRH
C
CW  14 = NUMBER OF WORDS
C
CD  NGROUP      NUMBER OF ENERGY GROUPS IN SET
CD  NISO        NUMBER OF ISOTOPE IN SET
CD  NAXUP       MAXIMUM NUMBER OF UPSCATTER GROUPS
CD  NAXDN       MAXIMUM NUMBER OF DOWNSCATTER GROUPS
CD  NAXORD      MAXIMUM SCATTERING ORDER (MAXIMUM VALUE OF
CD              LEGENDRE EXPANSION INDEX USED IN FILE)
CD  ICHIST      SET FISSION SPECTRUM FLAG
CD              1- SET FISSION SPECTRUM VECTOR
CD              .GT. 1- NUMBER OF SPECTRA FOR RANGES IN INCIDENT
CD              ENERGY DEPENDENT CHI
CD  NPSCS       LENGTH OF THE PRINCIPAL CROSS SECTION RECORDS
CD  NSTRPD      NUMBER OF COORDINATE DIRECTIONS FOR WHICH TRANSPORT
CD              CROSS SECTIONS ARE GIVEN, .LE. 3
CD  MCHIN       NUMBER OF ISOTOPE FOR WHICH THERE ARE INCIDENT
CD              ENERGY DEPENDENT CHI DATA
CD  WICHI       NUMBER OF INCIDENT ENERGY SPECTRA FOR ISOTOPE CHI
CD              DATA (MAXIMUM)
CD  NSCHAX      MAXIMUM NUMBER OF BLOCKS OF SCATTERING DATA
CD              FOR EACH GROUP SCATTERED INTO - CAN BE THE
CD              NUMBER OF TYPES OF SCATTERING FOR WHICH THERE
CD              ARE DATA
CD  NSBLOK      BLOCKING CONTROL FOR SCATTER MATRICES. THE
CD              SCATTERING DATA ARE BLOCKED INTO NSBLOK
CD              RECORDS PER SCATTERING BLOCK.
CD  NRG         RESERVED
CD  NRH         RESERVED
C-----

```

```

C-----
CR          FILE DATA (2D RECORD)
C
CL  (HSETID(I),I=1,12), (HISONM(I),I=1,NISO),
CL  ( CHI(J),J=1,NGROUP), (VEL(J),J=1,NGROUP),
CL  (EMAX(J),J=1,NGROUP), ENIN
C
CW  3*NGROUP+MULT*(NISO+12)+1=NUMBER OF WORDS
C
CD  HSETID(I)    HOLLERITH IDENTIFICATION OF SET (A6)
CD  HISONM(I)    HOLLERITH ISOTOPE LABEL FOR ISOTOPE I (A6)
CD  CHI(J)       SET FISSION SPECTRUM
CD  VEL(J)       NEAR NEUTRON VELOCITY IN GROUP J (CM/SEC)
CD  EMAX(J)      MAXIMUM ENERGY BOUND OF GROUP J (eV)
CD  ENIN         MINIMUM ENERGY BOUND OF SET (eV)
C-----

```

(CONT)

```

C-----
CR      SET CHI DATA  (3D RECORD)
C
CC      PRESENT IF ICHIST.GT.1
C
CL      ((CHI(K,J),K=1,ICHIST),J=1,NGROUP),(ISSPEC(I),I=1,NGROUP)
C
CW      NGROUP*(ICHIST+1)=NUMBER OF WORDS
C
CC      CHI(K,J)      FFACTION OF NEUTRONS EMITTED IN GROUP J AS A
CD                      RESULT OF FISSION IN ANY GROUP USING SPECTRUM K
CD      ISSPEC(I)      ISSPEC(I)=K IMPLIES THAT SPECTRUM K IS USED TO
CD                      CALCULATE EMISSION SPECTRUM FROM FISSION IN
CD                      GROUP I
C-----

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C-----
CR      ISOTOPE CONTROL AND GROUP INDEPENDENT DATA (ND RECORD)
C
CL      (HABSID(I),I=1,NISO),(HIDENT(I),I=1,NISO),(HMAT(I)=1,NISO),
CL      (AHASS(I),I=1,NISO),
CL      (EPISS(I),I=1,NISO),(ECAPT(I),I=1,NISO),(XN(I),I=1,NISO),
CL      (TEMP(I),I=1,NISO),(SIGPOT(I),I=1,NISO),(ADENS(I),I=1,NISO),
CL      (KBR(I),I=1,NISO),(IDSCT(N),N=1,NSCHAX),(LORD(N),N=1,NSCHAX),
CL      (ICHI(I),I=1,NISO),IALF,INP,IN2N,IND,INT,IX,IY
C
CW      NISO*(3*NULT+9)+2*NSCHAX+7=NUMBER OF WORDS
C
CD      HABSID(I)      HOLLERITH ABSOLUTE ISOTOPE LABEL (A6)
CD      HIDENT        IDENTIFIER, USUALLY ENDF NUMBER (A6)
CD      HMAT(I)        MATERIAL REFERENCE FOR IDENTIFICATION (A6)
CD      AHASS(I)       GRAM ATOMIC WEIGHT
CD      EPISS(I)       TOTAL THERMAL ENERGY YIELD/FISSION (W.SEC/FISS)
CD      ECAPT(I)       THERMAL ENERGY YIELD PER CAPTURE (W.SEC/CAP)
CD      XN(I)          RESERVED
CD      TEMP(I)        ISOTOPE TEMPERATURE (DEGREES KELVIN)
CD      SIGPOT(I)      AVERAGE EFFECTIVE POTENTIAL SCATTERING IN
CD                      RESONANCE RANGE (BARNS/ATOM)
CD      ADENS(I)       DENSITY OF ISOTOPE IN MIXTURE IN WHICH ISOTOPE
CD                      CROSS SECTIONS WERE GENERATED (A/BARN/CC)
CD      KBR(I)         ISOTOPE CLASSIFICATION
CD                      0=UNDEFINED
CD                      1=FISSILE
CD                      2=PERTILE
CD                      3=OTHER ACTINIDE
CD                      4=FISSION PRODUCT
CD                      5=STRUCTURE
CD                      6=COOLANT
CD                      7=CONTROL
C-----

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(CONT)

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CD      IDSCT(N)      SCATTERING MATRIX TYPE IDENTIFICATION FOR
CD                      SCATTERING BLOCK N. SIGNIFICANT ONLY IF
CD                      LORD(N).GT.0
CD                      IDSCT(N)=000+ NN, TOTAL SCATTERING/SUM OF
CD                      ELASTIC, INELASTIC, AND N, 2F SCATTERING)
CD                      =100 + NN, ELASTIC SCATTERING
CD                      =200 + NN, INELASTIC SCATTERING
CD                      =300 + NN, (N,2N) SCATTERING PER EMITTED NEUTRON
CD                      WHERE NN IS EXPANSION ORDER OF BLOCK N DATA,
CD                      DATA ORDERED BY INCREASING EXPANSION ORDER
CD                      FOR EACH OF THE TYPES IN THE ABOVE ORDER
CD      LORD(N)      NUMBER OF SCATTERING ORDERS IN BLOCK N. IF
CD                      LORD(N)=0. THIS BLOCK IS NOT PRESENT FOR THIS
CD                      ISOTOPE BLOCK. IF NN IS THE VALUE TAKEN FROM
CD                      IDSCT(N), THEN THE MATRICES IN THIS BLOCK
CD                      HAVE LEGENDRE EXPANSION INDICES OF NN,NN+1,
CD                      ....,NN+LORD(N)-1
CD      ICHI(I)      ISOTOPE FISSION SPECTRUM FLAG
CD                      0- USE SET CHI
CD                      1- ISOTOPE CHI VECTOR
CD                      .GT.1- NUMBER OF SPECTRA FOR RANGES IN INCIDENT
CD                      ENERGY DEPENDENT CHI
CD      IALF      (N,ALPHA) CROSS SECTION FLAG
CD                      IALF=1, (N,ALPHA) DATA IN THE FILE
CD                      IALF=0, NO (N,ALPHA) DATA IN THE FILE
CD      INP      (N,P) CROSS SECTION FLAG
CD                      SAME OPTIONS AS FOR IALF
CD      IN2N      (N,2N) CROSS SECTION FLAG
CD                      SAME OPTIONS AS FOR IALF
CD      IND      (N,D) CROSS SECTION FLAG
CD                      SAME OPTIONS AS FOR IALF
CD      INT      (N,T) CROSS SECTION FLAG
CD                      SAME OPTIONS AS FOR IALF
CD      IX      RESERVED
CD      IY      RESERVED
C
C-----

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C-----
CR      PRINCIPAL CROSS SECTIONS (50 RECORD)
C
CL      ((STRPL(I,L),I=1,NISO),L=1,NAXT),
CL      ((STUTPL(I,L),I=1,NISO),L=1,NAXT), (SNGAN(I),I=1,NISO),
CL      (SPIS(I),I=1,NISO), (SNUTOT(I),I=1,NISO),
CL      (CNISO(I),I=1,NISO), (SNALP(I),I=1,NISO),
CL      (SNP(I),I=1,NISO), (SN2N(I),I=1,NISO),
CL      (SND(I),I=1,NISO), (SNT(I),I=1,NISO),
CL      ((STRPD(I,J),I=1,NISO),J=1,NSTRPD)
C
CW      NPSCS=NISO*(2*NAXT+4*IALF+INP+IN2N+IND+INT+NSTRPD)=NUMBER
CW      OF WORDS
C

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(CONT)

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CD   STRPL(I,L)      PL WEIGHTED TRANSPORT CROSS SECTIONS      -
CD   STOTPL(I,L)     PL WEIGHTED TOTAL CROSS SECTIONS          -
CD   SNGAN(I)         (W,GANNA) CROSS SECTION                  -
CD   SPIS(I)          (W,FISSION) CROSS SECTION                -
CD   SHUTOT(I)        TOTAL NEUTRON YIELD/FISSION              -
CD   CHISO(I)         ISOTOPE CHI VECTOR                       -
CD   SWALF(I)         (W,ALPHA) (PRESENT IF IALF.GT.0)          -
CD   SWP(I)           (W,P) (PRESENT IF INP.GT.0)               -
CD   SW2N(I)          (W,2N) (LOSS) (PRESENT IF IN2N.GT.0)     -
CD   SWD(I)           (W,D) (PRESENT IF IND.GT.0)               -
CD   SWT(I)           (W,T) (PRESENT IF INT.GT.0)               -
CD   STRPD(I,J)       CGORDINATE DIRECTION J DEPENDENT TRANSPORT CROSS -
CD                       SECTION( PRESENT IF WSTRPD.GT.0)         -
CD   NAXT              NAXORD+1                                 -
C-----

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```

C-----
CR      ISOTOPE CHI DATA (6D RECORD)                          -
C-----
CC      PRESENT IF NCHIN.GT.0 AND ICHI(I).GT.1                 -
C-----
CL      ((CHISI(K,J),K=1,ICHII),J=1,NGROUP), (ISOPEC(I),I=1,NGROUP) -
C-----
CW      NGROUP*(ICHII + 1)=NUMBER OF WORDS                     -
C-----
CD      ICHII          =ICHI(I)                                 -
CD      CHISI(K,J)     FRACTION OF NEUTRONS EMITTED IN GROUP J AS A RESULT -
CD                       OF FISSION IN ANY GROUP USING SPECTRUM K      -
CD      ISOPEC(I)       ISOPEC(I)=K IMPLIES THAT SPECTRUM K IS USED TO -
CD                       CALCULATE EMISSION SPECTRUM FROM FISSION IN   -
CD                       GROUP I                                         -
C-----

```

```

C-----
CR      SCATTERING CONTROL (7D RECORD)                          -
C-----
CI      ((JBAND(I,N),I=1,NISO),N=1,NSCHAX),                   -
CL      ((IJJ(I,N),I=1,NISO), N=1,NSCHAX)                      -
C-----
CW      2*NISO*NSCHAX=NUMBER OF WORDS                           -
C-----
CD      JBAND(I,N)      SCATTERING BANDWIDTH FOR ISOTOPE I, BLOCK N   -
CD      IJJ(I,N)        POSITION OF IN-GROUP SCATTERING CROSS SECTION IN -
CD                       SCATTERING DATA FOR ISOTOPE I, SCATTERING BLOCK -
CD                       N, COUNTED FROM THE FIRST WORD OF ISOTOPE I DATA -
C-----

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(CONT)

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C-----
CR          SCATTERING SUB-BLOCK (RD RECORD)
C
CC          PRESENT IF LORD(N).GT.0
C
CL          ((SCAT(K,L),K=1,KMAX),L=1,LORDN)
C
CC          KMAX=SUM OVER I OF JBAND(I,N) WITHIN THE I-RANGE OF SUB-BLOCK N.
CC          THE I-RANGE IS IL=(N-1)*((NISO-1)/NSBLOK+1)+1
CC          TO IU=N*((NISO-1)/NSBLOK+1). LORDN=LORD(N)
C
CW          KMAX*LORDN=NUMBER OF WORDS
C
CD          SCAT(K,L)      SCATTERING MATRIX OF SCATTERING ORDER L, FOR
CD                          REACTION TYPE IDENTIFIED BY IDSCT(N) FOR THIS
CD                          BLOCK. JBAND(I) VALUES FOR SCATTERING INTO
CD                          GROUP J ARE STORED AT LOCATIONS K=SUM FROM 1
CD                          TO (I-1) OF JBAND(I) PLUS 1 TO K-1+JBAND(I).
CD                          THE SUM IS ZERO WHEN I=1. J-TO-J SCATTER IS
CD                          THE IJJ(I)-TH ENTRY IN THE RANGE JBAND(I).
CD                          VALUES ARE STORED IN THE ORDER (J+JUP),
CD                          (J+JUP-1),..., (J+1), J, (J-1),..., (J-JDN),
CD                          WHERE JUP=IJJ(I)-1 AND JDN=JBAND(I)-IJJ(I)
C
CW          BLOCKING OVER ISOTOPES FOR EACH ORDER IS
CW          NECESSARY IF THE DATA IS TO BE PROCESSED ONCE
CW          SEQUENTIALLY AND THE MACROSCOPIC DATA STORED
CW          ONE ORDER AT A TIME. IN THIS EVENT, EITHER
CW          VALUES OF LORD(N) MUST BE LIMITED TO 1 OR
CW          NSBLOK BE 1.
C
C-----

C*****
C
CCEOF          GROUPXS
C
C*****

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SPECIFICATIONS FOR INTERFACE FILE GEODST

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C*****
C                      REVISED 07/22/75
C
C      GEODST - III
C
C      GEOMETRY DESCRIPTION
C
C*****

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C-----
C      FILE IDENTIFICATION
C
C      NAME, (NUSE(I), I=1,2), IVERS
C
C      1+3*NULT=NUMBER OF WORDS
C
C      NAME          HOLLERITH FILE NAME - GEODST - (A6)
C      NUSE(I)       HOLLERITH USER IDENTIFICATION (A6)
C      IVERS         FILE VERSION NUMBER
C      NULT          DOUBLE PRECISION PARAMETER
C                   1- A6 WORD IS SINGLE WORD
C                   2- A6 WORD IS DOUBLE PRECISION WORD
C
C-----

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C-----
C      FILE SPECIFICATIONS      (1D RECORD)
C
C      IGOH, NZONE, NREG, NZCL, NCINTI, NCINTJ, NCINTK, NINTI, NINTJ, NINTK, INB1,
C      INB2, JHB1, JHB2, KHB1, KHB2, NBS, NBCS, NIBCS, NZWDB, NTRIAG, NRASS,
C      (NGOP(I), I=1,5)
C
C      27=NUMBER OF WORDS
C
C      IGOH          GEOMETRY 3- POINT (FUNDAMENTAL NODE)
C                   1- SLAB
C                   2- CYLINDER
C                   3- SPHERE
C                   6- X-Y
C                   7- R-Z
C                   8- THETA-R
C                   9- TRIANGULAR (6 MESH POINTS IN EACH
C                               HEXAGONAL ELEMENT)
C                   10- HEXAGONAL (1 MESH POINT IN EACH
C                               HEXAGONAL ELEMENT)
C                   11- R-THETA
C                   12- R-THETA-Z
C                   13- R-THETA-ALPHA
C                   14- X-Y-Z
C                   15- THETA-R-Z
C                   16- THETA-R-ALPHA
C                   17- TRIANGULAR-Z (MESH POINTS AS IN 9,

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(CONT)

CD		ABOVE)	-
CD		10- HEXAGON-Z (MESH POINTS AS IN 10	-
CD		ABOVE)	-
CD	NZONE	NUMBER OF ZONES (EACH HOMOGENEOUS IN NEUTRONICS	-
CD		PROBLEM - A ZONE CONTAINS ONE OR MORE REGIONS)	-
CD	NREG	NUMBER OF REGIONS	-
CD	NZCL	NUMBER OF ZONE CLASSIFICATIONS (EDIT PURPOSES)	-
CD	NCINTI	NUMBER OF FIRST DIMENSION COARSE MESH INTERVALS	-
CD	NCINTJ	NUMBER OF SECOND DIMENSION COARSE MESH	-
CD		INTERVALS, NCINTJ.EQ.1 FOR ONE	-
CD		DIMENSIONAL CASE.	-
CD	NCINTK	NUMBER OF THIRD DIMENSION COARSE MESH INTERVALS	-
CD		NCINTK.EQ.1 FOR ONE AND TWO	-
CD		DIMENSIONAL CASES.	-
CD	NINTI	NUMBER OF FIRST DIMENSION FINE MESH INTERVALS	-
CD	NINTJ	NUMBER OF SECOND DIMENSION FINE MESH INTERVALS	-
CD		NINTJ.EQ.1 FOR ONE DIMENSIONAL CASE.	-
CD	NINTK	NUMBER OF THIRD DIMENSION FINE MESH INTERVALS	-
CD		NINTK.EQ.1 FOR ONE AND TWO DIMENSIONAL	-
CD		CASES.	-
CD	INB1	FIRST BOUNDARY ON FIRST DIMENSION	-
CD		0- ZERO FLUX (DIFFUSION)	-
CD		1- REFLECTED	-
CD		2- EXTRAPOLATED (DIFFUSION - DEL PHI	-
CD		/PHI = -C/D WHERE C IS GIVEN AS BUDC	-
CD		BELOW AND D IS THE GROUP DIFFUSION	-
CD		CONSTANT, TRANSPORT - NO RETURN)	-
CD		3- REPEATING (PERIODIC) WITH OPPOSITE	-
CD		FACE	-
CD		4- REPEATING (PERIODIC) WITH NEXT	-
CD		ADJACENT FACE GOING CLOCKWISE	-
CD		AROUND THE FIRST AND SECOND	-
CD		DIMENSION PERIMETER. PERTINENT	-
CD		ONLY FOR 2 OR 3 DIMENSIONAL	-
CD		PROBLEMS.	-
CD		5- INVERTED REPEATING ALONG THIS FACE	-
CD		(180 DEGREE ROTATION)	-
CD		6- ISOTROPIC RETURN (TRANSPORT)	-
C		NOTE THAT FOR REPEATING BOUNDARIES, THE FIRST BOUNDARY IN	-
C		ORDER WHICH IS INVOLVED CARRIES THE DESIGNATOR DEFINING	-
C		THE REPEATING CONDITION.	-
CD	INB2	LAST BOUNDARY ON FIRST DIMENSION	-
CD	JNB1	FIRST BOUNDARY ON SECOND DIMENSION	-
CD	JNB2	LAST BOUNDARY ON SECOND DIMENSION	-
CD	KNB1	FIRST BOUNDARY ON THIRD DIMENSION	-
CD	KNB2	LAST BOUNDARY ON THIRD DIMENSION	-
CD	NBS	NUMBER OF BUCKLING SPECIFICATIONS	-
CD		1- SINGLE VALUE APPLIES EVERYWHERE	-
CD		.EQ,NZONE, ZONE-DEPENDENT	-
CD		.GT,NZONE, DATA IS GIVEN OVER ALL ZONES FOR	-
CD		THE FIRST ENERGY GROUP, THEN FOR THE NEXT	-
CD		GROUP, TO END OF LIST - IF THERE ARE MORE	-
CD		GROUPS, LAST GROUP DATA GIVEN IS USED	-

(CONT)

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CD  NBKS      NUMBER OF CONSTANTS FOR EXTERNAL BOUNDARIES -
CD           1- SINGLE VALUE USED EVERYWHERE -
CD           6- INDIVIDUAL VALUES FOR EACH POSSIBLE -
CD             SURFACE (BOUNDARY SPECS GIVE ACTUAL USE) -
CD           .GT.6- SIX VALUES ARE GIVEN FOR THE FIRST -
CD             ENERGY GROUP, THEN SIX FOR THE NEXT, TO -
CD             THE END OF THE LIST - THE LAST GROUP DATA -
CD             GIVEN APPLIES TO ALL ADDITIONAL GROUPS -
CD  NBKS      NUMBER OF CONSTANTS FOR INTERNAL BOUNDARIES -
CD           1- SINGLE VALUES USED EVERYWHERE -
CD           .GT.1- VALUES ARE GIVEN BY ENERGY GROUP -
CD             WITH NON-BLACK CONDITION INDICATED BY -
CD             ZERO ENTRY - LAST VALUE APPLIES TO -
CD             ADDITIONAL GROUPS -
CD  NBKS      NUMBER OF ZONES WHICH ARE BLACK ABSORBERS -
CD  NBKS      TRIANGULAR GEOMETRY OPTION -
CD           0- RHOMBUS WITH COORDINATES AT 120 DEGREES -
CD             ORIGIN IS AT THE CENTER OF A HEXAGONAL -
CD             ASSEMBLY, BOUNDARIES PASS THROUGH -
CD             CORNERS OF HEXAGONAL ASSEMBLIES. -
CD           1- SAME AS OPTION 0 EXCEPT COORDINATES AT -
CD             60 DEGREES -
CD           2- RECTANGLE (COORDINATES AT 90 DEGREES), -
CD             FIRST BOUNDARY PERPENDICULAR TO -
CD             HEXAGONAL FLAT. -
CD           3- EQUILATERAL (60 DEGREE) TRIANGLE. TWO -
CD             BOUNDARIES ORIGINATING AT CENTER OF -
CD             HEXAGONAL ASSEMBLY PASS THROUGH CORNERS -
CD             OF HEXAGONAL ASSEMBLIES. -
CD           4- TRIANGLE (30-60 DEGREE). FIRST BOUNDARY -
CD             PERPENDICULAR TO FLATS. -
CD  NBKS      REGION ASSIGNMENTS -
CD           0- TO COARSE MESH -
CD           1- TO FINE MESH -
CD  NBKS      RESERVED -
C-----

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```

C-----
CR      ONE DIMENSIONAL COARSE MESH INTERVAL BOUNDARIES AND FINE -
CR      MESH INTERVALS (2D RECORD) -
C-----
CC      PRESENT IF IGM.GT.0 AND IGM.LE.3 -
C-----
CL      (IMESH(I), I=1, NCBNDI), (IPINTS(I), I=1, NCINTI) -
C-----
CW      NCBNDI*MULT+NCINTI=NUMBER OF WORDS -
C-----
CD      IMESH(I)      COARSE MESH BOUNDARIES, FIRST DIMENSION -
CD      IPINTS(I)     NUMBER OF FINE MESH INTERVALS PER COARSE MESH -
CD                     INTERVAL, FIRST DIMENSION -
CD      NCBNDI        NCINTI+1, NUMBER OF FIRST DIMENSION COARSE MESH -
CD                     BOUNDARIES -

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(CONT)

C
CC UNITS ARE CM FOR LINEAR DIMENSIONS AND RADIAN FOR ANGULAR
CC DIMENSIONS
C
C-----

C-----
C TWO DIMENSIONAL COARSE MESH INTERVAL BOUNDARIES AND FINE
C MESH INTERVALS (3D RECORD)
C
CC PRESENT IF IGOH.GE.6 AND IGOH.LE.11
C
CL (XNESH(I),I=1,NCBNDI), (YNESH(J),J=1,NCBNDJ),
CL 1 (IPINTS(I),I=1,NCINTI), (JPINTS(J),J=1,NCINTJ)
C
CW (NCBNDI+NCBNDJ)*MULT+NCINTI+NCINTJ=NUMBER OF WORDS
C
CD YNESH(J) COARSE MESH BOUNDARIES, SECOND DIMENSION
CD JPINTS(J) NUMBER OF FINE MESH INTERVALS PER COARSE MESH
CD INTERVAL, SECOND DIMENSION
CD NCBNDJ NCINTJ+1, NUMBER OF SECOND DIMENSION COARSE
CD MESH BOUNDARIES
C
C-----

C-----
C THREE DIMENSIONAL COARSE MESH INTERVAL BOUNDARIES AND FINE
C MESH INTERVALS (4D RECORD)
C
CC PRESENT IF IGOH.GE.12
C
CL (XNESH(I),I=1,NCBNDI), (YNESH(J),J=1,NCBNDJ),
CL 1 (ZNESH(K),K=1,NCBNDK), (IPINTS(I),I=1,NCINTI),
CL 2 (JPINTS(J),J=1,NCINTJ), (KPINTS(K),K=1,NCINTK)
C
CW (NCBNDI+NCBNDJ+NCBNDK)*MULT+NCINTI+NCINTJ+NCINTK=NUMBER OF WORDS
C
CD ZNESH(K) COARSE MESH BOUNDARIES, THIRD DIMENSION
CD KPINTS(K) NUMBER OF FINE MESH INTERVALS PER COARSE MESH
CD INTERVAL, THIRD DIMENSION
CD NCBNDK NCINTK+1, NUMBER OF THIRD DIMENSION COARSE MESH
CD BOUNDARIES
C
C-----

C-----
C GEOMETRY DATA (5D RECORD)
C
CC PRESENT IF IGOH.GT.0 OR NBS.GT.0
C
CL (VOLR(N),N=1,NNEG), (BSQ(N),N=1,NBS), (BNDC(N),N=1,NBCS),
CL (BNCI(N),N=1,NIBCS), (NZHBB(N),N=1,NZHBB), (NZC(N),N=1,NZONE),
CL (NZWR(N),N=1,NREG)

(CONT)

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C
C 2*NREG+NBS+NDCS+NIBCS+NZBBB+NZONE=NUMBER OF WORDS
C
C  VOLR(N)          REGION VOLUMES (CC)
C  BSQ(N)           BUCKLING (B**2) VALUES (CH**2)
C  BNDC(N)          BOUNDARY CONSTANTS (DEL PHI/PHI ~-C/D)
C  BUCI(N)          INTERNAL BLACK BOUNDARY CONSTANTS
C  NZBBB(N)         ZONE NUMBERS WITH BLACK ABSORBER CONDITIONS
C  NEC(N)           ZONE CLASSIFICATIONS
C  NIMP(N)          ZONE NUMBER ASSIGNED TO EACH REGION
C
C-----
C
C  REGION ASSIGNMENTS TO COARSE MESH INTERVALS
C  (60 RECORD)
C
C  PRESENT IF IGOH.GT.0 AND NRRSS.EQ.0
C
C  ((NR(I,J),I=1,NCINTI),J=1,NCINTJ) ----NOTE STRUCTURE BELOW----
C
C  NCINTI*NCINTJ=NUMBER OF WORDS
C
C  DO 1 K=1,NCINTK
C  1 READ(N) *LIST AS ABOVE*
C
C  NR(I,J)          REGION NUMBERS ASSIGNED TO COARSE MESH
C                   INTERVALS
C
C-----
C
C  REGION ASSIGNMENTS TO FINE MESH INTERVALS
C  (70 RECORD)
C
C  PRESENT IF IGOH.GT.0 AND NRRSS.EQ.1
C
C  ((NR(I,J),I=1,NINTI),J=1,NINTJ) ----NOTE STRUCTURE BELOW----
C
C  NINTI*NINTJ=NUMBER OF WORDS
C
C  DO 1 K=1,NINTK
C  1 READ(N) *LIST AS ABOVE*
C
C  NR(I,J)          REGION NUMBERS ASSIGNED TO FINE MESH INTERVALS
C
C-----
C*****
C
C  CEOP          GEODST
C
C*****

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SPECIFICATIONS FOR INTERFACE FILE NDXSRF

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C*****
C                      REVISED 07/22/75
C
C                      NDXSRF - III
C
C                      NUCLIDE DENSITY, DATA, CROSS SECTION REFERENCING
C
C*****

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```

C-----
C                      FILE IDENTIFICATION
C
C                      NNAME, (NUSE(I), I=1,2), IVERS
C
C                      1+3*NULT=NUMBER OF WORDS
C
C                      NNAME      HOLLERITH FILE NAME - NDXSRF - (A6)
C                      NUSE(I)    HOLLERITH USER IDENTIFICATION (A6)
C                      IVERS      FILE VERSION NUMBER
C                      NULT        DOUBLE PRECISION PARAMETER
C                                1- A6 WORD IS SINGLE WORD
C                                2- A6 WORD IS DOUBLE PRECISION WORD
C
C-----

```

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C-----
C                      SPECIFICATIONS      (1D RECORD)
C
C                      NDN, NSN, NPS, NAW, NZONE, NSZ
C
C                      6      =NUMBER OF WORDS
C
C                      NDN        NUMBER OF NUCLIDES IN CROSS SECTION DATA
C                      NSN        NUMBER OF NUCLIDE SETS IDENTIFIED
C                      NPS        MAXIMUM NUMBER OF NUCLIDES IN ANY SET
C                      NAW        NUMBER OF DIFFERENT NUCLIDES IN DATA
C                      NZONE      NUMBER OF ZONES
C                      NSZ        NUMBER OF SUBZONES (SUBASSEMBLIES)
C
C-----

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C-----
C                      NUCLIDE REFERENCING DATA      (2D RECORD)
C
C                      (NNAME(N), N=1, NDN), (NANAME(N), N=1, NDN), (NPP(N), N=1, NDN),
C                      (ATWT(J), J=1, NAW), (NCLN(N), N=1, NDN), ((NDXS(K,L), K=1,4), L=1, NSN),
C                      ((NOS(I,L), I=1, NPS), L=1, NSN), ((NOR(N,L), N=1, NDN), L=1, NSN)
C
C                      NAW+2*NDN*(1+NULT)+NSN*(4+NPS+NDN)=NUMBER OF WORDS
C
C                      NNAME(N)    UNIQUE REFERENCE NUCLIDE NAME, IN LIBRARY ORDER
C                                (A6) ALPHANUMERIC
C                      NANAME(N)   ABSOLUTE NUCLIDE REFERENCE, IN LIBRARY ORDER
C                                (A6) ALPHANUMERIC
C
C-----

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(CONT)

CD	WPP(N)	RESERVED	-
CD	ATWT(J)	ATOMIC WEIGHT	-
CD	WCLN(N)	NUCLIDE CLASSIFICATION	-
CD		1- FISSION	-
CD		2- FERTILE	-
CD		3- OTHER ACTINIDE	-
CD		4- FISSION PRODUCT	-
CD		5- STRUCTURAL	-
CD		6- COOLANT	-
CD		7- CONTROL ROD	-
CD		GREATER THAN 7, UNDEFINED	-
CD	NDXS(K,L)	REFERENCE DATA FOR SET L	-
CD		K = 1, MEMBER OF NUCLIDES IN SET	-
CD		K = 2, RESERVED	-
CD		K = 3, RESERVED	-
CD		K = 4, RESERVED	-
CD	NOS(I,L)	ORDER NUMBER OF NUCLIDE IN CROSS SECTION DATA	-
CD		(IN NUCLIDE LIST) OF NUCLIDE ORDERED I IN	-
CD		SET L	-
CD	NOR(N,L)	ORDER NUMBER OF NUCLIDE IN SET L GIVEN ORDER	-
CD		NUMBER N IN CROSS SECTION DATA	-
C			-
C			-

C	-----		-
CR	NUCLIDE CONCENTRATION ASSIGNMENT DATA (3D RECORD)		-
C			-
CL	(VOLZ(N), N=1, NZONE), (VPPA(N), N=1, NZONE), (VLSA(N), N=1, NSZ),		-
CL	(NSPA(N), N=1, NZONE), (NSSA(N), N=1, NSZ), (NZSZ(N), N=1, NSZ)		-
C			-
CW	3*(NZONE+NSZ)=NUMBER OF WORDS		-
C			-
CD	VOLZ(N)	VOLUMES OF ZONES, CC	-
CD	VPPA(N)	VOLUME FRACTIONS FOR PRIMARY ZONE ASSIGNMENTS	-
CD	VLSA(N)	VOLUMES OF SUBZONES	-
CD	NSPA(N)	NUCLIDE SET REFERENCE, PRIMARY ZONE ASSIGNMENT	-
CD		(MAY BE ZERO ONLY IF THERE ARE SUBZONES)	-
CD	NSSA(N)	NUCLIDE SET REFERENCE ASSIGNMENT TO SUBZONES	-
CD	NZSZ(N)	ZONE CONTAINING SUBZONE	-
C			-
C	NOTE THAT TO CALCULATE MACROSCOPIC CROSS SECTIONS FOR A ZONE,		-
C	IT IS NECESSARY TO CONSIDER THE CONCENTRATION OF EACH NUCLIDE		-
C	IN THE PRIMARY SET ASSIGNMENT (UNLESS A ZERO IN NSPA INDICATES		-
C	THERE ARE NONE) TIMES THE VOLUME FRACTION, AND THE CONCENTRATION		-
C	OF EACH NUCLIDE IN EACH SUBZONE ASSIGNED TO THE ZONE TIMES THE		-
C	RATIO OF THE SUBZONE VOLUME TO THE ZONE VOLUME.		-
C			-
C	-----		-

C	*****		-
C			-
CEOF	NDXSRT		-
C			-
C	*****		-

SPECIFICATIONS FOR INTERPACE FILE ZHATDN

```

C*****
C                                REVISED 07/22/75
C
C                                ZHATDN - III
C
C                                ZONE ATOMIC DENSITIES (OF NUCLIDES)
C
C*****

```

```

C-----
CR                                FILE IDENTIFICATION
C
CL    HNAME, (HUSE(I), I=1,2), IVERS
C
CW    1+3*MULT=NUMBER OF WORDS
C
CD    HNAME                HOLLERITH FILE NAME - ZHATDN - (A6)
CD    HUSE(I)              HOLLERITH USER IDENTIFICATION (A6)
CD    IVERS                FILE VERSION NUMBER
CD    MULT                 DOUBLE PRECISION PARAMETER
CD                        1- A6 WORD IS SINGLE WORD
CD                        2- A6 WORD IS DOUBLE PRECISION WORD
C
C-----

```

```

C-----
CR                                SPECIFICATIONS                (1D RECORD)
C
CL    TIME, NCY, NTZSZ, NNS, NBLKAD
C
CW    5=NUMBER OF WORDS
C
CD    TIME                REFERENCE REAL TIME, DAYS
CD    NCY                 REFERENCE CYCLE NUMBER
CD    NTZSZ               NUMBER OF ZONES PLUS NUMBER OF SUBZONES
CD    NNS                 MAXIMUM NUMBER OF NUCLIDES IN ANY SET
CD    NBLKAD              NUMBER OF BLOCKS OF ATOM DENSITY DATA
C
C-----

```

(CONT)

```

C-----
C      ZONE ATOMIC DENSITIES (OF NUCLIDES) (2D RECORD)
C
C      ((ADEN(N,J),N=1,NNS),J=JL,JJ) ----SEE STRUCTURE BELOW----
C
C      NNS*((NTZSZ-1)/NBLKAD+1)=NUMBER OF WORDS
C
C      DO 1 N=1,NBLKAD
C      1 READ(N) *LIST AS ABOVE*
C
C      WITH N AS THE BLOCK INDEX, JL=(N-1)*((NTZSZ-1)/NBLKAD+1)+1
C      AND JU=N*((NTZSZ-1)/NBLKAD+1)
C
C      ADEN(N,J)          ATOMIC DENSITY OF NUCLIDE ORDERED N IN THE
C                        ASSOCIATED SET GIVEN IN ORDER FOR EACH ZONE
C                        FOLLOWED IN ORDER FOR EACH SUBZONE
C
C-----
C*****
C
C      CEOP      ZNATDN
C
C*****

```

SPECIFICATIONS FOR INTERPACX FILE RTFLUX

```

*****
C                                     REVISED 07/23/75 - REVISED 04/01/80
C
C                                     RTFLUX
C
C                                     REGULAR TOTAL FLUXES
C
*****

```

ORDER OF GROUPS IS ACCORDING TO DECREASING
ENERGY, NOTE THAT DOUBLE PRECISION FLUXES ARE
GIVEN WHEN MULT.EQ.2

```

-----
C                                     FILE IDENTIFICATION
C
C
C                                     HNAME, (HUSE(I), I=1,2), IVERS
C
C                                     1+3*MULT=NUMBER OF WORDS
C
C                                     HNAME          HOLLERITH FILE NAME - RTFLUX - (A6)
C                                     HUSE(I)         HOLLERITH USER IDENTIFICATION (A6)
C                                     IVERS          FILE VERSION NUMBER
C
C                                     MULT           DOUBLE-PRECISION PARAMETER
C                                     1- A6 WORD IS SINGLE WORD
C                                     2- A6 WORD IS DOUBLE PRECISION WORD
C
-----

```

```

-----
C                                     SPECIFICATIONS (1D RECORD)
C
C
C                                     NDIH, NGROUP, NINTI, NINTJ, NINTK, ITER, EPPK, POWER
C
C                                     8=NUMBER OF WORDS
C
C                                     NDIH          NUMBER OF DIMENSIONS
C                                     NGROUP         NUMBER OF ENERGY GROUPS
C                                     NINTI          NUMBER OF FIRST DIMENSION FINE MESH INTERVALS
C                                     NINTJ          NUMBER OF SECOND DIMENSION FINE MESH INTERVALS
C                                     NINTK          NUMBER OF THIRD DIMENSION FINE MESH INTERVALS,
C                                     NINTK.EQ.1 IF NDIH.LE.2
C
C                                     FOR MESHPOINT EDGE LOCATIONS, NINTI, NINTJ, AND NINTK ARE
C                                     INTERPRETED AS THE NUMBER OF POINTS (ONE MORE THAN THE
C                                     NUMBER OF INTERVALS)
C                                     FOR SPECIAL TRIANGULAR GEOMETRIES, NINTI IS THE NUMBER OF
C                                     POINTS ON EACH PLANE, AND NINTJ IS SET TO 1.
C
C                                     ITER          OUTER ITERATION NUMBER AT WHICH FLUX WAS WRITTEN
C                                     MADE NEGATIVE FOR MESH EDGE POINTS
C
-----

```

(CONT)

```

CD      EFFK      EFFECTIVE MULTIPLICATION FACTOR      -
CD      SET TO ZERO IF FIXED SOURCE PROBLEM      *--
CD      POWER      POWER IN WATTS TO WHICH FLUX IS NORMALIZED      -
C      -
C-----

```

```

C-----
CR      ONE DIMENSIONAL REGULAR TOTAL FLUX      (2D RECORD)      -
C      -
CC      PRESENT IF NDI=EQ.1      -
C      -
CL      ((PREG(I,J),I=1,NINTI),J=1,NGROUP)      -
C      -
CW      *NINTI*NGROUP*MULT=NUMBER OF WORDS      -
C      -
CD      PREG(I,J)      ONE DIMENSIONAL REGULAR TOTAL FLUX BY INTERVAL      -
CD      AND GROUP      -
C      -
C-----

```

```

C-----
CR      MULTI-DIMENSIONAL REGULAR TOTAL FLUX      (3D RECORD)      -
C      -
CC      PRESENT IF NDI=GE.2      -
C      -
CL      ((PREG(I,J),I=1,NINTI),J=1,NINTJ)-----NOTE STRUCTURE BELOW-----      -
C      -
CW      NINTI*NINTJ*MULT=NUMBER OF WORDS      -
C      -
CS      DO 1 L=1,NGROUP      -
CS      DO 1 K=1,NINTK      -
CS      1 READ(N)      *LIST AS ABOVE*      -
C      -
CD      PREG(I,J)      MULTI-DIMENSIONAL REGULAR TOTAL FLUX      -
CD      BY INTERVAL FOR EACH GROUP      -
C      -
C-----

```

```

C*****
C      RTFLUX      -
CD      -
C      -
C*****

```


SPECIFICATIONS FOR INTERFACE FILE ATFLUX

```

*****
C                                     REVISED 07/23/75 - REVISED 04/01/80
C
C                                     ATFLUX
C
C                                     ADJOINT TOTAL FLUXES
C
*****

```

ORDER OF GROUPS IS ACCORDING TO INCREASING
ENERGY, NOTE THAT DOUBLE PRECISION FLUXES ARE
GIVEN WHEN MULT.EQ.2

```

-----
C                                     FILE IDENTIFICATION
C
C                                     HNAME, (HUSE (I), I=1,2), IVERS
C
C                                     1+3*MULT=NUMBER OF WORDS
C
C                                     HNAME          HOLLERITH FILE NAME - ATFLUX - (A6)
C                                     HUSE(I)         HOLLERITH USER IDENTIFICATION (A5)
C                                     IVEPS          FILE VERSION NUMBER
C
C                                     MULT           DOUBLE-PRECISION PARAMETER
C                                     1- A6 WORD IS SINGLE WORD
C                                     2- A6 WORD IS DOUBLE PRECISION WORD
C
-----

```

```

-----
C                                     SPECIFICATIONS   (10 RECORD)
C
C                                     NDIM,NGROUP,NINTI,NINTJ,NINTK,ITER,EPPK,ADUM
C
C                                     8=NUMBER OF WORDS
C
C                                     NDIM          NUMBER OF DIMENSIONS
C                                     NGROUP         NUMBER OF ENERGY GROUPS
C                                     NINTI          NUMBER OF FIRST DIMENSION FINE MESH INTERVALS
C                                     NINTJ          NUMBER OF SECOND DIMENSION FINE MESH INTERVALS
C                                     NINTK          NUMBER OF THIRD DIMENSION FINE MESH INTERVALS,
C                                     NINTK.EQ.1 IF NDIM.LE.2
C
C                                     FOR MESHPOINT EDGE LOCATIONS, NINTI, NINTJ, AND NINTK ARE
C                                     INTERPRETED AS THE NUMBER OF POINTS (ONE MORE THAN THE
C                                     NUMBER OF INTERVALS)
C                                     FOR SPECIAL TRIANGULAR GEOMETRIES, NINTI IS THE NUMBER OF
C                                     POINTS ON EACH PLANE, AND NINTJ IS SET TO 1.
C
-----

```

(CONT)

```

CD      ITER      OUTER ITERATION NUMBER AT WHICH FLUX WAS WRITTEN      -
CD      NADE NEGATIVE FOR MESH EDGE POINTS                             *-
CD      SET TO ZERO IF FIXED SOURCE ADJOINT FLUXES                     *-
CD      (DOMINANT HARMONIC) HAVE BEEN CORRECTED FOR                   *-
CD      FUNDAMENTAL CONTAMINATION                                     *-
CD      EFFK      EFFECTIVE MULTIPLICATION FACTOR                      -
CD      ADUM      ZERO FOR NON FIXED SOURCE PROBLEM                   *-
CD      SUM FIXED SOURCE IF FIXED SOURCE PROBLEM                     *-
C
C-----

```

```

C-----
CR      ONE DIMENSIONAL ADJOINT TOTAL FLUX      (2D RECORD)           -
C
CC      PRESENT IF NDIM.EQ.1                                           -
C
CL      ((PADJ(I,J),I=1,NINTI),J=1,NGROUP)                             -
C
CW      NINTI*NGROUP*MULT=NUMBER OF WORDS                               -
C
CD      PADJ(I,J)      ONE DIMENSIONAL ADJOINT TOTAL FLUX BY INTERVAL  -
CD      AND GROUP                                             -
C
C-----

```

```

C-----
CR      MULTI-DIMENSIONAL ADJOINT TOTAL FLUX      (3D RECORD)         -
C
CC      PRESENT IF NDIM.GE.2                                           -
C
CL      ((PADJ(I,J),I=1,NINTI),J=1,NINTJ)-----NOTE STRUCTURE BELOW-----
C
CW      NINTI*NINTJ*MULT=NUMBER OF WORDS                               -
C
CS      DO 1 L=1,NGROUP                                                -
CS      DO 1 K=1,NINTK                                                -
CS      1 READ(N)      *LIST AS ABOVE*                                -
C
CD      PADJ(I,J)      MULTI-DIMENSIONAL ADJOINT TOTAL FLUX          -
CD      BY INTERVAL FOR EACH GROUP                                   -
C
C-----

```

```

C*****
C
CEOF      ATFLUX
C
C*****

```

SPECIFICATIONS FOR INTERFACE FILE RZFLUX

```

C*****
C                                     REFERENCE 02/01/79 ORNL-5180
C
C                                     RZFLUX
C
C                                     REGULAR ZONE FLUX BY 3POOP, AVERAGED OVER EACH ZONE
C
C                                     AN ASTEPISK IN COLUMN 72 INDICATES LOCAL MODIFICATION
C
C*****

```

```

C-----
C                                     FILE IDENTIFICATION
C
C                                     RNAME, (RUSE(I), I=1,2), IVERS
C
C                                     3*NULT + 1
C
C                                     RNAME      FILE NAME (A6) 'RZFLUX'
C                                     RUSE       USER IDENTIFICATION (A6)
C                                     IVERS      FILE VERSION NUMBER
C
C                                     NULT       1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
C-----

```

```

C-----
C                                     1D      FILE REFERENCE INFORMATION
C
C                                     TIME, POWER, VOL, EPPK, EIVS, DKDS, TNL, TNA, TNSL, TNBL, TNBAL, TNCRA,
C                                     CP, CE, CP, CC, ITPS, WZONE, NGROUP, NPV
C
C                                     20
C
C                                     TIME      REFERENCE REAL TIME, DAYS
C                                     POWER     POWER LEVEL FOR ACTUAL NEUTRONICS PROBLEM, WATTS
C                                               THERMAL
C                                     VOL      VOLUME OVER WHICH POWER WAS DETERMINED, CC
C                                     EPPK     MULTIPLICATION FACTOR
C                                     EIVS     EIGENVALUE OF SEARCH OF SEARCH PROBLEM
C                                     DKDS     DERIVATIVE OF SEARCH PROBLEM
C                                     TNL      TOTAL NEUTRON LOSSES
C                                     TNA      TOTAL NEUTRON ABSORPTIONS
C                                     TNSL     TOTAL NEUTRON SURFACE LEAKAGE
C                                     TNBL     TOTAL NEUTRON BUCKLING LOSS
C                                     TNBAL    TOTAL NEUTRON BLACK ABSORBER LOSS
C                                     TNCRA    TOTAL NEUTRON CONTROL ROD ABSORPTIONS

```

(CONT)

```

CD  CF      FRACTION OF COPE TREATED IN PROBLEM          *-
CD  CE      CONVERSION FACTOR, RATIO OF THERMAL ENERGY TO *-
CD                      FISSION + CAPTURE ENERGY AVAILABLE WITH *-
CD                      THE CROSS SECTIONS                  *-
CD  CR      ADDITIONAL DATA FLAG IF .GT.0 (TWO RECORDS)  *-
CD  CC      RESERVED                                       -
CD  ITPS     ITERATIVE PROCESS STATE                      -
CD                      =0, NO ITERATIONS DONE              -
CD                      =1, CONVERGENCE SATISFIED            -
CD                      =2, NOT CONVERGED, BUT CONVERGING    -
CD                      =3, NOT CONVERGED, NOT CONVERGING    -
CD  NZONE    NUMBER OF GEOMETRIC ZONES                     -
CD  NGROUP   NUMBER OF NEUTRON ENERGY GROUPS              -
CD  NPV      NUMBER OF BLOCKS OF LOCAL, FINE-SCALE FLUX VALUES *-
C
C-----

```

```

C-----
CR  2D      FLUX VALUES                                   -
C
CL  (ZGF(K,H),K=1,NGROUP),J=1,NZONE)                    -
C
CW          NGROUP*NZONE                                  -
C
CD  ZGF      REGULAR ZONE FLUX BY GROUP, AVERAGED OVER ZONE -
CD                      NEUTRONS/SEC-CM**2                 -
C
C-----

```

```

C-----
CR  3D      ADDITIONAL DATA, FIRST OF TWO RECORDS        *-
C
CC          PRESENT IF CR .GT.0                            *-
C
CL  (SHARE8(I),I=1,100),(SHARE(I),I=1,100),(LX(I),I=1,200) *-
C
CW          100*MULT + 300                                  *-
C
CD  SHARE8    NEUTRONICS DATA FOR REFERENCE              *-
C                      DOUBLE PRECISION ON A SHORT WORD MACHINE *-
CD  SHARE     NEUTRONICS DATA FOR REFERENCE              *-
CD  LX        NEUTRONICS FLAGS FOR REFERENCE               *-
C
C-----

```

(CONT)

```

C-----
CR  4D  ADDITIONAL DATA, SECOND OF TWO RECORDS      *-
C                                           *-
CC      PRESENT IF CR .GT.0                          *-
C                                           *-
CL      (INRS(I),I=1,NGROUP), (RHO(I),I=1,NGROUP), (DATA(I),I=1,NGROUP) *-
C                                           *-
CW      3*NGROUP                                      *-
C                                           *-
CD      INRS      NEUTRONICS ITERATION FLAGS          *-
CD      RHO       NEUTRONICS ITERATION DATA          *-
CD      DATA     NEUTRONICS ITERATION DATA          *-
C                                           *-
CW      NOTE NONSTANDARD DATA TYPE ORDER            *-
C                                           *-
C-----

```

THERE ARE NPV SETS OF THE FOLLOWING TWO RECORDS

```

C-----
CR  5D  LOCAL FLUX RECORD REFERENCE DATA            *-
C                                           *-
CL      (XPV(I),I=1,10), NLP, NRZ, (IPV(J),J=1,8)    *-
C                                           *-
CW      20                                             *-
C                                           *-
CD      XPV(1)    REFERENCE VOLUME, CC                *-
CD      XPV(2)    REFERENCE POWER LEVEL, WATTS        *-
CD      NLP       NUMBER OF LOCATIONS FOR WHICH DATA IS GIVEN *-
CD      NRZ       REFERENCE ZONE NUMBER                *-
C                                           *-
C-----

```

```

C-----
CR  6D  LOCAL NEUTRON FLUX VALUES                    *-
C                                           *-
CL      ((FLP(K,N),K=1,NGROUP),N=1,NLP)              *-
C                                           *-
CW      NGROUP*NLP                                    *-
C                                           *-
CD      FLP       LOCAL VALUE OF THE NEUTRON TOTAL FLUX, *-
CD                  AS ASSOCIATED WITH A SUB-VOLUME WITHIN THE *-
CD                  REFERENCE ZONE NRZ                  *-
C                                           *-
C-----

```

```

C*****
C
CR0P      RZFLUX
C
C*****

```

SPECIFICATIONS FOR INTERFACE FILE FIXSRC

```

C*****
C                                REVISED 07/23/75 - REVISED 04/01/80
C
CF      FIXSRC
C
CE      DISTRIBUTED AND SURFACE FIXED SOURCES
C
C*****

```

```

C-----
CR      FILE IDENTIFICATION
C
CL      HNAME, (HUSE(I), I=1,2), IVERS
C
CW      1+3*MULT=NUMBER OF WORDS
C
CD      HNAME      HOLLERITH FILE NAME - FIXSRC - (A6)
CD      HUSE(I)    HOLLERITH USER IDENTIFICATION (A6)
CD      IVERS      FILE VERSION NUMBER
CD      MULT       DOUBLE PRECISION PARAMETER
CD                  1- A6 WORD IS SINGLE WORD
CD                  2- A6 WORD IS DOUBLE PRECISION WORD
C
C-----

```

```

C-----
CR      SPECIFICATIONS (1D RECORD)
C
CL      ITYPE,NDIM,NGROUP,NINTI,NINTJ,NINTK,IDISTS,NDCONP,NSCONP,NEDGI,
CL      NEDGJ,NEDGK
C
CW      12=NUMBER OF WORDS
C
CD      ITYPE      TYPE SOURCE.
CD                  0=DIFFUSION
CD                  1=SN
CD      NDIM       NUMBER OF DIMENSIONS
CD      NGROUP     NUMBER OF GROUPS
CD      NINTI      NUMBER OF FIRST DIMENSION FINE MESH INTERVALS
CD      NINTJ      NUMBER OF SECOND DIMENSION FINE MESH INTERVALS
CD      NINTK      NUMBER OF THIRD DIMENSION FINE MESH INTERVALS
C
CN      FOR MESHPOINT EDGE LOCATIONS, NINTI, NINTJ, AND NINTK ARE *-
CN      INTERPRETED AS THE NUMBER OF POINTS (ONE MORE THAN THE *-
CN      NUMBER OF INTERVALS)
CN      FOR SPECIAL TRIANGULAR GEOMETRIES, NINTI IS THE NUMBER OF *-
CN      POINTS ON EACH PLANE, AND NINTJ IS SET TO 1.
C
C-----

```

(CONT)

```

CD      IDISTS          DISTRIBUTED SOURCE FLAG.                -
CD                                     0= NO DISTRIBUTED SOURCE GIVEN.      -
CD                                     1= DISTRIBUTED SOURCE IS GIVEN BY POINT  *--
CD                                     2= DISTRIBUTED SOURCE IS GIVEN BY ZONE  *--
CD                                     3= SAME AS 1 BUT AN ADDITIONAL RECORD IS *--
CD                                     PRESENT AT END OF DATA                *--
CD                                     4= SAME AS 2 BUT AN ADDITIONAL RECORD IS *--
CD                                     PRESENT AT END OF DATA                *--
CD      NDCOMP          NUMBER OF DISTRIBUTED SOURCE COMPONENTS      -
CD                                     = NUMBER OF ZONES IF IDISTS IS 2 OR 4  *--
CD      NSCOMP          NUMBER OF SURFACE SOURCE COMPONENTS (0)     *--
CD      NEDGI          NUMBER OF FIRST DIMENSION BOUNDARY SOURCES (0) *--
CD      NEDGJ          NUMBER OF SECOND DIMENSION BOUNDARY SOURCES (0) *--
CD      NEDGK          NUMBER OF THIRD DIMENSION BOUNDARY SOURCES (0) *--
C
C-----

```

```

C-----
CR      ONE-DIMENSIONAL DISTRIBUTED FIXED SOURCE (2D RECORD)      -
C
CC      PRESENT IF NDIM.EQ.1 AND IDISTS IS 1 OR 3                *--
C
CL      ((QDIST(L,I),L=1,NDCOMP),I=1,NINTI)---NOTE STRUCTURE BELOW---
C
CW      NDCOMP*NINTI=NUMBER OF WORDS                                -
C
CS      DO 1 J=1,NGROUP                                           -
CS      1 READ (N) *LIST AS ABOVE*                                -
C
CD      QDIST (L,I)        DISTRIBUTED SOURCE TIMES POINT VOLUME/CC *--
CD                        BY COMPONENT, INTERVAL, AND GROUP        *--
C
C-----

```

```

C-----
CR      MULTI-DIMENSIONAL DISTRIBUTED FIXED SOURCE (3D RECORD)    -
C
CC      PRESENT IF NDIM.GE.2 AND IDISTS IS 1 OR 3                *--
C
CL      ((QDIST(I,J),I=1,NINTI),J=1,NINTJ)---NOTE STRUCTURE BELOW---
C
CW      NINTI*NINTJ=NUMBER OF WORDS                                -
C
CS      DO 1 M=1,NGROUP                                           -
CS      DO 1 L=1,NDCOMP                                           -
CS      DO 1 K=1,NINTK                                           -
CS      1 READ (N) *LIST AS ABOVE*                                -
C
CD      QDIST (I,J)        AS DEFINED ABOVE.                      -
C
C-----

```

(CONT)

C	-----		
CR	FIRST DIMENSION SURFACE SOURCE POINTERS (4D RECORD)	-	
C		-	
CC	PRESENT IF WEDGI.WE.0	-	
C		-	
CN	NOT ALLOWED IN VENTURE	-	
C		-	
C	-----		

C	-----		
CR	FIRST DIMENSION SURFACE SOURCES (5D RECORD)	-	
C		-	
CC	PRESENT IF WEDGI.WE.0	-	
C		-	
CN	NOT ALLOWED IN VENTURE	-	
C		-	
C	-----		

C	-----		
CR	SECOND DIMENSION SURFACE SOURCE POINTERS (6D RECORD)	-	
C		-	
C	PRESENT IF NDIN.GE.2 AND WEDGJ.WE.0	-	
C		-	
CN	NOT ALLOWED IN VENTURE	-	
C		-	
C	-----		

C	-----		
CR	SECOND DIMENSION SURFACE SOURCES (7D RECORD)	-	
C		-	
CC	PRESENT IF NDIN.GE.2 AND WEDGJ.WE.0	-	
C		-	
CN	NOT ALLOWED IN VENTURE	-	
C		-	
C	-----		

C	-----		
CR	THIRD DIMENSION SURFACE SOURCE POINTERS (8D RECORD)	-	
C		-	
CC	PRESENT IF NDIN.EQ.3 AND WEDGK.WE.0	-	
C		-	
CN	NOT ALLOWED IN VENTURE	-	
C		-	
C	-----		

C	-----		
CR	THIRD DIMENSION SURFACE SOURCES (9D RECORD)	-	
C		-	
CC	PRESENT IF NDIN.EQ.3 AND WEDGK.WE.0	-	
C		-	
CN	NOT ALLOWED IN VENTURE	-	
C		-	
C	-----		

(CONT)


```

C-----
C      SOURCE BY ZONE AND GROUP (100 RECORD)
C
C      PRESENT IF IDISTS IS 2 OR 4
C
C      ((ZSOR(L,N),L=1,NDCONP),N=1,NGROUP)
C
C      NDCONP*NGROUP=NUMBER OF WORDS
C
C      ZSOR(L,N)      SOURCE BY ZONE AND GROUP - NOT MULTIPLIED
C                      BY ZONE VOLUME
C-----

```

```

C-----
C      ADDITIONAL RECORD IF IDISTS IS 3 OR 4 (110 RECORD)
C
C
C      CL      (R(N),N=1,20)
C
C      CW      20=NUMBER OF WORDS
C
C      CD      R(1)      KEFFECTIVE
C-----

```

```

C*****
C      CEOP      FIXSRC
C
C*****

```

SPECIFICATIONS FOR INTERPACE FILE SEARCH

```

C*****
C              REVISED 07/22/75 - REVISED 04/01/80
C
C  SEARCH -III
C
C  CRITICALITY SEARCH FILE
C
C*****

```

```

C-----
C          FILE IDENTIFICATION
C
C  CL  HNAME, (HUSE(I), I=1, 2), IVERS
C
C  CW  1+3*HULT=NUMBER OF WORDS
C
C  CD  HNAME          HOLLERITH FILE NAME - SEARCH - (A6)
C  CD  HUSE(I)        HOLLERITH USER IDENTIFICATION (A6)
C  CD  IVERS          FILE VERSION NUMBER
C  CD  HULT           DOUBLE PRECISION PARAMETER
C  CD                 1- A6 WORD IS SINGLE WORD
C  CD                 2- A6 WORD IS DOUBLE PRECISION WORD
C
C-----

```

```

C-----
C          INDIVIDUAL DATA SET IDENTIFIER (10 RECORD)
C
C  CL  NSHID, NREC, (NSP(I), I=1, 10)
C
C  CW  20=NUMBER OF WORDS
C
C  CD  NSHID          POSITIVE INTEGER IDENTIFYING A SET OF SEARCH
C  CD                 DATA, THIS AND FOLLOWING RECORDS REPEATED
C  CD                 UNTIL NEGATIVE NSHID TERMINATES FILE
C  CD  NREC           NUMBER OF RECORDS TO SKIP TO POSITION ON NEXT
C  CD                 INDIVIDUAL DATA SET IDENTIFIER RECORD
C  CD  NSP(I)         RESERVED
C
C-----

```

```

C-----
C          FILE SPECIFICATIONS          (20 RECORD)
C
C  CL  EYFK, DKEFF, EPSK, EPSEI, CMOO, (SRCH(I), I=1, 5), ISRCH, ISZDP, UNAXNP,
C  CL  NCINTI, NCINTJ, NCINTK, NISOSR, NSETS, NEIRNG, ITEND, ICEND,
C  CL  (WRCH(I), I=1, 19)
C
C  CW  40=NUMBER OF WORDS
C
C  CD  EYFK           DESIRED MULTIPLICATION FACTOR
C  CD  DKEFF          MULTIPLICATION FACTOR SLOPE

```

(CONT)

CD	EPSK	CONVERGENCE CRITERION TO BE MET BY EPFK	-
CD	EPSEI	CONVERGENCE CRITERION TO BE MET BY PRIMARY	-
CD		VARIABLE	-
CD	CMOD	MODIFIER APPLIED TO NUCLIDE CONCENTRATIONS	-
CD		VARIED SPECIALLY (ISRCH=7 BELOW), MAY BE	-
CD		.LT.0	-
CD	SRCH(I)	RESERVED	-
CD	ISRCH	TYPE OF SEARCH	-
CD		0- NOT DEFINED	-
CD		1- BUCKLING SEARCH	-
CD		2- ALPHA SEARCH	-
CD		5- DIMENSION SEARCH	-
CD		7- NUCLIDE CONCENTRATION SEARCH BY	-
CD		PROPORTIONAL ADJUSTMENTS OF SELECTED	-
CD		INITIAL CONCENTRATIONS	-
CD		9- NUCLIDE CONCENTRATION SEARCH BY ADDING	-
CD		WEIGHTED EIGENVALUE ADJUSTMENTS	-
CD		TO SELECTED INITIAL CONCENTRATIONS	-
CD	ISZOP	SUBZONE OPTION FOR ISRCH = 7 OR 9	-
CD		0- SEARCH DATA IS BY ZONE	-
CD		1- SEARCH DATA IS BY SUBZONE	-
CD	WMAXNP	MAXIMUM NUMBER OF NEUTRONICS PROBLEMS OR TRIAL	-
CD		EIGENVALUES ALLOWED IN A SEARCH. A ZERO	-
CD		HERE SPECIFIES A DIRECT SEARCH.	-
CD	NCINTI	NUMBER OF FIRST DIMENSION COARSE MESH INTERVALS	-
CD	NCINTJ	NUMBER OF SECOND DIMENSION COARSE MESH	-
CD		INTERVALS	-
CD	NCINTK	NUMBER OF THIRD DIMENSION COARSE MESH INTERVALS	-
CD	NISOSR	NUMBER OF ISOTOPES OR NUCLIDES INVOLVED IN	-
CD		CONCENTRATION SEARCH (ISRCH = 7 OR 9)	-
CD	NSETS	NUMBER OF SPECIFICATION SETS IN CONCENTRATION	-
CD		SEARCH (ISRCH = 7 OR 9)	-
CD	WEIRNG	EIGENVALUE (EI) RANGE RESTRICTIONS. SEARCH	-
CD		TERMINATED IF SPECIFIED RANGE IS VIOLATED.	-
CD		-1 EI.LT.0	-
CD		0- NO RESTRICTION ON EI	-
CD		1- EI.GT.0 AND .LT.1	-
CD		2- EI.GT.1	-
CD	ITEND	TERMINATION OPTION ON ITERATIVE PROCESS. SEARCH	-
CD		IS LIMITED BY WMAXNP, NUMBER OF OUTER	-
CD		ITERATIONS, OR OTHER PARAMETER, THEN	-
CD		0- NO RESTRAINT	-
CD		1- TERMINATE IF CONVERGENCE CRITERIA ARE	-
CD		NOT MET	-
CD		2- IF CONVERGENCE CRITERIA ARE NOT MET.	-
CD		TERMINATE ONLY IF PROBLEM IS NOT	-
CD		CONVERGING.	-
CD	ICEND	TERMINATION OPTIONS ON NUCLIDE CONCENTRATIONS	-
CD		0- TERMINATE IF ANY NUCLIDE CONCENTRATION	-
CD		BECOMES NEGATIVE AT ANY STAGE OF THE	-
CD		CALCULATION	-
CD		1- TERMINATE IF ANY NUCLIDE CONCENTRATION	-
CD		IS NEGATIVE AT THE END OF THE SEARCH	-
CD		2- ALLOW NEGATIVE NUCLIDE CONCENTRATIONS	-

(CONT)

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CD  NRCH(1)          .GT.0 - INDICATES THAT MACROSCOPIC CROSS  *--
CD                   SECTIONS ARE TO BE RECALCULATED DURING  *--
CD                   A DIRECT SEARCH                          *--
CD  NRCH(2)          .GT.0 - INDICATES SECONDARY SEARCH       *--
CD                   SPECIFICATIONS (REFERENCE SET) ARE TO BE USED *--
CD                   IF THE SPECIFIED CONSTRAINTS ON THE SEARCH *--
CD                   EIGENVALUE ARE NOT SATISFIED USING THE    *--
CD                   PRIMARY SEARCH DATA                      *--
CD  NRCH(3-19)       RESERVED                                  *--
C                                                           -
C-----

```

```

C-----
CR                   COARSE MESH MODIFIERS FOR DIMENSION SEARCH  -
CR                   (3D RECORD)                                -
C                                                           -
CC                   PRESENT IF ISRCH.EQ.5                      -
C                                                           -
CL  (SRHDI(I),I=1,NCINTI), (SRHDJ(J),J=1,NCINTJ), (SRHDK(K),K=1,NCINTK) -
C                                                           -
CW  NCINTI+NCINTJ+NCINTK=NUMBER OF WORDS                       -
C                                                           -
CD  SRHDI(I)          FIRST DIMENSION COARSE MESH MODIFIERS   -
CD  SRHDJ(J)          SECOND DIMENSION COARSE MESH MODIFIERS  -
CD  SRHDK(K)          THIRD DIMENSION COARSE MESH MODIFIERS   -
C                                                           -
C-----

```

```

C-----
CR                   NUCLIDES FOR PROPORTIONAL SEARCH AND SPECIAL SEARCH  -
CR                   (4D RECORD)                                -
C                                                           -
CC                   PRESENT IF ISRCH.EQ.7                      -
C                                                           -
CL  (NSHZ1(I),I=1,NSETS), (NSHZ2(I),I=1,NSETS),              -
CL  ((HNNAMS(N,I),N=1,NISOSH),I=1,NSETS), (HNSHN(J),J=1,10) -
C                                                           -
CW  2*NSETS+MULT*(NISOSH+NSETS+10)=NUMBER OF WORDS            -
C                                                           -
CD  NSHZ1(I)          FIRST NUMBER OF A CONSECUTIVE SET OF ZONES  -
CD                   IF ISZOP.EQ.0, OR OF A CONSECUTIVE SET OF  -
CD                   SUBZONES IF ISZOP.EQ.1                     -
CD  NSHZ2(I)          LAST NUMBER OF A SET OF ZONES OR SUBZONES  -
CD  HNNAMS(N,I)       REFERENCE NAMES OF NUCLIDES WHOSE        -
CD                   CONCENTRATIONS ARE TO BE ADJUSTED          -
CD                   PROPORTIONATELY IN ABOVE ZONES (A6)        -
CD  HNSHN(J)          SEARCH NUCLIDE REFERENCE USED AS NOTED BELOW -
CD                   (A6)                                         -
C                                                           -
C-----

```

(CONT)

```

CC      HNNAMS CONCENTRATIONS ADJUSTED ACCORDING TO      -
CC      C2 = C1*EI AND HNSHN CONCENTRATIONS ADJUSTED    -
CC      ACCORDING TO C2 = C1 + C1*(1.0-EI)*CHOD WHERE    -
CC      EI IS THE EIGENVALUE.                            -
CC      C1 IS THE INITIAL CONCENTRATION, AND            -
CC      C2 IS THE FINAL OR INTERMEDIATE VALUE OF        -
CC      THE CONCENTRATION                                  -
C      -
C-----

```

```

C-----
CR      NUCLIDES FOR SEARCH INVOLVING WEIGHTED EIGENVAL IE -
CR      ADJUSTMENTS TO INITIAL CONCENTRATIONS          -
CR      (5D RECORD)                                     -
C      -
CC      PRESENT IF ISRCH.FQ.9                            -
C      -
CL      (NSHZ1(I),I=1,NSETS), (NSHZ2(I),I=1,NSETS),     -
CL      ((HNNAMS(N,I),N=1,NISOSR),I=1,NSETS),          -
CL      ((CHZDN(N,I),N=1,NISOSR),I=1,NSETS)             -
C      -
CW      NSETS*(2+NISOSR*(1+MULT))=NUMBER OF WORDS      -
C      -
CD      NSHZ1(I)      FIRST NUMBER OF A CONSECUTIVE SET OF ZONES -
CD                      IF ISZOP.EQ.0, OR OF A CONSECUTIVE SET OF -
CD                      SUBZONES IF ISZOP.EQ.1             -
CD      NSHZ2(I)      LAST NUMBER OF A SET OF ZONES OR SUBZONES -
CD      HNNAMS(N,I)    REFERENCE NAMES OF NUCLIDES WHOSE      -
CD                      CONCENTRATIONS ARE TO BE ADJUSTED    -
CD      CHZDN(N,I)     CONCENTRATION MODIFIERS               -
C      -
CC      CONCENTRATIONS ADJUSTED ACCORDING TO            -
CC      C2 = C1*EI*CHZDN WHERE EI, C1, AND C2 ARE        -
CC      AS DEFINED UNDER ISRCH .EQ. 7                   -
C      -
C-----

```

```

C*****
C      SEARCH
C      -
C*****

```

SPECIFICATIONS FOR INTERFACE FILE DLAYXS

```

C*****
C                                     REVISED 07/23/75
C
C      DLAYXS - III
C
C      MICROSCOPIC GROUP DELAYED NEUTRON PRECURSOR DATA
C
C      THIS FILE PROVIDES PRECURSOR YIELDS,
C      EMISSION SPECTRA, AND DECAY CONSTANTS
C      ORDERED BY ISOTOPE. ISOTOPES ARE IDENTIFIED
C      BY ABSOLUTE ISOTOPE LABELS FOR RELATION TO
C      ISOTOPES IN EITHER FILE ISOTXS OR GROUPXS.
C
C*****

```

```

C-----
C      FILE STRUCTURE
C
C      RECORD TYPE                PRESENT IF
C      -----
C      FILE IDENTIFICATION        ALWAYS
C      FILE CONTROL                ALWAYS
C      FILE DATA, DECAY CONSTANTS, AND
C      EMISSION SPECTRA            ALWAYS
C      ***** (REPEAT FOR NISOD)
C      *      DELAYED NEUTRON PRECURSOR
C      *      YIELD DATA          ALWAYS
C      *****
C
C-----

```

```

C-----
C      FILE IDENTIFICATION
C
C      RNAME, (NUSE(I), I=1,2), IVERS
C
C      1+3*NULT=NUMBER OF WORDS
C
C      RNAME      HOLLERITH FILE NAME - DLAYXS - (A6)
C      NUSE(I)    HOLLERITH USER IDENTIFICATION (A6)
C      IVERS      FILE VERSION NUMBER
C      NULT       DOUBLE-PRECISION PARAMETER
C                1- A6 WORD IS SINGLE WORD
C                2- A6 WORD IS DOUBLE PRECISION WORD
C
C-----

```

```

C-----
C      FILE CONTROL      (1D RECORD)
C
C      NGRONP, NISOD, NPA7, IDUN
C
C      4=NUMBER OF WORDS
C
C-----

```

(CONT)

CD NGROUP NUMBER OF NEUTRON ENERGY GROUPS IN SET -
 CD NISOD NUMBER OF ISOTOPIES IN DELAYED NEUTRON SET -
 CD NPAH NUMBER OF DELAYED NEUTRON FAMILIES IN SET -
 CD IDUM DUMMY TO MAKE UP FOUR WORD RECORD. -
 C -
 C-----

C-----
 CR FILE DATA, DECAY CONSTANTS, AND EMISSION SPECTRA -
 CR (2D RECORD) -
 C -
 CL (HABSID(I), I=1, NISOD), (PLAN(N), N=1, NPAH), ((CHID(J, N), J=1, NGROUP), -
 CL N=1, NPAH), (ENAX(J), J=1, NGROUP), ENIN, (NKPAN(I), I=1, NISOD), -
 CL (LOCA(I), I=1, NISOD) -
 C -
 CW (2+MULT)*NISOD+(NGROUP+1)*(NPAH+1)=NUMBER OF WORDS -
 C -
 CD HABSID(I) HOLLERITH ABSOLUTE ISOTOPE LABEL FOR ISOTOPE I (A6) -
 CD PLAN(N) DELAYED NEUTRON PRECURSOR DECAY CONSTANT -
 CD FOR FAMILY N -
 CD CHID(J, N) FRACTION OF DELAYED NEUTRONS EMITTED INTO NEUTRON -
 CD ENERGY GROUP J FROM PRECURSOR FAMILY N -
 CD ENAX(J) MAXIMUM ENERGY BOUND OF GROUP J (EV) -
 CD ENIN MINIMUM ENERGY BOUND OF SET (EV) -
 CD NKPAN(I) NUMBER OF FAMILIES TO WHICH FISSION IN ISOTOPE I -
 CD CONTRIBUTES DELAYED NEUTRON PRECURSORS -
 CD LOCA(I) NUMBER OF RECORDS TO BE SKIPPED TO READ DATA FOR -
 CD ISOTOPE I, LOCA(1)=0 -
 C -
 C-----

C-----
 CR DELAYED NEUTRON PRECURSOR YIELD DATA (3D RECORD) -
 C -
 CL ((SNUDEL(J, K), J=1, NGROUP), K=1, NKPANI), (NUNPAN(K), K=1, NKPANI) -
 C -
 CC NKPANI=NKPAN(I) -
 C -
 CW (NGROUP+1)*NKPANI=NUMBER OF WORDS -
 C -
 CD SNUDEL(J, K) NUMBER OF DELAYED NEUTRON PRECURSORS PRODUCED IN -
 CD FAMILY NUMBER NUNPAN(K) PER FISSION IN -
 CD GROUP J -
 CD NUNPAN(K) FAMILY NUMBER OF THE K-TH YIELD VECTOR IN -
 CD ARRAY SNUDEL(J, K) -
 C -
 C-----

C*****
 C
 CEOF DLAYXS
 C
 C*****

SPECIFICATIONS FOR INTERFACE FILE PWDINT

```

C*****
C                                     REVISED 07/23/75 - REVISED 08/01/80
C
C      PWDINT
C
C      POWER DENSITY BY INTERVAL
C*****

```

```

C-----
C      FILE IDENTIFICATION
C
C      HNAME, (HUSE(I), I=1,2), IVERS
C
C      1+3*MULT=NUMBER OF WORDS
C
C      HNAME          HOLLERITH FILE NAME - PWDINT - (A6)
C      HUSE(I)        HOLLERITH USER IDENTIFICATION (A6)
C      IVERS          FILE VERSION NUMBER
C      MULT            DOUBLE PRECISION PARAMETER
C                     1- A6 WORD IS SINGLE WORD
C                     2- A6 WORD IS DOUBLE PRECISION WORD
C
C-----

```

```

C-----
C      SPECIFICATIONS (10 RECORD)
C
C      TIME, POWER, VOL, IN, JN, KN, NCV, NBLK
C
C      8=NUMBER OF WORDS
C
C      TIME          REFERENCE PEAL TIME, DAYS
C      POWER         POWER LEVEL FOR ACTUAL NEUTRONICS PROBLEM,
C                   WATTS THERMAL
C      VOL           VOLUME OVER WHICH POWER WAS DETERMINED, CC
C      IN            NUMBER OF FIRST DIMENSION FINE INTERVALS
C      JN            NUMBER OF SECOND DIMENSION FINE INTERVALS
C
C      FOR SPECIAL TRIANGULAR GEOMETRIES, IN IS THE NUMBER OF
C      TRIANGLES ON EACH PLANE AND JN IS NOT DEFINED (SET TO 1)
C
C      KN            NUMBER OF THIRD DIMENSION FINE INTERVALS
C      NCV           REFERENCE COUNT (CYCLE NUMBER)
C      NBLK          =1
C
C-----

```

(CONT)


```

C-----
CR                                POWER DENSITY VALUES (2D RECORD)          -
C                                -                                           -
CL      ((PWR (I,J) ,I=1,IN) ,J=1,JH) -----NOTE STRUCTURE BELOW----- -
C                                -                                           -
CW      IN*JH=NUMBER OF WORDS                                           -
C                                -                                           -
CS      DO 1 K=1,KN                                                    -
CS      1 READ(N) *LIST AS ABOVE*                                       -
C                                -                                           -
CD      PWR (I,J)              POWER DENSITY BY INTERVAL, WATTS/CC      -
C                                -                                           -
C-----

```

```

C*****
C                                -
CEOF      PWDINT                                                         -
C                                -
C*****

```

SPECIFICATIONS FOR INTERFACE FILE CXSPRR

```

C*****
C                                     PREPARED 10/18/73
C
C      CXSPRR
C
C      DATA FOR CROSS SECTION PROCESSOR
C
C      SEE INTERFACE FILE CONTRL, RECCRD XCPINS, FOR REFERENCES
C      TO ARRAY IX
C*****

C-----
C      FILE STRUCTURE
C
C      RECORD TYPE                      PRESENT IF
C      =====
C      FILE IDENTIFICATION              ALWAYS
C      10 FILE CONTROL                  ALWAYS
C      20 CITATION SET NUMBERS          NOP(1) GT 0
C      30 NEUTRON ENERGY SPECTRUM     NOP(3) GT 0
C      40 TRANSPORT MULTIPLIERS        NOP(4) GT 0
C
C      ***** (REPEAT FROM 1 TO NOP(5))
C      * 50 ISOTOPE DATA              NOP(5) GT 0
C      *****
C
C      ***** (REPEAT FROM 1 TO NOP(6))
C      * 60 ISOTOPE NAMES IN MIXTURE   NOP(6) GT 0
C      * 70 ISOTOPE DENSITIES IN MIXTURE NOP(6) GT 0
C      *****
C
C      ***** (REPEAT FROM 1 TO NOP(6))
C      * 80 MIXTURE DATA              NOP(6) GT 0
C      *****
C-----

C-----
C      FILE IDENTIFICATION
C
C      HNAME, (HUSE(I), I=1,2), IVERS
C
C      3*MULT + 1
C
C      HNAME      HOLLERITH FILE NAME - CXSPRR - (A6)
C      HUSE       HOLLPRITH USER IDENTIFICATION (A6)
C      IVERS      FILE VERSION NUMBER
C      MULT       DOUBLE PRECISION PARAMETER
C                  1 - A6 WORD IS SINGLE WORD
C                  2 - A6 WORD IS DOUBLE PRECISION WORD
C-----

```

(CONT)

```

C-----
CP 1D FILE CONTROL -
C -
CL (NOP(I),I=1,24) -
C -
CW 24 -
C -
CD NOP(1) NUMBER OF CITATION CROSS SECTION SETS TO PROCESS -
CD (IF NOP(1) EQ 0 AND IX(3) EQ 1 AND IX(5) EQ 1, -
CD SET ONE WILL BE PROCESSED) -
CD NOP(2) SCATTERING BLOCKING FACTOR FOR NUCLIDE-ORDERED -
CD FILE CREATED FROM CITATION CROSS SECTIONS -
CD 0 - NSBLOK = 1 -
CD N - NSBLOK = N, IF (NGROUP/N)*N EQ NGROUP, -
CD OTHERWISE NSBLOK = 1 -
CD NOP(3) OPTION TO INPUT A NEUTRON ENERGY SPECTRUM -
CD 0 - NO -
CD N - YES (N SHOULD BE EQUAL TO THE NUMBER OF -
CD ENERGY GROUPS ON THE CROSS SECTION FILE) -
CD NOP(4) OPTION TO CREATE PSEUDO DIRECTION DEPENDENT -
CD TRANSPORT DATA -
CD 0 - NO -
CD 1 - YES -
CD NOP(5) OPTION TO INPUT OVERRIDE DATA FOR ISOTOPES -
CD 0 - NO -
CD N - YES (N IS THE NUMBER OF RECORDS OF DATA) -
CD NOP(6) NUMBER OF MIXTURES (REQUIRED IF IX(11) EQ 1) -
CD NOP(7) MAXIMUM NUMBER OF ISOTOPES IN ANY MIXTURE -
CD (REQUIRED IF IX(11) EQ 1) -
CD NOP(8-9) RESERVED -
CD NOP(10) OPTION ON USE OF THE OVERRIDE DATA FOR ISOTOPES -
CD WHEN NOP(5) GT 0 (APPLICABLE ONLY WHEN -
CD IX(3) EQ 1 AND IX(5) EQ 0) -
CD 0 - DATA CORRESPONDS WITH THE ORDER OF -
CD ISOTOPES IN THE FILE -
CD 1 - DATA IDENTIFIES ISOTOPES TO BE SELECTED -
CD BY UNIQUE ISOTOPE LABEL -
CD NOP(11-23) RESERVED -
CD NOP(24) OPTION ON EDIT DURING CITATION CROSS SECTION -
CD PROCESSING -
CD 0 - NO -
CD 1 - YES -
C-----

```

(CONT)

```

C-----
CP  2D  CIPATION CROSS SECTION SET NUMBERS
C
CC      PRESENT IF NOP(1) GT 0
C
CL      (ISET(I),I=1,NOP1)
C
CW      NOP1 = NOP(1)
C
CD  ISET      SET NUMBERS IN ASCENDING ORDER OF APPEARANCE
CD              IN LIBRARY
C
C-----

```

```

C-----
CR  3D  NEUTRON ENERGY SPECTRUM
C
CC      PRESENT IF NOP(3) GT 0
C
CL      (WGT(I),I=1,NOP3)
C
CW      NOP3 = NOP(3)
C
CD  WGT      SPECTRUM FOR WEIGHTING IN MIXTURE CALCULATION
C
C-----

```

```

C-----
CR  4D  MULTIPLIERS FOR TRANSPORT CROSS SECTION
C
CC      PRESENT IF NOP(4) GT 0
C
CL      (TRMOD(I),I=1,3)
C
CW      3
C
CD  TRMOD      MULTIPLIER FOR EACH COORDINATE DIRECTION
CD              STRPD(I) = TRMOD(I)*STRPL(1) FOR EACH ENERGY
C
C-----

```

```

C-----
CR  5D  ISOTOPE DATA
C
CC      PRESENT IF NOP(5) GT 0
CC      THERE MUST BE NOP(5) RECORDS
C
CW      WHEN NOP(10) EQ 0,
CW      THIS DATA MAY BE USED WHEN IX(3) EQ 1 TO CONTROL THE
CW      PROCESSING OF THE INPUT CROSS SECTIONS. THE ORDER
CW      OF THESE RECORDS MUST BE ONE-TO-ONE WITH THE ORDER
CW      OF THE ISOTOPES IN THE INPUT CROSS SECTIONS. FOR EACH
CW      ISOTOPE READ FROM THE INPUT CROSS SECTIONS, ONE RECORD
CW      IS READ FROM THIS DATA
C

```

(CONT)

CN
 CN A) IF HISONM EQ 6HDFLETE, THE DATA FOR THIS ISOTOPE
 CN IS NOT WRITTEN ON THE NEW NUCLIDE-ORDERED FILE
 CN B) IF HISONM NE 6HDFLETE, THE DATA FOR THIS ISOTOPE
 CE WILL BE COPIED TO THE NEW NUCLIDE-ORDERED FILE
 CN (NON-BLANK OR NON-ZERO DATA WILL REPLACE THE
 CN DATA OF THE NEW FILE)
 CN C) IF AFTER READING NOP(5) RECORDS, THERE ARE ISOTOPES
 CN REMAINING IN THE INPUT CROSS SECTIONS, THOSE
 CN REMAINING WILL BE DELETED FROM THE NEW FILE
 CN
 CN WHEN NOP(10) EQ 1,
 CN THIS DATA MAY BE USED WHEN IX(3) EQ 1 AND IX(5) EQ 0 TO
 CN CONTROL THE CONTENT OF THE NEW ISOTXS FILE. THE ORDER
 CN OF THE RECORDS IS NOT SPECIFIED SINCE THE UNIQUE LABEL
 CN (HISONM) IS USED TO IDENTIFY ISOTOPES TO BE COPIED TO
 CN THE NEW FILE. NON-BLANK OR NON-ZERO VALUES FOR THE
 CN REST OF THE DATA WILL BE PUT ON THE NEW FILE.
 CN THE UNIQUE LABEL CAN NOT BE CHANGED WHEN USING THIS OPTION.
 CN
 CN IF THIS DATA IS NOT PRESENT, ALL ISOTOPES ON THE INPUT
 CN CROSS SECTIONS WILL BE COPIED TO THE NEW FILE
 C
 CL HISONM,HABSID,HMAT,ANASS,EPISS,ECAPT,KBR,(IOP(I),I=1,3)
 C
 CW 3*MULT + 7
 C
 CD HISONM HOLLERITH ISOTOPE LABEL (UNIQUE) (A6)
 CD HABSID HOLLERITH ISOTOPE LABEL (ABSOLUTE) (A6)
 CD HMAT HOLLERITH ISOTOPE LABEL (REFERENCE) (A6)
 CD ANASS GRAM ATOMIC WEIGHT
 CD EPISS TOTAL THERMAL ENERGY YIELD/FISSION (W.SEC/FISS)
 CD ECAPT TOTAL THERMAL ENERGY YIELD/CAPTURE(W,GAMMA)
 CD (W.SEC/CAPT)
 CD KBR ISOTOPE CLASSIFICATION
 CD IOP RESERVED
 C-----

C-----
 CR 6D ISOTOPE NAMES IN MIXTURE
 C
 CC PRESENT IF NOP(6) GT 0
 CC THIS RECORD AND THE RECORD FOLLOWING APPEAR IN PAIRS
 CC THERE MUST BE NOP(6) PAIRS
 C
 CL (HISONX(I),I=1,NOP7)
 C
 CW MULT*NOP7 = MULT*NOP(7)
 C
 CD HISONX UNIQUE NAME OF ISOTOPE TO BE INCLUDED IN MIXTURE
 C (BLANK NAMES ARE IGNORED)
 C
 CN ANY ISOTOPE INCLUDED IF A MIXTURE WILL BE DELETED FROM THE
 CN NEW FILE
 C-----

(CONT)

```

C-----
CP 7D ISOTOPE DENSITIES IN MIXTURE -
C -
CC PRESENT IF NOP(6) GT 0 -
C -
CL (RDENS(I), I=1, NOP7) -
C -
CW NOP7 = NOP(7) -
C -
CD RDENS DENSITY OF ISOTOPE TO BE INCLUDED IN MIXTURE -
C-----

```

```

C-----
CR 8D MIXTURE DATA -
C -
CC PRESENT IF NOP(6) GT 0 -
CC THERE MUST BE NOP(6) RECORDS -
C -
CL HISOMM, HABSID, HMAT, AMASS, EPISS, ECAPT, KBR, (IOP(I), I=1,3) -
C -
CW 3*MULT + 7 -
C -
CD HISOMM HOLLERITH MIXTURE LABEL (UNIQUE) (A6) -
CD HABSID HOLLERITH MIXTURE LABEL (ABSOLUTE) (A6) -
CD HMAT HOLLERITH MIXTURE LABEL (REFERENCE) (A6) -
CD AMASS GRAM ATOMIC WEIGHT -
CD EPISS TOTAL THERMAL ENERGY YIELD/FISSION (W.SEC/FISS) -
CD ECAPT TOTAL THERMAL ENERGY YIELD/CAPTURE (W,GAENA) -
CD (W.SEC/CAPT) -
CD KBR MIXTURE CLASSIFICATION -
CD IOP RESERVED -
C -
CN NON-BLANK DATA SHOULD BE SUPPLIED FOR LABELS -
CN AND NON-ZERO DATA FOR FM -
CN AMASS, EPISS, AND ECAPT ARE CALCULATED FOR MIXTURE BUT -
CN MAY BE REPLACED BY NON-ZERO ENTRIES -
C-----

```

```

C*****
C
CEOF CISP RR
C
C*****

```

SPECIFICATIONS FOR INTERFACE FILE PPRINT

```

C*****
C          REVISED 10/18/73
C          REVISED 8/14/75 (ORNL)
C          REVISED 11/16/78 (ORNL)
C
C          PPRINT
C
C          CODE-DEPENDENT INPUT DATA FILE FOR PRINT MODULE
C
C          CONTROLS FILE PRINTING AND PUNCHING.
C          FILES MAY BE PRINTED AND/OR SAVED IN CARD IMAGE FORM
C          SUITABLE FOR INPUT TO THE STANDARD INPUT PROCESSOR.
C          THE CARD IMAGES MAY BE SAVED ON TAPE, DISK, OR CARDS.
C
C*****

```

```

C-----
C          FILE STRUCTURE
C
C          RECORD TYPE          PRESENT IF
C          -----
C          0V    FILE IDENTIFICATION    ALWAYS
C          1D    FILE CONTROL            ALWAYS
C          * * * * * (REPEAT FROM 1 TO NSPCS)
C          * 2D    FILE PRINT/PUNCH CONTROL    ALWAYS
C          * 3D    RECORD-TYPE I.D. NUMBERS    WPREC.GT.0
C          * * * * *
C
C-----

```

```

C-----
C          FILE IDENTIFICATION
C
C          HNAME, (HUSE(I), I=1,2), IVERS
C
C          3*MULT+1
C
C          HNAME      HOLLERITH FILE NAME - PPRINT - (A6)
C          HUSE(1)     HOLLERITH USER IDENTIFICATION (2A6)
C          IVERS       FILE VERSION NUMBER
C          MULT        DOUBLE PRECISION PARAMETER
C                     1- A6 WORD IS SINGLE WORD
C                     2- A6 WORD IS DOUBLE WORD
C
C-----

```

(CONT)

```

C-----
CR    1D    FILE CONTROL
C
CL    NSPECS,WBCD,NSTOP,NDOH
C
CW    4
C
CD    NSPECS          NUMBER OF STANDARD FILES TO BE PROCESSED
CD                      (MUST BE .LE.20)
CD    WBCD            UNIT NUMBER FOR SAVING FILES IN CARD IMAGE FORM
CD                      DEFAULT IS UNIT 7 AND NO ENDFILE OR REWIND
CD                      IS PERFORMED. ANY OTHER UNIT SPECIFIED WILL
CD                      BE CLOSED OUT WITH ENDFILE AND REWIND.
CD    NSTOP           OPTION TO PLACE THE CHARACTERS 'STOP' AT THE
CD                      END OF THE CARD IMAGES
CD                      0- YES
CD                      1- NO
CD    NDOH            OPTION TO PURGE OR RETAIN THE PPRINT FILE
CD                      AFTER EXECUTION OF LAST PRINT/PUNCH
CD                      PROCESSOR
CD                      0- PURGE
CD                      1- RETAIN
C-----

```

```

C-----
CR    2D    FILE PRINT/PUNCH CONTROL
C
CL    FILEID,IVER,NOPT,NPREC
C
CW    MULT*3
C
CD    FILEID          HOLLERITH NAME OF FILE TO BE PROCESSED - (A6)
CD    IVER            VERSION OF FILE TO BE PROCESSED (IF IVER=0,
CD                      THE LATEST VERSION WILL BE PROCESSED)
CD    NOPT            PRINT/PUNCH OPTION
CD                      0- PRINT ONLY
CD                      1- PUNCH ONLY
CD                      2- PRINT AND PUNCH
CD    NPREC           SELECTED RECORDS FLAG
CD                      .EQ.0 - PRINT COMPLETE FILE
CD                      .GT.0 - PRINT SELECTED RECORD-TYPES AS
CD                      SPECIFIED IN THE NEXT RECORD
CD                      (MUST BE .LE.10)
C-----

```

(CONT)


```

C-----
CN      3D      RECORD-TYPE I.D. NUMBERS      -
C                                           -
CC      PRESENT IF NPREC.GT.0                -
C                                           -
CL      (ID(I),I=1,NPREC)                    -
C                                           -
CW      NPREC                                -
C                                           -
CD      ID(I)          IDENTIFICATION NUMBERS OF SELECTED -
CD                                RECORD-TYPES TO BE PRINTED -
CD                                (MUST BE .LE.10)           -
C                                           -
C-----

C*****
C
CEOF      FPRINT                                -
C
C*****

```

Figure C.4. Newly Defined Files

SPECIFICATIONS FOR INTERFACE FILE EXPOSE

```

*****
C                                     REFERENCE 02/01/79 ORNL-5180
C
C      EXPOSE
C
C      DATA FOR EXPOSURE CALCULATIONS
C
C      THE BASIC DATA REQUIRED FOR SOLVING THE CHAIN
C      EQUATIONS IDENTIFIES NUCLIDES, FISSIONING
C      NUCLIDES, FISSION PRODUCTS, AND GIVES DECAY, YIELD, ENERGY,
C      AND COUPLING DATA
C
*****

-----
C      FILE IDENTIFICATION
C
C      LNAME, (HUSE(I), I=1,2), IVERS
C
C      3*MULT + 1
C
C      HNAME      FILE NAME (A6) 'EXPOSE'
C      HUSE       USER IDENTIFICATION (A6)
C      IVERS      FILE VERSION NUMBER
C
C      MULT       1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
-----

-----
C      1D      FILE REFERENCE INFORMATION
C
C      NEXP1, NISOE, NANOPT, NYER, NGER, WPSLR, WYPR, WDCYR, NEXP9, NEXP10,
C      NEXP11, WNPATIE, LSEXCH, LBEXCH, NEXP15, WOEDCY, WOEPI5, NOECAP,
C      NEXP19, NEXP20
C
C      20
C
C      UNDEFINED DATA IS RESERVED FOR FUTURE USE
C
C      NEXP1      DOCUMENTING FILE REFERENCE NUMBER
C      NISOE      REFERENCE NUMBER OF NUCLIDES
C                  MUST BE NON-ZERO
C      NANOPT     OPTION ON NUCLIDE NAMES
C                  IF 0 - THEY ARE ABSOLUTE NAMES
C                  IF 1 - THEY ARE USER LABELS
C
C                  IN FILE ISOTXS, ABSOLUTE NAMES ARE
C      NABSID, WHILE USER LABELS ARE NISONH
C
C      UNIQUE NAMES ARE REQUIRED HERE
C

```

(CONT)

CD	MYER	NUMBER OF ENERGY RANGES FOR YIELD DATA	-
CD		(GENERALLY NON-ZERO)	-
CD	NGER	NUMBER OF ENERGY RANGES FOR GAMMA RAYS	-
CD	NPSLR	NUMBER OF IDENTIFIED FISSION NUCLIDES WHICH YIELD	-
CD		FISSION PRODUCTS	-
CD	NFPR	NUMBER OF FISSION PRODUCTS HAVING YIELD	-
CD	NDCYP	NUMBER OF NUCLIDES WHICH DECAY	-
CD	NEXP9	RESERVED	-
CD	NEXP10	RESERVED	-
CD	NEXP11	RESERVED	-
CD	NHATKE	OPTION IF .GT. 0 INDICATING THE NUMBER	-
CD		OF MATRIX EXPONENTIAL DATA ENTRIES	-
CD	LSEXCH	OPTION IF .GT.0 INDICATING THE NUMBER	-
CD		OF ENTRIES IN THE SUPPLEMENTING TABLE OF EXPLICIT	-
CD		CHAIN DATA (USED WITH MATRIX DATA)	-
CD	LSEXCH	OPTION IF .GT.0 INDICATING THE NUMBER	-
CD		OF ENTRIES IN THE BASIC TABLE OF EXPLICIT	-
CD		CHAIN DATA (USED ONLY ALONE)	-
CD	NEXP15	RESERVED	-
CD	NOEDCY	OPTION INDICATING DATA FOR THE DECAY PROCESS	-
CD		IS INCLUDED FOR GAMMA RAYS AND BETA PARTICLES	-
CD	NOEPIS	OPTION INDICATING DATA FOR THE FISSION PROCESS	-
CD		IS INCLUDED FOR GAMMA RAYS AND BETA PARTICLES	-
CD	NOECAP	OPTION INDICATING DATA FOR THE CAPTURE PROCESS	-
CD		IS INCLUDED FOR GAMMA RAYS AND BETA PARTICLES	-
CD	NEXP19	RESERVED	-
CD	NEXP20	RESERVED	-
C			-

C-----

C			-
CR	2D	TITLE AND NUCLIDE NAMES	-
C			-
CC		ALWAYS PRESENT	-
C			-
CW		HEREAFTER ALL REFERENCES TO NUCLIDES IN THIS FILE ARE	-
CW		BY THE ORDER NUMBER IN THIS TABLE OF NAMES	-
C			-
CL		(NTL(J), J=1, 12), (HNUC(I), I=1, NISOE)	-
C			-
CW		MULT*(12+NISOE)	-
C			-
CD	NTL	DOCUMENTING TITLE (12A6)	-
CD	HNUC(I)	NAME OF NUCLIDE ORDERED I (A6) SEE NAMOPT OPTION	-
C			-
CW		ALL NUCLIDES TO BE TREATED (EXPOSURE CALCULATED) MUST BE	-
CW		NAMED IN THIS LIST (NOMALLY EXCLUDE COOLANT, STRUCTURE).	-

(CONT)

C
 CN WHEN THE AVERAGE GENERATION RATE METHOD IS USED, THESE
 CN SPECIFICATIONS ARE PROCESSED IN THE ORDER IN THIS LIST, SO
 CN THEY SHOULD BE ORDERED ALONG CHAINS, DOMINATING ROUTES FIRST-
 CN (EXAMPLE, W....PU, I..IE, IE..CS), FISSION PRODUCTS LAST.
 C
 CN NUCLIDES SPECIFIED HERE BUT ABSENT IN THE SYSTEM OF COURSE
 CN ARE NOT TREATED - IMPACTS ARE DOCUMENTED ELSEWHERE.
 C
 C-----

C-----
 CR 3D REFERENCE DATA
 C
 CC PRESENT IF NYER+NGER+NPSLR+NPPR+NDCYR .GT. 0
 C
 CL (YER(N), N=1, NYER), (GER(J), J=1, NGER), (IPSLR(K), K=1, NPSLR),
 CL (IPPR(L), L=1, NPPR), (IDCYR(I), I=1, NDCYR)
 C
 CN NYER+NGER+NPSLR+NPPR+NDCYR
 C
 CD YER LOWER ENERGY OF RANGE OF INCIDENT
 CD NEUTRON ENERGY (EV), DECREASING ORDER
 CD (LAST NUMBER TYPICALLY ZERO, SINGLE VALUE USUALLY 0)
 CD GER MEAN OR EFFECTIVE ENERGY OF EACH RANGE
 CD OF DATA FOR GAMMA RAY ENERGY DATA, ORDERED BY
 CD DECREASING ENERGY, FOR DOCUMENTATION (EV PER PART.)
 CD IPSLR REFERENCE ORDER NUMBER OF IDENTIFIED
 CD NUCLIDES WHICH FISSION
 CD IPPR REFERENCE ORDER NUMBER OF FISSION PRODUCTS
 CD (NUCLIDES FOR WHICH FISSION YIELD DATA IS GIVEN)
 CD IDCYR REFERENCE ORDER NUMBER OF NUCLIDES WHICH DECAY
 C
 C-----

C-----
 CR 4D DECAY DATA
 C
 CC PRESENT IF NDCYR .GT. 0
 C
 CL (ALNDA(I), I=1, NDCYR)
 C
 CN NDCYR
 C
 CD ALNDA TOTAL DECAY CONSTANT FOR NUCLIDE ORDERED I IN THE
 CD REFERENCE SET IDCYR(I) (SEC-1)
 C
 C-----

(CONT)

C
 CH ONLY NUCLIDES GIVEN IN THESE CHAINS WILL BE TREATED
 CH (EXPOSED)
 C
 C-----

C-----
 CR 9D DECAY ENERGY RELEASE DATA
 C
 CC PRESENT IF NOEDCY .GT. 0 .AND. NDCYR*(NGER+2) .GT. 0
 C
 CL ((EGAMA(I,J),I=1,NDCYR),J=1,NGER),(EBETA(I),I=1,NDCYR),
 CL (EDCY(I),I=1,NDCYR)
 C
 CW ND.YR*(NGER+2)
 C
 CD EGAMA(I,J) THE AMOUNT OF ENERGY RELEASED PER ATOMIC
 CD DECAY OF PARENT NUCLIDE IDCYR(I)
 CD AS GAMMA RAYS IN ENERGY RANGE J (EV)
 CD EBETA(I) THE AMOUNT OF ENERGY RELEASED PER
 CD ATOMIC DECAY OF PARENT NUCLIDE IDCYR(I)
 CD AS BETA PARTICLES (EV)
 CD EDCY(I) THE AMOUNT OF ENERGY RELEASED PER ATOMIC DECAY OF
 CD PARENT NUCLIDE IDCYR(I), (EV)
 C
 C-----

C-----
 CR 10D SECONDARY ENERGY FROM FISSION
 C
 CC PRESENT IF NOEFIS .GT. 0 .AND. NPSLR*(NGER+1) .GT. 0
 C
 CL ((EFGAM(I,J),I=1,NPSLR),J=1,NGER),(EPBAT(I),I=1,NPSLR)
 C
 CW NPSLR*(NGER+1)
 C
 CD EFGAM(I,J) THE AMOUNT OF ENERGY RELEASED PER
 CD ATOMIC FISSION OF NUCLIDE IPSLR(I)
 CD AS GAMMA RAYS IN ENERGY RANGE J (EV)
 CD EPBAT(I) THE AMOUNT OF ENERGY RELEASED PER ATOMIC
 CD FISSION OF NUCLIDE IPSLR(I) AS BETA PARTICLES (EV)
 C
 C-----

(CONT)

```

C-----
CR 7D CHAIN DATA, SUPPLEMENTAL EXPLICIT -
C -
CC PRESENT IF LSEXCH .GT. 0 -
C -
CL (NSXCH(I),I=1,LSEXCH) -
C -
CW LSEXCH -
C -
CD NSXCH ENTRY IN THE SUPPLEMENTAL EXPLICIT CHAIN -
CD DATA TABLE (SEE DESCRIPTION BELOW) -
C -
C-----

```

```

C-----
CR 8D CHAIN DATA, COMPLETE BASIC DATA TO APPLY EXPLICIT SOLUTION -
C -
CC PRESENT IF LBEXCH .GT. 0 -
C -
CL (NBXCH(I),I=1,LBEXCH) -
C -
CW LBEXCH -
C -
CD NBXCH ENTRY IN THE BASIC EXPLICIT CHAIN DATA TABLE, -
CD OUTLINED HERE -
C -
CW THE FIRST ENTRY IS THE FIRST NUCLIDE IN THE FIRST -
CW CHAIN. THE NEXT ENTRY IS THE TRANSUTATION PROCESS FOR -
CW GENERATION OF THE PRODUCT (SEE THE VALUES OF MATXE(3,2) IN -
CW THE TABLE ABOVE). THE NEXT ENTRY IN THE LIST IS THE FIRST -
CW PRODUCT IN THE FIRST CHAIN. THUS FOR N NUCLIDES IN A CHAIN, -
CW THERE ARE 2*(N-1)+1 ENTRIES FOR THE CHAIN. THEN THERE IS A -
CW ZERO ENTRY. DATA FOLLOWS FOR THE NEXT CHAIN. A FINAL -
CW EXTRA ZERO IS PLACED AT THE END AFTER THE LAST CHAIN WHICH -
CW FLAGS THE END OF CHAINS. TWO ZERO ENTRIES AT THE END. -
CW ENTER ACTINIDE CHAINS FIRST. -
C -
CW REPEAT OF A NUCLIDE REFERENCE IN A CHAIN IS NOT ALLOWED. -
CW GIVEN A FIRST APPEARANCE IN ONE CHAIN, SUBSEQUENT ENTRIES OF -
CW A NUCLIDE REFERENCE INDICATE OTHER GENERATION ROUTES WHICH -
CW CONTRIBUTE INDEPENDENTLY. CARE MUST BE TAKEN TO SUPPLY -
CW REASONABLE SPECIFICATIONS - ONLY THE ACTUAL CHAINS SHOWN -
CW WILL BE TREATED, SO FULL SPECIFICATIONS REQUIRING REPEATS -
CW ARE REQUIRED, AND ONLY LIMITED BRANCHING IS ALLOWED. -
CW THE CONTRIBUTIONS ALONG A ROUTE THROUGH THE CHAINS ARE ONLY -
CW THOSE FOR THE NUCLIDES ACTUALLY GIVEN FOR THAT CHAIN. -
CW AS AN EXAMPLE, THE TABLE -
CW 1 +02 2 +02 3 +01 4 +02 5 0 1 +02 2 +01 6 +02 -4 +02 -5 0 0 -
CW ALLOWS TWO ROUTES TO BE TREATED FOR GENERATION OF NUCLIDES -
CW REFERENCED 4 AND 5. THE -4 AND -5 IN THE SECOND CHAIN -
CW INDICATE THESE CONTRIBUTIONS ARE ADDITIONAL. -
C-----

```

(CONT)

```

C-----
CP 50 FISSION PRODUCT YIELD DATA -
C -
CC PRESENT IF NFSLR*NPPR*MYER .GT. 0 -
C -
CL (((YFP(K,L,N),K=1,NPSLB),L=1,NPPR),N=1,MYER) -
C -
CW NFSLR*NPPR*MYER -
C -
CD YFP(K,L,N) YIELD OF FISSION PRODUCT IFPR(L) FROM -
CD FISSION OF NUCLIDE IFSLR(K) DUE TO FISSIONING -
CD NEUTRON IN ENRGY RANGE N -
CD (ATONS PER SECOND PER FISSION PER SECOND) -
C -
C-----

```

```

C-----
CR 60 CHAIN DATA FOR MATRIX EXPONENTIAL OR AVERAGE GENERATION RATE-
C -
CC PRESENT IF NHATX .GT. 0 -
C -
CL ((HATX(J,I),J=1,3),I=1,NHATX) -
C -
CW 3*NHATX -
C -
CD HATX(1,I) SOURCE NUCLIDE -
CD HATX(2,I) PRODUCT NUCLIDE -
CD HATX(3,I) SPECIFIES THE TRANSMUTATION PROCESS, -
CD 0- NOT ALLOWED -
CD 1- DECAY -
CD 2- (N,GAMMA), USUAL CAPTURE UP THE CHAIN -
CD 3- (N,ALPHA) -
CD 4- (N,P) -
CD 5- (N,2N), DOWN THE CHAIN -
CD 6- (N,D) -
CD 7- (N,T) -
CD 8- FISSION (DO NOT SPECIFY FOR A FISSION PRODUCT -
CD FOR WHICH YIELD DATA IS GIVEN, THIS IS TREATED -
CD DIRECTLY) -
CD 9- TOTAL CAPTURE, TOTAL ABSORPTION LESS FISSION -
C -
CW PARTIAL RATES OF PRODUCT GENERATION CAN BE CONSIDERED. THE -
CW PARTS PER MILLION IS EXPRESSED AS AN INTEGER (500000 IS THE -
CW FRACTION 0.5), ROUNDED TO THE NEAREST TEN (LAST DIGIT ZERO), -
CW ADDED TO THE NUMBER FROM THE ABOVE TABLE TO SPECIFY THE -
CW TRANSMUTATION PROCESS. FOR EXAMPLE, IF THE PARTIAL CAPTURE -
CW ROUTES OF P1-147 TO P1-148 AND TO P1-148N ARE BOTH TO BE -
CW CONSIDERED, THE FIRST AT FRACTION 0.53, THE APPROPRIATE -
CW ENTRIES TO INDICATE (N,GAMMA) REACTION PRODUCTS ARE 530002 -
CW FOR THE PRODUCT P1-148 AND 470002 FOR P1-148N. LESS THAN -
CW A TOTAL FRACTION OF UNITY MAY BE SPECIFIED, BUT TAKE CARE. -
C -
C-----

```

(CONT)

```

C-----
C2  11D  ENERGY RELEASE FROM CAPTURE                      -
C                                           -
CC      PRESENT IF NOECAP .GT. 0 .AND. NISOE*(NGER+1) .GT. 0 -
C                                           -
CL      ((ECGAN(I,J),I=1,NISOE),J=1,NGER),(ECBAT(I),I=1,NISOE) -
C                                           -
CW      NISOE*(NGER+1)                                     -
C                                           -
CD      ECGAN(I,J)    THE AMOUNT OF ENERGY RELEASED PER    -
CD                      ATOMIC CAPTURE OF NUCLIDE I AS GAMMA RAYS -
CD                      IN ENERGY RANGE J (EV)               -
CD      ECBAT(I)      THE AMOUNT OF ENERGY RELEASED PER ATOMIC -
CD                      CAPTURE OF NUCLIDE I AS BETA PARTICLES (EV) -
C                                           -
C-----

C*****
C
CEOP      EXPOSE
C
C*****

```


SPECIFICATIONS FOR INTERFACE FILE EXPORT

```

C*****
C               REFERENCE 02/01/79 ORNL-5180
C               MODIFIED 05/01/79
C
C      EXPORT
C
C      RECORD OF EXPOSURE HISTORY
C
C      ORIGINAL SPECS MODIFIED TO INCLUDE SUBZONE FLUENCE
C
C*****

```

```

C-----
C      FILE STRUCTURE
C
C      RECORD TYPE                PRESENT IF
C      =====
C      FILE IDENTIFICATION        ALWAYS
C      1D FILE REFERENCE INFORMATION  ALWAYS
C      ***** (REPEAT FROM 1 TO INIST)
C      * 2D GENERAL INFORMATION    ALWAYS
C      * 3D TOTAL FLUENCE          NPLUT = 1
C      * 4D FLUENCE RANGE 1        NPLU1 = 1
C      * 5D FLUENCE RANGE 2        NPLU2 = 1
C      * 8D FISSIONS               NRR1 = 1
C      * 9D EXPOSURE               NRR2 = 1
C      * 10D ENERGY               NRR3 = 1
C      * 11D UNDEFINED             NRR4 = 1
C      *****
C
C-----

```

```

C-----
C      FILE IDENTIFICATION
C
C      HNAME, (HUSE(I), I=1,2), IVERS
C
C      3*MULT + 1
C
C      HNAME      FILE NAME (A6) 'EXPORT'
C      HUSE       USER IDENTIFICATION (A6)
C      IVERS      FILE VERSION NUMBER
C
C      MULT       1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
C-----

```

(CONT)

```

C-----
CR  1D  FILE REFERENCE INFORMATION
C
CL  EXPH1,EXPH2,EXPH3,EPLU1,EPLU2,INIST,IZONE,ISZ,
CL  NPLUT,NPLU1,NPLU2,IXPH12,IXPH13,NRR1,NRR2,NRR3,
CL  NRR4,IXPH18,IXPH19,IXPH20
C
CN      20
C
CD  EXPH1      END OF EXPOSURE TIME (DAYS) FROM LAST SET OF DATA
CD  EXPH2      RESERVED
CD  EXPH3      RESERVED
CD  EPLU1      CUTOFF ENERGY (EV) FOR FIRST FLUENCE
CD  EPLU2      CUTOFF ENERGY (EV) FOR SECOND FLUENCE
CD  INIST      NUMBER OF SETS OF DATA
CD  IZONE      NUMBER OF ZONES
CD  ISZ        NUMBER OF SUBZONES
CD  NPLUT      OPTION FOR TOTAL FLUENCE
CD              0 - NOT PRESENT
CD              1 - PRESENT
CD  NPLU1      OPTION FOR FLUENCE IN FIRST RANGE
CD              0 - NOT PRESENT
CD              1 - PRESENT
C
CN              WHEN NPLU1 = 1, EPLU1 MUST BE GREATER THAN 0 AND
CN              LIE IN THE ENERGY RANGE SPECIFIED IN THE
CN              CROSS SECTION DATA
C
CD  NPLU2      OPTION FOR FLUENCE IN SECOND RANGE
CD              0 - NOT PRESENT
CD              1 - PRESENT
C
CN              WHEN NPLU2 = 1, EPLU2 MUST BE GREATER THAN 0 AND
CN              LIE IN THE ENERGY RANGE SPECIFIED IN THE
CN              CROSS SECTION DATA
C
CD  IXPH12     RESERVED
CD  IXPH13     RESERVED
CD  NRR1       OPTION FOR FISSIONS
CD              0 - NOT PRESENT
CD              1 - PRESENT
CD  NRR2       OPTION FOR EXPOSURE
CD              0 - NOT PRESENT
CD              1 - PRESENT
CD  NRR3       OPTION FOR ENERGY
CD              0 - NOT PRESENT
CD              1 - PRESENT
CD  NRR4       OPTION FOR UNDEFINED
CD              0 - NOT PRESENT
CD              1 - PRESENT
CD  IXPH18     RESERVED
CD  IXPH19     RESERVED
CD  IXPH20     INDICATOR NORMALLY = 0, BUT IS SET = 1 IF
C              A DISCONTINUITY EXISTS IN EXPOSURE TIMES
C-----

```

(CONT)

CR	2D	GENERAL INFORMATION
C		
CL	(EPHT (I), I=1,40)	
C		
CW	40	
C		
CD	EPHT (1)	END OF EXPOSURE TIME (DAYS)
CD	EPHT (2)	START OF EXPOSURE TIME (DAYS)
CD	EPHT (3)	FRACTION OF CORE TREATED IN PROBLEM
CD	EPHT (4)	CONVERSION FACTOR, RATIO OF THERMAL ENERGY TO FISSION + CAPTURE ENERGY (FROM CROSS SECTIONS)
CD	EPHT (5-10)	RESERVED
CD	EPHT (11)	CURRENT TOTAL SYSTEM FISSIONS (FISSIONS)
C		
CY		DEFINED WHEN NRR1 = 1
C		
CD	EPHT (12)	CURRENT TOTAL SYSTEM EXPOSURE (MEGAWATT (THERMAL)-DAYS/KG)
CD		
C		
CW		DEFINED WHEN NRR2 = 1
C		
CD	EPHT (13)	CURRENT TOTAL SYSTEM ENERGY (MEGAWATT (THERMAL)-DAYS)
CD		
C		
CW		DEFINED WHEN NRR3 = 1
C		
CD	EPHT (14)	CURRENT TOTAL SYSTEM UNDEFINED
C		
CW		DEFINED WHEN NRR4 = 1
C		
CD	EPHT (15-20)	RESERVED
CD	EPHT (21)	CUMULATIVE TOTAL SYSTEM FISSIONS (FISSIONS)
CD		
C		
CW		DEFINED WHEN NRR1 = 1
C		
CD	EPHT (22)	CUMULATIVE TOTAL SYSTEM EXPOSURE (MEGAWATT (THERMAL)-DAYS/KG)
CD		
C		
CW		DEFINED WHEN NRR2 = 1
C		
CD	EPHT (23)	CUMULATIVE TOTAL SYSTEM ENERGY (MEGAWATT (THERMAL)-DAYS)
CD		
C		
CW		DEFINED WHEN NRR3 = 1
C		
CD	EPHT (24)	CUMULATIVE TOTAL SYSTEM UNDEFINED
C		
CW		DEFINED WHEN NRR4 = 1
C		
CD	EPHT (25-40)	RESERVED
C		

(CONT)

```

C-----
CR 3D TOTAL FLUENCE -
C -
CC PRESENT IF NPLUT = 1 -
C -
CL (FLUT(NM),NM=1,ITZSZ) -
C -
CW ITZSZ = IZONE + ISZ -
C -
CD FLUT CUMULATIVE TOTAL FLUENCE BY ZONE AND SUBZONE -
CD (NEUTRONS/CM**2) -
C -
C-----

```

```

C-----
CR 4D FLUENCE TO FIRST CUTOFF ENERGY EFLU1 -
C -
CC PRESENT IF NPLU1 = 1 -
C -
CL (FLU1(NM),NM=1,ITZSZ) -
C -
CW ITZSZ = IZONE + ISZ -
C -
CD FLU1 CUMULATIVE FLUENCE IN FIRST RANGE BY ZONE -
CD AND SUBZONE (NEUTRONS/CM**2) -
C -
C-----

```

```

C-----
CR 5D FLUENCE TO SECOND CUTOFF ENERGY EFLU2 -
C -
CC PRESENT IF NPLU2 = 1 -
C -
CL (FLU2(NM),NM=1,ITZSZ) -
C -
CW ITZSZ = IZONE + ISZ -
C -
CD FLU2 CUMULATIVE FLUENCE IN SECOND RANGE BY ZONE -
CD AND SUBZONE (NEUTRONS/CM**2) -
C -
C-----

```

(CONT)

C-----
 CR 6D RESERVED -
 C-----

C-----
 CR 7D RESERVED -
 C-----

C-----
 CR 8D FISSIONS -
 C -
 CC PRESENT IF NRR1 = 1 -
 C -
 CL (RR1(NN), NN=1, ITZSZ) -
 C -
 CW ITZSZ = IZONE + ISZ -
 C -
 CD RR1 CUMULATIVE FISSIONS BY ZONE AND SUBZONE -
 CD (FISSIONS/CN**3) -
 C -
 C-----

C-----
 CR 9D EXPOSURE -
 C -
 CC PRESENT IF NRR2 = 1 -
 C -
 CL (RR2(NN), NN=1, ITZSZ) -
 C -
 CW ITZSZ = IZONE + ISZ -
 C -
 CD RR2 CUMULATIVE EXPOSURE BY ZONE AND SUBZONE -
 CD (MEGAWATT (THERMAL) - DAYS/KG) -
 C -
 C-----

C-----
 CR 10D ENERGY -
 C -
 CC PRESENT IF NRR3 = 1 -
 C -
 CL (RR3(NN), NN=1, ITZSZ) -
 C -
 CW ITZSZ = IZONE + ISZ -
 C -
 CD RR3 CUMULATIVE ENERGY BY ZONE AND SUBZONE -
 CD (MEGAWATT (THERMAL) - DAYS/CN**3) -
 C -
 C-----

(CONT)

```

C-----
C
C      REPORT
C-----
C-----
C
C      CD      RR#      UNDEFINED
C
C      CW      ITZSZ = IZOW# + ISZ
C
C      CL      (RR#(MM),MM=1,ITZSZ)
C
C      CC      PRESENT IF RR# = 1
C
C      CR      11D      UNDEFINED
C-----

```

SPECIFICATIONS FOR INTERFACE FILE CPHIST

```

C*****
C                                     REFERENCE 05/01/79
C
C      CPHIST
C
C      RECORD OF EXPOSURE HISTORY (CONTINUOUS FUELING MODEL)
C
C*****

```

```

C-----
C      FILE STRUCTURE
C
C      RECORD TYPE                                PRESEN. IF
C      =====
C      FILE IDENTIFICATION                        ALWAYS
C      1D FILE REFERENCE INFORMATION              ALWAYS
C      ***** (REPEAT FROM 1 TO IHIST)
C      * 2D GENERAL INFORMATION                  ALWAYS
C      * 3D TOTAL FLUENCE                        NPLUT = 1
C      * 4D FLUENCE RANGE 1                     NPLU1 = 1
C      * 5D FLUENCE RANGE 2                     NPLU2 = 1
C      * 8D FISSIONS                            NRR1 = 1
C      * 9D EXPOSURE                            NRR2 = 1
C      * 10D ENERGY                            NRR3 = 1
C      * 11D UNDEFINED                           NRR4 = 1
C      *****
C
C-----

```

```

C-----
C      FILE IDENTIFICATION
C
C      HNAME, (HUSE(I), I=1,2), IVERS
C
C      3*MULT + 1
C
C      HNAME      FILE NAME (A6) 'CPHIST'
C      HUSE       USER IDENTIFICATION (A6)
C      IVERS      FILE VERSION NUMBER
C
C      MULT       1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
C-----

```

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C-----
C      1D FILE REFERENCE INFORMATION
C
C      EXPH1, EXPH2, EXPH3, EFLU1, EFLJ2, IHIST, IZONE, ISZ,
C      NPLUT, NPLU1, NPLU2, IXPH12, IXPH13, NRR1, NRR2, NRR3,
C      NRR4, IXPH18, IXPH19, IXPH20, NRTZ, NRTSZ, KRTZ, KRTSZ,
C      MPDZ1, MPDZ2, MPDSZ1, MPDSZ2, IXPH29, IXPH30
C
C      30
C
C-----

```

(CONT)

C				
CD	EXPH1	END OF EXPOSURE TIME (DAYS) FROM LAST SET OF DATA	-	
CD	EXPH2	RESERVED	-	
CD	EXPH3	RESERVED	-	
CD	EFLU1	CUTOFF ENERGY (EV) FOR FIRST FLUENCE	-	
CD	EFLU2	CUTOFF ENERGY (EV) FOR SECOND FLUENCE	-	
CD	IHIST	NUMBER OF SETS OF DATA	-	
CD	IZONE	NUMBER OF ZONES	-	
CD	ISZ	NUMBER OF SUBZONES	-	
CD	NFLUT	OPTION FOR TOTAL FLUENCE	-	
CD		0 - NOT PRESENT	-	
CD		1 - PRESENT	-	
CD	NFLU1	OPTION FOR FLUENCE IN FIRST RANGE	-	
CD		0 - NOT PRESENT	-	
CD		1 - PRESENT	-	
C			-	
CN		WHEN NFLU1 = 1, EFLU1 MUST BE GREATER THAN 0 AND	-	
CN		LIE IN THE ENERGY RANGE SPECIFIED IN THE	-	
CN		CROSS SECTION DATA	-	
C			-	
CD	NFLU2	OPTION FOR FLUENCE IN SECOND RANGE	-	
CD		0 - NOT PRESENT	-	
CD		1 - PRESENT	-	
C			-	
CA		WHEN NFLU2 = 1, EFLU2 MUST BE GREATER THAN 0 AND	-	
CN		LIE IN THE ENERGY RANGE SPECIFIED IN THE	-	
CN		CROSS SECTION DATA	-	
C			-	
CD	IXPH12	RESERVED	-	
CD	IXPH13	RESERVED	-	
CD	NRR1	OPTION FOR FISSIONS	-	
CD		0 - NOT PRESENT	-	
CD		1 - PRESENT	-	
CD	NRR2	OPTION FOR EXPOSURE	-	
CD		0 - NOT PRESENT	-	
CD		1 - PRESENT	-	
CD	NRR3	OPTION FOR ENERGY	-	
CD		0 - NOT PRESENT	-	
CD		1 - PRESENT	-	
CD	NRR4	OPTION FOR UNDEFINED	-	
CD		0 - NOT PRESENT	-	
CD		1 - PRESENT	-	
CD	IXPH18	RESERVED	-	
CD	IXPH19	RESERVED	-	
CD	IXPH20	INDICATOR NORMALLY = 0, BUT IS SET = 1 IF	-	
CD		A DISCONTINUITY EXISTS IN EXPOSURE TIMES	-	
CD	MRTZ	NUMBER OF ZONE PATHS	-	
CD	MRTSZ	NUMBER OF SUBZONE PATHS	-	
C			-	
CN		MRTZ + MRTSZ MUST BE LESS THAN OR EQUAL TO 70	-	
C			-	
CD	KRTZ	NUMBER OF ZONES ALONG EACH ZONE PATH	-	
CD	KRTSZ	NUMBER OF SUBZONES ALONG EACH SUBZONE PATH	-	

(CONT)


```

CD   MFDZ1      ZONE NUMBER CONTAINING FIRST ZONE PATH FEED      -
CD   MFDZ2      ZONE NUMBER CONTAINING LAST ZONE PATH FEED      -
CD   MFDZ2      MATERIAL COMPOSITION                            -
CD   MFDZ2      ZONE NUMBER CONTAINING LAST ZONE PATH FEED      -
CD   MFDZ2      MATERIAL COMPOSITION                            -
C                                           -
CM   MFDZ2 = MFDZ1                                           -
CM   OR                                           -
CM   MFDZ2 = MFDZ1 + MFTZ - 1                               -
C                                           -
CD   MFDZ1      ZONE NUMBER CONTAINING FIRST SUBZONE PATH FEED  -
CD   MFDZ1      MATERIAL COMPOSITION                            -
CD   MFDZ2      ZONE NUMBER CONTAINING LAST SUBZONE PATH FEED  -
CD   MFDZ2      MATERIAL COMPOSITION                            -
C                                           -
CM   MFDZ2 = MFDZ1                                           -
CM   OR                                           -
CM   MFDZ2 = MFDZ1 + MFTSZ - 1                               -
C                                           -
CD   IXP29      RESERVED                                         -
CD   IXP30      RESERVED                                         -
C                                           -
C-----

```

```

C-----
CR   2D      GENERAL INFORMATION                                -
C                                           -
CL   (EPHT(I), I=1,40), (TPHT(MRT), MRT=1, MFTT)              -
C                                           -
CM   40 + MFTT = 40 + (MFTZ + MFTSZ)                            -
C                                           -
CD   EPHT(1)    END OF EXPOSURE TIME (DAYS)                     -
CD   EPHT(2)    START OF EXPOSURE TIME (DAYS)                   -
CD   EPHT(3)    FRACTION OF COPE TREATED IN PROBLEM              -
CD   EPHT(4)    CONVERSION FACTOR, RATIO OF THERMAL ENERGY TO  -
CD   EPHT(4)    FISSION + CAPTURE ENERGY (FROM CROSS SECTIONS) -
CD   EPHT(5-43) RESERVED                                         -
CD   TPHT       EXPOSURE TIME BY ZONE AND SUBZONE PATH          -
CD   TPHT       (DAYS PER ZONE (SUBZONE))                        -
C                                           -
C-----

```

```

C-----
CR   3D      TOTAL FLUENCE                                      -
C                                           -
CC   PRESENT IF MFLUT = 1                                       -
C                                           -
CL   (FLUT(MT), MT=1, ITZSZ), (FLUTD(MRT), MRT=1, MFTT)        -
C                                           -
CM   ITZSZ + MFTT = (IZONE + ISZ) + (MFTZ + MFTSZ)              -
C                                           -
CD   FLUT       TOTAL FLUENCE BY ZONE AND SUBZONE (NEUTRONS/CM**2) -
CD   FLUT       ACCUMULATED ALONG PATHS                          -
CD   FLUTD      DISCHARGE TOTAL FLUENCE BY ZONE AND SUBZONE PATH -
CD   FLUTD      (NEUTRONS/CM**2)                                  -
C                                           -
C-----

```

(CONT)

```

C-----
CR  4D  FLUENCE TO FIRST CUTOFF ENERGY EPLU1
C
CC      PRESENT IF NPLU1 = 1
C
CL      (PLU1(NH),NH=1,ITZSZ), (PLU1D(NRT),NRT=1,NRTT)
C
CW      ITZSZ + NRTT = (IZONE + ISZ) + (NRTZ + NRTSZ)
C
CD  PLU1      FLUENCE IN FIRST RANGE BY ZONE AND SUBZONE
CD              (NEUTRONS/CM**2) ACCUMULATED ALONG PATHS
CD  PLU1D     DISCHARGE FLUENCE IN FIRST RANGE BY ZONE AND
CD              SUBZONE PATH (NEUTRONS/CM**2)
C
C-----

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```

C-----
CR  5D  FLUENCE TO SECOND CUTOFF ENERGY EPLU2
C
CC      PRESENT IF NPLU2 = 1
C
CL      (PLU2(NH),NH=1,ITZSZ), (PLU2D(NRT),NRT=1,NRTT)
C
CW      ITZSZ + NRTT = (IZONE + ISZ) + (NRTZ + NRTSZ)
C
CD  PLU2      FLUENCE IN SECOND RANGE BY ZONE AND SUBZONE
CD              (NEUTRONS/CM**2) ACCUMULATED ALONG PATHS
CD  PLU2D     DISCHARGE FLUENCE IN SECOND RANGE BY ZONE AND
CD              SUBZONE PATH (NEUTRONS/CM**2)
C
C-----

```

```

C-----
CR  6D  RESERVED
C-----

```

```

C-----
CR  7D  RESERVED
C-----

```

```

C-----
CR  8D  FISSIONS
C
CC      PRESENT IF NRR1 = 1
C
CL      (RR1(NH),NH=1,ITZSZ), (RR1D(NRT),NRT=1,NRTT)
C
CW      ITZSZ + NRTT = (IZONE + ISZ) + (NRTZ + NRTSZ)
C
CD  RR1      FISSIONS BY ZONE AND SUBZONE
CD              (FISSIONS/CM**3) ACCUMULATED ALONG PATHS
CD  RR1D     DISCHARGE FISSIONS BY ZONE AND SUBZONE PATH
CD              (FISSIONS/CM**3)
C
C-----

```

(CONT)

```

C-----
CR   9D   EXPOSURE
C
CC      PRESENT IF NRR2 = 1
C
CL      (RR2(MN),MN=1,ITZSZ), (RR2D(MRT),MRT=1,MRTT)
C
CW      ITZSZ + MRTT = (IZONE + ISZ) + (MRTZ + MRTSZ)
C
CD   RR2      EXPOSURE BY ZONE AND SUBZONE
CD              (MEGAWATT(THERMAL)-DAYS/KG) ACCUMULATED ALONG
CD              PATHS
CD   RR2D     DISCHARGE EXPOSURE BY ZONE AND SUBZONE PATH
CD              (MEGAWATT(THERMAL)-DAYS/KG)
C-----

```

```

C-----
CR   10D  ENERGY
C
CC      PRESENT IF NRR3 = 1
C
CL      (RR3(MN),MN=1,ITZSZ), (RR3D(MRT),MRT=1,MRTT)
C
CW      ITZSZ + MRTT = (IZONE + ISZ) + (MRTZ + MRTSZ)
C
CD   RR3      ENERGY BY ZONE AND SUBZONE
CD              (MEGAWATT(THERMAL)-DAYS/CN**3) ACCUMULATED ALONG
CD              PATHS
CD   RR3D     DISCHARGE ENERGY BY ZONE AND SUBZONE PATH
CD              (MEGAWATT(THERMAL)-DAYS/CN**3)
C-----

```

```

C-----
CR   11D  UNDEFINED
C
CC      PRESENT IF NRR4 = 1
C
CL      (RR4(MN),MN=1,ITZSZ), (RR4D(MRT),MRT=1,MRTT)
C
CW      ITZSZ + MRTT = (IZONE + ISZ) + (MRTZ + MRTSZ)
C
CD   RR4      UNDEFINED BY ZONE AND SUBZONE
CD   RR4D     UNDEFINED BY ZONE AND SUBZONE PATH
C-----

```

```

C*****
C
CEOF      CPHIST
C
C*****

```

SPECIFICATIONS FOR INTERFACE FILE PTATDM

```

C*****
C                                     REFERENCE 02/01/79 ORNL-5180
C
C
CP      PTATDM
C
CE      POINT NUCLIDE DENSITIES
C
C*****

```

```

C-----
CR      FILE IDENTIFICATION
C
CL      HNAME, (HUSE(I), I=1,2), IVERS
C
CW      3*MULT + 1
C
CD      HNAME      FILE NAME (A6) 'PTATDM'
CD      HUSE       USER IDENTIFICATION (A6)
CD      IVERS      FILE VERSION NUMBER
C
CW      MULT       1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
C-----

```

```

C-----
CR      1D      FILE REFERENCE INFORMATION
C
CL      TIME, XPTD2, XPTD3, NCT, NZPT, NPT, NNS, NBLKPT, IPTD9, IPTD10,
CL      NZONE, NSZ, NINTI, NINTJ, NINTK, IPTD16, IPTD17, IPTD18, IPTD19, IPTD20
C
CW      20
C
CD      TIME      REFERENCE REAL TIME, DAYS
CD      XPTD2     RESERVED
CD      XPTD3     RESERVED
CD      NCT       REFERENCE CYCLE NUMBER
CD      NZPT      NUMBER OF ZONES FOR WHICH POINT DATA IS PRESENT
CD      NPT       NUMBER OF POINTS
C
CN      NPT = NZPNT(1) + NZPNT(2) + ... + NZPNT(NZPT)
C
CD      NNS       MAXIMUM NUMBER OF NUCLIDES IN ANY SET
CD      NBLKPT    NUMBER OF BLOCKS OF ATOM DENSITY DATA
CD              (MUST DIVIDE EVENLY INTO NPT)
CD      IPTD9     RESERVED
CD      IPTD10    OPTION TO INCLUDE VOLUME INFORMATION IF .EQ. 1
CD      NZONE     NUMBER OF ZONES
CD              FOR DOCUMENTATION (IF NONZERO MUST AGREE WITH OTHER
CD              PARAMETERS)
CD      NSZ       NUMBER OF SUBZONES
CD              FOR DOCUMENTATION (IF NONZERO MUST AGREE WITH OTHER
CD              PARAMETERS)
CD      NINTI     NUMBER OF FIRST DIMENSION FINE MESH INTERVALS
CD              FOR DOCUMENTATION (IF NONZERO MUST AGREE WITH OTHER
CD              PARAMETERS)

```

(CONT)

CD	NINTJ	NUMBER OF SECOND DIMENSION FINE MESH INTERVALS	-
CD		FOR DOCUMENTATION (IF NONZERO MUST AGREE WITH OTHER	-
CD		PARAMETERS)	-
CD	NINTK	NUMBER OF THIRD DIMENSION FINE MESH INTERVALS	-
CD		FOR DOCUMENTATION (IF NONZERO MUST AGREE WITH OTHER	-
CD		PARAMETERS)	-
CD	IPTD16	RESERVED	-
CD	IPTD17	RESERVED	-
CD	IPTD18	RESERVED	-
CD	IPTD19	RESERVED	-
CD	IPTD20	RESERVED	-
C			-
C			-

C	-----		
CR	2D	GENERAL INFORMATION	-
C			-
CL	(NZPNT(NZ), NZ=1, NZPT), (NZPNT(NZ), NZ=1, NZPT),		-
CL	(LZPNT(NZ), NZ=1, NZPT), (LOCPT(NP), NP=1, NPT)		-
C			-
CW	3*NZPT+NPT		-
C			-
CD	NZPNT(NZ)	ZONE NUMBERS	-
CD	NZPNT(NZ)	NUMBER OF POINTS IN EACH ZONE	-
CD	LZPNT(NZ)	NUCLIDE SET REFERENCE	-
CD		FOR DOCUMENTATION	-
CD	LOCPT(NP)	POINT LOCATIONS IN THE RANGE 1 TO NINTI*NINTJ*NINTK	-
CD		FOR DOCUMENTATION	-
CD		(MAY BE ZERO IF NINTI, NINTJ AND NINTK ARE ZERO)	-
C			-
CN		LOCPT = (K-1)*NINTI*NINTJ + (J-1)*NINTI + I	-
CN		WHERE I IS FIRST DIMENSION INDEX	-
CN		J IS SECOND DIMENSION INDEX	-
CN		K IS THIRD DIMENSION INDEX	-
C			-
CN		GIVEN NINTI, NINTJ, NINTK AND LOCPT THE INDICES	-
CN		I, J, K MAY BE DETERMINED	-
C			-
C			-

C	-----		
CR	3D	VOLUME INFORMATION	-
C			-
CC		PRESENT IF IPTD10 .EQ. 1	-
C			-
CL	(VZPNT(NZ), NZ=1, NZPT), (VOLPT(NP), NP=1, NPT)		-
C			-
CW	NZPT+NPT		-
C			-
CD	VZPNT(NZ)	ZONE VOLUME (CN**3)	-
CD	VOLPT(NP)	POINT VOLUME (CN**3)	-
C			-
C			-

(CONT)

```

C-----
C      AD      POINT NUCLIDE DENSITIES
C
C      ((PDEN(N,J),N=1,NNS),J=JL,JU) ----SPE STRUCTURE BELOW----
C
C      NNS*((NPT-1)/NBLKPT+1)
C
C      DO 1 N=1,NBLKPT
C      1 READ(I) *LIST AS ABOVE*
C
C      WITH N AS THE BLOCK INDEX, JL=(N-1)*((NPT-1)/NBLKPT+1)+1
C      AND JU=N*((NPT-1)/NBLKPT+1)
C
C      PDEN(N,J)      ATOMIC DENSITY OF NUCLIDE ORDERED N IN THE
C                      ASSOCIATED SET GIVEN IN ORDER FOR EACH POINT
C-----
C*****
C
C      CPOF      PTATDN
C
C*****

```

SPECIFICATIONS FOR INTERFACE FILE QNATDN

```

C*****
C               REFERENCE 02/01/79 ORNL-5180
C
C       QNATDN
C
C       ZONE(SUBZONE) NUCLIDE DENSITIES (DISCHARGE)
C
C*****

```

```

C-----
C       FILE IDENTIFICATION
C
C       HNAME, (HUSE(I), I=1,2), IVERS
C
C       3*MULT + 1
C
C       HNAME      FILE NAME (A6) 'QNATDN'
C       HUSE       USER IDENTIFICATION (A6)
C       IVERS      FILE VERSION NUMBER
C
C       MULT       1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
C-----

```

```

C-----
C       1D      FILE REFERENCE INFORMATION
C
C       TIME, NCY, NTZSZ, NNS, NBLKAD
C
C       5
C
C       TIME      REFERENCE REAL TIME, DAYS
C       NCY       REFERENCE CYCLE NUMBER
C       NTZSZ     NUMBER OF ZONES PLUS NUMBER OF SUBZONES
C       NNS       MAXIMUM NUMBER OF NUCLIDES IN ANY SET
C       NBLKAD    NUMBER OF BLOCKS OF ATOM DENSITY DATA
C                (MUST DIVIDE EVENLY INTO NTZSZ)
C
C-----

```

(CONT)

```

C-----
C 25  ZONE (SUBZONE) NUCLIDE DENSITIES (DISCHARGE) -
C -
C  ((ADEN(N,J),N=1,NNS),J=JL,JU) ----SEE STRUCTURE BELOW---- -
C -
C      NNS*((NTZSZ-1)/NBLKAD+1) -
C -
C  DO 1 N=1,NBLKAD -
C  1 READ(I) *LIST AS ABOVE* -
C -
C      WITH N AS THE BLOCK INDEX, JL=(N-1)*((NTZSZ-1)/NBLKAD+1)+1 -
C      AND JU=N*((NTZSZ-1)/NBLKAD+1) -
C -
C  ADEN(J,J)  ATOMIC DENSITY OF NUCLIDE ORDERED N IN THE -
C              ASSOCIATED SPT GIVEN IN ORDER FOR EACH ZONE -
C              FOLLOWED IN ORDER FOR EACH SUBZONE -
C-----
C*****
C
C  CEOP      QNATDN -
C -
C*****

```


SPECIFICATIONS FOR INTERFACE FILE ZNTENP

```

C*****
C                                REFERENCE 02/01/79 OZSL-5180
C
C      ORIGINAL SPECS REVISED TO INCLUDE SUBZONE DATA WHEN NEEDED
C
C      ZNTENP
C
C      ZONE TEMPERATURE DATA
C
C*****

```

```

C-----
C      FILE IDENTIFICATION
C
C      CL      RNAME, (RUSE(I), I=1, 2), IVERS
C
C      CW      3*NULT + 1
C
C      CD      RNAME      FILE NAME (A6) 'ZNTENP'
C      CD      RUSE      USER IDENTIFICATION (A6)
C      CD      IVERS      FILE VERSION NUMBER
C
C      CW      NULT      1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
C-----

```

```

C-----
C      FILE REFERENCE INFORMATION
C
C      CL      NRZ, NZT, NSZ, (NA(I), I=1, 17)
C
C      CW      20
C
C      CD      NRZ      NUMBER OF REACTOR ZONES, NOT ZERO
C      CD      NZT      NUMBER OF TEMPERATURES FOR EACH ZONE .LE. 5
C      CD      NSZ      NUMBER OF REACTOR SUBZONES
C      CD      NA      RESERVED
C
C      CW      OFTEN A SINGLE TEMPERATURE WILL BE CARRIED WHICH SERVES AS A
C      CW      REFERENCE, AS TO EXPRESS THE EFFECTIVE TEMPERATURE OF THE ZONE
C      CW      WHICH MAY BE USED SIMPLY FOR SUCH PURPOSE AS CROSS SECTION
C      CW      CORRELATION. EVEN IF TWO TEMPERATURES ARE CARRIED TO INCLUDE
C      CW      THE COOLANT TEMPERATURE, THE FIRST IS INTENDED TO ADMIT SUCH
C      CW      SIMPLE APPLICATION (LINEAR INTERPOLATION OF CROSS SECTIONS
C      CW      IS ADMITTED WHICH MAY BE DONE AT THE MACROSCOPIC LEVEL USING
C      CW      TWO MICROSCOPIC CROSS SECTION SETS).
C
C
C-----

```

(CONT)

```

C-----
C      ZONE TEMPERATURES
C
C      ALWAYS PRESENT
C
C      ((ZTEMP(I,N),I=1,NZT),N=1,NRZ)
C
C      NZT*NRZ
C
C      ZTEMP      TEMPERATURE OF REFERENCE I IN ZONE N (DEGREES C)
C                   I      REFERENCE
C                   -      -
C                   1      ACTINIDES (FUEL) --- REFERENCE
C                   2      COOLANT
C                   3      MODERATOR
C                   4      STRUCTURAL
C                   5      SPECIAL
C-----

```

```

C-----
C      SUBZONE TEMPERATURES
C
C      PRESENT IF NSZ .NE. 0
C
C      ((SZTEMP(I,N),I=1,NZT),N=1,NSZ)
C
C      NZT*NSZ
C
C      SZTEMP      TEMPERATURE OF REFERENCE I IN SUBZONE N (DEGREES C)
C
C      SEE NOTES ABOUT ZONE TEMPERATURE DATA
C-----

```

```

C*****
C      ZTEMP
C*****

```

SPECIFICATIONS FOR INTERFACE FILE ZRPOWD

```

*****
C                                     REFERENCE 02/01/79 ORNL-5180
C
C  ORIGINAL SPECS REVISED TO INCLUDE SUBZONE DATA WHEN NEEDED
C
C  ZRPOWD
C
C  ZONE AVERAGE AND PEAK POWER DENSITY
C
*****

```

```

-----
C  FILE IDENTIFICATION
C
C  NAME, (RUSE(I), I=1,2), IVERS
C
C  3*NULT + 1
C
C  NAME      FILE NAME (A6) 'ZRPOWD'
C  RUSE      USER IDENTIFICATION (A6)
C  IVERS     FILE VERSION NUMBER
C
C  NULT      1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
-----

```

```

-----
C  1D  FILE REFERENCE INFORMATION
C
C  POW, TIME, XZPD3, XZPD4, XZPD5, XZPD6, XZPD7, XZPD8,
C  NZONE, XZPD10, XZPD11, NSZ, XZPD13, XZPD14, XZPD15,
C  XZPD16, XZPD17, XZPD18, XZPD19, XZPD20
C
C  2D
C
C  POW      REFERENCE REACTOR POWER LEVEL, WATTS
C  TIME     REFERENCE TIME IN THE HISTORY, DAYS
C  XZPD3    RESERVED
C  XZPD4    RESERVED
C  XZPD5    RESERVED
C  XZPD6    RESERVED
C  XZPD7    RESERVED
C  XZPD8    RESERVED
C  NZONE    NUMBER OF REACTOR ZONES
C  XZPD10   OPTION FOR PEAK ZONE DATA
C  XZPD11   OPTION ON FILE CONTENTS
C           0- ZONE POWER DENSITY INCLUDES ANY SUBZONE
C             CONTRIBUTION (ALTHOUGH NSZ MAY BE ZERO)
C           1- ZONE POWER DENSITY AND SUBZONE POWER DENSITY
C             CARRIED SEPARATELY
C  NSZ      NUMBER OF REACTOR SUBZONES
C  XZPD13   OPTION FOR REFERENCE INFORMATION
C
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(CONT)

CD	IZPD14	RESERVED
CD	IZPD15	RESERVED
CD	IZPD16	RESERVED
CD	IZPD17	RESERVED
CD	IZPD18	RESERVED
CD	IZPD19	RESERVED
CD	IZPD20	RESERVED

C

C-----

CR	2D	ZONE AVERAGE POWER DENSITIES (TOTAL)
C		
CC		PRESENT IF IZPD11 .EQ. 0
C		
CL		(ZPOW (N) , N=1, NZONE)
C		
CW		NZONE
C		
CD	ZPOW	ZONE AVERAGE POWER DENSITY, WATTS/CC
C		
CH		$ZPOW(N) = VPPA(N) * ZPD(N) + SUM(OVER J FOR NZSZ(J) = N) OF$
CW		$VSSZ(J) * SZPD(J)$
C		

C-----

C-----

CR	3D	PEAK ZONE POWER DENSITIES
C		
CC		PRESENT IF IZPD11 .EQ. 0 AND IZPD10 .EQ. 1
C		
CL		(PZPOW (N) , N=1, NZONE)
C		
CW		NZONE
C		
CD	PZPOW	PEAK ZONE POWER DENSITY AT THE MESH POINT LEVEL,
CD		WATTS/CC
C		

C-----

C-----

CR	4D	ZONE AVERAGE POWER DENSITIES
C		
CC		PRESENT IF IZPD11 .EQ. 1
C		
CL		(ZPD (N) , N=1, NZONE)
C		
CW		NZONE
C		
CD	ZPD	ZONE AVERAGE POWER DENSITY, WATTS/CC
C		

C-----

(CONT)

C-129

C.....
C
CEDP ZEPOND
C
C.....

SPECIFICATIONS FOR INTERPACE FILE PERTUB

```

C *****
C                               REVISED 04/01/80
C
C      PERTUB
C
C      PERTURBATION DATA - REGULAR AND ADJOINT FLUX INTEGRALS
C
C *****

```

```

C -----
C      FILE IDENTIFICATION
C
C      CL      HNAME, (HUSE(I), I=1,2), IVERS
C
C      CN      3*NULT + 1
C
C      CD      HNAME          HOLLERITH FILE NAME - PERTUB - (A6)
C      CD      HUSE(1)        HOLLERITH USER IDENTIFICATION - (A6)
C      CD      IVERS          FILE VERSION NUMBER
C
C      CN      NULT           1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
C -----

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```

C -----
C      FILE REFERENCE INFORMATION (1D RECORD)
C
C      CL      BIGDAD, IK, CR, I1, NZONE, NGROUP, IND, N1, N2, N3, N4
C
C      CN      11
C
C      CD      BIGDAD          BIG-DADDY FORMALIZATION FACTOR
C                               INTEGRAL ADJOINT*CHI*FORWARD*HUSIGY/K
C      CD      IK              MULTIPLICATION FACTOR (K-EFF)
C      CD      CR              PRIMITIVE FISSILE CONVERSION RATIO
C      CD      I1              ABSORPTION RATE IN FISSILE NUCLIDES
C      CD      NZONE           NUMBER OF GEOMETRIC ZONES
C      CD      NGROUP          NUMBER OF NEUTRON ENERGY GROUPS
C      CD      IND             OPTION FOR INCLUDING TRANSPORT INTEGRALS
C      CD      1SD             FLAG ON PROBLEM TYPES -
C      CD      N1              0- MEANING NO PROBLEMS WERE SOLVED, OR THEY
C                               WERE EIGENVALUE PROBLEMS
C      CD      N2              1 IS ADDED TO THIS IF A FIXED SOURCE FORWARD
C                               PROBLEM WAS SOLVED
C      CD      N3              10 IS ADDED TO THIS IF A FIXED SOURCE ADJOINT
C                               PROBLEM WAS SOLVED
C      CD      N4              RESERVED FOR FUTURE USE
C      CD      N5              RESERVED FOR FUTURE USE
C      CD      N6              RESERVED FOR FUTURE USE
C
C -----

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(CONT)

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C-----
C      INTEGRALS FOR PRODUCTION MACRO (2D RECORD)
C
C      ((T(N,K),N=1,NZONE),K=1,NGROUP)
C
C      NZONE*NGROUP
C
C      T      FLUX(K)*CHI(KK)*ADJOINT(KK), INTEGRAL OVER KK
C              AND VOLJEF, DIVIDED BY THE MULTIPLICATION
C              FACTOR, VOLUME INTEGRALS
C-----

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```

C-----
C      FLUX, ADJOINT VOLUME INTEGRALS (3D RECORD)
C
C      ((S(N,KK),N=1,NZONE),KK=1,NGROUP)-----NOTE STRUCTURE BELOW-----
C
C      NZONE*NGROUP
C
C      DO 1 K=1,NGROUP
C      1 READ(N) *LIST AS ABOVE*
C
C      S      FLUX(KK)*ADJOINT(K) VOLUME INTEGRALS
C              (INTO GROUP K)
C-----

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```

C-----
C      INTEGRALS FOR TRANSPORT (4D RECORD)
C
C      PRESENT ONLY IF IND.GT.0
C
C      ((D(N,K),N=1,NZONE),K=1,NGROUP)
C
C      NZONE*NGROUP
C
C      D      FLUX(K)*ADJOINT(K) VOLUME INTEGRALS
C-----

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C-----
C      PERTUB
C-----

```


SPECIFICATIONS FOR INTERFACE FILE FISSOR

C.....
 C REVISED 04/01/80
 C
 CF FISSOR
 C
 CE FISSOR SOURCE BY INTERVAL AND DISTRIBUTION FUNCTION
 C
 C.....

C-----
 CF FILE IDENTIFICATION
 C
 CL HNAME, (HUSE(I), I=1,2), IVERS
 C
 CW 3*HULT + 1
 C
 CD HNAME HOLLERITH FILE NAME - FISSOR - (A6)
 CD HUSE(I) HOLLERITH USER IDENTIFICATION (A6)
 CD IVERS FILE VERSION NUMBER
 C
 CH HULT 1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
 C
 C-----

C-----
 CF FILE REFERENCE INFORMATION (1D RECORD)
 C
 CL TIME, POWER, KEFF, IN, JN, KN, NCY, NG, NZ
 C
 CW 9
 C
 CD TIME REFERENCE REAL TIME, DAYS
 CD POWER POWER LEVEL FOR ACTUAL NEUTRONICS PROBLEM,
 CD WATTS THERMAL
 CD KEFF MULTIPLICATION FACTOR
 CD IN NUMBER OF FIRST DIMENSION FINE INTERVALS
 CD JN NUMBER OF SECOND DIMENSION FINE INTERVALS
 C
 CH FOR SPECIAL TRIANGULAR GEOMETRIES, IN IS THE NUMBER OF
 CH TRIANGLES ON EACH PLANE AND JN IS NOT DEFINED (SET TO 1)
 C
 CD KN NUMBER OF THIRD DIMENSION FINE INTERVALS
 CD NCY REFERENCE COUNT (CYCLE NUMBER)
 CD NG NUMBER OF ENERGY GROUPS
 CD NZ NUMBER OF ZONES
 C
 C-----

(CONT)

```

C-----
CB          FISSION SOURCE DISTRIBUTION FUNCTION (2D RECORD)
C
CL          ((CHIN(N,K),N=1,NZ),K=1,NG)
C
CW          NG*NZ
C
CB          CHIN(N,K)    SOURCE OF NEUTRONS IN GROUP K, ZONE N
C
C-----

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```

C-----
CB          FISSION SOURCE VALUES (3D RECORD)
C
CL          ((PFS(I,J),I=1,IN),J=1,JN)-----NOTE STRUCTURE BELOW-----
C
CW          IN*JN
C
CS          DO 1 K=1,KH
CS 1 READ(N) *LIST AS ABOVE*
C
CB          PFS(I,J)          FISSION SOURCE BY INTERVAL, NEUTRONS/SEC/CC
C
C-----

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C*****
C
CEOF          FISSOR
C
C*****

```

SPECIFICATIONS FOR INTERFACE FILE RODSET

```

*****
C                                     REVISED 04/01/80
C
C
CF      RODSET
C
CE      CONTROL ROD REFERENCE POSITIONING DATA
C
*****

```

```

-----
C      FILE IDENTIFICATION
C
CL      NAME, (NUSE(I), I=1,2), IVERS
C
CW      (3*NULT+1) = NUMBER OF WORDS.
C
CD      NAME      FILE NAME (A6) 'RODSET'.
CD      NUSE      USER IDENTIFICATION (A6).
CD      IVERS     FILE VERSION NUMBER.
C
CW      NULT      1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES.
C
C
C
-----

```

```

-----
C      FILE REFERENCE INFORMATION (10 RECORD)
C
CL      NCRN, NFRN, NCR, NERT, NSRPS, NCTD, NSE, NOE, ISV, NRW, NRI, NSH,
CL      (I1(I), I=1,8)
C
CW      (20) = NUMBER OF WORDS.
C
CD      NCRN      NUMBER OF CONTROL ROD ZONE NUCLIDES.
C
CD      NFRN      NUMBER OF CONTROL ROD FOLLOWER ZONE NUCLIDES.
C
CD      NCR       NUMBER OF DIFFERENT ZONE SETS (RODS).
C
CD      NERT      NUMBER OF ENTRIES IN THE REFERENCE TABLE OF ROD
CD              ZONES.
C
CD      NSRPS     NUMBER OF SETS OF ROD POSITION SPECIFICATIONS.
C
CD      NCTD      NUMBER OF POINTS IN THE HISTORY (BETWEEN REFUELINGS)
CD              FOR WHICH ROD POSITIONING DATA IS SPECIFIED.
C
CD      NSE       NUMBER OF ZONES FOR WHICH SPECIAL FULL ROD INSERTION-
CD              (OR WITHDRAWAL) DATA ARE SPECIFIED BELOW, USED FOR
CD              'PODING' OPTION IX(10)=-2, OR --1. IF FULL ROD
CD              INSERTION (WITHDRAWAL) IS SPECIFIED AND THIS SPECIAL-
CD              DATA IS NOT PRESENT, THE MATERIAL ADR (ADP) WILL BE
CD              INSERTED IN ALL ROD ZONES NRZ BELOW.
C

```

(CONT)

C		
CD	NOZ	OPTION ON BSIS; FILL NOB INSERTION (WITHDRAWAL) DATA.
CB		0- THE ONLY SPECIFICATIONS GIVEN BY SPECIAL
CB		FILL NOB INSERTION (WITHDRAWAL) DATA.
CB		1- INSERT MAXIMUM ADR (ADR) IN ALL NOB ZONES FIRST,
CB		THEN APPLY SPECIAL FILL NOB INSERTION (WITHDRAWAL) DATA IN AN OVERLAY SENSE.
CB		*****NOTE FOR FILL NOB INSERTION, OR FILL NOB
CB		AND EXPOSED IN THE SPECIFIED ZONES PRIOR TO
CB		THE INSERTION.
CB	ISA	OPTION ON SAVE DATA RECORDS.
CB		0- NO SAVE DATA RECORDS PRESENT ON THIS FILE.
CB		67-0- THE TSD SAVE DATA RECORDS ARE 1 ASSET ON
CB		THIS FILE.
CB		*****NOTE - THE SAVE DATA RECORDS ARE A RECORD OF
CB		THE POSITIONING, IT IS RECOMMENDED THAT THIS
CB		OPTION BE 3 IN WHICH CASE THE CODE CREATES
CB		THE TWO RECORDS ON FIRST ACCESS.
CB	NBS	OPTION ON CONCENTRATIONS IN MARK-UP ZONE FOR NOB
CB		WITHDRAWAL (REI - 67, 0 BELOW) FOR .MODIMS. OPTION
CB		IX(10) 67, 0.
CB		0- ZERO NOC CONCENTRATIONS AND REPLACE FOLLOWER
CB		CONCENTRATIONS WITH ADR DATA (IF PRESENT).
CB		1- ONLY ZERO NOB CONCENTRATIONS.
CB		2- DO NOT CHANGE ANY CONCENTRATIONS.
CB	NSY	OPTION ON CONCENTRATIONS IN MARK-UP ZONE FOR NOB
CB		INSERTION (REI - 67, 0 BELOW) FOR .MODIMS. OPTION
CB		IX(10) 67, 0.
CB		0- REPLACE NOB CONCENTRATIONS WITH ADR DATA.
CB		1- DO NOT CHANGE ANY CONCENTRATIONS.
CB		2- ONLY ZERO NOB CONCENTRATIONS.
CB		3- ZERO NOB CONCENTRATIONS AND REPLACE FOLLOWER
CB		CONCENTRATIONS WITH ADR DATA (IF PRESENT).
CB	NSN	NUMBER OF ZONES FOR WHICH SPECIAL SHORT-DOWN NOB DATA
CB		ARE GIVEN BELOW. THIS DATA MUST BE PRESENT IF THE
CB		.MODIMS. OPTION IX(11)=1.

C-----
 C REFERENCE NUCLIDE DATA (2D RECORD) -----
 C
 C CC PRESENT IF NCRN + NFRN .GT. 0 -----
 C
 C CL (NUF(N), N=1, NCRN), (NUF(N), N=1, NFRN), (ADR(N), N=1, NCRN), (ADP(N), N=1, -----
 C NFRN)
 C
 C CN ((MULT+1)*(NCRN+NFRN)) = NUMBER OF WORDS. -----
 C
 C C NFR ROD ZONE NUCLIDE USER UNIQUE NAME, NISONS (A6). -----
 C
 C C NUF FOLLOWER ZONE NUCLIDE USER UNIQUE NAME, NISONS (A6). -----
 C C MAY INCLUDE NUCLIDES IN THE ROD LIST NFR.
 C
 C C ADR ROD NUCLIDE DENSITIES (ATOMS/BN-CM) - MAY BE ROD -----
 C C INSERTION FOLLOWER (TOP OF ROD) MATERIAL. IF SO
 C C IT CANNOT BE USED FOR FULL ROD INSERTION.
 C
 C C ADP FOLLOWER NUCLIDE DENSITY (ATOMS/BN-CM) - USED FOR -----
 C C ROD REMOVAL (BOTTOM OF ROD).
 C-----

C-----
 C REFERENCE TABLE OF ROD ZONES (3D RECORD) -----
 C
 C CC ALWAYS PRESENT -----
 C
 C CL (NRZ(I), I=1, NERT) -----
 C
 C CN (NERT) = NUMBER OF WORDS. -----
 C
 C C NRZ NUMBER OF A ZONE. -----
 C
 C CN THIS DATA IS PRESENTED IN SETS OF ZONE NUMBERS, EACH SET -----
 C CN REPRESENTING A ROD OR BLOCK OF THEM. EACH SET OF DATA IS
 C CN FOLLOWED BY A ZERO ENTRY. REFERENCE TO A SET IS BY ORDER OF
 C CN PRESENTATION (=J IN NZI (J,L) BELOW). THE ORDERING OF THE
 C CN ZONE NUMBERS IN EACH SET INDICATES ROD END POSITION BY
 C CN INSERTION. THUS ROD INSERTION IN ONLY THE FIRST ZONE GIVEN
 C CN WOULD BE MINIMUM INSERTION AND ROD INSERTION IN THE LAST
 C CN ZONE IN THE LIST WOULD BE MAXIMUM INSERTION.
 C CN IF THE LAST ZONE NUMBER IS A SET IS THE SAME AS THE FIRST
 C CN ZONE NUMBER, THIS INDICATES A 'CLOSED-LOOP' SET OF ZONES.
 C CN A 'CLOSED-LOOP' SET OF ZONES IS NOT A SET OF ROD ZONES, BUT
 C CN IS A SET IN WHICH ALL NUCLIDES IN THE ZONES MAY BE
 C CN INTERCHANGED. ONLY THE OPTIONS IX(10) =0 OR =1 APPLY AND
 C CN THESE SETS WILL BE IGNORED FOR ALL OTHERS. SEE NZI BELOW.
 C CN THERE MAY BE SUBZONES IN THE PROBLEM, BUT THE ROD AND
 C CN FOLLOWER NUCLIDES MUST BE ASSIGNED TO AND HANDLED ON A
 C CN ZONE BASIS, NOT SUBZONE.
 C
 C CN NCR SETS OF ZONE NUMBERS ARE REQUIRED. -----
 C-----

(CONT)

C-----
 C
 CS THE FOLLOWING RECORDS ARE IN SETS OF TWO, NSRPS OF THEM.
 C-----
 C

C-----
 CR REFERENCE POINT IN HISTORY (4D RECORD)
 C
 CC PRESENT IF NCYD .GT. 0
 C
 CL (PEH(L),L=1,NCYD),NOP,(J1(I),I=1,10)
 C
 CW (NCYD+11) = NUMBER OF WORDS.
 C
 CD PEH FRACTION OF THE EXPOSURE TIME BETWEEN PUELINGS,
 CD 0 MEANS START, 1.0 MEANS END, GT 1.0 IS GARBAGE.
 C
 CD NOP OPTION DISCUSSED BELOW.
 C-----
 C

C-----
 CR REFERENCE SET OF ROD POSITION SPECIFICATIONS (5D RECORD)
 C
 CC PRESENT IF NCYD .GT. 0
 C
 CL ((N2I(J,L),J=1,NCR),L=1,NCYD)
 C
 CW (NCR*NCYD) = NUMBER OF WORDS.
 C
 CD N2I HAS A MEANING WHICH IS DEPENDENT ON OPTION NOP.
 C
 C
 C IF NOP IS 0
 C
 C N2I IS THE NUMBER OF THE LAST ZONE IN SET J (NRZ ABOVE)
 C HAVING ROD INSERTION AT POINT L IN THE HISTORY, I.E., ALL
 C ROD AND FOLLOWER MATERIAL CONCENTRATIONS ARE ZEROED IN ALL
 C ZONES IN THE SET - THEN ROD MATERIAL (CONCENTRATIONS ADR)
 C IS INSERTED IN ORDER IN ALL ZONES IN THE SET THROUGH N2I AND
 C FOLLOWER (CONCENTRATIONS ADF) IS INSERTED IN ORDER FOR ALL
 C REMAINING ZONES IN THE SET. NOTE THAT ONLY THE NUCLIDES
 C THAT ARE ASSIGNED TO EACH ZONE, OUT OF THE NWR AND NWF LIST
 C ABOVE, ARE INVOLVED. THIS OPTION COULD BE USED TO INITIALIZE
 C THE CONTENTS OF THE ROD ZONES AT SOME POINT IN THE HISTORY.
 C ROD-FOLLOWER EXPOSURE CANNOT BE FOLLOWED.
 C IF N2I=0 FOR SOME SET J, NO CHANGES WILL BE MADE IN THAT
 C SET OF ROD ZONES.
 C THIS OPTION WILL BE IGNORED FOR A 'CLOSED-LOOP' SET.
 C IF NOP .EQ. 1
 C

(CONT)

WZI IS THE NUMBER OF ZONE MATERIAL INTERCHANGES REQUIRED
 FOR SET J AT POINT L IN THE HISTORY TO EFFECT THE DESIRED
 ROD WITHDRAWAL (OR INSERTION IF WZI .LT. 0). ROD AND
 FOLLOWER NUCLIDE CONCENTRATIONS (IN THE LIST OF ZONES ABOVE)
 WILL BE INTERCHANGED IN A PUSH-DOWN SENSE WZI TIMES. FOR
 EXAMPLE FOR A NON 'CLOSED-LOOP' SET, IF THE WZI ZONE
 NUMBERS FOR SET J WERE
 3(N3) 6(N6) 2(N2) 7(N7) 5(N5)
 WHERE N3'S REPRESENT THE ROD AND/OR FOLLOWER NUCLIDE
 CONCENTRATIONS IN THE ZONES AT POINT L IN THE HISTORY, THEN
 IF WZI = +2 (ROD WITHDRAWAL) TWO SUCCESSIVE INTERCHANGES
 WOULD BE MADE AND THE FINAL CONTENTS OF THE ZONES WOULD BE
 3(N2) 6(N7) 2(N5) 7(N6) 5(N3)
 WHERE N6 REPRESENTS THE CONCENTRATIONS INSERTED IN WAKED-UP
 ZONE 5 (SEE OPTION NWR ABOVE). IF WZI HAD BEEN -1 (ROD
 INSERTION), THEN THE CONTENTS OF THE ZONES WOULD BE
 3(N6) 6(N3) 2(N6) 7(N2) 5(N7)
 WHERE N6 REPRESENTS THE CONCENTRATIONS INSERTED IN WAKED-UP
 ZONE 3 (SEE OPTION NRI ABOVE).
 THIS WOP=1 OPTION MUST BE USED IF THE ROD-FOLLOWER EXPOSURE
 IS TO BE FOLLOWED.

IF A SET OF ZONES IS A 'CLOSED-LOOP' SET, I.E., THE LAST
 ZONE NUMBER EQUAL TO THE FIRST ZONE NUMBER, THEN MATERIAL
 IN THE SECOND (OR NEXT TO LAST IF WZI.LT.0) ZONE IS SAVED -
 THEN AFTER ALL INTERCHANGES HAVE BEEN MADE, THIS MATERIAL
 REPLACES THAT IN THE LAST (OR FIRST) ZONE IN THE LIST. FOR
 THE 'CLOSED-LOOP' SET, ALL NUCLIDES IN THE ZONES ARE
 INTERCHANGED, NOT JUST THOSE SPECIFIED BY NWR AND NRI.
 ALL ZONES IN A 'CLOSED-LOOP' SET MUST HAVE THE SAME NUCLIDES
 IN THE SAME ORDER. NORMALLY ONLY ONE INTERCHANGE WOULD BE
 SPECIFIED. FOR EXAMPLE IF THE 'CLOSED-LOOP' SET WERE
 3(N3) 6(N6) 2(N2) 7(N7) 3(N3)
 THEN AFTER ONE INTERCHANGE (WZI=+1) THE ZONES WOULD CONTAIN
 6(N2) 2(N7) 7(N3) 3(N6)
 FOR WZI=-1, THE ZONES WOULD CONTAIN
 3(N7) 6(N3) 2(N6) 7(N2)

TO CARRY OUT A CORRECT ROD POSITIONING SCHEDULE WITH THE
 AUTOMATED PROCEDURE, THE REPOSITIONING MUST INCLUDE EACH
 OF THE STEPS (POINTS IN THE HISTORY) IN THIS SET OF
 SPECIFICATIONS IF THEY ARE UNIQUE. (COMPLICATED
 APPLICATIONS CAN BE USED WHICH REQUIRE SELECTED
 APPLICATIONS, ONE OR MORE, TO CAUSE A PROPER SCHEDULE OF
 CONTROL ROD REMOVAL).
 THE OPTION WOP=0 IS GENERALLY MORE FLEXIBLE REGARDING THE
 POINTS IN THE HISTORY WHICH CAN BE USED FOR THE EXPOSURE
 THAN WOP=1, I.E., POINTS IN THE HISTORY MAY BE SKIPPED AND
 PROPER POSITIONING STILL BE ACCOMPLISHED.

(CONT)

CA	SPECIAL FILE NOB INSERION (WITHDRAWAL) DATA (66 RECORD)
CC	PRESENT IF 852-61.0
CL	(852(I)-1,852)
CM	(852) = NUMBER OF WORDS.
CD	852
C	NUMBER OF NOB 1021.

C-139


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C-----
CR      SPECIAL FULL ROD INSERTION (WITHDRAWAL) DATA (7L RECORDS) -
C
CC      PRESENT IF MSE.GT.0 -
C
C
CL      (ARD(J),J=1,NCRN), (APD(K),K=1,NPRN) ----SEE STRUCTURE BELOW----
C
CS      DO 1 I = 1,MSE
CS      1 READ(N) *LIST AS ABOVE*
C
CW      (NCRN+NPRN) = NUMBER OF WORDS.
C
CD      ARD          ATOM DENSITY OF ROD NUCLIDE.
C
CD      APD          ATOM DENSITY OF FOLLOWER NUCLIDE.
C
C-----

```

```

C-----
CR      SPECIAL SHUT-DOWN ROD DATA (8D RECORD) -
C
CC      PRESENT IF NSH.GT.0 -
C
C
CL      (NSH(I),I=1,NSH)
C
CW      (NSH) = NUMBER OF WORDS.
C
CD      NSH          NUMBER OF ROD ZONE.
C
C-----

```

```

C-----
CR      SPECIAL SHUT-DOWN ROD DATA (9D RECORDS) -
C
CC      PRESENT IF NSH.GT.0 -
C
C
CL      (SNR(J),J=1,NCRN) ----SEE STRUCTURE BELOW----
C
CS      DO 1 N = 1,NSH
CS      1 READ(N) *LIST AS ABOVE*
C
CW      (NCRN) = NUMBER OF WORDS.
C
CD      SNR          ATOM DENSITY OF ROD NUCLIDE.
C
C-----

```

(CONT)

```

C-----
CR      INTEGER SAVE DATA  (100 RECORD)
C
CC      PRESENT IF ISV.GT.0
C
CL      (IR(I),I=1,100)
C
CW      (100) = NUMBER OF WORDS.
C
CD      IR      INTEGER SAVE DATA - INITIALIZE ZERO.
C
CD      IR(1)    COUNT OF C.R.P. ACCESSSES.
CD      IR(2)    CYCLE NUMBER OF LAST C.R.P. ACCESS.
CD      IR(3)    C.R.P. OPTION (IR(10) - 'RODINS') OF LAST ACCESS.
CD      IR(4)    MEMORY REQUIRED FOR LAST C.R.P. ACCESS.
CD      IR(5)    POINT IN HISTORY OF LAST ACCESS.
C-----

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```

C-----
CR      REAL SAVE DATA  (110 RECORD)
C
CC      PRESENT IF ISV.GT.0
C
CL      (XR(I),I=1,100)
C
CW      (100) = NUMBER OF WORDS.
C
CD      XR      REAL SAVE DATA - INITIALIZE ZERO.
C
CD      XR(1)    TOTAL CYCLE TIME (XR(1) - 'RODINS') OF LAST ACCESS.
CD      XR(2)    TIME INTO CYCLE (TIME - 'ZNATDN') OF LAST ACCESS.
CD      XR(3)    FRACTION TIME INTO CYCLE OF LAST ACCESS.
C
CW      INFORMATION IS PLACED IN THESE TWO RECORDS BY THE CODE
CW      WHICH IS NEEDED FOR AUTOMATION OF ROD POSITIONING AND
CW      VERIFICATION TESTING. DATA NOT SPECIFIED HERE IS RESERVED
CW      FOR CODE INTERNAL USE AND SHOULD NOT BE SUPPLIED BY THE
CW      USER, BUT MAY BE RECOVERED FROM A FILE WRITTEN IN A
CW      PREVIOUS RUN TO CONTINUE A CALCULATION. THE USER SHOULD NOT
CW      SPECIFY THIS DATA AS A NORMAL INPUT.
C-----

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```

C-----
C
CEOF      RODSET
C
C-----

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SPECIFICATIONS FOR INTERFACE FILE RSTRTR

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C*****
C                                REVISED 08/01/80
C
C      RSTRTR
C
C      CODE-BLOCK-DEPENDENT RESTART DATA SAVED FOR RECOVERY
C
C*****

```

```

C-----
C      FILE IDENTIFICATION
C
C      CL      HNAME, (HUSE(I), I=1,2), IVERS
C
C      CW      3*HULT + 1
C
C      CD      HNAME          HOLLERITH FILE NAME - RSTRTR - (A6)
C      CD      HUSE(I)        HOLLERITH USER IDENTIFICATION (2A6)
C      CD      IVERS          FILE VERSION NUMBER
C                          VERSION 1 RESERVED FOR VENTURE
C
C      CW      HULT          1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
C-----

```

```

C-----
C      FILE REFERENCE INFORMATION
C
C      CL      NPI1, NPI2, NPI3, N1, N2, N3, N4, N5, NR1, NR2, L2
C
C      CW      11
C
C      CD      NPI1 - NPI3    FILE IDENTIFICATION FLAGS
C      CD      N1 - N5        RESERVED
C      CD      N1            NUMBER OF RECORDS OF TYPE 1 DATA
C      CD      NR2           NUMBER OF RECORDS OF TYPE 2 DATA
C      CD      L2            LENGTH OF ALL RECORDS OF TYPE 2 DATA
C
C-----

```

```

C-----
C      RECORD LENGTHS OF TYPE 1 DATA
C
C      CL      (NWIR(J), J=1, NR1)
C
C      CW      NR1
C
C      CD      NWIR(J)        NUMBER OF WORDS IN TYPE 1 DATA RECORD RECORD J
C
C-----

```

(CONT)

SPECIFICATIONS FOR INTERFACE FILE TRIGON

C.....
 C REVISED 04/01/80
 C
 CP TRIGON
 C
 CE TRIANGULAR GEOMETRY DESCRIPTION
 C
 C.....

C-----
 CR FILE IDENTIFICATION (UV)
 C
 CL NAME, (NUSE(I), I=1,2), IVERS
 C
 CW 1+3*NUST
 C
 CD NAME HOLLERITH FILE NAME - TRIGON (A6)
 CD NUSE HOLLERITH USER IDENTIFICATION (A6)
 CD IVERS FILE VERSION NUMBER
 C
 CW NUST 1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
 C
 C-----

C-----
 CR FILE REFERENCE INFORMATION (1D RECORD)
 C
 CL IGOH, NZONE, NREG, NZCL, NCINTI, NCINTJ, NCINTK, NINTI, NINTJ, NINTK, INB1,
 CL INB2, JNB1, JNB2, KNB1, KNB2, NBS, NBCS, NIBCS, NZWDB, NTRIAG, NTRASS,
 CL (NGOP(I), I=1,5)
 C
 CW 27
 C
 CD IGOH GEOMETRY 5- SPECIAL TRIANGULAR, TWO-DIMENSIONAL
 CD 19- SPECIAL TRIANGULAR-2, THREE-DIMENSIONAL
 CD NZONE NUMBER OF ZONES (EACH HOMOGENEOUS IN NEUTRONICS
 CD PROBLEM)
 CD NREG NOT DEFINED
 CD NZCL NUMBER OF ZONE CLASSIFICATIONS (EDIT PURPOSES)
 CD NCINTI NOT DEFINED
 CD NCINTJ NOT DEFINED
 CD NCINTK NUMBER OF THIRD DIMENSION COARSE MESH INTERVALS
 CD NCINTK.EQ.1 FOR ONE AND TWO
 CD DIMENSIONAL CASES.
 CD A COARSE MESH INTERVAL IS DEFINED AS ONE
 CD CONTAINING ONE OR MORE FINE MESH INTERVALS, EACH
 CD OF WHICH CONTAINS THE SAME MATERIAL ZONE.
 CD THE NUMBER OF POINTS ON A PLANE. POINTS ARE AT
 CD THE INTERSECTIONS OF MESH LINES.
 CD NINTI NOT DEFINED
 CD NINTJ NOT DEFINED
 CD NINTK NUMBER OF THIRD DIMENSION FINE MESH INTERVALS
 CD NINTK.EQ.1 FOR ONE AND TWO DIMENSIONAL
 CD CASES.

(CONT)

CD	INB1	FIRST BOUNDARY ON FIRST DIMENSION	-
CD		0- ZERO FLUX (DIFFUSION)	-
CD		1- REFLECTED	-
CD		2- EXTRAPOLATED (DIFFUSION - DEL PHI	-
CD		/PHI = -C/D WHERE C IS GIVEN AS BUNC	-
CD		BELOW AND D IS THE GROUP DIFFUSION	-
CD		CONSTANT, TRANSPORT - NO RETURN)	-
CD		3- NOT DEFINED	-
CD		4- REPEATING (PERIODIC) WITH NEXT	-
CD		ADJACENT FACE 60 OR 120 DEGREE	-
CD		ROTATION).	-
CD		THE LEFT AND TOP BOUNDARIES ARE	-
CD		REPEATING.	-
CD		5- NOT DEFINED	-
CD		6- NOT DEFINED	-
C			-
CH		NOTE THAT FOR REPEATING BOUNDARIES, THE FIRST BOUNDARY IN	-
CH		ORDER WHICH IS INVOLVED CARRIES THE DESIGNATOR DEFINING	-
CH		THE REPEATING CONDITION.	-
C			-
CD	INB2	LAST BOUNDARY ON FIRST DIMENSION	-
CD	JNB1	FIRST BOUNDARY ON SECOND DIMENSION	-
CD		5- REPEATING ALONG THIS BOUNDARY - 180	-
CD		DEGREES. IF NPP EQUALS THE NUMBER OF	-
CD		POINTS ON THIS BOUNDARY, THEN THE FLUX	-
CD		AT POINTS NPP/2 THROUGH NPP ARE EQUAL	-
CD		TO THE FLUXES AT POINTS 1 THROUGH NPP/2	-
CD		FOR THIS OPTION, INB1=INB2 AND	-
CD		NTRIAC=1.	-
CD	JNB2	LAST BOUNDARY ON SECOND DIMENSION	-
CD	KNB1	FIRST BOUNDARY ON THIRD DIMENSION	-
CD	KNB2	LAST BOUNDARY ON THIRD DIMENSION	-
CD	NBS	NUMBER OF BUCKLING SPECIFICATIONS	-
CD		1- SINGLE VALUE APPLIES EVERYWHERE	-
CD		.EQ.NZONE, ZONE-DEPENDENT	-
CD		N*ZONE, DATA IS GIVEN OVER ALL ZONES FOR	-
CD		THE FIRST ENERGY GROUP, THEN FOR THE NEXT	-
CD		GROUP, TO END OF LIST - IF THERE ARE MORE	-
CD		GROUPS, LAST GROUP DATA GIVEN IS USED	-
CD	NBCS	NUMBER OF CONSTANTS FOR EXTERNAL BOUNDARIES	-
CD		1- SINGLE VALUE USED EVERYWHERE	-
CD		6- INDIVIDUAL VALUES FOR EACH POSSIBLE	-
CD		SURFACE (BOUNDARY SPECS GIVE ACTUAL USE)	-
CD		N*6- SIX VALUES ARE GIVEN FOR THE FIRST	-
CD		ENERGY GROUP, THEN SIX FOR THE NEXT, TO	-
CD		THE END OF THE LIST - THE LAST GROUP DATA	-
CD		GIVEN APPLIES TO ALL ADDITIONAL GROUPS	-
CD	NIBCS	NUMBER OF CONSTANTS FOR INTERNAL BOUNDARIES	-
CD		1- SINGLE VALUES USED EVERYWHERE	-
CD		.GT.1- VALUES ARE GIVEN BY ENERGY GROUP	-
CD		WITH NON-BLACK CONDITION INDICATED BY	-
CD		ZERO ENPP - LAST VALUE APPLIES TO	-
CD		ADDITIONAL GROUPS	-

(CONT)

C
 CD KXESH LOCATION OF EACH MESHPOINT ON A PLANE MEASURED FROM
 CD REFERENCE ALONG X COORDINATE, CH
 CD YROW ROW LOCATION MEASURED FROM REFERENCE ALONG Y
 CD COORDINATE (NORMAL TO X), CH
 CD NRPZ NUMBER OF MESH POINTS OF THE ROW
 C

C-----
 C MESHPOINT ARRANGEMENTS (6D RECORD)
 C
 CC PRESENT IF NPO.EQ.2
 C
 CL ((KXESH(I,J),I=1,2),J=1,NRPZ)
 C
 CW 2*MULT*NRPZ
 C
 CD KXESH(1,J) LOCATION OF MESHPOINT MEASURED ALONG X COORDINATE
 CD FROM REFERENCE (INCREASING ORDER FOR ANY Y), CH
 CD KXESH(2,J) LOCATION OF MESHPOINT MEASURED ALONG Y COORDINATE
 CD FROM REFERENCE, Y NORMAL TO X, (INCREASING), CH
 C

THERE ARE POINT RECORDS WHICH FOLLOW IF NRPZ IS 0
 POINT RECORDS WHICH FOLLOW IF NRPZ IS 1
 BUT ONLY ONE SET IF ICON IS 5

C-----
 C TRIANGLE ZONE ASSIGNMENTS (7D RECORD)
 C
 CC ALWAYS PRESENT
 C
 CL (NR(I),I=1,NRZ)
 C
 CW NRZ
 C
 CD NR ZONE NUMBER ASSIGNMENT TO MESH INTERVAL
 C
 CC CONSIDER THAT NEAR-NEIGHBOR POINTS HAVE A LINE OF COUPLING.
 CC COUPLING LINES FORM TRIANGLES. THE TRIANGLES LYING
 CC WHOLLY BELOW A LOCAL HORIZONTAL LINE ARE ASSIGNED ZONE
 CC NUMBERS THROUGH THE MESH STARTING WITH THE FIRST (TOP)
 CC HORIZONTAL ROW, INCREASING X GIVEN Y, THEN INCREASING Y
 C

C-----
 C
 CDY TRIGON
 C
 C-----

SPECIFICATIONS FOR INTERFACE FILE HASBAL

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C*****
C                                     DATE 07-28-80
C                                     HASBAL
C                                     MASS BALANCE INFORMATION
C*****

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```

C-----
C                                     FILE IDENTIFICATION
C
C                                     NAME, (NAME(I), I=1,2), IVERS
C
C                                     3*NULT + 1 = NUMBER OF WORDS
C
C                                     NAME      FILE NAME (26) = 'HASBAL'
C                                     NAME      USER IDENTIFICATION (226)
C                                     IVERS     FILE VERSION NUMBER
C
C                                     NULT      1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C-----

```

```

C-----
C                                     FILE STRUCTURE
C
C                                     RECORD TYPE      PRESENT IF
C                                     -----
C                                     FILE IDENTIFICATION  ALWAYS
C                                     FILE CONTROL        ALWAYS
C                                     NUCLIDE IDENTIFICATION AND BASE DATA  ALWAYS
C                                     DISCHARGE BLOCK MATERIAL  NUTD*(NUTD+NUTDB).GT.0
C                                     SUPPLY BLOCK MATERIAL    NUTS*NUTSB.GT.0
C                                     INITIAL REACTOR INVENTORY  ALWAYS
C
C                                     ***** (REPEAT TO 14CY)
C                                     * FUELING INFORMATION      ALWAYS
C                                     * INITIAL LOADING MASS BALANCE DATA  ALWAYS
C                                     * DISCHARGE MATERIAL MASS BALANCE DATA  NUTD*NUTDB.GT.0
C                                     * FIXED FEED MASS BALANCE DATA    NUTF*NUTFB.GT.0
C                                     * SUPPLY MATERIAL MASS BALANCE DATA  NUTS*NUTSB.GT.0
C                                     * FINAL LOADING MASS BALANCE DATA    ALWAYS
C                                     *****
C-----

```

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C-----
C                                     FILE CONTROL (10 RECORDS)
C
C                                     NUT, NUTJ, NUTCY, NUTD, NUTF, NUTDB, NUTS, NUTFB, NUTY,
C                                     (KI(I), I=1,10)
C
C                                     20 = NUMBER OF WORDS
C-----

```

(CONT)

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C
C      UNDEFINED DATA IS RESERVED FOR FUTURE USE
C
C      NRP      NUMBER OF NUCLIDES FOR WHICH MASS ACCOUNTING IS
C      MAINTAINED
C      NRO      NUCLIDE MASS REFERENCE OPTION:
C      0 - BY ABSOLUTE NAME (NAME)
C      1 - BY UNIQUE NAME (UNNAME)
C      NRCY     NUMBER OF SETS OF FUELING MASS BALANCE DATA
C      WRITTEN
C      NRPB     NUMBER OF FUEL DISCHARGE BLOCKS
C      NRPD     MAXIMUM NUMBER OF NUCLIDES IN ANY FUEL
C      DISCHARGE BLOCK
C      NRPDB    NUMBER OF FUEL DELAYED DISCHARGE BLOCKS
C      NPSB     NUMBER OF FUEL SUPPLY BLOCKS
C      NPS      MAXIMUM NUMBER OF NUCLIDES IN ANY FUEL SUPPLY
C      BLOCK
C      NPPB     NUMBER OF FIXED FEED FUEL BLOCKS
C      NPP      MAXIMUM NUMBER OF NUCLIDES IN ANY FIXED
C      FEED FUEL BLOCK
C

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```

C-----
C      NUCLIDE IDENTIFICATION AND BASE DATA (2D RECORD)
C
C      (NPN(I), I=1, NRP),
C      ((NPN(K,N), K=1, NRPD), N=1, NRPB),
C      ((NPS(K,N), K=1, NPSB), N=1, NPSB),
C      ((NPP(K,N), K=1, NPPB), N=1, NPPB)
C
C      MULT*NR + NRPD*NRPB + NPS*NPSB + NPP*NPPB = NUMBER OF WORDS
C
C      NPN      NUCLIDE REFERENCE NAME FOR WHICH MASS
C      ACCOUNTING IS MAINTAINED. (A6)
C      NPN      REFERENCE NUCLIDES FOR DISCHARGE BLOCK N (ORDER
C      NUMBER IN NPN LIST)
C      NPSN     REFERENCE NUCLIDES FOR SUPPLY BLOCK N (ORDER
C      NUMBER IN NPN LIST)
C      NPN      REFERENCE NUCLIDES FOR FIXED FEED BLOCK N
C      (ORDER NUMBER IN NPN LIST)
C

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C-----
C      DISCHARGE BLOCK MATERIAL (3D RECORD)
C
C      PRESENT IF NRP*(NRPB + NRPDB).GT.0
C
C      ((RDMASS(I,J), I=1, NRPD), J=1, NRPB),
C      (NRPDB(J), J=1, NRPDB), (NCDDB(J), J=1, NRPDB),
C      (NPDLAY(J), J=1, NRPDB), ((RDMASS(I,J), I=1, NRPD), J=1, NRPDB)
C
C      NRPB*NRPD + NRPDB*(3 + NRPD) = NUMBER OF WORDS
C
C      (CONT)

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```

C
CD      DBRASS      MASS OF NUCLIDE I IN DISCHARGE BLOCK J
CD      WDDDB      DISCHARGE BLOCK TO RECEIVE MATERIAL FROM
CD                      DELAYED BLOCK J WHEN THE BLOCK BECOMES
CD                      ACTIVE (0 ENTRY IMPLIES SLOT J IS AVAILABLE
CD                      FOR DELAYED DISCHARGE).
CD      WCYDDDB     FUELING CYCLE REFERENCE NUMBER WHEN DELAYED
CD                      DISCHARGE IS CREATED
CD      WFDLAY      FUELING DELAY IN CYCLES ASSOCIATED WITH DELAYED
CD                      DISCHARGE BLOCK J
CD      DBDRSS      MASS OF NUCLIDE I IN DELAYED DISCHARGE BLOCK J
C
-----

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C-----
C      SUPPLY BLOCK MATERIAL (5D RECORD)
C
CC      PRESENT IF  NUTS*WPSD.GT.0
C
CL      (SBRASS(I,J),I=1,NUTS),J=1,WPSD)
C
C      WPSD*NUTS = NUMBER OF WORDS
C
CD      SBRASS      MASS OF NUCLIDE I IN SUPPLY BLOCK J
C
-----

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```

C-----
C      INITIAL REACTOR INVENTORY AND FUELING INFORMATION (5D RECORD)
C
CL      WCYI,RTINI,(RBRASS(I),I=1,NWR)
C
C      NWR*2 = NUMBER OF WORDS
C
CD      WCYI      REFERENCE CYCLE NUMBER FOR THE INITIAL REACTOR
CD                      MASS BALANCE HISTORY
CD      RTINI     REFERENCE REAL EXPOSURE TIME IN DAYS FOR THE
CD                      INITIAL REACTOR MASS BALANCE HISTORY
CD      RBRASS    REACTOR INVENTORY OF NUCLIDE I AT BEGINNING OF
CD                      MASS BALANCE HISTORY
C
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C-----
C      FUELING INFORMATION (6D RECORD)
C
CL      WCY,(IK(I),I=1,14),RTIN,POWER,THREL,CWSHPT
C
C      20 = NUMBER OF WORDS
C
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(CONT)

CD	WCY	REFERENCE CYCLE NUMBER FOR THIS SET OF MASS	-
CD		BALANCE DATA	-
CD	RTIN	REFERENCE REAL EXPOSURE TIME IN DAYS	-
CD		REPRESENTED BY THIS SET OF MASS BALANCE DATA	-
CD	POWER	ELECTRICAL POWER LEVEL OF THE REACTOR (WATTS)	-
CD	THPFL	THERMAL CONVERSION FACTOR FOR THE REACTOR	-
CD		(ELECTRICAL POWER/THERMAL POWER)	-
CD	CHSPT	RATE OF FUEL CONSUMPTION PER UNIT THERMAL	-
CD		ENERGY GENERATED (KG FISSILE/WATT-DAY)	-
C			-

C	-----		
CD		INITIAL LOADING MASS BALANCE DATA (70 RECORD)	-
C			-
CL		(RINASS(I), I=1, NNR)	-
C			-
CD		NNR = NUMBER OF WORDS	-
C			-
CD	RINASS	INITIAL REACTOR MASS (PRIOR TO FUELING) OF	-
CD		NUCLIDE I	-
C			-

C	-----		
CD		DISCHARGE MATERIAL MASS BALANCE DATA (80 RECORD)	-
C			-
CC		PRESENT IF NHPD*HFPD GT.0	-
C			-
CL		((TDHASS(I,J), I=1, NHPD), J=1, HFPD),	-
CL		((UDHASS(I,J), I=1, NHPD), J=1, HFPD)	-
C			-
CD		2*NHPD*HFPD = NUMBER OF WORDS	-
C			-
CD	TDHASS	MASS OF NUCLIDE I TRANSFERRED TO DISCHARGE	-
CD		BLOCK J FOR THIS FUELING	-
CD	UDHASS	MASS OF UNAVAILABLE DISCHARGE FROM DISCHARGE	-
CD		BLOCK J	-
C			-

C	-----		
CD		FIXED FEED MASS BALANCE DATA (90 RECORD)	-
C			-
CC		PRESENT IF NHPF*HFPB GT.0	-
C			-
CL		((VFNASS(I,J), I=1, NHPF), J=1, HFPB)	-
C			-
CD		NHPB*NHPF = NUMBER OF WORDS	-
C			-
CD	VFNASS	MASS OF NUCLIDE I ADDED FROM FIXED FEED BLOCK J	-
C			-

(CONT)

```

C-----
C          SUPPLY MATERIAL MASS BALANCE DATA (100 RECORD)
C-----
C
C          PRESENT I?  NIPS*NPSP.GT.0
C
C          ((SPMASS(I,J),I=1,NIPS),J=1,NPSP),
C          ((FDMASS(I,J),I=1,NIPS),J=1,NPSP),
C          ((PDMASS(I,J),I=1,NIPS),J=1,NPSP),
C          ((USMASS(I,J),I=1,NIPS),J=1,NPSP)
C
C          4*NPSP*NIPS = NUMBER OF WORDS
C
C          SPMASS      MASS OF NUCLIDE I ADDED FROM SUPPLY BLOCK J
C          FDMASS      MASS OF NUCLIDE I LOST FROM INITIAL VOLUME
C                      TRANSFERRED TO SUPPLY BLOCK J DUE TO
C                      FABRICATION LOSSES
C          PDMASS      MASS OF NUCLIDE I LOST FROM INITIAL VOLUME
C                      TRANSFERRED TO SUPPLY BLOCK J DUE TO
C                      PROCESSING LOSSES
C          USMASS      MASS OF NUCLIDE I LOST FROM INITIAL VOLUME
C                      TRANSFERRED TO SUPPLY BLOCK J DUE TO
C                      UNAVAILABLE SUPPLY.
C-----

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C-----
C          FINAL LOADING MASS BALANCE DATA (110 RECORD)
C-----
C
C          (FPMASS(I),I=1,NHR)
C
C          NHR = NUMBER OF WORDS
C
C          FPMASS      FINAL REACTOR MASS (AFTER FUELING) OF
C                      NUCLIDE I
C-----

```

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C*****
C
C          NASBAL
C
C*****

```

SPECIFICATIONS FOR INTERFACE FILE REFUEL

```

C*****
C                                     DATE 01-16-81
C
C                                     REFUEL
C
C                                     FUEL MANAGEMENT SPECIFICATIONS
C
C*****

```

```

C-----
C                                     FILE IDENTIFICATION
C
C                                     NAME, (NAME(I), I=1,2), IVERS
C
C                                     3*MULT * 1 = NUMBER OF WORDS
C
C                                     NAME      FILE NAME (A6) = 'REFUEL'
C                                     NAME      USER IDENTIFICATION (2A6)
C                                     IVERS     FILE VERSION NUMBER
C
C                                     MULT      1 FOR LONG WORD, 2 FOR SHORT WORD MACHINES
C
C-----

```

```

C-----
C                                     FILE STRUCTURE
C
C                                     RECORD TYPE      PRESENT IF
C                                     *****
C                                     FILE IDENTIFICATION  ALWAYS
C                                     FILE CONTROL         ALWAYS
C                                     NUCLIDE IDENTIFICATION AND BASE DATA  ALWAYS
C                                     TRANSITION DATA FOR FUEL RECYCLE  NTS.GT.0
C                                     FIXED FUEL FEED MATERIAL DATA BLOCKS  NNTF*NFPB.GT.0
C                                     SUPPLY AND DISCHARGE REFERENCE DATA  NNTS*NPSB*NFPD*NFDB.GT.0
C                                     SUPPLY BLOCK MATERIAL ALLOCATION  NFDB*NPSB.GT.0
C
C                                     ***** (REPEAT TO NNTS)
C                                     * FUEL MANAGEMENT CONTROL SPECIFICATIONS  ALWAYS
C                                     * FUEL MANAGEMENT SPECIFICATIONS          ALWAYS
C                                     *****
C-----

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C-----
C                                     FILE CONTROL (10 RECORD)
C
C                                     NWZ, NWX, NWR, NWO, NQN, NID, NTS, NO, NFPB, NNTF, NPSB, NNTS, NFDB,
C                                     NFPD, NNTS, NEC, NFDD, (NI(I), I=1,3)
C
C                                     20 = NUMBER OF WORDS
C
C                                     UNDEFINED DATA IS RESERVED FOR FUTURE USE
C

```

(CONT)

C		
CD	WUZ	*** RESERVED ***
CD	WUI	*** RESERVED ***
CD	WNR	TOTAL NUMBER OF NUCLIDE REFERENCES
CD	WNO	NUCLIDE REFERENCING OPTION
CD		0 BY ABSOLUTE NAME (WNAME)
CD		1 BY UNIQUE USER NAME (WUNAME)
CD	WQN	NUMBER OF NUCLIDE REFERENCES IN SUPPLEMENTAL LIST (IF THIS VALUE IS 0, A DEFAULT LIST IS GENERATED--SEE HIS DESCRIPTION IN NUCLIDE IDENTIFICATION AND BASE DATA)
CD	WID	*** RESERVED ***
CD	WTS	NUMBER OF TRANSITION SPECIFICATIONS
CD	WQ	*** RESERVED ***
CD	WFFB	NUMBER OF FIXED FUEL FEED BLOCKS
CD	WFFP	MAXIMUM NUMBER OF NUCLIDES IN ANY FIXED FUEL FEED BLOCK
CD	WFSB	NUMBER OF FUEL SUPPLY (RECYCLE) BLOCKS
CD	WFPS	MAXIMUM NUMBER OF NUCLIDES IN ANY SUPPLY BLOCK (IF WFPS IS 0 WHILE WFSB IS NOT, A DEFAULT NUCLIDE LIST IS GENERATED FOR EACH SUPPLY BLOCK --SEE WSPN DESCRIPTION IN SUPPLY AND DISCHARGE REFERENCE DATA)
CD	WFDB	NUMBER OF FUEL DISCHARGE BLOCKS
CD	WFDP	MAXIMUM NUMBER OF NUCLIDES IN ANY DISCHARGE BLOCK (IF THIS VALUE IS 0 WHILE WFDB IS NOT, A DEFAULT NUCLIDE LIST IS GENERATED FOR EACH BLOCK--SEE WDN DESCRIPTION IN SUPPLY AND DISCHARGE REFERENCE DATA)
CD	WPHS	NUMBER OF FUEL MANAGEMENT SPECIFICATION SETS
CD	WEC	*** RESERVED ***
CD	WFDDB	MAXIMUM NUMBER OF DELAYED DISCHARGE BLOCKS (A DELAYED DISCHARGE BLOCK IS CREATED AND MAINTAINED FOR ANY MATERIAL DISCHARGED WITH A FUELING DELAY)
CD		
C		

C	-----	
CR	NUCLIDE IDENTIFICATION AND BASE DATA (2D RECORD)	
C		
CL	(WPH(I), I=1, WPH), (WIS(J), J=1, WQN), (WLP(I), I=1, WNR),	
CL	(WLP(I), I=1, WNR), (WQ(I), I=1, WNR), (WQ(I), I=1, WNR)	
C		
CW	NUL?*(WNR + WQN) + 4*WPH = NUMBER OF WORDS	
C		
CD	WPH	NUCLIDE REFERENCE NAMES FOR NUCLIDE ORDERED 1
CD		IN THESE SPECIFICATIONS FOR FUEL MOVEMENT (SEE
CD		OPTION WNO). THIS LIST IS FOR ALL MATERIALS
CD		MOVED AND ACCOUNTED FOR. (16)
C		

(CONT)

C9 NIN NUCLIDE REFERENCE NAMES FOR NORMAL FUEL
 CD MOVEMENT AND FUEL FUEL DISCHARGE; HOWEVER, NO
 CD MASS BALANCE ACCOUNTING IS MADE FOR THESE
 CD NUCLIDES. IN ADDITION, THESE NUCLIDES ARE NOT
 CD INCLUDED IN RECYCLE SUPPLY PROCESSING. (A6)
 C
 C9 NOTE: IF NQH=0 IS THE FILE CONTROL(1D) RECORD, THEN A
 C9 DEFAULT NIN LIST IS GENERATED FROM THE LIBRARY
 C9 MATERIALS THAT ARE CLASSIFIED AS FISSION,
 C9 FERTILE, OTHER ACTINIDE OR FISSION PRODUCT AND
 C9 THAT ARE NOT ALREADY PRESENT IN THE NPH LIST.
 C
 C9 NOTE: NUCLIDES NOT PRESENT IN EITHER NPH OR NIN ARE
 C9 ASSUMED TO BE NON-MOBILE STRUCTURAL OR COOLANT
 C9 MATERIAL.
 C
 CD PLP FABRICATION LOSS FRACTIONS
 CD PLP PROCESSING LOSS FRACTIONS
 CD PQ *** RESERVED ***
 CD WQ *** RESERVED ***
 C

C-----
 C9 TRANSITION DATA FOR FUEL RECYCLE (3D RECORD)
 C
 CC PRESENT IF NTS.GT.0
 C
 CL (TSF(I), I=1, NTS), ((NTRN(K, I), K=1, 2), I=1, NTS)
 C
 C9 3*NTS = NUMBER OF WORDS
 C
 CD TSF(I) TRANSITION FRACTION FOR THE NUCLIDE PAIR I
 CD NTRN(1, I) ORIGINAL NUCLIDE I REFERENCE (ORDER NUMBER IN
 CD NPH LIST)
 CD NTRN(2, I) PRODUCT NUCLIDE I REFERENCE (ORDER NUMBER IN
 CD NPH LIST)
 C
 C9 THESE SPECIFICATIONS ALLOW DECAY OF ONE NUCLIDE TO ITS
 C9 PRODUCT, OR ALLOW TRANSLATION OF NUCLIDES IN RECYCLED
 C9 MATERIAL. MULTIPLE PRODUCTS CAN BE SPECIFIED FOR THE
 C9 SAME ORIGINAL NUCLIDE BUT THE SUM OF THE TRANSITION
 C9 FRACTIONS MUST BE LESS THAN OR EQUAL TO 1.0
 C
 C-----

C-----
 C9 FIXED FUEL FEED MATERIAL DATA BLOCKS (4D RECORD)
 C
 CC PRESENT IF NHFF*NFFB.GT.0
 C
 CL ((NPH(I, J), I=1, NHFF), J=1, NFFB), ((ADB(I, J), I=1, NHFF), J=1, NFFB)
 C
 C9 2*NHFF*NFFB = NUMBER OF WORDS
 C

(CONT)

CB WPN REFERENCE NUCLIDES FOR BLOCK J (ORDER NUMBER
 CB IN WPN LIST)
 C
 CB NOTE: ZEROS MUST BE ADDED TO THE END OF THE WPN STRINGS
 CB IN ORDER TO BLOCK THE ARRAY PROPERLY.
 C
 CB ADG ATOM DENSITY OF NUCLIDE WPN(I,J) FOR FEED
 CB MATERIAL (ATOMS/B-CM)

C-----
 CB SUPPLY AND DISCHARGE REFERENCE DATA (5D RECORD)
 C
 CB PRESENT IF WSPS*WFSB+WFPD*WFDG.GT.0
 C
 CB ((WSPN(I,J),I=1,WFSB),J=1,WFSB),
 CB ((WDM(K,H),K=1,WFDG),H=1,WFDG)
 C
 CB WSPS*WFSB + WFPD*WFDG = NUMBER OF WORDS
 C
 CB WSPN REFERENCE NUCLIDES FOR SUPPLY BLOCK J (ORDER
 CB NUMBER IN WPN LIST)
 C
 CB NOTE: IF WFSB .EQ. 0 WHILE WFSB .NE. 0, A DEFAULT LIST OF
 CB ALL WPN NUCLIDES IS GENERATED FOR EACH SUPPLY BLOCK
 C
 CB WDM REFERENCE NUCLIDES FOR DISCHARGE BLOCK H (ORDER
 CB NUMBER IN WPN LIST)
 C
 CB NOTE: IF WFDG .EQ. 0 WHILE WFDG .NE. 0, A DEFAULT LIST OF
 CB ALL WPN NUCLIDES IS GENERATED FOR EACH DISCHARGE
 CB BLOCK
 C
 CB NOTE: ZEROS MUST BE ADDED TO THE END OF THE WSPN AND WDM
 CB STRINGS IN ORDER TO BLOCK THE ARRAY PROPERLY.
 C-----

C-----
 CB SUPPLY BLOCK MATERIAL ALLOCATION (6D RECORD)
 C
 CB PRESENT IF WFDG*WFSB.GT.0
 C
 CB ((RVF(J,I),J=1,WFSB),I=1,WFDG),(WENO(I),I=1,WFDG)
 C
 CB WFDG*(1 + WFSB) = NUMBER OF WORDS
 C
 CB RVF FRACTION OF MATERIAL IN DISCHARGE BLOCK I TO
 CB PUT IN SUPPLY BLOCK J.
 CB WENO EXCESS MATERIAL OPTION FOR FUEL DISCHARGE
 CB 0-EXCESS MATERIAL NOT USED IN THE REACTOR
 CB 1-EXCESS AVAILABLE IN THE NEXT REFUELING

(CONT)

A RECORD IS KEPT OF THE MASS OF THE DISCHARGE MATERIAL FOR EACH BLOCK. SUPPLY BLOCKS ARE MADE UP OF MATERIAL TRANSFERRED FROM DISCHARGE BLOCKS AFTER A RECYCLE DELAY, ACCOUNTING FOR PROCESSING AND FABRICATION LOSSES AND TRANSITIONS. SUPPLY MATERIAL IS ALLOCATED UNIFORMLY INTO ALL FEED ZONES REFERENCED BASED ON VOLUME FRACTIONS.

FUEL MANAGEMENT CONTROL SPECIFICATIONS (7D RECORD)

NPST,NZS,ISZN,KFNO,(JI(I),I=1,16)

20 = NUMBER OF WORDS

WFST	NUMBER OF DIFFERENT INSTRUCTION LISTS IN THIS SPECIFICATION
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24
25	25
26	26
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	34
35	35
36	36
37	37
38	38
39	39
40	40
41	41
42	42
43	43
44	44
45	45
46	46
47	47
48	48
49	49
50	50
51	51
52	52
53	53
54	54
55	55
56	56
57	57
58	58
59	59
60	60
61	61
62	62
63	63
64	64
65	65
66	66
67	67
68	68
69	69
70	70
71	71
72	72
73	73
74	74
75	75
76	76
77	77
78	78
79	79
80	80
81	81
82	82
83	83
84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

NYS	OFFICE OF THE ATTORNEY GENERAL	
	MAXIMUM NUMBER OF ZONES (SUBZONES) IN EACH INSTRUCTION LIST	
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
17	17	17
18	18	18
19	19	19
20	20	20
21	21	21
22	22	22
23	23	23
24	24	24
25	25	25
26	26	26
27	27	27
28	28	28
29	29	29
30	30	30
31	31	31
32	32	32
33	33	33
34	34	34
35	35	35
36	36	36
37	37	37
38	38	38
39	39	39
40	40	40
41	41	41
42	42	42
43	43	43
44	44	44
45	45	45
46	46	46
47	47	47
48	48	48
49	49	49
50	50	50
51	51	51
52	52	52
53	53	53
54	54	54
55	55	55
56	56	56
57	57	57
58	58	58
59	59	59
60	60	60
61	61	61
62	62	62
63	63	63
64	64	64
65	65	65
66	66	66
67	67	67
68	68	68
69	69	69
70	70	70
71	71	71
72	72	72
73	73	73
74	74	74
75	75	75
76	76	76
77	77	77
78	78	78
79	79	79
80	80	80
81	81	81
82	82	82
83	83	83
84	84	84
85	85	85
86	86	86
87	87	87
88	88	88
89	89	89
90	90	90
91	91	91
92	92	92
93	93	93
94	94	94
95	95	95
96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

NOTE: FOR WZED=1 (FUEL RELOCATION), WZ5 IS THE NUMBER OF ZONE ENTRIES INCLUDING THE 0 TO TERMINATE THE EXIT ZONE AND FEED ZONE LIST AND THE TWO 0'S AT THE END OF THE MOVEMENT LIST.

IS2N FLAG TO INDICATE ZONE OR SUBZONE REFERENCES
0-NOVE ZONES
1-NOVE SUBZONES
2-NOVE ZONES TO SUBZONES (FOR WP30-1 ONLY)
3-NOVE SUBZONES TO ZONES (FOR WP30-1 ONLY)

WFSO FUEL MOVEMENT SPECIFICATION OPTION:
0-NORMAL FUEL ZONE MOVEMENT
1-FUEL RELOCATION ZONE MOVEMENT (CONTENTS OF
THE SPECIFIED EXIT ZONES ARE TO BE VOLUME
AVERAGED AND ADDED TO SPECIFIED FEED ZONES
WITHOUT CHECKING THE FEED ZONE VOLUMES)

NOTE: NPST MUST BE 1 FOR NPMO=1.

FUEL MANAGEMENT SPECIFICATIONS (80 RECORD)

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(NFB(L),L=1,NFST), (NFPB(L),L=1,NFST), (NSB(L),L=1,NFST),
(NDB(L),L=1,NFST), (NFD(L),L=1,NFST),
(NZ(I,L),I=1,NZS),L=1,NFST)
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WFST* (NLS + 5) = NUMBER OF WORDS

(CONT)

CD WFB FIXED FEED BLOCK REFERENCE PRIOR TO RECYCLE
 CD WFPB FIXED FEED BLOCK IF RECYCLE IS PRESENT
 CD WSB SUPPLY BLOCK REFERENCE (RECYCLE)
 CD WDB DISCHARGE BLOCK REFERENCE
 CD WPD REFUELING DELAY IN AVAILABILITY FOR RECYCLE
 CD 0-NO DELAY; THE DISCHARGED MATERIAL IS
 CD AVAILABLE AS RECYCLE SUPPLY FOR THE
 CD NEXT FUEL CYCLE
 CD N-DELAY "N" CYCLES; THE DISCHARGED MATERIAL
 CD IS AVAILABLE AS RECYCLE SUPPLY AFTER "N"
 CD CYCLES FROM THE CURRENT CYCLE HAVE
 CD ELAPSED (A DELAYED DISCHARGE BLOCK IS
 CD CREATED FOR EACH ZONE/SUBZONE DISCHARGED
 CD WITH A DELAY)
 CD WZ ZONE/SUBZONE (SPEC ISZN) NUMBER FOR FUEL
 CD MOVEMENT
 C
 C
 CN FOR WPHO=0: WPST SETS OF LISTS OF ZONES (SUBZONES) ARE PRESENTED
 CN IN WHICH THE STARTING ZONE IS TO BE REFUELED AND ITS
 CN MATERIAL IS TO BE MOVED INTO THE NEXT ZONE SPECIFIED,
 CN CONTINUING TO MOVE MATERIAL THROUGH THE LIST UNTIL THE
 CN LAST ZONE IS REACHED. ITS MATERIAL IS TRANSFERRED TO
 CN A DISCHARGE BLOCK UNLESS THE ZONE NUMBER IS NEGATIVE,
 CN INDICATING CLOSED-LOOP FUEL MOVEMENT IN WHICH THE
 CN CONTENTS OF THE LAST ZONE ARE MOVED TO THE FIRST ZONE.
 CN THE ZONE LIST IS TERMINATED BY THE FIRST WZ VALUE
 CN .LE. 0.
 C
 CN FOR WPHO=1: ONE LIST OF ZONES (SUBZONES) IS PRESENTED FOR FUEL
 CN RELOCATION. THE ZONE LIST CONSISTS OF A SET OF EXIT
 CN ZONES TERMINATED BY A 0 ZONE VALUE FOLLOWED BY A SET
 CN OF FEED ZONES TERMINATED BY A 0 ZONE VALUE. FOLLOWING
 CN THE FEED ZONE SET, OTHER SETS OF EXIT ZONES AND FEED
 CN ZONES MAY BE GIVEN. THE MOVEMENT LIST IS TERMINATED
 CN WHEN TWO SUCCESSIVE 0 ZONE VALUES ARE ENCOUNTERED OR
 CN WHEN THE END OF THE WZC LIST OF ZONES IS ENCOUNTERED.
 CN FOR EACH EXIT ZONE/FEED ZONE SET, THE CONCENTRATIONS IN
 CN THE EXIT ZONES ARE VOLUME AVERAGED AND PLACED IN THE
 CN FEED ZONES SPECIFIED WITHOUT CHECKING THE FEED ZONE
 CN VOLUMES. THE ORIGINAL EXIT ZONES REMAIN UNCHANGED
 CN (OTHER SPECIFICATIONS ARE NEEDED TO REFUEL OR TO MOVE
 CN MATERIAL INTO EXIT ZONES). IN ADDITION, THERE IS NO
 CN MASS BALANCE ACCOUNTING FOR FUEL RELOCATION. WFB, WFPB,
 CN WSB, WDB, AND WPD MUST BE 0 FOR FUEL RELOCATION
 CN ZONE MOVEMENT.
 C
 C

(CONT)

COST DATA		(9D RECORD)
CL	PXL, PKL, FEI, FEF, PLP, PLA, PLR, PCT, PFT, PST, PHT, PST, PWT,	
CL	PET, PRA, PRB, UCC, UNC, UPC, RTE, RFE, IF1, IF2, IF3, IF4, IF5,	
CL	IF6, IF7, IF8, IF9, IF10, IF11, IF12, IL, IN, JSS, ISS	
CW	47 = NUMBER OF WORDS	
CD	PXL FABRICATION LOSS FRACTION	
CD	PKL PROCESSING LOSS FRACTION	
CD	FEI FRACTION OF INITIAL LOADING AND FABRICATION TO BE	
CD	CARRIED OVER LIFE OF PLANT	
CD	FEF FRACTION OF ACTUAL MAKE-UP FUEL THAT MUST BE CARRIED	
CD	ON HAND FOR REPLACEMENT OVER AND ABOVE USUAL REFUELING	
CD	(NOT APPLIED TO INITIAL INVENTORY, BUT TO MAKE-UP	
CD	QUANTITIES OVER PRECEDING PERIOD)	
CD	PLP REACTOR PLANT LOAD FACTOR	
CD	(CAPACITY DIVIDED BY DESIGN CAPACITY)	
CH	NOTE: THE DESIGN CAPACITY IS USED IF THE CORE HISTORY IS RUN	
CH	AT THE DESIGN CAPACITY. IF THE CORE HISTORY IS RUN ON	
CH	AN EXPONENTIAL LOAD FACTOR, THE AVERAGE CAPACITY IS USED.	
CD	PLI INITIAL PLANT LOAD FACTOR IF THE LOAD FACTOR DECREASES	
CD	EXPONENTIALLY. NOT USED IF LOAD FACTOR IS CONSTANT.	
CD	PLA ***RESERVED***	
CD	PLB ***RESERVED***	
CD	PCT CONVERSION COST LEAD TIME (FROM START OF USE OF FUEL,	
CD	IN YEARS)	
CD	PFT FABRICATION COST LEAD TIME	
CD	PST SHIPPING COST LEAD TIME	
CD	PHT HOT STORAGE LAG TIME (FROM REMOVAL FROM THE REACTOR,	
CD	IN YEARS)	
CD	PST SHIPPING COST LAG TIME	
CD	PWT WASTE DISPOSAL COST LAG TIME	
CD	PET UNUSED MATERIAL COST LAG TIME	
CD	PRA ***RESERVED***	
CD	PRB ***RESERVED***	
CD	UOC UNIT ORE FEED COST (/KG)	
CD	UNC UNIT SEPARATIVE WORK COST, EQUIVALENT (/KG)	
CD	UPC UNIT PRODUCT TREATMENT COST (/KG)	
CD	RTE REFERENCE TAILS ENRICHMENT (FRACTION)	
CD	RFE REFERENCE FEED ENRICHMENT (FRACTION)	
CH	****10 MORE UNDEFINED FLOATING POINT NUMBERS****	

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CD      IP1      FISSION ENRICHMENT COST CALCULATION OPTION
CD          0      NO COST CALCULATION IS PERFORMED. THE INPUT NUC-
CD                  LIDE RELATIVE WORTH IS USED WITHOUT MODIFICATION.
CD                  (APPLICABLE TO FULLY ENRICHED COSTING BUT BEWARE
CD                  DILUTION WORTHS)
CD          1      CALCULATE AT FIXED ENRICHMENT TAILS CONDITION.
CD                  NUCLEIDE WORTH IS CALCULATED USING THE INPUT TAILS
CD                  ENRICHMENT.
CD          2      CALCULATE AT OPTIMUM ENRICHMENT TAILS CONDITION.
CD                  THE OPTIMUM TAILS ENRICHMENT IS CALCULATED
CD                  AND USED TO CALCULATE THE NUCLEIDE WORTH.
CD      IP2      ***RESERVED***
CD          !
CD          !
CD          !
CD          V
CD      IP12     ***RESERVED***
CD      IL      NUMBER OF SETS OF DATA ASSOCIATED WITH FABRICATION
CD      IN      NUMBER OF SETS OF DATA ASSOCIATED WITH PROCESSING
C
C      NOTE: THE FIRST SET IS THE REFERENCE SET. IF THERE ARE MORE
C      THAN ONE SET, THE SECOND SET APPLIES TO THE FIRST
C      STREAM, ETC. THE REFERENCE DATA IS USED FOR ANY
C      STREAM NOT ASSIGNED A SPECIFIC DATA SET.
C
CD      JSS     MAXIMUM NUMBER OF ACTINIDE ISOTOPES IN ANY SET
CD      ISS     NUMBER OF ACTINIDE ISOTOPE SETS
C
C-----

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C-----
C      FUEL MANAGEMENT ECONOMICS DATA (100 RECORD)
C
CL      (FPC(L),L=1,IL), (PDD(L),L=1,IL), (PRC(L),L=1,IL),
CL      (FSC(L),L=1,IL), (PSQ(L),L=1,IL),
CL      (PHC(H),H=1,IN), (PSC(H),H=1,IN), (PPC(H),H=1,IN),
CL      (PNC(H),H=1,IN), (PEC(H),H=1,IN), (PRQ(H),H=1,IN),
CL      (FPC(I),I=1,NHR), (PHC(I),I=1,NHR), (PRQ(I),I=1,NHR),
CL      (ISX(I,J),I=1,ISS,J=1,JSS), (ISX(I,K),I=1,ISS,K=1,3)
C
C      5*IL + 6*IN + 3*NHR + ISS(JSS+3) = NUMBER OF WORDS
C
CD      FCC(L)   CONVERSION COST FOR STREAM L ( /KG DISCHARGE)
CD      FPC(L)   FRESH FABRICATION COST ( /KG DISCHARGE)
CD      PRC(L)   RECYCLE FABRICATION COST ( /KG DISCHARGE)
CD      PSC(L)   SHIPPING COST TO PLANT ( /KG DISCHARGE)
CD      PSQ(L)   ***RESERVED***
CD      PHC(H)   HOT STORAGE COST ( /KG DISCHARGE)
CD      PSC(H)   SHIPPING COST TO PROCESSING ( /KG DISCHARGE)
CD      PPC(H)   PROCESSING COST ( /KG DISCHARGE)
CD      PNC(H)   WASTE DISPOSAL COST ( /KG DISCHARGE)

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(CONT)

CB PFC (M) COST OF HANDLING USED MATERIAL (COULD BE A DISPOSAL
 CB COST (/KG DISCHARGE)
 CB PFD (M) ***RESERVED***
 CB PFC (I) COST OF NUCLIDE ORDERED I IN NUCLIDE REFERENCE LIST
 CB PURCHASED (/KG)
 CB PFW (I) WORTH OF NUCLIDE ORDERED I IN NUCLIDE REFERENCE LIST
 CB SOLD (/KG)
 C
 CB NOTE: NEGATIVE VALUES FOR PFC AND PFW MAY BE APPROPRIATE,
 CB SUCH AS A PENALTY FOR 9236
 C
 CB PFD (I) ***RESERVED***
 CB ISX(I,J) ACTINIDE ISOTOPE ORDER NUMBER IN NUCLIDE REFERENCE NAME
 CB LIST (20 RECORD) IN SET J INDEX I. ZERO ENTRIES ALLOW
 CB AT THE END OF LIST (REQUIRED TO DETERMINE ENRICHMENT
 CB WORKS)
 CB IXP(I,J) REFERENCE FISSILE NUCLIDE IN SET I FOR WHICH ENRICHMENT
 CB COSTS ARE CALCULATED
 C
 CB NOTE: ENRICHMENT WORKS ARE BASED ON THE SUM OF THE INDIVIDUAL
 CB FISSILE ISOTOPE FRACTIONS AND DISTRIBUTED BY RELATIVE WORTH
 C
 C-----
 C*****
 C
 CB REFUEL
 C
 C*****