NOTICE

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

THE JOSHUA SYSTEM

Vol. 3 DATA SET SPECS

Approved by

J. R. Hilley, Research Manager
Computer Applications Division

NOTICE

~~This document contains descriptions of the JOSHUA Operating System and Applications Modules. The document is prepared as a set of loose-leaf notebooks which will be periodically updated. All of the material is preliminary and should not be referenced.~~

September 1973

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

E. I. du Pont de Nemours & Co.
Savannah River Laboratory
Aiken, S. C. 29801

MASTER

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

DATA SET SPECIFICATIONS

CONTENTS

Section A - Summary Descriptions of Data Sets

- A.1 - Guidelines for Specifications of Data Sets
- A.2 - Cross Section Data Sets
- A.3 - Lattice Physics Data Sets
- A.4 - Correlation Data Sets
- A.5 - Reactor Physics Data Sets
- A.6 - Engineering Data Sets

Section B - Cross Section Data Sets

- B.1 - ENDFB Data Set
- B.2 - FINEGRP Data Set
- B.3 - MULTIGRP Data Set
- B.4 - FEWGRP Data Set
- B.5 - NUCPARAM Data Set

Section C - Lattice Physics Data Sets

- C.1 - ASSEMBLY Data Set
- C.2 - LATTICE Data Set
- C.3 - RILIB Data Set
- C.4 - CELL Data Set

Section D - Correlation Data Sets

- D.1 - PARMEQ Data Set

Section E - Reactor Physics Data Sets

- E.1 - REACTOR Data Set

Section F - Engineering Data Sets

- F.1 - PROPERTY Data Set

Contents

- A.1 Guidelines for Specifications of Data Sets
- A.2 Cross Section Data Sets
- A.3 Lattice Physics Data Sets
- A.4 Correlation Data Sets
- A.5 Reactor Physics Data Sets
- A.6 Engineering Data Sets

JOSHUA DPSTM-500	Title Part A - Introduction	Vol. III	Page A.O.2
		Rev.	Date 9/73

(Blank)

JOSHUA

DPSTM-500

Title Introduction
Guidelines for the Specification of
Data Sets.

Vol.
III

Page
A.1.1

Rev.

Date
9/73

Report Written By

H. C. Honeck

Work Done By

H. C. Honeck

Contents

	<u>Page</u>
1. Introduction	A.1.3
2. Selection of the Types of Data	A.1.3
3. Organization of a Data Set	A.1.5
4. Selection of Names	A.1.6

JOSHUA

DPSTM-500

Title Introduction
Guidelines for the Specification of
Data Sets.

Vol.
III

Page
A.1.2

Rev.

Date
9/73

(Blank)

1. Introduction

This volume of the JOSHUA Manual contains the specifications for data sets. These data sets are the heart of the JOSHUA system; they provide input data for the execution of modules, they store the output produced by modules, and they can be displayed and modified by users from a terminal. Considerable thought is required to properly design a data set. If it is well designed, it will serve many applications and require few changes. If it is poorly designed (or designed for a single application) it will require modification for each new application and all codes using the data set will have to be changed. This section offers some guidelines for the proper design of data sets.

2. Selection of the Types of Data

Selecting the types of data to be included is the most difficult part of designing a data set. Several factors must be considered:

- Lasting value of the data.
- Utility of the data.
- Frequency of use of the data.
- Regeneration of data.

Data sets are permanent stores of data on disks backed up with tapes. The operating system will provide facilities for the maintenance of data sets so that incorrect or unwanted data can be easily deleted. It is also necessary to design the data sets so that they contain only the essential data.

If data is to be saved, there must be some lasting value to the data because either

- the user will need to look at this data at some future time, or,
- the data is required for later calculational steps.

The time element is important here. If the user wants to look at the data at the end of a job to verify that the job was done properly, and there is little need to look at the data at a later time, the data should be placed on a temporary data set. This data set can be displayed at the end of job execution but is not permanently saved. If the data is needed for a later calculational step, will that step always be executed following this step? If that data has no lasting value, it should be transmitted to later calculational steps using a scratch data set. A scratch data set is active until a job is completed, but is deleted at the end of the job.

If it is determined that there is some lasting value to the data, it is better to

- permanently store the data, or,
- recalculate it.

Some statistics needed to answer the latter question are that it takes an average of 75 milliseconds to access a record on the IBM 2314 disk, the data transfer rate is 40 words/msec, and the CPU can execute about 500 operations/msec.

As an example, consider a lattice physics module which computes the flux $\phi(\underline{r}, E)$ at 50 space points and 80 energy points. Since all other results can be deduced from this flux, it has a lasting value and should be stored. Should we also store averages of the flux such as

$$\phi(\underline{r}) = \int dE \phi(\underline{r}, E)$$

$$\phi(E) = \int d\underline{r} \phi(\underline{r}, E)$$

$$\phi = \int d\underline{r} \int dE \phi(\underline{r}, E) \quad ?$$

Assume that a later module has read the record containing $\phi(\underline{r}, E)$ and the choice is either to read the averages or compute them. The following table summarizes the reading times.

<u>Array</u>	<u>Words</u>	<u>Transfer Time, (msec)</u>	<u>Access Time, (msec)</u>	<u>Total Time, (msec)</u>
$\phi(E)$	80	2	75	77
$\phi(\underline{r})$	50	1	75	76
ϕ	1	0	75	75

If it takes 10 operations/point to compute the integrals, the compute time is about 75 msec in each case. Clearly, the simple computations illustrated above can be done in 10 operations so that computing is faster than reading. Why take up valuable disk space for these arrays when they can so easily and quickly be computed?

In a multi-programming environment one might argue that reading time is overlapped with other computation so that it might be more efficient to read than compute. To an extent this is true, but as CPU's become faster, programs become more I/O bound and probably it is better to compute than read.

In the case of few-group cross sections, it is clearly better to store them since all data necessary to compute them is probably in core at one time. A later module would have to make many accesses to both the flux data and cross section data.

A third example is a neutron balance sheet. Like few-group cross sections, many accesses to the flux data and cross section data are required to compute a neutron balance sheet. In this case, however, it is probably not justified to devote a few thousand words of disk space for each lattice to a neutron balance sheet since

- it is not used in later calculation steps
- it is not frequently examined by the user
- the total time required to generate it is small (probably less than a minute).

It would be better to have a special module to prepare a neutron balance sheet and other tables for human consumption and display them as needed.

3. Organization of a Data Set

Having decided what data is to be stored, the next step is to organize the data into named data records. The following things must be considered:

- logical association
- module requirements
- record size
- future expansion
- display
- list complexity

Organizing the data into groups by logical association provides more than just esthetic appeal. People (programmers and users) must use the data, and the easier it is to remember where the data is and what it means, the easier it will be to develop and use the system. If the data is used by other modules, their requirements must be considered. For example, nearly all modules using the data set named 'MULTIGRP' will need cross sections and transfer matrices blocked by final energy group. Since this data set is primarily

JOSHUA DPSTM-500	Title Introduction Guidelines for the Specification of Data Sets.	Vol. III	Page A.1.6
		Rev.	Date 9/73

for use by modules and not user, it is structured in this way. When several modules with conflicting requirements are involved, a compromise slanted toward the module with the greatest expected use must be made.

If a record is intended primarily for display purposes, the size of the record should be small, perhaps 10 - 100 numbers. If a record is intended primarily for use by other modules, it should be larger, perhaps 50 - 500 numbers. It takes an average of about 10 words (40 bytes) to store the record name and associated pointers. If the record contains only 10 words, then 50% of the disk space is allocated to the name and pointers, and 50% to the data (50% efficiency). If the data record contains 100 words, the storage efficiency is about 90%. It would be desirable to achieve an over-all storage efficiency of at least 80%.

A major advantage of using named data records is the convenience for future expansion. Named data records defined now (if reasonable foresight is used) will not have to be modified when future modules require additional data. New data records can be defined as needed. The presence of these new records will not affect the operation of older modules. It is desirable, however, to anticipate the needs of future modules and include sufficient data (where possible) in the data sets so that the new data needed can be deduced from the data already stored.

It is a programming convenience to have simple I/Ø lists. A simple list is also easier to display and provides a more compact and readable display. If the record is primarily for display purposes, the list should be tailored to the display. Simple lists will greatly facilitate the future development of information retrieval capability. It is recommended that the I/Ø list be no more complex than a single two-dimensional array or several one-dimensional arrays.

4. Selection of Names

The reason for identifying data by name is to make it convenient for the user at a terminal to interrogate the data base. If the names are not a part of the user's natural language, or do not have a high mnemonic content, the usefulness of the names is lost. There are several other considerations in choosing names:

- hierarchy
- uniqueness
- disk ordering

Qualifiers in a name should follow a hierarchial structure starting with the highest order name first. Unfortunately, in the English language, one generally starts with the lowest order name first.

JOSHUA DPSTM-500	Title Introduction Guidelines for the Specification of Data Sets.	Vol.	Page
		III	A.1.7
		Rev.	Date
			9/73

One would state, "I want the fission cross section for ^{235}U from the multigroup data set". Clearly, the proper order is

'MULTIGRP'. 'U235'. 'XSECTION'. 'FISSION'

When other cross section types (capture, scattering, etc.), other data types (transfer matrices, resonance parameters, etc., and other isotopes are considered, the entire collection of names fall into a well-ordered tree structure.

The data manager writes records on the disk sequentially within a data set. All records of the 'MULTIGRP' data set are in one area of the disk but they appear in the order written. Maintenance programs will clean up the disk and reorder the records according to the hierarchy of their names. This means that, in the example above, all cross sections for ^{235}U are in contiguous areas of the disk. This grouping provides the data manager with the possibility for "looking ahead", since, if a request has been made for data from one part of the tree, there is a good chance that the next request will be for data in the same part of the tree and hence the same area of the disk. It is also possible to program modules to take advantage of this "look ahead".

Care must be taken that the names are unique. If the above example were a valid name, the names

'MULTIGRP'. 'U235'. 'XSECTION'
'MULTIGRP'. 'U235'
'MULTIGRP'

are not valid record names since they refer to groups of records. A record name must uniquely point to a single record.

JOSHUA DPSTM-500	Title Introduction Guidelines for the Specification of Data Sets.	Vol. III	Page A.1.8
		Rev.	Date 9/73

(Blank)

JOSHUA

DPSTM-500

Title Introduction
Cross Section Data Sets

Vol.
III

Page
A.2.1

Rev.

Date
9/73

Report Written By

D. R. Finch

Work Done By

D. R. Finch

Contents

	<u>Page</u>
1. General Description of Cross Section Data Sets and Their Organization	A.2.2

JOSHUA DPSTM-500	Title Introduction Cross Section Data Sets	Vol.	Page
		III	A.2.2
		Rev.	Date
			9/73

(Blank)

The cross section data sets in the JOSHUA system are designed to store data for the following generic classes: (1) neutron interaction, (2) photon interaction, and (3) photon production from neutron interaction. The structure is arranged so that data for neutronic and photonic calculations are segregated for normal calculation, but may be combined easily for a coupled neutron-photon calculation. A distinction between neutron and photon cross sections will be made in the following discussion only when necessary for clarity.

Cross section data sets in the JOSHUA system are designed to provide as gross or as detailed a representation of a cross section as desired by a user. The cross section data sets range from a pointwise representation to cell spectrum and composition-averaged data in few groups. Temperature dependences are accounted for throughout all cross section data sets.

The cross section data sets may loosely be thought of as falling into the following hierarchy:

- ENDFB Data Set - pointwise cross sections in a format very similar to the standard ENDF/B format.
- FINEGRP Data Set - isotopic multigroup neutron cross sections in hundreds of energy groups; atomic multigroup photon cross sections in tens of energy groups; fully coupled photon production matrices.
- NUCPARAM Data Set - nuclear constants and parameters which are independent of energy group structure.
- MULTIGRP Data Set - isotopic multigroup neutron cross sections in tens of energy groups; atomic multigroup photon cross sections in twenty or less energy groups; fully coupled photon production matrices.
- FEWGRP Data Set - cell spectrum and composition-averaged multigroup cross sections with less than ten groups.

Within each of these data sets several versions may be available, each corresponding to a different energy group structure and/or energy spectrum. Standard sets of data are available in each data set for general usage; special versions may be created at any time to contain special-purpose libraries for other purposes.

The several cross section data sets are interconnected by computational modules that allow energy spectrum, energy group structure, cell geometry, and material composition to be properly accounted for in each data set. Figure 1 shows the relationship and flow of data between the data sets, and a set of computational modules for reducing the data from one data set to another.

In the above descriptions no essential distinction has been made between the FINEGRP and MULTIGRP data sets other than MULTIGRP has generally fewer energy groups. The FINEGRP data set is designed to accept as many or as few energy groups as is necessary to retain the

JOSHUA DPSTM-500	Title Introduction Cross Section Data Sets	Vol.	Page
		III	A.2.4
		Rev.	Date
			9/73

integrity of the cross sections for a given energy spectrum. Since the need for energy spectrum detail decreases as group widths decrease (number of group increases) it is possible to get accurate cross sections in the FINEGRP data set by use of larger numbers of energy groups when no detailed energy spectrum is available. Alternatively, if a highly detailed energy spectrum is known, a fewer number of energy groups may be utilized to accurately represent the cross sections. The MULTIGRP data set assumes that a detailed energy spectrum has been used, and that the fewest possible energy groups are used that give an accurate representation of the cross sections. The data structure used in the MULTIGRP data set is also defined so as to be more easily utilized in repetitive production-type calculations.

Figure 1 shows that cross sections may be processed by the Lattice Physics Subsystem in many or a few groups. This provides a way to ascertain a detailed energy spectrum for use in collapsing data sets. Cross sections with little spectrum dependence (but perhaps a large number of energy groups) may be utilized in a cell spectrum calculation to obtain the detailed spectrum. This spectrum may then be used by computational modules to produce broader group cross sections in the MULTIGRP data set.

From any cell spectrum calculation there will result cell spectrum and material composition-averaged cross sections suitable for use in a variety of static or dynamic reactor codes. These cross sections are stored in versions of the FEWGRP data set as defined by the user.

Other types of computational modules (e.g., Monte Carlo, S_n , and other transport theory codes) may be interfaced easily to the FINEGRP or MULTIGRP data sets as required by the individual code modules.

All cross section data sets are capable of being expanded to include new types of data or new representations of data by including uniquely-named records for these data.

JOSHUA DPSTM-500	Title Introduction Cross Section Data Sets	Vol. III	Page A.2.6
		Rev.	Date 9/73

(Blank)

Report Written By

D. R. Finch

Work Done By

H. C. Honeck
R. J. Pryor
M. M. Anderson

Contents

	<u>Page</u>
1. Purpose of Lattice Physics Data Sets	A.3.3
2. ASSEMBLY Data Set	A.3.3
3. LATTICE Data Set	A.3.4
4. RILIB Data Set	A.3.4
5. CELL Data Set	A.3.4

JOSHUA DPSTM-500	Title Introduction Lattice Physics Data Sets	Vol. III	Page A.3.2
		Rev.	Date 9/73

(Blank)

1. Purpose

The purpose of the Lattice Physics Data Sets is (1) to share the basic descriptive information about material and geometric properties of assemblies and lattices of assemblies in terms that are meaningful to the designers (2) to catalog the basic assembly and lattice properties and variations from these properties in a consistent and easily referencable manner, and (3) to store meaningful and reusable results of lattice physics calculations in a consistent and easily referencable manner.

There may be several modules that compute neutron flux distribution in a lattice, each of which uses a different spatial mesh layout and different theory. These modules will contain routines to convert the physical descriptions in the ASSEMBLY and LATTICE data sets to that used internally in the module. This procedure allows the same physical description to be used in both physics and engineering modules.

To provide the results of the lattice physics calculations to reactor calculations (static or transient) requires the results to be cataloged in an easily referenced form. This is provided by a catalog stored in the LATTICE data set which points to data stored in the LATTICE and FEWGRP data sets. This catalog provides access to data for use in other JOSHUA subsystems (such as the correlation subsystem).

2. ASSEMBLY Data Set

The ASSEMBLY data set contains the material and geometrical descriptions of fuel, target, and control assemblies plus the surrounding moderator inside a cell of a lattice. This data is the main input to the Lattice Physics Subsystem which computes flux distributions in infinite lattices of these cells and to engineering modules (such as DITTY) which computes the thermal-hydraulic characteristics of the assemblies.

The geometry types presently contained in the ASSEMBLY data set are:

- . nested annular finned tubes
- . rod clusters
- . hexagonal cells
- . square cells

JOSHUA DPSTM-500	Title Introduction Lattice Physics Data Sets	Vol. III	Page A.3.4
		Rev.	Date 9/73

3. LATTICE Data Set

The LATTICE data set contains (1) lattice reference state data, (2) changes to the reference state data, (3) flags specifying the numerical approximations used to compute lattice states, and (4) computed integral and differential neutronic state characteristics. Information contained in the ASSEMBLY data set is duplicated in the LATTICE data set to enable a complete catalog of lattice reference states to be maintained.

The information in the LATTICE data set is created, updated, maintained, and deleted through appropriate computational and house-keeping modules (such as CRELAT or RAHAB) so as to maintain a properly referencable set of lattice states.

The LATTICE data set is the primary input to lattice physics modules (such as RAHAB) which compute flux distributions in infinite lattices. The LATTICE data set and the FEWGRP data set are the data sets used for storing the cataloged results of lattice physics calculations. The catalogs are maintained in the LATTICE data set for all lattice states in both LATTICE and FEWGRP data sets.

4. RILIB Data Set

The RILIB data set contains the results of resonance integral calculations performed by lattice physics modules (such as CREEP). The intent is to store calculational results in a form reusable in later calculations.

5. CELL Data Set

The CELL data set contains the results of lattice physics current response function calculations. These response functions are used as input to a lattice or reactor calculation based on balancing the net current and flux at each cell boundary (such as is performed by the RASCAL module).

JOSHUA DPSTM-500	Title Introduction Correlation Data Sets	Vol. III	Page A.4.1
		Rev.	Date 9/73

Report Written By

M. R. Buckner

Work Done By

M. R. Buckner
H. C. Honeck

Contents

	<u>Page</u>
1. PARMEQ Data Set	A.4.3

JOSHUA DPSTM-500	Title Introduction Correlation Data Sets	Vol. III	Page A.4.2
		Rev.	Date 9/73

(Blank)

JOSHUA

DPSTM-500

Title Introduction
Correlation Data Sets

Vol.

III

Page

A.4.3

Rev.

Date

9/73

The PARMEQ data set in JOSHUA provides the data interface necessary for supplying lattice physics parameters to the Reactor Subsystem. The position of this interface relative to the stages of a reactor calculation is shown in Figure 1. Lattice physics parameters for many different states are required in detailed static or dynamic reactor calculations. Due to the voluminous amount of data required, it is necessary to provide a compact representation of this data which can be accessed frequently during a calculation. A JOSHUA correlation subsystem was developed to provide such a representation of lattice parameters. Correlation equations in terms of one or more lattice state parameters are developed by the correlation subsystem and stored in a PARMEQ block for use in subsequent reactor static, depletion, and transient calculations.

FIGURE 1. Stages in Reactor Calculations

JOSHUA

DPSTM-500

Title Introduction
Reactor Physics Data Sets

Vol.
III

Page
A.5.1

Rev.

Date
9/73

Report Written By

D. R. Finch

Work Done By

H. C. Honeck

Contents

	<u>Page</u>
1. Purpose	A.5.3
2. REACTOR Data Set	A.5.3

JOSHUA DPSTM-500	Title Introduction Reactor Physics Data Sets	Vol. III	Page A.5.2
		Rev.	Date 9/73

(Blank)

JOSHUA DPSTM-500	Title Introduction Reactor Physics Data Sets	Vol.	Page
		III	A.5.3
		Rev.	Date
			9/73

1. Purpose

The REACTOR data set contains the material and geometrical description of the reactor and its subdivisions in terms that are meaningful to the reactor designer. This is a description of physical quantities and is not related to the codes that use the data. Several modules may compute neutron flux distributions in a reactor, each of which uses a different spatial mesh point layout and different theory. These modules will contain the necessary routines to convert the physical description given in the REACTOR data set to the descriptions used internally in the module. In this way the same physical description can be used in both physics and engineering modules.

2. REACTOR Data Set

The REACTOR data set contains the material and geometrical description of reactors. The geometrical descriptions are applicable to all orthogonal geometries of practical interest and to hex and hex-z coordinates. The geometry is specified in terms of a finite difference mesh structure and a relation between mesh points, regions, and zones. Materials are assigned to regions and associated with cross section data contained in the FEWGRP data set. Neutron flux or current boundary conditions are also specified.

JOSHUA

DPSTM-500

Title Introduction
Engineering Data Sets

Vol.
III

Page
A.6.1

Rev.

Date
9/73

Report Written By

M. R. Buckner

Work Done By

M. M. Anderson
M. R. Buckner

JOSHUA DPSTM-500	Title Introduction Engineering Data Sets	Vol. III	Page A.6.2
		Rev.	Date 9/73

(Blank)

JOSHUA

DPSTM-500

Title Introduction
Engineering Data Sets

Vol. III
Page A.6.3

Rev.
Date 9/73

The PRØPERTY data set is designed to provide engineering properties to calculational modules. The properties are represented by polynomial expansions in one or more engineering state variables. The data set contains the correlation parameters for each property. These data are processed by the subroutine PRØPTY (DPSTM-500, Vol. 5, Part I) and the value of the property is returned to the calculational module.

The data set contains correlations for materials presently used in reactor charge design at the Savannah River Laboratory. Additional materials will be added as the need develops and additional data becomes available.

JOSHUA DPSTM-500	Title Introduction Engineering Data Sets	Vol. III	Page A.6.4
		Rev.	Date 9/73

(Blank)

JOSHUA DPSTM-500	Title Part B - Cross Section Data Sets	Vol. III	Page B.O.1
		Rev.	Date 9/73

Contents

- B.1 - ENDFB
- B.2 - FINEGRP
- B.3 - MULTIGRP
- B.4 - FEWGRP
- B.5 - NUCPARAM

JOSHUA
DPSTM-500

Title Part B - Cross Section Data Sets

Vol.
III

Page
B.O.2

Rev.

Date
9/73

(Blank)

JOSHUA
DPSTM-500

Title Cross Section Data Sets
ENDFB

Vol. III
Page B.1.1

Rev.
Date 9/73

Report Written By

D. R. Finch

Work Done By

D. R. Finch

Contents

	<u>Page</u>
1. Introduction	B.1.3
2. Record Descriptions	B.1.7

JOSHUA DPSTM-500	Title Cross Section Data Sets ENDFB	Vol.	Page
		III	B.1.2
		Rev.	Date
			9/73

(Blank)

1. Introduction

The cross sections stored in the ENDFB data set have a pointwise representation which means that values of $\sigma(E)$ are tabulated for given values of E and an interpolation relation between adjacent points is specified. This representation allows any cross section variation to be specified to any accuracy required. The content of this data set is essentially that of the ENDF/B library* distributed by the National Neutron Cross Section Center. Local evaluations of cross sections may be included as well by formatting the data in the ENDF/B* format.

The arrangement of the cross section data in the JOSHUA ENDFB data set differs slightly from that in the standard ENDF/B arrangement. The differences are the following:

1. The ENDFB data set contains no marker records of the type designated SEND, FEND, MEND, or TEND in the standard ENDF/B.
2. Records within a section of data are sequentially numbered in the name string in the ENDFB data set.
3. The numerical record type designation is contained in the name string in the ENDFB data set. The numerical designations are as follows:

<u>Record Type</u>	<u>Numerical Type (MR)</u>
CONTROL	1
LIST	2
TAB1	3
TAB2	4
HOLL	5

4. The ENDFB data set contains contents records both for versions of the data set and for isotopes within versions of the data set.

A section of data in the standard ENDF/B arrangement is specified by a material number (mnemonic MAT), a data type or file number (mnemonic MF), and a reaction type (mnemonic MT). In the ENDFB data set the data set name ('ENDFB') and the version name of the data set are prefixed to these same three parameters to form the name string for a section of data. Within a section of data the record sequence number and numerical record type designation are added to complete the standard name string for a record of data in the ENDFB data set.

ENDFB.?VERSN?.?MAT?.?MF?.?MT?.?MS?.?MR? → Std. Name String

Figure 1. Structure of Records in Data Set ENDFB

Three CONTENTS records serve to catalog all data in the data set. The record with name string ENDFB.CONTENTIS contains the names of all versions (mnemonic ?VERSN?) of the data set. The versions of this data set differentiate periods of time and the accepted ENDF/B data at these times.

The record with name string ENDFB.?VERSN?.CØNTENTS contains the isotope designations (mnemonic ?MAT?) for all isotopes in a version (with name ?VERSN?) of the data set.

The record with name string ENDFB.?VERSN?.?MAT?.CØNTENTS contains the data type (mnemonic ?MF?) and reaction type (mnemonic ?MT?) designations of all data available for an isotope (with name ?MAT?) in a version (with name ?VERSN?) of the data set.

Figure 1 shows the over-all structure of the ENDFB data set. Details of the records that are contained in each section of data are contained in the ENDF/B library* specifications. Detailed record descriptions and nomenclature are given in the following paragraphs.

* Drake, M. K., Ed., Data Formats and Procedures for The ENDF Neutron Cross Section Library, Brookhaven National Laboratory, Upton, N.Y., USAEC document BNL 50274 (ENDF 102, Vol. 1), 1970.

JOSHUA DPSTM-500	Title Cross Section Data Sets ENDFB	Vol. III	Page B.1.6
		Rev.	Date 9/73

(Blank)

2. RECORD DESCRIPTIONS

LIST OF DATA SET VERSIONS

```

|
| NAME - 'ENDFB'.'CONTENTS'
|
| LIST - NVX,(VERSN(NV),NV=1,NVX)
|

```

SYMBOL	DEFINITION	TYPE
NV	VERSION INDEX. E.G. VERSN(NV)	I4
NVX	MAXIMUM VALUE OF NV USED	I4
VERSN	NAME OF A VERSION OF THE ENDFB DATA SET	C8

CONTENTS OF A VERSION OF DATA SET

```

|
| NAME - 'ENDFB'.'?VERSN?'. 'CONTENTS'
|
| LIST - ISOX,(DISO(ISO),(DESC(L,ISO),L=1,18),ISO=1,ISOX)
|

```

SYMBOL	DEFINITION	TYPE
DESC	72 CHARACTER DESCRIPTION OF A MATERIAL	C4
DISO	ENDF/B MAT NUMBER FOR A MATERIAL	R8
ISO	ISOTOPE INDEX. E.G. DISO(ISO)	I4
ISOX	MAXIMUM VALUE OF ISO USED	I4
L	INDEX FOR HOLLERITH DESCRIPTION ARRAY	I4
VERSN	NAME OF A VERSION OF THE ENDFB DATA SET	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets ENDFB	Vol. III	Page B.1.8
		Rev.	Date 9/73

FILE NUMBERS AND REACTION TYPES FOR A MATERIAL

```

| NAME - 'ENDFB'.?VERSN?.?DISO?.?CONTENTS'
| LIST - NDRX,(DTYPE(NDR),RTYPE(NDR),NDR=1,NDRX)

```

SYMBOL	DEFINITION	TYPE
DISO	ENDF/B MAT NUMBER FOR A MATERIAL	R8
DTYPE	ENDF/B FILE NUMBER OF A DATA ENTRY	R8
NDR	FILE NUMBER AND REACTION TYPE INDEX. E.G. DTYPE(NDR)	I4
NDRX	MAXIMUM VALUE OF NDR USED	I4
RTYPE	ENDF/B REACTION TYPE NUMBER OF A DATA ENTRY	R8
VERSN	NAME OF A VERSION OF THE ENDFB DATA SET	C8

CONT RECORD

NAME - 'ENDFB'.?VERSN?.?MAT?.?MF?.?MT?.?MS?.1
LIST - MAT,MF,MT,C1,C2,L1,L2,N1,N2

SYMBOL	DEFINITION	TYPE
C1	FLOATING POINT PARAMETER	R4
C2	FLOATING POINT PARAMETER	R4
L1	INTERGER PARAMETER	I4
L2	INTERGER PARAMETER	I4
MF	FILE NUMBER	I4
MS	RECORD SEQUENCE NUMBER WITHIN A SECTION OF DATA	I4
MT	REACTION TYPE NUMBER	I4
MAT	MATERIAL I.D. NUMBER	I4
N1	LENGTH OF INTERPOLATION TABLE (TAB1 OR TAB2) OR LENGTH OF LIST (LIST RECORD)	I4
N2	LENGTH OF DATA TABLE (TAB1 RECORD)	I4
VERSN	NAME OF A VERSION OF THE ENDFB DATA SET	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets ENDFB	Vol. III	Page B.1.10
		Rev.	Date 9/73

LIST RECORD

NAME - 'ENDFB'.?VERSN?.?MAT?.?MF?.?MT?.?MS?.2
LIST - MAT,MF,MT,C1,C2,L1,L2,N1,N2,(B(K),K=1,N1)

SYMBOL	DEFINITION	TYPE
B	LIST RECORD PARAMETER TABLE	R4
C1	FLOATING POINT PARAMETER	R4
C2	FLOATING POINT PARAMETER	R4
L1	INTERGER PARAMETER	I4
L2	INTERGER PARAMETER	I4
MF	FILE NUMBER	I4
MS	RECORD SEQUENCE NUMBER WITHIN A SECTION OF DATA	I4
MT	REACTION TYPE NUMBER	I4
MAT	MATERIAL I.D. NUMBER	I4
N1	LENGTH OF INTERPOLATION TABLE (TAB1 OR TAB2) OR LENGTH OF LIST (LIST RECORD)	I4
N2	LENGTH OF DATA TABLE (TAB1 RECORD)	I4
VERSN	NAME OF A VERSION OF THE ENDFB DATA SET	C8

TAB1 RECORD

```
NAME - 'ENDFB'.?VERSN?.?MAT?.?MF?.?MT?.?MS?.3
LIST - MAT,MF,MT,C1,C2,L1,L2,N1,N2,(NBT(I),JNT(I),I=1,N1),
      (X(J),Y(J),J=1,N2)
```

SYMBOL	DEFINITION	TYPE
C1	FLOATING POINT PARAMETER	R4
C2	FLOATING POINT PARAMETER	R4
I	INDEX OF INTERPOLATION TABLE	I4
J	INDEX OF DATA TABLE	I4
JNT	INTERPOLATION TABLE. E.G. JNT(I) IS CODE FOR REGION I.	I4
L1	INTERGER PARAMETER	I4
L2	INTERGER PARAMETER	I4
MF	FILE NUMBER	I4
MS	RECORD SEQUENCE NUMBER WITHIN A SECTION OF DATA	I4
MT	REACTION TYPE NUMBER	I4
MAT	MATERIAL I.D. NUMBER	I4
N1	LENGTH OF INTERPOLATION TABLE (TAB1 OR TAB2) OR LENGTH OF LIST (LIST RECORD)	I4
N2	LENGTH OF DATA TABLE (TAB1 RECORD)	I4
NBT	BREAK POINTS IN INTERPOLATION TABLE. E.G. NBT(I) IS LAST POINT IN REGION I.	I4
X	INDEPENDENT VARIABLE IN DATA TABLE	R4
Y	DEPENDENT VARIABLE IN DATA TABLE	R4
VERSN	NAME OF A VERSION OF THE ENDFB DATA SET	C8

TAB2 RECORD

NAME - 'ENDFB'.?VERSN?.?MAT?.?MF?.?MT?.?MS?.4

LIST - MAT,MF,MT,C1,C2,L1,L2,N1,N2,(NBT(I),JNT(I),I=1,N1)

SYMBOL	DEFINITION	TYPE
C1	FLOATING POINT PARAMETER	R4
C2	FLOATING POINT PARAMETER	R4
I	INDEX OF INTERPOLATION TABLE	I4
JNT	INTERPOLATION TABLE. E.G. JNT(I) IS CODE FOR REGION I.	I4
L1	INTERGER PARAMETER	I4
L2	INTERGER PARAMETER	I4
MF	FILE NUMBER	I4
MS	RECORD SEQUENCE NUMBER WITHIN A SECTION OF DATA	I4
MT	REACTION TYPE NUMBER	I4
MAT	MATERIAL I.D. NUMBER	I4
N1	LENGTH OF INTERPOLATION TABLE (TAB1 OR TAB2) OR LENGTH OF LIST (LIST RECORD)	I4
N2	LENGTH OF DATA TABLE (TAB1 RECORD)	I4
NBT	BREAK POINTS IN INTERPOLATION TABLE. E.G. NBT(I) IS LAST POINT IN REGION I.	I4
VERSN	NAME OF A VERSION OF THE ENDFB DATA SET	C8

HOLL RECORD

NAME - 'ENDFB'.?VERSN?.?MAT?.?MF?.?MT?.?MS?.5
LIST - MAT,MF,MT,C1,C2,L1,L2,N1,N2,(B(K),K=1,N1)

SYMBOL	DEFINITION	TYPE
B	LIST RECORD PARAMETER TABLE	R4
C1	FLOATING POINT PARAMETER	R4
C2	FLOATING POINT PARAMETER	R4
K	INDEX OF LIST RECORD TABLE	I4
L1	INTERGER PARAMETER	I4
L2	INTERGER PARAMETER	I4
MF	FILE NUMBER	I4
MS	RECORD SEQUENCE NUMBER WITHIN A SECTION OF DATA	I4
MT	REACTION TYPE NUMBER	I4
MAT	MATERIAL I.D. NUMBER	I4
N1	LENGTH OF INTERPOLATION TABLE (TAB1 OR TAB2) OR LENGTH OF LIST (LIST RECORD)	I4
N2	LENGTH OF DATA TABLE (TAB1 RECORD)	I4
VERSN	NAME OF A VERSION OF THE ENDFB DATA SET	C8

JOSHUA
DPSTM-500

Title Cross Section Data Sets
 FINEGRP

Vol. III	Page B.2.1
Rev.	Date 9/73

Report Written By

D. R. Finch

Work Done By

H. C. Honeck
D. R. Finch

Contents

	<u>Page</u>
1. Introduction	B.2.3
2. Record Descriptions	B.2.9

JOSHUA DPSTM-500	Title Cross Section Data Sets FINEGRP	Vol. III	Page B.2.2
		Rev.	Date 9/73

(Blank)

JOSHUA DPSTM-500	Title Cross Section Data Sets FINEGRP	Vol. III	Page B.2.3
		Rev.	Date 9/73

1. Introduction

The FINEGRP data set is designed to provide multigroup neutron or photon cross sections to whatever degree of accuracy required. Each version of the data set has a specified energy group structure and energy spectrum associated with it. Any number of groups may be chosen by the user, however, a practical limit of 1000 neutron energy groups and 100 photon energy groups is generally reasonable for any application. Provisions are made for utilizing neutron and photon cross sections separately or as a coupled structure.

The number of energy groups for a neutron version of the FINEGRP data set is usually conditioned by how well the energy spectrum of neutrons is known. If little spectrum detail is available a larger number of energy groups is required to represent the cross sections adequately. If a detailed spectrum is available then the cross sections may be averaged using the detailed spectrum as a weighting function into broader (hence fewer) energy groups. Similar comments apply also to photon data.

The FINEGRP data set has several records that catalog the contents of the data set and specify the neutron and photon group structures and spectrums of the various versions of the data set. The record with name string FINEGRP.CØNTENTS contains the names of all neutron versions (mnemonic ?VERSN?) of the data set and the record with name string FINEGRP.PHOTON.VERSIONS contains the names of all photon versions (mnemonic ?VERSP?). Some of these versions are standardized versions available for general usage; others are special-purpose versions for specialized applications.

The record with name string FINEGRP.?VERSN?.CØNTENTS contains the names of all isotopes (mnemonic ?DISØ?) in the neutron versions of the data set with name ?VERSN?. A similar set of data for photons is contained in the record with name string FINEGRP.PHOTON.?VERSP?.CØNTENTS.

The record with name string FINEGRP.?VERSN?.GRØUPS contains the neutron group structure for the version of the data set with name ?VERSN?. Group boundaries, group widths, and velocity average characteristic energies are given in this record. Photon group structure data is given in the record with name string FINEGRP.PHOTON.?VERSP?.GRØUPS.

The record with name string FINEGRP.?VERSN?.SPECTRUM contains a pointwise representation of the energy spectrum of neutrons in the version of the data set with name ?VERSN?. This record is in the form of an ENDF/B TAB1 record* and is necessary for use by computational modules which average pointwise data from the ENDFB data set into the FINEGRP data set. The spectrum stored in this record is arbitrary and requires no special normalization. The photon energy spectrum is contained in the record with name string FINEGRP.PHOTON.?VERSN?.SPECTRUM.

* See Section B.1

JOSHUA DPSTM-500	Title Cross Section Data Sets FINEGRP	Vol. III	Page B.2.4
		Rev.	Date 9/73

The record with name string FINEGRP.?VERSN?.WEIGHTS contains the integrals of the neutron spectrum stored in the record with name string FINEGRP.?VERSN?.SPECTRUM over the energy groups stored in the record with name string FINEGRP.?VERSN?.GROUPS. A similar record for the integrals over the photon spectrum is contained in the record with name string FINEGRP.PHOTON.?VERSP?.WEIGHTS.

The record with name string FINEGRP.?VERSN?.DISØ?.CONTENTS contains the names of data types (mnemonic ?DTYPE?) and reaction types (mnemonic ?RTYPE?) contained in the neutron version of the data set with name ?VERSN? for the isotope with name ?DISØ?. The same data for a photon version and isotope is contained in the record with name string FINEGRP.PHOTON.?VERSP?.?DISP?.CONTENTS.

The neutron data in the FINEGRP data set is coupled to the NUCPARAM data set. For each neutron version (?VERSN?) of the FINEGRP data set there exists a version of the NUCPARAM data set with the same version name containing potential scattering cross sections for each isotope, decay constants and decay modes for all fission products of each fissionable isotope, resolved and unresolved resonance parameters for each isotope, and fission product yields for each isotope.

The FINEGRP data set neutron and photon versions and isotopes may be coupled through photon production matrices describing the photon spectrum produced through neutron interactions, such as fission, capture processes, or inelastic scattering processes. The record with name string FINEGRP.PHOTON.?VERSP?.?DISP?.COUPLING contains a list of all neutron versions and isotopes to which this photon version (?VERSP?) and isotope (?DISP?) is coupled through production matrices.

At the present time coupling is provided only from neutron interaction to photon production; however, it is possible by simple extension to couple photon interaction to neutron production.

Photon interaction cross sections are isotopically independent; i.e., they depend only on the nuclide Z and not on nuclide A. For this reason the photon interaction cross sections are stored only once by an IZ designation and coupled to the various neutron isotopes via appropriate production matrices.

The following paragraphs describe the detailed records for each data type and reaction type for each isotope in each version of the data set. Figures 1 through 3 show the structure of the records within the data set.

Figure 1. Structure of FINEGRP Data Set for Neutron Interaction Data

Figure 2. Structure of FINEGRP Data Set for Photon Interaction Data

Figure 3. Structure of FINEGRP Data Set for Photon Production Data

JOSHUA
DPSTM-500

Title Cross Section Data Sets
FINEGRP

Vol. III
Page B.2.8

Rev.
Date 9/73

(Blank)

2. Record Descriptions

VERSION NAMES OF NEUTRON VERSIONS

NAME = FINEGRP.CONTENTS

LIST = NVX, (VERSN(NV), NV=1, NVX)

SYMBOL	DEFINITION	TYPE
NV	VERSION INDEX. E.G. VERSN(NV)	I4
NVX	MAXIMUM VALUE OF NV USED	I4
VERSN	NEUTRON VERSION NAMES	C8

ISOTOPES IN A NEUTRON VERSION

NAME = 'FINEGRP'.?VERSN?. 'CONTENTS'

LIST = ISOX, (DISO(ISO), IZAS(ISO), AWR(ISO), ITDF(ISO), ISO=1, ISOX)

SYMBOL	DEFINITION	TYPE
AWR	RATIO OF ISOTOPE ATOMIC WEIGHT TO NEUTRON ATOMIC WGT	R4
DISO	ISOTOPE OR MATERIAL NAME	C8
ISO	ISOTOPE INDEX. E.G. DISO(ISO)	I4
ISOX	MAXIMUM VALUE OF ISO USED	I4
ITDF	TEMPERATURE DEPENDENCE FLAG. IF ITDF = 0 ALL DATA FOR AN ISOTOPE IS TEMPERATURE INDEPENDENT. IF ITDF IS NOT 0 SOME DATA IS TEMPERATURE DEPENDENT	I4
IZAS	ISOTOPE DESIGNATION IN FORM ZZAAS WHERE: ZZ = 2 DIGIT ATOMIC NUMBER AAA = 3 DIGIT ATOMIC WEIGHT S = 1 DIGIT STATE NUMBER EXAMPLES: 922380 = U-238 IN GROUND STATE 10010 = HYDROGEN IN GROUND STATE 952420 = AM-242 IN GROUND STATE 952421 = AM-242 IN FIRST EXCITED STATE	I4
VERSN	NEUTRON VERSION NAME	C8

POINTWISE NEUTRON WEIGHTING SPECTRUM

NAME = 'FINEGRP'.?VERSN?. 'SPECTRUM'

LIST = TMAXW,0,IWSOP,JFTG,N1,N2,(NBT(M),INT(M),M=1,N1),
(EPT(N),FLX(N),N=1,N2)

NOTE - THIS IS AN ENDF/B TAB1 RECORD DEFINED IN ENDF 102, VOL I

SYMBOL	DEFINITION	TYPE
--------	------------	------

EPT	ENERGY POINT (EV) AT WHICH FLUX IS TABULATED	R4
-----	--	----

FLX	NEUTRON FLUX AT AN ENERGY POINT	R4
-----	---------------------------------	----

INT	INTERPOLATION CODE TO BE USED TO OBTAIN FLUX VALUES BETWEEN TABULATED POINTS. ALLOWED VALUES ARE:	I4
-----	---	----

INT	INTERPOLATION METHOD
1	FLX CONSTANT
2	FLX LINEAR IN E
3	FLX LINEAR IN LN(E)
4	LN(FLX) LINEAR IN E
5	LN(FLX) LINEAR IN LN(E)

IWSOP	WEIGHTING SPECTRUM OPTION. ALLOWED VALUES ARE:	I4
-------	--	----

IWSOP	DESCRIPTION
1	NOT USED
2	UNIT SPECTRUM
3	MAXWELLIAN + 1/E
4	MAXWELLIAN + 1/E + FISSION SPECTRUM
5	ARBITRARY TABULATED SPECTRUM

JFTG	NUMBER OF HIGHEST ENERGY THERMAL GROUP	I4
------	--	----

M	INTERPOLATION REGION INDEX. E.G. NBT(M),INT(M)	I4
---	--	----

N	ENERGY POINT INDEX	I4
---	--------------------	----

N1	MAXIMUM VALUE OF M USED	I4
----	-------------------------	----

N2	MAXIMUM VALUE OF N USED	I4
----	-------------------------	----

NBT	VALUE OF N BELOW WHICH INTERPOLATION CODE INT IS TO	I4
-----	---	----

JOSHUA DPSTM-500	Title Cross Section Data Sets FINEGRP	Vol. III	Page B.2.12
		Rev.	Date 9/73

SYMBOL	DEFINITION	TYPE
	BE USED	
0	- DUMMY VARIABLE, NOT USED.	R4
TMAXW	: CHARACTERISTIC TEMPERATURE (EV) OF MAXWELLIAN DISTRIBUTION USED IN THERMAL REGION.	R4
VERSN	: NEUTRON VERSION NAME	C8

GROUP INTEGRALS OF NEUTRON SPECTRUM

NAME = 'FINEGRP'.?VERSN?. 'WEIGHTS'

LIST = NEG, (WGTS(I), I=1, NEG)

SYMBOL	DEFINITION	TYPE
I	ENERGY GROUP INDEX	I4
NEG	NUMBER OF ENERGY GROUPS	I4
VERSN	NEUTRON VERSION NAME	C8
WGTS	INTEGRALS OF FLX OVER ENERGY GROUPS. THESE WEIGHTS CAN BE USED TO FURTHER COMPRESS THE GROUP STRUCTURE.	R4

NOTE: THESE GROUP INTEGRALS CAN BE USED TO COMPRESS THE GROUP
STRUCTURE BASED ON SPECTRUM GIVEN IN RECORD
FINEGRP.?VERSN?.SPECTRUM

JOSHUA DPSTM-500	Title Cross Section Data Sets FINEGRP	Vol. III	Page B.2.14
		Rev.	Date 9/73

GROUP STRUCTURE FOR A NEUTRON VERSION

NAME = 'FINEGRP'.?VERSN?.?GROUPS'

LIST = NEG,JFTG,(E(1),EB(1),DE(1),I=1,NEG),E(NEG+1)

SYMBOL	DEFINITION	TYPE
DE	GROUP WIDTH (EV). $DE(I) = E(I) - E(I+1)$	R4
E	UPPER ENERGY OF A GROUP (EV). ENERGIES ARE GIVEN IN DECREASING ORDER. I.E. $E(1) > E(2) > \dots > E(I) > \dots > E(NEG+1)$	R4
EB	VELOCITY AVERAGE CHARACTERISTIC ENERGY OF A GROUP (EV) $E(I) > EB(I) > E(I+1)$	R4
I	INITIAL GROUP INDEX. S.G. E(I)	I4
JFTG	GROUP INDEX OF FIRST THERMAL GROUP	I4
NEG	NUMBER OF ENERGY GROUPS USED	I4
VERSN	NEUTRON VERSION NAME	C8

CROSS SECTION CONTENTS FOR AN ISOTOPE IN A NEUTRON VERSION

NAME = 'FINEGRP'.?VERSN?.?DISO?. 'CONTENTS'

LIST = NDRX, (DTYPE(NDR), RTYPE(NDR), NDR=1, NDRX)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
DTYPE	DATA TYPE NAME. ALLOWED TYPES ARE:	C8

DTYPE	DESCRIPTION
XSECTION	CROSS SECTION OR PO LEGENDRE COMPONENT
PLXSECT	LEGENDRE CROSS SECTIONS P1,P2,P3,...
PMATRIX	TRANSFER MATRIX (PO LEGENDRE COMPONENT)
PLMATRIX	LEGENDRE TRANSFER MATRIX P1,P2,P3,...
DELAYED	DELAYED NEUTRON DATA
BRATIO	BRANCHING RATIOS FOR ISOTOPIC DECAY

NDR	DATA TYPE AND REACTION TYPE INDEX. E.G. DTYPE(NDR)	I4
NDRX	MAXIMUM VALUE OF NDR USED	I4
RTYPE	REACTION TYPE NAME. ALLOWED TYPES ARE LISTED BELOW. TYPES MARKED WITH (S) ARE ONLY TYPES USED WITH DATA TYPES PLXSECT, PMATRIX, PLMATRIX.	C8

RTYPE	USE	DESCRIPTION
TOTAL		TOTAL CROSS SECTION
SCATTER	(S)	TOTAL SCATTERING = ELASTIC+INELAST
ELASTIC	(S)	ELASTIC SCATTERING
INELAST	(S)	INELASTIC SCATTERING
N2N	(S)	(N,2N)
N3N	(S)	(N,3N)
CHI	(S)	FISSION NEUTRON SPECTRUM
CAPTURE		CAPTURE = (N,G)+(N,P)+(N,A)+ETC.
FISSION		FISSION
NU		NEUTRON YIELD PER FISSION
NG		(N,GAMMA) TO ALL FINAL STATES
NGN		(N,GAMMA) TO N' TH EXCITED STATE
NP		(N,P)
ND		(N,D)

PO NEUTRON INTERACTION CROSS SECTION

```
NAME = 'FINEGRP'.?VERSN?.?DISO?. 'XSECTION'.?RTYPE?
LIST = IA,IB,KTX,(TDK(KT),(X(I,KT),I=IA,IB),KT=1,KTX)
```

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
I	ENERGY GROUP INDEX	I4
IA	LOWER LIMIT OF ENERGY INDEX I FOR NON-ZERO DATA	I4
IB	UPPER LIMIT OF ENERGY INDEX I FOR NON-ZERO DATA	I4
KT	TEMPERATURE INDEX. E.G. TDK(KT)	I4
KTX	MAXIMUM VALUE OF KT USED	I4
RTYPE	REACTION TYPE	C8
TDK	TEMPERATURE (DEG. K) = T(DEG C) + 273	R4
VERSN	NEUTRON VERSION NAME	C8
X	CROSS SECTION (BARNs). E.G. X(I)	R4
	<div> <div>NT</div> <div>NA</div> </div> <div> <div>(N,T)</div> <div>(N,A)</div> </div>	
VERSN	NEUTRON VERSION NAME	C8

HIGHEST LEGENDRE ORDER IN NEUTRON INTERACTION PL CROSS SECTIONS

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PLXSECT?.?RTYPE?.?SIZE'
LIST = LX

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
LX	MAXIMUM VALUE OF L USED	I4
RTYPE	REACTION TYPE	C8
VERSN	NEUTRON VERSION NAME	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets FINEGRP	Vol. III	Page B.2.18
		Rev.	Date 9/73

LTH LEGENDRE COMPONENT OF NEUTRON INTERACTION CROSS SECTION

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PLXSECT?.?RTYPE?.?L?
LIST = IA,IB,KTX,(TDK(KT),(XL(I,KT),I=IA,IB),KT=1,KTX)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
I	ENERGY GROUP INDEX	I4
IA	LOWER LIMIT OF ENERGY INDEX I FOR NON-ZERO DATA	I4
IB	UPPER LIMIT OF ENERGY INDEX I FOR NON-ZERO DATA	I4
KT	TEMPERATURE INDEX. F.G. TDK(KT)	I4
KTX	MAXIMUM VALUE OF KT USED	I4
RTYPE	REACTION TYPE	C8
L	LEGENDRE ORDER	I4
TDK	TEMPERATURE (DEG. K) = T(DEG C) + 273	F4
VERSN	NEUTRON VERSION NAME	C8
XL	LEGENDRE CROSS SECTION (BARNs). XL(I,L) IS THE VALUE IN GROUP I FOR THE LTH LEGENDRE COMPONENT. VALUES ARE GIVEN FOR L=1,2,3,....,LX.	R4

NOTE = ONE RECORD OF THIS TYPE IS GIVEN FOR EACH L=1,2,....,LX

PO TRANSFER MATRIX SIZE FOR NEUTRON INTERACTION CROSS SECTION

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PMATRIX'.?RTYPE?.SIZE

LIST = MLX,MHX

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
MHX	LARGEST VALUE OF M USED. MAX.LE.(NEG-1)	I4
MLX	SMALLEST VALUE OF M USED. MLX.GE.-(NEG-1)	I4
RTYPE	REACTION TYPE	C8
VERSN	NEUTRON VERSION NAME	C8

NO TRANSFER MATRIX DIAGONAL FOR NEUTRON INTERACTION CROSS SECTION

NAME = 'FINEGRP', 2VRSN2, 2DIS02, 'PMATRIX', RTYPE7, PM7

LIST = IA, IB, KTX, (TOK(KT), (P(I, J, KT), I=IA, IB), KT=1, KTX)

SYMBOL	DEFINITION	TYPE
DIS0	ISOTOPE NAME	C8
I	ENERGY GROUP INDEX	I4
IA	LOWER LIMIT OF ENERGY INDEX I FOR NON ZERO DATA	I4
IB	UPPER LIMIT OF ENERGY INDEX I FOR NON ZERO DATA	I4
KT	TEMPERATURE INDEX. E.G. TOK(KT)	I4
KTX	MAXIMUM VALUE OF KT USED	I4
M	M=J-I DIAGONAL INDEX	I4
P	ISOTROPIC (L=0) TRANSFER MATRIX (PARNS/EV). P(I, J) IS THE ELEMENT FOR TRANSFER FROM GROUP I TO GROUP J.	R4
RTYPE	REACTION TYPE	C8
TOK	TEMPERATURE (DEG. K) = T(DEG C) + 273	R4
VERSN	NEUTRON VERSION NAME	C8
NOTE	J=M+I. ONE RECORD IS GIVEN FOR EACH MLX.LE.M.LE.MHX	

HIGHEST LEGENDRE ORDER FOR NEUTRON INTERACTION TRANSFER MATRICES

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PLMATRIX'.?RTYPE?.?SIZE'

LIST = LX

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
LX	MAXIMUM VALUE OF L USED	I4
RTYPE	REACTION TYPE	C8
VERSN	NEUTRON VERSION NAME	C8

SIZE OF LTH LEGENDRE ORDER NEUTRON INTERACTION TRANSFER MATRIX

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PLMATRIX'.?RTYPE?.?L?.?SIZE'

LIST = MLX,MHX

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
L	LEGENDRE ORDER	I4
MHX	LARGEST VALUE OF M USED	I4
MLX	LOWEST VALUE OF M USED	I4
RTYPE	REACTION TYPE	C8
VERSN	NEUTRON VERSION NAME	C8

NOTE = ONE RECORD IS GIVEN FOR EACH L=1,2,3,...,LX

L*TH LEGENDRE ORDER NEUTRON INTERACTION TRANSFER MATRIX DIAGONAL

```

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PLMATRIX'.?RTYPE?.?L?.?M?
LIST = IA,IB,KTX,(TDK(KT),(PL(I,J,KT),I=IA,IB),KT=1,KTX)

```

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
I	= ENERGY GROUP INDEX	I4
IA	= LOWER LIMIT OF ENERGY INDEX I FOR NON-ZERO DATA	I4
IB	= UPPER LIMIT OF ENERGY INDEX I FOR NON-ZERO DATA	I4
KT	= TEMPERATURE INDEX. E.G. TDK(KT)	I4
KTX	= MAXIMUM VALUE OF KT USED	I4
L	= LEGENDRE ORDER	I4
M	= M=J-I DIAGONAL INDEX	I4
PL	LEGENDRE TRANSFER MATRIX (BARN/TV). PL(I,J) IS THE ELEMENT FOR TRANSFER FROM GROUP I TO GROUP J. VALUES ARE GIVEN FOR L=1,2,3,...,LX.	R4
RTYPE	= REACTION TYPE	C8
TDK	= TEMPERATURE (DEG. K) = T(DEG C) + 273	R4
VERSN	= NEUTRON VERSION NAME	C8

NOTE = J=M+I. ONE RECORD IS GIVEN FOR L=1,2,...,LX, AND FOR EACH
MLX.LE.M.LE.MHX. MLX AND MHX ARE DIFFERENT FOR EACH L

VERSION NAMES OF PHOTON VERSIONS

```

NAME = 'FINEGRP','PHOTON','VERSIONS'
LIST = NVPX,(PVERS(NVP),NVP=1,NVPX)

```

SYMBOL	DEFINITION	TYPE
NVP	PHOTON VERSION INDEX	I4
NVPX	MAXIMUM VALUE OF NVP	I4
PVERS	PHOTON VERSION NAMES	C8

ISOTOPES IN A PHOTON VERSION

NAME = 'FINEGRP'. 'PHOTON'. '2PVERS?'. 'ISOTOPES'

LIST = ISOX, (DISP(ISO), IZ(ISO), AW(ISO), ISO=1, ISOX)

SYMBOL	DEFINITION	TYPE
AW	RATIO OF ATOMIC WEIGHT OF NATURALLY OCCURRING MATERIAL TO NEUTRON ATOMIC WEIGHT	R4
DISP	ISOTOPE OR MATERIAL NAME	C8
ISO	ISOTOPE INDEX	I4
ISOX	MAXIMUM VALUE OF ISO	I4
IZ	ISOTOPE IZ IN FORM ZZ0000 WHERE: ZZ = 2 DIGIT ATOMIC NUMBER 0000= ZEROS	I4
PVERS	PHOTON VERSION NAME	C8

POINTWISE PHOTON WEIGHTING SPECTRUM

NAME = 'FINEGRP'. 'PHOTON'. 'PVERS?'. 'SPECTRUM'

LIST = IWOP, MX, NX, (NBT(M), INT(M), M=1, MX), (EP(N), FLX(N), N=1, NX)

SYMBOL	DEFINITION	TYPE
EP	ENERGY POINT (EV) AT WHICH FLUX IS TABULATED	R4
FLX	PHOTON FLUX AT AN ENERGY POINT	R4
INT	INTERPOLATION CODE TO BE USED BETWEEN TABULATED POINTS. ALLOWED VALUES ARE: INT INTERPOLATION METHOD	I4
	1 FLUX CONSTANT	
	2 FLUX LINEAR IN ENERGY	
	3 FLUX LINEAR IN NATURAL LOGARITHM OF ENERGY	
	4 NATURAL LOGARITHM OF FLUX LINEAR IN ENERGY	
	5 NATURAL LOGARITHM OF FLUX LINEAR IN NATURAL LOGARITHM OF ENERGY	
IWOP	WEIGHTING SPECTRUM FLAG. ALLOWED VALUES ARE: IWOP SPECTRUM TYPE	I4
	1 UNIT SPECTRUM	
	2 1/E SPECTRUM	
	3 F SPECTRUM	
	4 ARBITRARY TABULAR SPECTRUM	
M	INTERPOLATION REGION INDEX	I4
MX	MAXIMUM VALUE OF M	I4
N	ENERGY POINT INDEX	I4
NX	MAXIMUM VALUE OF N	I4
NBT	VALUE OF M BELOW WHICH INTERPOLATION CODE INT IS USED	I4
PVERS	PHOTON VERSION NAME	C8

GROUP INTEGRALS OF PHOTON SPECTRUM

NAME = 'FINEGRP','PHOTON'.?PVERS?. 'WEIGHTS'

LIST = NPEG,(WHT(N),N=1,NPEG)

SYMBOL	DEFINITION	TYPE
NPEG	NUMBER OF PHOTON GROUPS	I4
PVERS	PHOTON VERSION NAME	C8
WHT	INTEGRAL OF WEIGHTING SPECTRUM OVER EACH PHOTON GROUP	R4

NOTE: THESE GROUP INTEGRALS ARE USED TO COMPRESS GROUP
STRUCTURES WHEN REQUIRED.

GROUP STRUCTURE FOR A PHOTON VERSION

NAME = 'FINEGRP'. 'PHOTON'. ?PVERS?. 'GROUPS'

LIST = NPEG, (EP(N), EBP(N), DEP(N), N=1, NPEG), EP(NPEG+1)

SYMBOL	DEFINITION	TYPE
DEP	GROUP WIDTH (EV). $DEP(N) = EP(N) - EP(N+1)$	R4
EP	UPPER ENERGY OF GROUP (EV). ENERGIES ARE GIVEN IN ORDER OF DECREASING ENERGY, I.E. $EP(1) > EP(2) > \dots > EP(N) > \dots > EP(NPEG+1)$	R4
EBP	VELOCITY AVERAGE CHARACTERISTIC ENERGY OF A GROUP (EV). $EP(N) > EBP(N) > EP(N+1)$	R4
N	GROUP INDEX	I4
NPEG	NUMBER OF PHOTON ENERGY GROUPS	I4
PVERS	PHOTON VERSION NAME	C8

CROSS SECTION CONTENTS FOR AN ISOTOPE IN A PHOTON VERSION

NAME = 'FINEGRP'. 'PHOTON'. '?PVERS?'. '?DISP?'. 'CONTENTS'

LIST NDPX, (DPTYP (NDP), RPTYP (NDP), NDP=1, NDPX)

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME	C8
DPTYP	DATA TYPE NAME. ALLOWED TYPES ARE:	C8
	DPTYP DESCRIPTION	
	XSECTION P0 LEGENDRE CROSS SECTION	
	PLXSECT P1 AND HIGHER LEGENDRE CROSS SECTIONS	
	PMATRIX P0 LEGENDRE TRANSFER MATRIX	
	PLMATRIX P1 AND HIGHER LEGENDRE TRANSFER MATRICES	
NDP	DATA AND REACTION TYPE INDEX	I4
NDPX	MAXIMUM VALUE OF NDP	I4
RPTYP	REACTION TYPE NAME. ALLOWED TYPES ARE LISTED BELOW TYPES MARKED WITH (S) ARE TYPES FOR WHICH DATA TYPES PLXSECT, PMATRIX, OR PLMATRIX ARE ALLOWED	C8
	RPTYP USE DESCRIPTION	
	TOTAL TOTAL PHOTON CROSS SECTION	
	COHERENT COHERENT SCATTERING CROSS SECTION	
	INCOHRNT (S) INCOHERENT (COMPTON) SCATTERING CROSS SECTION	
	PAIRPROD PAIR PRODUCTION CROSS SECTION	
	PHOTO PHOTOELECTRIC CROSS SECTION	
	GAMHEAT GAMMA HEATING CROSS SECTION	
	INCABS ABSORPTION COMPONENT OF INCOHERENT	

SYMBOL	DEFINITION	TYPE
SCATTERING CROSS SECTION		
FISSPROD	(S) CROSS SECTION FOR PHOTON YIELD FROM NEUTRON INDUCED FISSION	
NGPROD	(S) CROSS SECTION FOR PHOTON YIELD FROM NEUTRON (N,GAMMA) REACTION	
INELPROD	(S) CROSS SECTION FOR PHOTON YIELD FROM ALL INELASTIC NEUTRON INTERACTIONS (INEL. SCAT.,(N,A), (N,P),(N,T),(N,D),(N,2N),(N,3N))	

PVERS PHOTON VERSION NAME

C8

INDEX OF DATA COUPLING NEUTRON AND PHOTON VERSIONS

NAME = 'FINEGRP','PHOTON'.?PVERS?.?DISP?. 'COUPLING'

LIST = NPCX,(DPTYP(NPC),RPTYP(NPC),VERSN(NPC),DISO(NPC),NUNIT(NPC),
NPC=1,NPCX)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
DPTYP	DATA TYPE NAME	C8
NPC	INDEX OF ENTRIES	I4
NPCX	MAXIMUM VALUE OF NPC	I4
NUNIT	UNIT FLAG	I4
=0, UNITS ARE PHOTON BNS/EVENT/EV FOR DATA TYPES PMATRIX AND PLMATRIX; UNITS ARE PHOTON-BNS/ EVENT FOR DATA TYPES XSECTION OR PLXSECT		
=1, UNITS ARE PHOTONS/EVENT/EV FOR DATA TYPES PMATRIX AND PLMATRIX; UNITS ARE PHOTONS/EVENT FOR DATA TYPES XSECTION OR PLXSECT		
RPTYP	REACTION TYPE NAME	C8
PVERS	PHOTON VERSION NAME	C8
VERSN	NEUTRON VERSION NAME	C8

PO PHOTON INTERACTION CROSS SECTIONS

```
NAME = 'FINEGRP','PHOTON',?PVERS?,?DISP?, 'XSECTION',?RPTYP?
LIST = IA,IB,(XS(I),I=IA,IB)
```

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
I	PHOTON GROUP INDEX	I4
IA	LOWEST VALUE OF I FOR NON-ZERO DATA	I4
IB	HIGHEST VALUE OF I FOR NON-ZERO DATA	I4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8
XS	CROSS SECTION (BARNs)	R4

PO COUPLED NEUTRON-PHOTON CROSS SECTIONS

```

NAME = 'FINEGRP'.?VERSN?.?DISO?. 'PHOTON'.?PVERS?.?DISP?. 'XSECTION'.
      .?RPTYP?
LIST = IA,IB,(XS(I),I=IA,IB)

```

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
I	NEUTRON GROUP INDEX	I4
IA	LOWEST VALUE OF I FOR NON ZERO DATA	I4
IB	HIGHEST VALUE OF I FOR NON-ZERO DATA	I4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8
VERSN	NEUTRON VERSION NAME	C8
XS	CROSS SECTION. (UNITS SPECIFIED IN 'COUPLING' RECORD)	R4

HIGHEST LEGENDRE ORDER IN PHOTON INTERACTION CROSS SECTIONS

NAME = 'FINEGRP'. 'PHOTON'. ?PVERS?. ?DISP?. 'PLXSECT'. ?RPTYP?. 'SIZE'
LIST = LX

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
LX	MAXIMUM LEGENDRE ORDER IN PLXSECT CROSS SECTIONS	I4
RPTYP	REACTION TYPE NAME	C8
PVERS	PHOTON VERSION NAME	C8

HIGHEST LEGENDRE ORDER IN COUPLED NEUTRON-PHOTON CROSS SECTIONS

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PHOTON'.?PVERS?.?DISP?.?PLXSECT'.?RPT'
 .'SIZE'

LIST = LX

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
LX	MAXIMUM LEGENDRE ORDER IN PLXSECT CROSS SECTIONS	I4
RPTYP	REACTION TYPE NAME	C8
PVERS	PHOTON VERSION NAME	C8
VERSN	NEUTRON VERSION NAME	C8

LIST LEGENDRE COMPONENT OF PHOTON INTERACTION CROSS SECTION

NAME = 'FINEGRP'. 'PHOTON'. ?PVERS?. ?DISP?. 'PLXSECT'. ?RPTYP?. ?L?

LIST = IA, IB, (XL(I), I=IA, IB)

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
I	PHOTON GROUP INDEX	I4
IA	LOWEST VALUE OF I HAVING NON-ZERO DATA	I4
IB	HIGHEST VALUE OF I HAVING NON ZERO DATA	I4
PVERS	PHOTON VERSION NAME	C8
L	LEGENDRE ORDER (1,2,...)	I4
RPTYP	REACTION TYPE NAME	C8
XL	LEGENDRE CROSS SECTION (BARNs). XL(I,L) IS THE VALUE IN PHOTON GROUP I AND LEGENDRE ORDER L.	R4

JOSHUA DPSTM-500	Title Cross Section Data Sets FINEGRP	Vol. III	Page B.2.37
		Rev.	Date 9/73

L*TH LEGENDRE COMPONENT OF COUPLED NEUTRON PHOTON CROSS SECTION

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PHOTON'.?PVERS?.?DISP?.?PLXSECT'.?RPTYP?
.?L?

LIST = IA,IB,(XL(I),I=IA,IB)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
I	NEUTRON GROUP INDEX	I4
IA	LOWEST VALUE OF I FOR NON-ZERO DATA	I4
IB	HIGHEST VALUE OF I FOR NON-ZERO DATA	I4
L	LEGENDRE ORDER (1,2,...)	I4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8
VERSN	NEUTRON VERSION NAME	C8
XL	LEGENDRE CROSS SECTION (UNITS SPECIFIED IN COUPLING RECORD). XL(I,L) IS THE VALUE IN NEUTRON GROUP I AND LEGENDRE ORDER L.	R4

JOSHUA DPSTM-500	Title Cross Section Data Sets FINEGRP	Vol.	Page
		III	B.2.38
		Rev.	Date
			9/73

PO TRANSFER MATRIX SIZE FOR PHOTON INTERACTION DATA

NAME = 'FINEGRP'.'PHOTON'.'PVERS'.'DISP'.'PMATRIX'.'RPTYP'.'SIZE'

LIST = NLX,NHX

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
NHX	LARGEST DIAGONAL INDEX VALUE. (NHX.LE.(NPEG-1))	I4
NLX	SMALLEST DIAGONAL INDEX VALUE. (NLX.GE.(NPEG-1))	I4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8

PO MATRIX DIAGONAL FOR PHOTON INTERACTION DATA

NAME = 'FINEGRP'. 'PHOTON'. ?PVERS?. ?DISP?. 'PMATRIX'. ?RPTYP?. ?N?

LIST = IA, IB, (P(I, J), I=IA, IB)

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
I	INDEX OF INITIAL PHOTON GROUP	I4
IA	LOWEST VALUE OF I FOR NON-ZERO DATA	I4
IB	HIGHEST VALUE OF I FOR NON-ZERO DATA	I4
J	INDEX OF FINAL PHOTON GROUP	I4
N	DIAGONAL INDEX: $N=J-I$	I4
P	PO TRANSFER MATRIX ELEMENT (BARN/EV). $P(I, J)$ IS THE MATRIX ELEMENT FOR TRANSFER FROM PHOTON GROUP I TO PHOTON GROUP J.	R4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8

HIGHEST LEGENDRE ORDER OF TRANSFER MATRICES FOR PHOTON INTERACTION

NAME = 'FINEGRP'. 'PHOTON'. '2PVERS?'. '2DISP?'. 'PLMATRIX'. '2RPTYP?'. 'SIZE'
LIST = LX

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
LX	MAXIMUM LEGENDRE ORDER FOR WHICH TRANSFER MATRIX DATA EXISTS	I4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8

SIZE OF L*TH LEGENDRE ORDER TRANSFER MATRIX FOR PHOTON INTERACTION

NAME = 'FINEGRP'. 'PHOTON'. ?PVERS?. ?DISP?. 'PLMATRIX'. ?RPTYP?. ?L?. 'SIZE'
LIST = NLX, NHX

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
L	LEGENDRE ORDER (1,2,...)	I4
NHX	LARGEST DIAGONAL INDEX VALUE. (NHX.LE.(NPEG-1))	I4
NLX	SMALLEST DIAGONAL INDEX VALUE. (NLX.GE.(NPEG-1))	I4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8

NOTE: ONE RECORD IS GIVEN FOR EACH L=1,2,...,LX

LTH LEGENDRE ORDER TRANSFER MATRIX DIAGONAL FOR PHOTON INTERACTION DATA

```
NAME = 'FINEGRP'. 'PHOTON'. ?PVERS?. ?DISP?. 'PLMATRIX'. ?RPTYP?. ?L?. ?N?
LIST = IA, IB, (P(I, J), I=IA, IB)
```

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
I	INITIAL PHOTON GROUP INDEX	I4
IA	SMALLEST VALUE OF I FOR NON ZERO DATA	I4
IB	LARGEST VALUE OF I FOR NON-ZERO DATA	I4
J	FINAL PHOTON GROUP INDEX	I4
L	LEGENDRE ORDER OF TRANSFER MATRIX	I4
N	DIAGONAL INDEX: N=J-I	I4
PL	LEGENDRE TRANSFER MATRIX ELEMENT (BARN/FEV) PL(I, J) IS THE ELEMENT FOR TRANSFER FROM PHOTON GROUP I TO PHOTON GROUP J	R4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8

NOTE: ONE RECORD IS GIVEN FOR EACH N AND L FOR
NLX.LE.N.LE.NHX AND 1.LE.L.LE.LX. NLX AND NHX
ARE DIFFERENT FOR EACH L

PO TRANSFER MATRIX SIZE FOR COUPLED NEUTRON-PHOTON DATA

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PHOTON?.?PVERS?.?DISP?.?PMATRIX?.?RPTYP?
.'SIZE'

LIST = NLX,NHX

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
MHX	LARGEST DIAGONAL INDEX VALUE. (NHX.LE.(NPEG-1))	I4
MLX	SMALLEST DIAGONAL INDEX VALUE. (NLX.GE.(NEG-1))	I4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8
VERSN	NEUTRON VERSION NAME	C8

PO MATRIX DIAGONAL FOR COUPLED NEUTRON-PHOTON DATA

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PHOTON?.?PVERS?.?DISP?.?PMATRIX?.?RPTYP?
?N?

LIST = IA,IB,(PR(I,J),I=IA,IB)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
I	INITIAL NEUTRON GROUP INDEX	I4
IA	LOWEST VALUE OF I FOR NON-ZERO DATA	I4
IB	HIGHEST VALUE OF I FOR NON-ZERO DATA	I4
J	FINAL PHOTON GROUP INDEX	I4
N	DIAGONAL INDEX: N=J I	I4
PR	PO PRODUCTION MATRIX ELEMENT. UNITS OF MATRIX SPECIFIED IN 'COUPLING' RECORD. PR(I,J) IS THE ELEMENT FOR PRODUCTION OF PHOTONS IN PHOTON GROUP J FROM NEUTRON INTERACTION IN NEUTRON GROUP I.	R4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8
VERSN	NEUTRON VERSION NAME	C8

NOTE: ONE RECORD IS GIVEN FOR EACH N, NLX.LE.N.LE.NHX

HIGHEST LEGENDRE ORDER FOR PHOTON PRODUCTION MATRICES

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PHOTON?.?PVERS?.?DISP?.?PLMATRIX'.
 ?RPTYP?.?SIZE'

LIST = LX

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
LX	MAXIMUM LEGENDRE ORDER MATRIX	I4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8
VERSN	NEUTRON VERSION NAME	C8

SIZE OF LTH LEGENDRE ORDER PHOTON PRODUCTION MATRIX

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PHOTON'.?PVERS?.?DISP?.?PLMATRIX'.
 .?RPTYP?.?L?.?SIZE'

LIST = NLX,NHX

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
L	LEGENDRE ORDER OF MATRIX	I4
NHX	LARGEST VALUE OF DIAGONAL INDEX. (NHX.LE.(NPEG-1))	I4
NLX	SMALLEST VALUE OF DIAGONAL INDEX. (NLX.GE.-(NEG-1))	I4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8
VERSN	NEUTRON VERSION NAME	C8

NOTE: ONE RECORD IS GIVEN FOR EACH L, 1.LE.L.LE.LX.

L*TH LEGENDRE ORDER PHOTON PRODUCTION MATRIX DIAGONAL

NAME = 'FINEGRP'.?VERSN?.?DISO?.?PHOTON'.?PVERS?.?DISP?.?PLMATRIX'.
?RPTYP?.?L?.?N?

LIST = IA,IB,(PR(I,J,L),I=IA,IB)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
I	INITIAL NEUTRON GROUP INDEX	I4
IA	SMALLEST VALUE OF I FOR NON-ZERO DATA	I4
IB	LARGEST VALUE OF I FOR NON-ZERO DATA	I4
J	FINAL PHOTON GROUP INDEX	I4
L	LEGENDRE ORDER OF MATRIX	I4
N	DIAGONAL INDEX: N=J-I	I4
PR	L*TH LEGENDRE ORDER PRODUCTION MATRIX ELEMENT. UNITS OF MATRIX SPECIFIED IN 'COUPLING' RECORD. PR(I,J,L) IS THE MATRIX ELEMENT FOR THE PRODUCTION OF PHOTONS IN PHOTON GROUP J FROM A NEUTRON INTERACTION IN NEUTRON GROUP I.	R4
PVERS	PHOTON VERSION NAME	C8
RPTYP	REACTION TYPE NAME	C8
VERSN	NEUTRON VERSION NAME	C8

NOTE: ONE RECORD IS GIVEN FOR EACH N AND L FOR
NLX.LE.N.LE.NHX AND 1.LE.L.LE.LX. NLX AND NHX
ARE DIFFERENT FOR EACH L.

DELAYED NEUTRON DECAY CONSTANTS

```

NAME = 'FINEGRP'.?VERSN?.?DISO?.?DELAYED?.?DECAY'
LIST NDF, (DLAM(NDI), NDI=1, NDF)

```

SYMBOL	DEFINITION	TYPE
DLAM	DELAYED NEUTRON FAMILY DECAY CONSTANT (1/SEC).	R4
DISO	ISOTOPE NAME	C8
NDF	MAXIMUM VALUE OF NDI USED	I4
NDI	DELAYED NEUTRON FAMILY INDEX	I4
VERSN	NEUTRON VERSION NAME	C8

DELAYED NEUTRON FISSION SPECTRUM

NAME = 'FINEGRP'.?VERSN?.?DISO?. 'DELAYED'. 'CHI'

LIST = IA,IB,NDF,((DCHI(I,NDI),I=IA,IB),NDI=1,NDF)

SYMBOL	DEFINITION	TYPE
DCHI	DELAYED NEUTRON FISSION SPECTRUM. DCHI(I,NDI) IS FRACTION OF TOTAL NEUTRONS PRODUCED IN GROUP I BY DELAYED FAMILY NDI.	R4
DISO	ISOTOPE NAME	C8
I	ENERGY GROUP INDEX	I4
IA	LOWER LIMIT OF ENERGY INDEX I FOR NON ZERO DATA	I4
IB	UPPER LIMIT OF ENERGY INDEX I FOR NON-ZERO DATA	I4
NDF	MAXIMUM VALUE OF NDI USED	I4
NDI	DELAYED NEUTRON FAMILY INDEX	I4
VERSN	NEUTRON VERSION NAME	C8

DELAYED NEUTRON YIELD PER FISSION

NAME = 'FINEGRP'.?VERSN?.?DISO?.'DELAYED'.'NU'

LIST = IA,IB,NDF,((DNU(I,NDI),I=IA,IB),NDI=1,NDF)

SYMBOL	DEFINITION	TYPE
DNU	DELAYED NEUTRONS PER FISSION FOR GROUP I, AND FAMILY NDI	R4
DISO	ISOTOPE NAME	C8
I	ENERGY GROUP INDEX	14
IA	LOWER LIMIT OF ENERGY INDEX I FOR NON-ZERO DATA	14
IB	UPPER LIMIT OF ENERGY INDEX I FOR NON-ZERO DATA	14
NDF	MAXIMUM VALUE OF NDI USED	14
NDI	DELAYED NEUTRON FAMILY INDEX	14
VERSN	NEUTRON VERSION NAME	C8

BRANCHING RATIO REACTION TYPE INDEX

NAME = 'FINEGRP'.?VERSN?.?DISO?. 'BRATIO'. 'TYPES'

LIST = NTYP, (IZASI(N), PTYPE(N), IZASF(N), N=1, NTYP)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
IZASF	IZAS OF FINAL NUCLIDE	I4
IZASI	IZAS OF INITIAL STATE OF ISOTOPE DISO	I4
NTYP	NUMBER OF BRANCHING RATIO SETS	I4
RTYPE	REACTION TYPE - ALLOWED REACTIONS ARE: NG, NA, NP, NT, ND, N2N, N3N, FISSION, SPONT	C8
VERSN	NEUTRON VERSION NAME	C8

IOSHUA DPSTM-500	Title Cross Section Data Sets FINEGRP	Vol. III	Page B.2.52
		Rev.	Date 9/73

GROUPWISE BRANCHING RATIOS BY REACTION, INITIAL STATE, FINAL STATE

```

| NAME = 'FINEGRP'.?VERSN?.?DISO?.?BRATIO?.?IZASI?.?RTYPE?.?IZASE?
| LIST = IA,IB,(BR(I),I=IA,IB)

```

SYMBOL	DEFINITION	TYPE
BR	BRANCHING RATIO BY GROUP. BR(N)=FRACTION APPEARING IN GROUP N BY THIS REACTION	R4
DISO	ISOTOPE NAME	C8
IA	LOW LIMIT OF INDEX I FOR NON-ZERO DATA	I4
IB	HIGH LIMIT OF INDEX I FOR NON ZERO DATA	I4
IZASE	IZAS OF FINAL NUCLIDE	I4
IZASI	IZAS OF INITIAL STATE OF ISOTOPE DISO	I4
RTYPE	REACTION TYPE (NG,NA,NP,NT,ND,N2N,N3N,FISSION,SPONT)	C8
VERSN	NEUTRON VERSION NAME	C8

JOSHUA

DPSTM-500

Title Cross Section Data Sets
MULTIGRP

Vol.
III

Page
B.3.1

Rev.

Date
9/73

Report Written By

D. R. Finch

Work Done By

H. C. Honeck
W. V. Baxter
J. W. Stewart

Contents

	<u>Page</u>
1. Introduction	B.3.3
2. Record Descriptions	B.3.11

JOSHUA DPSTM-500	Title Cross Section Data Sets MULTIGRP	Vol. III	Page B.3.2
		Rev.	Date 9/73

(Blank)

JOSHUA DPSTM-500	Title Cross Section Data Sets MULTIGRP	Vol. III	Page B.3.3
		Rev.	Date 9/73

1. Introduction

The MULTIGRP data set is designed to provide neutron and photon multigroup cross sections to production calculational modules. The structure of this data set is specified so as to be easily utilized in repetitive calculations. The number of groups used is arbitrary, however, a practical limit of about 100 energy groups is generally reasonable.

Cross sections in the MULTIGRP data set are generally broad group spectrum averaged values in as few groups as necessary to represent the data for a particular application. Standard versions of the data set are available that correspond to typical neutron and photon energy spectra that are in general use. Computational modules are available to create cross sections in the MULTIGRP data set by spectrum weighting data from the FINEGRP data set.

The MULTIGRP data set specifications given here are an adaptation of those developed by an AEC-DRDT sponsored committee (maintained by the LMFBR Program Office at Argonne National Laboratory) to facilitate exchange of codes among LMFBR contractors. No changes have been made in the type or definition of the data nor in the structure of most records. However, because the JOSHUA MULTIGRP data set is a random access data set, some reblocking of the records is desirable to reduce the number of disk accesses. Some new records have also been added to facilitate calculation of the core size needed to contain segments of the data set.

An attempt has been made to accommodate all types of neutronic and photonic nuclear data needed for static, depletion, kinetics, and heating calculations using both diffusion and transport theory. Several types of data have been omitted for the following reasons:

Resonance Parameters - Assumed to be included in the NUCPARAM data set.

Fission Product Yields - Assumed to be included in the NUCPARAM data set.

Radioactive Decay Data - Assumed to be included in the NUCPARAM data set.

Tabulated Angular Distribution - These are needed by Monte Carlo codes and can be included if desired. They have been omitted here since they are not needed by diffusion and most transport codes.

1.1 Conventions

Group Structure:

Groups are listed in order of decreasing energy (ev). Energy breakpoints, widths, and characteristics are given. The characteristic energy is primarily of use in the thermal region where point-to-point transfer matrices are used. Group velocities are also given for kinetics calculations.

IZAS Number:

To account for excited states in ^{242}Am , the IZAS number is written ZZAAAS, where ZZ is the atomic number, AAA is the atomic weight, and S is the final state number. For example, 922380 (U238), 10010 (H), 942421 (Am242, first excited state). The IZAS number is intended for use in depletion calculations. Photon interaction cross sections are not dependent on mass number or excited state; hence an IZ designation in the form ZZ0000 where ZZ is the atomic number, is sufficient.

Atomic Weight Ratio:

The ratio of atomic weight to neutron weight is used instead of just the atomic weight since it is needed directly for elastic scattering calculations and is independent of the mass units used.

Interaction Cross Sections:

Units are barns. Definitions follow those for ENDF/B except for transport:

$$\sigma_{tr} = \sigma_{total} - [\sigma_{s,1} + \sigma_{n2n,1}]$$

Fission Spectrum:

The spectrum is normalized to unity

$$\int_0^{\infty} dE \chi(E' \rightarrow E) = 1 \quad .$$

Group values contain the ΔE factor so that the normalization is

$$\sum_J x(I,J) = 1 \quad .$$

Delay d neutron spectra are normalized so that

$$\sum_J x_n(J) = y_n$$

where y_n is the yield of the n^{th} family. Then

$$\sum_n y_n = y$$

where y is the total yield assumed independent of incident energy.

Legendre Expansions:

Angular distributions are expressed by Legendre expansion coefficients defined by

$$\sigma(J,\mu) = \sum_{\ell=0}^L \frac{2\ell+1}{2} \sigma_{\ell}(J) P_{\ell}(\mu) \quad , \quad \text{Group } J$$

$$\sigma(I \rightarrow J, \mu) = \sum_{\ell=0}^L \frac{2\ell+1}{2} \sigma_{\ell}(I \rightarrow J) P_{\ell}(\mu) \quad , \quad \text{Group } I \text{ to } J$$

These moments are numbered with $LP = \ell + 1$ in the file.

Transfer Matrices:

Transfer matrix elements contain the factor $DE(J)$ so that the normalization is

$$\sigma_{\ell}^x(I) = \sum_J \sigma_{\ell}^x(I \rightarrow J) \quad .$$

Transfer matrix units are in barns for all interaction matrices, and the matrix elements are the same for energy, lethargy, or velocity space. Photon production matrices are expressed in either photons/event or in photon-barns/event by a unit flag stored with the matrix limits specifications. Superscript x denotes the reaction types, elastic, inelastic, $n2n$, and total (= elastic + inelastic + $2n2n$) for interaction matrices, and denotes the reaction

05-11A Title

Order for the State

1941
[Illegible]

Application for the State

JOSHUA

DPSTM-500

Title Cross Section Data Sets
MULTIGRP

Vol. III Page B.3.7

Rev. Date 9/73

Q.CØNTENTS	P.LIMITS.PHXSECT
Q.LIMITS .XSECTION	P.LIMITS.INCØHRNT
Q.LIMITS .XSECT2	
Q.LIMITS .ELASTIC	
Q.LIMITS .INELAST	
Q.LIMITS .N2N	
Q.LIMITS .TØTAL	
Q.PHØTØN.?PVERS?.?DISP?.LIMITS.FISSPRØD	
Q.PHØTØN.?PVERS?.?DISP?.LIMITS.NGPRØD	
Q.PHØTØN.?PVERS?.?DISP?.LIMITS.INELPRØD	

tell what and how much data is present. These records contain the information necessary to compute storage requirements in computational modules, and can be used to control the reading of data to avoid requests for non-existent records. The data records:

Q.XSECTION
Q.XSECT2
Q.DELAYED
Q.PLMATRIX.?RTYPR?.?J?
Q.PHØTØN .?PVERS?.?DISP?.PLMATRIX.?RPTYP?.J
P.PHXSECTS
P.PLMATRIX.?RPTYP?.?J?

give the primary and secondary cross sections, delayed neutron fission spectrum, transfer matrices, and photon production matrices by reaction type and final energy group.

OSHUA [unclear] Credit [unclear] Date [unclear]
[unclear]

[unclear] [unclear] [unclear]

Figure 2. Structure of Photon Interaction Data in MULTIGRP Data Set

* Low and high limits are given in the LIMITS record for this reaction type.

Figure 3. Structure of Photon Production Data in The MULTIGRP Data Set

* Low and high limits are given in the LIMITS record for this reaction type.

JOSHUA DPSTM-500	Title Cross Section Data Sets MULTICRP	Vol. III	Page B.3.11
		Rev.	Date 9/73

2. Record Descriptions

LIST OF NEUTRON VERSIONS OF DATA SET

```

| NAME = 'MULTICRP'. 'CONTENTS'
|
| LIST = NVX, (VERSN(NV), NV=1, NVX)
|

```

SYMBOL	DEFINITION	TYPE
NV	VERSION INDEX	I4
NVX	NUMBER OF CATALOGUED VERSIONS	I4
VERSN	NEUTRON VERSION NAMES	C8

LIST OF ISOTOPES IN A NEUTRON VERSION

```

| NAME = 'MULTIGRP'.?VERSN?. 'ISOTOPES'
|
| LIST = NEG, ISOX, (DISO(N), ITDC(N), N=1, ISOX)
|

```

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
ISOX	NUMBER OF CATALOGUED ISOTOPE/TEMPERATURE PAIRS	I4
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
N	ISOTOPE INDEX	I4
NEG	NUMBER OF ENERGY GROUPS	I4
VERSN	NEUTRON VERSION NAME	C8

GROUP STRUCTURE FOR A NEUTRON VERSION

NAME = 'MULTIGRP'.?VERSN?. 'GROUPS'

LIST = NEG, JETG, IDBF, (E(I), U(I), RV(I), EBAR(I), I=1, NEG), E(NEG+1)

SYMBOL	DEFINITION	TYPE
E	ENERGY BREAK POINT (EV). E(I) IS THE UPPER LIMIT FOR GROUP I. ENERGIES ARE LISTED IN DECREASING ORDER $E(1) > E(2) > \dots > E(I) > \dots > E(NEG+1)$.	R4
EBAR	CHARACTERISTIC ENERGY (EV) FOR GROUP I USED IN CONJUNCTION WITH POINT-POINT MATRICES.	R4
I	INITIAL ENERGY GROUP INDEX	I4
IDBF	DETAILED BALANCE FACTOR INDICATOR IDBF=0, UP-SCATTER ELEMENTS ARE GIVEN. IDBF=1, COMPUTE UP-SCATTER ELEMENTS FROM DETAILED BALANCE.	I4
JETG	INDEX TO FIRST THERMAL ENERGY GROUP. THERMAL GROUPS ARE DEFINED BY JETG.LE.J.LE.NEG	I4
NEG	NUMBER OF ENERGY GROUPS	I4
RV	AVERAGE RECIPROCAL VELOCITY (SEC/CM) FOR GROUP I, FOR KINETICS CALCULATIONS	R4
U	LOWER LETHARGY LIMIT OF GROUP I $U(I) = \ln(E(1)/E(I))$	R4
VERSN	NEUTRON VERSION NAME	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets MULTIGRP	Vol. III	Page B.3.14
		Rev.	Date 9/73

LEGENDRE NEUTRON FLUX WEIGHTS USED TO COMPRESS GROUP STRUCTURE

```

NAME = 'MULTIGRP'.?VERSN?. 'WEIGHTS'
LIST = LPX,NEGM,DSM,VERSM,((WGTS(I,LP),I=1,NEGM),LP=1,LPX)

```

SYMBOL	DEFINITION	TYPE
DSM	SOURCE DATA SET, EITHER 'MULTIGRP' OR 'FINEGRP'	C8
I	GROUP INDEX	I4
L	LEGENDRE ORDER INDEX, L=0,1,2,...	I4
LP	LEGENDRE INDEX, LP=L+1=1,2,....,LPX	I4
LPX	MAXIMUM VALUE OF LP USED.	I4
NEGM	NUMBER OF GROUPS IN VERSION OF 'DSM' DATA SET WITH NAME ?VERSM?	I4
VERSM	NAME OF THE VERSION OF 'DSM' DATA SET FROM WHICH DATA WAS COLLAPSED	C8
VERSN	NEUTRON VERSION NAME	C8
WGTS	LEGENDRE FLUX COMPONENTS USED AS WEIGHTS TO COMPRESS DATA.	R4
NOTE	THIS RECORD IS OMITTED IF DATA WAS NOT COMPRESSED.	

GENERAL PARAMETERS AND LIMITS FOR NEUTRON ISOTOPIC DATA

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'CONTENTS'

LIST = IZAS,AWR,ICHI,JHCHI,JLTME,JHTME,JLTMI,JHTMI,JLTMN,JHTMN,
JLMT,JHTMT,JLSX,JHSX,JLDN,JHDN,NFAM

SYMBOL	DEFINITION	TYPE
AWR	= RATIO OF ATOMIC WEIGHT TO NEUTRON ATOMIC WEIGHT	R4
DISO	= EIGHT-CHARACTER ISOTOPE NAME	C8
ICHI	= FISSION SPECTRUM INDICATOR ICHI=0, NON-FISSIONABLE ICHI=1, FISSIONABLE, SPECTRUM INDEPENDENT OF INCIDENT ENERGY. ICHI=2, FISSIONABLE, SPECTRUM DEPENDS ON INCIDENT E.	I4
NOTE = IN THE PRESENT STRUCTURE OF 'MULTIGRP' DATA SET, ICHI=2 IS NOT ALLOWED. HENCE JHCHI, DEFINED BELOW, IS PRESENTLY ZERO.		
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
IZAS	= INTEGER Z, A, STATE NO. IZAS = 10000*Z + 10*A + S Z = ATOMIC NUMBER A = ATOMIC WEIGHT S = FINAL STATE NUMBER (0 = GROUND STATE)	I4
JHDN	= HIGHEST GROUP NO. FOR WHICH DELAYED NEUTRON SPECTRA DATA ARE GIVEN IF NONE, JHDN=0.	I4
JLDN	= LOWEST GROUP NO. FOR WHICH DELAYED NEUTRON SPECTRA DATA ARE GIVEN IF NONE, JLDN=0.	I4
JHSX	= HIGHEST GROUP NO. FOR WHICH SECONDARY CROSS SECTION DATA ARE GIVEN IF NONE, JHSX=0.	I4
JLSX	= LOWEST GROUP NO. FOR WHICH SECONDARY CROSS-SECTION DATA ARE GIVEN IF NONE, JLSX=0.	I4
JHCHI	= HIGHEST GROUP NO. AT WHICH CHI IS GIVEN USED ONLY WHEN ICHI.NE.0; OTHERWISE JHCHI=0.	I4

SYMBOL	DEFINITION	TYPE
	(SEE NOTE ABOVE)	
JHTME	HIGHEST GROUP NO. FOR WHICH ELASTIC TRANSFER MATRIX DATA ARE GIVEN - IF NO TR. MATRIX DATA, JHTME=0.	I4
JLTME	LOWEST GROUP NO. FOR WHICH ELASTIC TRANSFER MATRIX DATA ARE GIVEN - IF NO TR. MATRIX DATA, JLTME=0.	I4
JHTMI	HIGHEST GROUP NO. FOR WHICH INELASTIC TRANSFER MATRIX DATA ARE GIVEN - IF NO DATA, JHTMI=0.	I4
JLTMI	LOWEST GROUP NO. FOR WHICH INELASTIC TRANSFER MATRIX DATA ARE GIVEN - IF NO DATA, JLTMI=0.	I4
JHTMN	HIGHEST GROUP NO. FOR WHICH (N,2N) TRANSFER MATRIX DATA ARE GIVEN - IF NO DATA, JHTMN=0.	I4
JLTMN	LOWEST GROUP NO. FOR WHICH (N,2N) TRANSFER MATRIX DATA ARE GIVEN - IF NO DATA, JLTMN=0.	I4
JHTMT	HIGHEST GROUP NO. FOR WHICH TOTAL TRANSFER MATRIX DATA ARE GIVEN - IF NO DATA, JHTMT=0.	I4
JLTMT	LOWEST GROUP NO. FOR WHICH TOTAL TRANSFER MATRIX DATA ARE GIVEN - IF NO DATA, JLTMT=0.	I4
NEAM	NUMBER OF DELAYED NEUTRON FAMILIES	I4
VERSN	NEUTRON VERSION NAME	C8

CROSS-SECTION LIMITS FOR NEUTRON INTERACTION CROSS SECTIONS

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'LIMITS'. 'XSSECTION'

LIST = JLTOT, JHTOT, JLCAP, JHCAP, JLFIS, JHFIS, JLNU, JHNU, JLTR, JHTR,
JLN2N, JHN2N, JLCHI, JHCHI

SYMBOL	DEFINITION	TYPE
DISO	EIGHT CHARACTER ISOTOPE NAME	C8
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
JHNU	HIGHEST GROUP INDEX J FOR NON-ZERO NU VALUES	I2
JLNU	LOWEST GROUP INDEX J FOR NON-ZERO NU VALUES	I2
JHTR	HIGHEST GROUP INDEX J FOR NON ZERO SIGMA TRANSPORT	I2
JLTR	LOWEST GROUP INDEX J FOR NON ZERO SIGMA TRANSPORT	I2
JHCAP	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA CAPTURE	I2
JLCAP	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA CAPTURE	I2
JHCHI	HIGHEST GROUP INDEX J FOR NON-ZERO FISSION SPECTRA	I2
JLCHI	LOWEST GROUP INDEX J FOR NON-ZERO FISSION SPECTRA	I2
JHFIS	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA FISSION	I2
JLFIS	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA FISSION	I2
JHN2N	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA (N,2N)	I2
JLN2N	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA (N,2N)	I2
JHTOT	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA TOTAL	I2
JLTOT	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA TOTAL	I2
VERSN	NEUTRON VERSION NAME	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets MULTIGRP	Vol. III	Page B.3.18
		Rev.	Date 9/73

SECONDARY CROSS SECTION LIMITS FOR NEUTRON INTERACTION DATA

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'LIMITS'. 'XSECT2'

LIST = JLNG,JHNG,JLNA,JHNA,JLNP,JHNP,JLND,JHND,JLNT,JHNT,JLNG1,JHNG1

NOTE - RECORD IS OMITTED IF JHSX=0.

SYMBOL	DEFINITION	TYPE
DISO	EIGHT-CHARACTER ISOTOPE NAME	C8
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
JHNA	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA (N,ALPHA)	I2
JLNA	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA (N,ALPHA)	I2
JHND	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA (N,D)	I2
JLND	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA (N,D)	I2
JHNG	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA (N,GAMMA)	I2
JLNG	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA (N,GAMMA)	I2
JHNP	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA (N,P)	I2
JLNP	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA (N,P)	I2
JHNT	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA (N,T)	I2
JLNT	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA (N,T)	I2
JHNG1	HIGHEST GROUP INDEX J FOR NON-ZERO SIGMA (N,GAMMA*)	I2
JLNG1	LOWEST GROUP INDEX J FOR NON-ZERO SIGMA (N,GAMMA*)	I2
VERSN	NEUTRON VERSION NAME	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets MULTIGRP	Vol. III	Page B.3.19
		Rev.	Date 9/73

ELASTIC TRANSFER MATRIX LIMITS

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'LIMITS'. 'ELASTIC'

LIST = JLTME, JHTME, (LPXL(J), ILEL(J), IHXL(J), J=JLTME, JHTME)

NOTE - RECORD IS OMITTED IF JHTME=0.

SYMBOL	DEFINITION	TYPE
DISO	EIGHT-CHARACTER ISOTOPE NAME	C8
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
IHXL	HIGHEST LIMIT OF INITIAL ENERGY GROUP INDEX I FOR ELASTIC TRANSFER DATA TO GROUP J	I2
ILEL	LOWEST LIMIT OF INITIAL ENERGY GROUP INDEX I FOR ELASTIC TRANSFER DATA TO GROUP J	I2
JHTME	HIGHEST GROUP NO. FOR WHICH ELASTIC TRANSFER MATRIX DATA ARE GIVEN	I4
JLTME	LOWEST GROUP NO. FOR WHICH ELASTIC TRANSFER MATRIX DATA ARE GIVEN	I4
LPXL	MAXIMUM ANGULAR EXPANSION INDEX USED FOR ELASTIC TRANSFER DATA TO GROUP J	I2
VERSN	NEUTRON VERSION NAME	C8

INELASTIC TRANSFER MATRIX LIMITS

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'LIMITS'. 'INELAST'
LIST = JLTMI, JHTMI, (LPIN(J), ILIN(J), IHIN(J), J=JLTMI, JHTMI)

NOTE - RECORD IS OMITTED IF JHTMI=0.

SYMBOL	DEFINITION	TYPE
DISO	EIGHT CHARACTER ISOTOPE NAME	C8
IHIN	HIGHEST LIMIT OF INITIAL ENERGY GROUP INDEX I FOR INELASTIC TRANSFER DATA TO GROUP J	I2
ILIN	LOWEST LIMIT OF INITIAL ENERGY GROUP INDEX I FOR INELASTIC TRANSFER DATA TO GROUP J	I2
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
JHTMI	HIGHEST GROUP NO. FOR WHICH INELASTIC TRANSFER MATRIX DATA ARE GIVEN	I4
JLTMI	LOWEST GROUP NO. FOR WHICH INELASTIC TRANSFER MATRIX DATA ARE GIVEN	I4
LPIN	MAXIMUM ANGULAR EXPANSION INDEX USED FOR INELASTIC TRANSFER DATA TO GROUP J	I2
VERSN	NEUTRON VERSION NAME	C8

N2N TRANSFER MATRIX LIMITS

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'LIMITS'. 'N2N'

LIST = JLTMN, JHTMN, (LPN2N(J), ILN2N(J), IHN2N(J), J=JLTMN, JHTMN)

NOTE - RECORD IS OMITTED IF JHTMN=0.

SYMBOL	DEFINITION	TYPE
DISO	EIGHT-CHARACTER ISOTOPE NAME	C8
IHN2N	HIGHEST LIMIT OF INITIAL ENERGY GROUP INDEX I FOR (N,2N) TRANSFER TO GROUP J	I2
ILN2N	LOWEST LIMIT OF INITIAL ENERGY GROUP INDEX I FOR (N,2N) TRANSFER TO GROUP J	I2
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
JHTMN	HIGHEST GROUP NO. FOR WHICH (N,2N) TRANSFER MATRIX DATA ARE GIVEN	I4
JLTMN	LOWEST GROUP NO. FOR WHICH (N,2N) TRANSFER MATRIX DATA ARE GIVEN	I4
LPN2N	MAXIMUM ANGULAR EXPANSION INDEX LP FOR (N,2N) TRANSFER TO GROUP J	I2
VERSN	NEUTRON VERSION NAME	C8

JOSHUA DPSM-500	Title Cross Section Data Sets MULTIGRP	Vol. III Rev 002-M-500	Page B.6.22 Date 9/4/89

TOTAL TRANSFER MATRIX LIMITS

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?.?LIMITS?.?TOTAL'
LIST = JLTMT,JHTMT,(LPTOT(J);(ILTOT(J);(IHTOT(J);(ITDC(J);JHTMT)
(MMTL,MMTL=0,(L)MSHL,(L)MSHL,(L)MSHL,(L)MSHL,MMTL,MMTL=0

NOTE - RECORD IS OMITTED IF JHTMT=0.

SYMBOL	DEFINITION	UNIT
DISO	EIGHT-CHARACTER ISOTOPE NAME	C8
IHTOT	HIGHEST LIMIT OF INITIAL ENERGY GROUP INDEX FOR TOTAL TRANSFER DATA TO GROUP J	I2
ILTOT	LOWEST LIMIT OF INITIAL ENERGY GROUP INDEX FOR TOTAL TRANSFER DATA TO GROUP J	I2
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
JHTMT	HIGHEST GROUP NO. FOR WHICH TOTAL TRANSFER DATA ARE GIVEN	I4
JLTMT	LOWEST GROUP NO. FOR WHICH TOTAL TRANSFER DATA ARE GIVEN	I4
LPTOT	MAXIMUM ANGULAR EXPANSION INDEX USED FOR TOTAL TRANSFER DATA TO GROUP J	I2
VERSN	NEUTRON VERSION NAME	C8

PRIMARY NEUTRON INTERACTION CROSS SECTIONS

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?.?XSECTION'

LIST = NEG,(XTOT(J),XCAP(J),XFIS(J),XNU(J),XTR(J),XN2N(J),
CHI(J),J=1,NEG)

SYMBOL	DEFINITION	TYPE
CHI	FISSION FRACTION IN GROUP J VALUE IS ZERO IF ICHI.NE.1. SEE O.CONTENTS RECORD.	R4
DISO	EIGHT CHARACTER ISOTOPE NAME	C8
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
NEG	NO. OF ENERGY GROUPS	I4
XNU	NEUTRONS/FISSION IN GROUP J	R4
XTR	TRANSPORT CROSS-SECTION (BARNs) IN GROUP J	R4
XCAP	CAPTURE CROSS SECTION (BARNs) IN GROUP J	R4
XFIS	FISSION CROSS SECTION (BARNs) IN GROUP J	R4
XN2N	(N,2N) CROSS-SECTION (BARNs) IN GROUP J	R4
XTOT	TOTAL CROSS-SECTION (BARNs) IN GROUP J	R4
VERSN	NEUTRON VERSION NAME	C8

9869 IO SHUA DPST M-500	Title Cross Section Data Sets MULTIGRP	Title Cross Section Data Sets MULTIGRP	Vol. 1 IO SHUA DPST M-500	Page 1 9/73

SECONDARY NEUTRON INTERACTION CROSS SECTION RECORD

NAME 'MULTIGRP' .?VERSION? .?ISO? .?ITDC? .?XSECT2?
 LIST - JLSX, JHSX, (XNG(J), XNA(J), XNP(J), XND(J), XNT(J), XNG1(J), J=JLSX, JHSX)

SYMBOL	DEFINITION	UNIT	TYPE
DISO	EIGHT CHARACTER ISOTOPE NAME		C8
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)		I4
JHSX	HIGHEST GROUP NO. FOR WHICH SECONDARY CROSS SECTION DATA ARE GIVEN		I4
JLSX	LOWEST GROUP NO. FOR WHICH SECONDARY CROSS SECTION DATA ARE GIVEN		I4
XNA	(N, ALPHA) CROSS-SECTION (BARNS) IN GROUP J		R4
XND	(N, D) CROSS SECTION (BARNS) IN GROUP J		R4
XNG	(N, GAMMA) CROSS SECTION (BARNS) IN GROUP J		R4
XNP	(N, P) CROSS SECTION (BARNS) IN GROUP J		R4
XNT	(N, T) CROSS-SECTION (BARNS) IN GROUP J		R4
XNG1	(N, GAMMA) CROSS SECTION (BARNS) IN GROUP J TO FIRST EXCITED STATE		R4
VERSION	NEUTRON VERSION NAME		C8

DELAYED NEUTRON DATA

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?.?DELAYED'

LIST = JLDN,JHND,NFAM,(PXNUF(J),(DNCHI(N,J),N=1,NFAM),
J=JLDN,JHND)

SYMBOL	DEFINITION	TYPE
DISO	= EIGHT-CHARACTER ISOTOPE NAME	C8
DNCHI	= FRACTION OF DELAYED FISSION NEUTRONS ASSOCIATED WITH FAMILY N, WHICH ENTER GROUP J THE SUM OF DNCHI(N,J) OVER ALL J IS THE YIELD FOR FAMILY N.	R4
ITDC	= INTEGER VALUE OF TEMPERATURE (DEG C)	I4
JHND	HIGHEST ENERGY GROUP NO. FOR WHICH DELAYED NEUTRON SPECTRA DATA ARE GIVEN	I4
JLDN	= LOWEST ENERGY GROUP NO. FOR WHICH DELAYED NEUTRON SPECTRA DATA ARE GIVEN	I4
NFAM	= NO. OF DELAYED NEUTRON FAMILIES	I4
PXNUF	= PROMPT VALUE OF $\nu \cdot \Sigma$ FISSION (BARNS) FOR GROUP J; ARRAY USES SUBSCRIPT J	R4
VERSN	= NEUTRON VERSION NAME	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets MULTIGRP	Vol. III	Page B.3.26
		Rev.	Date 9/73

ELASTIC TRANSFER MATRIX FOR GROUP J

```

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'PLMATRIX'. 'ELASTIC'.?J?
LIST = LPEL(J), IHEL(J), IHEL(J), (XSEL(J,LP), (TMEL(I,J,LP), I=IHEL(J),
      IHEL(J))), LP=1, LPEL(J))

```

SYMBOL	DEFINITION	TYPE
DISO	EIGHT CHARACTER ISOTOPE NAME	C8
IHEL	HIGHER LIMIT OF INITIAL ENERGY GROUP INDEX I	I2
IHEL	LOWER LIMIT OF INITIAL ENERGY GROUP INDEX I	I2
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
J	FINAL ENERGY GROUP INDEX. P(I,J) MEANS P(I->J)	I4
LP	ANGULAR EXPANSION INDEX	
NOTE = LP IS ANGULAR EXPANSION INDEX. LP = L+1 L IS THE LEGENDRE ORDER INDEX. L = 0,1,2,...		
LPEL	MAXIMUM VALUE OF LP USED FOR GROUP J	I2
TMEL	SUBSCRIPTED ARRAY TMEL(I,J,LP) = ELASTIC TRANSFER MATRIX ELEMENT (BARNs) FOR TRANSFER FROM GROUP I TO GROUP J, ANGULAR EXPANSION INDEX LP TMEL(I,J,LP) IS THE TOTAL NUMBER OF NEUTRONS TRANSFERRED BY ELASTIC SCATTERING INTO GROUP J BY A UNIT TOTAL FLUX IN GROUP I.	R4
VERSN	NEUTRON VERSION NAME	C8
XSEL	SUBSCRIPTED ARRAY XSEL(J,LP) = ELASTIC CROSS SECTION (BARNs) FOR GROUP J, ANGULAR EXPANSION INDEX LP OBTAINED FROM ELASTIC TRANSFER MATRIX XSEL(I,LP) = SUM OVER J FROM 1 TO NEG OF TMEL(I,J,LP).	R4

INELASTIC TRANSFER MATRIX FOR GROUP J

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?.?PLMATRIX'.?INELAST'.?J?

LIST = LPIN(J),ILIN(J),IHIN(J),(XSIN(J,LP),(TMIN(I,J,LP),I=ILIN(J),
IHIN(J)),LP=1,LPIN(J))

SYMBOL	DEFINITION	TYPE
DISO	EIGHT-CHARACTER ISOTOPE NAME	C8
IHIN	HIGHER LIMIT OF INITIAL ENERGY GROUP INDEX I	I2
ILIN	LOWER LIMIT OF INITIAL ENERGY GROUP INDEX I	I2
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
J	FINAL ENERGY GROUP INDEX. P(I,J) MEANS P(I>J)	I4
NOTE = LP IS ANGULAR EXPANSION INDEX. LP = L+1 L IS THE LEGENDRE ORDER INDEX. L = 0,1,2,...		
LPIN	MAXIMUM VALUE OF LP USED FOR GROUP J	I2
TMIN	SUBSCRIPTED ARRAY TMIN(I,J,LP) = INELASTIC TRANSFER MATRIX ELEMENT (BARNs) FOR TRANSFER FROM GROUP I TO GROUP J, ANGULAR EXPANSION INDEX LP TMIN(I,J,LP) IS THE TOTAL NUMBER OF NEUTRONS TRANSFERRED BY INELASTIC SCATTERING INTO GROUP J BY A UNIT TOTAL FLUX IN GROUP I.	R4
VERSN	NEUTRON VERSION NAME	C8
XSIN	SUBSCRIPTED ARRAY XSIN(J,LP) = INELASTIC CROSS- SECTION (BARNs) FOR GROUP J, ANGULAR EXPANSION INDEX LP OBTAINED FROM INELASTIC TRANSFER MATRIX XSIN(I,LP) = SUM OVER J FROM 1 TO NEG OF TMIN(I,J,LP).	R4

N2N TRANSFER MATRIX FOR GROUP J

```

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?.?PLMATRIX'.?N2N'.?J?
LIST = LPN2N(J),ILN2N(J),IHN2N(J),(XSN2N(J,LP),(TMN2N(I,J,LP),
      I=ILN2N(J),IHN2N(J)),LP=1,LPN2N(J))

```

SYMBOL	DEFINITION	TYPE
DISO	EIGHT-CHARACTER ISOTOPE NAME	C8
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
IHN2N	HIGHER LIMIT OF INITIAL ENERGY GROUP INDEX I	I2
ILN2N	LOWER LIMIT OF INITIAL ENERGY GROUP INDEX I	I2
J	FINAL ENERGY GROUP INDEX. P(I,J) MEANS P(I→J)	I4
NOTE - LP IS ANGULAR EXPANSION INDEX. LP = L+1 L IS THE LEGENDRE ORDER INDEX. L = 0,1,2,...		
LPN2N	MAXIMUM VALUE OF LP USED FOR GROUP J	I2
TMN2N	SUBSCRIPTED ARRAY TMN2N(I,J,LP) = (N,2N) TRANSFER MATRIX ELEMENT (BARNs) FOR TRANSFER FROM GROUP I TO GROUP J, ANGULAR EXPANSION INDEX LP TMN2N(I,J,LP) IS THE TOTAL NUMBER OF NEUTRONS TRANSFERRED BY (N,2N) SCATTERING INTO GROUP J BY A UNIT TOTAL FLUX IN GROUP I.	R4
VERSN	NEUTRON VERSION NAME	C8
XSN2N	SUBSCRIPTED ARRAY XSN2N(J,LP) = (N,2N) CROSS SECTION (BARNs) FOR GROUP J, ANGULAR EXPANSION INDEX LP OBTAINED FROM (N,2N) TRANSFER MATRIX XSN2N(I,LP) = SUM OVER J FROM 1 TO NEG OF TMN2N(I,J,LP).	R4

TOTAL TRANSFER MATRIX FOR GROUP J

```
NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'PLMATRIX'. 'TOTAL'.?J?
LIST = LPTOT(J),ILTOT(J),IHTOT(J),(XSTOT(J,LP),(TMTOT(I,J,LP),
      I=ILTOT(J),IHTOT(J)),LP=1,LPTOT(J))
```

SYMBOL	DEFINITION	TYPE
DISO	EIGHT-CHARACTER ISOTOPE NAME	C8
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
IHTOT	HIGHER LIMIT OF INITIAL ENERGY GROUP INDEX I	I2
ILTOT	LOWER LIMIT OF INITIAL ENERGY GROUP INDEX I	I2
J	FINAL ENERGY GROUP INDEX. P(I,J) MEANS P(I->J)	I4
NOTE	LP IS ANGULAR EXPANSION INDEX. LP = L+1 L IS THE LEGENDRE ORDER INDEX. L = 0,1,2,...	
LPTOT	MAXIMUM VALUE OF LP USED FOR GROUP J	I2
TMTOT	SUBSCRIPTED ARRAY TMTOT(I,J,LP) = TOTAL TRANSFER MATRIX ELEMENT (BARNs) FOR TRANSFER FROM GROUP I TO GROUP J, ANGULAR EXPANSION INDEX LP TMTOT(I,J,LP) = TMEL(I,J,LP) + TMIN(I,J,LP) + 2.*TMN2N(I,J,LP).	R4
VERSN	NEUTRON VERSION NAME	C8
XSTOT	SUBSCRIPTED ARRAY XSTOT(J,LP) = TOTAL CROSS-SECTION (BARNs) FOR GROUP J, ANGULAR EXPANSION INDEX LP OBTAINED FROM TOTAL TRANSFER MATRIX XSTOT(I,LP) = SUM OVER ALL J FROM 1 TO NEG OF TMTOT(I,J,LP).	R4

PHOTON VERSIONS

=====

```

NAME = 'MULTIGRP'. 'PHOTON'. 'CONTENTS'
LIST = NPVX, (PVERS(NPV), NPV=1, NPVX)
=====

```

=====

SYMBOL	DEFINITION	TYPE
NPVX	NUMBER OF PHOTON VERSIONS IN LIST	I4
PVERS	PHOTON VERSION NAMES	C8

ENERGY GROUPS FOR A PHOTON VERSION

```
NAME = 'MULTIGRP'. 'PHOTON'. ?PVERS?. 'GROUPS'
LIST = NPEG, (EP(N), UP(N), EPPAR(N), N=1, NPEG), EP(NPEG+1)
```

SYMBOL	DEFINITION	TYPE
EP	ENERGY BREAK POINT FOR GROUP N (EV). EP(N) IS THE UPPER ENERGY LIMIT OF GROUP N. GROUPS ARE SPECIFIED IN ORDER OF DECREASING ENERGY. I.E. $EP(1) > EP(2) > \dots > EP(N) > \dots > EP(NPEG+1)$	R4
EPPAR	VELOCITY AVERAGE ENERGY BY GROUP $EP(N+1) < EPPAR(N) < EP(N)$	R4
N	PHOTON ENERGY GROUP INDEX	I4
NPEG	NUMBER OF PHOTON ENERGY GROUPS	I4
UP	LOW LETHARGY BREAK POINT FOR GROUP N. $UP(N) = \ln(EP(1)/EP(N))$	R4
PVERS	PHOTON VERSION NAME	C8

LEGENDRE PHOTON FLUX WEIGHTS FOR GROUP COMPRESSION

```
NAME = 'MULTIGRP'.'PHOTON'.'?PVERS?'. 'WEIGHTS'
LIST = LPX,NEGP,DSP,VERSP,((WTP(I,LP),I=1,NEGP),LP=1,LPX)
```

SYMBOL	DEFINITION	TYPE
DSP	SOURCE DATA SET, EITHER 'MULTIGRP' OR 'FINEGRP'	C8
I	PHOTON GROUP INDEX	I4
LP	LEGENDRE INDEX $LP=L+1=1,2,\dots,LPX$	I4
LPX	MAXIMUM VALUE OF LP	I4
NEGP	NUMBER OF PHOTON ENERGY GROUPS IN VERSION OF 'DSP' WITH NAME ?VERSP?	I4
PVERS	PHOTON VERSION NAME	C8
VERSP	NAME OF VERSION OF 'DSP' DATA SET FROM WHICH DATA WAS COLLAPSED	C8
WTP	LEGENDRE PHOTON FLUX COMPONENTS USED AS WEIGHTS TO COMPRESS DATA	R4

NOTE - THIS RECORD IS OMITTED IF DATA WAS NOT COMPRESSED

ISOTOPE NAMES IN A PHOTON VERSION

```
NAME = 'MULTIGRP'. 'PHOTON'. ?PVERS?. 'ISOTOPE'
LIST = ISOX, (DISP(ISO), AWP(ISO), IZ(ISO), ISO=1, ISOX)
```

SYMBOL	DEFINITION	TYPE
AWR	RATIO OF MATERIAL ATOMIC WEIGHT TO NEUTRON ATOMIC WEIGHT	R4
DISP	ISOTOPE NAMES	C8
ISO	ISOTOPE INDEX	I4
ISOX	NUMBER OF ISOTOPES IN VERSION ?PVERS?	I4
IZ	INTEGER Z DESIGNATION IN FORM ZZ0000	I4
PVERS	PHOTON VERSION NAME	C8

PHOTON CROSS SECTION LIMITS

NAME = 'MULTIGRP'. 'PHOTON'. ?PVERS?. ?DISP?. 'LIMITS'. 'PHXSECTS'

LIST = JLTOTP, JHTOTP, JLGAM, JHGAM, JLINCS, JHINCS, JLCOHS, JHCOHS, JLP AIR,
JHPAIR, JLFOTO, JHFOTO, JLINCA, JHINCA

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
JHCOHS	HIGH GROUP INDEX FOR COHERENT SCATTERING	I2
JHINCA	HIGH GROUP INDEX FOR INCOHERENT ABSORPTION	I2
JHINCS	HIGH GROUP INDEX FOR INCOHERENT SCATTERING	I2
JHGAM	HIGH GROUP INDEX FOR GAMMA HEATING CROSS SECTION	I2
JHPAIR	HIGH GROUP INDEX FOR PAIR PRODUCTION	I2
JHFOTO	HIGH GROUP INDEX FOR PHOTOELECTRIC CROSS SECTION	I2
JHTOTP	HIGH GROUP INDEX FOR TOTAL CROSS SECTION	I2
JLCOHS	LOW GROUP INDEX FOR COHERENT SCATTERING	I2
JLINCA	LOW GROUP INDEX FOR INCOHERENT ABSORPTION	I2
JLINCS	LOW GROUP INDEX FOR INCOHERENT SCATTERING	I2
JLGAM	LOW GROUP INDEX FOR GAMMA HEATING CROSS SECTION	I2
JLP AIR	LOW GROUP INDEX FOR PAIR PRODUCTION	I2
JLFOTO	LOW GROUP INDEX FOR PHOTOELECTRIC CROSS SECTION	I2
JLTOTP	LOW GROUP INDEX FOR TOTAL CROSS SECTION	I2
PVERS	PHOTON VERSION NAME	C8

COMPTON SCATTERING TRANSFER MATRIX LIMITS

NAME = 'MULTIGRP','PHOTON',?PVERS?,?DISP?,'LIMITS','INCOHERNT'

LIST = JLINCS,JHINCS,(LPINCS(J),ILINCS(J),IHINCS(J),J=JLINCS,JHINCS)

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
IHINCS	HIGH VALUE OF INITIAL PHOTON GROUP INDEX I FOR INCOHERENT SCATTERING TO PHOTON GROUP J.	I2
ILINCS	LOW VALUE OF INITIAL PHOTON GROUP INDEX I FOR INCOHERENT SCATTERING TO PHOTON GROUP J.	I2
JHINCS	HIGH VALUE OF FINAL PHOTON ENERGY GROUP INDEX J FOR INCOHERENT SCATTERING MATRIX.	I4
JLINCS	LOW VALUE OF FINAL PHOTON ENERGY GROUP INDEX J FOR INCOHERENT SCATTERING MATRIX	I4
LPINCS	MAXIMUM LEGENDRE ORDER FOR INCOHERENT SCATTERING TO PHOTON GROUP J.	I2
PVERS	PHOTON VERSION NAME	C8

PHOTON FISSION PRODUCTION MATRIX LIMITS

```
NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'PHOTON'.?PVERS?.?DISP?.
      . 'LIMITS'. 'FISSPROD'
```

```
LIST = JLFISS, JHFISS, NUNIT, (LPFISS(J), ILFISS(J), IHFISS(J), J=JLFISS,
      JHFISS)
```

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
IHFISS	HIGH VALUE OF INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON ENERGY GROUP J.	I2
ILFISS	LOW VALUE OF INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON ENERGY GROUP J.	I2
ITDC	INTEGER VALUE OF TEMPERATURE (DEG.C)	I4
JHFISS	HIGH VALUE OF PHOTON ENERGY GROUP INDEX J IN MATRIX	I4
JLFISS	LOW VALUE OF PHOTON ENERGY GROUP INDEX J IN MATRIX	I4
LPFISS	MAXIMUM LEGENDRE ORDER FOR PHOTON PRODUCTION IN GROUP J	I2
NUNIT	MATRIX UNITS FLAG: =0, UNITS OF MATRIX ARE PHOTON BNS/EVENT =1, UNITS OF MATRIX ARE PHOTONS/EVENT	I4
PVERS	PHOTON VERSION NAME	C8
VERSN	NEUTRON VERSION NAME	C8

PHOTON (N,GAMMA) PRODUCTION MATRIX LIMITS

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'PHOTON'.?PVERS?.?DISP?.
 .'LIMITS'. 'NGPROD'

LIST = JLNG,JHNG,NUNIT,(LPNG(J),ILNG(J),IHNG(J),J=JLNG,JHNG)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
IHNG	HIGH VALUE OF INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON ENERGY GROUP J.	I2
ILNG	LOW VALUE OF INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON ENERGY GROUP J.	I2
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
JHNG	HIGH VALUE OF PHOTON GROUP INDEX J IN PRODUCTION MATRIX	I4
JLNG	LOW VALUE OF PHOTON GROUP INDEX J IN PRODUCTION MATRIX	I4
LPNG	MAXIMUM LEGENDRE ORDER FOR PHOTON PRODUCTION IN GROUP J	I2
NUNIT	MATRIX UNITS FLAG: =0, UNITS OF MATRIX ARE PHOTON-BNS/EVENT =1, UNITS OF MATRIX ARE PHOTONS/EVENT	I4
PVERS	PHOTON VERSION NAME	C8
VERSN	NEUTRON VERSION NAME	C8

PHOTON INELASTIC PRODUCTION MATRIX LIMITS

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'PHOTON'.?PVERS?.?DISP?.
 .'LIMITS'. 'INELPROD'

LIST = JLINEL, JHINEL, NUNIT, (LPINEL(J), ILINEL(J), IHINEL(J),
 J=JLINEL, JHINEL)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
IHINEL	HIGH VALUE OF INITIAL NEUTRON ENERGY GROUP I FOR PRODUCTION OF PHOTONS IN PHOTON ENERGY GROUP J	I2
ILINEL	LOW VALUE OF INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON ENERGY GROUP J	I2
ITDC	INTEGER VALUE OF TEMPERATURE (DEG C)	I4
JHINEL	HIGH VALUE OF PHOTON ENERGY GROUP INDEX J IN MATRIX	I4
JLINEL	LOW VALUE OF PHOTON ENERGY GROUP INDEX J IN MATRIX	I4
LPINEL	MAXIMUM LEGENDRE ORDER PHOTON PRODUCTION IN GROUP J	I2
NUNIT	MATRIX UNITS FLAG: =0, UNITS OF MATRIX ARE PHOTON BARNS/EVENT =1, UNITS OF MATRIX ARE PHOTONS/EVENT	I4
PVERS	PHOTON VERSION NAME	C8
VERSN	NEUTRON VERSION NAME	C8

PG PHOTON INTERACTION CRSSS SECTIONS

NAME = 'MULTIGRP','PHOTON'.?PVERS?.?DISP?. 'PHXSSECTS'

LIST = NPEG,(XTOTP(J),XINCS(J),XINCA(J),XCOH(J),XPAIR(J),XPHOT(J),
XGAM(J),J=1,NPEG)

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
NPEG	NUMBER OF PHOTON GROUPS	I4
PVERS	PHOTON VERSION NAME	C8
XCOH	COHERENT SCATTERING CROSS SECTION (BARNs)	R4
XGAM	GAMMA HEATING CROSS SECTION (BARNs) = XINCA + XPAIR + XPHOT	R4
XINCA	INCOHERENT ABSORPTION CROSS SECTION (BARNs) (COMPTON ABSORPTION)	R4
XINCS	INCOHERENT SCATTERING CROSS SECTION (BARNs) (COMPTON SCATTERING)	R4
XPAIR	TOTAL PAIR PRODUCTION CROSS SECTION (BARNs)	R4
XPHOT	TOTAL PHOTOELECTRIC CROSS SECTION (BARNs)	R4
XTOTP	TOTAL PHOTON CROSS SECTION (BARNs) = XCOH + XINCS + XINCA + XPAIR + XPHOT	R4

PHOTON INCOHERENT SCATTERING MATRIX

```

NAME = 'MULTIGRP','PHOTON','PVERS','DISP','PLMATRIX','INCOHRNT','J?
LIST = LPINCS(J), ILINCS(J), IHINCS(J), (XINCS(J,LP), (TMINCS(I,J,LP),
      I=ILINCS(J), IHINCS(J)), LP=1, LPINCS(J))

```

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
IHINCS	HIGH LIMIT OF INITIAL PHOTON GROUP INDEX I FOR TRANSFER TO PHOTON GROUP J.	I2
ILINCS	LOW LIMIT OF INITIAL PHOTON GROUP INDEX I FOR TRANSFER TO PHOTON GROUP J.	I2
J	FINAL PHOTON ENERGY GROUP INDEX	I4
LP	LEGENDRE ORDER INDEX, LP=L+1=1, I, ..., LPINCS	I4
LPINCS	HIGH LIMIT OF LP FOR PHOTON GROUP J	I2
PVERS	PHOTON VERSION NAME	C8
TMINCS	SUBSCRIPTED INCOHERENT SCATTERING TRANSFER ELEMENT TMINCS(I,J,LP) OR BARPS	R4
XINCS	ARRAY XINCS(J,LP) - INCOHERENT PHOTON SCATTERING CROSS SECTION (BARNS) FOR GROUP J AND LEGENDRE ORDER LP-1.	R4

PHOTON FISSION PRODUCTION MATRIX

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITOC?.?PHOTON?.?PVERS?.?DISP?.
 .?PLMATRIX?.?FISSPROD?.?J?

LIST = LPFISS(J),ILFISS(J),IHFISS(J),((TMFISS(I,J,LP),
 I=ILFISS(J),IHFISS(J)),LP=1,LPFISS(J))

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
IHFISS	HIGH LIMIT OF INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON ENERGY GROUP J.	I2
ILFISS	LOW LIMIT OF INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON ENERGY GROUP J.	I2
ITOC	INTEGER TEMPERATURE (DEG C)	I4
J	FINAL PHOTON ENERGY GROUP INDEX	I4
LP	LEGENDRE ORDER INDEX, LP=L+1=1,2,...LPFISS	I4
LPFISS	HIGH LIMIT OF LP FOR PHOTON GROUP J	I2
PVERS	PHOTON VERSION NAME	C8
TMFISS	SUBSCRIPTED FISSION PRODUCTION MATRIX ELEMENT TMFISS(I,J,LP). UNITS SPECIFIED IN LIMITS RECORD	R4
VERSN	NEUTRON VERSION NAME	C8

PHOTON (N,GAMMA) PRODUCTION MARTIX

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?.?PHOTON?.?PVERS?.?DISP?.
 .'PLMATRIX'.?NGPROD?.?J?

LIST = LPNG(J),ILNG(J),IHNG(J),((TMNG(I,J,LP),I=ILNG(J),IHNG(J)),
 LP=1,LPNG(J))

SYMBOL	DEFINITION	TYPE
DISP	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
IHNG	HIGH LIMIT OF INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTON IN PHOTON GROUP J.	I2
ILNG	LOW LIMIT OF INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON GROUP J	I2
ITDC	INTEGER TEMPERATURE (DEG C).	I4
J	FINAL PHOTON ENERGY GROUP INDEX	I4
LP	LEGENDRE ORDER INDEX, LP=L+1,2,...,LPNG	I4
LPNG	HIGH LIMIT OF LP FOR PHOTON GROUP J	I2
PVERS	PHOTON VERSION NAME	C8
TMNG	SUBSCRIPTED (N,GAMMA) PRODUCTION MATRIX ELEMENT TMNG(I,J,LP). UNITS SPECIFIED IN LIMITS RECORD	R4
VERSN	NEUTRON VERSION NAME	C8

PHOTON INELASTIC PRODUCTION MATRIX

NAME = 'MULTIGRP'.?VERSN?.?DISO?.?ITDC?. 'PHOTON'.?PVERS?.?DISP?.
 .'PLMATRIX'. 'INELPROD'.?J?

LIST = LPINEL(J), ILINEL(J), IHINEL(J), ((TMINEL(I,J,LP),
 I=ILINEL(J), IHINEL(J)), LP=1, LPINEL(J))

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME IN NEUTRON VERSION	C8
DISP	ISOTOPE NAME IN PHOTON VERSION	C8
IHINEL	HIGH LIMIT FOR INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON GROUP J.	I2
ILINEL	LOW LIMIT FOR INITIAL NEUTRON ENERGY GROUP INDEX I FOR PRODUCTION OF PHOTONS IN PHOTON GROUP J.	I2
ITDC	INTEGER TEMPERATURE (DEG C)	I4
J	FINAL PHOTON ENERGY GROUP INDEX	I4
LP	LEGENDRE ORDER INDEX, LP=L+1=1,2,... LPINEL	I4
LPINEL	HIGH LIMIT OF LP FOR PHOTON GROUP J	I2
PVERS	PHOTON VERSION NAME	C8
TMINEL	SUBSCRIPTED INELASTIC PHOTON PRODUCTION MATRIX ELEMENT TMINEL(I,J,LP). UNITS SPECIFIED IN LIMITS RECORDS.	R4
VERSN	NEUTRON VERSION NAME	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets FEWGRP	Vol. III	Page B.4.1
		Rev.	Date 9/73

Report Written By

D. R. Finch

Work Done By

J. W. Stewart
H. C. Honeck
R. J. Pryor

Contents

	<u>Page</u>
1. Description	B.4.3
2. Record Descriptions	B.4.7

JOSHUA
DPSTM-500

Title Cross Section Data Sets
FEWGRP

Vol.
III

Page
B.4.2

Rev.

Date
9/73

(Blank)

JOSHUA DPSTM-500	Title Cross Section Data Sets FEWGRP	Vol. III	Page B.4.3
		Rev.	Date 9/73

1. Description

The FEWGRP data set contains few group (2-10) neutron cross sections and nuclear parameters. FEWGRP neutron cross sections and nuclear parameters are generated by modules of the Lattice Physics Subsystem and are correlated on a one-to-one basis with lattice descriptive data in the LATTICE data set (Section C.2). Data in the FEWGRP data set with the data in the LATTICE data set forms the basic interface between the Lattice Physics Subsystem and the Correlation Subsystem.

The structure of the FEWGRP data set is shown in Figure 1 and described below.

The record with name string FEWGRP.CØNTENTS contains (a) a catalog of FEWGRP versions (?FGV?) and (b) a catalog of lattice names (?DLAT?), lattice versions (?VLAT?), and concatenated lattice name/versions (?LNV?). The lattice name/version (?LNV?) is used to catalog FEWGRP data and corresponds uniquely to the ?DLAT?/?VLAT? name pair used to catalog data in the LATTICE data set.

The record with name string FEWGRP.?FGV?.GRØUPS contains the energy group structure for version ?FGV?. This structure is expressed as the group width of each group and the low energy of the last group.

The record with name string FEWGRP.?FGV??.?LNV?.CØNTENTS contains a catalog of concatenated assembly (cell) name/version/position qualifiers (mnemonic ?ANVP?). This record also specifies the number of lattice states for which data are cataloged in the LATTICE data set under the lattice name/version pair ?DLAT?/?VLAT?.

Neutronic cross sections and nuclear parameters are stored under five data classes. These classes are:

- MACRØ (macroscopic cross sections, diffusion coefficients, and fission spectra)
- MICRØ (microscopic cross sections and isotopic concentrations)
- ANISØ (Legendre components of scattering)
- DELAYED (delayed neutron data)
- FLUX (flux-volume data)

Data is stored for each lattice state index for which there is a cataloged entry in the LATTICE data set. Lattice average neutronic data is stored with the name LATTICE replacing the assembly name/version/position parameter (mnemonic ?ANVP?) for all of the above type of data.

JOSHUA DPSTM-500	Title Cross Section Data Sets FEWGRP	Vol. III	Page B.4.4
		Rev.	Date 9/73

Because of the cataloged structure and cross linked catalogs to the LATTICE data set care must be exercised in copying FEWGRP records from one user data set to another; or from user to standard, etc. Such transfers of FEWGRP data require that the catalogs be updated. Catalog updating will be performed automatically for new FEWGRP data records generated by Lattice Physics modules; however the proper housekeeping modules must be used to facilitate additions, deletions, and library maintenance when Lattice Physics modules are not employed.

Figure 1. Structure of FEWGRP Data Set

JOSHUA
DPSTM-500

Title Cross Section Data Sets
FEWGRP

Vol.
III

Page
B.4.6

Rev.

Date
9/73

(Blank)

2. Record Descriptions

CONTENTS OF THE FEWGRP DATA SET

```
NAME = 'FEWGRP'. 'CONTENTS'
LIST = NLNVX, NFGVX, (LNV(NLNV), DLAT(NLNV), VLAT(NLNV), NLNV=1, NLNVX),
      (FGV(NFGV), NFGV=1, NFGVX)
```

SYMBOL	DEFINITION	TYPE
DLAT	LATTICE NAME	C8
FGV	FEWGRP VERSION NAMES	C8
LNv	CONCATENATED LATTICE NAME/VERSION	C8
NFGV	FEWGRP VERSION INDEX	I4
NFGVX	NUMBER OF FEWGRP VERSIONS	I4
NLNV	CONCATENATED LATTICE NAME/VERSION INDEX	I4
NLNVX	NUMBER OF CONCATENATED LATTICE NAME/VERSIONS	I4
VLAT	LATTICE VERSION	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets FEWGRP	Vol. III	Page B.4.8
		Rev.	Date 9/73

GROUP STRUCTURE OF A VERSION OF FEWGRP LIBRARY

```

| NAME = 'FEWGRP'.?FGV?.'GROUPS'
| LIST = NEG,MULTV,E0,(DE(I),I=1,NEG)

```

SYMBOL	DEFINITION	TYPE
DE	DELTA ENERGY (EV) FOR EACH ENERGY GROUP	R4
E0	LOWER ENERGY LIMIT OF THERMAL-MOST GROUP (EV)	R4
FGV	FEWGRP VERSION NAME	C8
MULTV	MULTIGRP VERSION NAME USED TO GENERATE FEWGRP LIBRARY	C8
NEG	NUMBER OF ENERGY GROUPS	I4

CONTENTS CATALOGUED BY FEWGRP VERSION, CONCATENATED LATTICE NAME

NAME = 'FEWGRP'.?FGV?.?LVN?. 'CONTENTS'

LIST = NCLX,NSTX,(ANVP(NCL),TLPCL(NCL),NCL=1,NCLX)

SYMBOL	DEFINITION	TYPE
ANVP	ASSEMBLY NAME/VERSION/POSITION	C8
NCL	ASSEMBLY NAME/VERSION/POSITION INDEX	I4
NCLX	NUMBER OF ASSEMBLY NAME/VERSION/POSITION INDICES USED	I4
NSTX	NUMBER OF LATTICE STATES CATALOGUED	I4
TLPCL	NUMBER OF TIMES ASSEMBLY APPEARS IN LATTICE.	R4

NEUTRON FLUX DATA

```

NAME = 'FEWGRP'.?FGV?.?LNV?.?ANVP?. 'FLUX'.?NST?
LIST = NEG, (FLUX(I), I=1, NEG)

```

SYMBOL	DEFINITION	TYPE
ANVP	CONCATENATED ASSEMBLY NAME/VERSION/POSITION	C8
FGV	FEWGRP VERSION	C8
FLUX	TOTAL FLUX*VOLUME FOR ENERGY GROUP I.	R4
LNV	CONCATENATED LATTICE NAME/VERSION	C8
NEG	NUMBER OF ENERGY GROUPS.	I4
NST	LATTICE STATE NUMBER	I4

MACROSCOPIC DATA

```

NAME = 'FEWGRP'.?EGV?.?LNV?.?ANVP?.?MACRO'.?NST?
LIST = NEG, (D(J), SIGC(J), SIGF(J), SIGFNU(J), J=1, NEG),
          ((T(I, J), I=1, NEG), J=1, NEG),
          ((CHI(I, J), I=1, NEG), J=1, NEG)

```

SYMBOL	DEFINITION	TYPE
ANVP	CONCATENATED ASSEMBLY NAME/VERSION/POSITION	C8
CHI	FISSION SPECTRUM, TOTAL. CHI(I,J) = FRACTION OF FISSION NEUTRONS ULTIMATELY APPEARING IN GROUP J WHICH RESULT FROM FISSION EVENT PRODUCED BY A NEUTRON OF INCIDENT ENERGY I.	R4
D	ARRAY OF GROUP DIFFUSION COEFFICIENTS (CM.)	R4
EGV	FEWGRP VERSION	C8
I	INCIDENT ENERGY GROUP.	I4
J	FINAL ENERGY GROUP.	I4
LNV	CONCATENATED LATTICE NAME/VERSION	C8
NEG	NO. OF ENERGY GROUPS	I4
NST	LATTICE STATE NUMBER	I4
SIGC	ARRAY OF GROUP CAPTURE CROSS-SECTIONS (CM.**=1).	R4
SIGF	ARRAY OF GROUP FISSION CROSS-SECTIONS (CM.**=1).	R4
SIGFNU	ARRAY OF GROUP FISSION CROSS-SECTIONS TIMES NU (1./CM-FISSIONS).	R4
T	GROUP TO GROUP TRANSFER MATRIX (CM.**=1). T(I,J) = TRANSFER CROSS-SECTION FROM GROUP I TO GROUP J.	R4

MICROSCOPIC DATA

NAME = 'FEWGRP'.?FGV?.?LNV?.?ANVP?. 'MICRO'.?NST?

LIST = NISO,NEG,MX,(DISO(N),ITDC(N),CONC(N),((SIGMA(M,I,N),M=1,MX),
I=1,NEG),N=1,NISO)

SYMBOL	DEFINITION	TYPE
ANVP	CONCATENATED ASSEMBLY NAME/VERSION/POSITION	C8
CONC	ARRAY OF ISOTOPIC CONCENTRATIONS (AT/RN=CM).	R4
DISO	ARRAY OF ISOTOPIC NAMES.	C8
FGV	FEWGRP VERSION	C8
I	ENERGY GROUP INDEX.	I4
ITDC	ARRAY OF ISOTOPIC TEMPERATURE IDENTIFICATIONS.	I4
LVN	CONCATENATED LATTICE NAME/VERSION	C8
M	REACTION TYPE INDEX	I4
	M REACTION TYPE	
	1 CAPTURE - SMOOTH	
	2 CAPTURE - RESONANCE	
	3 FISSION - SMOOTH	
	4 FISSION - RESONANCE	
	5 NU	
	6 SELF-SHIELDING FACTOR	
	7 (N,ALPHA)	
	8 (N,P)	
	9 (N,GAMMA*) TO FIRST EXCITED STATE	
	10 (N,2N)	
	ETC. 	
	NOTE: SELF-SHIELDING FACTOR IS RATIO OF RESONANCE INTEGRAL TO THAT AT INFINITE DILUTION.	
MX	MAXIMUM VALUE OF REACTION TYPE INDEX REFERENCED	I4
N	ISOTOPE INDEX	I4
NEG	NO. OF ENERGY GROUPS.	I4

JOSHUA DPSTM-500	Title Cross Section Data Sets FEWGRP	Vol. III	Page B.4.13
		Rev.	Date 9/73

SYMBOL	DEFINITION	TYPE
NISO	NO. OF ISOTOPES.	I4
NST	LATTICE STATE NUMBER	I4
SIGMA	MICROSCOPIC CROSS-SECTION (BARNs)	R4

ANISOTROPIC SCATTERING DATA

```

1 NAME = 'FEWGRP'.?FGV?.?LNV?.?ANVP?. 'ANISO'.?NST?
1
1 LIST = NEG,LMAX,(((T(I,J,L),I=1,NEG),J=1,N*G),L=1,LMAX)
1

```

SYMBOL	DEFINITION	TYPE
ANVP	CONCATENATED ASSEMBLY NAME/VERSION/POSITION	C8
FGV	FEWGRP VERSION	C8
I	INITIAL ENERGY GROUP INDEX.	I4
J	FINAL ENERGY GROUP INDEX.	I4
L	LEGENDRE EXPANSION INDEX.	I4
LMAX	NO. OF LEGENDRE EXPANSION TERMS.	I4
LNV	CONCATENATED LATTICE NAME/VERSION	C8
NEG	NO. OF ENERGY GROUPS.	I4
NST	LATTICE STATE NUMBER	I4
T	GROUP TO GROUP TRANSFER MATRIX (CM**1) T(I,J,L) = TRANSFER FROM GROUP I TO GROUP J FOR LTH EXPANSION TERM.	R4

DELAYED NEUTRON DATA

```

NAME = 'FEWGRP'.?EGV?.?LNV?.?ANVP?. 'DELAYED'.?NST?
LIST = NEG, NEAM, (XLAMDA(N), N=1, NEAM), (VELINV(J), SIGEPN(J), J=1, NEG),
      ((CHID(J,N), N=1, NEAM), J=1, NEG)

```

SYMBOL	DEFINITION	TYPE
ANVP	CONCATENATED ASSEMBLY NAME/VERSION/POSITION	C8
CHID	DELAYED FISSION SPECTRUM BY FAMILY AND FINAL ENERGY GROUP. NOTE: CHID(J,N) IS THE FRACTION OF TOTAL FISSION NEUTRONS WHICH APPEAR IN DELAYED FAMILY N, ENERGY GROUP J, AND IS ASSUMED TO BE INDEPENDENT OF INCIDENT NEUTRON ENERGY.	R4
EGV	FEWGRP VERSION	C8
J	FINAL ENERGY GROUP INDEX.	I4
LNV	CONCATENATED LATTICE NAME/VERSION	C8
N	DELAYED NEUTRON FAMILY INDEX.	I4
NEG	NO. OF ENERGY GROUPS.	I4
NEAM	NO. OF DELAYED NEUTRON FAMILIES.	I4
NST	LATTICE STATE NUMBER	I4
SIGEPN	ARRAY OF GROUP VALUES OF NU*SIGMA FISSION (PROMPT), (CM** 1).	R4
VELINV	ARRAY OF INVERSE NEUTRON GROUP VELOCITIES (SEC./CM.).	R4
XLAMDA	ARRAY OF DELAYED NEUTRON TIME CONSTANTS (SEC.**-1).	R4

JOSHUA DPSTM-500	Title Cross Section Data Sets FEWGRP	Vol. III	Page B.4.16
		Rev.	Date 9/73

SUMMARY OF NAMES AND LISTS IN JOSHUA LIBRARY FEWGRP

NAME

'FEWGRP'. 'CONTENTS'

'FEWGRP'. ?FGV?. 'GROUPS'

'FEWGRP'. ?FGV?. ?LNV?. 'CONTENTS'

'FEWGRP'. ?FGV?. ?LNV?. ?ANVP?. 'FLUX'. ?NST?

'FEWGRP'. ?FGV?. ?LNV?. ?ANVP?. 'MACRO'. ?NST?

'FEWGRP'. ?FGV?. ?LNV?. ?ANVP?. 'MICRO'. ?NST?

'FEWGRP'. ?FGV?. ?LNV?. ?ANVP?. 'ANISO'. ?NST?

'FEWGRP'. ?FGV?. ?LNV?. ?ANVP?. 'DELAYED'. ?NST?

LIST

NLNVX, NEGVX, (LNV(NLNV), DLAT(NLNV), VLAT(NLNV), NLNV=1, NLNVX),
(EGV(NEGV), NEGV=1, NEGVX)

NEG, MULTV, EO, (DE(I), I=1, NEG)

NCLX, NSTX, (ANVP(NCL), TLPCL(NCL), NCL=1, NCLX)

NEG, (FLUX(I), I=1, NEG)

NEG, (D(J), SIGC(J), SIGF(J), SIGFNU(J), J=1, NEG),
((T(I, J), I=1, NEG), J=1, NEG),
((CHI(I, J), I=1, NEG), J=1, NEG)

NISO, NEG, MX, (DISO(N), ITDC(N), CONC(N), ((SIGMA(M, I, N), M=1, MX),
I=1, NEG), N=1, NISO)

NEG, LMAX, (((T(I, J, L), I=1, NEG), J=1, NEG), L=1, LMAX)

NEG, NFAM, (XLAMDA(N), N=1, NFAM), (VEL INV(J), SIGFPN(J), J=1, NEG),
((CHID(J, N), N=1, NFAM), J=1, NEG)

JOSHUA DPSTM-500	Title Cross Section Data Sets FEWGRP	Vol. III	Page B.4.18
		Rev.	Date 9/73

(Blank)

NEUTRON FLUX DATA

NAME - 'FEWGRP'.?VERSION?.?LATT?.?ASSY?.?FLUX?.?NCASE?

LIST - VCL,TLPCL,NEG,(FLUX(I),I=1,NEG)

SYMBOL	DEFINITION	TYPE
VCL	VOLUME OF ASSEMBLY.	R4
TLPCL	NUMBER OF TIMES ASSEMBLY APPEARS IN LATTICE.	R4
NEG	NUMBER OF ENERGY GROUPS.	I4
FLUX(I)	TOTAL FLUX*VOLUME FOR ENERGY GROUP I.	R4
VERSN	FEWGRP VERSION NAME	C8

JOSHUA

DPSTM-500

Title Cross Section Data Sets
NUCPARAM

Vol. III	Page B.5.1
Rev.	Date 9/73

Report Written By

J. W. Stewart

Work Done By

J. W. Stewart
D. R. Finch
R. J. Pryor

Contents

	<u>Page</u>
1. Description	B.5.2
2. Record Descriptions	B.5.4

JOSHUA DPSTM-500	Title Cross Section Data Sets NUCPARAM	Vol. III	Page B.5.2
		Rev.	Date 9/73

1. Description

The NUCPARAM data set contains nuclear parameters which are essentially independent of the multigroup energy structure. Data contained is, however, related to the FINEGRP data set.

The record NUCPARAM.CØNTENTS contains a catalog of data set versions (mnemonic ?VERSN?).

For each data set version the catalogued reaction types are listed in a record NUCPARAM.?VERSN?.CØNTENTS. The record NUCPARAM.?VERSN?.SIGMAP contains the potential scattering cross section for each isotope in the version of the data set with the name ?VERSN?. The record NUCPARAM.?VERSN?.DECAY contains decay constants and decay modes for all fission products of all isotopes in the version.

Resolved and unresolved resonance parameters are stored rather than tabulated smooth resonance cross sections.

Fission product yields are catalogued by isotope.

Resonance, decay, potential scattering, and fission product yield data in a particular version of NUCPARAM are related to the neutron spectrum used to generate the FINEGRP data set version of the same name.

Depletion data is provided as input to depletion modules such as RAID. This data includes the depletion chain isotopes, reaction Q-values (Mev/fission, etc.), and effective (APE-type) two-group cross sections.

A summary table of all isotopes catalogued in the NUCPARAM and MULTIGRP data sets is contained in the record NUCPARAM.ISØTØPES. Catalogued data include isotope name, IZAS identification number, and atomic weight ratio.

The following paragraphs contain a detailed description of the record types in the NUCPARAM data set.

Figure 1. Structure of Records in NUCPARAM Data Set

2. RECORD DESCRIPTIONS

LIBRARY CONTENTS

```

|
| NAME - 'NUCPARAM'. 'CONTENTS'
|
| LIST - NVX, (VERSN(NV), NV=1, NVX)
|

```

SYMBOL	DEFINITION	TYPE
NV	VERSION INDEX	I4
NVX	NO. OF VERSIONS	I4
VERSN	VERSION NAME	C8

TABLE OF ISOTOPIES FOR PHYSICS CALCULATIONS

```

|
| NAME - 'NUCPARAM'. 'ISOTOPES'
|
| LIST - NISO, (DISO(ISO), IZAS(ISO), ATW(ISO), ISO=1, NISO)
|

```

SYMBOL	DEFINITION	TYPE
ATW	ATOMIC WEIGHT (RELATIVE TO NEUTRON)	R4
DISO	ISOTOPE NAME	C8
ISO	ISOTOPE INDEX	I4
IZAS	ISOTOPE NUMBER-WEIGHT-STATE ID NO.	I4
NISO	NO. OF ISOTOPES	I4

CONTENTS (ISOTOPE) OF A VERSION

NAME - 'NUCPARAM'.?VERSN?. 'CONTENTS'

LIST - ISOX, (DISO(ISO), IZAS(ISO), AWR(ISO), ISO=1, ISOX)

SYMBOL	DEFINITION	TYPE
AWR	RATIO OF ISOTOPE ATOMIC WEIGHT TO NEUTRON WEIGHT	R4
DISO	ISOTOPE OR MATERIAL NAME	C8
ISO	ISOTOPE INDEX	I4
ISOX	MAXIMUM VALUE OF ISO USED	I4
IZAS	ISOTOPE DESIGNATION IN FORM ZZAAAS WHERE: ZZ - 2 DIGIT ATOMIC NUMBER AAA - 3 DIGIT ATOMIC WEIGHT S - 1 DIGIT FINAL STATE NUMBER	I4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

DATA TYPES FOR AN ISOTOPE IN A VERSION

NAME = 'NUCPARAM'.?VERSN?.?DISO?.?CONTENTS'

LIST = NDRX, (DTYPE(NDR), NDR=1, NDRX)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
DTYPE	DATA TYPE. ALLOWED TYPES ARE: RESOLVED UNRESOLV YIELDS DECAY DPCHAIN DPDATA	C8
NDR	DATA TYPE INDEX	I4
NDRX	MAXIMUM VALUE OF NDR USED	I4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

DEPLETION CHAIN CONTENTS

NAME - 'NUCPARAM'.?VERSN?. 'DPCHAIN'. 'CONTENTS'

LIST - NCHNS, (CHNNAM(IC), IC=1, NCHNS)

SYMBOL	DEFINITION	TYPE
CHNNAM	CHAIN SEGMENT NAMES	C8
IC	CHAIN SEGMENT INDEX	I4
NCHNS	NO. OF CHAIN SEGMENTS	I4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

DEPLETION CHAIN SPECIFICATIONS

NAME - 'NUCPARAM'.?VERSN?.?DPCHAIN?.?CHNNAM?

LIST - NISO,(DISO(I),IZAS(I),I=1,NISO)

SYMBOL	DEFINITION	TYPE
CHNNAM	DEPLETION CHAIN SEGMENT NAME	C8
DISO	ISOTOPE NAME	C8
I	ISOTOPE INDEX	I4
IZAS	ISOTOPE DESIGNATION IN FORM ZZAAAS	I4
NISO	MAXIMUM VALUE OF I USED	I4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

EFFECTIVE CROSS SECTIONS

NAME - 'NUCPARAM'.?VERSN?. 'DPDATA'. 'XSECTION'

LIST - NISO, (DISO(I), IZAS(I), AWR(I), SIG22A(I), SIG22F(I), RIDIL(I),
RFPERA(I), SIGN2N(I), SIG22G(I), RING(I), I=1, NISO)

SYMBOL	DEFINITION	TYPE
I	ISOTOPE INDEX	I4
NISO	MAXIMUM VALUE OF I USED	I4
DISO	ISOTOPE NAME	I4
IZAS	ISOTOPE DESIGNATION OF FORM ZZAAS	C8
AWR	RATIO OF ATOMIC WGT TO THAT OF THE NEUTRON	R4
SIG22A	2200 METER/SEC. ABSORPTION CROSS SECTION (BARNs)	R4
SIG22F	2200 METER/SEC. FISSION CROSS SECTION (BARNs)	R4
RIDIL	INFINITELY DILUTE RESONANCE INTEGRAL FOR ABSORPTION (BARNs)	R4
RFPERA	RESONANCE FISSION PER ABSORPTION RATIO AT INFINITE DILUTION	R4
SIGN2N	EFFECTIVE (N,2N) CROSS SECTION (BARNs) FOR NEUTRON ENERGIES > 1 MEV.	R4
SIG22G	2200 METER/SEC. N,GAMMA TO FIRST EXCITED STATE CROSS SECTION (BARNs)	R4
RING	INFINITELY DILUTE RESONANCE INTEGRAL FRD N,GAMMA TO THE FIRST EXCITED STATE (BARNs)	R4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

Q-VALUES FOR DEPLETION CALCULATIONS

NAME - 'NUCPARAM'.?VERSN?. 'DPDATA'. 'QVALUE'

LIST - NISO, (DISO(ISO), IZAS(ISO), QFISS(ISO), QN2N(ISO), QEFF(ISO),
ISO=1, NISO)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
ISO	ISOTOPE INDEX	I4
IZAS	ISOTOPE DESIGNATION IN FORM IIAAAS	I4
NISO	MAXIMUM VALUE OF ISO	I4
QFISS	ENERGY RELEASE (MEV), EXCLUSIVE OF NEUTRINO ENERGY, PER FISSION.	R4
QN2N	ENERGY RELEASE (MEV) PER (N,2N) REACTION	R4
QEFF	EFFECTIVE ENERGY RELEASE (MEV) FOR FISSION, EXCLUSIVE OF NEUTRINO ENERGY, PLUS (N,2N) REACTION PER FISSION	R4
VERSN	NUCPARAM VERSION NAME	C8

DECAY DATA FOR EACH ISOTOPE

NAME = 'NUCPARAM'.?VERSN?. 'DECAY'

LIST = NDCX, (IZASI(NDC), IZASP(NDC), IZASF(NDC), DC(NDC), EREL(NDC),
NDC=1, NDCX)

SYMBOL	DEFINITION	TYPE
DC	DECAY CONSTANT (1/SEC)	R4
EREL	ENERGY RELEASED IN DECAY (EV)	R4
IZASF	IZAS OF FINAL NUCLIDE STATE	I4
IZASI	IZAS OF INITIAL NUCLIDE STATE	I4
IZASP	IZAS OF EMITTED PARTICLE	I4
NDC	INDEX OF DECAY DATA	I4
NDCX	HIGH LIMIT OF NDC	I4
VERSN	NUCPARAM VERSION NAME	C8

LIST OF ISOTOPES IN A MATERIAL (?DISO?) WITH RESOLVED RESONANCE
PARAMETERS IN A VERSION OF DATA SET

NAME - 'NUCPARAM'.?VERSN?.?DISO?. 'RESOLVED'. 'CONTENTS'

LIST - NRIX, (IZASRI(NRI), ABUN(NRI), AWR(NRI), IRF(NRI), AP(NRI), AM(NRI),
EL(NRI), NRI=1, NRIX)

SYMBOL	DEFINITION	TYPE
AWR	RATIO OF ISOTOPE ATOMIC WEIGHT TO THAT OF NEUTRON	R4
AM	SPIN DOWN SCATTERING LENGTH (1.E-12 CM)	R4
AP	SPIN UP SCATTERING LENGTH (1.E-12 CM)	R4
ABUN	ISOTOPIIC ABUNDANCE (FRACTION) IN AN ISOTOPIIC MIXTURE	R4
DISC	ISOTOPE NAME	C8
EL	LOWER ENERGY (EV) LIMIT TO WHICH VALUES ARE VALID	R4
IRF	RESOLVED RESONANCE FORMULA FLAG. ALLOWED VALUES ARE: IRF = 1 - SINGLE LEVEL BREIT-WIGNER FORMULA WITH NO INTERFERENCE TERMS IN SCATTERING. IRF = 2 - SINGLE LEVEL BREIT-WIGNER FORMULA WITH INTERFERENCE SCATTERING TERMS INCLUDED.	I4
IZASKI	ISOTOPE DESIGNATION IN FORM OF ZZAAS.	I4
NRI	INDEX TO ISOTOPES HAVING RESOLVED PARAMETERS. E.G. ZA(NRI) IS THE ZA NUMBER OF SUCH AN ISOTOPE.	I4
NRIX	MAXIMUM VALUE OF NRI USED	I4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

SINGLE LEVEL BREIT-WIGNER (IRF=1 OR 2) RESOLVED RESONANCE
PARAMETERS FOR ISOTOPE (?IZASRI?) IN MATERIAL (?DISO?) IN
A VERSION OF DATA SET

NAME - 'NUCPARAM'.?VERSN?.?DISO?.RESOLVED.?IZASRI?

LIST - NRESX,(SPL(NRES),ERES(NRES),G(NRES),GAMT(NRES),GAMN(NRES),
GAMG(NRES),GAMF(NRES),NRES=1,NRESX)

NOTE - ONE RECORD IS GIVEN FOR EACH ISOTOPE IZASRI(NRI),NRI=1,NRIX.

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
ERES	- RESONANCE ENERGY (EV)	R4
G	- STATISTICAL CHANNEL SPIN FACTOR	R4
GAMF	- FISSION WIDTH (EV)	R4
GAMG	- RADIATION WIDTH (EV)	R4
GAMN	- NEUTRON WIDTH (EV)	R4
GAMT	- TOTAL WIDTH (EV)	R4
IZASRI	ISOTOPE DESIGNATION IN FORM OF ZZAAAS.	I4
NRES	- RESOLVED RESONANCE INDEX. E.G. ERES(NRES)	I4
NRESX	- MAXIMUM VALUE OF NRES USED.	I4
SPL	- ANGULAR SPIN L FOR A RESONANCE	R4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

LIST OF ISOTOPES IN A MATERIAL (?DISO?) WITH UNRESOLVED RESCANCE
PARAMETERS IN A VERSION OF DATA SET

NAME - 'NUCPARAM'.?VERSN?.?DISO?. 'UNRESOLV'. 'CONTENTS'

LIST - NUIX, (IZASUI(NUI), ABUN(NUI), AWR(NUI), IUF(NUI), A(NUI), NUI=1, NUIX)

SYMBOL	DEFINITION	TYPE
A	SCATTERING LENGTH (1.0E-12 CM)	R4
AWR	RATIO OF ISOTOPE ATOMIC WEIGHT TO THAT OF NEUTRON	R4
ABUN	ISOTOPIC ABUNDANCE (FRACTION) OF AN ISOTOPIC MIXTURE	R4
DISC	ISOTOPE NAME	C8
IUF	UNRESOLVED RESONANCE FORMULA FLAG. ALLOWED VALUES ARE: IUF =1 - SINGLE LEVEL BREIT-WIGNER FORMULA	I4
IZASUI	ISOTOPE DESIGNATION IN FORM OF ZZAAAS.	I4
NUI	INDEX TO ISOTOPES HAVING UNRESOLVED PARAMETERS. E.G. ZA(NUI) IS THE ZA NUMBER OF SUCH AN ISOTOPE	I4
NUIX	MAXIMUM VALUE OF NUI USED	I4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

SINGLE LEVEL BREIT-WIGNER (IUF=1) UNRESOLVED RESONANCE PARAMETERS
FOR ISOTOPE (?IZASUI?) IN MATERIAL (?DISO?) IN A VERSION OF
DATA SET

NAME - 'NUCPARAM'.?VERSN?.?DISO?. 'UNRESOLV'.?IZASUI?

LIST - NUSX, (SPL(NUS), DBAR(NUS), G(NUS), GAMNO(NUS), GAMG(NUS), GAMF(NUS),
GAMX(NUS), DFN(NUS), DFG(NUS), DFF(NUS), DFX(NUS), ELUN(NUS),
EHUN(NUS), NUS=1, NUSX)

NOTE - ONE RECORD IS GIVEN FOR EACH ISOTOPE IZASUI(NUI), NUI=1, NUIX

SYMBOL	DEFINITION	TYPE
DFX	DEGREES OF FREEDOM IN FISSION WIDTH DISTRIBUTION	R4
DFG	DEGREES OF FREEDOM IN RADIATION WIDTH DISTRIBUTION	R4
DFN	DEGREES OF FREEDOM IN NEUTRON WIDTH DISTRIBUTION	R4
DFX	DEGREES OF FREEDOM IN COMPETING PROCESS WIDTH DIST.	R4
DBAR	AVERAGE RESONANCE SPACING (EV)	R4
DISO	ISOTOPE NAME	C8
EHUN	UPPER ENERGY LIMIT (EV) FOR THESE PARAMETERS	R4
ELUN	LOWER ENERGY LIMIT (EV) FOR THESE PARAMETERS	R4
G	STATISTICAL CHANNEL SPIN FACTOR	R4
GAMF	FISSION WIDTH (EV)	R4
GAMG	RADIATION WIDTH (EV)	R4
GAMX	COMPETING PROCESS WIDTH (EV)	R4
GAMNO	REDUCED NEUTRON WIDTH (EV)	R4
IZASUI	ISOTOPE DESIGNATION IN FORM OF ZZAAS.	I4
NUS	UNRESOLVED RESONANCE INDEX. E.G. DBAR(NUS)	R4
NUSX	MAXIMUM VALUE OF NUS USED	I4
SPL	ANGULAR SPIN L FOR A RESONANCE	R4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

LIST OF FISSION PRODUCTS FOR ISOTOPE (?DISO?) IN A VERSION OF
DATA SET

NAME - 'NUCPARAM'.?VERSN?.?DISO?. 'YIELDS'. 'SIZE'

LIST - NBNDX,NFPX,(IZAS(NFP),NFP=1,NFPX),(EU(NBND),NBND=1,NBNDX),EO

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
EU	UPPER ENERGY LIMIT (EV) OF EACH BAND	R4
EO	LOWER ENERGY LIMIT (EV)	R4
IZAS	ISOTOPE DESIGNATION IN FORM OF ZZAAAS.	I4
NFP	FISSION PRODUCT INDEX. E.G. ZA(NFP)	I4
NFPX	MAXIMUM VALUE OF NFP USED	I4
NBNDX	MAXIMUM VALUE OF NBND USED	I4
VERSN	NUCPARAM DATA SET VERSION NAME	C8

JOSHUA DPSTM-500	Title Cross Section Data Sets NUCPARAM	Vol. III	Page B.5.17
		Rev.	Date 5/70

FISSION PRODUCT YIELDS IN BAND (?NBND?) FOR ISOTOPE (?DISO?) FOR
A VERSION OF DATA SET

NAME - 'NUCPARAM'.?VERSN?.?DISO?. 'YIELDS'.?NBND?
LIST - NFPX,(YLD(NFP,NBND),NFP=1,NFPX)

SYMBOL	DEFINITION	TYPE
DISO	ISOTOPE NAME	C8
NBND	- ENERGY BAND INDEX. YIELDS ARE CONSTANT IN A BAND	I4
VERSN	NUCPARAM DATA SET VERSION NAME	C8
YLD	- FRACTIONAL YIELD OF A FISSION PRODUCT NORMALIZED SO THE SUM OVER ALL PRODUCTS = 2 (BINARY FISSION).	R4

JOSHUA
DPSTM-500

Title Part C - Lattice Physics Data Sets

Vol.
III

Page
C.O.1

Rev.

Date
9/73

Contents

- C.1 - ASSEMBLY Data Set
- C.2 - LATTICE Data Set
- C.3 - RILIB Data Set
- C.4 - CELL Data Set

JOSHUA DPSTM-500	Title Part C - Lattice Physics Data Sets	Vol. III	Page C.O.2
		Rev.	Date 9/73

(Blank)

JOSHUA DPSTM-500	Title Lattice Physics Data Sets Assembly Data Set	Vol. III	Page C.1.1
		Rev.	Date 9/73

Report Written By

H. C. Honeck

Work Done By

C. E. Bailey
W. H. Hightower
H. C. Honeck
C. E. Parker

Contents

	<u>Page</u>
1. Introduction	C.1.3
1.1 Names	C.1.5
1.2 Material Records	C.1.5
1.3 Standard Materials	C.1.6
1.4 Geometry Records	C.1.7
1.5 Resume Record	C.1.8
1.6 Processing Module Features	C.1.12
2. Record Descriptions	C.1.13

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol. III	Page C.1.2
		Rev.	Date 9/73

(Blank)

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol. III	Page C.1.3
		Rev.	Date 9/73

1. Introduction

The ASSEMBLY data set contains physical descriptions of fuel, target, or control assemblies and the associated moderator, that is, everything inside the boundary of a cell. The ASSEMBLY data set is the main input to lattice physics and engineering modules.

Each cell on the ASSEMBLY data set is identified by an 8-character cell name (mnemonic ?DCEL) and an 8-character version (mnemonic ?VCEL). The cell name should be the generic name (i.e., MK-6B) and the version should denote modifications to the standard cell.

The data for a particular cell is divided into material records and geometry records (see Figure 1). Two material records are required. The first (MATERIAL.DENSITY) contains the densities and temperatures for all materials used in the cell. The second (MATERIAL.ISOTOPES) contains the concentrations of isotopes in each material. Additional record types can be defined as needed.

There are several types of geometry records, each corresponding to a different geometry type. The cell description consists of a collection of geometry types. For example, a central cluster sub-assembly surrounded by an annular sub-assembly surrounded by a hexagonal sub-assembly would be used to describe a control rod cell. Since there are only a few sub-assembly types, no directory or "contents" record is used. The module processing the geometry data asks for each permitted record type and uses those found to construct the cell. The user need only insure that the boundaries between sub-assemblies are consistent.

It should be remembered that the ASSEMBLY data contains the physical description of the components of a cell, and not the mathematical descriptions used to perform a calculation. This physical description must be adequate to provide input to several neutronics and engineering modules. Each module will alter the physical description as required to obtain the mathematical description for that module.

Figure 1. Structure of the ASSEMBLY Data Set.

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol. III	Page C.1.5
		Rev.	Date 9/73

1.1 Names

The user must provide names (up to 8 characters) for geometric regions, materials, and isotopes.

The isotope names must conform with the names used on the MULTIGRP data set. The convention used is to construct the isotope name from the chemical symbol, and the atomic weight, e.g., U235, LI6, PU239. If the isotope is the naturally occurring mixture of isotopes in an element, only the element chemical symbol is used, e.g., Ø, C, AL. A few exceptions to these rules will be made, e.g., D instead of H2, and defining frequently occurring materials as isotopes. Alternate evaluations of the same cross sections may appear on the same version of the MULTIGRP data set. These are named by appending a dash and additional characters, e.g., U235-EP. The modules processing the material data will first attempt to find the full user-supplied isotope name on the contents record of the MULTIGRP data. If it is not found, the dash and following characters are dropped and the contents record scanned again. If it is not found, the atomic weight is dropped and the record scanned again. If it is still not found, the module reports the error. If in any of these steps the name is found, the name in the MULTIGRP contents record will replace the user-supplied name.

Material names are arbitrary but must be assigned consistently. A geometry record contains the names of materials assigned to each region. These same material names must appear in material records and/or be defined as "standard materials" in a STD MAT record. Material names must not be the same as isotope names.

Region names are assigned to allow each region of a lattice cell to be identified. This is necessary to allow interface with the Correlation Sub-System and other sub-systems that use lattice physics results. All region names must be an eight-character string with no embedded blanks of the form: AA-nn-mm. Characters three and six must be a hyphen ("-"). The first two characters, denoted AA, are chosen from the following list (no others are allowed):

<u>AA Symbol</u>	<u>Type of Region</u>
CØ	Coolant
CL	Cladding
HØ	Housing
DS	Dead Space (within housing)
MØ	Moderator
FT	Fuel Tube (tube "core" only)

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol.	Page
		III	C.1.6
		Rev.	Date
			9/73

<u>AA Symbol</u>	<u>Type of Region</u>
TT	Target Tube (tube "core" only)
CT	Control Tube (tube "core" only)
FS	Fuel Slug (with or without clad or core)
TS	Target Slug (with or without clad or core)
CR	Control Rod (excluding clad)
FC	Fuel and Cladding (homogenized)
TC	Target and Cladding (homogenized)

Characters four and five, denoted nn, are non-blank, numeric characters designating contiguous regions of the same state (i.e., solid or liquid). This designation is used to associate contiguous regions comprising a single coolant channel, a single moderator space, or a single physical tube (core plus clad).

Characters seven and eight, denoted mm, are non-blank, numeric characters used to uniquely identify regions with the same AA and nn designations.

Figure 2 shows an example of these region naming conventions. The upper half-cell in Figure 2 shows the physical geometrical specifications, and the lower half-cell shows the homogenized computational description.

Fig. 2. ASSEMBLY Region Name Example

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol. III	Page C.1.8
		Rev.	Date 9/73

1.2 Material Records

The first record (MATERIAL.DENSITY) contains the material name (DMAT), temperature in °C (ITDC), the density in gm/cc (DENS), and an engineering material name (FORM) for each material in the cell (a primary material) and for each material used to define a primary material (a secondary material). One exception to this rule occurs if a material is defined as a "standard material" in an ASSEMBLY.STDMAT record. If the "standard material" name does not appear in the MATERIAL.DENSITY record the default value of density is read from the STDMAT record. If a "standard material" name does appear in the MATERIAL.DENSITY record this density specified therein is used. At the present the engineering material name is ignored. In the future this engineering material name will be used to determine the density from the temperature, isotope concentrations, and data from the PROPERTY data set.

The second record (MATERIAL.ISOTOPES) describes the concentration of the isotopes in each material. The record consists of lines containing the material name (DMAT), the concentration (CONC), the concentration units (UNIT), and the isotope name.

The concentration may be given in a variety of units; atoms/barn-cm, gm/cc, gm/ft, weight percent, weight fraction, atom percent, atom fraction, ppm, etc. The processing module will automatically convert these to the standard internal units of atoms/barn-cm. The user need only insure that his description is complete but not over-specified.

Primary materials may be defined in terms of secondary materials, and secondary materials may again be defined in terms of other secondary materials, etc. Up to 10 levels of sub-definition may be used. When this facility is used, the isotope name will be a secondary material name.

Any material name referenced in the geometry records which does not appear in the MATERIAL.ISOTOPES record is assumed to be a "standard material" and the isotope composition data are read from a STDMAT record.

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol.	Page
		III	C.1.9
		Rev.	Date
			9/73

1.3 Standard Materials

As a user-convenience standard materials may be defined via the STDMAT record. This record contains the temperature in °C (ITDC), density in gm/cc (DENS), engineering material name (ENGNAM) and a composition table with one entry for each of NISØ isotopes. The composition table includes concentration (CØNC), the concentration units (UNITS), and isotope name (DISØ). At the present the engineering name is ignored. In the future this engineering material name will be used to determine the density from the temperature, isotope concentrations, and data from the PRØPERTY data set.

For any material name referenced in the geometry records which does not appear in the MATERIAL.DENSITY and/or the MATERIAL.ISØTØPES records default values of composition will be read from the STDMAT record. If the material name appears in neither the DENSITY nor ISØTØPES records both density and composition data are read from the STDMAT record. However, if the material name appears only in the DENSITY record, the specified value of density will be used (in lieu of the density value catalogued in the STDMAT) record.

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol. III	Page C.1.10
		Rev.	Date 9/73

1.4 Geometry Records

The geometry records contain the dimensions in inches and the names of the materials used in each region.

The annular sub-assembly is described in the GEOMETRY.ANNULAR record. The basic information (see Figure 2) is the region name (REGNAM), material name (REGMAT), and outer diameter (REGØD) of each region. Ribs either inner or outer, may be specified and are treated as rectangular in cross section. If required, the number of ribs (NRIBS), rib thickness (RIBTH), and rib ØD (RIBØD), must be given. The processing module can homogenize the ribs into the region and compute the new region ØD.

The hexagonal sub-assembly is described in the GEOMETRY.HEXAGONAL record. The basic information (see Figure 3) is the region name (REGNAM), material name (REGMAT), and the pitch (PITCH). Subdivision into nested hexagonal regions is required only if different materials are used in each region. Sub-division to obtain better calculational resolution can be done at execution time by the processing module.

The cluster sub-assembly (see Figure 4) is described in the records GEOMETRY.CLUSTER.RODS and PATTERN. The first record contains the coolant name (CØLNAM), material name (CØLMAT), and outer diameter (CØLØD), and the description of each different type of rod used in the cluster. Rods are described in terms of the rod name (RØDNAM), rod ØD (RØDØD), rod material name (RØDMAT), cladding ØD (CLDØD), and cladding material name (CLDMAT). The cladding may be omitted (CLDØD=0). The second record (GEOMETRY.CLUSTER.PATTERN) describes the pattern of the rods in the cluster in terms of a number of rods (NRØD) of one type (RØDNAM) equally spaced on a ring of radius (RNGRAD) starting at some angle (RSANG). Each ring specification overwrites the preceding specification allowing rings with several rod types to be defined.

The inner dimension of a sub-assembly is determined by the outer dimension of another sub-assembly. The order (from center to edge of cell) is cluster, annular, and hexagonal. If no cluster sub-assembly is given, the inner diameter of the annular sub-assembly is zero. If no cluster or annular sub-assembly is given, the inner diameter of the hexagonal sub-assembly is zero.

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol. III	Page C.1.11
		Rev.	Date 9/73

1.5 Resume Record

A resume record is provided in order to maintain a catalogue of case descriptors. Data contained includes exposure, control rod configuration, temperatures, densities, moderator and coolant purity, liquid poison contamination, fission product concentration, and enrichment.

Figure 2. Annular Sub-assembly.

Figure 3. Hexagonal Sub-assembly.

Figure 4. Cluster Sub-assembly.

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol. III	Page C.1.15
		Rev.	Date 9/73

1.6 Processing Module Features

The ASSEMBLY data is processed by the ASP (ASsembly Processor) module and many features have been provided to facilitate data preparation. These features can be summarized as follows:

- All names are automatically left-adjusted.
- Blank lines will be ignored so that lines can be easily deleted.
- In tables where order is meaningful, the tables are automatically reordered. Additions to tables can then be made at the end of the table and the line will be inserted in the proper place.
- In the MATERIAL.ISOTOPES record, material names can be left blank for the second and remaining isotopes of that material.

2. RECORD DESCRIPTIONS

ANNULAR GEOMETRY

NAME - 'ASSEMBLY'.?DCEL?.?VCEL?. 'GEOMETRY'. 'ANNULAR'
LIST - NRX,ASID,(REGNAM(NR),REGCD(NR),REGMAT(NR),NRIBS(NR),RIBTH(NR),
RIBD(NR),NR=1,NRX)

SYMBOL	DEFINITION	TYPE
ASID	SUBASSEMBLY INNER DIAMETER (INCHES)	R4
DCEL	CELL (ASSEMBLY) NAME	C8
NR	REGION INDEX. E.G. REGCD(NR)	I4
NRX	NUMBER OF REGIONS	I4
NRIBS	NO. OF RIBS	I4
RIBD	RIB TIP DIAMETER (I.D. OR O.D.) (INCHES)	R4
REGCD	ANNULAR REGION C.D. (INCHES)	R4
RIBTH	RIB THICKNESS (INCHES)	R4
REGNAM	REGION NAME	C8
REGMAT	REGION MATERIAL NAME	C8
VCEL	CELL (ASSEMBLY) VERSION NAME	C8

CLUSTER GEOMETRY, MODERATOR AND ROD DESCRIPTION

NAME - 'ASSEMBLY'.?DCEL?.?VCEL?. 'GEOMETRY'. 'CLUSTER'. 'RODS'

LIST - NRTYP, COLNAM, COLMAT, COLOD, (RODNAM(I), RODMAT(I), RODOD(I), CLDMAT(I),
CLDOD(I), I=1, NRTYP)

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
CLDOD	CLADDING OUTER DIAMETER	R4
COLOD	COOLANT OUTER DIAMETER	R4
CLDMAT	CLADDING MATERIAL NAME	C8
COLMAT	COOLANT MATERIAL	C8
COLNAM	COOLANT NAME	C8
NRTYP	NUMBER OF ROD TYPES	I4
RODOD	ROD OUTER DIAMETER	R4
RODMAT	ROD MATERIAL NAME	C8
RODNAM	ROD NAME	C4
VCEL	CELL (ASSEMBLY) VERSION NAME	C8

CLUSTER GEOMETRY, ROD PATTERN

```

NAME - 'ASSEMBLY'.?DCEL?.?VCEL?. 'GEOMETRY'. 'CLUSTER'. 'PATTERN'
LIST - NPOS, (RODNAM(I), NROD(I), RNGRAD(I), RSANG(I), I=1, NPOS)

```

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
VCEL	CELL (ASSEMBLY) VERSION NAME	C8
RODNAM	ROD NAME	C4
NPOS	NUMBER OF ROD-PIG POSITIONS IN TABLE	I4
NROD	NUMBER OF RODS IN RING	I4
RNGRAD	ROD RING RADII (IN)	R4
RSANG	ANGLE (DEGREES) TO FIRST ROD IN RING	R4

HEXAGON GEOMETRY

```

NAME - 'ASSEMBLY'.?DCEL?.?VCEL?. 'GEOMETRY'. 'HEXAGON'
LIST - NRX, HEXID, (REGNAM(I), REGMAT(I), PITCH(I), I=1, NRX)

```

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
HEXID	SUBASSEMBLY INNER DIAMETER (INCHES)	R4
I	REGION INDEX	I4
NRX	NUMBER OF REGIONS	I4
PITCH	PITCH OF REGULAR HEXAGON	R4
REGMAT	MATERIAL NAME WITHIN A REGION	C8
REGNAM	REGION NAME	C8
VCEL	CELL (ASSEMBLY) VERSION NAME	C8

MATERIAL TEMPERATURES AND DENSITIES

```
NAME - 'ASSEMBLY'.?DCEL.?VCEL.'MATERIAL'.'DENSITY'
LIST - NMAT, (DMAT(M), ITDC(M), DENS(M), FORM(M), M=1, NMAT)
```

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
DENS	DENSITY (GM/CC) OF A MATERIAL	R4
DMAT	MATERIAL NAME	C8
FORM	ENGINEERING MATERIAL NAME (PROPERTY DATA SET)	C8
ITDC	INTEGER TEMPERATURE (DEGREES C)	I4
M	MATERIAL INDEX	I4
NMAT	NUMBER OF MATERIALS	I4
VCEL	CELL (ASSEMBLY) VERSION NAME	C8

SQUARE GEOMETRY

```
NAME - 'ASSEMBLY'.?DCEL.?VCEL.'GEOMETRY'.'SQUARE'
LIST - NRX, SCID, (REGNAM(I), REGMAT(I), PITCH(I), I=1, NRX)
```

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
PITCH	SQUARE PITCH (IN)	R4
NRX	NUMBER OF REGIONS	I4
REGNAM	REGION NAME	C8
REGMAT	MATERIAL NAME	C8
SCID	SUBASSEMBLY INNER DIAMETER (INCHES)	R4
VCEL	CELL (ASSEMBLY) VERSION	C8

MATERIAL ISOTOPES AND CONCENTRATIONS

NAME - 'ASSEMBLY'.?DCEL?.?VCEL?. 'MATERIAL'. 'ISOTOPES'
LIST - MX, (DMAT(M), CONC(M), UNIT(M), DISO(M), M=1, MX)

SYMBOL	DEFINITION	TYPE
CONC	ISOTOPE CONCENTRATION	R4
DCEL	CELL (ASSEMBLY) NAME	C8
DMAT	MATERIAL NAME	C8
DISO	ISOTOPE NAME	C8
M	ISOTOPE/REGION INDEX	I4
MX	NUMBER OF ISOTOPE/REGION PAIRS	I4
UNIT	CONCENTRATION UNITS ALLOWED- ATM/B-CM PPM ATM-RATO WGT-RATO ATM-FRAC WGT-FRAC ATM-PCNT WGT-PCNT GM/FT GM/CC BALANCE	C8
VCEL	CELL (ASSEMBLY) VERSION NAME	C8

JOSHUA DPSTM-500	Title Lattice Physics Data Sets ASSEMBLY Data Set	Vol. III	Page C.1.21
		Rev.	Date 9/73

CELL RESUME RECORD. USED TO CATALOGUE FEWGRP DATA.

NAME - 'ASSEMBLY'.?DCEL?.?VCEL?. 'RESUME'

LIST - (A(I), I=1,15)

SYMBOL	DEFINITION	TYPE
A	CASE DESCRIPTORS	R4
I	A(I)	
1	ASSEMBLY-TYPE FLAG	
2	EXPOSURE (MWD)	
3	CONTROL FLAG (SEE FOLLOWING LIST)	
4	MODERATOR TEMPERATURE (DEGREES C)	
5	MODERATOR DENSITY (GM/CC)	
6	ATOM FRACTION D2O IN MODERATOR (ATOM FRACT)	
7	CONCENTRATION OF LIQUID POISON IN MODERATOR (ATOM/BARN/CM)	
8	COOLANT TEMPERATURE (DEGREES C)	
9	COOLANT DENSITY (GM/CC)	
10	ATOM FRACTION D2O IN COOLANT	
11	CONCENTRATION LIQUID POISON IN COOLANT (ATOM/BARN-CM)	
	IASSTY=1 IASSTY=2 IASSTY=3	
12	FUEL TEMP. TARGET TEMP. ROD TEMP.	
13	FUEL DENSITY TARGET DENSITY ROD DENSITY	
14	F.P. CONC. F.P. CONC. F.P. CONC.	
	F.P. CONC -> FISSION PRODUCT CONCENTRATION, (ATOM/BARN-CM)	
15	ENRICHMENT ENRICHMENT ENRICHMENT	
	ENRICHMENT IN UNITS (ATOM FRACTION)	

CONTROL FLAG, DISPLAYED AS A HEX INDEX (Z7 FORMAT)
FIRST CHARACTER REFERS TO SEPTIFOIL POSITION A
SECOND CHARACTER REFERS TO SEPTIFOIL POSITION B
ETC.
SEVENTH CHARACTER REFERS TO SEPTIFOIL POSITION G

SYMBOL	DEFINITION	TYPE
--------	------------	------

CHARACTER	ROD TYPE
0	EMPTY POSITION
1	1.0 STRENGTH LI-AL ROD
2	1.5 STRENGTH LI-AL ROD
3	3.2 STRENGTH LI-AL ROD
4	7.4 STRENGTH LI-AL ROD
5	10.0 STRENGTH LI-AL ROD
6	14.4 STRENGTH LI-AL ROD
7	CADMIUM ROD
8	CADMIUM ROD
9	CADMIUM ROD
A	CADMIUM ROD
B	COBALT ROD
C	COBALT ROD
D	COBALT ROD
E	COBALT ROD
F	SPECIAL CONTROL ROD

DCEL	CELL (ASSEMBLY) NAME	C8
VCEL	CELL (ASSEMBLY) VERSION NAME	C8

STANDARD MATERIAL DEFINITIONS

NAME - 'ASSEMBLY'.'STDMAT'.?MATNAM

LIST - ITDC,DENS,ENGNAM,NISC,(CCNC(ISO),UNITS(ISO),DISO(ISO),ISO=1,NISO)

SYMBOL	DEFINITION	TYPE
CONC	ISOTOPIC CONCENTRATION	R4
DENS	DENSITY (GM/CC)	R4
DISC	ISCTCPE NAME	C8
ENGNAM	ENGINEERING NAME	C8
ISO	ISOTOPE INDEX	I4
ITDC	INTEGER ISOTOPIC TEMPERATURE (O C)	I4
MATNAM	MATERIAL NAME	C8
NISO	NO. OF ISOTOPES	I4
UNITS	UNITS OF CONCENTRATION	C8

1. *Pharmaceuticals* (1997) 10, 115-120.
 2. *Pharmaceuticals* (1998) 11, 115-120.
 3. *Pharmaceuticals* (1999) 12, 115-120.
 4. *Pharmaceuticals* (2000) 13, 115-120.
 5. *Pharmaceuticals* (2001) 14, 115-120.
 6. *Pharmaceuticals* (2002) 15, 115-120.
 7. *Pharmaceuticals* (2003) 16, 115-120.
 8. *Pharmaceuticals* (2004) 17, 115-120.
 9. *Pharmaceuticals* (2005) 18, 115-120.
 10. *Pharmaceuticals* (2006) 19, 115-120.
 11. *Pharmaceuticals* (2007) 20, 115-120.
 12. *Pharmaceuticals* (2008) 21, 115-120.
 13. *Pharmaceuticals* (2009) 22, 115-120.
 14. *Pharmaceuticals* (2010) 23, 115-120.
 15. *Pharmaceuticals* (2011) 24, 115-120.
 16. *Pharmaceuticals* (2012) 25, 115-120.
 17. *Pharmaceuticals* (2013) 26, 115-120.
 18. *Pharmaceuticals* (2014) 27, 115-120.
 19. *Pharmaceuticals* (2015) 28, 115-120.
 20. *Pharmaceuticals* (2016) 29, 115-120.
 21. *Pharmaceuticals* (2017) 30, 115-120.
 22. *Pharmaceuticals* (2018) 31, 115-120.
 23. *Pharmaceuticals* (2019) 32, 115-120.
 24. *Pharmaceuticals* (2020) 33, 115-120.
 25. *Pharmaceuticals* (2021) 34, 115-120.
 26. *Pharmaceuticals* (2022) 35, 115-120.
 27. *Pharmaceuticals* (2023) 36, 115-120.
 28. *Pharmaceuticals* (2024) 37, 115-120.
 29. *Pharmaceuticals* (2025) 38, 115-120.
 30. *Pharmaceuticals* (2026) 39, 115-120.
 31. *Pharmaceuticals* (2027) 40, 115-120.
 32. *Pharmaceuticals* (2028) 41, 115-120.
 33. *Pharmaceuticals* (2029) 42, 115-120.
 34. *Pharmaceuticals* (2030) 43, 115-120.
 35. *Pharmaceuticals* (2031) 44, 115-120.
 36. *Pharmaceuticals* (2032) 45, 115-120.
 37. *Pharmaceuticals* (2033) 46, 115-120.
 38. *Pharmaceuticals* (2034) 47, 115-120.
 39. *Pharmaceuticals* (2035) 48, 115-120.
 40. *Pharmaceuticals* (2036) 49, 115-120.
 41. *Pharmaceuticals* (2037) 50, 115-120.
 42. *Pharmaceuticals* (2038) 51, 115-120.
 43. *Pharmaceuticals* (2039) 52, 115-120.
 44. *Pharmaceuticals* (2040) 53, 115-120.
 45. *Pharmaceuticals* (2041) 54, 115-120.
 46. *Pharmaceuticals* (2042) 55, 115-120.
 47. *Pharmaceuticals* (2043) 56, 115-120.
 48. *Pharmaceuticals* (2044) 57, 115-120.
 49. *Pharmaceuticals* (2045) 58, 115-120.
 50. *Pharmaceuticals* (2046) 59, 115-120.
 51. *Pharmaceuticals* (2047) 60, 115-120.
 52. *Pharmaceuticals* (2048) 61, 115-120.
 53. *Pharmaceuticals* (2049) 62, 115-120.
 54. *Pharmaceuticals* (2050) 63, 115-120.
 55. *Pharmaceuticals* (2051) 64, 115-120.
 56. *Pharmaceuticals* (2052) 65, 115-120.
 57. *Pharmaceuticals* (2053) 66, 115-120.
 58. *Pharmaceuticals* (2054) 67, 115-120.
 59. *Pharmaceuticals* (2055) 68, 115-120.
 60. *Pharmaceuticals* (2056) 69, 115-120.
 61. *Pharmaceuticals* (2057) 70, 115-120.
 62. *Pharmaceuticals* (2058) 71, 115-120.
 63. *Pharmaceuticals* (2059) 72, 115-120.
 64. *Pharmaceuticals* (2060) 73, 115-120.
 65. *Pharmaceuticals* (2061) 74, 115-120.
 66. *Pharmaceuticals* (2062) 75, 115-120.
 67. *Pharmaceuticals* (2063) 76, 115-120.
 68. *Pharmaceuticals* (2064) 77, 115-120.
 69. *Pharmaceuticals* (2065) 78, 115-120.
 70. *Pharmaceuticals* (2066) 79, 115-120.
 71. *Pharmaceuticals* (2067) 80, 115-120.
 72. *Pharmaceuticals* (2068) 81, 115-120.
 73. *Pharmaceuticals* (2069) 82, 115-120.
 74. *Pharmaceuticals* (2070) 83, 115-120.
 75. *Pharmaceuticals* (2071) 84, 115-120.
 76. *Pharmaceuticals* (2072) 85, 115-120.
 77. *Pharmaceuticals* (2073) 86, 115-120.
 78. *Pharmaceuticals* (2074) 87, 115-120.
 79. *Pharmaceuticals* (2075) 88, 115-120.
 80. *Pharmaceuticals* (2076) 89, 115-120.
 81. *Pharmaceuticals* (2077) 90, 115-120.
 82. *Pharmaceuticals* (2078) 91, 115-120.
 83. *Pharmaceuticals* (2079) 92, 115-120.
 84. *Pharmaceuticals* (2080) 93, 115-120.
 85. *Pharmaceuticals* (2081) 94, 115-120.
 86. *Pharmaceuticals* (2082) 95, 115-120.
 87. *Pharmaceuticals* (2083) 96, 115-120.
 88. *Pharmaceuticals* (2084) 97, 115-120.
 89. *Pharmaceuticals* (2085) 98, 115-120.
 90. *Pharmaceuticals* (2086) 99, 115-120.
 91. *Pharmaceuticals* (2087) 100, 115-120.
 92. *Pharmaceuticals* (2088) 101, 115-120.
 93. *Pharmaceuticals* (2089) 102, 115-120.
 94. *Pharmaceuticals* (2090) 103, 115-120.
 95. *Pharmaceuticals* (2091) 104, 115-120.
 96. *Pharmaceuticals* (2092) 105, 115-120.
 97. *Pharmaceuticals* (2093) 106, 115-120.
 98. *Pharmaceuticals* (2094) 107, 115-120.
 99. *Pharmaceuticals* (2095) 108, 115-120.
 100. *Pharmaceuticals* (2096) 109, 115-120.
 101. *Pharmaceuticals* (2097) 110, 115-120.
 102. *Pharmaceuticals* (2098) 111, 115-120.
 103. *Pharmaceuticals* (2099) 112, 115-120.
 104. *Pharmaceuticals* (2100) 113, 115-120.
 105. *Pharmaceuticals* (2101) 114, 115-120.
 106. *Pharmaceuticals* (2102) 115, 115-120.
 107. *Pharmaceuticals* (2103) 116, 115-120.
 108. *Pharmaceuticals* (2104) 117, 115-120.
 109. *Pharmaceuticals* (2105) 118, 115-120.
 110. *Pharmaceuticals* (2106) 119, 115-120.

JOSHUA DPSTM-500	Title Lattice Physics Data Sets LATTICE Data Set	Vol. III	Page C.2.1
		Rev.	Date 9/73

Report Written By

D. R. Finch

Work Done By

H. C. Honeck
R. J. Pryor

Contents

	<u>Page</u>
1. Introduction	C.2.3
2. Record Descriptions	C.2.7

JOSHUA
DPSTM-500

Title Lattice Physics Data Sets
 LATTICE Data Set

Vol.
III

Page
C.2.2

Rev.

Date
9/73

(Blank)

JOSHUA DPSTM-500	Title Lattice Physics Data Sets LATTICE Data Set	Vol. III	Page C.2.3
		Rev.	Date 9/73

1. Introduction

The LATTICE data set contains specifications of reactor lattices and results of lattice fine structure calculations such as performed by the RAHAB module. The structure of the LATTICE data set is shown in Figure 1.

The physical makeup of a lattice contains 1) the geometrical specifications for each cell in the lattice, 2) the pattern of cells that make up the lattice, and 3) the materials that are in each region of a cell. The results of a lattice fine structure calculation produce 1) region average, cell average, and lattice average fluxes, reaction rates, and cross sections and 2) lattice integral parameters such as k_{eff} , resonance escape probability, etc. Of these quantities only integral parameters are stored in the LATTICE data set.

For each lattice in the LATTICE data set there exists a set of reference state data for the physical makeup of the lattice. Changes from this data are specified by storing the changes rather than respecifying a new reference state.

The results of a lattice fine structure calculation are stored as a lattice state. Included with these lattice state results are records which contain 1) changes to lattice reference state data, 2) a description of the numerical approximations used to compute the lattice state, and 3) integral and differential neutronic state characteristics.

Lattice patterns are specified in the record with name string LATTICE.PATTERN.?PATNAM?. This record relates the faces of cells filling each position in the lattice pattern.

The record with name string LATTICE.CONTENTES contains a catalog of all lattice names (mnemonic ?DLAT?), and the record with name string LATTICE.?DLAT?.CONTENTES contains a catalog of lattice version names (mnemonic ?VLAT?) and concatenated lattice name/version names (mnemonic ?LNV?). The concatenated lattice name/version is used for cataloging data in the FEWGRP data set. Each unique ?DLAT?/?VLAT? pair must correspond to a unique ?LNV? name. The total number of lattice states (mnemonic ?NSTX?) is stored in this record also.

Catalogued under each ?DLAT?/?VLAT? pair are various lattice states designated by index ?NST?. For each ?DLAT?/?VLAT? pair a set of lattice reference state data exists. Each state indexed by ?NST? then corresponds to a modification of the lattice reference state.

The reference state of a lattice is described via the records with name strings

```

LATTICE.?DLAT?.?VLAT?.SPECS
LATTICE.?DLAT?.?VLAT?.BURN
LATTICE.?DLAT?.?VLAT?.ISOTOPES
LATTICE.?DLAT?.?VLAT?.METHOD

```

JOSHUA DPSTM-500	Title Lattice Physics Data Sets LATTICE Data Set	Vol. III	Page C.2.4
		Rev.	Date 9/73

Changes to the lattice reference state are contained in the record with name string

LATTICE.?DLAT?.?VLAT?.STATE.?NST? .

After a lattice fine structure calculation the basic integral neutronic parameters (such as k_{eff} , B^2 , M^2 , α , Power, or exposure) are restored into this STATE record. Differential neutronic state variables are stored in the records with name strings

LATTICE.?DLAT?.?VLAT?.LFLUX.?NST?

and

LATTICE.?DLAT?.?VLAT?.FISSION.?NST? .

Fewgroup cross sections are stored in the FEWGRP data set catalogued by the concatenated lattice name/version (mnemonic.?LNV?). The lattice name/version is cross referenced to the state index (mnemonic ?NST?) via catalogs in both the LATTICE and FEWGRP data sets.

All other variables not altered in the STATE record (such as MULTIGRP and/or NUCPARAM version names, lattice pattern, cell name/version, cell region subdivision and/or homogenization) are invariant among the lattice states and are specified in the SPECS and ISOTOPES records for the lattice reference state.

The SPECS record for a lattice reference state defines the lattice pattern and the cell name/version (mnemonic ?DCEL?/?VCEL?) contained in each lattice position. These cells are described in the records with name strings

LATTICE.?DCEL?.?VCEL?.GEOMETRY.ANNULAR
LATTICE.?DCEL?.?VCEL?.GEOMETRY.SQUARE
LATTICE.?DCEL?.?VCEL?.GEOMETRY.HEXAGON
LATTICE.?DCEL?.?VCEL?.GEOMETRY.CLUSTER.POSITION
LATTICE.?DCEL?.?VCEL?.GEOMETRY.CLUSTER.DETAIL
LATTICE.?DCEL?.?VCEL?.MATERIAL.DENSITY
LATTICE.?DCEL?.?VCEL?.MATERIAL.ISOTOPES

These records that describe the cells are equivalent to records in the ASSEMBLY data set with the same names, except that all "standard materials" are extended.

JOSHUA

DPSTM-500

Title Lattice Physics Data Sets
LATTICE Data Set

Vol.

III

Page

C.2.6

Rev.

Date

9/73

(Blank)

JOSHUA DPSTM-500	Title Lattice Physics Data Sets LATTICE Data Set	Vol. III	Page C.2.7
		Rev.	Date 9/73

2. Record Descriptions

LATTICE PATTERN RECORD

```

NAME = 'LATTICE'.'PATTERN'.'?PATNAM'
LIST = NLPX,(NLP(N),NCL(N),(NALP(J,N),IAFC(J,N),J=1,6),
      N=1,NLPX)

```

SYMBOL	DEFINITION	TYPE
IAFC	ADJACENT FACE NUMBER	I4
NALP	ADJACENT LATTICE POSITION NUMBER	I4
NCL	LATTICE CELL TYPE NUMBER	I4
NLP	LATTICE POSITION NUMBER	I4
NLPX	NUMBER OF LATTICE POSITIONS	I4
PATNAM	PATTERN NAME	C8

JOSHUA DPSTM-500	Title Lattice Physics Data Sets LATTICE Data Set	Vol. III	Page C.2.8
		Rev.	Date 9/73

LATTICE NAMES CATALOGUED

```

NAME = 'LATTICE'. 'CONTENTS'
LIST = NLX, (DLAT(NL), NL=1, NLX)

```

SYMBOL	DEFINITION	TYPE
DLAT	LATTICE NAME	C8
NL	LATTICE INDEX	I4
NLX	NUMBER OF LATTICES CATALOGUED	I4

LATTICE VERSIONS AND STATES CATALOGUED UNDER A LATTICE NAME

NAME = 'LATTICE'.?DLAT.'CONTENTS'

LIST = NLVX,(VLAT(NLV),LNV(NLV),NSTX(NLV),NLV=1,NLVX)

SYMBOL	DEFINITION	TYPE
LNv	CONCATENATED LATTICE NAME/VERSION	C8
NLV	CONCATENATED LATTICE NAME/VERSION INDEX	
NLVX	NUMBER OF LATTICE VERSIONS CATALOGUED UNDER THE NAME DLAT	I4
NSTX	MAXIMUM VALUE OF STATE INDEX FOR WHICH DATA ARE CATALOGUED UNDER THE NAME DLNV	I4
VLAT	LATTICE VERSION	C8

LATTICE SPECS RECORD

NAME = 'LATTICE'.?DLAT.?VLAT.'SPECS'

LIST = PATRN,MULTV,NUCPV,NCLX,(DCEL(N),VCSEL(N),ANVP(N),N=1,NCLX),
(NCLA(N),REGNEW(N),(REGOLD(M,N),M=1,4),N=1,16),
(NC(N),R(N),NS(N),NA(N),N=1,24)

SYMBOL	DEFINITION	TYPE
ANVP	CONCATENATED CELL NAME/VERSION/POSITION	C8
DCEL	CELL NAME	C8
DLAT	LATTICE NAME	C8
MULTV	VERSION OF MULTIGRP DATA SET	C8
NA	NUMBER OF AZIMUTHAL SUB DIVISIONS	I4
NC	CELL IN WHICH REGION R OCCURS	I4
NS	NUMBER OF RADIAL OR PITCH SUB DIVISIONS.	I4
NCLA	CELL NUMBER IN WHICH REGION REGNEW OCCURS	I4
NCLX	NUMBER OF UNIQUE CELLS	I4
NUCPV	VERSION OF NUCPARAM DATA SET	C8
PATRN	LATTICE PATTERN NAME	C8
R	NAME OF REGION TO BE SUB-DIVIDED	C8
REGNEW	NEW REGION NAME	C8
REGOLD	1-4 REGION NAMES WHICH ARE TO BE HOMOGENIZED	C8
VCSEL	CELL VERSION	C8
VLAT	LATTICE VERSION	C8

JOSHUA DPSTM-500	Title Lattice Physics Data Sets LATTICE Data Set	Vol.	Page
		III	C.2.11
		Rev.	Date
			9/73

LATTICE METHOD RECORD

NAME = 'LATTICE'.?DLAT.?VLAT.'METHOD' (FREE-FORM SYNTAX)

LIST = NLX,((C(I,NL),I=1,63),NL=1,NLX)

SYMBOL	DEFINITION	TYPE
C	CHARACTER STRING INTO WHICH THE USER PLACES FREE-FORM SYNTAX SPECIFICATION OF OVERRIDES.	C1
DLAT	LATTICE NAME	C8
NLX	NUMBER OF LINES	I4
VLAT	LATTICE VERSION	C8

LATTICE ISOTOPE RECORD

NAME = 'LATTICE'.?DLAT.?VLAT.' ISOTOPES'

LIST = NISOX, (DISO(N), DISN(N), ISPECT(N), VERSN1(N), VERSN2(N), N=1, NISOX)

SYMBOL	DEFINITION	TYPE
DISN	NEW ISOTOPE NAME	C8
DISO	ORIGINAL ISOTOPE NAME	C8
DLAT	LATTICE NAME	C8
ISPECT	SPECTRUM CALCULATION OPTION 1-PRIMARY ISOTOPE 2-SECONDARY ISOTOPE	I4
NISOX	NUMBER OF ISOTOPES TO BE CHANGED	C8
VERSN1	MULTIGRP VERSION NAME	C8
VERSN2	NUCPARAM VERSION NAME	C8
VLAT	LATTICE VERSION	C8

LATTICE BURN RECORD

NAME = 'LATTICE'.?DLAT.?VLAT.'BURN'

LIST = HEIGHT,NCLP,ISOS,REGS,NCLS,PCTS,PCTR,NREGD,
(NCLD(N),REGND(N),CHNAM(N),N=1,NREGD),
(ISOEQU(N),N=1,30)

SYMBOL	DEFINITION	TYPE
CHNAM	NAME OF NUCPARAM CHAIN TO BE USED	C8
DLAT	LATTICE NAME	C8
HEIGHT	CELL/SUPERCCELL HEIGHT (CM)	R4
ISOEQU	NAME OF ISOTOPE TO BE TREATED AS IN EQUILIBRIUM	C8
ISOS	NAME OF ISOTOPE, THE CONCENTRATION CHANGE OF WHICH SPECIFIES FREQUENCY OF SPECTRUM CALCULATION	C8
NCLD	CELL NUMBER IN WHICH REGION REGND IS FOUND	I4
NCLP	CELL NUMBER TO WHICH POWER WILL APPLY	I4
NCLS	CELL NUMBER IN WHICH REGION REGS APPEARS	I4
NREGD	NUMBER OF REGIONS TO BE DEPLETED	I4
PCTR	PERCENT CHANGE IN CONCENTRATION OF ISOS BEFORE RESONANCE CALCULATION IS REPEATED	R4
PCTS	PERCENT CHANGE IN CONCENTRATION OF ISOS BEFORE SPECTRUM CALCULATION IS REPEATED	R4
REGND	NAME OF REGION TO BE DEPLETED	C8
REGS	REGION NAME IN WHICH ISOS APPEARS	C8
VLAT	LATTICE VERSION	C8

LATTICE STATE RECORD

NAME = 'LATTICE'.?DLAT.?VLAT.'STATE'.?NST (FREE FORM SYNTAX)
LIST = NLX,(C(I,NL),I=1,63),NL=1,NLX)

SYMBOL	DEFINITION	TYPE
C	CHARACTER STRING INTO WHICH FREE-FORM STATE PARAMETERS ARE PLACED	C1
DLAT	LATTICE NAME	C8
NLX	NUMBER OF LINES	14
NST	LATTICE STATE INDEX	14
VLAT	LATTICE VERSION	C8

LEGENDRE FLUX AND Q BY GROUP

NAME = 'LATTICE'.?DLAT?.?VLAT?. 'LFLUX'.?NST

LIST = LPX,NEG,(Q(I),(LFLUX(LP,I),LP=1,LPX),I=1,NEG)

SYMBOL	DEFINITION	TYPE
DLAT	LATTICE NAME	C8
I	ENERGY GROUP INDEX	I4
LFLUX	SUPERCCELL LEGENDRE FLUX (NEUTRON/SEC CM**2)	R4
LP	LEGENDRE INDEX = 1+LEGENDRE ORDER	I4
LPX	MAX. LEGENDRE INDEX	I4
NEG	NUMBER OF ENERGY GROUPS	I4
NST	LATTICE STATE	C8
Q	SUPERCCELL SLOWING DOWN DENSITY (NEUTRONS/SEC)	R4
VLAT	LATTICE VERSION NAME	C8

FISSIONS BY ISOTOPE/REGION

NAME = 'LATTICE'.?DLAT.?VLAT.'FISSION'.?NST

LIST = NIRX,(ISONAM(NIR),REGNAM(NIR),FISS(NIR),NIR=1,NIRX)

SYMBOL	DEFINITION	TYPE
DLAT	LATTICE NAME	C8
FISS	FISSION DENSITY (FISSION/CC SEC) BY ISOTOPE AND REGION	R4
ISONAM	ISOTOPE NAME	C8
NIR	INDEX FOR ISOTOPE/REGION COMBINATIONS	I4
NIRX	NO. OF ISOTOPE/REGION COMBINATIONS	I4
NST	LATTICE STATE	C8
REGNAM	REGION NAME	C8
VLAT	LATTICE VERSION NAME	C8

CLUSTER GEOMETRY, MODERATOR AND ROD DESCRIPTION

NAME = 'LATTICE'.'?DCFL?.'?VCEL?.'GEOMETRY'.'CLUSTER'.'POSITION'

LIST = NRTYP, COLNAM, COLMAT, COLOD, (RODNAM(I), RODMAT(I), RODOD(I), CLDMAT(I),
CLODD(I), I=1, NRTYP)

SYMBOL	DEFINITION	TYPE
CLDMAT	CLADDING MATERIAL NAME	C8
CLODD	CLADDING OUTER DIAMETER	R4
COLMAT	COOLANT MATERIAL	C8
COLNAM	COOLANT NAME	C8
COLOD	COOLANT OUTER DIAMETER	R4
DCFL	CELL (ASSEMBLY) NAME	C8
NRTYP	NUMBER OF ROD TYPES	I4
RODMAT	ROD MATERIAL NAME	C8
RODNAM	ROD NAME	C4
RODOD	ROD OUTER DIAMETER	R4
VCEL	CELL (ASSEMBLY) VERSION NAME	C8

CLUSTER GEOMETRY, ROD PATTERN

```

| NAME = 'LATTICE'.'?DCEL?.'?VCSEL?.'GEOMETRY?.'CLUSTER?.'DETAIL'
| LIST = NPOS,(RODNAM(I),NROD(I),RNGRAD(I),RSANG(I),I=1,NPOS)

```

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
NPOS	NUMBER OF ROD RING POSITIONS IN TABLE	I4
NROD	NUMBER OF RODS IN RING	I4
RNGRAD	ROD RING RADIUS (IN)	R4
RODNAM	ROD NAME	C4
RSANG	ANGLE (DEGREES) TO FIRST ROD IN RING	R4
VCSEL	CELL (ASSEMBLY) VERSION NAME	C8

JOSHUA DPSTM-500	Title Lattice Physics Data Sets LATTICE Data Set	Vol. III	Page C.2.19
		Rev.	Date 9/73

SQUARE GEOMETRY

NAME = 'LATTICE'.?DCEL.?VCEL.'GEOMETRY'.'SQUARE'

LIST = NRX, SQID, (REGNAM(I), REGMAT(I), PITCH(I), I=1, NRX)

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
NRX	NUMBER OF REGIONS	I4
PITCH	SQUARE PITCH (IN)	R4
REGMAT	MATERIAL NAME	C8
REGNAM	REGION NAME	C8
SQID	SUBASSEMBLY INNER DIAMETER (INCHES)	R4
VCEL	CELL (ASSEMBLY) VERSION	C8

ANNULAR GEOMETRY

NAME = 'LATTICE ' .?DCEL?.?VCEL?. 'GEOMETRY'. 'ANNULAR'

LIST = NRX, ASID, (REGNAM(NR), REGOD(NR), REGMAT(NR), NRIBS(NR), RIBTH(NR),
RIBD(NR), NR=1, NRX)

SYMBOL	DEFINITION	TYPE
--------	------------	------

ASID	SUBASSEMBLY INNER DIAMETER (INCHES)	R4
------	-------------------------------------	----

DCEL	CELL (ASSEMBLY) NAME	C8
------	----------------------	----

NR	REGION INDEX. E.G. REGOD(NR)	I4
----	------------------------------	----

NRIBS	NO. OF RIBS	I4
-------	-------------	----

NRX	NUMBER OF REGIONS	I4
-----	-------------------	----

REGMAT	REGION MATERIAL NAME	C8
--------	----------------------	----

REGNAM	REGION NAME	C8
--------	-------------	----

REGOD	ANNULAR REGION O.D. (INCHES)	R4
-------	------------------------------	----

RIBD	RIB TIP DIAMETER (I.D. OR O.D.) (INCHES)	R4
------	--	----

RIBTH	RIB THICKNESS (INCHES)	R4
-------	------------------------	----

VCEL	CELL (ASSEMBLY) VERSION NAME	C8
------	------------------------------	----

HEXAGON GEOMETRY

```

NAME = 'LATTICE '.?DCEL?.?VCEL?. 'GEOMETRY'. 'HEXAGON'
LIST = NRX, HEXID, (REGNAM(I), REGMAT(I), PITCH(I), I=1, NRX)

```

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
HEXID	SUBASSEMBLY INNER DIAMETER (INCHES)	R4
I	REGION INDEX	I4
NRX	NUMBER OF REGIONS	I4
PITCH	PITCH OF REGULAR HEXAGON	R4
REGMAT	MATERIAL NAME WITHIN A REGION	C8
REGNAM	REGION NAME	C8
VCEL	CELL (ASSEMBLY) VERSION NAME	C8

JOSHUA DPSTM-500	Title Lattice Physics Data Sets LATTICE Data Set	Vol.	Page
		III	C.2.22
		Rev.	Date
			9/73

MATERIAL TEMPERATURES AND DENSITIES

```

NAME = 'LATTICE ' .?DCEL?.?VCEL?. 'MATERIAL' . 'DENSITY'
LIST = NMAT, (DMAT(M), ITDC(M), DENS(M), FORM(M), M=1, NMAT)

```

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
DENS	DENSITY (GM/CC) OF A MATERIAL	R4
DMAT	MATERIAL NAME	C8
FORM	ENGINEERING MATERIAL NAME (PROPERTY DATA SET)	C8
ITDC	INTEGER TEMPERATURE (DEGREES C)	I4
M	MATERIAL INDEX	I4
NMAT	NUMBER OF MATERIALS	I4
VCEL	CELL (ASSEMBLY) VERSION NAME	C8

MATERIAL ISOTOPES AND CONCENTRATIONS

```
NAME = 'LATTICE ' .?DCFL?.?VCFL?. 'MATERIAL'. 'ISOTOPES'
LIST = MX, (DMAT(M), CONC(M), UNIT(M), DISO(M), M=1, MX)
```

SYMBOL	DEFINITION	TYPE
CONC	ISOTOPE CONCENTRATION	R4
DCFL	CELL (ASSEMBLY) NAME	C8
DISO	ISOTOPE NAME	C8
DMAT	MATERIAL NAME	C8
M	ISOTOPE/REGION INDEX	I4
MX	NUMBER OF ISOTOPE/REGION PAIRS	I4
UNIT	CONCENTRATION UNITS ALLOWED: ATM/B-CM PPM ATM-RATO WGT-RATO ATM-FRAC WGT-FRAC ATM-PCNT WGT-PCNT GM/FT GM/CC BALANCE	C8
VCFL	CELL (ASSEMBLY) VERSION NAME	C8

JOSHUA DPSTM-500	Title Lattice Physics Data Sets LATTICE Data Set	Vol.	Page
		III	C.2.24
		Rev.	Date
			9/73

(Blank)

JOSHUA DPSTM-500	Title Lattice Physics Data Sets RILIB Data Set	Vol. III	Page C.3.1
		Rev.	Date 9/73

Report Written By

H. C. Honeck

Work Done By

D. A. Sharp
H. C. Honeck

Contents

	<u>Page</u>
1. Introduction	C.3.3
2. Record Descriptions	C.3.7

JOSHUA DPSTM-500	Title Lattice Physics Data Sets RILIR Data Set	Vol. III	Page C.3.2
		Rev. 1	Date 9/73

(Blank)

JOSHUA DPSTM-500	Title Lattice Physics Data Sets RILIB Data Set	Vol. III	Page C.3.3
		Rev.	Date 9/73

1. Introduction

The RILIB contains the results of resonance integral calculations. The data is catalogued by cell name (DCEL) and version (VCEL). For each cell (see Figure 1) a CONTENTS record is given which lists the names of the regions (DREG) of the cell in which resonance capture occurs, the names of the isotopes (DISO) involved, the region temperature (TDC), and the isotope concentration (CONC). For each isotope/region combination there is a RESULTS record containing the resonance energy (ER), the absorption rate (RA), the fission rate (RF), and the absorption shielding factor (SF) for each resonance.

The resolved resonance rates are defined as the total number of absorptions or fissions for this resonance of this isotope in this region for a unit slowing density in the cell. Unresolved resonance rates are signaled by a negative resonance energy and are rates/unit lethargy for a unit slowing down density in the cell. If unresolved rates are used, at least two values must be given. It is assumed that the unresolved rates can be interpolated linearly in lethargy between tabulated points.

Summary information for each cell is contained in two records. The RESUME record contains a table of region name, outer radius, material name, and region volume for each region in the cell. The TOTALS record contains a table of isotope names, slowing-down sources, effective resonance integrals, infinitely dilute resonance integrals and number densities for each resonance absorber isotope. The resonance integrals and number densities are averaged over all regions in the cell that contain the isotope.

The self-shielding factor, SF, is defined as the actual absorption resonance integral divided by the infinite dilute absorption resonance integral. It is included in the data so that minor variations of the resonance rates with concentration and temperature can be made without repeating the full resonance integral calculation. The temperatures and concentrations at which the resonance rates were calculated are given in the CONTENTS record for this purpose.

JOSHUA DPSTM-500	Title Lattice Physics Data Sets RILIB Data Set	Vol. III	Page C.3.4
		Rev.	Date 9/73

(Blank)

JOSHUA
DPSTM-500

Title Lattice Physics Data Sets
RILIB Data Set

Vol.
III

Page
C.3.6

Rev.

Date
9/73

(Blank)

JOSHUA DPSTM-500	Title Lattice Physics Data Sets RILIB Data Set	Vol. III	Page C.3.7
		Rev.	Date 9/73

2. RECORD DESCRIPTIONS

LIST OF ISOTOPE AND REGION NAMES USED IN THIS CELL

```

|
| NAME - 'RILIB'.?DCEL?.?VCEL?. 'CONTENTS'
|
| LIST - NENT,(DISO(N),DREG(N),TDC(N),CONC(N),N=1,NENT)
|

```

<u>SYMBOL</u>	<u>DEFINITION</u>	<u>TYPE</u>
CONC	CONCENTRATION (ATM/B-CM) OF ISOTOPE IN REGION	R4
DCEL	CELL (ASSEMBLY) NAME	C8
DISO	ISOTOPE NAME	C8
DREG	REGION NAME	C8
DVEL	CELL (ASSEMBLY) VERSION NAME	C8
N	ISOTOPE/REGION INDEX	I4
NENT	NUMBER OF ISOTOPE/REGION RECORDS GIVEN	I4
TDC	REGION TEMPERATURE (DEGREES C)	R4

JOSHUA DPSTM-500	Title Lattice Physics Data Sets RILIB Data Set	Vol. III	Page C.3.8
		Rev.	Date 9/73

RESONANCE RATES FOR ISOTOPE(DIS0) AND REGION(DREG)

| NAME - 'RILIB'.?DCEL?.?VCEL?.?DIS0?.?DREG?. 'RESULTS'
| LIST - NRES,(ER(N),RA(N),RF(N),SF(N),N=1,NRES)
|

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
DIS0	ISOTOPE NAME	C8
DREG	REGION NAME	C8
DVEL	CELL (ASSEMBLY) VERSION NAME	C8
ER	RESONANCE ENERGY (EV)	R4
N	ISOTOPE/REGION INDEX	I4
NRES	NUMBER OF RESONANCES	I4
RA	RESONANCE ABSORPTION RATE FOR ONE RESONANCE, ISOTOPE, AND REGION BASED ON A UNIT SLOWING DOWN DENSITY IN CELL	R4
RF	RESONANCE FISSION RATE FOR ONE RESONANCE, ISOTOPE, AND REGION BASED ON A UNIT SLOWING DOWN DENSITY IN CELL	R4
SF	RESONACE ABSORPTION SHIELDING FACTOR = ACTUAL RESONANCE INTEGRAL/INFINITE DILUTE RESONANCE INTEGRAL	R4

TOTAL RESONANCE INTEGRALS BY ISOTOPE

NAME - 'RILIB'.?DCEL?.?VCEL?. 'TOTALS'

LIST - NISO, (DISC(I), Q(I), RI(I), RINF(I), CBAR(I), I=1, NISO)

SYMBOL	DEFINITION	TYPE
CBAR	AVERAGE ISOTOPE NUMBER DENSITY	P4
DCELL	CELL (ASSEMBLY) NAME	C8
I	ISOTOPE INDEX	I4
NISO	NO. OF ISOTOPES	I4
Q	NEUTRON SLOWING-DOWN SOURCE IN THE CELL	R4
RI	RESOLVED RESONANCE INTEGRAL	P4
RINF	RESOLVED RESONANCE INTEGRAL AT INFINITE DILUTION	R4
VCEL	CELL (ASSEMBLY) VERSION	C8

JOSHUA DPSTM-500	Title Lattice Physics Data Sets RILIB Data Set	Vol.	Page
		III	C.3.10
		Rev.	Date
			9/73

RILIB CELL RESUME DATA

```

NAME - 'RILIB'.?DCEL?.?VCEL?.?RESUME'
LIST - NREG, (DREG(IR), RMAX(IR), DMAT(IR), REGVOL(IR), IF=1, NREG)

```

SYMBOL	DEFINITION	TYPE
DCEL	CELL (ASSEMBLY) NAME	C8
DMAT	MATERIAL NAME	C8
DREG	REGION NAME	C8
IR	REGION INDEX	I4
NREG	NO. OF REGIONS	I4
RMAX	CUTER RADIUS OF REGION (CM)	R4
REGVOL	REGION VOLUME (CC)	R4
VCEL	CELL (ASSEMBLY) VERSION	C8

JOSHUA DPSTM-500	Title Lattice Physics Data Sets CELL Data Set	Vol.	Page
		III	C.4.1
		Rev.	Date
			9/73

Report Written By

J. W. Stewart

Work Done By

R. J. Pryor
J. W. Stewart

Contents

	<u>Page</u>
1. Introduction	C.4.3
2. Record Descriptions	C.4.5

JOSHUA DPSTM-500	Title Lattice Physics Data Sets CELL Data Set	Vol.	Page
		III	C.4.2
		Rev.	Date
			9/73

(Blank)

1. Introduction

The CELL data set contains the results of lattice physics current response function calculations. The record CELL.CØNTENTS contains a list of all CELL data set version names (see Figure 1). A version of this data set is characterized by a specific few-group energy structure. This structure is catalogued in the GRØUPS record. Within a given version of the data set a variety of multigroup neutron current shapes may be utilized. The multigroup energy structure and shape function are catalogued in SHAPE records. Each version of the cell data set has a CØNTENTS record in which is catalogued all the cell name (?CELNAM)-cell version (?CELVER) pairs contained for which data are catalogued. The cell name used in the CELL data set corresponds with that used in the ASSEMBLY data set. However, the cell version names used in CELL and ASSEMBLY do not necessarily correspond. For each cell name/version pair there are five record types. The SUMMARY record contains the names of the NUCPARAM and MULTIGRP data set versions, the ASSEMBLY cell version name, and the current shape function name used in the calculation of the response function. Also included are region subdivision and homogenization modifications to the description contained in ASSEMBLY data set GEØMETRY records. The RESPØNSE, FLUX, REACTIØN, and SCATTER records contain outward-directed current response, flux response, reaction rates, and scattering rates, respectively, by neutron generation, fewgroup, and incident current fewgroup.

JOSHUA DPSTM-500	Title Lattice Physics Data Sets CELL Data Set	Vol. III	Page C.4.4
		Rev.	Date 9/73

JOSHUA DPSTM-500	Title Lattice Physics Data Sets CELL Data Set	Vol. III	Page C.4.5
		Rev.	Date 5/71

2. Record Descriptions

CELL DATA SET VERSIONS CATALOGUED

```

NAME - 'CELL','CONTENTS'
LIST - IVER SX, (CVER SN( IVER S), IVER S=1, IVER SX)

```

SYMBOL	DEFINITION	TYPE
CVER SN	CELL DATA SET VERSION NAME	C8
IVER S	VERSION INDEX	I4
IVER SX	NO. OF VERSIONS CATALOGUED	I4

CELL NAMES/VERSIONS CATALOGUED

NAME - 'CELL',?CVERSN,'CONTENTS'
LIST - ICNVX,(CELNAM(ICNV),CELVER(ICNV),ICNV=1,ICNVX)

SYMBOL	DEFINITION	TYPE
CELNAM	CELL NAME (SAME AS CELL NAME IN ASSEMBLY DATA SET)	C8
CELVER	CELL VERSION (DOES NOT NECESSARILY CORRESPOND TO CELL VERSION, 'VCEL', IN ASSEMBLY DATA SET)	C8
CVERSN	VERSION OF CELL DATA SET	C8
ICNV	CELL NAME/VERSION INDEX	I4
ICNVX	NO. OF CELL NAME/VERSION PAIRS CATALOGUED	I4

FEWGROUP ENERGY STRUCTURE

NAME - 'CELL', ?OVERSN, 'GROUPS'

LIST - IFGX,EOFG,(DEFG(IFG),IFG=1,IFGX)

SYMBOL	DEFINITION	TYPE
OVERSN	VERSION OF CELL DATA SET	C8
DEFG	ENERGY WIDTH (EV) OF FEWGROUPS	R4
EOFG	LOWER ENERGY LIMIT (EV) OF THERMAL-MOST FEWGROUP	R4
IFG	INDEX OF FEWGROUP	I4
IFGX	NO. OF FEWGROUPS	I4

JOSHUA DPSTM-500	Title Lattice Physics Data Sets CELL Data Set	Vol.	Page
		III	C.4.8
		Rev.	Date
			9/73

SHAPE OF SOURCE CURRENT FUNCTION

NAME - 'CELL'.?CVERSN.' SHAPE'.?SNAME
LIST - IMGX,(EMG(IMG),SOURCE(IMG),IMG=1,IMGX),EMG(IMGX+1)

SYMBOL	DEFINITION	TYPE
CVERSN	VERSION OF CELL DATA SET	C 8
EMG	UPPER ENERGY LIMIT (EV) OF MULTIGROUPS	I 4
IMG	MULTIGROUP INDEX	I 4
IMGX	NO. OF MULTIGROUPS	I 4
SOURCE	VALUE OF CURRENT SOURCE SHAPE FUNCTION	R 4

SUMMARY DESCRIPTION OF CELL NAME/VERSION DATA

NAME - 'CELL'.?CVERSN.?CELNAM.?CELVER.'SUMMARY'

LIST - VNUCP,VMULT,AVCEL,SNAME,(REG(IS),NSUB(IS),NAZM(IS),IS=1,24),
(REGNEW(IH),(REGOLD(ID,IH),ID=1,4),IH=1,8)

SYMBOL	DEFINITION	TYPE
AVCEL	CELL VERSION NAME IN ASSEMBLY DATA SET	C8
CVERSN	VERSION OF CELL DATA SET	C8
CELNAM	CELL NAME (SAME AS CELL NAME IN ASSEMBLY DATA SET)	C8
CELVER	CELL VERSION (DOES NOT NECESSARILY CORRESPOND TO CELL VERSION, 'VCEL', IN ASSEMBLY DATA SET)	C8
IH	INDEX OF HOMOGENIZED REGION	I4
ID	INDEX OF REGION TO BE HOMOGENIZED	I4
IS	INDEX OF REGION TO BE SUBDIVIDED	I4
NAZM	NO. OF AZIMUTHAL SUBDIVISIONS	I4
NSUB	NO. OF RADIAL SUBDIVISIONS	I4
REG	NAME OF REGION TO BE SUBDIVIDED	C8
REGNEW	NAME OF HOMOGENIZED REGION	C8
REGOLD	NAME OF REGION TO BE HOMOGENIZED	C8
SNAME	NAME OF SOURCE SHAPE FUNCTION USED	C8
VMULT	VERSION OF MULTIGRP DATA SET USED	C8
VNUCP	VERSION OF NUCPARAM DATA SET USED	C8

JOSHUA DPSTM-500	Title Lattice Physics Data Sets CELL Data Set	Vol. III	Page C.4.10
		Rev.	Date 9/73

CURRENT RESPONSE FUNCTION

```

NAME - 'CELL', ?CVERSN, ?CELNAM, ?CELVER, 'RESPONSE'
LIST - IGENX, NFCX, IFGX, (((((JOUT (IGEN, NFC, IFG, IFGS), IGEN=1, IGENX),
      NFC=1, NFCX), IFG=1, IFGX), IFGS=1, IFGX)

```

SYMBOL	DEFINITION	TYPE
CELNAM	CELL NAME (SAME AS CELL NAME IN ASSEMBLY DATA SET)	C8
CELVER	CELL VERSION (DOES NOT NECESSARILY CORRESPOND TO CELL VERSION, 'VCEL', IN ASSEMBLY DATA SET)	C8
CVERSN	VERSION OF CELL DATA SET	C8
IFG	INDEX OF FEWGROUP FOR CURRENT FUNCTION	I4
IFGS	INDEX OF FEWGROUP FOR SOURCE CURRENT	I4
IFGX	NO. OF FEWGROUPS	I4
IGEN	INDEX OF NEUTRON GENERATIONS	I4
IGENX	NO. OF NEUTRON GENERATIONS	I4
JOUT	OUTWARD DIRECTED PARTIAL NEUTRON CURRENT (NEUTRONS/CM/CM/SEC)	I4
NFC	CELL FACE INDEX	I4
NFCX	NO. OF CELL FACES	I4

FLUX FUNCTION

```

NAME - 'CELL',?CVERSN.?CELNAM.?CELVER,'FLUX'
LIST - IGENX,IFGX,(((FLUX(IGEN,IFG,IFGS),IGEN=1,IGENX),IFG=1,IFGX),
        IFGS=1,IFGX)

```

SYMBOL	DEFINITION	TYPE
CELNAM	CELL NAME (SAME AS CELL NAME IN ASSEMBLY DATA SET)	C8
CELVER	CELL VERSION (DOES NOT NECESSARILY CORRESPOND TO CELL VERSION, 'VCEL', IN ASSEMBLY DATA SET)	C8
CVERSN	VERSION OF CELL DATA SET	C8
IFG	INDEX OF FEWGROUP FOR FLUX	I4
IFGS	INDEX OF FEWGROUP FOR CURRENT SOURCE	I4
IFGX	NO. OF FEWGROUPS	I4
IGEN	NEUTRON GENERATION INDEX	I4
IGENX	NO. OF NEUTRON GENERATIONS	I4
FLUX	NEUTRON FLUX DENSITY (NEUTRONS/CM/CM/SEC)	R4

REACTION RATES

```

NAME - 'CELL'.?CVERSN.?CELNAM.?CELVER.'REACTION'
LIST - IGENX,IFGX,((((PRATE(IGEN,ITYPE,IFG,IFGS),IGEN=1,IGENX),
           ITYPE=1,4),IFG=1,IFGX),IFGS=1,IFGX)

```

SYMBOL	DEFINITION	TYPE
CELNAM	CELL NAME (SAME AS CELL NAME IN ASSEMBLY DATA SET)	C8
CELVER	CELL VERSION (DOES NOT NECESSARILY CORRESPOND TO CELL VERSION, 'VCEL', IN ASSEMBLY DATA SET)	C8
CVERSN	VERSION OF CELL DATA SET	C8
IFG	INDEX OF FEWGROUP FOR REACTIONS	I4
IFGS	INDEX OF FEWGROUP FOR CURRENT SOURCE	I4
IFGX	NO. OF FEWGROUPS	I4
IGEN	INDEX OF NEUTRON GENERATIONS	I4
IGENX	NO. OF NEUTRON GENERATIONS	I4
ITYPE	INDEX OF REACTION TYPE ITYPE TYPE	I4
	1 TRANSPORT	
	2 CAPTURE	
	3 FISSION	
	4 PRODUCTION	
RRATE	REACTION RATES (REACTIONS/SEC)	P4

SCATTERING REACTION RATES

```
NAME - 'CELL',?CVERSN,?CELNAM,?CELVER,'SCATTER'
LIST - IGENX,IFGX,((((SRATE(IGEN,IFGF,IFGI,IFGS),IGEN=1,IGENX),
      (IFGF=1,IFGX),IFGI=1,IFGX),IFGS=1,IFGX)
```

SYMBOL	DEFINITION	TYPE
CELNAM	CELL NAME (SAME AS CELL NAME IN ASSEMBLY DATA SET)	C8
CELVER	CELL VERSION (DOES NOT NECESSARILY CORRESPOND TO CELL VERSION, 'VCEL', IN ASSEMBLY DATA SET)	C8
CVERSN	VERSION OF CELL DATA SET	C8
IFGI	INDEX OF FEWGROUPO FOR INITIAL ENERGY GROUP	I4
IFGF	INDEX OF FEWGROUPO FOR FINAL ENERGY GROUP	I4
IFGS	INDEX OF FEWGROUPO FOR CURRENT SOURCE	I4
IFGX	NO. OF FEWGROUPS	I4
IGEN	INDEX OF NEUTRON GENERATION	I4
IGENX	NO. OF NEUTRON GENERATIONS	I4
SRATE	SCATTER REACTION RATES	R4

JOSHUA DPSTM-500	Title Lattice Physics Data Sets CELL Data Set	Vol. III	Page C.4.14
		Rev.	Date 9/73

(Blank)

JOSHUA DPSTM-500	Title Part D - Correlation Data Sets	Vol. III	Page D.O.1
		Rev.	Date 9/73

Contents

D.1 - PARMEQ Data Set

JOSHUA DPSTM-500	Title Part D - Correlation Data Sets	Vol. III	Page D.O.2
		Rev.	Date 9/73

(Blank)

JOSHUA

DPSTM-500

Title Correlation Data Sets
PARMEQ Data Set

Vol.
III

Page
D.1.1

Rev.

Date
9/73

Report Written By

M. R. Buckner

Work Done By

M. R. Buckner
H. C. Honeck

Contents

	<u>Page</u>
1. Introduction	D.1.3
2. Record Descriptions	D.1.11

JOSHUA DPSTM-500	Title Correlation Data Sets PARMEQ Data Set	Vol. III	Page D.1.2
		Rev.	Date 9/73

(Blank)

JOSHUA DPSTM-500	Title Correlation Data Sets PARMEQ Data Set	Vol. III	Page D.1.3
		Rev.	Date 9/73

1. Introduction

The PARMEQ data set contains the parametric equation data that results from the cross-section reduction and blocking operations performed by the Correlation Subsystem. The structure of the data set is shown in Figure 1.

The record PARMEQ.CONTENTES contains the names of FEWGRP data set versions (?CFGV) for which correlation data exists. The lattices (?DLNV) contained in a particular version are listed in the record PARMEQ.?CFGV.CONTENTES.

Correlation data for use in different types of reactor calculations (static, burnup, power flattening, or kinetics) are listed in PARMEQ.?CFGV.?DLNV.CONTENTES by block usage qualifier (?USE). Records for the same lattice and fewgroup version but for a different use would differ by the type of lattice physics parameters contained in the records and the lattice state parameters used to correlate the data. The record PARMEQ.?CFGV.?DLNV.?USE.CONTENTES contains a list of fitting methods (?METH) that have been used to develop correlation equations for a particular lattice as well as the Correlation case name and block number that were used in generating the correlation data. These qualifiers are used to identify the record CRAB.?NCASE.?NBK.SUMMARY which lists the case numbers of the FEWGRP records used in developing the correlation equations and also identifies the cells that make up the lattice.

The correlation data is stored in the record PARMEQ.?CFGV.?DLNV.?USE.?METH which is a list-processed array having the over-all structure shown in Figure 2. Each cell represents a particular aspect of the correlation data. The detailed structure of each cell is shown in Figure 3. The array is seen to be a list of four-byte words defined so that all the information needed to construct the correlation equations is available. The header cell (H-cell) contains the number of independent variables (lattice state parameters used in correlating the data), the number of dependent variables (few-group parameters for which correlation equations are available), and the location of the first cell of each type.

Figure 1. Structure of Records in PARMEQ Data Set.

```

C-----CFGD RECORD STRUCTURE-----
C
C   KD-> +-----+      CFGD OCCUPIES NWRD WORDS OF THE ARRAY R4(K)
C         1         1
C         1 H-CELL 1      REAL*4 R4(1)
C         1         1      COMMON/DATA/R4
C         +-----+
C   KFXC-> 1         1      FROM K=KD+1 THRU K=KMAX=KD+NWRD
C         1 NXX 1
C         1 X-CELLS 1     EQUIVALENT ARRAYS ARE:
C         1         1
C         +-----+
C   KFYC-> 1         1      LOGICAL*1 L1(4,1)
C         1 NYX 1      INTEGER*2 I2(2,1),J2(1)
C         1 Y-CELLS 1
C         1         1      THE I-TH BYTE OF WORD K IS      L1(I,K)
C         +-----+      THE LEFT HALF OF WORD K IS      I2(1,K)
C         1         1      THE RIGHT HALF OF WORD K IS     I2(2,K)
C         1         1      THE I-TH 2-BYTE GROUP
C         1 MIXED 1      STARTING AT WORD K IS      J2(2*K+1-2)
C   KFFC-> 1 F-CELLS 1
C   KFTC-> 1 T-CELLS 1
C   KFCC-> 1 C-CELLS 1
C         1         1
C   KMAX-> +-----+
C

```

Figure 2. CRAB Block Structure

Each independent variable is defined by an x-cell. This cell contains a key indicator which identifies the variable, the reference value of the variable, and the minimum and maximum values of x for which the correlation applies. The other four positions are presently not being used. The y-cells are used to define the dependent variables which are represented as

$$y_n(\bar{x}) = y_n(\bar{x}_1) \times f_{p_n}(\bar{x}, \bar{a}_{m_n})$$

Each y-cell contains a key indicator which identifies the data type, the reference value of the variable $[y_n(\bar{x}_1)]$ and pointers to the function cell and coefficient cell which are needed to define the correlation equation for this variable. These pointers give the location of the cells that define the p_n functional form (f_{p_n}) and the m_n coefficient set (a_{m_n}).

JOSHUA DPSTM-500	Title Correlation Data Sets PARMEQ Data Set	Vol. III	Page D.1.6
		Rev.	Date 9/73

```

C-----HEADER CELL (H-CELL)-----
C
C      +-----+-----+      KO   - RECORD ORIGIN (FIRST WORD -1)
C      KO+1 1  NXX   1  NYX   1  NXX   - NO OF X'S
C      +-----+-----+      NYX   - NO OF Y'S
C      +2 1  KFXC   1  KPXC   1  KFXC   - POINTER TO FIRST X-CELL
C      +-----+-----+      KPXC   - POINTER TO PRINCIPAL X-CELL
C      +3 1  KFYC   1  KFFC   1  KFYC   - POINTER TO FIRST Y-CELL
C      +-----+-----+      KFFC   - POINTER TO FIRST F-CELL
C      +4 1  KFTC   1  KFCC   1  KFTC   - POINTER TO FIRST T-CELL
C      +-----+-----+      KFCC   - POINTER TO FIRST C-CELL
C                                  NPX   - PRINCIPAL X NUMBER
C
C-----INDEPENDENT VARIABLE CELL (X-CELL)-----
C
C      +-----+-----+      KXC   - LOCATION OF X-CELL
C      KXC+0 1      XTYPE   1      XTYPE - X TYPE MADE UP OF THE NUMBERS:
C      +-----+-----+      NDT,NIS,NGF,NCL
C      +1 1      XO      1      XO   - REFERENCE VALUE OF X
C      +-----+-----+      XMIN   - MINIMUM VALUE OF X
C      +2 1      XMIN   1      XMAX   - MAXIMUM VALUE OF X
C      +-----+-----+
C      +3 1      XMAX   1
C      +-----+-----+
C
C      +-----+-----+
C      +7 1      1
C      +-----+-----+
C
C-----DEPENDENT VARIABLE CELL (Y-CELL)-----
C
C      +-----+-----+      KYC   - LOCATION OF Y-CELL
C      KYC+0 1      YTYPE   1      YTYPE - Y TYPE MADE UP OF THE NUMBERS:
C      +-----+-----+      NDT,NIS,NGF,NCL
C      +1 1  KFC   1  KCC   1  NF   - FUNCTION NUMBER
C      +-----+-----+      KFC   - POINTER TO F-CELL
C      +2 1      Y0      1  NC   - COEF SET NUMBER
C      +-----+-----+      KCC   - POINTER TO C-CELL
C                                  Y0   - REFERENCE VALUE OF Y
C
C      NOTE:      NF,NC ARE INITIALLY LOADED INTO
C                  CELL AND THEN REPLACED BY KFC,KCC
C
C-----FUNCTION CELL (F-CELL)-----
C
C      +-----+-----+      KFC   - LOCATION OF F-CELL
C      KFC+0 1  NF   1  KNFC  1  NF   - FUNCTION NUMBER
C      +-----+-----+      KNFC   - POINTER TO NEXT F-CELL
C      +1 1  LX   1  KTC(1) 1  LX   - NUMBER OF TERMS IN FUNCTION
C      +-----+-----+      NT(L)  - TERM NUMBER OF THE L-TH TERM
C      +2 1  KTC(2) 1  KTC(3) 1  IN FUNCTION, L=1,LX
C      +-----+-----+      KTC(L)- POINTER TO T-CELL USED FOR L-TH
C      1      1      1      TERM IN FUNCTION, L=1,LX
C      /      /      /
C
C      NOTE:      NT(L) ARE INITIALLY LOADED INTO
C                  CELL AND THEN REPLACED BY KTC(L)
C
C-----TERM CELL, TYPE 1 (T-CELL)-----
C
C      +-----+-----+      KTC   - LOCATION OF T-CELL
C      KTC+0 1  1      1  KNTC  1  KNTC - POINTER TO NEXT T-CELL
C      +-----+-----+      JX   - NUMBER OF FACTORS IN TERM

```

Figure 3. Detailed Block Structure.


```

C      +1 1  JX  1  NT  1  NT  - TERM NUMBER
C      +-----+-----+
C      +2 1  NX(1) 1  MU(1) 1  NX(J) - X NUMBER USED FOR THE J-TH FACTOR
C      +-----+-----+
C      +3 1  NX(2) 1  MU(2) 1  MU(J) - EXPONENT OF THE J-TH FACTOR
C      +-----+-----+
C      1 1 1 1 1  ICV - INDEX IN SCRATCH ARRAY TO THE
C      /  /  /  CURRENT VALUE OF THIS TERM
C
C      NOTE: DURING RETRIEVAL NT IS
C      OVER-WRITTEN WITH ICV
C
C-----TERM CELL, TYPE 2 (T-CELL)-----
C
C      +-----+-----+
C      KTC+3 1  2  1  KNTC 1  KTC - LOCATION OF T-CELL
C      +-----+-----+
C      +1 1  JX  1  NT  1  KNTC - POINTER TO NEXT T-CELL
C      +-----+-----+
C      +2 1  KFC(1) 1  KCC(1) 1  JX - NUMBER OF FACTORS IN TERM
C      +-----+-----+
C      +3 1  KFC(2) 1  KCC(2) 1  NT - TERM NUMBER
C      +-----+-----+
C      1 1 1 1 1  NF(J) - FUNCTION NUMBER USED FOR THE J-TH
C      /  /  /  FACTOR IN THIS TERM, J=1,JX
C      KFC(J)- COEF SET NUMBER USED FOR THE J-TH
C      KCC(J)- FACTOR IN THIS TERM, J=1,JX
C      ICV - POINTER TO THE F-CELL USED FOR
C      THE J-TH FACTOR THIS TERM, J=1,JX
C      THE J-TH FACTOR THIS TERM, J=1,JX
C      INDEX IN SCRATCH ARRAY TO THE
C      CURRENT VALUE OF THIS TERM
C
C      NOTE: NF(J),NC(J) ARE INITIALLY LOADED
C      INTO CELL AND REPLACED BY KFC(J)
C      AND KCC(J)
C
C      NOTE: DURING RETRIEVAL NT IS
C      OVER-WRITTEN WITH ICV
C
C-----TERM CELL, TYPE 3 (T-CELL)-----
C
C      +-----+-----+
C      KTC+3 1  3  1  KNTC 1  KTC - LOCATION OF T-CELL
C      +-----+-----+
C      +1 1  JX  1  NT  1  KNTC - POINTER TO NEXT T-CELL
C      +-----+-----+
C      +2 1  PXL(1) 1  JX - NUMBER OF FUNCTION CHOICES
C      +-----+-----+
C      +3 1  KFC(1) 1  KCC(1) 1  NT - TERM NUMBER
C      +-----+-----+
C      +4 1  PXL(2) 1  NF(J) - FUNCTION NUMBER USED FOR THE J-TH
C      +-----+-----+
C      +5 1  KFC(2) 1  KCC(2) 1  NC(J) - COEF SET NUMBER USED FOR THE J-TH
C      +-----+-----+
C      1 1 1 1 1  KFC(J)- CHOICE IN THIS TERM, J=1,JX
C      /  /  /  KCC(J)- POINTER TO F-CELL USED FOR THE
C      PXL(J)- J-TH CHOICE FOR THIS TERM, J=1,JX
C      PRINCIPAL X LIMIT FOR THE J-TH
C      CHOICE FOR THIS TERM, J=1,JX.
C      IF THE CURRENT PRINCIPAL X IS XP,
C      AND IF PXL(J-1).LT.XP.LE.PXL(J),
C      THEN NF(J),NC(J) IS CHOSEN AS
C      THE VALUE OF THIS TERM.
C      (XMIN IS USED FOR PXL(0))
C      ICV - INDEX IN SCRATCH ARRAY TO THE
C      CURRENT VALUE OF THIS TERM
C
C      NOTE: NF(J),NC(J) ARE INITIALLY LOADED
C      INTO CELL AND REPLACED BY KFC(J)
C      AND KCC(J)
C
C      NOTE: DURING RETRIEVAL NT IS
C      OVER-WRITTEN WITH ICV
C
C-----COEF CELL (C-CELL)-----

```

Figure 3. Detailed Block Structure (Continued).

JOSHUA DPSTM-500	Title Correlation Data Sets PARMEQ Data Set	Vol. III	Page D.1.8
		Rev.	Date 9/73

C					KCC	-	LOCATION OF C-CELL		
C	KCC+0	1	NC	1	KNCC	1	NC	-	COEF SET NUMBER
C							KNCC	-	POINTER TO NEXT C-CELL
C	+1	1		C(1)		1	C(L)	-	COEF, L=1,LX
C									
C	+2	1		C(2)		1	NOTE: LX IS STORED IN THE F-CELL WHICH USES THESE COEFFICIENTS		
C									

FIGURE 3. Detailed Block Structure (continued)

The functional forms are expressed as

$$f_p(\bar{x}, \bar{a}_m) = \sum_{\ell=1}^{L_p} a_{m\ell} T_{k_{p\ell}}(\bar{x})$$

Each functional form is defined by a f-cell. An f-cell contains the function number (p), a pointer to the next f-cell, the number of terms in f_p (L_p), and pointers to each of the t-cells that are used to define the functional form. These pointers give the location of the t-cell which defines the $k_{p\ell}$ term.

The unique terms required to define all the functional forms are numbered 1 through K and are allowed to be one of three types. Term type one is defined as

$$T_k(\bar{x}) = \sum_{j=1}^{J_k} x_{i_{jk}}^{\mu_{jk}}$$

This information is contained in the t-cell for term type one in which JX, NT, NX(J), and MU(J) correspond respectively to J_k , k, i_{jk} , and μ_{jk} . Term type two is defined as

$$T_k(\bar{x}) = \prod_{j=1}^{J_k} f_{p_{jk}}(\bar{x}, a_{m_{jk}})$$

In the term type two cell, JX and NT correspond respectively to J_k and k, while KPC(J) is a pointer to the f-cell that defines p_{jk}^{th} functional form, and KCC(J) is a pointer to the c-cell that defines the m_{jk}^{th} coefficient set. Term type three is defined as

$$T_k(\bar{x}) = F_j \left[f_{p_{kj}}(\bar{x}, a_{m_{kj}}), PXL_{kj} \right]$$

JOSHUA DPSTM-500	Title Correlation Data Sets PARMEQ Data Set	Vol. III	Page D.1.9
		Rev.	Date 9/73

In the term type three cell, JX and NT correspond respectively to j and k , while PXL(J) is upper limit for the j^{th} range (PXL $_{kj}$), and the pointers KFC(J) and KCC(J) give the location of the f-cell that defines the p_{kj} th functional form and the c-cell that defines the m_{kj} th coefficient set.

The coefficient sets are defined by the c-cells. Each coefficient [m_n in Equation (B.1)] has a corresponding function (p_n) which contains L_p terms. The c-cell contains the coefficient set number (NC corresponding to m_n) and L_p coefficients.

JOSHUA DPSTM-500	Title Correlation Data Sets PARMEQ Data Set	Vol.	Page
		III	D.1.10
		Rev.	Date
			9/73

(Blank)

JOSHUA DPSTM-500	Title Correlation Data Sets PARMEQ Data Set	Vol. III	Page D.1.11
		Rev.	Date 9/73

2. Record Descriptions

CONTENTS OF 'PARMEQ' LIBRARY

```

| NAME - 'PARMEQ'. 'CONTENTS'
| LIST - NV, (CFGV(N), N=1, NV)

```

SYMBOL	DEFINITION	TYPE
CFGV	FEWGFP VERSION NAME	C8
NV	NUMBER OF FEWGFP VERSIONS	I4

CONTENTS OF A VERSION OF PARMEQ LIBRARY

```

| NAME - 'PARMEQ'. ?CFGV. 'CONTENTS'
| LIST - NLAT, (DLNV(N), N=1, NLAT)

```

SYMBOL	DEFINITION	TYPE
CFGV	FEWGFP VERSION NAME	C8
DLNV	LATTICE/VERSION QUALIFIER	C8
NLAT	NO. OF LATTICES FOR WHICH DATA EXISTS	I4

JOSHUA DPSTM-500	Title Correlation Data Sets PARMEQ Data Set	Vol. III	Page D.1.12
		Rev.	Date 9/73

LIST OF USES FOR WHICH PARMEQ RECORDS ARE AVAILABLE

NAME - 'PARMEQ'.?CFGV.?DLNV.'CONTENTS'

LIST - NUSE,(USE(N),N=1,NUSE)

SYMBOL	DEFINITION	TYPE
CFGV	FEWGER VERSION NAME	C8
DLNV	LATTICE/VERSION NAME	C8
NUSE	NO. OF SPECIFIC USES	I4
USE	BLOCK USAGE QUALIFIER	C8

CONTENTS OF FITTING METHODS APPLIED TO A PARTICULAR SET OF DATA

NAME - 'PARMEQ'.?CFGV.?DLNV.?USE.'CONTENTS'

LIST - '14.(METH(N),NCASE(N),NRK(N),N=1,NM)

SYMBOL	DEFINITION	TYPE
CFGV	FEWGER VERSION NAME	C8
DLNV	LATTICE/VERSION NAME	C8
METH	FITTING METHOD QUALIFIER	C8
NRK	CRAB BLOCK NUMBER	I4
NCASE	CRAB CASE NAME USED IN GENERATING PARMEQ BLOCK	I4
NM	NO. OF FITTING METHODS	I4
USE	BLOCK USAGE QUALIFIER	C8

PARMEQ BLOCK

```
NAME - 'PARMEQ'.?CEGV.?DLNV.?USE.?METH
LIST - NWRD, (A(NW), NW=1, NWRD)
```

SYMBOL	DEFINITION	TYPE
A	FOUR-BYTE ELEMENT OF THE LIST-PROCESSED ARRAY	B4
CEGV	COLLAPSED FEW-GROUP VERSION NAME	C8
DLNV	LATTICE NAME/VERSION	C8
METH	FITTING METHOD QUALIFIER	C8
NWRD	NUMBER OF WORDS IN LIST-PROCESSED ARRAY	I4
USE	BLOCK USAGE NAME	C8

JOSHUA DPSTM-500	Title Correlation Data Sets PARMEQ Data Set	Vol.	Page
		III	D.1.14
		Rev.	Date
			9/73

(Blank)

JOSHUA DPSTM-500	Title Part E - Reactor Physics Data Sets	Vol. III	Page E.O.1
		Rev.	Date 9/73

Contents

E.1 - REACTOR Data Set

JOSHUA DPSTM-500	Title Part E - Reactor Physics Data Sets	Vol. III	Page E.O.2
		Rev.	Date 9/73

(Blank)

JOSHUA

DPSTM-500

Title Reactor Physics Data Sets
REACTOR Data Set

Vol.
III

Page
E.1.1

Rev.

Date
9/73

Report Written By

J. H. Carswell, Jr.

Work Done By

J. H. Carswell, Jr.

Contents

	<u>Page</u>
1. Introduction	E.1.3
1.1 Names	E.1.3
1.2 Material Record	E.1.3
1.3 Geometry Records	E.1.4
1.3.1 Definitions	E.1.4
1.3.2 Use of the RM Function	E.1.6
1.4 Flux Records	E.1.7
1.5 Source Records	E.1.7
1.6 Adjoint Records	E.1.7
2. Record Descriptions	E.1.13

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.2
		Rev.	Date 9/73

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.3
		Rev.	Date 9/73

1. Introduction

The REACTOR data set contains a physical description of all materials within the reactor vessel. The REACTOR data set is the main input to reactor physics modules.

Each reactor on the REACTOR data set is identified by an 8-character reactor name (mnemonic ?RNAME) and an 8-character version name (mnemonic ?RVSN). The reactor name should be the generic name and the version name should denote modifications to the standard reactor.

The data for a particular reactor is divided into a material record, a geometry record, a neutron flux record, and a neutron source record. The last two records will not always be required. The material record contains a list of 8-character material names; the 8-character version, lattice, and assembly names; and the 8-character case identification number (or, alternatively, a set of fifteen 4-byte case descriptors corresponding to FEWGRP data records.)

There are several types of geometry records, each corresponding to a different geometry type. The reactor description requires only one geometry record.

1.1 Names

The user must provide names (up to 8 characters) for materials and geometric regions and zones. All of these names are arbitrary but must be assigned consistently. A geometry record contains the names of materials assigned to each region. The same material names must appear in the material records. The geometry record also contains the names of the regions and the names of the zones.

1.2 Material Records

The material record, REACTOR.?RNAME.?RVER.MATERIAL, contains the material name (DMAT), the FEWGRP data set version name, lattice name, and assembly name (DZVN, DZLT, and DZAS) and either the FEWGRP library case name (DZID) or a set of 15 case descriptors (i.e., buckling, exposure, etc.) for each material in the reactor. If a case name is supplied then the 15 case descriptors must be entered as zeros. If the case name is not supplied then values must be entered for the case descriptors. These case descriptors will then be compared to sets of case descriptors in the FEWGRP CONTENTS record for this version, lattice, and assembly. If there is a perfect match for any case listed, then that case name will be used. If no perfect match is found, then a new case will be created by interpolating the cross sections found in the other cases. (Note: This interpolation option has not yet been implemented. An other-than-perfect match will result in an error stop.)

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.4
		Rev.	Date 9/73

1.3 Geometry Records

The geometry record(s) contain(s) the dimensions of the reactor, the physical layout of the reactor by region, the names of the regions, the names of the materials in the regions, the names of the edit zones, and a list of regions in each zone. For orthogonal geometry, the record used is:

REACTOR.?RNAME.?RVSN.GEOMETRY.?GEOM.

For hexagonal geometry two sets of records are used:

REACTOR.?RNAME.?RVSN.GEOMETRY.?GEOM.SPECS and

REACTOR.?RNAME.?RVSN.GEOMETRY.HEX.MESH.?LEVL.

The variable qualifier ?GEOM is the mnemonic for the geometry type (i.e., SLAB, CYLINDER, HEX, etc.), while ?LEVL is the mnemonic for a particular level of the HEX-Z reactor in question.

1.3.1 Definitions

Following is a glossary of terms used in the reactor geometry specifications:

<u>Material</u>	-	A material is defined by a specific set of homogenized few-group cross sections.
<u>Mesh Point</u>	-	A mesh point is defined by a set of coordinates in volumetric reactor space. In spite of the unusual placement of mesh points in a hexagonal mesh, they are numbered, from the user's point of view, in the same way as those in an orthogonal mesh (i.e., from x-min. to x-max., from y-min. to y-max., and from z-min. to z-max.)
<u>Mesh Interval</u>	-	A mesh interval is a division of a coordinate axis, at the middle of which lies the projection of a mesh point.
<u>Axis Segment</u>	-	An axis segment is a set of contiguous mesh intervals containing one, and only one, material. Axis segment indices increase with increasing value of the coordinate.

Region

- A region is a partition of volumetric reactor space containing one, and only one, material and bounded by axis segment boundaries (i.e., the extremity of an axis segment.)

Hex

- A hex is a partition of the plane of a reactor with a hexagonal lattice structure. A hex may include within its boundaries one, three, six, or an average of three mesh points. In two-dimensional hexagonal geometry a region is equivalent to one hex. In three-dimensional hexagonal-z geometry, if the same hex in each of several z-axis segments has the same properties, the z-axis segments may be grouped to form a z-region. The resulting partition of volumetric space is one region. From the user point of view, hexes in a plane of the reactor are numbered from x-min. to x-max. and from y-min. to y-max. (see Figure 4).

Patch

- A patch is a cluster of seven hexes. The method of numbering them is shown in Figure 2.

Ring

- A ring is a collection of patches forming one complete circuit of the reactor. A ring is one patch thick. They are numbered outward from the center of the reactor. The central patch is not a part of any ring.

Gang

- A gang is a different collection of patches than a ring, but it still forms one complete circuit of the reactor. The first gang consists of the central patch and the first two rings of the reactor, the second and third gangs contain the third and fourth rings respectively, and the fourth gang contains all other rings. This is the gang structure used in the RM function, but not by the Reactor Technology Department.

- Sector - In hexagonal geometry a sector is one-sixth of the reactor lattice. A division of the lattice into sectors is shown in Figure 2. The first sector is the one which would be wholly contained in the first quadrant of an orthogonal mesh. Sectors are numbered clockwise. A one-sector mesh is shown in Figure 4.
- Gang-sector - Gang-sectors are numbered clockwise through each sector of each gang. The central patch is now a separate entity.
- Ring-sector - Ring-sectors are numbered clockwise through each sector of each ring. Again, the central patch is unique.
- Zone - A zone is a set of contiguous regions. A zone may be heterogeneous. In hexagonal geometry a zone may be a collection of any of the lattice units defined above (e.g., hex, patch, ring, gang, etc.)

1.3.2 Use of the RM Function

A terminal function has been installed to assist users in specifying SRP reactor descriptions for a hexagonal geometry calculation. This function is a graphical representation of the named data list structure

REACTOR.?RNAME.?RVSN.GEOMETRY.HEX.MESH.?LEVL

Use of the RM function allows the user to associate a two-character mnemonic with each of up to 40 different assembly types, and to specify a reactor charge by locating these mnemonics in a graphical representation of the charge face map on the CRT display panel. The user is referred to Volume II (page F.O.1) of this series for detailed information.

Care should be taken by the user to provide cross section records for all materials in the reactor. The RM function adds a moderator (MD) and a reflector (RE) to the mesh so that complete rings of patches may be considered. Thus, the number of materials is two greater than the user expects.

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.7
		Rev.	Date 9/73

1.4 Flux Record

There is a flux record REACTØR.?RNAME.?RVSN.FLUX.PØINT.?IGRP for each energy group (mnemonic ?IGRP). This record contains the neutron flux (n/cm²-sec) for the designated energy group at each "mesh point" in the reactor. These records are created only when specifically requested and may be used as input guesses for future problems.

1.5 Source Records

There are three different types of source records:

- REACTØR.?RNAME.?RVSN.SØURCE.GRØUP, in which the neutron source (n/cm³-sec) over the entire reactor for all energy groups is specified.
- REACTØR.?RNAME.?RVSN.SØURCE.REGION, in which the neutron source over each region of the reactor is given for all energy groups.
- REACTØR.?RNAME.?RVSN.SØURCE.PØINT.?IGRP, in which the neutron source at each point in the reactor is given for a single energy group (?IGRP).

1.6 Adjoint Records

Adjoint flux and adjoint source records have exactly the same form as the flux and source records. The only difference is the name ADFLUX is substituted for the name FLUX in the flux record name, and the name ADSØURCE is substituted for the name SØURCE in the source record name.

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set.	Vol.	Page
		III	E.1.8
		Rev.	Date
			9/73

Figure 1. Sample XY Mesh

Note that $N1SX = 4$ and $N2SX = 4$, and note also that each segment is divided into mesh intervals. The Roman numerals are region numbers. There are, thus, five different material compositions spread throughout the reactor, each region containing a different material. These regions can be further grouped to form zones; e.g., let regions I through IV be ZONE---1, and let region V be ZONE---2.

Figure 2. Reactor Face Map

Note the division of the reactor into sectors. One, two, three, or six of the sectors may be entered (in addition to the central hex). Recall that each hex ("circle") is a separate region. A typical patch of hexes is shown centered around septifoil number 46.

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.10
		Rev.	Date 9/73

GAUGE Method - FINE Mesh

Either Method - COARSE Mesh

GRIM Method - FINE Mesh

GRIM Method - SUPRFINE Mesh

Figure 3. Hexagonal Meshes

The central hex plus one sector of hexes is shown in the plan. The numbers indicate the indexing of the hexes. The heavy line is the boundary of the mesh before RM. The elevation shows 3 axis segments.

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.12
		Rev.	Date 9/73

(Blank)

d

2. Record Descriptions

MATERIAL RECCFC

NAME - 'REACTOR'.?RNAME.?RVSN.'MATERIAL'

LIST - NMTX, (CMAT(NMT), CZVN(NMT), CZLT(NMT), CZAS(NMT), CZID(NMT), NMT=1,
NMTX), ((A(I,NMT), I=1,15), NMT=1, NMTX)

SYMBOL	DEFINITION	TYPE
NMTX	NUMBER OF MATERIALS	I4
CMAT	MATERIAL NAME	C8
CZVN	FEWGFP LIBRARY VERSION NAME	C8
CZLT	FEWGFP LIBRARY LATTICE NAME	C8
CZAS	FEWGFP LIBRARY ASSEMBLY NAME	C8
CZID	FEWGFP LIBRARY CASE NAME	C8
A	IF CZID IS BLANK, ENTER FIFTEEN (15) CASE DESCRIPTORS I A(I,NMT)	R4
1	BUCKLING (CM ⁻²)	
2	EXPOSURE (MWD)	
3	CONTROL FLAG (SEE FOLLOWING LIST)	
4	MODERATOR TEMPERATURE (DEGREES C)	
5	MODERATOR DENSITY (GM/CC)	
6	ATOM FRACTION D2O IN MODERATOR (ATOM FRACT)	
7	CONCENTRATION OF LIQUID POISON IN MODERATOR (ATOM/BARN-CM)	
8	COOLANT TEMPERATURE (DEGREES C)	
9	COOLANT DENSITY (GM/CC)	
10	ATOM FRACTION D2O IN COOLANT	
11	CONCENTRATION LIQUID POISON IN COOLANT (ATOM/BARN-CM)	

IASSY	DESCRIPTION
1	FUEL ASSEMBLY
2	TARGET ASSEMBLY
3	CONTROL ASSEMBLY

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.14
		Rev.	Date 9/73

SYMBOL	DEFINITION	TYPE
	IASSY=1 IASSY=2 IASSY=3	
12	FUEL TEMP.	ROD TEMP.
13	FUEL DENSITY	ROD DENSITY
14	F.P. CONC.	F.P. CONC.
	F.P. CONC -> FISSION PRODUCT CONCENTRATION, (ATOM/BARN-CM)	
15	ENRICHMENT	ENRICHMENT
	ENRICHMENT IN UNITS (ATOM FRACTION)	

CONTROL FLAG, DISPLAYED AS A HEX INDEX (Z7 FORMAT)
FIRST CHARACTER REFERS TO SEPTIFOIL POSITION A
SECOND CHARACTER REFERS TO SEPTIFOIL POSITION B
ETC.
SEVENTH CHARACTER REFERS TO SEPTIFOIL POSITION G

CHARACTER	ROD TYPE
C	EMPTY POSITION
1	1.0 STRENGTH LI-AL ROD
2	1.5 STRENGTH LI-AL ROD
3	3.2 STRENGTH LI-AL ROD
4	7.4 STRENGTH LI-AL ROD
5	10.0 STRENGTH LI-AL ROD
6	14.4 STRENGTH LI-AL ROD
7	CADMIUM ROD
8	CADMIUM ROD
9	CADMIUM ROD
A	CADMIUM ROD
B	COBALT ROD
C	COBALT ROD
D	COBALT ROD
E	COBALT ROD
F	SPECIAL CONTROL ROD

GECMETRY RECORD--SLAB/SPHERE/CYLINDER

NAME - 'REACTOR'.?PNAM.?PVSN.'GECMETRY'. 'SLAB'
'REACTOR'.?PNAM.?PVSN.'GECMETRY'. 'SPHERE'
'REACTOR'.?PNAM.?PVSN.'GECMETRY'. 'CYLINDER'

LIST - N1SX, (CBCL1, CBCR1, NRGX, NZNX, (NPT1(N1S), TOP1(N1S), N1S=1, N1SX),
(DREG(NRG), DCMF(NRG), N1MN(NRG), N1MX(NRG), NRG=1, NRGX),
(DZCN(NZN), NRMN(NZN), NRMX(NZN), NZN=1, NZNX)

SYMECL	DEFINITION	TYPE
N1SX	NUMBER OF AXIS SEGMENTS	14
CBCL1	LEFT BOUNDARY CONDITION--ZERO ('FLUX' '/' 'CURRENT') OR 'PERIODIC'	C8
CBCR1	RIGHT BOUNDARY CONDITION--ZERO ('FLUX' '/' 'CURRENT') OR 'PERIODIC'	C8
NRGX	NUMBER OF REGIONS	14
NZNX	NUMBER OF ZONES	14
NPT1	NUMBER OF MESH POINTS IN AXIS SEGMENTS BY SEGMENT	12
TOP1	DISTANCE (CM) FROM INNER EDGE OF REACTOR TO OUTER EDGE OF SEGMENTS BY AXIS SEGMENT	P4
DREG	REGION NAME BY REGION	C8
DCMF	MATERIAL NAME BY REGION	C8
N1MN	INDEX OF FIRST AXIS SEGMENT IN THE REGION	12
N1MX	INDEX OF LAST AXIS SEGMENT IN THE REGION	12
DZCN	ZONE NAME BY ZONE	C8
NRMN	INDEX OF LOWEST NUMBERED REGION IN THE ZONE	12
NRMX	INDEX OF HIGHEST NUMBERED REGION IN THE ZONE	12

JOSHUA
DPSTM-500

Title Reactor Physics Data Sets
REACTOR Data Set

Vol.
III

Page
E.1.16

Rev.

Date
9/73

(Blank)

GECOMETRY RECORD--XY/RZ/R-TTHETA

```

NAME - 'REACTOR'.?RNAM.?RVSN.'GECOMETRY'. 'XY'
      'REACTOR'.?RNAM.?RVSN.'GECOMETRY'. 'RZ'
      'REACTOR'.?RNAM.?RVSN.'GECOMETRY'. 'R-TTHETA'

LIST - N1SX,N2SX,CBCL1,DCR1,CBCL2,DBCR2,NRGX,NTBX,NZNX,NZTX,(NPT1(N1S)
      ,TOP1(N1S),N1S=1,N1SX),(NPT2(N2S),TOP2(N2S),N2S=1,N2SX),
      (DREG(NTB),DCMP(NTB),N1MN(NTB),N1MX(NTB),N2MN(NTB),
      N2MX(NTB),NTE=1,NTBX),(CZCN(NZT),NRMN(NZT),NRMX(NZT),
      NZT=1,NZTX)
  
```

SYMBOL	DEFINITION	TYPE
N1SX	NUMBER OF X (OR R) AXIS SEGMENTS	14
N2SX	NUMBER OF Y (OR Z OR T) AXIS SEGMENTS NOTE: THE LETTER 'T' IS USED TO REPRESENT THETA.	14
CBCL1	BOUNDARY CONDITION--ZERO ('FLUX' OR 'PERIODIC' AT XMIN (RMIN))	C8
DBCR1	BOUNDARY CONDITION--ZERO ('FLUX' OR 'PERIODIC' AT XMAX (RMAX))	C8
DBCL2	BOUNDARY CONDITION--ZERO ('FLUX' OR 'PERIODIC' AT YMIN (ZMIN/TMIN))	C8
DBCR2	BOUNDARY CONDITION--ZERO ('FLUX' OR 'PERIODIC' AT YMAX (ZMAX/TMAX))	C8
NRGX	NUMBER OF REGIONS	14
NTBX	THE TOTAL NUMBER OF ENTRIES REQUIRED TO DESCRIBE ALL THE REGIONS	14
NZNX	NUMBER OF ZONES	14
NZTX	NUMBER OF ENTRIES IN THE ZONE DESCRIPTION TABLE	14
NPT1	NUMBER OF MESH POINTS IN X (R) AXIS SEGMENTS BY SEGMENT	12
TOP1	DISTANCE (CM) FROM INNER X (R) EDGE OF REACTOR TO OUTER EDGE OF SEGMENTS BY SEGMENT	R4
NPT2	NUMBER OF MESH POINTS IN Y (Z/T) AXIS SEGMENTS BY SEG-	

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.18
		Rev.	Date 9/73

SYMBOL	DEFINITION	TYPE
	MENT	I 2
TOP2	DISTANCE (CM/DEGREES) FROM INNER Y (Z/T) EDGE OF REACTOR TO OUTER EDGE OF SEGMENTS BY SEGMENT	R 4
DREG	REGION NAME BY REGION	C 8
LCMP	MATERIAL NAME BY REGION	C 8
N1MN	INDEX OF LOWEST NUMBERED X (R) SEGMENT IN THIS REGION	I 2
N1MX	INDEX OF HIGHEST NUMBERED X (R) SEGMENT IN THIS REGION	I 2
N2MN	INDEX OF LOWEST NUMBERED Y (Z/T) SEGMENT IN THIS REGION	I 2
N2MX	INDEX OF HIGHEST NUMBERED Y (Z/T) SEGMENT IN THIS REGION	I 2
	NOTE: THIS TABLE USES OVERLAY; THAT IS, EACH SUBSEQUENT ENTRY IN THE TABLE OVERLAYS PREVIOUSLY ENTERED DATA. ALSO EVERY PEGNAM AND COMP FIELD MUST CONTAIN THE APPROPRIATE HOLLERITH DATA; IF EITHER FIELD IS BLANK, THE LAST NON-BLANK VALUE IS ASSUMED	
DZCN	ZONE NAME BY ZONE	C 8
NRMN	INDEX OF LOWEST NUMBERED REGION IN THE ZONE	I 2
NRMX	INDEX OF HIGHEST NUMBERED REGION IN THE ZONE	I 2

GEOMETRY RECCRD--XYZ/R-THETA-Z/R-THETA-MU

NAME - 'REACTOR'.?RNAME.?RVSN.'GEOMETRY'. 'XYZ'
'REACTOR'.?RNAME.?RVSN.'GEOMETRY'. 'RTHETA-Z'
'REACTOR'.?RNAME.?RVSN.'GEOMETRY'. 'RTHETAMU'

LIST - N1SX,N2SX,N3SX,MXSX,ARGX,NZNX,NTBX,NZTX,CBCL1,CBCR1,CBCL2,CBCF2,
CBCL3,CBCR3,(NPT1(MXS),TOP1(MXS),NPT2(MXS),TOP2(MXS),
NPT3(MXS),TCP3(MXS),MXS=1,MXSX),(CREG(NTB),DCMP(NTB),
N1MN(NTB),N1MX(NTB),N2MN(NTB),N2MX(NTB),N3MN(NTB),N3MX(NTB),
NTB=1,NTBX),(CZCN(NZT),NRMN(NZT),NRMX(NZT),NZT=1,NZTX)

SYMBOL	DEFINITION	TYPE
N1SX	NUMBER OF X (R) AXIS SEGMENTS	I4
N2SX	NUMBER OF Y (T) AXIS SEGMENTS	I4
N3SX	NUMBER OF Z (M) AXIS SEGMENTS NOTE: THE LETTER 'T' IS USED TO REPRESENT THETA. THE LETTER 'M' IS USED TO REPRESENT 'MU'.	I4
MXSX	LARGEST OF THE THREE NUMBERS ABOVE	I4
ARGX	NUMBER OF REGIONS	I4
NZNX	NUMBER OF ZONES	I4
NTBX	THE TOTAL NUMBER OF ENTRIES REQUIRED TO DESCRIBE ALL REGIONS	I4
NZTX	NUMBER OF ENTRIES IN ZONE DEFINITION TABLE	I4
CBCL1	BOUNDARY CONDITION--ZERO ('FLUX' OR 'PERIODIC' AT XMIN (RMIN) OR 'CURRENT')	C8
CBCR1	BOUNDARY CONDITION--ZERO ('FLUX' OR 'PERIODIC' AT XMAX (RMAX) OR 'CURRENT')	C8
CBCL2	BOUNDARY CONDITION--ZERO ('FLUX' OR 'PERIODIC' AT YMIN (TMIN) OR 'CURRENT')	C8
CBCR2	BOUNDARY CONDITION--ZERO ('FLUX' OR 'PERIODIC' AT YMAX (TMAX) OR 'CURRENT')	C8
CBCL3	BOUNDARY CONDITION--ZERO ('FLUX' OR 'PERIODIC' AT ZMIN (MMIN) OR 'CURRENT')	C8

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.20
		Rev.	Date 9/73

SYMBOL	DEFINITION	TYPE
	'PERIODIC' AT ZMIN (MMIN)	C8
DSCR3	BOUNDARY CONDITION--ZERO ('FLUX' OR 'CURRENT') OR 'PERIODIC' AT ZMAX (MMAX)	C8
NPT1	NUMBER OF MESH POINTS IN X (R) AXIS SEGMENTS BY SEGMENT	I2
TOP1	DISTANCE (CM) FROM INNER X (R) EDGE OF REACTOR TO OUTER EDGE OF SEGMENTS BY SEGMENT	R4
NPT2	NUMBER OF MESH POINTS IN Y (T) AXIS SEGMENTS BY SEGMENT	I2
TOP2	DISTANCE (CM/DEGREES) FROM INNER Y (T) EDGE OF REACTOR TO OUTER EDGE OF SEGMENTS BY SEGMENT	R4
NPT3	NUMBER OF MESH POINTS IN Z (M) AXIS SEGMENTS BY SEGMENT	I2
TOP3	DISTANCE (CM/COSINE UNITS) FROM INNER Z (M) EDGE OF REACTOR TO OUTER EDGE OF SEGMENTS BY SEGMENT	R4
DREG	REGION NAME BY REGION	C8
DCMP	MATERIAL NAME BY REGION	C8
N1MN	INDEX OF LOWEST NUMBERED X (R) AXIS SEGMENT	I2
N1MX	INDEX OF HIGHEST NUMBERED X (R) AXIS SEGMENT	I2
N2MN	INDEX OF LOWEST NUMBERED Y (T) AXIS SEGMENT	I2
N2MX	INDEX OF HIGHEST NUMBERED Y (T) AXIS SEGMENT	I2
N3MN	INDEX OF LOWEST NUMBERED Z (M) AXIS SEGMENT	I2
N3MX	INDEX OF HIGHEST NUMBERED Z (M) AXIS SEGMENT	I2
	NOTE: THIS TABLE USES OVERLAY; THAT IS, EACH SUBSEQUENT ENTRY IN THE TABLE OVERLAYS PREVIOUSLY ENTERED DATA. ALSO EVERY REGNAM AND COMP FIELD MUST CONTAIN THE APPROPRIATE HOLLERITH DATA; IF EITHER FIELD IS BLANK, THE LAST NON-BLANK VALUE IS ASSUMED	
DZON	ZONE NAME BY ZONE	C8
NRMN	INDEX OF LOWEST NUMBERED REGION IN THE ZONE	I2
NRMA	INDEX OF HIGHEST NUMBERED REGION IN THE ZONE	I2

GECMETRY RECORD--FEX MESH

NAME - 'REACTOR'.?RNAM.?RVSN.'GECMETRY'.'FEX'.'MESH'.'?ZPGN

LIST - RTYP,NSYM,NTBX,(IY1(NTB),IX1(NTB),ASSY(NTB),NTE=1,NTBX),NMNX,
(MENU(NMN),MTRL(NMN),NMN=1,NMNX)

SYMBOL	DEFINITION	TYPE
RTYP	REACTOR TYPE (R/P/L/K/C/O/1/2/3/4/5) NOTE: THE LETTERS INDICATE A SRP REACTOR TYPE. THE NUMBERS INDICATE THE NUMBER OF RINGS OF PATCHES IN REACTORS OTHER THAN SRP	C1
NSYM	SYMMETRY INDICATOR (60/120/180/360)	I4
NTBX	NUMBER OF ENTRIES IN THE MESH SPECIFICATION TABLE	I4
IY1	X COORDINATE BY ASSEMBLY	I2
IX1	Y COORDINATE BY ASSEMBLY NOTE: THE X COORDINATE HERE REFERS TO THE Y1 COOR- DINATE ON THE SRP PRINTED FACE MAP FORMS; THE Y COORDINATE REFERS TO THE X1 COORDINATE	I2
ASSY	ASSEMBLY IDENTIFIER BY ASSEMBLY	C2
NMNX	NUMBER OF ENTRIES IN THE MENU	I4
MENU	ASSEMBLY IDENTIFIER BY TYPE. THESE IDENTIFIERS RELATE TO THE EIGHT-CHARACTER MATERIAL NAMES IN THE MATERIAL RECORD	C2
MTRL	FOUR CHARACTER MATERIAL IDENTIFIERS USED IN SETTING UP THIS RECORD FROM THE REACTOR MAP (RM) FUNCTION	

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.22
		Rev.	Date 9/73

(Blank)

GECOMETRY RECORD--HEX SPECS

NAME - 'REACTOR'.?RNAM.?RVSN.'GECOMETRY'. 'HEX'. 'SPECS'

LIST - IYC,IXC,PITCH,NMTX,NZNX,NZTX,DHTP,CBCH,DZRG,CZTA,(MENU(NMT),
ECMP(NMT),NMT=1,NMTX),(DZON(NZT),DZTM(NZT),NZL1(NZT),
NZL2(NZT),NZT=1,NZTX)

SYMBOL	DEFINITION	TYPE
IYC	X COORDINATE AT CENTER OF REACTOR	I4
IXC	Y COORDINATE AT CENTER OF REACTOR NOTE: X AND Y COORDINATES HERE REFER RESPECTIVELY TO Y1 AND X1 COORDINATES OF SRP PRINTED FACE MAP FORMS	I4
PITCH	HEXAGONAL LATTICE FITCH (INCHES)	R4
NMTX	NUMBER OF MATERIALS. THIS NUMBER MUST BE THE SAME AS THAT IN THE MATERIAL RECORD	I4
NZNX	NUMBER OF ZONES (0 FOR AUTOMATIC ZONE SETUP)	I4
NZTX	NUMBER OF ENTRIES IN THE ZONE DESCRIPTION TABLE NOTE: THE VALUE OF NZTX MUST BE AT LEAST ONE, EVEN IF THE SINGLE SET OF ENTRIES IN THE ZONE DES- SCRIPTION TABLE ARE LEFT BLANK	I4
DHTP	MESH TYPE TO BE CONSIDERED ('SUPRFINE'/'FINE' 'COARSE') NOTE: 'SUPRFINE' MESH IS NOT AVAILABLE WITH GAUGE CALCULATIONAL METHODS	C8
CBCH	CUTTER BOUNDARY CONDITION OF MESH--ZERO ('FLUX' 'CURRENT'), OR 'PERIODIC'	C8
CZTA	AUTOMATIC ZONE ALLOCATION INDICATOR ('PLANE' 'SECTOR'/'PATCH'/'HEX'/'GANG'/'GANG-SEC' 'RING'/'RING-SEC'). IF THIS TERM IS ENTERED BLANK, THEN THE ZONE DESCRIPTION TABLE WILL BE USED	C8
DZRG	QUALIFIER TO BE USED IN HEX.MESH RECORD NAME	C8
MENU	ASSEMBLY IDENTIFIER BY MATERIAL. THIS DATA MUST CORRES-	

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.24
		Rev.	Date 9/73

SYMBOL	DEFINITION	TYPE
	PCND TO THAT IN THE HEX.MESH RECORD	C2
CCMP	MATERIAL NAME BY MATERIAL. THIS DATA MUST CORRESPOND TO THAT IN THE MATERIAL RECORD	C8
CZCN	ZONE NAME BY ZONE. THIS IS LEFT BLANK FOR AUTOMATIC ZONE ALLOCATION	C8
DZTM	MANUAL ZONE ALLOCATION INDICATOR BY ZONE ENTRY ('SECTOR' '/'PATCH' '/'HEX' '/'GANG' '/'GANG-SEC'/'RING' '/'RING-SEC')	C8
NZL1	LOWER LIMIT OF MANUAL ZONE ALLOCATION INDICATOR	I2
NZL2	UPPER LIMIT OF MANUAL ZONE ALLOCATION INDICATOR	I2
NOTE: THIS TABLE USES OVERLAY; THAT IS, EACH SUBSEQUENT ENTRY IN THE TABLE OVERLAYS PREVIOUSLY ENTERED DATA. ALSO, EVERY CZCN AND CZTM FIELD MUST CONTAIN THE APPROPRIATE HOLLERITH DATA; IF EITHER FIELD IS BLANK, THE LAST NON-BLANK VALUE IS ASSUMED		

GEOMETRY RECORD--HEX-Z SPECS

NAME - 'REACTOR'.?RNAME.?RVSN.'GEOMETRY'. 'HEX-Z'. 'SPECS'

LIST - IY0,IX0,PITCH,N3SX,NMTX,NZNX,NZTX,DHTP,DBCH,DBCL3,DBCR3,DZTA,
(NPT3(N3S),TOP3(N3S),DZRG(N3S),N3S=1,N3SX),(MENU(NMT),
DCMP(NMT),NMT=1,NMTX),(DZON(NZT),DZTM(NZT),NZL1(NZT),
NZL2(NZT),NZMN(NZT),NZMX(NZT),NZT=1,NZTX)

SYMBOL	DEFINITION	TYPE
IY0	X COORDINATE AT CENTER OF REACTOR	I4
IX0	Y COORDINATE AT CENTER OF REACTOR NOTE: X AND Y COORDINATES HERE REFER RESPECTIVELY TO Y1 AND X1 COORDINATES OF SRP PRINTED FACE MAP FORMS	I4
PITCH	HEXAGONAL LATTICE PITCH (INCHES)	R4
N3SX	NUMBER OF Z-AXIS SEGMENTS. ALL HEXAGONAL PLANES IN A SEGMENT MUST HAVE THE SAME MATERIAL LAYOUT	I4
NMTX	NUMBER OF MATERIALS	I4
NZNX	NUMBER OF ZONES NOTE: NO VALUE OF NZNX IS REQUIRED IF AN AUTOMATIC ZONE SETUP IS REQUESTED	I4
NZTX	NUMBER OF ENTRIES IN ZONE DESCRIPTION TABLE NOTE: THE VALUE OF NZTX MUST BE AT LEAST ONE, EVEN IF THE SINGLE SET OF ENTRIES IN THE ZONE DES- SCRIPTION TABLE ARE LEFT BLANK	I4
DHTP	MESH TYPE TO BE CONSIDERED ('SUPRFINE'/'FINE' 'COARSE') NOTE: 'SUPRFINE' MESH IS NOT AVAILABLE WITH GAUGE CALCULATIONAL METHODS	C8
DBCH	OUTER BOUNDARY CONDITION OF MESH--ZERO ('FLUX' 'CURRENT'), OR 'PERIODIC'	C8
DBCL3	LOWER Z-AXIS BOUNDARY CONDITION--ZERO ('FLUX' 'CURRENT') OR 'PERIODIC'	C8
DBCR3	UPPER Z-AXIS BOUNDARY CONDITION--ZERO ('FLUX' 'CURRENT')	C8

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.26
		Rev.	Date 9/73

SYMBOL	DEFINITION	TYPE
	'CURRENT ') OR 'PERIODIC'	C8
DZTA	AUTOMATIC ZONE ALLOCATION INDICATOR ('PLANE ' / 'SECTOR '//'PATCH '//'HEX '//'GANG '//'GANG-SEC' / 'RING'/'RING-SEC'). IF THIS TERM IS ENTERED BLANK, THEN THE ZONE DESCRIPTION TABLE WILL BE USED	C8
NPT3	NUMBER OF INDIVIDUAL HEXAGONAL PLANES IN Z-AXIS SEGMENTS BY SEGMENT	I2
TUP3	DISTANCE (CM) FROM LOWER (Z) EDGE OF REACTOR TO UPPER EDGE OF SEGMENTS BY SEGMENT	R4
DZRG	Z-REGION INDICATOR TO BE USED FOR ?ZRG IN THE RECORD 'REACTOR'.?RNAM.?RVSN.'GEOMETRY'.'HEX'.'MESH'.?ZRG	
MEND	ASSEMBLY IDENTIFIER BY MATERIAL. THIS DATA MUST CORRES- POND TO THAT IN THE HEX.MESH RECORD	C2
DCMP	MATERIAL NAME BY MATERIAL. THIS DATA MUST CORRESPOND TO THAT IN THE MATERIAL RECORD	C8
DZON	ZONE NAME BY ZONE. ENTER BLANK FOR AUTOMATIC ZONE ALLOCATION	C8
DZTM	MANUAL ZONE ALLOCATION INDICATOR BY ZONE ENTRY ('PLANE ' / 'SECTOR ' // 'PATCH ' // 'HEX ' // 'GANG ' / 'GANG-SEC' / 'RING ' // 'RING-SEC')	C8
NZL1	LOWER LIMIT OF MANUAL ZONE ALLOCATION INDICATOR	I2
NZL2	UPPER LIMIT OF MANUAL ZONE ALLOCATION INDICATOR	I2
NZMN	INDEX OF LOWEST Z REGION IN THE ZONE	I2
NZMA	INDEX OF HIGHEST Z-REGION IN THE ZONE	I2
	NOTE: THIS TABLE USES OVERLAY; THAT IS, EACH SUB- SEQUENT ENTRY IN THE TABLE OVERLAYS PREVIOUSLY ENTERED DATA. ALSO, EVERY DZON AND DZTM FIELD MUST CONTAIN THE APPROPRIATE HOLLERITH DATA; IF EITHER FIELD IS BLANK, THE LAST NON-BLANK VALUE IS ASSUMED	

FLUX RECORD

```

NAME - 'REACTOR'.?RNAME.?RVSN.'FLUX'.'PCINT'.?IGRP
LIST - NGIX,N1X,N2X,N3X,(((FLUX(N1,N2,N3),N1=1,N1X),N2=1,N2X),N3=1,N3X)

```

SYMBOL	DEFINITION	TYPE
NGIX	NUMBER OF ENERGY GROUPS	I4
N1X	FOR NON-HEXAGONAL GEOMETRIES, THIS IS THE NUMBER OF POINTS IN DIMENSION ONE. FOR HEXAGONAL GEOMETRIES, THIS IS THE TOTAL NUMBER OF MESH POINTS REQUIRED TO FILL IN THE HEXES IN THE REACTOR MAP. A POINTWISE ARRAY IS SET UP READING FROM LEFT TO RIGHT ACROSS EACH ROW OF MESH POINTS AND FROM THE BOTTOM OF THE MESH TO THE TOP	I4
N2X	FOR NON-HEXAGONAL GEOMETRIES, THIS IS THE NUMBER OF POINTS IN DIMENSION TWO. FOR HEXAGONAL GEOMETRIES, THIS PARAMETER SHOULD ALWAYS BE GIVEN THE VALUE 1	I4
N3X	NUMBER OF POINTS IN DIMENSION THREE	I4
FLUX	NEUTRON FLUX (NEUTRON-CM/CC-SEC) NOTE: THERE MUST BE A DIFFERENT RECORD FOR EACH ENERGY GROUP	R4

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.28
		Rev.	Date 9/73

(Blank)

ADJOINT FLUX RECORD

NAME - 'REACTOR'.?RNAME.?RVSN.'ADFLUX'. 'POINT'.?IGRP

LIST - NGIX,N1X,N2X,N3X,(((AFLX(N1,N2,N3),N1=1,N1X),N2=1,N2X),N3=1,N3X)

SYMBOL	DEFINITION	TYPE
NGIX	NUMBER OF ENERGY GROUPS	14
N1X	FOR NON-HEXAGONAL GEOMETRIES, THIS IS THE NUMBER OF POINTS IN DIMENSION ONE. FOR HEXAGONAL GEOMETRIES, THIS IS THE TOTAL NUMBER OF MESH POINTS REQUIRED TO FILL IN THE HEXES IN THE REACTOR MAP. A POINTWISE ARRAY IS SET UP READING FROM LEFT TO RIGHT ACROSS EACH ROW OF MESH POINTS AND FROM THE BOTTOM OF THE MESH TO THE TOP	14
N2X	FOR NON-HEXAGONAL GEOMETRIES, THIS IS THE NUMBER OF POINTS IN DIMENSION TWO. FOR HEXAGONAL GEOMETRIES, THIS PARAMETER SHOULD ALWAYS BE GIVEN THE VALUE 1	14
N3X	NUMBER OF POINTS IN DIMENSION THREE	14
AFLX	ADJOINT NEUTRON FLUX NOTE: THERE MUST BE A DIFFERENT RECORD FOR EACH ENERGY GROUP	84

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.30
		Rev.	Date 9/73

(Blank)

JOSHUA

DPSTM-500

Title Reactor Physics Data Sets
REACTOR Data Set

Vol.
III

Page
E.1.31

Rev.

Date
9/73

SOURCE RECORD BY GROUP

NAME - 'REACTOR'.?RNAM.?RVSN.'SOURCE'. 'GROUP'

LIST - NGIX, (SCRC(NGI), NGI=1, NGIX)

SYMBOL	DEFINITION	TYPE
NGIX	NUMBER OF ENERGY GROUPS	14
SCRC	NEUTRON SOURCE (NEUTRONS/CC-SEC)	R4

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol.	Page
		III	E.1.32
		Rev.	Date
			9/73

(Blank)

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.33
		Rev.	Date 9/73

ADJOINT SOURCE RECORD BY GROUP

```

NAME - 'REACTOR'.?PNAM.?PVSN.'ADSOURCE'. 'GROUP'
LIST - NGIX, (ASRC(NGI),NGI=1,NGIX)

```

SYMBOL	DEFINITION	TYPE
NGIX	NUMBER OF ENERGY GROUPS	14
ASRC	ADJOINT NEUTRON SOURCE	24

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.34
		Rev.	Date 9/73

(Blank)

SOURCE RECORD BY GROUP AND REGION

```

-----
| NAME - 'REACTOR'.?KNAME.?RVSN.'SOURCE'. 'REGION'
| LIST - NGIX,NRGX,((SCPC(ARG,NGI),ARG=1,NRGX),NGI=1,NGIX)
|
-----

```

SYMBOL	DEFINITION	TYPE
NGIX	NUMBER OF ENERGY GROUPS	I4
NRGX	NUMBER OF REGIONS NOTE: FOR HEXAGONAL GEOMETRIES, A REGIONWISE ARRAY IS SET UP READING FROM LEFT TO RIGHT ACROSS EACH ROW OF HEXES AND FROM THE BOTTOM OF THE MAP TO THE TOP	I4
SCRC	NEUTRON SOURCE (NEUTRONS/CC-SEC)	R4

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol.	Page
		III	E.1.36
		Rev.	Date
			9/73

(Blank)

ADJOINT SOURCE RECORD BY GROUP AND REGION

NAME - 'REACTOR'.?FNAM.?RVSN.'ADSOURCE'.'REGION'
LIST - NGIX,NRGX,((ASRC(NRG,NGI),NRG=1,NRGX),NGI=1,NGIX)

SYMBOL	DEFINITION	TYPE
NGIX	NUMBER OF ENERGY GROUPS	I4
NRGX	NUMBER OF REGIONS NOTE: FOR HEXAGONAL GEOMETRIES, A REGIONWISE ARRAY IS SET UP READING FROM LEFT TO RIGHT ACROSS EACH ROW OF HEXES AND FROM THE BOTTOM OF THE MAP TO THE TOP	I4
ASRC	ADJOINT NEUTRON SOURCE	R4

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol.	Page
		III	E.1.38
		Rev.	Date
			9/73

(Blank)

SOURCE RECORD BY POINT

```

| NAME - 'REACTOR'.?FNAM.?RVSN.'SOURCE'.'PCINT'.'?IGRP
| LIST - NGIX,N1X,N2X,N3X,(((SORC(N1,N2,N3),N1=1,N1X),N2=1,N2X),N3=1,N3X)

```

SYMBOL	DEFINITION	TYPE
NGIX	NUMBER OF ENERGY GROUPS	I4
N1X	FOR NON-HEXAGONAL GEOMETRIES, THIS IS THE NUMBER OF POINTS IN DIMENSION ONE. FOR HEXAGONAL GEOMETRIES, THIS IS THE TOTAL NUMBER OF MESH POINTS REQUIRED TO FILL IN THE HEXES IN THE REACTOR MAP. A POINTWISE ARRAY IS SET UP READING FROM LEFT TO RIGHT ACROSS EACH ROW OF MESH POINTS AND FROM THE BOTTOM OF THE MESH TO THE TOP	I4
N2X	FOR NON-HEXAGONAL GEOMETRIES, THIS IS THE NUMBER OF POINTS IN DIMENSION TWO. FOR HEXAGONAL GEOMETRIES, THIS PARAMETER SHOULD ALWAYS BE GIVEN THE VALUE 1	I4
N3X	NUMBER OF POINTS IN DIMENSION THREE	I4
SORC	NEUTRON SOURCE (NEUTRONS/CC-SEC) NOTE: THERE MUST BE A DIFFERENT RECORD FOR EACH ENERGY GROUP	R4

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol. III	Page E.1.40
		Rev.	Date 9/73

(Blank)

ADJOINT SOURCE RECORD BY POINT

NAME - 'REACTOR'.?RNAM.?RVSN.'ADSCURCE'. 'PCINT'.?IGRF

LIST - NGIX,N1X,N2X,N3X,(((ASRC(N1,N2,N3),N1=1,N1X),N2=1,N2X),N3=1,N3X)

SYMBOL	DEFINITION	TYPE
NGIX	NUMBER OF ENERGY GROUPS	14
N1X	FOR NON-HEXAGONAL GEOMETRIES, THIS IS THE NUMBER OF POINTS IN DIMENSION ONE. FOR HEXAGONAL GEOMETRIES, THIS IS THE TOTAL NUMBER OF MESH POINTS REQUIRED TO FILL IN THE HEXES IN THE REACTOR MAP. A POINTWISE ARRAY IS SET UP READING FROM LEFT TO RIGHT ACROSS EACH ROW OF MESH POINTS AND FROM THE BOTTOM OF THE MESH TO THE TOP	14
N2X	FOR NON-HEXAGONAL GEOMETRIES, THIS IS THE NUMBER OF POINTS IN DIMENSION TWO. FOR HEXAGONAL GEOMETRIES, THIS PARAMETER SHOULD ALWAYS BE GIVEN THE VALUE 1	14
N3X	NUMBER OF POINTS IN DIMENSION THREE	14
ASRC	ADJOINT NEUTRON SOURCE NOTE: THERE MUST BE A DIFFERENT RECORD FOR EACH ENERGY GROUP	P4

JOSHUA DPSTM-500	Title Reactor Physics Data Sets REACTOR Data Set	Vol.	Page
		III	E.1.42
		Rev.	Date
			9/73

(Blank)

JOSHUA DPSTM-500	Title Part F - Engineering Data Sets	Vol. III	Page F.O.1
		Rev.	Date 9/73

Contents

F.1 PRØPERTY Data Set

JOSHUA DPSTM-500	Title Part F - Engineering Data Sets	Vol.	Page
		III	F.0.2
		Rev.	Date
			9/73

(Blank)

JOSHUA

DPSTM-500

Title Engineering Data Set
PRØPERTY Data Set

Vol. III	Page F.1.1
Rev.	Date 9/73

Report Written By

M. R. Buckner

Work Done By

M. M. Anderson
M. R. Buckner

Contents

	<u>Page</u>
1. Introduction	F.1.3
1.1 Introduction	F.1.3
1.2 Structure	F.1.3
1.3 Definition of Variables	F.1.5
2. Record Descriptions	F.1.7

JOSHUA
DPSTM-500

Title Engineering Data Set
 PRØPERTY Data Set

Vol.
III

Page
F.1.2

Rev.

Date
9/73

(Blank)

JOSHUA DPSTM-500	Title Engineering Data Set PRØPERTY Data Set	Vol.	Page
		III	F.1.3
		Rev.	Date
			9/73

1. Introduction

1.1 Introduction

The PRØPERTY data set is designed to provide engineering properties to calculational modules. The engineering properties are represented by polynomial correlations in one or more independent variables. This type of representation is preferred instead of tabular data because of the smaller storage requirements and the ease of use.

As described in Volume V of this document, the correlation data is processed by the subroutine PRØPTY which should be included in each calculational module using the PRØPERTY data set. It is only necessary for the user to provide the version name (VERSN) of the data set, the property name (PROP), and the material name (MAT) along with the engineering state of the problem to this subroutine. The property value at this engineering state is returned.

The materials included in the data set are those presently used in the reactor charge designs at the Savannah River Plant. Other materials will be added as a need is developed and additional data becomes available. It is important to note that engineering properties for materials of the same composition sometimes differ due to the methods of preparation, past thermal history, and physical structure. Thus, it is necessary for each user to verify the authenticity of a property correlation relative to the materials in his problem.

1.2 Structure

The structure of the PRØPERTY data set is illustrated in Figure 1.

The record PRØPERTY.CØNTENTS contains the names of all versions (VERSN) of the PRØPERTY data set.

For a given version (VERSN), the record PRØPERTY.?VERSN.CØNTENTS contains the names of all properties contained in that version along with a list of materials for which correlations are available. A short description (as Hollerith text) of each material is also included.

The record PRØPERTY.?VERSN.?PRØP.SVAR contains all the single variable correlations of the property (PRØP) in a version (VERSN) of the data set. The correlations are listed by material name (MAT). The units of the property are given along with the expansion variable, its units, and the upper and lower limits of the range of the independent variables.

PROPERTY.

<u>CONTENTS</u> Names of all versions of this data set.
Data for first version
...
Data for version ?VERSN
...
Data for last version

?VERSN.

<u>CONTENTS</u> Names of all properties in this version.
<u>VARIABLE</u> Record defining expansion variables such as weight % and enrichment.
Data for first property
...
Data for property ?PROP
...
Data for last property

?PROP.

<u>SVAR</u> Single variable data for each property
<u>MVAR</u> Multi-variable data for materials requiring such correlations.
Multi-variable data for first material.
...
Multi-variable data
...
Multi-variable data for last material.

Figure 1. Structure of PROPERTY Data Set.

JOSHUA DPSTM-500	Title Engineering Data Set PRØPERTY Data Set	Vol.	Page
		III	F.1.5
		Rev.	Date
			9/73

In the case of a material (MAT) which requires a multi-variable polynomial representation of a property, the correlation data is contained in the record PRØPERTY.?VERSN.?PROP.MVAR.?MAT. The maximum number of independent variables is five.

1.3 Definition of Variables

In some cases, the definition of an independent variable must be clearly stated in order to avoid errors in using a correlation. This is true for correlations depending on the weight percent of one component or the enrichment of an isotope. This information is contained in the record PRØPERTY.?VERSN.VARIABLE. The record contains the material name, variable name, the element or isotope to which the variable refers, and the units of the variable. These data are used by PRØPTY to process ASSEMBLY data.

JOSHUA DPSTM-500	Title Engineering Data Set PRØPERTY Data Set	Vol.	Page
		III	F.1.6
		Rev.	Date
			9/73

(Blank)

JOSHUA DPSTM-500	Title Engineering Data Set PRØPERTY Data Set	Vol. III	Page F.1.7
		Rev.	Date 9/73

2. Record Descriptions

LIST OF VERSIONS OF DATA SET

```

| NAME - 'PROPERTY'. 'CONTENTS'
| LIST - NVX, (VERSN(NV), NV=1, NVX)

```

SYMBOL	DEFINITION	TYPE
NVX	NUMBER OF DATA SET VERSIONS	I4
VERSN	NAME OF DATA SET VERSIONS	C8

CONTENTS (PROPERTIES) OF A VERSION OF DATA SET

NAME - 'PROPERTY'.?VERSN?. 'CONTENTS'

LIST - NPX,NMAT,(PROP(NP),(MAT(IM,NP),DESC(IM,NP),IM=1,NMAT),NP=1,NPX)

SYMBOL	DEFINITION	TYPE
DESC	32 CHARACTER MATERIAL DESCRIPTION	C32
MAT	MATERIAL NAME	C8
NMAT	MAXIMUM NUMBER OF MATERIALS FOR WHICH DATA IS AVAILABLE FOR ANY PROPERTY IN THIS VERSION OF THE DATA SET	I4
NPX	NUMBER OF PROPERTIES IN THIS DATA SET VERSION	I4
PROP	PROPERTY NAME	C8
VERSN	DATA SET VERSN NAME	C8

SINGLE VARIABLE CORRELATIONS FOR A PROPERTY (?PROP?) IN A
VERSION (?VERSN?) OF DATA SET

NAME - 'PROPERTY'.?VERSN?.?PROP?. 'SVAR'

LIST - NENTRY, NTERMS, PRUNIT, (MATNAM(I), EXTYPE(I), EXUNIT(I), LOWLIM(I),
HILIM(I), (COEFF(I, J), J=1, NTERMS), I=1, NENTRY)

SYMBOL	DEFINITION	TYPE
--------	------------	------

COEFF	COEFFICIENTS OF THE POLYNOMIAL EXPANSION LISTED IN ORDER STARTING WITH THE ZEROth ORDER TERM	R4
-------	---	----

EXTYPE	EXPANSION VARIABLE NAME. ALLOWED NAMES ARE:	C8
--------	---	----

NAME	DESCRIPTION	UNITS
ENRICH	ENRICHMENT	ATM PCNT
PRESS	PRESSURE	PSIA
TEMP	TEMPERATURE	DEG C
WGT COMP	WEIGHT COMPOSITION	WGT PCNT

EXUNIT	UNITS OF EXPANSION VARIABLE	C8
--------	-----------------------------	----

HILIM	UPPER LIMIT OF THE RANGE OF THE EXPANSION VARIABLE OVER WHICH CORRELATION APPLIES	R4
-------	--	----

LOWLIM	LOWER LIMIT OF THE RANGE OF THE EXPANSION VARIABLE OVER WHICH CORRELATION APPLIES	R4
--------	--	----

MATNAM	MATERIAL NAME	C8
--------	---------------	----

NENTRY	NUMBER OF ENTRIES	I4
--------	-------------------	----

NTERMS	MAXIMUM NUMBER OF TERMS IN THE POLYNOMIAL CORRELATIONS	I4
--------	--	----

PROP	PROPERTY NAME. ALLOWED NAMES ARE:	C8
------	-----------------------------------	----

NAME	DESCRIPTION	UNITS
DENSITY	DENSITY	LBS/FT3
HTFUSION	HEAT OF FUSION	PCU/LB
HTVAPOR	HEAT OF VAPORIZATION	PCU/LB
TMELT	MELTING TEMPERATURE	DEG C

JOSHUA DPSTM-500	Title Engineering Data Set PROPERTY Data Set	Vol.	Page
		III	P. 1.10
		Rev.	Date
			9/73

SYMBOL	DEFINITION	TYPE
PSAT	SATURATION PRESSURE	PSIA
TSAT	SATURATION TEMPERATURE	DEG C
SPHEAT	SPECIFIC HEAT	PCU/LB/C
SURTENS	SURFACE TENSION	LBS(F)/FT
KCCND	THERMAL CONDUCTIVITY	PCU/HR/FT/C
VISC	VISCOSITY	LB(M)/FT/HR
PPUINT	PROPERTY UNITS	C17
VERSN	DATA SET VERSION NAME	C8

MULTI-VARIABLE CORRELATIONS FOR A PROPERTY (?PROP?) OF A
MATERIAL (?MAT?) IN A VERSION (?VERSN?) OF DATA SET

NAME - 'PROPERTY'.?VERSN?.?PROP?.'MVAR'.?MAT?

LIST - NRANGE,NVAR,NTERMS,((VARNAM(I,K),VUNITS(I,K),LOWLIM(I,K),
HILIM(I,K),I=1,NVAR),K=1,NRANGE),((COEFF(M,N),PV1(M,N),PV2(M,N),
PV3(M,N),PV4(M,N),PV5(M,N),M=1,NTERMS),N=1,NRANGE)

SYMBOL	DEFINITION	TYPE
COEFF	COEFFICIENT OF A TERM OF A CORRELATION	R4
HILIM	UPPER LIMIT OF RANGE OF AN EXPANSION VARIABLE OVER WHICH A CORRELATION APPLIES	R4
LOWLIM	LOWER LIMIT OF RANGE OF AN EXPANSION VARIABLE OVER WHICH A CORRELATION APPLIES	R4
MAT	MATERIAL NAME	C8
NRANGE	NUMBER OF RANGES FOR WHICH CORRELATIONS ARE GIVEN	I4
NTERMS	MAXIMUM NUMBER OF TERMS IN ANY CORRELATION	I4
NVAR	MAXIMUM NUMBER OF INDEPENDENT VARIABLES (<6)	I4
PROP	PROPERTY NAME	C8
PV1	EXPONENT OF FIRST INDEPENDENT VARIABLE IN THIS TERM	R4
PV2	EXPONENT OF SECOND INDEPENDENT VARIABLE IN THIS TERM	R4
PV3	EXPONENT OF THIRD INDEPENDENT VARIABLE IN THIS TERM	R4
PV4	EXPONENT OF FOURTH INDEPENDENT VARIABLE IN THIS TERM	R4
PV5	EXPONENT OF FIFTH INDEPENDENT VARIABLE IN THIS TERM	R4
VARNAM	EXPANSION VARIABLE NAMES	C8
VERSN	DATA SET VERSION NAME	C8
VUNITS	UNITS OF EXPANSION VARIABLE	C8

JOSHUA DPSTM-500	Title Engineering Data Set PRØPERTY Data Set	Vol. III	Page F.1.12
		Rev.	Date 9/73

VARIABLE DEFINITION RECORD

NAME - 'PROPERTY'.?VERSN?. 'VARIABLE'
 LIST - NE, (MAT(I), VAR(I), ELISO(I), UN(I), I=NE)

SYMBOL	DEFINITION	TYPE
ELISO	ELEMENT OR ISOTOPE SYMBOL	C8
MAT	MATERIAL NAME	C8
NE	NUMBER OF ENTRIES	I4
UN	UNITS OF VARIABLE	C8
VAR	VARIABLE NAME. ALLWED NAMES ARE:	C8

NAME	DESCRIPTION	UNITS
ENRICH WGT COMP	ENRICHMENT WEIGHT COMPOSITION	ATM PCNT WGT PCNT

VERSN DATA SET VERSION NAME

C8

DISTRIBUTION

1. F. P. Baranowski, Washington	53. M. B. Stroud
2. J. H. Carswell	54. R. E. Cooper
3. M. M. Anderson	55. W. B. Brotherton, Jr.
4. W. L. Dietz	56. Helen P. Thompson, GE
5. T. B. Niland	57. F. D. Knight
6. D. N. Bridges	58. F. D. King
7. R. W. Guy, TN	59. W. V. Baxter
8. C. W. Farmer	60. R. J. Pryor
9. B. G. Kingery	61. M. R. Buckner
10. J. W. Croach, Wilmington	62. J. P. Church
11. F. E. Kruesi, Wilmington	63. B. Toppel, ANL
12. Kent F. Hansen, MIT	64. Richard Ehrlich, KAPL
13. R. F. Gambill, Jr.	65. D. Vondy, ORNL
15. L. W. Patrick	66. C. W. Craven, Jr., ORNL
17. O. A. Towler	67. R. L. Howell, Oak Ridge
18. D. A. Ward	68. M. Levine, BNL
19. C. J. Temple	69. Neal Carter, BMI
20. R. L. Carson	70. G. H. Best, LASL
21. J. N. Wilson	71. R. A. Dannels, WAPD
22. C. E. Parker	72. D. Roy, B&W
24. J. W. Wade	73. P. G. Aline, GE
25. H. C. Honeck	74. B. Hutchins, GE
26. J. H. Hightower	75. Alleen Thompson, GE
27. W. R. Hartshorn	76. H. Alter, AI
28. J. C. Jensen	77. R. F. DeAngelis, GU
29. R. S. Wood	78. Martin Becker, RPD
30. R. L. Karel	79. D. S. Craig, AECL
31. D. R. Finch	80. D. S. Craig, AECL
33. J. H. Maddox	81. A. B. Thomas
34. R. C. Haywood	82. L. A. Heinrich
35. J. W. Stewart	83. R. A. Thomason
36. B. P. Compton	84. Mrs. Margaret Butler, ANL
37. W. E. Graves	85. H. L. Dodds,
38. D. A. Sharp	86. George Minton, PWR
39. F. J. McCrosson	87. Bruce M. Beardsley, IN
40. P. L. Ames	88. R. L. Hellens, CEI
41. D. E. Hostetler	90. J. M. Sicilian
42. J. E. Beach	96. C. M. Brown
43. R. M. Wallace	97. A. N. Mallen
44. H. K. Clark	98. David S. Selengut, KAPL
45. F. R. Field	100. Vital Records
46. D. H. Knoebel	
47. I. M. Macafee	
49. J. R. Taylor	
50. P. B. Parks	
51. J. R. Hilley	
52. J. D. Spencer	
- TIS File:
14, 16, 48, 89, 91-95, 99
Destroyed
23, 32