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AMPX: A Modular Code System for Generating Coupled Multigroup Neutron-Gamma Libraries from ENDF/B

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OAK RIDGE NATIONAL LABORATORY

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COMPUTER SCIENCES DIVISION

AMPX: A MODULAR CODE SYSTEM FOR GENERATING COUPLED MULTIGROUP NEUTRON-GAMMA LIBRARIES FROM ENDF/B

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NOTICE

This document contains information of a preliminary nature. It is subject to revision or correction and therefore does not represent a final report.

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ABSTRACT

AMPX is a modular system for producing coupled multigroup neutron-gamma cross section sets. Basic neutron and gamma cross-section data for AMPX are obtained from ENDF/B libraries. Most commonly used operations required to generate and collapse multigroup cross-section sets are provided in the system.

AMPX is flexibly dimensioned; neutron group structures, gamma group structures, expansion orders to represent anisotropic processes are all arbitrary and limited only by available computer core and budget. The basic processes provided will (1) generate multigroup neutron cross sections; (2) generate multigroup gamma cross sections; (3) generate gamma yields for gamma-producing neutron interactions; (4) combine neutron cross sections, gamma cross sections, and gamma yields into final "coupled sets"; (5) perform one-dimensional discrete ordinates transport or diffusion theory calculations for neutrons and gammas and, on option, collapse the cross sections to a broad-group structure, using the one-dimensional results as weighting functions; (6) plot cross sections, on option, to facilitate the "evaluation" of a particular multigroup set of data; (7) update and maintain multigroup cross section libraries in such a manner as to make it not only easy to combine new data with previously processed data but also to do it in a single pass on the computer; and (8) output multigroup cross sections in convenient formats for other codes.

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COMPUTER CODE ABSTRACT

1. Name of program: AMPX
2. Computer for which program is designed: IBM 360 Series. Some versions have been made operational on a CDC-6600 and a UNIVAC 1108.
3. Nature of physical problem solved: Starting with basic ENDF/B data, this modular package will generate neutron, gamma or coupled neutron-gamma multigroup cross sections. A one-dimensional S_n calculational capability is provided for general use and for cross section collapsing. Treatments are included for resonance self-shielding effects.
4. Method of solution: Solution details are discussed in refs. 2 through 5 under item 16 below.
5. Restrictions on the complexity of the problem: The principle restriction is the availability of adequate core storage. All large modules are variably dimensioned which means that array sizes are set for the particular problem being run.
6. Typical machine time: Running times for this system are a function of several things: (a) the number of neutron groups; (b) the number of thermal neutron groups; (c) the number of gamma groups; (d) the number of resolved and unresolved resonances; (e) the detail in a one-dimensional S_n calculation; (f) the spectral weighting options; (g) the manner in which the ENDF/B evaluator represents his data; and (h) whether one Doppler broadens or resonance self-shields, etc., etc. A carbon run with 141 neutron groups (no thermal) and 26 gamma groups generated P_8 cross sections in 3.14 minutes on the IBM 360/91. A 21 neutron group, 18 gamma group P_3 case for nitrogen required 2.54 minutes on the CDC-6600 corresponding to 1.06 minutes on the 360/91.
7. Unusual features of the program: All major modules are variably dimensioned permitting optimal use of available core. Certain modules will automatically use external storage (disk, tape) if in-core storage is inadequate. All basic data processing modules can combine data from any combination of binary or BCD ENDF/B libraries. Very general multigroup interfaces are employed throughout. All major modules use free-form input data and can be executed in any order.

8. Related and auxiliary programs: AMPX produces cross sections compatible with the ANISN, DOT, CITATION, KENØ, and MORSE computer codes.
9. Status: The IBM version is in production use at ORNL. Versions have been made operational on both an CDC-6600 and UNIVAC 1108.
10. Machine requirements:

    IBM version - requires~410K bytes of storage in addition to the usual complement of tapes and direct access devices.

    CDC version - requires~90K words for present version. Extended Core Storage (ECS) is used to simulate the IBM random access facility.

    UNIVAC version - requires~90K words.
11. Programming language: The IBM version is written in IBM 360 FORTRAN IV H level.
12. Operating system: IBM ØS 360 with the FORTRAN H compiler (MVT version 21.6).
13. Other programming information: The modules in the present system are on ~50K source cards. Overlay facilities are employed throughout.
14. Material available: Source decks for the IBM version of AMPX can be obtained through the Radiation Shielding Information Center (RSIC) at ORNL.
15. This work was supported by the Neutron Physics Division of ORNL as part of the Reactor and Weapons Shielding Program under Subtask PE-074 for the Defense Nuclear Agency.
16. References:

1. N. M. Greene, J. L. Lucius, W. E. Ford, III, J. E. White, R. Q. Wright, and L. M. Petrie, "AMPX: A Modular Code System for Generating Coupled Multigroup Neutron-Gamma Libraries from ENDF/B," ORNL-TM-3706 (1974) (this document).
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- F. R. Mynatt of ORNL for his direction and guidance throughout the project.
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Without the aid of these gracious individuals, this project would have been futile.

1.0 INTRODUCTION

AMPX is a modular system for producing coupled multigroup neutron-gamma cross section sets from ENDF/B[1] data.† This document is a "user's manual" for that system. As such, it does not necessarily contain detailed descriptions of the physics employed by the various modules but is intended primarily to describe the mechanics for setting up and executing problems.

All commonly used techniques required to generate and collapse multigroup cross section sets are provided. In the initial stage of AMPX planning existing methods were evaluated and the capabilities of the computer codes XLACS,[2] MUG,[3] LAPHANO,[4] and XSDRN[5] were selected as the nucleus for AMPX development. As these codes were adapted to become modular components of the AMPX system, their capabilities were expanded and computational efficiency increased. These activities are described in some detail in Sections 3.0, 4.0, 5.0, 7.0, and 8.0 of this document.

AMPX is flexibly dimensioned; neutron group structures, gamma group structures, expansion orders to represent anisotropic processes are all arbitrary and limited only by available computer core and budget. The basic processes provided will (1) generate multigroup neutron cross sections; (2) generate multigroup gamma cross sections; (3) generate gamma yields for gamma-producing neutron interactions; (4) combine neutron cross sections, gamma cross sections, and gamma yields into final "coupled sets"; (5) perform one-dimensional transport calculations for neutrons and gammas and, an option, collapse the cross sections to a broad-group structure, using the one-dimensional results as weighting functions; (6) plot cross sections, on option, to facilitate the "evaluation" of a particular multigroup set of data; (7) update and maintain

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†The designations ENDF and ENDF/B are used in this document to refer both to a basic data library and to the overall Evaluated Nuclear Data File Procedures.

multigroup cross section libraries in such a manner as to make it not only easy to combine new data with previously processed data but also to do it in a single pass on the computer; and (8) output multigroup cross sections in convenient formats for other codes.

This version of AMPX includes the following modules (detailed descriptions of each are available in the indicated sections of this document):

1. DRIVER - The AMPX module manager, Section 2.0.
2. XLACS - Produces weighted multigroup neutron cross sections from ENDF/B, Section 3.0.
3. LAPHNGAS - Generates multigroup secondary gamma-ray production cross sections, Section 4.0.
4. SMUG - Generates multigroup photon cross sections, Section 5.0.
5. CHOX - Performs cross section interface management, Section 6.0.
6. NITAWL - Provides for resonance self-shielding and working library production, Section 7.0.
7. XSDRNPM - Provide one-dimensional S_n capability for spatial cross section weighting, Section 8.0.
8. NPTXS - Prepares point files for ENDF/B resonance nuclides, Section 9.0.
9. LAVA - Prepare an AMPX working library from an ANISN cross section library, Section 9.0.
10. CØMAND - Collapse ANISN libraries to coarser group ANISN libraries, Section 9.0.
11. ARID - Reduce the 37-21 DNA broad group library (ANISN formats), Section 9.0.
12. CØNVERT - Transform the old XSDRN-formatted neutron libraries to the AMPX master neutron library format, Section 9.0.
13. REVERT - Transform the new AMPX master neutron formats to the old XSDRN formats, Section 9.0.
14. VASELINE - Plot multigroup versus point, etc. data, Section 9.0.
15. OCTAGN - Generate libraries for the 1, 2, or 3 dimensional diffusion code, CITATION, Section 9.0.

16. RADE - Check AMPX multigroup libraries for consistency and reasonableness, Section 9.0.
17. MALØCS - Collapse any AMPX multigroup interface over an input spectrum.

Figures 1.1 through 1.17 describe the salient features of the above modules.

Section 10.0 presents several sample problems and lists their input and output.

Section 11.0 describes a miscellaneous collection of AMPX features and may be useful in specialized applications.

The input to all major modules is in the ANISN formats which are discussed in Section 13.0. A free-field option is available which greatly simplifies input data preparation for most problems.

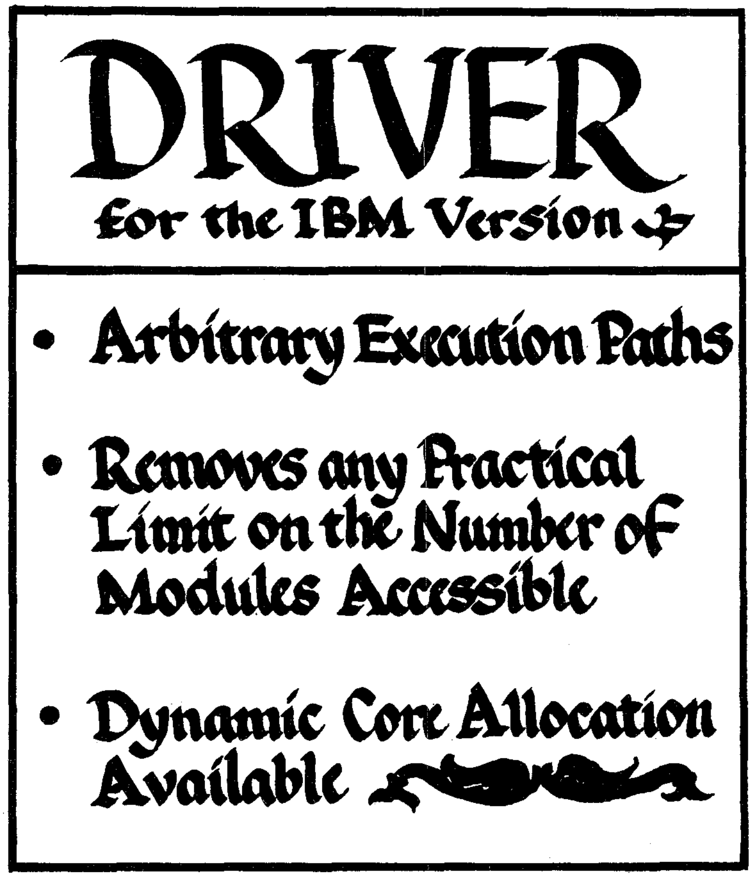

Figure 1.1. AMPX DRIVER program features (IBM version).

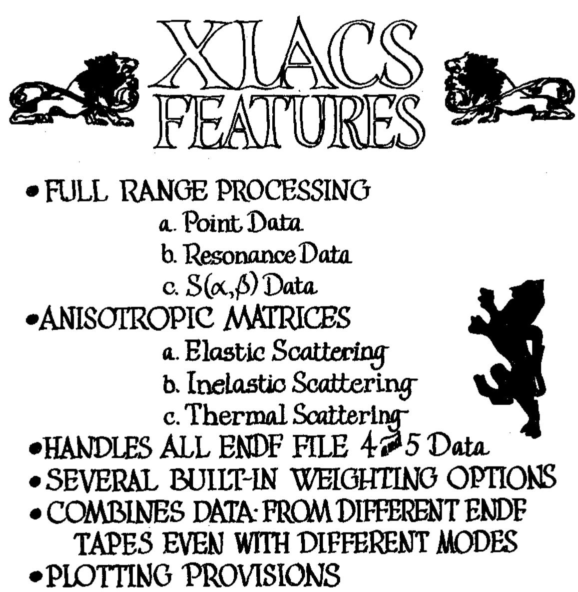

Figure 1.2. XLACS features.

LAPHNGAS

- Relative of Famous Los Alamos Family of "LAPH" Codes that make Photon Production Matrices
- Variety of Flux Weighting Options
- Anisotropic Production Matrices
- Free Form Input Data
- Flexible Dimensioning

Figure 1.3. LAPHNGAS features.

SMUG

- 10-15 times faster than MUG due to improved calculational techniques.
- Accepts ENDF Data
- Completely Flexible Dimensioned
- Built-in Photon Response Functions

Figure 1.4. SMUG features.

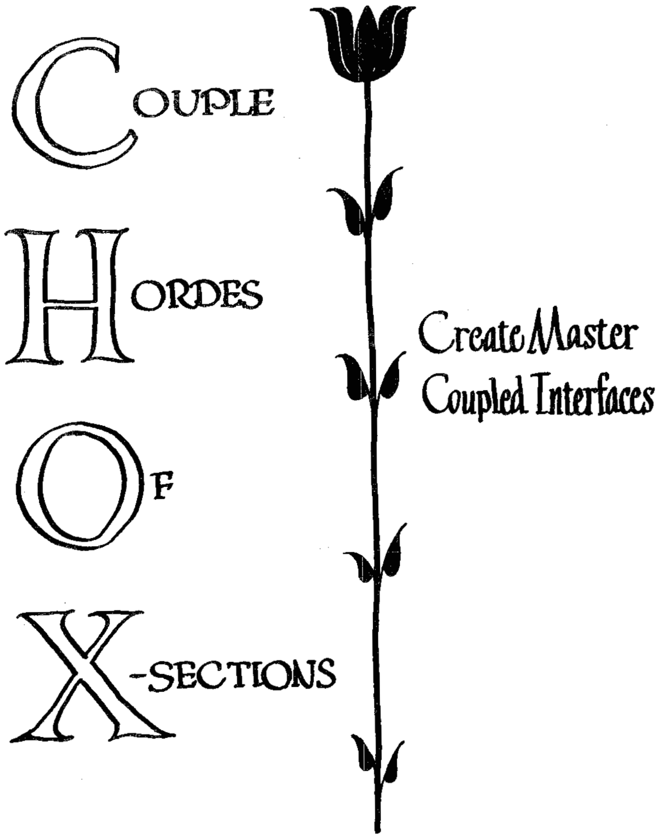

Figure 1.5. CHOX features.

Figure 1.6. NITAWL features.

XSDRNPM

XSDRN with Petrie Modifications

Latest ANISN Coarse Mesh
Rescaling for Convergence Acceleration

Very efficient Cross Section Storage

Variety of Weighting Options

a. Zone
b. Cell
c. Region
d. Cell Embedded in Reactor

Cross Section Output for ANISN, or MORSE

Figure 1.7. XSDRNPM features.

NPTXS

Produce Point Files for ENDF/B Resonance Nuclides

Numerical Doppler Broadening

Figure 1.8. NPTXS features.

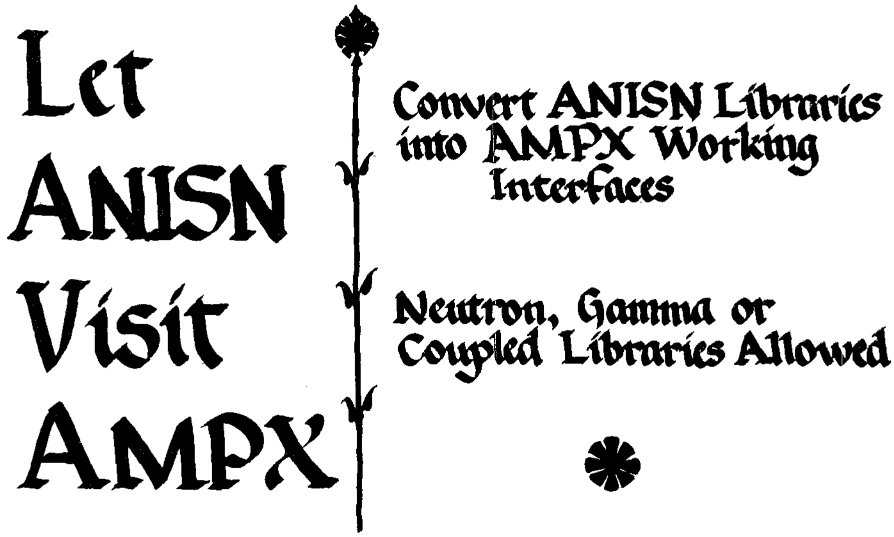

Figure 1.9. LAVA features

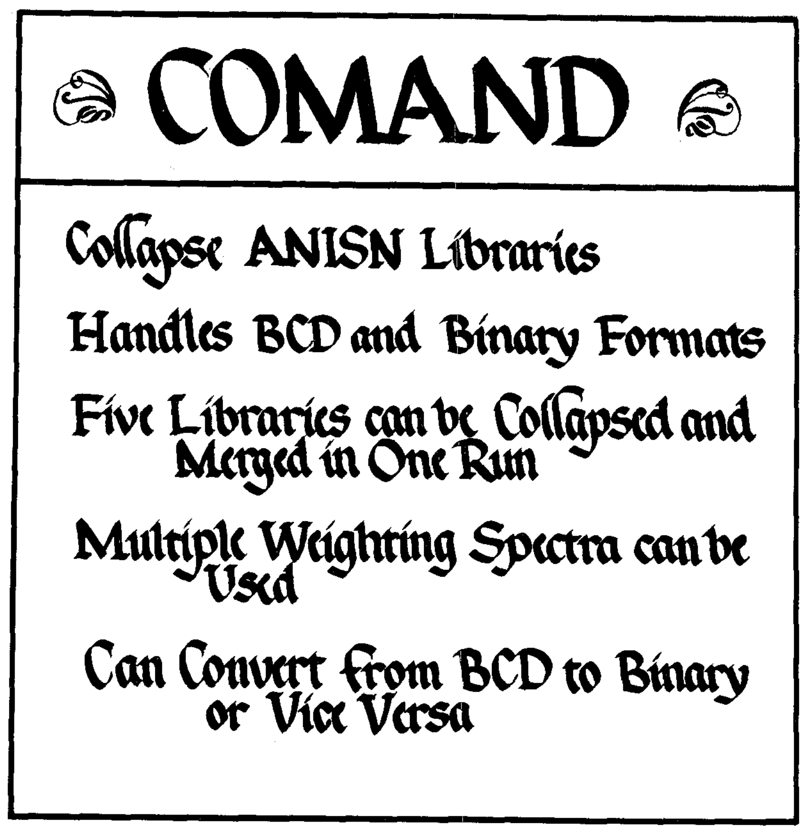

Figure 1.10. COMAND features.

ARID

Very Simple Input

Accesses DNA 37/21 Library

Features Similar to COMAND

Figure 1.11. ARID features.

CONVERT

Take Libraries formatted for the
ANTIQUE XSDRN Program
and Convert to an AMPX Master
Neutron Interface

Very Simple to Use

Figure 1.12. CONVERT features.

REVERT

Visit the Past

Convert an XLACS Library and Convert
it for Use in the XSDRN Code

Maximum of ~150 Groups Allowed

Not Free Form

Not Flexibly Dimensioned — Yecch!

Why not Use NITAWL and XSDRNPM
with your Library and forego
Using this Module?

Figure 1.13. REVERT features.

VASELINE

- Plot multigroup-versus-point data
- Plot multigroup-versus-multigroup data
- Plot point-versus-point data
- Plot, plot, plot
- Up to 100 plot commands in one run
- Any number of curves on same plot
- CRT facilities used
- Plot from neutron, gamma or coupled libraries
- Any number of ENDF/B libraries can be accessed in a run
- ENDF Tapes can be mixture of BCD & Binary modes
- Range selection provision allows "blowing up" details
- Flexibly dimensioned

Figure 1.14. VASELINE features.

OCTAGN

Convert an AMPX Working or Weighted Multigroup Library to a CITATION Library

Figure 1.15. OCTAGN features.

RADE

Extremely Easy to Use

Checks Neutron, Gamma or Coupled Libraries

ANISN Library Checking Option Available

Negative Cross Section Scan

Consistency Checks on 1-D an 2-D Cross Sections

Cosines of Group-to-Group Terms Checked

Figure 1.16. RADE features.

MALOCS

Collapse AMPX Master Cross Section Interfaces--Neutron, Gamma or Coupled Neutron-Gamma

Easy to Use

Fast and Efficient

Retains full Resonance Self Shielding Capabilities and full Generalities of the Original Master Library

Figure 1.17. MALOCS features.

2.0. DRIVER: THE AMPX MØDULE MANAGER

L. M. Petrie

The AMPX module manager, DRIVER, is a machine language module which has the following features:

1. It removes any practical limitation with respect to the number of modules (computer programs) which can be built into AMPX. Except for conflicts in I/Ø assignments, virtually any computer codes can be run "back-to-back" in the system.
2. The modules are independent of each other and communicate only through well-defined interfaces (tapes, disks). Each module can have its own overlay structure.
3. Provisions are provided to allow dynamically allocating all of the core available in a job step to the various modules. A module can then use this storage for "FORTRAN arrays." (This requires restructuring of the programs somewhat, and all AMPX modules have not been converted to use this feature.)

The execution path in AMPX is determined from the order a user inputs his data. In cases where a module does not require data produced by another module, the execution order is irrelevant; e.g., the order in which XLACS, LAPHNGAS, and SMUG are executed is completely flexible; however, these modules would all three have to be run before CHØX can make a coupled interface. If the AMPX interface (cross section library, point data file, etc.) is saved, the mounting of the interface eliminates the need for executing a particular module. For example, an XLACS neutron library can be saved and coupled with any number of different gamma structures in subsequent AMPX calculations that will not run XLACS.

A module is selected by an

= module name

card, where the = sign must appear in column 1 and the module name or alias must immediately follow (without imbedded blanks). The input data for a module are placed immediately after the = module name card for the module. AMPX modules will generally read input from logical 5 and can test an end-of-data, etc., exactly as they would in a stand-alone computer code. The input data for a module are exactly as they would be in a stand-alone version of the module. The input data for the various AMPX modules are described in the following sections of this document.

Module	Section
XLACS	3.0
LAPHNGAS	4.0
SMUG	5.0
CHØX	6.0
NITAWL	7.0
XSDRNPM	8.0
NPTXS	9.1
LAVA	9.2
CØNVERT	9.3
REVERT	9.4
OCTAGN	9.5
CØMAND	9.6
ARID	9.7
MALØCS	9.8
RADE	9.9
VASELINE	9.10

To illustrate how the modules might be executed, assume the following hypothetical problem:

- coupled neutron-gamma cross sections for sodium (MAT 4156), a resonance nuclide,
- neutron weighting to be $1/E\sigma_T$,
- plots desired
- coupled libraries should be checked
- ANISN library of fine group library desired,
- broad group ANISN library desired.

The setup could be:

=NPTXS

Make point sodium data from DNA file to use in XLACS and LAPHNGAS.

=XLACS

Produce multigroup neutron library which is $1/E\sigma_T$ weighted with point values from NPTXS.

=SMUG

Produce multigroup gamma library.

=LAPHNGAS

Produce multigroup neutron-to-gamma transfer coefficients that are $1/E\sigma_T$ weighted with NPTXS results.

=CHØX

Prepare master coupled library which combines libraries from XLACS, SMUG and LAPHNGAS.

=NITAWL

Prepare working library for subsequent XSDRNPM calculation and output fine group ANISN formatted library.

=XSDRNPM

Perform one-dimensional calculation and collapse to a broad group structure which is output in ANISN formats.

=VASELINE

Plot data from any multigroup library or ENDF library in this job-step, including the NPTXS point file.

=RADE

Check any of the AMPX formatted multigroup libraries produced in this job step.

In certain cases there is a need to execute the same module more than once. There are no restrictions in doing this except that one must take care that subsequent runs of the same module do not overwrite desirable information from previous runs. Some modules have provisions to alter the I/Ø assignments to alleviate this difficulty.

2.1 DRIVER Input/Output Assignments

The following are required I/Ø devices for the DRIVER module:

Logical Number or Name	Use
SYSIN	Card Input Stream
AMPXPRT	Output from the DRIVER
5*	Scratch device on which the SYSIN data are split and written on for various AMPX modules

*The default size of logical 5 is such that one can read approximately 1000 cards of input data on this device. The space allocation for this unit should be increased if the number of input cards exceeds this amount.

3.0. XLACS: A PROGRAM TO PRODUCE WEIGHTED MULTIGROUP NEUTRON CROSS SECTIONS FROM ENDF/B

J. E. White N. M. Greene J. L. Lucius

XLACS[1] is a computer program which calculates weighted multigroup neutron cross sections from ENDF/B data.[2] Its basic calculational routines were originally taken from the SUPERTOG[3] and the FLANGE-II[4] computer programs. XLACS is designed to produce full-energy range neutron cross section libraries. Provisions are included for treating fast, resonance, and thermal ENDF/B data in a single calculation. Energy group structure and expansion orders used to represent differential cross sections can be arbitrarily specified by the user. Smooth cross sections can be averaged over an arbitrary user-supplied weighting function or over any of several built-in weighting functions.

The ENDF/B format is very general. It allows data to be specified in several ways for practically any nuclear process. This generality requires a corresponding generality on the part of the processing codes which use the data. The XLACS program attempts not only to accommodate this generality but also to allow new processing methods to be easily added as modifications and improvements in data representation are made.

Most of the techniques employed in XLACS are briefly discussed in ref. 1. However, the elastic and inelastic routines have been upgraded and improved[5] since the original release of the program. The new coding:

a. allows discrete inelastic levels to be treated anisotropically to any order,
b. treats all forms of the angular distribution data (File 4),
c. allows producing anisotropic matrices for "continuum" inelastic processes, and
d. is more efficient both timewise and coding-wise than the original routines.

The input description for XLACS is given below. All data with the exception of a few title cards are read in the ANISN formats -- either free field, fixed field, or user field -- employed throughout AMPX.

3.1. XLACS Input Data

The first cards for XLACS will always be title cards, and the number of cards (one to five) will be determined by the operation to be performed. An XLACS calculation will do one of the following:

a. make a neutron cross-section library,

b. update a previously made neutron library,

c. selectively print or plot data from a neutron library.

Any reasonable combination of these operations can be performed. Data will be required according to the order of execution described below.

The first word on the first title card is used to select a starting operation in the sequence.

If the first four nonblank characters on the title card are UPDAte, step b is executed first.

If the first four nonblank characters are PLOT or EDIT, step c is first.

For any other group of nonblank characters, step a is first by default.

Step a requires five title cards. **The other steps require only one title card.**

Cards (1-5): Format (20A4)

TITLE - one card or five cards of Hollerith information depending on the operation to be performed first. These cards are used as title information for the neutron library to be produced.

The data now revert to the ANISN format. The first block of data has arrays 1$, 2$, and 3$.

NOTE: In the discussion which follows, the number in square brackets is the array length, that is, the number of items needed. Any condition connected with the array is stated in braces. Only required arrays (nonzero length) are input.

3.1.1. Input Data to Create a Neutron Library

Data Block 1

1$ - General Problem Information [5]

1. ID - Identification number for the neutron library. Any number will suffice. This number is carried as a user identifier on the library, but is not actually used by any module in AMPX.

2. NNUC - Number of ENDF materials to be processed.
3. MAXG - Number of neutron energy groups (total).
4. NEG - Number of thermal energy groups ($\leq$ MAXG).
5. IW - Weighting option. (The one thermal group problem is treated as a special case. In this instance, a Maxwellian spectrum is assumed for the thermal range. The Maxwellian shape is normalized to the requested weighting function at 5 kT.)

   0 - 1/E.

   1 - constant [W(E) = 1.0].

   2 - 1/E joined to fission spectrum above 67.4 keV joined to a Maxwellian spectrum at 5 kT. The temperature T is specified in the 2$ array.

   3 - $1/(\sigma_T E)$; each material has a unique weighting function, determined from the point values of the total cross section of the material. **(This option should not be used for resonance nuclides. Instead, the IW = 5 option is provided.)**

   4 - arbitrary function input in the 5$ and 6* arrays.

   5 - $1/(\sigma_T E)$ where σ_T will be read from logical unit 31 which is produced by the AMPX module NPTXS. NPTXS will process the resonance data for a nuclide, make point arrays for the (n,γ), fission, elastic and total cross sections and write these in an ENDF-like file on logical 31. The "MAT" number for the data is specified in the 71* array.

   6 - arbitrary function which is read from an existing library of weighting functions residing on logical unit 46. These weight functions are selected with the NPE parameter in the 2$ array. The following functions are presently available:

Identifier	Function
101	Inconel $(1/E\Sigma_t)$
102	Concrete $(1/E\Sigma_t)$
103	Air $(1/E\Sigma_t)$
104	SS-304 $(1/E\Sigma_t)$

   A more complete description of the data on logical 46 is given in Section 11.7 of this document.

7 - $(\frac{1}{\sigma_t + \sigma_0})\frac{1}{E}$ where σ_0 is given with the SIGP parameter of the 71* array described below. The "MAT" number and logical unit of the σ_t data is also given in the 71* array.

2$ - Secondary Problem Information [12]

{This array is required only if one of its elements is different from the default value shown in parentheses.}

1. LSLAB - The mean temperature in degrees Kelvin for the thermal Maxwellian Spectrum (300).
2. LCYL - The maximum number of points contained in any of the ENDF/B File 3 arrays (5000). Note that NPTXS will for many nuclides generate more than 5000 points which will require increasing this parameter.
3. LUNR - The dimension of an array used in conjunction with cross section weighting (5000). The worst case is probably for $\frac{1}{E\sigma_t}$ weighting of a nuclide with a large number of points in the total cross section array in which case LUNR needs to be approximately four times the number of points.
4. MSN - The maximum number of interpolation regions needed to describe any ENDF/B File 3 array or to describe any TAB1 record produced in XLACS; for example, the array produced by multiplying a cross section by a weighting function (250).
5. NPE - Identification of built-in weighting spectrum used when IW = 6 (0).
6. NPEP - Not used (0).
7. IDTAP - Number of reaction sections to be punched in ANISN free-form formats. This option is explained below (4$ array) (0).
8. MODE - ENDF library mode for fast data (0).

   0 or 1 - binary library,

   2 - BCD library.
9. NGMA - Logical number of the device which contains ENDF/B neutron cross-section data, i.e., the ENDF library (11). Data for the thermal energy range may or may not be on this device. Input data is provided in the 70$ array, items 6, 7, and 9, to accommodate the case when the thermal data resides in a separate file.

10. LCSM - Number of interpolation regions used to specify an arbitrary weighting spectrum (IW = 4). (0)

11. MCSM - Number of points in arbitrary weighting spectrum (IW = 4). (0)

12. NDNP - Trigger used for special functions. (0)
    = 0, no effect,
    ≠ 0, average the response functions and integrate built-in sources over the problem group structure. More than twenty functions are presently available. These are described in Section 11.6 of this document. These will be carried as a separate set of data on the XLACS neutron library.

3$ - General Output Options [6]
{Other than abbreviated printed output desired.}

i	IØPT(i) Correspondence	Value 0	Value 1	Value 2	Value 3
1	Resolved and Unresolved Resonance Processing	No Effect	Edit in AMPX Formats	Edit P_ℓ Data[a] in AMPX Formats $\ell > 0$ (if applicable)	Edit in Convenient Formats[b] As Processed.
2	Averaged Cross Sections by Energy Group and Process				
3	Elastic Scattering Matrices				
4	Thermal Scattering Matrices				
5	Inelastic Scattering Matrices				
6	(n,2n) Scattering Matrices				

[a]The P_0 data, if applicable, are edited with an IØPT(i=1; a value of 2 includes the P_0 data.

[b]The terminology "convenient" is used to imply a convenient form from a programming viewpoint.

T Terminate this data block.

Data Block 2

4$ - ENDF MT Identifiers of Cross Sections to be Punched in ANISN Formats [IDTAP]. File 3 cross sections averaged by XLACS can be punched in free-form formats for any applications that require this type of data.

5$ - Interpolation Schemes for Arbitrary Weighting Spectrum (NBT(I),JNT(I),I=1,LCSM) [2*LCSM] {IW=4}. See ref. 2 for format of TAB1 record. Standard ENDF/B conventions should be followed.

6* - Arbitrary Weighting Spectrum (per unit energy) (E(I),W(I),I=1,MCSM) [2*MCSM] {IW=4}. Low-to-high in energy. See ref. 2. Units are in eV.

7* - Energy Group Boundaries [MAXG + 1] {Not a standard set of boundaries}. The group boundaries are input (high-to-low) in eV. Many "standard" group structures are built into AMPX and, when these are desired, this array is omitted. See Section 11.7 for a list of the standard structures.

T Terminate this data block.

The data for NNUC ENDF materials to be processed are stacked one set after the other. A "set" of data for a nuclide is now described:

Card Type A - (20A4)

This card is a title card for the nuclide. This card will be carried throughout AMPX with the neutron cross sections. The first 12 words will be used as a title for ANISN cross section sets.

Data Block 3

70$ - Nuclide General Information [9]

1. ID19 - The identification number for this nuclide. This number is carried as the identifier of the data on the neutron cross library produced by XLACS.
2. MATNO - The ENDF/B material number of the set of data to be processed (fast data).
3. NTEMP - The number of temperatures at which a thermal scattering kernel will be calculated. Doppler broadening is included in the resonance treatments, but only at the first temperature specified in the 73* array of Data Block 4.

4. LORDER - Order of expansion for the scattering matrices above thermal. Elastic scattering and all inelastic levels (MT=51-90) will have matrices to this order.
5. NL - Order of expansion for the thermal scattering matrices.
6. NFY - ENDF tape mode for thermal data.

   0 or 1 - Binary,

   2 - BCD.
7. MATID - ENDF identification for $S(\alpha,\beta)$ data (if different from MATNO). In addition, this parameter serves as a trigger to perform a P_0 analytic free gas calculation. A free gas thermal kernel is generated using routines taken from the THERMOS[6] code.

   = -1, calculate analytic free gas kernel,

   = -2, normalize an analytic free gas kernel to the scattering cross section derived from the ENDF/B data.
8. KMXB - Number of atoms per molecule of principal scatterer for which $S(\alpha,\beta)$ data in File 7 of ENDF apply. For example, hydrogen is the principal scatterer in water and has two atoms per molecule.
9. KMXA - Logical number of device containing thermal data (MATID), if not the same device as MATNO.

71* - Resonance Information [6] {Needed for a resonance nuclide only}.

1. SIG - σ_0, the potential scattering cross section in barns per atom of the resonance nuclide for a nuclide (or mixture of nuclides) which is admixed with the resonance nuclide. This parameter is needed in the unresolved calculation and can be used to mock cell leakages by including an effective escape cross-section value. A large σ_p -- e.g., 10^6 -- is used for the infinite dilution case. **(Default = 1.0E+8)**
2. AJIN - The $\ell = 0$ j-state for which unresolved parameters will be passed to NITAWL. The NITAWL unresolved treatment is restricted to one unresolved sequence. The "most important" sequence should be identified and passed via this input parameter. The resonance with the smallest mean level spacing is usually the "most important".
3. RFACT - The r-factor in the Nordheim[7] resolved resonance treatment. This factor is used to determine the integration mesh

spacing (lethargy) through

$$\varepsilon_1 = (\Gamma_{D_0}/rE_0),$$

where ε_1 is the mesh size, Γ_{D_0} is the Doppler width at 273°K and E_0 is the resonance peak energy. A value of 5.0 has been found adequate for most cases. (5.0)

4. SFACT - The s-factor in the Nordheim resolved resonance treatment. This is the number of practical widths on either side of a resonance peak to which the Nordheim treatment is applied. A value of 5.0 has proven sufficient. (5.0)
5. MATPT - The "MAT" number of the point data set used for the σ_t in the IW = 5 or 7 options. (0)
6. NUNIT - The logical number of the device which contains the MATPT data described in item 5. (0)

T Terminate this data block.

Data Block 4 {NTEMP > 0}

Ignore this data block, if not required.

73* - Temperatures at Which to Evaluate the Thermal Scattering Kernel [NTEMP] {NTEMP > 0}.

Temperature (°K) are input (low-to-high).

T Terminate this data block.

This concludes the data for step a. Repeat the sets starting with Card Type A for each nuclide.

3.1.2 Input Data for Editing, Plotting, or Updating

The input data for problem types b and c are now described.

If, and only if, step a is not executed, the data for these steps require one title card which has the first 4 non-blank characters in the sequence UPDA, EDIT, or PLOT; otherwise these data are stacked without title card, behind the step a data.

Data Block 5

11$ - General Data for Steps b and c [6]

1. NEWID - Identification number of the neutron library to be created by an UPDATE operation.

2. ITRGUP - Update trigger.

   0 - do not update.

   1 - add the nuclides on logical 23 to those on a previously made neutron library (logical unit 21) and produce an updated library (logical unit 22). The new data produced in step a override in the case where duplicate identifications are encountered on logical 21 and 23.

   2 - copy the neutron library mounted on logical 23. The new library is produced on logical 22.

   -IIJJ - add |II| nuclides from step a (logical unit 23) and delete |JJ| from logical 21 to create a new library on logical unit 22; e.g., -II00 adds |II| nuclides from 23 to those on 21 to create a new 22, -JJ deletes |JJ| from 21 to create a new 22. A -123 adds 1 nuclide from 23 and deletes 23 from those in 21. A -14 would delete 14 nuclides from 21 in creating a new 22. Affected nuclides are specified in the 12$ and 13$ arrays.

3. IEDIT - Produce printed edits for IEDIT nuclides. Particular arrays to be edited are selected in the 16$ array.

4. IPLOT - Plot data for IPLOT nuclides. Options are provided in the 18$ array.

5. IPART - Perform IPART partial updates. This operation is described under the discussion of the 19$ and 20* arrays.

6. IOLD = 0, this run does not update a previously made neutron library.

   = 1, a previously made neutron library is mounted on logical 21.

T Terminate this data block.

<u>Data Block 6</u> {IEDIT + IPLOT + IPART > 0 or ITRGUP < 0}

12$ - Identification Numbers of Nuclides to be Used from Logical 23 in Making a New Logical 22 [II] {If -IIJJ option has been used for ITRGUP of 11$ array}.

13$ - **Identification** Numbers of Nuclides to be Deleted from Logical 21 in Constructing a New Library on Logical 22 [JJ] {If -IIJJ option has been selected}.

15$ - Identification Numbers of Nuclides for Which Edits are Desired [IEDIT] {IEDIT > 0}.

16$ - Edit Option Array [10] {IEDIT > 0}.

The following are off-on triggers. An integer 1 selects the data. A zero suppresses it.

1. Resonance data. (Averaged resonance cross sections and resonance parameters are printed.)
2. Averaged cross sections by group and process.
3. P_0 elastic scattering matrices.
4. P_ℓ ($\ell > 0$) elastic scattering matrices.
5. P_0 thermal scattering matrices.
6. P_ℓ ($\ell > 0$) thermal scattering matrices.
7. Inelastic scattering matrices.
8. (n,2n) scattering matrices.
9. Open.
10. Open.

17$ - Identifications of Nuclides for Which Plots are Desired [IPLOT] {IPLOT > 0}.

18$ - Plot Options [20] {IPLOT > 0}.

The process numbers for which plots are desired are input one after the other, in any order. XLACS uses the Calcomp CRT facility available at ORNL for its plots. ENDF process identifications (MT numbers) are used. Up to 20 different processes can be selected. Fill unused positions of this array with zeros. The identifications which can be edited or plotted are tabulated below.

MT	Description
1	Total cross section (sum of all partial cross sections).
2	Elastic scattering cross section.
4	Total inelastic cross section (sum of MT = 51, 52, 53, . . ., 90, 91).
16	(n,2n) cross section.
18	Total fission cross section (sum of MT = 19, 20, 21, plus any undefined part)
27	Absorption cross section (sum of MT = 18 and 101).

MT	Description
101	Parasitic absorption (sum of MT = 102, 103, 104, 105, 106, 107, 108, 109).
102	(n,γ) radiative capture cross section.
103	(n,p) cross section.
104	(n,d) cross section.
105	(n,t) cross section.
106	(n,He^3) cross section.
107	(n,α) cross section.
108	(n,2α) cross section.

19$ - Identification Numbers of Nuclides for Which a Partial Update is Desired [IPART] {IPART > 0}.

A partial update consists of an update of one set (i.e., process) of averaged values for a nuclide. Scattering matrices cannot be updated. This option is provided to be able to replace or augment sets deriving from ENDF data with alternate information.

20* - Partial Update Arrays [IPART*(MAXG+1)] {IPART > 0}.

The new arrays are stacked one after the other corresponding to the ID numbers in the 19$ array as follows:

Process 1 MT Number (use ENDF/B specifications)
cross section for group 1 (highest energy)
.
.
.
cross section for group MAXG
Process 2 MT number
.
.
.
Process IPART MT Number
cross section for group 1
.
.
.
cross section for group MAXG

T Terminate this data block and the XLACS case.

This concludes the input data specifications for XLACS.

Table 3.1. XLACS I/O Requirements

Logical Device	Process ENDF/B Data	Update Neutron Library	Edit Neutron Library	Plot	Approximate Space (Words)
5	Yes	Yes	Yes	Yes	
6	Yes	Yes	Yes	Yes	Problem dependent
11	Yes	No	No	No	--
14	Yes	No	No	No	A
15	Yes	No	No	No	A
16	Yes	No	No	No	A
17	Yes	No	No	No	D
18	Yes	No	No	No	BxD
21	No	Yes	No	No	--
22	No	Yes	Yes	Yes	CxD
23	Yes	Yes	No	No	BxD
Plot Tape	No	No	No	Yes	Determined by plots

A = max |number resolved resonances*6, $n*\ell$|

B = number of nuclides processed from ENDF/B

C = total number of nuclides on final tape

D = $n(n + 1)/2*(\ell + 50) + 2n$

n = number of energy groups

ℓ = maximum expansion order

3.2. XLACS Input/Output Assignments

An XLACS execution will generally require some combination of the following I/O devices:

Logical Number	Purpose
5	Standard input
6	Standard output
11	ENDF/B library (fast)
12	ENDF/B library (thermal)
14	Scratch device
15	Scratch device
16	Scratch device
17	Scratch device
18	Scratch device
21	Existing neutron library (old)
22	Final neutron library produced by update operation
23	Neutron multigroup library containing only the nuclides processed from ENDF/B by the XLACS run (new)

3.3. XLACS Error Messages

During execution, XLACS makes many checks to determine if a calculation is proceeding correctly. If difficulties are encountered, a message is printed, and the problem may be terminated. Some of the messages are printed by the routine where they are detected; others are "numbered" messages from one of the special error subroutines, ERR or ERROR. The following is a list of the numbered messages, the detecting subroutine, and a description of the difficulty.

Error Number	Detecting Subroutine	Description
1	UPDATE	Attempted to merge two neutron libraries with different energy group structures.
110	ECSI	Interpolation code not in range 1-5.
130	TERP2	Data, X(N) not in increasing order - probable program bug in thermal treatment.

Error Number	Detecting Subroutine	Description
131	TERP2	Interpolation points, XP(N), not in increasing order - probable program bug in thermal treatment.
132	TERP2	Interpolation table incorrect - probable program bug in thermal treatment.
133	TERP1	Interpolation code not in range 1-5.
134	TERP1	$X \leq 0$ cannot be interpolated by logs.
223	REATS	Temperature out of range given on library - $S(\alpha,\beta)$ data must span requested temperatures.
224	REATS	Improper T dependence, lists different lengths - probable ENDF/B error.
225	REATS	More than ND7 $S(\alpha,\beta)$ given for one β - increase ND7 in XLACS Routine.
226	REATS	More than NDR entries in α interpolation table - increase NDR in XLACS Routine.
230	PRØF7	Improper β interpolation table - probable program bug in thermal treatment.
231	PRØF7	Scattering law not given - free atom scattering value of zero.
232	KERC	Improper β interpolation table.
233	KERC	$S(\alpha,\beta)$ not integrable at small α.
234	KERA	Analytic $S(\alpha,\beta)$ not specified on ENDF/B.
235	KERA	$S(\alpha,\beta)$ not integrable at low α.
300	STØRE	Illegal record type encountered. Six types of ENDF/B records are allowed - probable program bug.
301	STØRE	Illegal record identifier encountered - identifier cannot be zero - probable program bug.
302	EU GPAV AVRG CRØS CWAX	Dense storage array count overflow - increase LUNR in 2$ array.
303	AVRG CRØS	A fetch-operation was attempted but the required array was not in dense storage - probable program bug.

Error Number	Detecting Subroutine	Description
308	AVRG GPAV CRØS DWAX	Overflow from a combine operation, generated data exceeds storage allocated - increase LUNR in 2$ array.
309	AVRG GPAV CRØS CWAX	A combine operation was attempted but a required array was not in dense storage - probable program bug.
310	CØMB	XL > XH - probable program bug.
311	CØMB	Illegal record identifier encountered - zero not allowed - probable program bug.
314	IPDS	Interpolation table incomplete - probable program bug.
315	GRATE	Interpolation table incomplete - probable program bug.
701	CRAV	Expects to integrate over a mesh defined from low to high in energy - probable program bug.
702	CRAV	Same as 701 reached by a different computational path.
2000	RESR	Encountered too many J states per ℓ state; increase the variable NJSPL in Subroutine RESN.

The following is a list of error messages printed out directly by the detecting subroutine:

Message: ****** ERROR XXXXXX ENTRIES REQUIRED IN XXX ARRAY
DATA EDIT CONTINUES

Detecting Routine: FIDO

Cause: Incorrect number of entries entered for the array. Check data and especially parameters which might be used to calculate the length of the array.

Message: ****** WARNING INTERPOLATION USED IN XX INTEGER ARRAY

Detecting Routine: FIDO

Cause: Interpolation has been requested in an integer array. Care must be taken to ensure entries are rounded correctly when the fixed point conversion is made.

Message: ****** FILL OPTION IGNORED IN XX ARRAY

Detecting Routine: FIDO

Cause: An attempt has been made to fill an array whose length is zero or which is already full.

Message: ****** WARNING ADDRESS XXXXXX IS BEYOND LIMITS OF XX ARRAY

Detecting Routine: FIDO

Cause: The address option has been used to modify a location beyond the limits of the identified array.

Message: XXXX RECORD INCORRECT OR MISSING

Detecting Routine: CONT

Cause: Requested array not found in dense storage - probable program bug.

Message: DESIRED MATERIAL NUMBER XXXXX IS NOT ON TAPE OR IS OUT OF ORDER. TAPE HAS BEEN SEARCHED TO MATERIAL NUMBER XXXXX.

Detecting Routine: TMAT

Cause: The material requested is not available on the ENDF/B library designated for use (logical NDFB or KMXA).

Message: ERROR-LNU = XX, BUT MUST BE EITHER 1 OR 2

Detecting Routine: TMF1

Cause: Data error on ENDF/B library relevant to the representation of ν. Check library.

Message: **** CANNOT FIT MESH IN 20 TRIES FOR RESONANCE
X ... X

Detecting Routine: MASH

Cause: RFACT and SFACT supplied in 71* array should probably be increased.

Message: INSUFFICIENT STORAGE TO RUN ELASTIC SCATTERING CALCULATION -- REQUIRED = XXXXXX HAVE XXXXX.

Detecting Routine: ELAS

Cause: Not enough core allocated to accommodate the problem. Increase LIMIT in the MAIN program.

Message: SOMETHING IS AMISS WITH YOUR THERMAL STRUCTURE -- IT SHOULD DESCEND

XXXXX XX ... X

Detecting Routine: REC4

Cause: Self-explanatory, check input data.

Message: BPLOT ERROR = X

Detecting Routine: BLAB

Cause: Complete printed message is self-explanatory.

Message: IMPROPER ARGUMENTS GRID NOT DRAWN

Detecting Routine: CRTGRD

Cause: Data cannot be plotted, see subroutine CRTGRD for details.

Message: MAGIC WORD ERROR - (MW, IIG, IMX, IMN) XXXXX XXXXX XXXXX XXXXX

Detecting Routine: MWLS

Cause: MWLS has encountered an impossible magic word, probably indicating a programming error.

Message: ERROR IN GRID SETUP

X X

Detecting Routine: GØTS

Cause: A precision problem in the elastic scattering calculation was encountered. Detailed information is printed with the error message.

In addition to the above messages, "numbered" stop statements are sometimes used to indicate error conditions:

STØP 1 (Subroutine RESN) indicates inadequate space to read resonance data. Increase LIMIT in MAIN Routine.

STØP 2 (Subroutine RESN) indicates inadequate space to perform resolved resonance calculation. Increase LIMIT in MAIN Routine.

STØP 3 (Subroutine RESN) indicates inadequate space to perform unresolved resonance calculation. Increase LIMIT as above.

STØP 0304	(Subroutine TMF4) no transformation matrix given to transform Legendre coefficients to required system. Regenerate ENDF/B data.
STØP 03114	(Subroutine TMF3) inadequate space allocated to process temperature-dependent file 3 data. Increase NDP in MAIN Routine.
STØP 12915	(Subroutine INELAS) insufficient space for inelastic calculation. Increase LIMIT in MAIN Routine.
STØP 26135	(Subroutine FLANGE) insufficient space for thermal calculation. Increase LIMIT in MAIN Routine.
STØP 29142	(Subroutine IMAT2) inadequate space allocated to process level model data. Increase NDP in MAIN Routine.

REFERENCES

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2. M. K. Drake, Editor, "Data Formats and Procedures for the ENDF Neutron Cross Section Library," BNL-50279 (October 1970).

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4.0. LAPHNGAS: AMPX MODULE FOR GENERATING MULTIGROUP SECONDARY GAMMA-RAY PRODUCTION CROSS SECTIONS

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LAPHNGAS retrieves photon production data from the ENDF data file and calculates either multigroup secondary gamma-ray production cross sections (SGRPXS) and/or multigroup secondary gamma-ray yields (multiplicities). To form coupled neutron-gamma cross sections, the SGRPXS or yields are passed to another AMPX module, CHØX, to be combined with multigroup neutron and photon interaction cross sections. When used as a stand-alone code, LAPHNGAS can calculate either fine neutron group or broad neutron group SGRPXS for use with other codes.

D. J. Dudziak, et al., of the Los Alamos Scientific Laboratory have written a series of codes to prepare multigroup photon-production matrices from ENDF data.[1] These codes have evolved from an early code called LAPH,[2] through a series of codes which incorporated various ENDF format changes to the LAPHANO[3] code, which served as the starting point for the development of LAPHNGAS. The following modifications were made to LAPHANO to produce LAPHNGAS:

- The code was flexibly dimensioned.
- The capability of computing anisotropic photon-production matrices was added.
- Various weighting options were provided.
- The input format was restructured to incorporate the FIDØ (ANISN) Input System described in Section 13.0.
- A cross section or yield matrix for each reaction type processed is uniquely identified and made available to other AMPX modules. Yield matrices are calculated for the fission and capture reactions of resonance materials. This allows "self-shielded" gamma production matrices to be formed.
- Data management changes were made to reduce input-output operations and to allow processing of both unformatted (binary) and formatted (BCD) ENDF libraries.

- Cross section and yield matrices are printed and punched only when indicated via input data (see 2$ array, items 7 and 8).
- Binary search techniques were implemented to locate specific energy points within energy arrays arranged in ascending order.

The elimination of LAPHANO calculations not required for SGRPXS and the modifications described above have reduced running times by a factor of six for materials having large quantities of data in ENDF file 15.

The LAPHANO report, reference 3, should be used as the theoretical reference for LAPHNGAS.

4.1. LAPHNGAS Input Data

With the exception of the ENDF data and title cards, all data for LAPHNGAS are input in the FIDO (ANISN) format. Input data for the code are as follows:

A. Title Card (format 18A4) - Problem Title.

B. 1$ Array - General Problem Information (4 entries):

1. MCR - Number of materials to be processed.
2. NFG - Number of neutron fine groups.
3. NGG - Number of gamma groups.
4. IM - Neutron reaction cross section (MF = 3) and/or photon production cross section (MF = 13) point weighting option:

   = 1, constant weighting.

   = 2, 1/E weighting.

   = 3, fission spectrum weighting for $E_n > 6.74 \times 10^4$ eV and 1/E weighting for $E_n \leq 6.74 \times 10^4$ eV, where the fission spectrum equation used is

$$W(E) = \sqrt{\frac{4E}{\pi\theta^3}}\, e^{-E/\theta} ,$$

   where $\theta = 1.273$ MeV.

   = 4, exact 1/E. An analytic solution of

$$\bar{\sigma} = \frac{\int \sigma(E) W(E) dE}{\int W(E) dE}$$

is programmed into LAPHNGAS. The equation used for the analytic solution depends on the interpolation scheme defined for adjacent $\sigma(E)$ values. The equations are defined in ref. 4, pp. 29-31.

= 5, $1/(E\sigma_T)$ weighting.

= 6, arbitrary function input in 11$ and 13* arrays. (Enter a -6 to suppress the listing of the arbitrary weight function.)

= 7, $1/(E\sigma_T)$ weighting where σ_T is obtained from the NPTXS module via logical unit 31.

$\geq$ 100, the arbitrary weighting function identified by |IM| will be read from the weighting function library located on logical unit 46. IM < 0 will delete printing of the function.

NOTE: When either weighting option 5 or 7 is selected, a constant, σ_0, may be entered in the 13* array which is added to σ_T. This provides the capability for Bondarenko weighting, i.e.,

$$W(E) = \left(\frac{1}{\sigma_T + \sigma_0}\right)\left(\frac{1}{E}\right)$$

2$ Array - General Problem Information (10 entries):

All parameters in this array have default values set by the code. For problems that can run with these default values, the 2$ array may be omitted.

1. LCSM - If $|IM| \neq 6$, enter zero. If $|IM| = 6$, enter the number of interpolation regions used to specify the arbitrary weighting spectrum. (Default value is 0.)
2. MCSM - If $|IM| \neq 6$, enter zero. If $|IM| = 6$, enter the number of points in the arbitrary weighting spectrum. (Default value is 0.)
3. IZM = 0, calculate photon-(number) production cross sections (SGRPXS's). (Default value is 0.)

   = 1, calculate photon-energy-production cross sections (SGREPXS's).

4. MS - Thermal capture cross section representation:
   = 0, no effect, i.e., weighting scheme identified by IM is used over the entire neutron energy range,
   = 1, use a Maxwellian weighting on the energy region lower than EUP (see 3* array). The temperature for the Maxwellian spectrum is given in the 3* array.

   (Default value is 1.)
5. MM - Maximum number of reaction types (MT numbers) to be entered in a 14$ array for this case. Default value is 1 to facilitate use of the MT = -1 option (see 14$ array).
6. IWO = 1, photon effective average energy for each gamma group is assumed to be the group midpoint energy (Track 1 calculation in ref. 2).
   = 2, yield function is the photon energy weighting function (Track 2 calculation in ref. 2).
   = 3, photon effective average energy for each gamma group is input in the 9* array (Track 1 calculation in ref. 2).

   (Default value is 1.)
7. IOO = -9, prints SGRPXS matrix for total only. (Default value is -9).

   IOO = 0, print yield or SGRPXS matrix for each reaction.
8. IAM = 0, no effect. (Default value is 0.)
   = 1, punch the SGRPXS or SGREPXS.

   The punched data are in a format for use in the ASCC coupling code.† The punched output will not include the resonance yield data.
9. ICK = 0, no effect. (Default value is 0.)
   = 1, print a detailed output.

†The Sample Coupling Code (ASCC) is documented in Appendix B of ref. 5.

10. NNBDGP = 0, the LAPHNGAS fine neutron group SGRPXS and resonance MT = 102 and MT = 18 yields are passed to a subsequent AMPX module. (Default value is 0.)

= number of broad neutron groups. This triggers a stand-alone LAPHNGAS calculation to reduce the fine neutron group SGRPXS to the broad neutron group structure identified in data blocks E - K.

End data block B with a T.

C. Thermal information, group structures, and weighting function data. Arrays not applicable to problem should be omitted.

3* Array, enter only if MS = 1 and default values are unacceptable.

1. TEMP - Mean neutron temperature of Maxwellian distribution (°K). Default value is 293.6.
2. EUP - Upper neutron energy for application of the thermal (n,γ) correction (eV). Default value is 5kT = .125.
3. VNON - Not used.

7* Array (NFG+1 entries): Neutron fine-group energy mesh in decreasing magnitude of energy (eV units). Many "standard" group structures are built into AMPX and, when one of these is desired, this array is omitted. See Section 11.7 for a list of the standard structures.

8* Array (NGG+1 entries): Gamma group energy mesh in decreasing magnitude of energy (eV units). If one of the "standard" gamma group structures will suffice, this array may be omitted.

9* Array (NGG entries) - enter only if IWO = 3.
Effective average gamma energy, $\overline{E}_g$, for each group. (Same for all materials and reaction types. Code checks that $E_g < \overline{E}_g \leq E_{g+1}$.) Energies are in units of eV's - high to low.

11$ and 13* are entered only if $|IM| = 6$.

11$ Array (2*LCSM entries): Interpolation data for arbitrary weighting spectrum (NBT(I), JNT(I), I=1, LCSM).

13* Arbitrary weighting spectrum (per unit energy), (E(I),W(I), I = 1, MCSM) low to high energy. Units of E(I) are eV.

End data block C with a T.

D. 14$ Array (5+MM entries), material-dependent data. Enter a 14$ array for each material to be processed.

1. Material identification (ENDF MAT number).
2. IQA - Order of P_n. (Default value is 0.)
3. NDFB - Logical unit for the ENDF cross section library. (Default value is 11.)
4. MODE = 1, ENDF/B library in unformatted (binary) mode. (Default value is 1.)
   = 2, ENDF/B library in formatted (BCD) mode.
5. MTSL - The number of reaction types designated by the user to be processed. Default value is 1 to accommodate the normal case where MT = -1.
6. MT - Enter the ENDF/B MT's, reaction type identifiers, to be processed. If the default is not being used, MM (item 5, 2$ array, this section) entries are required. MT = -1 means use all MT numbers for which photon production data exist. (Default value is -1.)

End each 14$ array with a T.

If NNBDGP (2$ array) was equal to 0, this concludes the input to LAPHNGAS. If NNBDGP was greater than 0, the following data are required.

E. 15$ Array - Broad Group Numbers (NFG entries):

This array contains the broad-group numbers into which the fine neutron groups are collapsed. For example, if the first five neutron groups are to be collapsed into the 1st broad group, the first five entries in the 15$ array are 1's; if the 6th through 8th neutron groups are to be collapsed into the 2nd broad group, the 6th through 8th entries in the 15$ array are 2's; etc.

End data block E with a T.

F. Nonresonance Weighting Functions:

1. Title card in 18A4 format.
2. 17* Array (NFG entries):

   Fine-group smooth (flux) weighting functions for reduction of the nonresonance SGRPXS's to the broad group structure. Data should start at the top group. These data are normalized to 1.0 in LAPHNGAS.

End data block F with a T.

If, and only if, one or more of the materials was a resonance material, enter the following data block. (If the case consists entirely of non-resonance materials, the input to LAPHNGAS is complete.)

G. Resonance Weighting Functions:

1. Title card in 18A4 format.
2. 18* Array (NFG entries):

   Fine-group resonance weighting functions for the reduction of the resonance SGRPXS's to the broad group structure. Data should start at the top group. These data are normalized to 1.0 in LAPHNGAS.

End data block G with a T.

The following four data blocks are repeated for each resonance material in the order which the resonance material numbers appear in the 14$ arrays, i.e., enter data blocks H, I, J, and K for the first resonance material identified in a 14$ array, repeat the sequence for the second resonance material, etc.

H. Resonance Capture Cross Sections:

1. Title card in 18A4 format.
2. 19* Array (NFG entries):

   Fine-group resonance capture cross sections (MT = 102) starting at the top group.

End data block H with a T.

I. Resonance Fission Cross Sections:

1. Title card in 18A4 format.
2. 20* Array (NFG entries):

   Fine-group resonance fission cross sections (MT = 18) starting at the top group.

End data block I with a T.

J. Smooth Capture Cross Sections:

1. Title card in 18A4 format.
2. 21* Array (NFG entries):

   Fine-group smooth (including unresolved resonance) capture cross sections (MT = 102) starting at the top group.

End data block J with a T.

K. Smooth Fission Cross Sections:

1. Title card in 18A4 format.
2. 22* Array (NFG entries):
   Fine-group smooth (including unresolved resonance) fission cross sections (MT = 18) starting at the top.

End data block K with a T.

This concludes the input to LAPHNGAS.

4.2. LAPHNGAS Input/Output Assignments

Input/output devices required for LAPHNGAS are as follows:

Logical Number	Use
5	Input
6	Printed Output
7	Punched Card Output
14	Scratch Device
15	Scratch Device
16	Scratch Device
17	Scratch Device
18	Scratch Device
19	Scratch Device
24	AMPX Interface
31	Total cross section from the NPTXS module, used only when weighting option 7 is selected
46	Weighting function library, used only when selected by input option
NDFB (14$ Array)	ENDF Cross Section Library (Default value is 11)

The logical unit numbers for the input, printed output, and punched card output - ISO, ISI, and NPU, respectively - are "set" in LAPHNGAS subroutine LAPHOR. These numbers can be easily redefined for LAPHNGAS by changing the appropriate statement in LAPHOR.

4.3. LAPHNGAS Error Messages

Various error stops are included in LAPHNGAS which cause the module to stop computing and return control to the DRIVER module when an error condition is encountered. The fatal error returns are as follows:

Error Number	Detecting Subroutine	Explanation
50	LAPHOR	Input error, see code output for an explanation.
100	PROB1	Input error, the neutron fine and broad group energy boundaries must be given in order of decreasing magnitude in energy.
110	PROB1	Input error, arbitrary weighting function energies must be input in ascending order.
133	TERP1	Interpolation code not in range 1-5.
134	TERP1	$X \leq 0$ cannot be interpolated by logs.
150	MUSH	σ_T not found, check ENDF library file 3, MT = 1.
200	INTG	The flag indicating dependence of Y(X) on X is 0, but must be in range 1-5; error is probably a program bug.
400	MUSH	Number of points at which σ_T is defined plus number of neutron groups exceeds 5000. Increase dimension of IAUG in PROB1.
501	PR15	The neutron energy must not lie outside the range of energies for which the photon yield is tabulated, or photon distribution given, check ENDF data.
502	PR15	Interpolation table incorrect - probable program bug.
504	PR15	File 15 data incompatible with mesh formed by merger of energy points at which σ_T is defined and neutron energy group boundaries. See subroutine PR15, statement 606, for additional information.
506	PR15	Gamma group structure and file 15 data incompatible. Check gamma group structure for input error and then ENDF/B file 15 data files.

Error Number	Detecting Subroutine	Explanation
507	PR15	See error message 506.
550	MATT	σ_T not found, check ENDF library file 3, MT = 1.
600	TRC2	Error in determining from which level in a cascade a transition occurs. If an MT number for inelastic scattering is input in the 2$ array, the MT numbers for all lower levels must also be included.
603	TRC2	Interpolation table incorrect; see code output for additional information.
604	TRC2	Subsequent cascades for File 12, LO = 2 data exceeded the core allocation parameter MNC (set in MATT). Increase MNC and resubmit case.
610	TRC2	The energy range of the arbitrary weighting function read in may be incomplete. Check the 13* array.
620	TRC2	Interpolation table for arbitrary weighting function read in is probably incorrect. Check the 11$ array.
630	TRC2	Denominator was $\leq$ zero in weighting calculation. Check group structures and 3* array input.
640	TRC2	Interpolation table for σ_T incorrect; check ENDF library MF = 3, MT = 1.
701	XSEC	Interpolation table probably in error. See code output for additional information.
702	XSEC	Cross sections in File 3 cannot be found corresponding to the MT number written on unit 15 or unit 17. Check ENDF data.
710	XSEC	The energy range of the arbitrary weighting function read in may be incomplete. Check the 13* array.

Error Number	Detecting Subroutine	Explanation
720	XSEC	Interpolation table for arbitrary weighting function read in is probably incorrect. Check the 11$ array.
730	XSEC	Interpolation table for σ_T may be incorrect. Check ENDF library MF = 3, MT = 1.
740	XSEC	Denominator was ≤ 0 in weighting calculation. Check group structures and 3* array input.
750	XSEC	Code is attempting to execute an impossible path. Check all input relevant to the weighting options.
1001	PHOTON	First card on unit IEN is not head record. Ensure that the proper library was mounted on unit IEN.
1002	PHOTON	Files 12 and 13 both missing from ENDF library. LAPHNGAS cannot process this material.
1200	CRAVE	Interpolation code not in range 1 - 5.
1210	CRAVE	X1 > X2, attempting to integrate over a range where no data is defined - probable program bug.
1220	CRAVE	XL < X1, attempting to integrate over a range where no data is defined - probable program bug.
1230	CRAVE	XU > X2, see error message 1220.
1250	CRAVE	XL > XU, expects limits of integration to be in ascending order - probable program bug.
1300	INGATE	Lower limit of integral > upper limit of function - probable program bug.
1310	INGATE	Upper limit of integral $\leq$ lower limit of function - probable program bug.
1320	INGATE	No data available within integration limits - probable program bug.

Error Number	Detecting Subroutine	Explanation
1330	INGATE	Interpolation code not in range 1 - 5.
1400	LEGMOM	LI flag from File 14 data was not 0 or 1.
1410	LEGMOM	Could not find File 14 data.
1420	LEGMOM	Isotropic calculation requested via input parameter IQA, attempting anisotropic calculation - probable program bug.
1440	LEGMOM	Interpolation table incorrect. Check ENDF File 14 data.
1450	LEGMOM	LTT flag from File 14 was not 1 or 2.
1460	LEGMOM	ILO > NPTS, data not available for processing; see subroutine LEGMOM in the vicinity of statement 755 for details.
1510	BRDGP	Broad group numbers not in increasing order.
1520	BRDGP	Process ID numbers must be 3, 18, or 102.
1530	REDUCE	NBG > NFG, requesting an impossible operation; check input data.

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1. D. J. Dudziak, Editor, "ENDF Formats and Procedures for Photon Production and Interaction Data," LA-4549 (1971).
2. D. J. Dudziak, A. H. Marshall, and R. E. Seamon, "LAPH, A Multigroup Photon Production Matrix and Source Vector Code for ENDF/B," LA-4337 (1969).
3. D. J. Dudziak, R. E. Seamon, and D. V. Susco, "LAPHANO: A P_0 Multigroup Photon-Production Matrix and Source Code for ENDF," LA-4750-MS (1972).
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5. W. E. Ford, III, and J. S. Gillen, "The Testing of ^{238}U Secondary Gamma-Ray Production Data Sets from the POPOP4 Library," ORNL-TM-3482 (February 1972).

5.0. SMUG: AN AMPX MODULE

FOR GENERATING MULTIGROUP PHOTON CROSS SECTIONS

J. L. Lucius W. E. Ford, III

SMUG is a revision of the MUG[1] code incorporating the necessary programming changes to create a functional module in the AMPX system. It calculates multigroup photon cross sections with transfer coefficients represented by a Legendre approximation of an arbitrary order. The scattering moments are computed from the Klein-Nishina[2] equation. The photo-electric and pair production cross sections are obtained from ENDF/B[3]. Three sets of tissue dose factors, Henderson[4], Silicon[5], and Claiborne, Trubey[6] are built in and can be averaged over the problem group structure. The MUG report is the reference for the theory used in SMUG and the primary programming differences are outlined below.

MUG solves the Klein-Nishina equation by treating each moment independently. In SMUG the programming is restructured to take advantage of the recursive properties of the Legendre polynomial. This reduces the impact of the order of P_n as a factor in calculation time. Reductions by a factor of 5 to 10 have been observed.

SMUG is flexibly dimensioned permitting efficient use of core storage. Problem size is limited only by total core storage available rather than the size of any single parameter.

5.1. SMUG Input Data

The following is the input description for SMUG. ANISN-type input (Section 13.0) is used exclusively except for the title card.

A. Title Card (20A4)

B. General Problem Information

1$ Array (3 entries)

1. NGG - number of gamma groups.
2. NNUC - number of nuclides.
3. LMAX - order of P_n.

2$ Array (8 entries) Default values are set for all parameters in this array. If all of the default values are acceptable for the calculation, the array may be omitted.

1. MF = 1, flat weighting.
   (Default = 1)
   = 6, arbitrary weighting spectrum to be entered in 6$ and 7* arrays.
2. NWR = number of interpolation regions used to specify the arbitrary weighting spectrum (Default = 0)
3. NWP = number of points in the arbitrary weighting spectrum. (Default = 0)
4. NUF = 0, energy-dependent flux,
   = 1, photon number flux.
   (Default = 1)
5. NSP = number of intervals in outer integral. (Default = 31)
6. NPHI = number of intervals in inner integral. (Default = 51)
7. NDS = number of downscatters required. (Default = NGG-1)
8. NDF = 0, no print.
   = 1, print a set of dose factors for the problem group structure. (Default = 1)
   = 2, print and punch the dose factors.

End Data Block B with a T.

C. Weighting Spectrum and Group Boundaries

6$ and 7* arrays are entered only if MF = 6

6$ (2*NWR entries): interpolation data for arbitrary weighting spectrum (NBT(I),JNT(I),I=1,NWR).

7* (2*NWP entries) arbitrary weighting spectrum (per unit energy), (E(I),W(I),I=1,NWP), ascending in energy. Units of energy are eV.

8* Array (NGG+1 entries): Gamma group energy mesh in decreasing magnitude of energy. Energies are in units of eV's. Several "standard" group structures are built into AMPX and when one of these is desired this array is omitted. See Section 11.7 for a list of the standard structures.

End Data Block C with a T.

D. The following array is repeated NNUC times, i.e., input a 10$ array for each nuclide.

10$ Array (5 entries)

1. LEMNO - The ENDF/B material number.
2. LORDER - The highest order of P_n to be printed/punched for this nuclide. (Default = 0)
3. ILT - Logical number of cross section library for this material. (Default = 11)
4. MODE = 0, indicates cross section library is unformatted (binary). (Default = 0)

   = 2, indicates cross section library is formatted (BCD).
5. LPUN - Controls printing and punching of P_n cross section arrays.

   = 0, print, no punch.

   = 1, print and punch.

   = -1, no print, no punch. (Default = -1)

   = 2, punch, no print.

End each 10$ Array with a T.

5.2. SMUG Input/Output Assignments

Smug requires the following INPUT/OUTPUT devices during an execution.

Logical Number	Purpose
5	Input
6	Printed Output
7	Punched Card Output
14	Scratch
15	Scratch
26	AMPX Interface which Contains the Multigroup Gamma Libraries
ILT (supplied by user in 10$ array of input)	Cross Section Library

5.3. SMUG Error Messages

When errors are encountered which SMUG cannot overcome, one of the following messages will be printed and control returned to the AMPX DRIVER.

Message: CORE USED XXXXXXXX LIMIT XXXXXXXX

Detecting Routine: SMUG

Cause: Inadequate space available. Reduce problem complexity or increase space allocated in SMUG main program.

Message: MATERIAL XXXXXX NOT ON ENDF TAPE

Detecting Routine: FINDXS

Cause: Self-explanatory, check input data and contents of ENDF library requested.

Message: FILE 23 OF MATERIAL XXXXXX NOT ON ENDF TAPE

Detecting Routine: FINDXS

Cause: Self-explanatory, check contents of ENDF library requested.

Message: SECTION XXXX OF FILE 23 OF MATERIAL XXXXXX NOT ON ENDF TAPE

Detecting Routine: FINDXS

Cause: SMUG expects to find reaction types 501, 502, 504, 516, 602 in file 23. The calculation cannot be performed if these data are not available.

Message: STOP IN FINDXS, NRI, XXXXXX NPI XXXXXX

Detecting Routine: FINDXS

Cause: Programming error, ENDF data more voluminous than anticipated. Programming changes are required in subroutines SMUG and FINDXS.

Message: DATA FOR MATERIAL XXXXXX SECTION XXX ARE TEMPERATURE DEPENDENT

Detecting Routine: FINDXS

Cause: This version of SMUG does not accept temperature dependent file 23 data.

Message: ENERGY ARRAY OUT OF SEQUENCE MATERIAL XXXXXX SECTION XXXX

Detecting Routine: FINDXS

Cause: Energies not in increasing order, check ENDF data

5.4. SMUG Warning Messages

When data is not defined by ENDF to cover the entire energy range required by the problem, SMUG defines the cross sections in the undefined range as zero, prints a warning message, and continues the calculation. If any of these warnings should occur, the user must assess the validity of the calculation.

REFERENCES

1. J. R. Knight and F. R. Mynatt, "MUG: A Program for Generating Multigroup Photon Cross Sections," CTC-17 (January 1970).
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3. D. J. Dudziak, "ENDF Formats and Procedures for Photon Production and Interaction Data," LA-4549 (ENDF-102) Rev. Vol. II (July 1971).
4. B. J. Henderson, "Conversion of Neutron or Gamma Ray Flux to Absorbed Dose Rate," XDC-59-8-179 (August 1959).
5. Private communication, J. V. Pace.
6. H. C. Claiborne and D. K. Trubey, "Dose Rates in a Slab Phantom from Monoenergetic Gamma Rays," ORNL-TM-2574 (April 1969).

6.0. CHOX: THE AMPX MODULE FOR CROSS SECTION INTERFACE MANIPULATION

N. M. Greene   J. E. White

CHOX is a module which serves to combine the various cross section interfaces produced in AMPX. AMPX can make neutron libraries (XLACS), gamma libraries (SMUG), photon production libraries (LAPHNGAS), and coupled libraries (this module -- CHOX). All these libraries are written in the same format. CHOX is mainly intended to take a neutron interface, a gamma interface, and a photon production interface and prepare a coupled interface. In addition, the new coupled information can be combined with previously prepared coupled information.

6.1. CHOX Input Data

The input data for this module is described below:

Data Block 1

0$ Logical Assignments [9]

1. NT1 - Neutron cross sections (Default=23)
2. NT2 - Photon production cross sections (Default=24)
3. NT3 - Gamma cross sections (Default=26)
4. NT4 - Coupled library to be created (Default=1)
5. NT5 - Coupled library to be added to (Default=28)
6. NT6 - Presently not used (Default=0)
7. NT7 - Presently not used (Default=0)
8. NT8 - Scratch device (Default=18)
9. NT9 - Scratch device (Default=17)

Data Block 1

1$ Control Information [2]

a. NC - number of coupled sets to be created
b. NLIB - 0, no effect,
   1, previously made coupled library is mounted.

T Terminate this data block.

2$ Identification numbers† for the neutron sets of data [NC]

3$ Identification numbers† for the photon production sets of data [NC]

4$ Identification numbers† for the gamma sets of data [NC]

5$ New identification numbers to be given the coupled sets of data [NC]

T Terminate this data block.

---

† A zero identification signals that no data of a particular type will be put in a coupled set.

6.2. CHOX Input/Output Assignments

CHOX uses the following logical units.

Logical	Interface
1	New Coupled Library
23	Neutron Cross Sections from XLACS
24	Photon production cross sections from LAPHNGAS
26	Gamma Cross Sections from SMUG
28	Previously Prepared Coupled Library

7.0. NITAWL: AMPX MODULE

FOR RESONANCE SELF-SHIELDING AND WORKING LIBRARY PRODUCTION

L. M. Petrie N. M. Greene J. L. Lucius J. E. White

A basic philosophy of AMPX is to retain as much generality as possible in creating the standard data interfaces, the so-called cross section libraries. It is felt that this generality does not overtly affect the programming which has to use the data. Indeed, because of it AMPX can serve many specialized needs. For example, detailed cross section sensitivity analyses require each partial cross section to be retained in full detail and identified.

The AMPX library formats, described as part of Section 11.0 of this document, are quite general. They allow any number of processes to be passed. They use the identification schemes from ENDF/B where possible. They allow any scattering process to be represented anisotropically. They allow some temperature dependence. Resonance parameters comprise part of the data, so that libraries tend to be more problem-independent.

Obviously, a transport calculation does not need much of this detail. NITAWL, which is an acronym for Nordheim's[1] Integral Treatment And Working Library production, has the responsibility for reading these general formats, for doing resonance self-shielding calculations, and collecting data into "workable" arrangements such as the format required by the ANISN, DOT, or MORSE code.

In particular, NITAWL will output working libraries in two forms:

1. on cards or tape or disk for ANISN, DOT, or MORSE, and
2. on tape or disk for the XSDRNPM module discussed in Section 8.0 of this document.

Of interest is the treatment of resonance nuclides. The LAPHNGAS module (Section 4.0) passes yields in this case for capture and fission. NITAWL multiplies the shielded cross section values by these yields to produce self-shielded gamma production matrices. The actual neutron resonance self-shielding calculation generally employs the Nordheim Integral Treatment, though the narrow resonance and an infinite mass treatment are available as alternate methods.

7.1 NITAWL Input Data

The following is the input description for NITAWL. ANISN-type input (Section 13.0) is used exclusively.

Data Block 1

0$ Logical Assignments [9]. This array is input only if a user needs to modify default values (shown in parentheses).

1. N1 - Master Cross Section Interface (1)
2. N2 - Working/Weighted Cross Section Interface (2)
3. N3 - Working/Weighted Cross Section Interface (3)
4. N4 - Working Cross Section Library made by NITAWL (4)
5. N5 - Scratch (18)
6. N6 - Scratch (19)
7. N7 - Direct Access Scratch (9)
8. N8 - Scratch (15)
9. N9 - ANISN Binary Library (20)

1$ Integer Parameters [12]

1. MSCM - Number of extra cross sections to be placed above σ_a in the ANISN cross section formats. The ENDF/B MT-numbers for these processes are input in the 5$ array described below. These cross sections will appear in positions 1 through MSCM in the order requested in the 5$ array.
2. MMT - Number of nuclides from the master cross section library generally mounted on logical N1. Resonance calculations can be made with "resonance" nuclides from a master library but not from a working/weighted library.
3. MWT - Number of nuclides from a working/weighted library mounted on logical N2.
4. MXT - Number of nuclides from a working/weighted library on logical N3. The libraries are discussed in more detail below where the 2$ array is defined.

5. MCR - ANISN/DOT/MORSE output trigger.

   = 0, no effect,

   = |1|, cross sections output on cards,

   = |2|, cross sections output in binary format.

   Note - If MCR is input less than zero; i.e., MCR = -1 or -2, NITAWL will produce a sensitivity library such as is required for the SWANLAKE[2] program. This means that every partial cross section becomes a set; every expansion coefficient matrix is set; in addition, the combined matrices normally required are output, so that this is a more inclusive option.

6. MXX - Total cross section position in the ANISN formats [3] MSCM.

7. MS - Within-group scattering cross section position in the ANISN formats [4] MSCM.

8. IRES - Number of resonance calculations to be performed. Resonance data is required in the 3* array discussed below.

9. IQM - Table length for cross sections in ANISN formats. [number of groups + MXX]

10. IPM - Is a previously prepared ANISN library mounted on logical N9?

    0 - no.

    1 - yes. Cross sections from this run will be concatenated to this library. The old data will remain intact. [0]

11. IPP - Output option trigger. For large group structures, NITAWL can generate considerable output. The table below gives options for selecting or suppressing the various types of output. [0]

IPP	Edit Reaction X-Sects	Edit Transfer Matrices[a]	Edit ANISN Matrices
-1	No	No	No
0	No	No	Yes
1	Yes	No	Yes
2	Yes	Yes	Yes

[a]This option will edit transfer matrices in the AMPX "magic word" formats.

12. IFG - print control for ANISN output. If ANISN edits are selected, ANISN cross sections will be edited through this order. A 0 selects all orders. [0]

T Terminate this data block.

Data Block 2

2$ Identification Numbers of Nuclides to be placed on the Working Library or on an ANISN Library. [MMT+MWT+MXT]

NITAWL can combine data from three sources to make working library on logical unit N4. This working library contains only those nuclides selected and is intended for use by other AMPX modules, such as XSDRNPM module described in Section 8.0. The MORSE II and KENO II programs will also access this library. The nuclide identifications are input in the order:

1. MMT identifications for nuclides from the master library on N1,
2. MWT identifications for nuclides from the working/weighted library on logical unit N2,
3. MXT identifications for nuclides from the working/weighted library on logical unit N3.

Within these three groupings, the identifications can be in any order.

A facility is provided for creating duplicate sets for a particular nuclide. For example, a resonance nuclide might occur in different compositions, thereby requiring different resonance calculations. To create a new set, place a unique negative number in the identification string after the nuclide's identification which is to be duplicated. As many sets as needed can be had, merely by stringing out negative numbers. All subsequent references to the new sets of data should use a positive identification. The values MMT, MWT, and MXT must be increased to reflect the inclusion of these sets.

3* Resonance Data [IRES*15] {IRES > 0}

For each resonance calculation, fifteen items are required. These blocks of data are placed, one set after the other, in any order in the 3* array. Note that only one 3* array is input. Resonance calculations can only be performed on resonance nuclides from a master library. The fifteen items are:

1. Nuclide's identification on the master library.
2. Temperature (°K).
3. Geometry for Nordheim Treatment

   0 - homogeneous,

   1 - slab,

   2 - cylindrical,

   3 - spherical.
4. Absorber lump dimension in centimeters; i.e., the thickness of the slab or radius of a sphere or cylinder. A zero is used for the homogeneous case.
5. Dancoff correction factor.[3] This factor corrects for shadowing effects due to the presence of other absorber lumps (e.g., fuel elements) in the neighborhood of the lump being calculated. It is zero for the homogeneous and the one lump case.
6. $(\sigma_m)_{eff}$, the effect moderator cross section per absorber atom.

$$(\sigma_m)_{eff} = \sigma_{po} + \sigma_m + \sigma_e \quad ,$$

   where

   σ_{po} = absorber potential scattering cross section

   σ_m = moderator cross section per absorber atom,

   σ_e = effective escape cross section = $\frac{1}{\bar{\ell} N_a}$,

   $\bar{\ell}$ = mean chord length in the lump. The factor, $\bar{\ell}$, is strongly geometry dependent and can be determined analytically only for very simple cases. Monte Carlo routines[4] are available which allow its calculation for very general geometries.

   This cross section is only used in the unresolved calculation and does not affect the Nordheim Treatment.
7. N_a, absorber number density in the lump.
8. Treatment of absorber's contribution to the collision density.

   1 - Nordheim integral method.

   2 - narrow resonance approximation.

   3 - infinite mass approximation.

9. Atomic mass of the first moderator in the lump.† The resonance routines have provisions for treating two moderators.

10. σ_{s1}, first moderator scattering cross section per absorber atom.

$$\sigma_{s1} = \frac{N_1}{N_a} \sigma_s \text{ (moderator 1)} \quad ,$$

where N_1 is the number density of the first moderator.

11. Treatment of first moderator's contribution to the collision density.

    0 - no first moderator.

    1 - Nordheim's integral method.

    2 - asymptotic approximation.

12. Atomic mass of the second moderator in the lump.

13. σ_{s2}, the second moderator scattering cross section per absorber atom.

14. Treatment of the second moderator's contribution to the collision density.

    0 - no second moderator.

    1 - Nordheim's integral method.

    2 - asymptotic approximation.

15. Volume fraction of the absorber lump in the cell. This parameter is used for calculating "cell-averaged" resonance cross sections.

4* Thermal Scattering Kernel Temperature for Nuclides Selected (°K) [MMT]

Scattering kernels are sometimes provided at several temperatures for a nuclide. NITAWL will pick the one closest to the temperature input in this array. This array has no effect for sets of data with zero or one thermal kernel.

5$ Extra Cross Section MT-numbers. [MSCM]

These are the ENDF MT-numbers of the cross sections which are to be placed above the absorption cross section in the ANISN cross section tables.

T Terminate this data block.

---

†This is a moderator <u>in</u> the lump. The parameter $\bar{\ell}$ and the Dancoff correction factor take into account the effect of a moderator surrounding a fuel lump in the Nordheim Treatment.

7.2. NITAWL Input/Output Assignments

NITAWL typically requires the following input/output devices during an execution:

Logical Number	Purpose	
N1 (1)	Master Cross Section Library	
N2 (2)	Previously Prepared Working/Weighted Library	
N3 (3)	Previously Prepared Working/Weighted Library	
N4 (4)	New Working Library	
5	Card Input	
6	Standard Output	
7	ANISN Punched Cards	
9	Direct Access I/Ø (Scratch)	
15	Scratch Device	Sensitivity Option Only
16	Scratch Device	Sensitivity Option Only
18	Scratch Device	Sensitivity Option Only
19	Scratch Device	
20	ANISN Binary Library	

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8.0. XSDRNPM: AMPX MODULE WITH ONE-DIMENSIONAL S_n CAPABILITY FOR SPATIAL WEIGHTING

L. M. Petrie N. M. Greene

The XSDRNPM module is provided in AMPX for two purposes:

1. to provide a one-dimensional transport calculation capability for calculating reaction rates, eigenvalues, and critical dimensions, and
2. to allow spatial cross section weighting to be performed.

XSDRNPM† differs from its predecessor, XSDRN[1], in several important respects.

- It will do coupled neutron-gamma calculations.
- It allows any mixture to be represented to an arbitrary order of anisotropic representation.
- It will do an adjoint calculation.
- It is considerably more efficient in the manner in which data storage is used and, hence, will run much larger problems in less core storage.
- The resonance calculation is removed and is provided in AMPX in the NITAWL module (Section 7.0).
- It employs improved thermal flux scaling techniques for better problem convergence.
- Input specifications have been re-ordered, and more defaults have been provided to make the use of this module easier.
- It will calculate S_n constants for any even order for any of the three one dimensional geometries available.
- Mixture-dependent fission spectra are calculated and used in XSDRNPM, which takes into account all fissionable nuclides in a problem.

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†XSDRN with Petrie Modifications.

The collapsed cross sections from XSDRNPM are written as an AMPX weighted library on logical 3 which can be used directly by the module to do transport calculations. They can also be output on cards or in a binary format suitable for the ANISN, DOT, or MORSE codes. Four weighting options are provided:

1. cell weighting, which generates cross sections consistent with mocking up a cellular configuration as a homogenized region; viz., the spatial "disadvantage factors" are taken into account in the cross section weighting,
2. zone weighting, which produces a set of cross sections weighted over each material region in which a nuclide occurs,
3. "region" weighting, which produces one set of cross sections for a nuclide but weighted over a composite spectrum made up of all spectra from zones where the nuclide is present,
4. "inner" cell weighting, which performs a cell weighting as in 1 but only over the N regions selected by the input. This allows one to mock-up a calculation which can include non-zero leakage at the outer boundary of the cell; e.g., an explicit cell mock-up can be described within a homogeneous description of a reactor.

The identification numbers for the nuclides on logical 3, the weighted library, are formed from the original identification number as follows:

a. for zone weighting the original identification is prefixed by the zone number in which a nuclide occurs. Note that zone weighting, in many cases, will produce several sets of cross sections for each nuclide,
b. for all other weightings, the identification remains identical to the original.

A variety of options is provided to use for calculating transport cross sections needed in diffusion theory applications. For all weighting options above, XSDRNPM calculates transport cross sections based on the so-called "inscatter" and "outscatter" approximations.

Inscatter: $$\sigma_{tr}(E) = \sigma_t(E) - \frac{1}{3j(E)} \int_0^{\infty} dE' \sigma_1(E' \to E) j(E')$$

Outscatter: $\sigma_{tr}(E) = \sigma_t(E) - \overline{\mu}\sigma_s(E)$

Four options are provided to use for the current weighting term, j(E), in these approximations.

1. The first moment of the flux, Φ_1, is calculated by zone; the weighting function is the absolute value;

   i.e., $j_g \sim \left| \int_{\text{zone}} \Phi_1^g \right|$.

2. The weighting function is $DB^2\Phi_0$ plus the integral of μ times the angular flux in each zone;

   i.e., $j_g \sim DB^2\Phi_0^g + \int_{\text{zone}} d\vec{r} \int_{-1}^{1} d_\mu \; \mu\Phi(g,\vec{r},\mu)$.

3. The weighting function is $DB^2\Phi_0$ plus the right leakage from the system;

   i.e,, $j_g \sim DB^2\Phi_0^g + \int_{-1}^{1} d_\mu \; \mu\Phi(g,\text{outside},\mu)$.

4. The weighting function is the scalar flux divided by a macroscopic total cross section;

   i.e., $j_g \sim \dfrac{\Phi_0^g}{\Sigma_t^g}$.

In cases 2 and 3, if a cell is mocked with no outside leakage; e.g., if $DB^2 = 0$ and the cell has a white or reflected outside boundary, XSDRNPM will use the scalar flux as a weighting function;

i.e., $j_g = \Phi_0^g$.

8.1. XSDRNPM Input Data

The input data to XSDRNPM consists of a title card and up to five data blocks, depending on the particular problem. All data in these blocks is entered using the ANISN formats discussed in Section 13.0 of this document.

In the description which follows, the quantity in square brackets is the number of items in an array. The quantity in braces is the condition which requires the array to be input. If no condition is specified, an array must be input. Default parameters that are used if an array is not input are shown in parentheses if non-zero.

Title Card - Format (20A4)

This is the title card for the problem. It will be used to label the problem output.

Data Block 1

This block contains information to set up various array dimensions and most calculational and editing options. Various convergence criteria and special constants can be input.

1$ General Problem Description [15]

1. IGE - problem geometry (1)
   - 0 - homogeneous
   - 1 - slab
   - 2 - cylinder
   - 3 - sphere
2. IZM - number of separate material regions or zones. (1)
3. IM - number of spatial intervals in the problem. (1)
4. IBL - the boundary condition at the left-hand boundary of the system . (1)
   - 0 - vacuum boundary
   - 1 - reflected boundary
   - 2 - periodic boundary
   - 3 - white/albedo boundary

5. IBR - the boundary condition at the right-hand boundary of the system. (1)
   0 - vacuum boundary
   1 - reflected boundary
   2 - periodic boundary
   3 - white/albedo boundary
6. MXX - the number of compositions used in the problem mockup.
7. MS - the number of entries in the mixing table which specifies the makeup of the MXX compositions.
8. ISN - the order of angular quadrature to be used. If ISN > 0 XSDRNPM will calculate a default angular quadrature.
9. ISCT - the order of scattering. Flux moments will be calculated through this order.
10. IEVT - the type of calculation. (1)
    0 - fixed source
    1 - k calculation
    2 - α calculation (flux is assumed to have an $e^{-\alpha t}$ time variation)
    3 - inoperable in present version
    4 - zone width search
    5 - outer radius search
    6 - buckling search
11. IIM - the inner iteration maximum used in an S_n calculation. (10)
12. ICM - the outer iteration maximum. (10)
    After ICM outer iterations, the problem will be forced into the termination phase and the program will continue as if full convergence was attained. A message to this effect is printed.
13. ICLC - theory option. (0)
    0 - use S_n theory always
    N - use alternate theory (diffusion or infinite medium) for N outer iterations, after which revert back to S_n theory.
14. ITH - forward/adjoint selector. (0)
    0 - solve the forward Boltzmann equation.
    1 - solve the adjoint Boltzmann equation.

15. IFLU - S_n solution method. (0)

 0 - use the "diamond-difference" model, but use the "step" model if negative fluxes are encountered.

 1 - use the "diamond-difference" model exclusively.

 2 - use the "step" model exclusively.

 3 - use the "weighted diamond-difference" model exclusively.

 4 - use the "diamond-difference" model, but use the "weighted diamond-difference" model if negative fluxes are encountered.

2$ Editing and Special Options [10]

1. IPRT - fine group mixture cross sections. (-1)

 -2 - no edits

 -1 - edit one-dimensional cross sections

 0 } - edit through P_N cross sections.
 N } One-dimensional edits are made, also.

2. ID1 - flux editing options. (0)

ID1	Print Angular Fluxes	Print Scalar Fluxes	Punch[a] Scalar Fluxes
-1	No	No	No
0	No	Yes	No
1	Yes	Yes	No
2	No	Yes	Yes
3	Yes	Yes	Yes

|ID1| > 3 fluxes written on |ID1| in binary format.

[a]The fluxes will be punched in a format suitable for restarting an XSDRNPM calculation.

3. IPBT - balance table edits. (0)

 -1 - none

 0 - make fine group balance tables

 1 - make fine and broad group balance tables

4. ISX - not used in this version.

5. ISEN - not used in this version.

6. IBLN - not used in this version.

7. ISRC - not used in this version.

8. IDM2 - not used.

9. IDM3 - not used.
10. IDM4 - not used.

3$ Various Options [12]

1. IFG - cross section weighting. (0)
   0 - none required
   1 - collapse cross sections
2. IQM - volumetric sources. (0)
   0 - none
   N - N volumetric source spectra will be input in the 31* array
3. IPM - boundary sources. (0)
   0 - none
   N - N boundary source spectra will be input in the 32* array
4. IFN - starting guess. (0)
   0 - flux guess (33* array)
   1 - fission density guess (34* array)
   >2 - unit on which fluxes are stored in a binary format
5. ITMX - maximum time allowed for the flux calculation in minutes. A value of zero will not terminate a calculation because of time; otherwise the problem will be forced into the termination phase when ITMX is exceeded. (0)
6. IDAT1 - external data storage. If IDAT1 is input as zero, XSDRNPM will automatically select the most efficient means of storing data.
   0 - keep all arrays in core if possible
   1 - store mixture cross sections externally on a direct access device
   2 - store cross sections and fixed sources externally on direct access devices
   3 - store cross sections, fixed sources, and flux moments externally on direct access devices
7. IPN - not used in this version. (0)
8. IDFM - density factors. (0)
   0 - none
   1 - read in density factors in the 38* array

9. IAZ - activity calculation trigger. (0)
   - 0 - none
   - N - calculate the reaction rates by material zone for N different processes specified in the 49$ and 50$ arrays
10. IAI - spatially dependent activity rates. (0)
   - 0 - none
   - 1 - calculate reaction rates in each interval for IAZ processes
11. IFCT - thermal upscatter scaling. (0)
   - 0 - none
   - 1 - use upscatter scaling for accelerated problem convergence
12. IPVT - parametric eigenvalue search. (0)
   - 0 - none
   - 1 - a search calculation will be made for an eigenvalue other than 1.0

4$ Cross Section Weighting Options [9] {IFG = 1}

1. ICON - type of weighting.
   - -N - inner cell (with N zones in the cell). Cell weighting is performed over the N innermost regions in the problem. Nuclides outside these regions are not weighted.
   - -1 - cell
   - 0 - zone
   - 1 - region
2. IGMF - number of energy groups in the collapsed sets.
3. ITP - collapsed output format desired.
   - 0-19 - cross sections are written only in the AMPX weighted library formats on logical 3. A weighted library is always written when IFG=1.
   - 20-29 - output in the CCCC ISØTXS[2] Version 3 format.
   - 30-39 - output in the ANISN/DØT/MØRSE card format.
   - 40-49 - output in the ANISN/DØT/MØRSE binary format on logical 20.

   The various values of ITP (modulo 10) are used to select the different transport cross section weighting options mentioned earlier. The options are:

ITP = 0,10,20,... absolute value of current

ITP = 1,11,21,... $DB^2\Phi$ + zone current

ITP = 2,12,22,... $DB^2\Phi$ + outside leakage

ITP = 3,13,23,... Φ/Σ_t

4. IPP - weighted cross section edit option (-1).

   -2 - none

   -1 - edit one-dimensional data

   0 }
   N } - edit through the P_N cross section arrays. One-dimensional edits are given.

5. IHTF - total cross section position in the ANISN format. (3)

6. NDSF - within-group scattering cross section position in the ANISN format. (4)

7. NUSF - table length in the ANISN formats. (IGMF + NDSF - 1)

8. IAP - ANISN cross section edit. (-1)

   -1 - none

   0 }
   N } - edit through the P_N arrays.

9. MSCM - extra "activity" cross sections in ANISN formats. MSCM extra cross section types are put above the absorption cross section position in the ANISN formats. The types are specified in the 12$ array.

5* Convergence Criteria and Assorted Constants [12]

1. EPS - overall problem convergence. (10^{-4})

2. PTC - scalar flux convergence. (10^{-4})

3. XNF - normalization factor. (1.0)

   When IEVT = 0, the fixed sources are normalized to XNF.

   For IEVT > 0, the fission rate is normalized to XNF.

   When XNF = 0.0, no normalization is made.

4. EV - starting eigenvalue guess.

5. EVM - eigenvalue modifier used in a search calculation. The following is a tabulation of recommended values for EV and EVM.

IEVT	EV	EVM
0	0	0
1	0	0
2	0	0
3	-	-
4	0	-0.1
5	starting outer radius	-0.1*EV
6	1.0	-0.1

6. BF - buckling factor (1.420892). This parameter is two times the multiplier on the relaxation length used to get an extrapolated boundary; e.g., for slabs, the extrapolation distance is $\cong 0.71\lambda_{tr}$ and, hence, BF $\cong$ 1.42.
7. DY - first transverse dimension in centimeters used in a buckling correction to calculate leakage normal to the principal calculation direction; i.e., the height of a slab or a cylinder.
8. DZ - second transverse dimension in centimeters used for a buckling correction; i.e., the depth of a slab.
9. VSC - void streaming correction. This is the height of a cylinder or slab in centimeters around a void region.
10. PV - parametric eigenvalue. When IPVT = 1 and IEVT > 1, this is the eigenvalue on which the search calculation is based.
11. EQL - eigenvalue convergence for a search. (10^{-3})
12. XNPM - new parameter modifier used in search calculations. (0.75)

6$ Direct Access Scratch Make-up [6]

1. NRC8 - number of physical records on logical 8.
2. LRC8 - length in words of a record on logical 8.
3. NRC9 - number of physical records on logical 9.
4. LRC9 - length in words of a record on logical 9.
5. NRC10 - number of physical records on logical 10.
6. LRC10 - length in words of a record on logical 10.

It is highly unlikely that the 6$ will be required as input for any except very large problems. A message will be printed to indicate when a change is needed. The efficient selection of values for this array is a very complicated process involving consideration of the actual "direct access" programming in XSDRNPM and should not be attempted by the casual AMPX user.

T Terminate data block.

Data Block 2

This block contains information on the composition of the materials used in the calculation. Also included is an array to select special cross sections for ANISN and an array to identify cross sections written on the CCCC ISØTXS library.

12$ Special Cross Section ENDF/B Identifiers for Inclusion in ANISN Libraries [MSCM]

This option allows the placement of "activity" cross sections in positions one through MSCM of ANISN formatted data. The user must ensure that MSCM is consistent with other positional parameters given in the 4$ array. Use ENDF MT numbers.

The next three arrays (13$, 14$, and 15*) comprise the mixing table in XSDRNPM. The entries in the arrays go together in a one-to-one correspondence to form triplets:

13$	14$	15*
M	N	X

This command instructs that nuclide N is to be added into mixture M with a concentration (atoms/barn-cm) of X.

13$ Mixture Numbers in Mixing Table [MS]

The values range from 1 to MXX.

14$ Isotope Identifiers in Mixing Table [MS]

A set of data with this identification must be on logical 4, the XSDRNPM working library.

15* Isotope Concentrations in Mixing Table [MS]

16$$ CCCC Identification Numbers [MS] $\{20 \leq ITP \leq 29\}$

This array is input in a one-to-one correspondence with entries in the mixing table and gives the identification numbers which will be placed on the CCCC library. Note that one should limit these numbers to six digits. If less than six digits are input, the CCCC identification has the front part filled with zeros. This is important because CCCC identification schemes are alphameric (A6). As an example, if one inputs 1234 in the 16$$ array, the actual CCCC identification is 001234.

T Terminate this data block.

Data Block 3 {IEVT = 0}

This block is used to specify fixed sources.

30$ Source Spectrum Number by Interval [IM]

31* Volumetric Source Spectra [IQM*IGM]

32* Surface Source Spectra [IPM*IGM*MM]

Each of the IQM or IPM spectra is specified in the 31* or 32* array and are stacked one after the other in that array. A problem cannot use both fixed and surface sources.

A volumetric spectrum will consist of IGM (number of energy groups) entries which are the relative integrated values of the source in each group.

A surface source is always assumed to be on the righthand side of a spatial interval. It is input as was the volumetric source, except that each group contains entries for the MM angles in the S_n quadrature chosen for the problem. Note that a surface source is an integrated value and is actually a flux condition in the S_n equations.

In the 30$ array, a zero entry specifies that no source is in an interval.

T Terminate this data block.

Data Block 4

This data block contains starting guesses for fluxes and fission densities.

33* Flux Guess [IM*IGM] {IFN = 0}

A guess for the scalar flux is specified in the order: all intervals for a group until all groups are exhausted. For fixed source problems, in the lack of better information, use zeros. For eigenvalue problems, a non-zero flux guess must be used. The fluxes punched by using the ID1 parameter in the 2$ array can be used here in restart calculations.

34* Fission Density Guess [IM] {IFN = 1}

This is a guess at the number of fission neutrons produced in an interval. When IFN = 1, XSDRNPM uses diffusion theory for the first outer iteration, after which it reverts to the normal mode.

T Terminate this data block.

Data Block 5

This block contains the remaining data needed for an XSDRNPM calculation.

35* Interval Boundaries [IM + 1] (cm)

This array describes the spatial quadrature into which the problem mockup is divided. The boundaries are non-negative and in increasing order.

36$ Zone Number for Each Spatial Interval [IM]

Spatial zones should be contiguous.

38* Density Factors by Interval [IM] {IDFM $\neq$ 0}

These factors are used to affect a density variation in a mixture as a function of spatial interval. Zero for a density factor affords a convenient way for mocking a void region.

39$ Mixture Numbers by Zone [IZM]

The mixture that is in a zone is specified here.

40$ Order of Scattering by Zone [IZM]

This is the order, ℓ, of the S_nP_ℓ calculation which is desired in a zone. This number must be no larger than ISCT.

41* Radius Modifiers by Zone [IZM] {IEVT = 4}

These parameters specify the relative movement of the width of a zone in a zone width search. A zero indicates that a zone's width is fixed.

42* Weights of the Angles in the Discrete-Ordinates Quadrature [MM†]

Input this set to override those provided by XSDRNPM.

43* Cosines of the Angles in the Discrete-Ordinates Quadrature [MM]

Input this set to override those provided by XSDRNPM.

---

†MM = ISN+1 for slabs and spheres,
= ISN*(ISN+4)/4 for a cylinder.

46$ Calculational Option by Group [IGM] {ICLC > 0}

0 - perform discrete-ordinates calculation for this group.

1 - perform a diffusion calculation for this group for ICLC outer iterations; use discrete-ordinates theory after this.

2 - perform a homogeneous calculation for this group for ICLC outer iterations; then revert back to discrete-ordinates theory.

47* Right Boundary Albedos by Group [IGM] {IBR = 3}

A right boundary albedo is specified for each fine group. The return current is distributed isotropically in angle.

48* Left Boundary Albedos by Group [IGM] {IBL = 3}

As for the 47* array but for the left boundary. Note that if IBR or IBL is 3 and the corresponding 47* or 48* array is omitted, XSDRNPM fills the array with 1.0's affecting a boundary with zero net current and with isotropic neutron return.

49$ Material Number for Activities [IAZ] {IAZ ≠ 0}

50$ Process Number for Activities [IAZ] {IAZ ≠ 0}

The 49$ and 50$ arrays provide a means of obtaining the activity for any process for which cross sections are available in the XSDRNPM calculation. A representative activity table entry is shown below:

ACTIVITY TABLE ENTRY	
49$	50$
M	N

This entry specifies that the activity N for material M be calculated for all parts of the system which contain that material.

51$ Broad Group Numbers [IGM] IFG ≠ 0}

This array contains the broad-group numbers into which the fine groups are collapsed in a flux-weighting calculation. For example, if the first five fine groups are to be collapsed to the first broad group, the first five entries in the 51$ array are 1, etc.

T Terminate this data block.

8.2. XSDRNPM Input/Output Assignments

The following logical units can be required in an XSDRNPM calculation.

Logical Unit	Purpose
3	Weighted Library (Produced by XSDRNPM)
4	Working Library (Input)
5	Card Input
6	Standard Output
7	Punch Fluxes or ANISN Libraries
8	Scratch Direct Access Device for External Cross Section Storage
9	Scratch Direct Access Device for Mixing and Weighting Operations
10	Scratch Direct Access Device for External Flux Moment Storage
16	Forward Angular Fluxes
17	Adjoint Angular Fluxes
18	Scratch Device
19	Scratch Device
20	ANISN Binary Libraries or CCCC ISØTXS Interface

8.3. Error Messages

During the course of a problem, XSDRNPM makes many checks to determine if input data is in the required form. If inconsistencies are spotted, a message is printed, and the problem may be terminated. Some of these messages are listed below along with a brief description of their possible cause.

CORE	N	Insufficient core storage, N = required storage locations.
DATA	N	N arrays have been input with incorrect length. See the messages produced as arrays are read to determine specific arrays.
SN-1	N	The Nth entry in the S_n quadrature directions is zero. (43* array)
SN-2	0	The S_n weights do not sum to 1.0. (42* array)

SN-3	0	The sum of the products of S_n weights and directions is not 0.0; i.e., the directions are not symmetric. (42* and 43* arrays)
FIXS	0	Fixed source calculation requested (IEVT = 0) and total fixed sources are zero.
Q-HI	N	A volumetric source spectrum numbered N has been requested where N is greater than IQM.
B-HI	N	A boundary source spectrum numbered N has been requested where N is greater than IPM.
FISS	0	IEVT $\geq$ 1 and the total fission source is zero.
8101	N	The Nth radius is negative.
8102	N	The Nth radius is less than the (N-1)th radius.
8103	N	Zone N dimensions have become negative in a zone width search.
MIX	N	A request has been made to use the Nth component from the mixing table, but this nuclide has not been requested from a library.

Several messages may be encountered during an XSDRNPM run as various discrepancies are detected:

THE FOLLOWING NUCLIDES WERE NOT FOUND

(list follows)

Cause: XSDRNPM has searched the master library, working, and weighted cross section tapes and could not find the nuclides listed.

****** WARNING INTERPOLATION USED IN XX$ INTEGER ARRAY

DATA EDIT CONTINUES

Cause: Interpolation has been requested in an integer array. Care must be taken to ensure numbers are rounded correctly, when the fixed point conversion is made.

****** FILL OPTION IGNORED IN $XX^{\$}_{*}$ ARRAY

Cause: An attempt has been made to fill any array whose length is zero or which is already full.

****** WARNING ADDRESS XXXXXX IS BEYOND THE LIMITS OF THE

$XX^{\$}_{*}$ ARRAY

Cause: The address option has been used to modify a location beyond the limits of the identified array.

INSUFFICIENT STORAGE FOR WEIGHTING--REQUESTED XXXXXX LOCATIONS AND HAVE ONLY XXXXX

Cause: Self-explanatory. Increasing IDT1 may correct this difficulty.

SUMMARY TABLE STORAGE INSUFFICIENT SYSTEM TREATED AS ONE ZONE

Cause: Insufficient core is available to set up all the arrays needed for balance tables. Increasing IDT1 may correct this difficulty.

TAPE N Insufficient storage is available to produce a library tape for another code in the form specified. N locations needed.

***** CAUTION ***** CAUTION ***** CAUTION *****
THIS CELL HAS ZERO LEAKAGE--THE SCALAR FLUX WILL BE USED TO WEIGHT CROSS SECTIONS

Cause: The definition of a transport cross section requires a leakage spectrum. A completely reflected cell has been specified.

REFERENCES

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9.0. AMPX UTILITY MODULES

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During AMPX development, many situations have arisen which require interfacing with codes external to the system. In some cases, requests have been made to convert non-AMPX formatted libraries for use in the AMPX environment. Plotting requests have been received. Processed libraries containing errors have inadvertantly been produced suggesting the need for more extensive checking.

This section describes several "utility modules" which have been written to alleviate many of the above difficulties and to make AMPX available for a larger number of applications and users.

The modules discussed are:

Section	Module	Purpose
9.1	NPTXS	Point Files from Resonance Nuclides
9.2	LAVA	AMPX Interfaces from ANISN Data
9.3	CØNVERT	Convert Old XSDRN Libraries
9.4	REVERT	Make Old XSDRN Library
9.5	OCTAGN	Create a CITATION Library
9.6	CØMAND	Collapse ANISN Libraries
9.7	ARID	Collapse DNA 37-21 ANISN Library
9.8	MALØCS	Collapse AMPX Interface
9.9	RADE	Check AMPX Interface
9.10	VASELINE	Plot AMPX Data

9.1. NPTXS -- AMPX Module to Produce Point Data for Resonance Nuclides

NPTXS is provided to allow one to "preprocess" resonance ENDF nuclides and make point files for the total, fission, elastic scattering, and (n,γ) cross sections.

The library written by NPTXS on logical 31 looks very much like File 3 of an ENDF library. It can be used to augment the ENDF data selected in an XLACS or LAPHNGAS execution, in which case, these modules can completely skip "resonance" processing. One of its more important uses is to allow one to $\frac{1}{E\sigma_T}$ weight the data for a resonance nuclide. Both XLACS and LAPHNGAS can access logical 31 for this purpose.

Other features of NPTXS are as follows:

1. At present it can process SLBW and MLBW resolved resonance data. These can be Doppler-broadened using the numerical integration techniques developed by Cullen and used in the MINX code. (Note that the background File 3 data will also be Doppler-broadened.
2. Unresolved processing uses the same techniques employed in XLACS and originally developed for the MC-2 code.

9.1.1 NPTXS Input Data

ANISN input schemes are employed throughout NPTXS.

Block 1

1$ Case Description [1]

1. NNUC - number of ENDF nuclides to be processed.

T Terminate Block 1.

Repeat the following block for NNUC nuclides.

Block 2

2$ Nuclide Selection Array [5]

1. MATNO - ENDF MAT number for nuclide
2. NDFB - logical unit containing the data (Default = 11)
3. IDTAP - check the library label (0/1: no/yes) (Default = 1)
4. MØDE - ENDF library mode (0,1/2: binary/BCD) (Default = 0)
5. NSIGP - number of σ_o values (Default = 1)

3* Nuclide Options [4]

1. RFACT - the resolved resonance region energy mesh is based directly on this parameter. Points are chosen such that the ratio of total cross section from point-to-point is roughly RFACT. (Default = 0.9)
2. SFACT - number of practical widths over which the RFACT scheme is used for a particular resonance. (Default = 10)
3. SIGP - σ_0 for the unresolved calculation (Default = 10^8)
4. TDEGIC - temperature in degrees Kelvin for Doppler broadening the resolved and unresolved regions. (Default = 0)

T Terminate each Block 2 with a T.

<u>Block 3</u>

4* σ_o array for the unresolved calculation [NSIGP] {NSIGP > 1}
(SIGNL(N),N=1, NSIGP)

The σ_o values should be input high to low and NSIGP must not exceed 7.

T Terminate each Block 3 with a T.

[a]If NSIGP = 1, the desired σ_o should be input in the 3* array, and the 4* array is not required.

9.1.2 NPTXS Input/Output Assignments

The following input/output assignments are required by NPTXS.

Logical Number	Purpose
5	Card Input
6	Standard Output
11 (or NDFB)	ENDF/B Library
14	Scratch Device
15	Scratch Device
16	Scratch Device
17	Scratch Device
18	Scratch Device
19	Scratch Device
31	Point Files Produced by NPTXS

9.2. LAVA -- AMPX Module to Make AMPX Working Library from an ANISN Library

LAVA (Let ANISN Visit AMPX) is a module which can take an ANISN library (neutron, gamma, or coupled neutron-gamma) and transform it to an AMPX working library which can be used in XSDRNPM. ANISN cross sections can be supplied on cards (fixed or free-form) or on a binary library.

9.2.1 LAVA Input Data

Block 1

0$ Logical Definitions (these are defaulted as shown) [6]

1. N1 - ANISN library (20)
2. N2 - AMPX working library (4)
3. N3 - Scratch (18)
4. N4 - Scratch (19)
5. N5 - Input (5)
6. N6 - Output (6)

1$ ANISN Library Parameter Data [8]

1. NNUC - Number of isotopes to be put on new library
2. IGM - Number of neutron groups
3. IHT - Position of σ_T
4. IHS - Position of $\sigma_{g \to g}$
5. IHM - Table length
6. IFTG - First thermal group
7. IPM - Number of gamma groups
8. IFM - Format of ANISN library
   - -1, binary
   - 0, free-form BCD
   - 1, formatted BCD

T Terminate Block 1

Block 2

2$ Identifiers of P_0 Parts of Nuclides on ANISN Library [NNUC]

3$ Order of Scattering by Nuclides Selected form ANISN Library [NNUC]

4$ AMPX Identifiers for the Nuclides Selected from ANISN Library [NNUC]

7* Neutron Energy Group Boundaries† [IGM+1]

8* Gamma Energy Group Boundaries† [IPM+1]

T Terminate this block.

9.2.2 LAVA Input/Output Specifications

The following devices are normally needed in running the LAVA module.

Logical Number	Purpose
4	AMPX Working Library Written by LAVA
5	Card Input
6	Standard Output
18	Scratch Device
19	Scratch Device
20	ANISN Library

†Read high-to-low in energy (eV).

9.3. CONVERT: AMPX Module to Produce AMPX Master Neutron Library from Old XSDRN Library

A fairly extensive body of multigroup neutron information has been generated in the past for use with the XSDRN program. The library formats for this code are somewhat different from those employed in AMPX. CONVERT serves to "convert" the older formats to AMPX schemes.

9.3.1 CONVERT Input Data

1$ Case Description [2]

1. NC - number of sets of data to convert (a zero value converts the whole older library)
2. IFTG - the first thermal group on the old library (with the standard 123 group XSDRN libraries, IFTG = 94)

2$ Library Logical Definitions [2]

1. N1 - Old XSDRN Library is mounted on this logical number (Default = 2)
2. N2 - New AMPX Library is produced on this logical number (Default = 1)

3$ Scratch Logical Assignments [2]

1. N3 - Scratch device (Default = 18)
2. N4 - Scratch device (Default = 19)

T Terminate this block.

Block 2

4$ Identifications for Nuclides to be Converted [NC]

T Terminate this block.

9.3.2 CONVERT Input/Output Specifications

CONVERT generally requires the following input/output devices to be made available.

Logical Number	Purpose
1	AMPX Interface Produced by CONVERT
2	Old XSDRN Library
5	Card Input
6	Standard Output
18	Scratch Device
19	Scratch Device

9.4. REVERT -- AMPX Module to Produce Neutron Libraries for the Old XSDRN Code

REVERT is provided to allow users who wish to retain XSDRN capability to use libraries produced in AMPX. Its function mirrors that of the CONVERT module.

REVERT is not flexibly dimensioned. Its dimensions are set to handle group structures on the order of the XSDRN 123 group structure and smaller group structures.

The input data uses FORTRAN formatting as opposed to the ANISN-type data generally used throughout AMPX.

9.4.1 REVERT Input Data

Card 1 (6I12)

1. NNNC - Number of sets to be converted
2. NPREL - Elastic matrix print flag (0/1 = no/yes)
3. NPRIN - Inelastic matrix print flag (0/1 = no/yes)
4. PPRZN - n2n matrix print flag (0/1 = no/yes)
5. N8 - AMPX neutron interface (Default = 21)
6. N9 - New XSDRN library in old format is made here (Default = 22)

Card(s) 2 (4I12) -- NNNC Cards

1. NID_i - AMPX Identification of the set of data
2. $NIDN_i$ - XSDRN Identification of the converted set
3. IT_i - Temperature desired (°K)
4. $IRES_i$ - (0/1 - no/resonance nuclide desired)

9.4.2 REVERT Input/Output Specifications

REVERT generally requires the following devices.

Logical Number	Purpose
5	Card Input
6	Standard Output
14	Scratch Device
15	Scratch Device
16	Scratch Device
17	Scratch Device
18	Scratch Device
19	Scratch Device
21	Old Format XSDRN Library
22	New AMPX neutron interface

9.5. OCTAGN - AMPX Module to Produce CITATION Libraries From AMPX Working Libraries

OCTAGN (Old CITATION Tapes from AMPX Generated Numbers) is a module to make CITATION libraries from AMPX weighted libraries. It is somewhat less convenient than the CITATION option in the old XSDRN code and is presently restricted in that the sets will not interface properly with CITATION depletion calculations. However, it does afford a way of making libraries to use with 1, 2, or 3-D diffusion and perturbation calculations in CITATION.

9.5.1 OCTAGN Input Data

OCTAGN will make a CITATION library from an AMPX weighted library. (Note that n2n's are included in the scattering matrices. This means that CITATION libraries from OCTAGN will not interface properly with depletion calculations in CITATION, but k-calculations, perturbation calculations, etc. should be actually improved.)

Title Card (20A4) for case

Block 1

1$ Case Description [7]

1. NFILE - number of CITATION "Files" to be created.
2. NUP - number of upscatters allowed.
3. NDOWN - number of downscatters allowed.
4. LOGWT - logical number for AMPX weighted library (Default = 3).
5. LOGCIT - logical number for CITATION library (Default = 22).
6. NCHI - not used.
7. NFIRST - first file to be made. This allows appending the new files to an old CITATION library.

T Terminate Block 1.

The next 2 blocks are repeated NFILE times.

Block 2

2$ NNUC - number of nuclides in this "File".

T Terminate Block 2.

Block 3

3$ Identifications for desired nuclides on AMPX working library.

4$ CITATION identifiers for the nuclides in this "File".

T Terminate Block 3.

9.5.2 OCTAGN Input/Output Specifications

OCTAGN generally requires the following devices to be made available.

Logical Number	Purpose
3	AMPX Working/Weighted Library
5	Card Input
6	Standard Output
18	Scratch Device
22	CITATION Library

9.6. COMAND - AMPX Module to Collapse ANISN Cross Section Libraries

COMAND (Collapse Multigroup ANISN Data) is a module for collapsing ANISN libraries. It accepts cards or tapes; it truncates upscatters, downscatters, combines ANISN data from up to 5 sources, and allows for stripping groups (neutrons or gammas) from the base library. Several weighting spectra can be read in and used on the same computer run.

9.6.1 COMAND Input Data

Block 1

1$ ANISN Library Parameters [8]

Fine Group Library:

1. IGM - Total number of groups.
2. IHT - Position of σ_T.
3. IHS - Position of $\sigma_{g\to g}$.
4. IHM - Table length.

Broad Group Library:

5. IGMF - Total number of groups.
6. IHTF - Position of σ_T.
7. IHSF - Position of $\sigma_{g\to g}$.
8. IHMF - Table length.

2$ More Data [8]

1. IEDIT - 0, almost no edit.
   1, edit collapsed data.
   2, edit fine group and collapsed data.
2. NCARDS - 0, no BCD formatted input cross sections.
   N, use the Nth spectra to weight BCD formatted input cross sections.
3. MODE - 0, BCD input is free form.
   1, BCD input is formatted.
4. NPNCH - 0, no punch.
   1, punch collapsed cross sections.
5. NSPEC - number of weighting spectra that will be read in the 4* array.
6. NSCRTH - a collapsed ANISN library is written on this logical number. (Default = 2)

7. NUNIT - BCD formatted data is input on this logical unit.
8. NCHI - position of χ in fine group tables, if these are included in the ANISN library.

3$ Logical Units of ANISN Binary Libraries and Weighting Spectrum Selectors [8]

1. NT1 - logical number of 1st ANISN binary library to be collapsed.
2. NT2 - logical number of 2nd ANISN binary library to be collapsed.
3. NT3 - logical number of 3rd ANISN binary library to be collapsed.
4. NT4 - logical number of 4th ANISN binary library to be collapsed.
5. NS1 - weighting spectra to associate with NT1.
6. NS2 - weighting spectra to associate with NT2.
7. NS3 - weighting spectra to associate with NT3.
8. NS4 - weighting spectra to associate with NT4.

(Note how NT2 might equal NT1 and allow weighting the same cross sections over different spectra.)

T Terminate Block 1.

Block 2

4* Few Group Weighting Spectra [NSPEC*IGM]
Stack NSPEC sets of IGM numbers in this array.

5$ Broad Group Numbers by Few Group
This corresponds to the 28$ array in ANISN and 51$ array in XSDRN. A zero entry will delete a group. This allows stripping neutron or gamma groups.

T Terminate Block 2.

9.6.2 COMAND Input/Output Specifications

COMAND generally requires the following input/output devices to be available.

Logical Number	Purpose
2	Collapsed ANISN Binary Library
5	Card Input
6	Standard Output
7	Punched Output
NT1	ANISN Binary Library Input
NT2	ANISN Binary Library Input
NT3	ANISN Binary Library Input
NT4	ANISN Binary Library Input
NUNIT	BCD ANISN Library

9.7. ARID -- AMPX Module to Collapse the 37/21 Group DNA Few Group Library in ANISN Formats

The collapser to go with the DNA Few Group Library is a simplified version of the AMPX COMAND module.

This module, ARID (ANISN Reduction If DNA Few Group Library is Your Base Cross Section Set), assumes the following:

1. An ANISN library in card image or binary format is mounted on logical unit 20. It has the ANISN P_ℓ decks stacked with control cards interspersed as if one were getting ready to run ALC1 to make an ANISN library.
2. A collapsed library will be written in ANISN binary format on logical unit 18. These can be punched onto cards in the ANISN free-form BCD format on logical 7.
3. ARID assumes:
   a. total number of groups on DNA library is 58 (37 neutron and 21 gamma),
   b. the total cross section is in position 3,
   c. the within group cross section is in position 4,
   d. the table length of the DNA library is 61.
4. One can selectively collapse the data over a built-in spectrum, or the user may override the built-in data by inputting his own. The build-in spectrum consists of a 1/E variation joined to a thermal Maxwellian (300K) for neutrons and has a flat variation for gamma groups.

9.7.1 ARID Input Data

Block 1

1$ Collapsing Case Description [8]

1. IGMF - total number of groups in broad structure.
2. IHTF - position of σ_T in broad structure.
3. IHSF - position of σ_{gg} in broad structure.
4. IHMF - table length in broad structure.
5. IEDIT - 0, almost no edit,
   1, edit collapsed data,
   2, edit fine group and collapsed data.

6. NSPEC - spectrum number to use in collapsing (input a zero).
7. NPNCH - 0, no punch,
   1, punch collapsed cross sections in ANISN free-form format.
8. NFM - -1, DNA Few Group Library is in ANISN binary format,
   0, DNA Few Group Library is in ANISN BCD free-form format,
   1, DNA Few Group Library is in ANISN BCD fixed form format.

T Terminate Block 1.

Block 2

4* Weighting Spectrum (This will override a selected spectrum.)

5$ Broad Group Numbers by Fine Group
This corresponds to the 28$ array in ANISN or 51$ array in XSDRN.
A zero entry will suppress a group.

T Terminate Case Data

Note that one can use ARID to convert ANISN library formats, either BCD to binary or binary to BCD.

9.7.2 ARID Input/Output Specifications

ARID generally requires the following input/output devices to be made available.

Logical Number	Purpose
5	Card Input
6	Standard Output
7	Card Output
18	Collapsed Binary ANISN Library
20	37-21 DNA Few Group ANISN Library

9.8. MALØCS -- AMPX Module to Collapse AMPX Neutron, Gamma and Coupled Neutron-Gamma Interfaces

MALOCS (Miniature AMPX Library of Cross Sections) is provided to allow one to collapse "Master" AMPX libraries to smaller group structures.

9.8.1 MALOCS Input Data

Block 1

1$ Case Description [6]

1. NNEUT - number of neutron fine groups.
2. IGMF - number of neutron broad groups.
3. NGAMM - number of gamma fine groups.
4. IPMF - number of gamma broad groups.
5. IWN - neutron weighting option. Input zero.
6. IWG - gamma weighting option. Input zero.

2$ Library Logical Numbers [2]

1. NØLD - logical number of device containing fine group library (Default = 1).
2. NNEW - logical number of device containing broad group library (Default = 22).

T Terminate Block 1.

Block 2

4$ Neutron Broad Group Numbers by Fine Group [NNEUT]

5* Neutron Weighting Spectrum [NNEUT]

6$ Gamma Broad Group Numbers by Broad Group [NGAMM]

7* Gamma Weighting Spectrum [NGAMM]

T Terminate Block 2.

9.8.2 MALOCS Input/Output Specifications

MALØCS generally requires the following input/output assignments.

Logical Number	Purpose
1	Fine Group AMPX Master Library
5	Card Input
6	Standard Output
18	Scratch Device
19	Scratch Device
22	Broad Group AMPX Master Library Produced by MALØCS

9.9. RADE -- AMPX Module to Check AMPX Master Cross Section Libraries

RADE (Rancid AMPX Data Exorcist) is provided to check the multigroup libraries produced by the various AMPX modules. It will check neutron, gamma, or coupled neutron-gamma libraries.

In its present version, the checking includes:

1. $\sigma_T \overset{?}{=} \sigma_a + \sigma_s$
2. $\sigma_{in} \overset{?}{=} \Sigma\ \sigma_{in}^{partial}$
3. $\sigma_a \overset{?}{=} \sigma_c + \sigma_f$
4. $\sigma_c \overset{?}{=} \sigma_{n\gamma} + \sigma_{n\alpha} + \sigma_{np} + \sigma_{nd} + \ldots$
5. $\sigma_{e\ell}^{g} \overset{?}{=} \sum_{g'} \sigma_{e\ell,0}\ (g\to g')$
6. $\sigma_0(g\to g') \overset{?}{>} 0$
7. $\sigma_T, \sigma_a, \sigma_f, \sigma_{n\gamma}, \sigma_{np}, \ldots \overset{?}{>} 0$
8. $-1 \le \bar{\mu}(g\to g') \left(= \dfrac{\sigma_1(g\to g')}{3\sigma_0(g\to g')} \right) \le 1$

In addition to these checks, the code will compute an estimate of the capture binding energy for each neutron group in a coupled neutron-gamma set. On option, one can request a display of differential cross sections.

9.9.1 RADE Input Data

Block 1

1\$ Checking Commands [4]

1. MMT - Check the AMPX Master Interface on logical MMT. This can be a neutron, gamma, or a coupled neutron-gamma library.
2. MWT - Check the AMPX Working/Weighted Interface on logical MWT. This operation is not operable in the present version.
3. MAN - Check the ANISN binary formatted library on logical MAN.

4. IFM - -1, ANISN library is binary formatted;
   0, ANISN library is BCD free form;
   1, ANISN library is BCD fixed form.

2$ Options [20]

1. IØPT1 - number of angles at which a display of differential cross sections is desired. These angles will be equally spaced in the cosine range, -1 to +1. These edits are for the group integrated cross sections and not for each group-to-group transfer.
2. IØPT2 - the ε, in 1/1000's of a percent, to which checks are made; e.g., IOPT2=1 is equivalent to 0.001% checking. This is the default value when IØPT2 is not input or when a zero value is input.

3. IØPT3 . . . 20. IØPT20 — Future checking options; skip or input zeros.

3$ ANISN Options [7] {MAN $\neq$ 0}

1. NSET - number of ANISN sets to check.
2. IHT - position of σ_T.
3. IHS - position of σ_{gg}.
4. ITL - table length.
5. NL - maximum order of scattering.
6. IGM - number of neutron groups.
7. IPM - number of photon groups.

T Terminate this block.

Block 2 {Input only when MAN > 0}

4$ Identification Numbers of P_0 Sets on ANISN Binary Library on Logical MAN [NSET]

5$ Order of Scattering for Sets of ANISN Data on Logical MAN [NSET]

7* Neutron Group Structure, high-to-low in eV [IGM+1]

8* Gamma Group Structure, high-to-low in eV [IPM+1]

T Terminate this block.

9.9.2 RADE Input/Output Specifications

RADE requires the following input/output assignments:

Logical	Purpose
5	Card Input
6	Standard Output
18	Scratch Device
19	Scratch Device
MMT	Master Library
MWT	Working Library
MAN	ANISN Library

9.10. VASELINE -- AMPX Module to Plot ENDF Point and AMPX Group-Averaged Cross Sections

VASELINE (Visual Aids SELected IN Ecstasy) is a plotting module for AMPX. It is written to plot point-versus-point data, point-versus-multigroup data, or multigroup-versus-multigroup data. Any ENDF array from files 3, 13, or 23 can be plotted as can any one-dimensional group averaged neutron or gamma cross section on a master or working/weighted cross section interface. Selections can be made from any combination of ENDF or multigroup sources. The number of curves on any plot is arbitrary.

9.10.1 VASELINE Input Data

Block 1

1$ Plot Selection [2]

1. MPLØT - number of plot commands given below. This is presently limited to 100 but can be increased with a simple modification to the "main" VASELINE subroutine.
2. IPLØT*-0 points only
   1 lines between points
   2 points and lines
   3 histogram

T Terminate this block.

Block 2 This block of 3 arrays will be repeated MPLØT times.

3$ Identifiers of Data to be Plotted [5]

1. NPLØT - the plot number on which the data selected by this block will be plotted.
2. MT - the process to be plotted. ENDF process identifiers are employed where applicable.
3. IDM - the identification number of a set of data on an AMPX Master Interface which contains the "MT" data. A zero indicates that this command does not select from a master interface.
4. IDW - the identification number of a set of data on an AMPX Working Interface which contains the "MT" data.

---

*This parameter applies to data taken from ENDF libraries only.

5. IDE - the ENDF "MAT" number for the set of data which contains "MT".

4$ Library Selectors [5]

{Omit this array if default values are acceptable.}

1. MMTN - logical number of AMPX Master Interface (Default = 1).
2. MWTN - logical number of AMPX Working Interface (Default = 4).
3. MENDF - logical number of the ENDF library (Default = 11).
4. MØDE - tape mode of MENDF (Default = 1 for binary).
5. MFILE - file number containing ENDF data (Default = 3).
   (Note that data can only be plotted from files 3, 13, and 23 in the present version of VASELINE.)

5* Plot Range [2]

1. ELØ - low energy limit of plot (eV).
2. EHI - high energy limit of plot (eV).

This array can be omitted, in which case the range is automatically determined to be the full range of the data selected.

T Terminate Block 2.

9.10.2 VASELINE Input/Output Requirements

VASELINE generally requires the following I/Ø assignments:

Logical	Purpose
5	Card Input
6	Standard Output
18	Scratch Device
MMTN(1)	AMPX Master Interface
MWTN(4)	AMPX Working Interface
MENDF(11)	ENDF Library
CRTTAPE	CRT Plot Tape

10.0. SAMPLE PROBLEMS

N. M. Greene

This section will demonstrate some of the major capabilities of the AMPX system, by presenting the input and condensed output of several sample calculations. In some cases, the problems may appear "ill-conceived" due to the execution path selected. However, they are purposely designed to demonstrate the power and flexibility of this modular system.

To conserve space, the outputs are presented in very abbreviated form, but are extensive enough to serve as "check cases" to use in making AMPX operational on another computing system.

10.1. Problem 1

This calculation will produce P_5 coupled neutron-gamma cross sections for the ENDF-IV evaluations of hydrogen and oxygen in the 37 neutron group, 21 gamma group DNA shielding structure. The neutron weighting is 1/E tied to a Maxwellian spectrum at $\sim$0.125 eV. The gamma weighting is flat. Cross sections are produced in the ANISN binary formats on punched cards.

On the 360/91 at ORNL, the calculation requires 410K bytes of storage and 1.43 minutes of CPU time. AMPX modules XLACS, LAPHNGAS, SMUG, CHOX, and NITAWL are required. The RADE module is also employed to check the coupled library.

The input data are shown on the following page with an abbreviated and annotated listing of the output following that.

EDIT OF CARD INPUT

```
THIS IS THE TOP OF AMPX

MODULE XLACS    HAS BEEN CALLED

SAMPLE PROBLEM 1
HYDROGEN AND OXYGEN
IN 37 GROUP STRUCTURE
USING 1/E-TO-MAXWELLIAN WEIGHTING
VERSION IV ENDF EVALUATIONS
1$$ 1 2 37 1 0 3$$ 2Q1 F2 T
T    THE 37 GROUP STRUCTURE IS BUILT IN
HYDROGEN      1269
70$$ 2R1269 0 5 E T
OXYGEN    1276
70$$ 2R1276 0 5 E T
T
T

MODULE XLACS    IS FINISHED. USER CODE 0000   SYSTEM CODE 000
```

XLACS

```
MODULE LAPHNGAS HAS BEEN CALLED

LAPHNGAS RUN FOR HYDROGEN AND OXYGEN
1$$ 2 37 21 5 T
T   THE 37 AND 21 GROUP STRUCTURES ARE BUILT IN
14$$ 1269 5 E T
14$$ 1276 5 E T

MODULE LAPHNGAS IS FINISHED. USER CODE 0000   SYSTEM CODE 000
```

LAPHNGAS

```
MODULE SMUG     HAS BEEN CALLED

SMUG RUN FOR HYDROGEN AND OXYGEN
1$$ 21 2 5 T
T   THE 21 GROUP STRUCTURE IS BUILT IN
10$$ 8 5 40 2 E T
10$$ 1 5 40 2 E T

MODULE SMUG     IS FINISHED. USER CODE 0000   SYSTEM CODE 000
```

SMUG

```
MODULE CHOX     HAS BEEN CALLED

1$$ 2 0 T
2$$ 1269 1276 3$$ 1269 1276 4$$    1    8 5$$ 1269 1276 T

MODULE CHOX     IS FINISHED. USER CODE 0000   SYSTEM CODE 000
```

CHOX

```
MODULE RADE     HAS BEEN CALLED

1$$ 1 E T

MODULE RADE     IS FINISHED. USER CODE 0000   SYSTEM CODE 000
```

RADE

```
MODULE NITAWL   HAS BEEN CALLED

1$$ 0 2 0 0 1 E T
2$$ 1269 1276 T

MODULE NITAWL   IS FINISHED. USER CODE 0016   SYSTEM CODE 000
```

NITAWL

```
XX          XX  LL              AAAAAAAAA     CCCCCCCCCCC    SSSSSSSSSSS
 XX        XX   LL             AAAAAAAAAAA   CCCCCCCCCCCCC  SSSSSSSSSSSSS
  XX      XX    LL            AA         AA  CC         CC  SS         SS
   XX    XX     LL            AA         AA  CC             SS
    XX  XX      LL            AA         AA  CC             SS
     XXX        LL            AAAAAAAAAAAAA  CC             SSSSSSSSSSSS
     XXX        LL            AAAAAAAAAAAAA  CC              SSSSSSSSSSSS
    XX  XX      LL            AA         AA  CC                        SS
   XX    XX     LL            AA         AA  CC                        SS
  XX      XX    LL            AA         AA  CC         CC  SS         SS
 XX        XX   LLLLLLLLLLLL  AA         AA  CCCCCCCCCCCCC  SSSSSSSSSSSSS
XX          XX  LLLLLLLLLLLL  AA         AA   CCCCCCCCCCC    SSSSSSSSSSS
```

A header page separates the output from various modules

```
   0000000     555555555555             //        11      777777777777               //   777777777777  555555555555
  000000000    555555555555            //        111      77777777777               //    77777777777   555555555555
 00       00   55                     //        1111      77        77             //     77        77  55
00         00  55                    //           11               77             //               77   55
00         00  55                   //            11              77             //               77    55
00         00  55555555555         //             11             77             //               77     55555555555
00         00  555555555555       //              11             77            //                77     555555555555
00         00             55     //               11            77            //                77                 55
00         00             55    //                11            77           //                 77                 55
 00       00   55         55   //                 11           77           //                 77      55         55
  000000000    555555555555   //              11111111         77          //                  77      555555555555
   0000000      5555555555   //               11111111         77         //                   77       5555555555
```

```
  3333333333              555555555555        44                  2222222222   555555555555
 333333333333             555555555555       444                 222222222222  555555555555
 33        33             55                4444                 22        22  55
           33             55               44 44                           22  55
           33             55              44  44                           22  55
         333              55555555555    44   44                          22   55555555555
         333      ....    555555555555  44    44      ....               22    555555555555
           33     ....              55  44444444444   ....              22                55
           33     ....              55  444444444444  ....             22                 55
 33        33     ....    55        55        44      ....           22       55          55
 333333333333             555555555555        44                 222222222222  555555555555
  3333333333               5555555555         44                 222222222222   5555555555
```

1$ ARRAY 5 ENTRIES READ

3$ ARRAY 6 ENTRIES READ

0T

A STANDARD 37 NEUTRON GROUP STRUCTURE HAS BEEN INSERTED FOR YOU AND WILL BE USED UNLESS YOU OVERRIDE IT

0T

AN XSDRN TAPE WILL BE WRITTEN WITH THE AUSPICIOUS TITLE

```
***************************************************************************************
SAMPLE PROBLEM 1
HYDROGEN AND OXYGEN
IN 37 GROUP STRUCTURE
USING 1/E-TO-MAXWELLIAN WEIGHTING
VERSION IV ENDF EVALUATIONS
```

XSDRN TAPE IDENTIFICATION	1	TRANSFER INTEGRATION MESH-SRCE	0
NUMBER OF NUCLIDES	2	TRANSFER INTEGRATION MESH-SINK	0
NUMBER OF ENERGY GROUPS	37	ENDF TAPE IDENTIFICATION	0
NUMBER OF THERMAL GROUPS	1	ENDF TAPE MODE (FAST DATA)	0
WEIGHTING OPTION	0	PEAK TEMPERATURE (MAXWELLIAN)	0

OUTPUT LISTING OPTIONS

RESONANCE DATA	1
1-DIMENSIONAL ARRAYS	1
ELASTIC SCATTERING	2
THERMAL SCATTERING	2
INELASTIC SCATTERING	2
N2N TRANSFERS	2

MULTIGROUP STRUCTURE

GROUP	ENERGY RANGE	LETHARGY RANGE	GROUP	ENERGY RANGE	LETHARGY RANGE
1	1.6905E 07 - 1.9640E 07	-0.675 - -0.525	20	1.1080E 06 - 1.8268E 06	1.700 - 2.200
2	1.4918E 07 - 1.6905E 07	-0.525 - -0.400	21	5.5023E 05 - 1.1080E 06	2.200 - 2.900
3	1.4191E 07 - 1.4918E 07	-0.400 - -0.350	22	1.5764E 05 - 5.5023E 05	2.900 - 4.150
4	1.3840E 07 - 1.4191E 07	-0.350 - -0.325	23	1.1109E 05 - 1.5764E 05	4.150 - 4.500
5	1.2840E 07 - 1.3840E 07	-0.325 - -0.250	24	5.2475E 04 - 1.1109E 05	4.500 - 5.250
6	1.2214E 07 - 1.2840E 07	-0.250 - -0.200	25	2.4788E 04 - 5.2475E 04	5.250 - 6.000
7	1.1052E 07 - 1.2214E 07	-0.200 - -0.100	26	2.1875E 04 - 2.4788E 04	6.000 - 6.125
8	1.0000E 07 - 1.1052E 07	-0.100 - 0.0	27	1.0333E 04 - 2.1875E 04	6.125 - 6.875
9	9.0484E 06 - 1.0000E 07	0.0 - 0.100	28	3.3546E 03 - 1.0333E 04	6.875 - 8.000
10	8.1873E 06 - 9.0484E 06	0.100 - 0.200	29	1.2341E 03 - 3.3546E 03	8.000 - 9.000
11	7.4082E 06 - 8.1873E 06	0.200 - 0.300	30	5.8295E 02 - 1.2341E 03	9.000 - 9.750
12	6.3763E 06 - 7.4082E 06	0.300 - 0.450	31	1.0130E 02 - 5.8295E 02	9.750 - 11.500
13	4.9659E 06 - 6.3763E 06	0.450 - 0.700	32	2.9023E 01 - 1.0130E 02	11.500 - 12.750
14	4.7237E 06 - 4.9659E 06	0.700 - 0.750	33	1.0677E 01 - 2.9023E 01	12.750 - 13.750
15	4.0657E 06 - 4.7237E 06	0.750 - 0.900	34	3.0590E 00 - 1.0677E 01	13.750 - 15.000
16	3.0119E 06 - 4.0657E 06	0.900 - 1.200	35	1.1254E 00 - 3.0590E 00	15.000 - 16.000
17	2.3852E 06 - 3.0119E 06	1.200 - 1.433	36	4.1400E-01 - 1.1254E 00	16.000 - 17.000
18	2.3069E 06 - 2.3852E 06	1.433 - 1.467	37	1.0000E-05 - 4.1400E-01	17.000 - 27.631
19	1.8268E 06 - 2.3069E 06	1.467 - 1.700			

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          COMMENCE PROCESSING DATA FOR
     HYDROGEN          1269

    70$ ARRAY          9 ENTRIES READ

     0T

     XSDRN IDENTIFIER                      1269      ENDF TAPE MODE (THERMAL DATA)              0
     ENDF/B MATERIAL ID (FAST DATA)        1269      ENDF/B MATERIAL ID (THERMAL DATA)       1269
     NUMBER OF THERMAL TEMPERATURES           0      NUMBER OF ATOMS/MOLECULES                  0
     ORDER OF FAST EXP COEFF                  5      LOGICAL UNIT (THERMAL DATA)               11
     ORDER OF THERMAL EXP COEFF               0


   THE (TAPE) DESCRIPTION OF MATERIAL   1269 IS -
        1- H-  1  LASL        EVAL-AUG70 L.STEWART,R.J.LABAUVE,P.G.YOUNG
       LA-4574    %1971<      DIST-MAY74

       ****************    DNA 4148 MOD 2    ****************************

           AUGUST  1973          COMMENTS AND CHANGES

                 1.  RECENT TOTAL MEASUREMENTS BY CLEMENT AND STOLER
                     %RPI< AND BY HEATON ET AL. %NBS< DO NOT INDICATE
                     THE NEED FOR CHANGES AT THIS TIME.
                 2.  THE LP#2 FLAG HAS BEEN IMPLEMENTED IN MF#12,
                     MT#102 IN VERSION IV.

                 3.  A NEW LISTING HAS BEEN GENERATED FOR THE TOTAL
                     CROSS SECTION TO INSURE THAT THE SUMMATION OF THE
                     PARTIALS IS CONSERVED TO HIGHER PRECISION.

                 4.  THE NORMALIZATION AND STANDARDS SUBCOMMITTEE OF
                     CSEWG REVIEWED THIS FILE IN MARCH, 1973 AND
                     RECOMMENDED NO CHANGES TO THE SCATTERING CROSS
                     SECTION FOR VERSION IV.

       ****************    DNA 4148 MOD 1    ****************************
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MT#102, GAMMA RAY ANGULAR DISTRIBUTION --- ASSUMED ISOTROPIC
        AT ALL NEUTRON ENERGIES.


ELAPSED TIME   0.15 MIN.

ELAPSED TIME   0.15 MIN.
NO FILE 3 DATA FOR MATERIAL 1269 REACTION   4---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  16---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  17---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  22---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  23---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  24---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  25---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  26---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  27---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  28---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  29---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  30---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  31---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  32---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  33---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  34---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  35---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  36---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  37---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  51---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  52---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  53---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  54---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  55---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION  91---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 103---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 104---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 105---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 106---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 107---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 108---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 109---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 110---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 111---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 112---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 113---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 114---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 115---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 116---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 117---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 118---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1269 REACTION 119---TAPE SEARCHED TO MAT=1269 MF= 3 MT= 251

ELAPSED TIME   0.15 MIN.
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  ELAPSED TIME    0.18 MIN.
NO FILE 5 DATA FOR MATERIAL 1269 REACTION  16---TAPE SEARCHED TO MAT=1269 MF= 7 MT=    4
NO FILE 5 DATA FOR MATERIAL 1269 REACTION  17---TAPE SEARCHED TO MAT=1269 MF= 7 MT=    4
NO FILE 5 DATA FOR MATERIAL 1269 REACTION  18---TAPE SEARCHED TO MAT=1269 MF= 7 MT=    4
NO FILE 5 DATA FOR MATERIAL 1269 REACTION  22---TAPE SEARCHED TO MAT=1269 MF= 7 MT=    4
NO FILE 5 DATA FOR MATERIAL 1269 REACTION  23---TAPE SEARCHED TO MAT=1269 MF= 7 MT=    4
NO FILE 5 DATA FOR MATERIAL 1269 REACTION  24---TAPE SEARCHED TO MAT=1269 MF= 7 MT=    4
NO FILE 5 DATA FOR MATERIAL 1269 REACTION  25---TAPE SEARCHED TO MAT=1269 MF= 7 MT=    4
NO FILE 5 DATA FOR MATERIAL 1269 REACTION  28---TAPE SEARCHED TO MAT=1269 MF= 7 MT=    4

  ELAPSED TIME    0.19 MIN.

  ELAPSED TIME    0.19 MIN.


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        COMMENCE PROCESSING DATA FOR
   OXYGEN     1276

  70$ ARRAY       9 ENTRIES READ

   0T

   XSDRN IDENTIFIER                      1276     ENDF TAPE MODE (THERMAL DATA)          0
   ENDF/B MATERIAL ID (FAST DATA)        1276     ENDF/B MATERIAL ID (THERMAL DATA)   1276
   NUMBER OF THERMAL TEMPERATURES           0     NUMBER OF ATOMS/MOLECULES              0
   ORDER OF FAST EXP COEFF                  5     LOGICAL UNIT (THERMAL DATA)           11
   ORDER OF THERMAL EXP COEFF               0
```

FO70 J.L.FOWLER AND C.H.JOHNSON, PHYS.REV.C2,124 %1970<
FO73 J.L.FOWLER ET AL., PHYS.REV. C8,545 %1973<
HI58 R.W.HILL, PHYS.REV. 109,2105 %1958<
HU62 W.HUNZINGER AND P.HUBER, HELV.PHYS.ACTA 35,351 %1962<
JO48 W.B.JONES,JR., PHYS. REV. 74, 364 %1948<
JO67 C.H.JOHNSON AND J.L.FOWLER, PHYS.REV. 162,890 %1967<
JO73 C.H.JOHNSON, PHYS.REV. C7,561 %1973<
JU64 E.T.JURNEY AND H.T.MOTZ, BULL.AM.PHYS.SOC. 9, 176 %1964<
KI72 W.E.KINNEY AND F.G.PEREY, ORNL-4780 %1972<
LA60 R.O.LANE ET AL., ANL-6172 %1960<
LE68 B.LEROUX ET AL., NUCL. PHYS. A116, 196 %1968<
LI52 A.B.LILLIE, PHYS. REV. 87, 716 %1952<
LI66 D.LISTER AND A.SAYRES, PHYS.REV. 143,745 %1966<
LU70 B.LUNDBERG ET AL., PHYSICA SCRIPTA 2, 273 %1970<
MA54 H.C.MARTIN, PHYS. REV. 93, 498 %1954<
MA62 J.P.MARTIN AND M.S.ZUCKER, BULL.AM.PHYS.SOC. 7,72 %1962<
MA68 D.R.MAXSON & R.D.MURPHY, NUCL. PHYS. A110, 555 %1968<
MC66 W.J.MCDONALD ET AL., NUCL. PHYS. 75, 353 %1966<
MC66A W.N.MCDICKEN & W.JACK, NUCL. PHYS. 88, 457 %1966<
ME49 E.MELKONIAN, PHYS. REV. 76, 1750 %1949<
NE71 D.O.NELLIS&P.S.BUCHANAN, PRIVATE COMMUNICATION %1971<
NE72 D.O.NELLIS AND P.S. BUCHANAN, DNA-2716 %1972<
NY69 K.NYBERG, PRIV. COMM. TO LEONA STEWART %1969<
OK55 A.OKAZAKI, PHYS. REV. 99, 55 %1955<
OR70 V.J.ORPHAN ET AL., NUCL. SCI. ENG. 42, 352 %1970<
PH61 D.D.PHILLIPS, PRIVATE COMMUNICATION TO BNL %1961<
SC71 R.B.SCHWARTZ, PRIVATE COMMUNICATION %1971<
SE62 K.W.SEEMANN&W.E.MOORE, KAPL-2214 %1962<
SI68 VON I. SICK ET AL., HELV. PHYS. ACTA 41, 573 %1968<
SL65 E.L.SLAGGIE&J.T.REYNOLDS, KAPL-M-6452 %1965<

ELAPSED TIME 0.22 MIN.

ELAPSED TIME 0.22 MIN.

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NO FILE 3 DATA FOR MATERIAL 1276 REACTION  16---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  5.
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  17---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  22---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  23---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  24---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  25---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  26---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  27---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  28---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  29---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  30---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  31---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  32---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  33---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  34---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  35---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  36---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  37---TAPE SEARCHED TO MAT=1276 MF= 3 MT=  51
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  90---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1276 REACTION  91---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 105---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 107
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 106---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 107
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 108---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 109---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 110---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 111---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 112---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 113---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 114---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
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NO FILE 3 DATA FOR MATERIAL 1276 REACTION 115---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 116---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 117---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 118---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1276 REACTION 119---TAPE SEARCHED TO MAT=1276 MF= 3 MT= 251

  ELAPSED TIME   0.26 MIN.

  ELAPSED TIME   0.54 MIN.
NO FILE 5 DATA FOR MATERIAL 1276 REACTION  16---TAPE SEARCHED TO MAT=1276 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1276 REACTION  17---TAPE SEARCHED TO MAT=1276 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1276 REACTION  18---TAPE SEARCHED TO MAT=1276 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1276 REACTION  22---TAPE SEARCHED TO MAT=1276 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1276 REACTION  23---TAPE SEARCHED TO MAT=1276 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1276 REACTION  24---TAPE SEARCHED TO MAT=1276 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1276 REACTION  25---TAPE SEARCHED TO MAT=1276 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1276 REACTION  28---TAPE SEARCHED TO MAT=1276 MF= 7 MT=   4

  ELAPSED TIME   0.60 MIN.

  ELAPSED TIME   0.60 MIN.

  ELAPSED TIME   0.60 MIN.
```

```
AN XSDRN MASTER LIBRARY TAPE WILL BE CREATED ON LOGICAL UNIT   23
    * ITS IDENTIFICATION NUMBER IS     1
    *  2 NUCLIDES HAVE BEEN PROCESSED
    *  37 ENERGY GROUPS      * 37 1ST THERMAL GRP

PERTINENT INFORMATION CONCERNING THIS TAPE IS

    ******************************************************************************************
    *                                                                                        *
    *    SAMPLE PROBLEM 1                                                                    *
    *    HYDROGEN AND OXYGEN                                                                 *
    *    IN 37 GROUP STRUCTURE                                                               *
    *    USING 1/E-TO-MAXWELLIAN WEIGHTING                                                   *
    *    VERSION IV ENDF EVALUATIONS                                                         *
    *                                                                                        *
    ******************************************************************************************

                          T A B L E   O F   C O N T E N T S

                          NUCLIDE TITLE                                                    IDENTIFICATION NUMBER

  1     HYDROGEN       1269                                                                      1269
  2     OXYGEN     1276                                                                          1276
```

ONE DIMENSION AVERAGES FOR HYDROGEN 1269 IDENTIFIER 1269

XSEC ID GRP.	1	2	27	101	102	1099
1	5.32304E-01	5.32277E-01	2.68675E-05	2.68675E-05	2.68675E-05	1.49959E-01
2	6.12464E-01	6.12435E-01	2.83341E-05	2.83341E-05	2.83341E-05	1.25040E-01
3	6.67596E-01	6.67567E-01	2.93464E-05	2.93464E-05	2.93464E-05	4.99605E-02
4	6.92217E-01	6.92187E-01	2.97984E-05	2.97984E-05	2.97984E-05	2.50450E-02
5	7.25987E-01	7.25957E-01	3.00698E-05	3.00698E-05	3.00698E-05	7.49975E-02
6	7.69677E-01	7.69647E-01	3.06027E-05	3.06027E-05	3.06027E-05	4.99824E-02
7	8.24700E-01	8.24669E-01	3.13507E-05	3.13507E-05	3.13507E-05	9.99714E-02
8	9.02483E-01	9.02451E-01	3.21842E-05	3.21842E-05	3.21842E-05	1.00026E-01
9	9.84747E-01	9.84714E-01	3.29410E-05	3.29410E-05	3.29410E-05	9.99970E-02
10	1.07177E 00	1.07174E 00	3.35593E-05	3.35593E-05	3.35593E-05	1.00004E-01
11	1.16451E 00	1.16448E 00	3.42197E-05	3.42197E-05	3.42197E-05	9.99966E-02
12	1.28789E 00	1.28785E 00	3.52373E-05	3.52373E-05	3.52373E-05	1.49999E-01
13	1.50018E 00	1.50015E 00	3.59930E-05	3.59930E-05	3.59930E-05	2.49993E-01
14	1.67239E 00	1.67235E 00	3.63977E-05	3.63977E-05	3.63977E-05	5.00021E-02
15	1.79255E 00	1.79252E 00	3.63252E-05	3.63252E-05	3.63252E-05	1.50006E-01
16	2.08199E 00	2.08196E 00	3.59786E-05	3.59786E-05	3.59786E-05	3.00015E-01
17	2.45550E 00	2.45547E 00	3.52369E-05	3.52369E-05	3.52369E-05	2.33288E-01
18	2.65748E 00	2.65744E 00	3.47342E-05	3.47342E-05	3.47342E-05	3.33783E-02
19	2.87298E 00	2.87294E 00	3.43741E-05	3.43741E-05	3.43741E-05	2.33339E-01
20	3.53525E 00	3.53522E 00	3.43694E-05	3.43694E-05	3.43694E-05	5.00009E-01
21	4.88398E 00	4.88395E 00	3.53677E-05	3.53677E-05	3.53677E-05	6.99975E-01
22	8.12390E 00	8.12385E 00	5.13733E-05	5.13733E-05	5.13733E-05	1.25002E 00
23	1.15198E 01	1.15197E 01	8.71964E-05	8.71964E-05	8.71964E-05	3.49973E-01
24	1.38983E 01	1.38982E 01	1.32163E-04	1.32163E-04	1.32163E-04	7.50003E-01
25	1.65985E 01	1.65983E 01	2.21885E-04	2.21885E-04	2.21885E-04	7.49977E-01
26	1.77896E 01	1.77893E 01	2.93816E-04	2.93816E-04	2.93816E-04	1.25015E-01
27	1.86032E 01	1.86028E 01	3.89943E-04	3.89943E-04	3.89943E-04	7.50001E-01
28	1.96593E 01	1.96586E 01	6.82156E-04	6.82156E-04	6.82156E-04	1.12501E 00
29	2.01747E 01	2.01735E 01	1.18950E-03	1.18950E-03	1.18950E-03	9.99990E-01
30	2.03353E 01	2.03335E 01	1.81401E-03	1.81401E-03	1.81401E-03	7.49995E-01
31	2.04061E 01	2.04027E 01	3.48742E-03	3.48742E-03	3.48742E-03	1.75001E 00
32	2.04559E 01	2.04486E 01	7.28390E-03	7.28390E-03	7.28390E-03	1.25000E 00
33	2.04617E 01	2.04490E 01	1.27107E-02	1.27107E-02	1.27107E-02	9.99996E-01
34	2.04715E 01	2.04490E 01	2.24407E-02	2.24407E-02	2.24407E-02	1.25000E 00
35	2.04882E 01	2.04490E 01	3.91591E-02	3.91591E-02	3.91591E-02	9.99949E-01
36	2.05136E 01	2.04490E 01	6.45677E-02	6.45677E-02	6.45677E-02	1.00003E 00
37	2.07143E 01	2.04483E 01	2.66029E-01	2.66029E-01	2.66029E-01	6.85856E 00

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	1001001	1002002	1003003	1004004	1005005	1006006	1007007	1008008
2	3.69754E-02	3.60038E-02	1.62667E-02	8.55910E-03	2.62491E-02	1.87714E-02	3.92816E-02	4.30342E-02
3		5.82171E-02	2.80910E-02	1.61099E-02	4.93984E-02	3.41136E-02	7.14347E-02	7.47585E-02
4			2.13005E-02	1.35622E-02	4.58935E-02	3.09200E-02	6.33226E-02	6.46753E-02
5				1.02841E-02	3.86412E-02	2.87311E-02	5.73958E-02	5.73276E-02
6					2.92991E-02	2.41884E-02	5.33320E-02	5.19631E-02
7						1.83417E-02	4.48997E-02	4.82816E-02
8							3.40452E-02	4.06493E-02
9								3.08231E-02

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	1009009	1010010	1011011	1012012	1013013	1014014	1015015	1016016
2	4.69609E-02	5.11344E-02	5.55750E-02	9.01576E-02	1.67781E-01	4.08992E-02	1.25810E-01	2.74697E-01
3	8.17824E-02	8.92425E-02	9.71211E-02	1.54461E-01	2.64924E-01	6.49842E-02	2.27257E-01	4.31999E-01
4	6.76236E-02	7.40041E-02	8.07438E-02	1.28634E-01	2.11119E-01	4.54942E-02	1.76544E-01	3.63961E-01
5	5.84990E-02	6.11915E-02	6.69574E-02	1.06944E-01	1.75817E-01	3.62542E-02	1.23597E-01	2.82740E-01
6	5.18573E-02	5.29382E-02	5.53662E-02	8.86828E-02	1.46170E-01	3.01923E-02	9.84944E-02	1.97941E-01
7	4.70048E-02	4.69257E-02	4.78975E-02	7.33300E-02	1.21213E-01	2.51018E-02	8.20242E-02	1.57743E-01
8	4.36745E-02	4.25328E-02	4.24563E-02	6.34362E-02	1.00226E-01	2.08146E-02	6.81928E-02	1.31366E-01
9	3.67696E-02	3.95195E-02	3.84841E-02	5.62330E-02	8.67074E-02	1.72118E-02	5.65526E-02	1.09209E-01
10	2.78805E-02	3.32733E-02	3.57563E-02	5.09724E-02	7.68598E-02	1.48899E-02	4.67572E-02	9.05625E-02
11		2.52296E-02	3.01047E-02	4.73592E-02	6.96728E-02	1.32006E-02	4.04563E-02	7.48911E-02
12			2.28272E-02	3.98726E-02	6.47272E-02	1.19638E-02	3.58530E-02	6.47744E-02
13				3.02337E-02	5.44989E-02	1.11155E-02	3.25024E-02	5.74268E-02
14					4.13232E-02	9.35869E-03	3.02004E-02	5.20521E-02
15						7.09616E-03	2.54244E-02	4.83647E-02
16							1.92791E-02	4.07188E-02
17								3.08755E-02

	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23	GRP. 24
1	1017017	1018018	1019019	1020020	1021021	1022022	1023023	1024024
2	2.59535E-01	4.37138E-02	3.03706E-01	7.21289E-01	1.29636E 00	3.24879E 00	1.76336E 00	3.99405E 00
3	3.76047E-01	7.20868E-02	5.43961E-01	1.01093E 00	1.41654E 00	2.55976E 00	1.43957E 00	5.14779E 00
4	2.56914E-01	4.69818E-02	4.42006E-01	8.14407E-01	7.84457E-01	9.97043E-01	3.03514E-01	1.81269E 00
5	2.16450E-01	3.20968E-02	2.88081E-01	6.61764E-01	6.31957E-01	5.52146E-01	1.18221E-01	3.82181E-01
6	1.68147E-01	2.70445E-02	1.96816E-01	4.31312E-01	5.13512E-01	4.44803E-01	6.54676E-02	1.48862E-01
7	1.17721E-01	2.10088E-02	1.65815E-01	2.94668E-01	3.34684E-01	3.61439E-01	5.27458E-02	8.24373E-02
8	9.38029E-02	1.47060E-02	1.28813E-01	2.48252E-01	2.28655E-01	2.35570E-01	4.28562E-02	6.64113E-02
9	7.81220E-02	1.17204E-02	9.01800E-02	1.92858E-01	1.92645E-01	1.60941E-01	2.79318E-02	5.39641E-02
10	6.49505E-02	9.76040E-03	7.18657E-02	1.35016E-01	1.49652E-01	1.35595E-01	1.90830E-02	3.51714E-02
11	5.38598E-02	8.11454E-03	5.98481E-02	1.07595E-01	1.04768E-01	1.05334E-01	1.60777E-02	2.40289E-02
12	4.45350E-02	4.72913E-03	4.97577E-02	8.96037E-02	8.34915E-02	7.37429E-02	1.24895E-02	2.02449E-02
13	3.85286E-02	5.56425E-03	4.12603E-02	7.44964E-02	6.95302E-02	5.87659E-02	8.74368E-03	1.57267E-02
14	3.41517E-02	4.81434E-03	3.41163E-02	6.17752E-02	5.78058E-02	4.89386E-02	6.96802E-03	1.10100E-02
15	3.09545E-02	4.26663E-03	2.95173E-02	5.10790E-02	4.79353E-02	4.06876E-02	5.80278E-03	8.77387E-03
16	2.87643E-02	3.86553E-03	2.61623E-02	4.41893E-02	3.96369E-02	3.37398E-02	4.82435E-03	7.30684E-03
17	2.42157E-02	3.59336E-03	2.37149E-02	3.91716E-02	3.42903E-02	2.78983E-02	4.00060E-03	6.07484E-03
18	1.83618E-02	3.02541E-03	2.20349E-02	3.55057E-02	3.03957E-02	2.41357E-02	3.30792E-03	5.03743E-03
19		2.29443E-03	1.85515E-02	3.29893E-02	2.75480E-02	2.13941E-02	2.86171E-03	4.16530E-03
20			1.40661E-02	2.77743E-02	2.56006E-02	1.93914E-02	2.53673E-03	3.60358E-03
21				2.10605E-02	2.15519E-02	1.80184E-02	2.29926E-03	3.19422E-03
22					1.63423E-02	1.51696E-02	2.13651E-03	2.89516E-03
23						1.15026E-02	1.79869E-03	2.69020E-03
24							1.36386E-03	2.26488E-03
25								1.71739E-03

	GRP. 25	GRP. 26	GRP. 27	GRP. 28	GRP. 29	GRP. 30	GRP. 31	GRP. 32
1	1025025	1026026	1027027	1028028	1029029	1030030	1031031	1032032
2	4.81962E 00	7.06424E 00	5.46749E 00	7.80929E 00	7.40461E 00	6.02481E 00	1.07656E 01	8.77557E 00
3	5.22566E 00	7.38420E 00	8.82474E 00	8.87097E 00	7.49021E 00	6.73729E 00	1.18223E 01	6.87604E 00

4	2.43157E 00	5.49800E-01	5.48451E 00	5.33563E 00	2.69559E 00	2.30004E 00	4.98352E 00	1.77407E 00
5	8.56229E-01	2.55831E-01	2.17844E 00	3.31598E 00	1.62128E 00	8.27743E-01	1.70132E 00	7.47832E-01
6	1.80524E-01	9.00850E-02	1.01366E 00	1.31710E 00	1.00762E 00	4.97854E-01	6.12276E-01	2.55303E-01
7	7.03152E-02	1.89932E-02	3.56940E-01	6.12869E-01	4.00224E-01	3.09412E-01	3.68258E-01	9.18788E-02
8	3.89394E-02	7.39803E-03	7.52558E-02	2.15809E-01	1.86230E-01	1.22898E-01	2.28870E-01	5.52612E-02
9	3.13694E-02	4.09685E-03	2.93126E-02	4.55003E-02	6.55771E-02	5.71864E-02	9.09066E-02	3.43445E-02
10	2.54901E-02	3.30091E-03	1.62329E-02	1.77227E-02	1.38260E-02	2.01370E-02	4.23003E-02	1.36416E-02
11	1.66133E-02	2.68184E-03	1.30767E-02	9.81454E-03	5.38533E-03	4.24560E-03	1.48952E-02	6.34762E-03
12	1.13501E-02	1.74789E-03	1.06262E-02	7.90669E-03	2.98231E-03	1.65369E-03	3.14044E-03	2.23519E-03
13	9.56264E-03	1.19425E-03	6.92566E-03	6.42467E-03	2.40253E-03	9.15782E-04	1.22322E-03	4.71259E-04
14	7.42855E-03	1.00613E-03	4.73158E-03	4.18731E-03	1.95225E-03	7.37788E-04	6.77403E-04	1.83558E-04
15	5.20059E-03	7.81557E-04	3.98637E-03	2.86076E-03	1.27238E-03	5.99482E-04	5.45689E-04	1.01652E-04
16	4.14444E-03	5.47164E-04	3.09677E-03	2.41025E-03	8.69294E-04	3.90716E-04	4.43434E-04	8.18893E-05
17	3.45137E-03	4.36039E-04	2.16800E-03	1.87234E-03	7.32374E-04	2.66931E-04	2.89009E-04	6.65420E-05
18	2.86942E-03	3.63130E-04	1.72770E-03	1.31079E-03	5.68941E-04	2.24907E-04	1.97450E-04	4.33691E-05
19	2.37947E-03	3.01898E-04	1.43879E-03	1.04458E-03	3.98305E-04	1.74706E-04	1.66355E-04	2.96297E-05
20	1.96748E-03	2.50344E-04	1.19620E-03	8.69907E-04	3.17416E-04	1.22309E-04	1.29229E-04	2.49633E-05
21	1.70220E-03	2.07006E-04	9.91940E-04	7.23233E-04	2.64335E-04	9.74692E-05	9.04709E-05	1.93922E-05
22	1.50878E-03	1.79086E-04	8.20197E-04	5.99733E-04	2.19765E-04	8.11707E-05	7.20972E-05	1.35762E-05
23	1.36756E-03	1.58745E-04	7.09580E-04	4.95902E-04	1.82237E-04	6.74843E-05	6.00409E-05	1.08190E-05
24	1.27073E-03	1.43872E-04	6.28980E-04	4.29012E-04	1.50688E-04	5.59606E-05	4.99177E-05	9.00984E-06
25	1.06982E-03	1.33696E-04	5.70099E-04	3.80285E-04	1.30365E-04	4.62720E-05	4.13937E-05	7.49072E-06
26	9.11208E-04	1.12559E-04	5.29736E-04	3.44684E-04	1.15557E-04	4.00316E-05	3.42272E-05	6.21157E-06
27		8.53485E-05	4.45981E-04	3.20284E-04	1.04738E-04	3.54842E-05	2.96108E-05	5.13615E-06
28			3.38171E-04	2.69645E-04	9.73237E-05	3.21627E-05	2.62474E-05	4.44348E-06
29				2.04462E-04	8.19359E-05	2.98853E-05	2.37902E-05	3.93872E-06
30					6.21291E-05	2.51603E-05	2.21060E-05	3.56997E-06
31						1.90782E-05	1.86109E-05	3.31724E-06
32							1.41120E-05	2.79278E-06
33								2.11766E-06

	GRP. 33	GRP. 34	GRP. 35	GRP. 36	GRP. 37
1	1033033	1034034	1035035	1036036	1037037
2	7.52276E 00	8.77684E 00	7.52254E 00	7.52303E 00	2.04482E 01
3	7.37879E 00	9.22285E 00	7.37804E 00	8.17128E 00	1.29260E 01
4	1.74533E 00	3.06397E 00	2.34094E 00	2.71449E 00	4.75518E 00
5	4.50309E-01	7.24734E-01	7.77696E-01	8.61266E-01	1.57966E 00
6	1.89822E-01	1.86986E-01	1.83952E-01	2.86126E-01	5.01204E-01
7	6.48032E-02	7.88214E-02	4.74609E-02	6.76784E-02	1.66507E-01
8	2.33215E-02	2.69089E-02	2.00065E-02	1.74615E-02	3.93848E-02
9	1.40269E-02	9.68402E-03	6.83001E-03	7.36067E-03	1.01615E-02
10	8.71762E-03	5.82453E-03	2.45800E-03	2.51286E-03	4.28345E-03
11	3.46263E-03	3.61991E-03	1.47838E-03	9.04333E-04	1.46233E-03
12	1.61121E-03	1.43782E-03	9.18805E-04	5.43919E-04	5.26266E-04
13	5.67356E-04	6.69040E-04	3.64948E-04	3.38041E-04	3.16527E-04
14	1.19619E-04	2.35589E-04	1.69816E-04	1.34270E-04	1.96719E-04
15	4.65925E-05	4.96707E-05	5.97971E-05	6.24776E-05	7.81367E-05
16	2.58021E-05	1.93470E-05	1.26074E-05	2.20002E-05	3.63581E-05
17	2.07361E-05	1.07141E-05	4.91067E-06	4.63845E-06	1.28028E-05
18	1.68903E-05	8.63116E-06	2.71945E-06	1.80670E-06	2.69928E-06
19	1.10083E-05	7.01354E-06	2.19083E-06	1.00052E-06	1.05139E-06
20	7.52086E-06	4.57109E-06	1.78016E-06	8.06022E-07	5.82243E-07
21	6.33646E-06	3.12297E-06	1.16024E-06	6.54950E-07	4.69054E-07
22	4.92231E-06	2.63113E-06	7.92670E-07	4.26879E-07	3.81141E-07
23	3.44601E-06	2.04395E-06	6.67837E-07	2.91627E-07	2.48399E-07
24	2.74621E-06	1.43093E-06	5.18793E-07	2.45705E-07	1.69721E-07
25	2.28694E-06	1.14030E-06	3.63198E-07	1.90866E-07	1.42987E-07
26	1.90135E-06	9.49647E-07	2.89436E-07	1.33630E-07	1.11081E-07
27	1.57669E-06	7.89522E-07	2.41036E-07	1.06495E-07	7.77574E-08
28	1.30371E-06	6.54692E-07	2.00397E-07	8.86776E-08	6.19626E-08
29	1.12787E-06	5.41354E-07	1.66190E-07	7.37210E-08	5.16103E-08
30	9.99750E-07	4.68340E-07	1.37398E-07	6.11272E-08	4.29125E-08
31	9.06154E-07	4.15140E-07	1.18899E-07	5.05587E-08	3.55758E-08
32	8.42025E-07	3.76279E-07	1.05348E-07	4.37195E-08	2.94218E-08
33	7.08890E-07	3.49639E-07	9.55275E-08	3.87904E-08	2.54413E-08
34	5.37521E-07	2.94359E-07	8.87515E-08	3.51017E-08	2.25602E-08

35		2.23201E-07	7.47097E-08	3.26466E-08	2.04653E-08
36			5.66579E-08	2.74946E-08	1.89979E-08
37				2.08380E-08	1.59944E-08
38					1.21305E-08

P1 ELASTIC (MT= 2)--HYDROGEN 1269 IDENTIFIER 1269

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	1001001	1002002	1003003	1004004	1005005	1006006	1007007	1008008
2	1.08304E-01	1.05860E-01	4.83776E-02	2.55526E-02	7.78093E-02	5.58347E-02	1.15954E-01	1.27027E-01
3		1.63530E-01	8.07940E-02	4.74615E-02	1.44619E-01	9.92380E-02	2.06527E-01	2.13636E-01
4			5.72287E-02	3.82683E-02	1.31824E-01	8.76771E-02	1.77544E-01	1.77922E-01
5				2.71275E-02	1.06401E-01	8.00364E-02	1.56906E-01	1.52883E-01
6					7.53649E-02	6.45324E-02	1.43049E-01	1.35102E-01
7						4.57211E-02	1.15453E-01	1.23214E-01
8							8.17761E-02	9.94168E-02
9								7.04308E-02

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	1009009	1010010	1011011	1012012	1013013	1014014	1015015	1016016
2	1.38625E-01	1.50950E-01	1.64017E-01	2.64062E-01	4.84139E-01	1.21629E-01	3.68467E-01	7.86914E-01
3	2.33709E-01	2.55027E-01	2.77541E-01	4.36201E-01	7.22863E-01	1.81819E-01	6.49374E-01	1.16563E 00
4	1.83824E-01	2.01167E-01	2.19486E-01	3.45542E-01	5.40582E-01	1.14805E-01	4.70358E-01	9.32700E-01
5	1.53074E-01	1.58230E-01	1.73134E-01	2.73270E-01	4.28238E-01	8.58500E-02	2.96988E-01	6.75490E-01
6	1.31551E-01	1.31760E-01	1.36183E-01	2.15561E-01	3.38668E-01	6.80070E-02	2.22123E-01	4.26519E-01
7	1.16237E-01	1.13234E-01	1.13398E-01	1.69548E-01	2.67138E-01	5.37976E-02	1.75944E-01	3.18966E-01
8	1.06021E-01	1.00058E-01	9.74572E-02	1.41192E-01	2.10128E-01	4.24279E-02	1.39141E-01	2.52681E-01
9	8.55426E-02	9.12558E-02	8.61127E-02	1.21336E-01	1.74964E-01	3.33734E-02	1.09761E-01	1.99822E-01
10	6.05955E-02	7.36341E-02	7.85529E-02	1.07223E-01	1.50375E-01	2.77864E-02	8.63256E-02	1.57630E-01
11		6.21591E-02	6.33662E-02	9.77638E-02	1.32857E-01	2.38834E-02	7.18991E-02	1.23989E-01
12			4.48929E-02	7.89053E-02	1.21195E-01	2.11146E-02	6.17802E-02	1.03230E-01
13				5.58915E-02	9.77788E-02	1.92463E-02	5.45772E-02	8.87269E-02
14					6.92693E-02	1.55299E-02	4.97935E-02	7.84091E-02
15						1.10010E-02	4.01740E-02	7.15062E-02
16							2.84602E-02	5.76948E-02
17								4.08711E-02

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	1001001	1002002	1003003	1004004	1005005	1006006	1007007	1008008
2	2.79739E-01	2.89733E-01	1.57893E-01	8.83920E-02	2.39381E-01	1.82166E-01	3.36520E-01	3.68555E-01
3		1.71891E-01	1.48522E-01	1.32017E-01	3.64686E-01	2.25561E-01	4.19965E-01	3.41887E-01
4			-1.28692E-02	4.38367E-02	2.32416E-01	1.11479E-01	1.64052E-01	6.11911E-02
5				-1.70208E-02	4.19052E-02	5.45648E-02	2.61477E-02	-6.30670E-02
6					-7.95715E-02	-2.56437E-02	-4.13135E-02	-1.23461E-01
7						-6.74514E-02	-1.23137E-01	-1.47900E-01
8							-1.46197E-01	-1.65011E-01
9								-1.40242E-01

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	1009009	1010010	1011011	1012012	1013013	1014014	1015015	1016016
2	4.02243E-01	4.37920E-01	4.75858E-01	6.80927E-01	9.83979E-01	3.96811E-01	9.49577E-01	1.41548E 00
3	3.73897E-01	4.07940E-01	4.43881E-01	5.29274E-01	2.18733E-01	1.80607E-01	1.04803E 00	8.88027E-02
4	8.54433E-03	9.28991E-03	1.01071E-02	-7.36063E-02	-5.66812E-01	-1.52758E-01	-1.34605E-01	-9.34910E-01
5	-1.22023E-01	-1.56180E-01	-1.70960E-01	-3.13596E-01	-6.99585E-01	-1.62307E-01	-5.25699E-01	-1.13728E 00
6	-1.68089E-01	-1.98861E-01	-2.20084E-01	-3.66715E-01	-6.50395E-01	-1.37838E-01	-4.46080E-01	-8.22277E-01
7	-1.83446E-01	-2.01080E-01	-2.14726E-01	-3.33076E-01	-5.29336E-01	-1.05989E-01	-3.45254E-01	-5.44948E-01
8	-1.84085E-01	-1.92662E-01	-1.94651E-01	-2.84840E-01	-3.93697E-01	-7.54359E-02	-2.47065E-01	-3.57615E-01
9	-1.66889E-01	-1.81290E-01	-1.74532E-01	-2.40108E-01	-2.99090E-01	-4.95701E-02	-1.63358E-01	-2.10907E-01
10	-1.20661E-01	-1.48417E-01	-1.58469E-01	-2.04579E-01	-2.30229E-01	-3.38125E-02	-9.76801E-02	-1.02733E-01
11		-9.57761E-02	-1.21042E-01	-1.79449E-01	-1.81505E-01	-2.32679E-02	-5.94263E-02	-2.76428E-02
12			-7.05746E-02	-1.26824E-01	-1.49168E-01	-1.61576E-02	-3.49797E-02	1.15937E-02
13				-6.36930E-02	-8.82560E-02	-1.17070E-02	-1.88962E-02	3.42843E-02
14					-2.28713E-02	-3.70322E-03	-9.08650E-03	4.79691E-02
15						4.00141E-03	7.76270E-03	5.53306E-02
16							2.25890E-02	6.57399E-02
17								6.96761E-02

	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23	GRP. 24
1	1017017	1018018	1019019	1020020	1021021	1022022	1023023	1024024
2	1.58458E 00	4.42593E-01	1.85412E 00	2.19512E 00	2.26373E 00	5.29695E-01	7.91229E 00	5.61796E 00
3	-2.64809E-01	2.45948E-01	1.78728E 00	-2.01413E 00	-4.18954E 00	-5.34867E 00	-3.42407E 00	-1.44559E 01
4	-1.11758E 00	-1.70189E-01	-4.67507E-01	-3.16701E 00	-1.90687E 00	6.91112E-01	7.24408E-01	-1.81240E 00
5	-9.66607E-01	-1.42157E-01	-1.23496E 00	-2.67779E 00	-8.99413E-01	1.39396E 00	4.39703E-01	1.34641E 00
6	-6.44962E-01	-1.06649E-01	-7.34339E-01	-1.22158E 00	-2.58407E-01	1.31372E 00	2.45392E-01	5.43219E-01
7	-2.81234E-01	-6.14132E-02	-5.00922E-01	-3.18492E-01	3.92601E-01	1.16514E 00	1.93833E-01	2.76301E-01
8	-1.28571E-01	-1.88297E-02	-2.44727E-01	-7.71173E-02	5.30425E-01	8.40155E-01	1.53464E-01	2.13477E-01
9	-4.59785E-02	-3.38782E-03	-2.64561E-02	1.23118E-01	5.20321E-01	5.91446E-01	9.34417E-02	1.66427E-01
10	9.19700E-03	4.05553E-03	4.27189E-02	2.44260E-01	4.63048E-01	4.98008E-01	5.92703E-02	9.87351E-02
11	4.35476E-02	8.60042E-03	7.25776E-02	2.55505E-01	3.66579E-01	3.82008E-01	4.81724E-02	6.15303E-02
12	6.24029E-02	1.09116E-02	8.73187E-02	2.45430E-01	3.04427E-01	2.58940E-01	3.55225E-02	4.96940E-02
13	6.95766E-02	1.17603E-02	9.17259E-02	2.26325E-01	2.58445E-01	2.00649E-01	2.29477E-02	3.63807E-02
14	7.16290E-02	1.17009E-02	8.93037E-02	2.02492E-01	2.17018E-01	1.62869E-01	1.73635E-02	2.32908E-02
15	7.18340E-02	1.13804E-02	8.48294E-02	1.76914E-01	1.80399E-01	1.31634E-01	1.38663E-02	1.75409E-02
16	7.09898E-02	1.09983E-02	7.99063E-02	1.57959E-01	1.48553E-01	1.05872E-01	1.10466E-02	1.39644E-02
17	6.71018E-02	1.06030E-02	7.55206E-02	1.42706E-01	1.27668E-01	8.47345E-02	8.77091E-03	1.10924E-02
18	5.80277E-02	9.61386E-03	7.20508E-02	1.31027E-01	1.12287E-01	7.14203E-02	6.94002E-03	8.78523E-03
19		7.93168E-03	6.37401E-02	1.22633E-01	1.01034E-01	6.19353E-02	5.80280E-03	6.93474E-03
20			5.10548E-02	1.04436E-01	9.32801E-02	5.51141E-02	5.00277E-03	5.78980E-03
21				7.97148E-02	7.72521E-02	5.05136E-02	4.43084E-03	4.98481E-03
22					5.67809E-02	4.11813E-02	4.04837E-03	4.41177E-03
23						2.96093E-02	3.27817E-03	4.02756E-03
24							2.33433E-03	3.25683E-03
25								2.31447E-03

XSEC ID GRP.	1	2	4	27	101	102	103	104
1	1.63505E 00	1.00704E 00	5.78462E-01	4.95466E-02	4.95466E-02	6.63360E-09	2.43523E-02	4.36242E-03
2	1.61391E 00	9.38119E-01	5.62718E-01	1.13074E-01	1.13074E-01	7.10512E-09	3.34322E-02	9.15662E-03
3	1.68237E 00	9.96340E-01	5.16225E-01	1.69803E-01	1.69803E-01	7.42179E-09	3.95443E-02	1.36965E-02
4	1.62522E 00	9.61281E-01	4.76222E-01	1.87716E-01	1.87716E-01	7.56214E-09	4.67773E-02	1.51721E-02
5	1.60158E 00	9.88673E-01	4.25982E-01	1.86928E-01	1.86928E-01	7.75413E-09	4.09571E-02	1.49220E-02
6	1.55634E 00	1.03515E 00	3.45505E-01	1.75687E-01	1.75687E-01	7.99993E-09	2.47956E-02	1.11512E-02
7	1.67934E 00	1.12923E 00	3.30555E-01	2.13556E-01	2.13556E-01	8.30619E-09	4.20532E-02	3.79429E-03
8	1.35599E 00	9.32724E-01	2.35834E-01	1.87435E-01	1.87435E-01	8.73205E-09	1.51368E-03	2.77854E-05
9	1.23323E 00	8.43469E-01	2.41391E-01	1.48366E-01	1.48366E-01	9.17984E-09	0.0	0.0
10	1.26716E 00	8.86047E-01	2.73110E-01	1.08001E-01	1.08001E-01	9.65059E-09	0.0	0.0
11	1.18895E 00	9.02908E-01	2.21299E-01	6.47476E-02	6.47476E-02	1.01454E-08	0.0	0.0
12	1.11102E 00	9.31437E-01	7.64133E-02	1.03170E-01	1.03170E-01	1.08011E-08	0.0	0.0
13	1.29478E 00	1.24084E 00	0.0	5.39460E-02	5.39460E-02	1.19419E-08	0.0	0.0
14	1.28075E 00	1.20611E 00	0.0	7.46472E-02	7.46472E-02	1.28640E-08	0.0	0.0
15	1.72048E 00	1.63764E 00	0.0	8.28381E-02	8.28381E-02	1.35267E-08	0.0	0.0
16	2.66188E 00	2.65292E 00	0.0	8.96019E-03	8.96019E-03	1.51477E-08	0.0	0.0
17	1.05752E 00	1.05752E 00	0.0	2.60312E-07	2.60312E-07	1.73016E-08	0.0	0.0
18	2.40890E-01	2.40890E-01	0.0	1.84863E-08	1.84863E-08	1.84843E-08	0.0	0.0
19	1.65295E 00	1.65295E 00	0.0	1.97699E-08	1.97699E-08	1.97699E-08	0.0	0.0
20	2.69714E 00	2.69714E 00	0.0	2.37961E-08	2.37961E-08	2.37961E-08	0.0	0.0
21	3.60901E 00	3.60901E 00	0.0	3.22014E-08	3.22014E-08	3.22014E-08	0.0	0.0
22	4.86093E 00	4.86093E 00	0.0	5.30187E-08	5.30187E-08	5.30187E-08	0.0	0.0
23	3.52875E 00	3.52875E 00	0.0	7.79212E-08	7.79212E-08	7.79212E-08	0.0	0.0
24	3.60780E 00	3.60780E 00	0.0	1.03056E-07	1.03056E-07	1.03056E-07	0.0	0.0
25	3.67811E 00	3.67811E 00	0.0	1.49944E-07	1.49944E-07	1.49944E-07	0.0	0.0
26	3.70394E 00	3.70394E 00	0.0	1.85552E-07	1.85552E-07	1.85552E-07	0.0	0.0
27	3.71730E 00	3.71730E 00	0.0	2.32240E-07	2.32240E-07	2.32240E-07	0.0	0.0
28	3.73474E 00	3.73474E 00	0.0	3.73841E-07	3.73841E-07	3.73841E-07	0.0	0.0
29	3.74358E 00	3.74358E 00	0.0	6.34181E-07	6.34181E-07	6.34181E-07	0.0	0.0
30	3.74629E 00	3.74629E 00	0.0	9.77789E-07	9.77789E-07	9.77789E-07	0.0	0.0
31	3.74742E 00	3.74742E 00	0.0	1.87461E-06	1.87461E-06	1.87461E-06	0.0	0.0
32	3.74798E 00	3.74798E 00	0.0	3.90765E-06	3.90765E-06	3.90765E-06	0.0	0.0
33	3.74809E 00	3.74808E 00	0.0	6.81832E-06	6.81832E-06	6.81832E-06	0.0	0.0
34	3.74811E 00	3.74810E 00	0.0	1.20366E-05	1.20366E-05	1.20366E-05	0.0	0.0
35	3.74813E 00	3.74810E 00	0.0	2.10020E-05	2.10020E-05	2.10020E-05	0.0	0.0
36	3.74814E 00	3.74810E 00	0.0	3.46265E-05	3.46265E-05	3.46265E-05	0.0	0.0
37	3.74810E 00	3.74796E 00	0.0	1.42635E-04	1.42635E-04	1.42635E-04	0.0	0.0

XSEC ID GRP.	107	1099
1	2.08319E-02	1.49959E-01
2	7.04854E-02	1.25040E-01
3	1.16562E-01	4.99605E-02
4	1.25767E-01	2.50450E-02
5	1.31049E-01	7.49975E-02
6	1.39740E-01	4.99824E-02
7	1.67709E-01	9.99714E-02
8	1.85893E-01	1.00026E-01
9	1.48366E-01	9.99970E-02
10	1.08001E-01	1.00004E-01
11	6.47476E-02	9.99966E-02
12	1.03170E-01	1.49999E-01
13	5.39459E-02	2.49993E-01
14	7.46472E-02	5.00021E-02
15	8.28381E-02	1.50006E-01
16	8.96018E-03	3.00015E-01
17	2.43010E-07	2.33288E-01
18	2.02816E-12	3.33783E-02
19	0.0	2.33339E-01

20	0.0	5.00009E-01
21	0.0	6.99975E-01
22	0.0	1.25002E 00
23	0.0	3.49973E-01
24	0.0	7.50003E-01
25	0.0	7.49977E-01
26	0.0	1.25015E-01
27	0.0	7.50001E-01
28	0.0	1.12501E 00
29	0.0	9.99900E-01
30	0.0	7.49995E-01
31	0.0	1.75001E 00
32	0.0	1.25000E 00
33	0.0	9.99906E-01
34	0.0	1.25000E 00
35	0.0	9.99949E-01
36	0.0	1.00003E 00
37	0.0	6.85856E 00

P0 ELASTIC (MT= 2)--OXYGEN 1276 IDENTIFIER 1276

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	1001001	1002002	1003003	1004004	1005005	2006006	2007007	3008008
2	7.95589E-01	6.73470E-01	5.94910E-01	4.05869E-01	5.71395E-01	4.96502E-01	5.85252E-01	4.25303E-01
3		1.85610E-01	1.56124E-01	1.57162E-01	3.60128E-01	1.90785E-01	3.74453E-01	3.15901E-01
4			1.57343E-02	3.42574E-02	1.55617E-01	1.11472E-01	1.74856E-01	1.22504E-01
5				5.20416E-03	5.53888E-02	5.33675E-02	6.89865E-02	5.15865E-02
6					4.90082E-03	1.45755E-02	3.52156E-02	1.48253E-02
7							4.29440E-03	6.84943E-05

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	5009009	7010010	8011011	9012012	10013013	12014014	13015015	13016016
2	3.57409E-01	3.06320E-01	3.09197E-01	3.69098E-01	7.75571E-01	3.88181E-01	8.51669E-01	1.92857E 00
3	2.68208E-01	2.74104E-01	3.19054E-01	4.87831E-01	5.62257E-01	1.84536E-01	6.03580E-01	7.85970E-01
4	1.89317E-01	2.09276E-01	1.88265E-01	2.60476E-01	1.05879E-01	8.19880E-05	2.58735E-01	2.14346E-01
5	4.16880E-02	3.87598E-02	2.99367E-02	2.36916E-02	1.87999E-04			2.19952E-02
6	4.93944E-05							

	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23	GRP. 24
1	16017017	16018018	17019019	18020020	20021021	21022022	22023023	23024024
2	6.13487E-01	1.14001E-02	6.98268E-01	2.00007E 00	3.15927E 00	4.47636E 00	2.19638E 00	2.99739E 00
3	7.22447E-01	1.36103E-01	2.08668E-01	9.54685E-01	6.97066E-01	4.49732E-01	3.84568E-01	1.33236E 00
4		1.90481E-03	3.07925E-01	2.08224E-02				

	GRP. 25	GRP. 26	GRP. 27	GRP. 28	GRP. 29	GRP. 30	GRP. 31	GRP. 32
1	24025025	25026026	25027027	27028028	28029029	29030030	30031031	31032032
2	3.07083E 00	9.66437E-01	3.11183E 00	3.33160E 00	3.29009E 00	3.14167E 00	3.48832E 00	3.38523E 00
3	6.10411E-01	4.56531E-01	2.73750E 00	6.05465E-01	4.03146E-01	4.53483E-01	6.04619E-01	2.59094E-01
4			1.50749E-01					

	GRP. 33	GRP. 34	GRP. 35	GRP. 36	GRP. 37
1	32033033	33034034	34035035	35036036	36037037
2	3.29465E 00	3.38536E 00	3.29466E 00	3.29469E 00	3.74796E 00
3	3.62744E-01	4.53431E-01	3.62743E-01	4.53438E-01	4.53414E-01

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P5 ELASTIC (MT= 2)--OXYGEN 1276 IDENTIFIER 1276

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	1001001	1002002	1003003	1004004	1005005	2006006	2007007	3008008
2	2.48147E 00	2.13881E 00	2.14410E 00	2.14735E 00	1.99886E 00	2.00816E 00	1.91120E 00	1.23459E 00
3		1.30090E-01	3.71088E-02	-1.62961E-01	-9.95741E-02	7.73314E-02	3.42828E-01	2.94816E-01
4			-7.99102E-03	4.45999E-02	2.69397E-01	2.24099E-01	1.38336E-01	-5.92993E-02
5				6.31388E-03	7.12088E-03	-7.78295E-02	-7.91524E-02	2.87639E-02
6					-7.15568E-04	3.65320E-03	-2.29045E-02	-4.81582E-02
7							-3.18499E-03	-6.79066E-04

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	5009009	7010010	8011011	9012012	10013013	12014014	13015015	13016016
2	7.41872E-01	7.64604E-01	6.55096E-01	4.33273E-01	9.98467E-01	8.96560E-01	7.63115E-01	3.13952E-01
3	1.58928E-02	-1.33329E-02	2.52329E-01	-2.61853E-01	-4.66118E-01	2.53963E-02	-2.69283E-01	-1.61441E-02
4	-1.04842E-01	-2.75480E-01	-2.45969E-01	-1.19670E-01	-1.22534E-01	-8.14745E-04	2.79505E-02	1.25696E-01
5	-5.63921E-03	-6.53537E-02	-8.12011E-02	-4.24486E-02	-1.86664E-03			-1.77328E-02
6	-4.89089E-04							

	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23	GRP. 24
1	16017017	16018018	17019019	18020020	20021021	21022022	22023023	23024024
2	-8.87581E-02	1.62057E-02	1.15571E-02	4.28305E-02	2.64552E-02	-4.87759E-02	-6.39830E-05	3.81860E-04
3	-9.72543E-02	2.02000E-02	1.40663E-01	5.58524E-02	2.34944E-02	5.17267E-04	1.14090E-04	7.45235E-04
4		-8.61846E-03	4.16319E-02	-9.03937E-02				

	GRP. 25	GRP. 26	GRP. 27	GRP. 28	GRP. 29	GRP. 30	GRP. 31	GRP. 32
1	24025025	25026026	25027027	27028028	28029029	29030030	30031031	31032032
2	-2.31829E-05	-2.17590E-02	-1.93279E-04	-1.34433E-04	-2.02845E-04	-3.08216E-04	-9.96589E-05	-1.65420E-04
3	3.40363E-04	1.55774E-03	2.16097E-02	3.73183E-04	2.52527E-04	2.85435E-04	3.81120E-04	1.63514E-04
4			-3.55596E-03					

	GRP. 33	GRP. 34	GRP. 35	GRP. 36	GRP. 37
1	32033033	33034034	34035035	35036036	36037037
2	-2.21698E-04	-1.65847E-04	-2.21737E-04	-3.82577E-04	1.70920E-05
3	2.28944E-04	5.86167E-04	2.28932E-04	7.23442E-04	3.15467E-04

P0 (N,N') LEVEL 1 (MT=51)--OXYGEN 1276 IDENTIFIER 1276

	GRP. 7	GRP. 8	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14
1	1001007	1001008	1002009	2002010	2003011	3005012	5007013	7007014
2	5.78463E-03	1.08685E-02	4.66280E-03	1.63859E-02	9.15470E-03	1.09430E-02	1.09270E-02	1.82217E-02
3			8.50320E-03		1.39322E-02	4.29102E-02	5.11280E-02	
4						3.13224E-02	3.49430E-02	

	GRP. 15	GRP. 16	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22
1	7008015	8009016	9009017	9010018	10010019	10011020	11012021	12012022
2	5.64152E-03	1.27914E-02	2.69467E-02	4.56456E-03	4.12635E-02	3.27819E-02	2.31703E-02	1.86287E-02
3	6.39487E-02	3.66686E-02		4.42843E-03		1.95330E-02	5.10236E-02	

	GRP. 23	GRP. 24	GRP. 25	GRP. 26
1	12012023	12012024	12012025	12012026
2	1.46769E-04	4.70795E-05	4.29617E-06	1.64574E-08

PO (N,N') LEVEL 2 (MT=52)--OXYGEN 1276 IDENTIFIER 1276

	GRP. 7	GRP. 8	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14
1	1001007	1001008	1002009	2002010	2003011	3005012	5007013	7007014
2	4.69827E-03	1.10892E-02	4.98270E-03	2.72149E-02	8.31291E-03	1.27628E-02	8.81764E-03	1.92228E-02
3			1.20086E-02		2.78700E-02	7.56587E-02	7.87622E-02	
4						6.42385E-02	6.49922E-02	

	GRP. 15	GRP. 16	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22
1	7007015	7009016	9009017	9009018	9010019	10011020	11012021	12012022
2	6.10164E-02	1.51923E-02	8.91315E-02	1.54386E-02	8.48179E-02	6.09786E-02	2.09297E-02	1.30382E-02
3		8.16045E-02			7.34889E-03	7.51197E-02	5.01821E-02	
4		1.28550E-03						

	GRP. 23	GRP. 24	GRP. 25	GRP. 26
1	12012023	12012024	12012025	12012026
2	3.16516E-04	1.21698E-04	8.87644E-06	2.30277E-08

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PO (N,N') LEVEL 25 (MT=75)--OXYGEN 1276 IDENTIFIER 1276

	GRP. 16	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23
1	1001016	1001017	1001018	1001019	1002020	2002021	2002022	2002023
2	9.49715E-03	8.40719E-03	1.16839E-03	7.54506E-03	7.39207E-03	7.02266E-03	2.13120E-03	7.02452E-05
3					4.96681E-03			

	GRP. 24
1	2002024
2	3.08525E-05

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●
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PO (N,N') LEVEL 38 (MT=88)--OXYGEN 1276 IDENTIFIER 1276

	GRP. 22	GRP. 23	GRP. 24
1	1001022	1001023	1001024
2	2.86457E-04	4.78364E-05	1.42112E-05

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SAMPLE PROBLEM 1
HYDROGEN AND OXYGEN
IN 37 GROUP STRUCTURE
USING 1/E-TO-MAXWELLIAN WEIGHTING
VERSION IV ENDF EVALUATIONS
    TAPE ID                          1           NUMBER OF NUCLIDES               2
    NUMBER OF NEUTRON GROUPS        37           NUMBER OF GAMMA GROUPS           0
    FIRST THERMAL GROUP             37
                              TABLE OF CONTENTS
  HYDROGEN      1269                                               ID      1269
  OXYGEN     1276                                                  ID      1276

ELAPSED TIME   0.68 MIN.

 0T

GENERAL INFORMATION CONCERNING UPDATE OPTION

NEWID     IDENTIFICATION OF NEW AMPX LIBRARY                          0
ITRGUP    UPDATE TRIGGER  0/1/2  NO/ADD 21 TO 23/COPY 21              0
IEDIT     PRODUCE EDITS OF CROSS-SECTIONS                             0
IPLOT     PLOT CROSS-SECTIONS                                         0
IPART     UPDATE PARTIAL CROSS-SECTIONS                               0
IOLD      IS AN OLD AMPX LIBRARY MOUNTED?  (0/1:NO/YES)               0


******************************************************************************
YOU HAVE COME TO THE END OF A PERILOUS FLIGHT THROUGH THAT MAGNIFICENT
PROGRAM....X L A C S.....I TRUST IT HAS BEEN A MOVING PERFORMANCE
SEE YOU ON THE NEXT TIME THROUGH
******************************************************************************


ELAPSED TIME   0.68 MIN.
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LAPHNGAS

05/17/75

4:07:45

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LAPHNGAS

LAPHNGAS RUN FOR HYDROGEN AND OXYGEN

    1$ ARRAY      4 ENTRIES READ

     T

INTEGER PARAMETERS (1$ AND 2$ ARRAYS)
MCR     NUMBER OF NUCLIDES                                  2
NFG     NO. NEUT FINE GPS.                                 37
NGG     NO. GAMMA GRS.                                     21
IM      NON RES WT. FUNCTION 1/2/3/4/5/6 -
        1.0/(1/E)/(1/E-FISS)/EXACT (1/E)/
        (1/E*SIG-T)/ARBITRARY/                              5
LCSM    NO. INTERPOLATION REGIONS                           0
MCSM    NO. PTS. IN ARB. WT. FCTN.                          0
IZM     0/1 CAL SGRRXS/CAL SGRFPXS                          0
MS      0/1 NO EFF/MAXWELLIAN THERMAL DIST                  1
MM      NO. REACTION TYPES                                  1
IWO     1/2/3 MIDPOINT/YIELD FCT/E(BAR) INPUT               1
IOO     0/1 PRINT (X OR SIG)/DO NOT PRINT                   0
IAM     0/1 NO EFFECT/PUNCH SGRP DATA                       0
ICK     0/1 NO EFFECT/DETAIL CK.                           -9
NNBBGP  0/N NO EFFECT/COLLAPSE TO N BROAD GPS.              0

A STANDARD  37 NEUTRON GROUP STRUCTURE HAS BEEN INSERTED FOR YOU AND WILL BE USED UNLESS YOU OVERRIDE IT
A STANDARD  21 GAMMA GROUP STRUCTURE HAS BEEN INSERTED FOR YOU AND WILL BE USED UNLESS YOU OVERRIDE IT

     T

MEAN TEMPERATURE OF MAXWELLIAN DISTRIBUTION (DEG K)     2.93600E 02

UPPER ENERGY FOR THERMAL (N,G) CORRECTION (EV)     1.26390E-01

NON 1/V FACTOR     1.00000E 00
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GAMMA-RAY AND NEUTRON ENERGY MESHES (EV)

	GAMMA EFF. AVG. ENERGY	GAMMA MESH	NEUTRON FINE GP
1	1.20000E 07	1.40000E 07	1.96400E 07
2	9.00000E 06	1.00000E 07	1.69050E 07
3	7.50000E 06	8.00000E 06	1.49180E 07
4	6.50000E 06	7.00000E 06	1.41910E 07
5	5.50000E 06	6.00000E 06	1.38400E 07
6	4.50000E 06	5.00000E 06	1.28400E 07
7	3.50000E 06	4.00000E 06	1.22140E 07
8	2.75000E 06	3.00000E 06	1.10520E 07
9	2.25000E 06	2.50000E 06	1.00000E 07
10	1.75000E 06	2.00000E 06	9.04840E 06
11	1.25000E 06	1.50000E 06	8.18730E 06
12	8.50000E 05	1.00000E 06	7.40820E 06
13	5.75000E 05	7.00000E 05	6.37630E 06
14	3.75000E 05	4.50000E 05	4.96590E 06
15	2.25000E 05	3.00000E 05	4.72370E 06
16	1.25000E 05	1.50000E 05	4.06570E 06
17	8.49999E 04	9.99990E 04	3.01190E 06
18	5.74999E 04	6.99990E 04	2.38520E 06
19	3.75000E 04	4.50000E 04	2.30690E 06
20	2.50000E 04	3.00000E 04	1.82680E 06
21	1.50000E 04	2.00000E 04	1.10800E 06
22		1.00000E 04	5.50230E 05
23			1.57640E 05
24			1.11090E 05
25			5.24750E 04
26			2.47880E 04
27			2.18750E 04
28			1.03330E 04
29			3.35460E 03
30			1.23410E 03
31			5.82950E 02
32			1.01300E 02
33			2.90230E 01
34			1.06770E 01
35			3.05900E 00
36			1.12540E 00
37			4.14000E-01
38			1.00000E-05

14$ ARRAY 6 ENTRIES READ

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14$ ARRAY 6 ENTRIES READ

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MATERIAL                                              1269
IQA    ORDER P(N)                                        5
NDFB   LOG. UNIT FOR ENDF DATA                          11
MODE   1/2 ENDF BINARY/BCD                               1
REACTION TYPES
  -1
IN PHOTON AFTER TMATI   1.0010E 03   9.9917E-01      0       0       6      12    1269       1     451
   UNDER THE OPTION PROVIDED WHEN INPUT MT=-1 IS USED, THERE WILL BE    1 REACTION TYPES USED AS FOLLOWS -
    MTNO%I<# 102
FILE  3      1.00100E 03     9.9917E-01       0        0        0        0     1269       3       1
FILE 12      1.00100E 03     9.9917E-01       1        0        1        0     1269      12     102
FILE 14      1.00100E 03     9.9917E-01       1        0        1        0     1269      14     102
READ/COPY ENDF/B MASTER LIBRARY COMPLETE FILES PROC.     3    12    14

USER REQUESTED P- 5 CALCULATION.  HOWEVER, ALL FILE 14 DATA ARE FOR ISOTROPIC DISTRIBUTIONS.
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**********   ***********   Total Matrix for Hydrogen

THE PHOTON PRODUCTION MATRIX, MATERIAL 1269 REACTION TYPE 1 P 0 COMPONENT

G GP	N GP 1	N GP 2	N GP 3	N GP 4	N GP 5	N GP 6	N GP 7	N GP 8
1	2.68483E-05	2.83198E-05	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	2.93489E-05	2.97973E-05	3.00695E-05	3.06034E-05	3.13469E-05	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.21857E-05
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

G GP 5 THRU G GP 21 SAME AS ABOVE

G GP	N GP 9	N GP 10	N GP 11	N GP 12	N GP 13	N GP 14	N GP 15	N GP 16
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G GP 2 THRU G GP 3 SAME AS ABOVE								
4	3.29397E-05	3.35630E-05	3.42145E-05	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	3.52287E-05	3.59984E-05	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	3.63952E-05	3.63198E-05	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.59829E-05
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

G GP 9 THRU G GP 21 SAME AS ABOVE

G GP	N GP 17	N GP 18	N GP 19	N GP 20	N GP 21	N GP 22	N GP 23	N GP 24
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G GP 2 THRU G GP 6 SAME AS ABOVE								
7	3.52343E-05	3.47196E-05	3.43656E-05	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	3.43582E-05	3.52806E-05	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	4.95019E-05	8.69303E-05	1.31210E-04
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

G GP 11 THRU G GP 21 SAME AS ABOVE

G GP	N GP 25	N GP 26	N GP 27	N GP 28	N GP 29	N GP 30	N GP 31	N GP 32
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G GP 2 THRU G GP 9 SAME AS ABOVE								
9	2.21541E-04	2.91477E-04	3.82558E-04	6.77096E-04	1.12763E-03	9.10466E-04	1.79994E-03	9.39965E-06
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

G GP 11 THRU G GP 21 SAME AS ABOVE

G GP	N GP 33	N GP 34	N GP 35	N GP 36	N GP 37
1	0.0	0.0	0.0	0.0	0.0
G GP 2 THRU G GP 8 SAME AS ABOVE					
9	2.43623E-05	1.48232E-04	7.03943E-04	3.10719E-03	1.12815E-01
10	0.0	0.0	0.0	0.0	0.0

G GP 11 THRU G GP 21 SAME AS ABOVE

********* ***********

Total for Oxygen

THE PHOTON PRODUCTION MATRIX, MATERIAL 1276 REACTION TYPE 1 P 0 COMPONENT

G GP	N GP 1	N GP 2	N GP 3	N GP 4	N GP 5	N GP 6	N GP 7	N GP 8
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.28483E-03	3.02515E-03	4.28683E-03	4.32790E-03	4.16575E-03	3.84702E-03	3.39874E-03	2.16164E-03
3	1.48650E-02	3.56895E-02	5.05013E-02	5.25208E-02	5.07124E-02	4.65709E-02	4.74748E-02	5.00077E-02
4	5.92814E-02	1.32947E-01	1.75641E-01	1.78013E-01	1.73725E-01	1.62013E-01	1.65453E-01	1.37075E-01
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	1.49039E-01	1.06219E-01	5.60019E-02	3.81418E-02	1.94550E-02	4.29068E-03	1.40802E-04	0.0
7	1.80956E-02	6.27930E-02	1.01665E-01	1.06230E-01	1.10087E-01	1.19064E-01	1.39109E-01	1.56883E-01
8	1.35620E-02	3.19321E-02	4.52502E-02	4.56839E-02	4.39718E-02	4.06073E-02	3.58756E-02	2.28175E-02
9	1.85288E-03	4.26669E-03	5.18839E-03	3.75289E-03	1.86496E-03	4.89424E-04	2.68264E-05	7.45665E-09
10	2.99797E-03	7.05869E-03	1.00027E-02	1.00985E-02	9.71999E-03	8.97638E-03	7.93038E-03	5.04383E-03
11	5.66601E-09	6.06441E-09	6.33919E-09	6.45787E-09	6.62214E-09	6.83227E-09	7.09131E-09	7.45665E-09
12	7.64026E-05	2.57772E-04	4.07832E-04	4.21867E-04	4.31672E-04	4.45873E-04	4.94183E-04	5.77842E-04
13	5.03262E-02	7.00289E-02	8.12611E-02	8.61920E-02	9.25579E-02	1.03164E-01	1.85667E-01	8.35299E-02
14	7.52772E-04	1.35376E-03	1.89511E-03	2.17036E-03	1.92341E-03	1.21637E-03	2.02877E-03	5.73927E-05
15	1.11554E-02	2.38772E-02	3.49958E-02	3.85299E-02	3.59359E-02	2.77716E-02	3.95545E-02	1.90044E-02
16	3.13310E-03	5.59576E-03	7.90702E-03	8.95150E-03	7.93747E-03	4.91370E-03	8.44476E-03	4.26764E-04
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

G GP 18 THRU G GP 21 SAME AS ABOVE

G GP	N GP 9	N GP 10	N GP 11	N GP 12	N GP 13	N GP 14	N GP 15	N GP 16
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.85962E-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	3.55293E-02	2.31956E-02	8.37836E-03	0.0	0.0	0.0	0.0	0.0
4	1.61203E-01	1.85531E-01	1.26012E-01	2.84556E-02	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1.08815E-01	6.80122E-02	1.94360E-02	3.65519E-03	6.33268E-05	1.87840E-09	1.97061E-09	2.22215E-09
8	1.96293E-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	7.84408E-09	8.23982E-09	8.65353E-09	9.25504E-09	1.01631E-08	1.09874E-08	1.15266E-08	1.29981E-08
10	4.33913E-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	7.84408E-09	8.23982E-09	8.65353E-09	9.25504E-09	1.01631E-08	1.09874E-08	1.15266E-08	1.29981E-08
12	2.01594E-04	1.92448E-04	4.85277E-05	6.80686E-06	1.19006E-08	1.28657E-08	1.34973E-08	1.52202E-08
13	8.72677E-02	1.34399E-01	1.62714E-01	7.75181E-02	3.45840E-08	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	5.88991E-03	5.87295E-03	1.42163E-03	2.26532E-04	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

G GP 17 THRU G GP 21 SAME AS ABOVE

G GP	N GP 17	N GP 18	N GP 19	N GP 20	N GP 21	N GP 22	N GP 23	N GP 24
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G GP 2 THRU G GP 6 SAME AS ABOVE								
7	2.54058E-09	2.69600E-09	2.85300E-09	3.41963E-09	4.77759E-09	8.00372E-09	1.10816E-08	1.40091E-08
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	1.48608E-08	1.57697E-08	1.66881E-08	2.00026E-08	2.79456E-08	4.68161E-08	6.48198E-08	8.19437E-08
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	1.48608E-08	1.57697E-08	1.66881E-08	2.00026E-08	2.79456E-08	4.68161E-08	6.48198E-08	8.19437E-08
12	1.74013E-08	1.84659E-08	1.95411E-08	2.34221E-08	3.27231E-08	5.48199E-08	7.59015E-08	9.59528E-08
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

G GP 14 THRU G GP 21 SAME AS ABOVE

G GP	N GP 25	N GP 26	N GP 27	N GP 28	N GP 29	N GP 30	N GP 31	N GP 32
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G GP 2 THRU G GP 6 SAME AS ABOVE								
7	1.39508E-08	1.59960E-08	2.56963E-08	4.70959E-08	5.96046E-08	1.31209E-07	1.91064E-07	2.22410E-07
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	8.16027E-08	9.35653E-08	1.50306E-07	2.75479E-07	3.48646E-07	7.67481E-07	1.11760E-06	1.30094E-06
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	8.16027E-08	9.35653E-08	1.50306E-07	2.75479E-07	3.48646E-07	7.67481E-07	1.11760E-06	1.30094E-06

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G GP	N GP 1	N GP 2	N GP 3	N GP 4	N GP 5	N GP 6	N GP 7	N GP 8
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	G GP 2 THRU G GP 6 SAME AS ABOVE							
7	1.64006E-02	6.79751E-02	9.46760E-02	1.00279E-01	1.06937E-01	1.18139E-01	1.39005E-01	1.56883E-01
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	G GP 9 THRU G GP 11 SAME AS ABOVE							
12	6.59832E-05	2.32765E-04	3.72449E-04	3.85070E-04	3.96141E-04	4.13243E-04	4.60919E-04	5.42804E-04
13	5.21374E-05	1.84580E-04	3.06053E-04	3.31296E-04	3.64828E-04	4.25587E-04	5.04684E-04	5.09284E-04
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	2.19945E-03	7.75868E-03	1.24151E-02	1.28357E-02	1.32049E-02	1.37747E-02	1.53642E-02	1.80935E-02
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	G GP 17 THRU G GP 21 SAME AS ABOVE							

G GP	N GP 9	N GP 10	N GP 11	N GP 12	N GP 13	N GP 14	N GP 15	N GP 16
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	G GP 2 THRU G GP 6 SAME AS ABOVE							
7	1.08815E-01	6.80122E-02	1.94360E-02	3.65519E-03	6.33250E-05	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	G GP 9 THRU G GP 11 SAME AS ABOVE							
12	1.76697E-04	1.76190E-04	4.26486E-05	6.79603E-06	0.0	0.0	0.0	0.0
13	4.10785E-04	1.90136E-04	5.98022E-05	1.43474E-05	3.45840E-08	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	5.88991E-03	5.87296E-03	1.42163E-03	2.26532E-04	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	G GP 17 THRU G GP 21 SAME AS ABOVE							

G GP	N GP 17	N GP 18	N GP 19	N GP 20	N GP 21	N GP 22	N GP 23	N GP 24
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	G GP 2 THRU G GP 21 SAME AS ABOVE							

G GP	N GP 25	N GP 26	N GP 27	N GP 28	N GP 29	N GP 30	N GP 31	N GP 32
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	G GP 2 THRU G GP 21 SAME AS ABOVE							

G GP	N GP 33	N GP 34	N GP 35	N GP 36	N GP 37
1	0.0	0.0	0.0	0.0	0.0
	G GP 2 THRU G GP 21 SAME AS ABOVE				

THE PHOTON PRODUCTION MATRIX, MATERIAL 1276 REACTION TYPE 107 P 1 COMPONENT

ALL ZERO

```
 SSSSSSSSSSS   MM         MM   UU         UU    GGGGGGGGGGG
SSSSSSSSSSSSS  MMM       MMM   UU         UU   GGGGGGGGGGGGG
SS         SS  MMMM     MMMM   UU         UU   GG         GG
SS             MM MM   MM MM   UU         UU   GG
SS             MM  MM MM  MM   UU         UU   GG
SSSSSSSSSSSS   MM   MMM   MM   UU         UU   GG    GGGGGGG
 SSSSSSSSSSSS  MM    M    MM   UU         UU   GG    GGGGGGG
           SS  MM         MM   UU         UU   GG         GG
           SS  MM         MM   UU         UU   GG         GG
SS         SS  MM         MM   UU         UU   GG         GG
SSSSSSSSSSSSS  MM         MM   UUUUUUUUUUUUU   GGGGGGGGGGGGG
 SSSSSSSSSSS   MM         MM    UUUUUUUUUUU     GGGGGGGGGGG
```

```
   0000000     5555555555555            //      11     7777777777777            //  7777777777777  5555555555555
  000000000    5555555555555           //      111     777777777777            //   777777777777   5555555555555
 00       00   55                     //      1111     77        77           //    77        77   55
00         00  55                    //         11              77           //              77    55
00         00  55                   //          11             77           //              77     55
00         00  555555555555        //           11            77           //              77      555555555555
00         00  5555555555555      //            11            77          //               77      5555555555555
00         00             55     //             11           77          //               77                  55
00         00             55    //              11           77         //                77                  55
 00       00   55         55   //               11          77         //                77      55         55
  000000000    5555555555555  //             11111111       77        //                 77      5555555555555
   0000000      55555555555  //              11111111       77       //                  77       55555555555
```

```
       44                  11      66666666666                 33333333333   22222222222
      444                 111     6666666666666               3333333333333 2222222222222
     4444                1111     66                          33         33 22         22
    44 44                  11     66                                     33            22
   44  44                  11     66                                     33            22
  44   44                  11     666666666666                         333            22
 44    44       .....      11     6666666666666       .....            333           22
44444444444     .....      11     66         66       .....              33         22
4444444444444   .....      11     66         66       .....              33       22
       44       .....      11     66         66       .....   33         33     22
       44               11111111  6666666666666               3333333333333 2222222222222
       44               11111111   66666666666                 33333333333  2222222222222
```

10-27

SMUG RUN FOR HYDROGEN AND OXYGEN

LANO NUCLIDE ATOMIC NUMBER 8
LEMNO ENDF/B MATERIAL NUMBER 8
LPUN 0/1 NO EFFECT/PUNCH X-SECTS -1
LORDER ORDER PL TO BE PRINTED 5

OXYGEN

PHOTON INTERACTION CROSS SECTIONS

GROUP	GROUP LIMITS (MEV)		SIG ABS	SIG PE	SIG PP	ENERGY DEP
1	1.00000E 01	1.40000E 01	1.63813E-01	2.90548E-06	1.63810E-01	4.78338E 00
2	8.00000E 00	1.00000E 01	1.31391E-01	3.95505E-06	1.31387E-01	3.72920E 00
3	7.00000E 00	8.00000E 00	1.09652E-01	4.86732E-06	1.09648E-01	3.20092E 00
4	6.00000E 00	7.00000E 00	9.52302E-02	5.74695E-06	9.52245E-02	2.86601E 00
5	5.00000E 00	6.00000E 00	8.08303E-02	6.97869E-06	8.08234E-02	2.53767E 00
6	4.00000E 00	5.00000E 00	6.38719E-02	8.93821E-06	6.38630E-02	2.19949E 00
7	3.00000E 00	4.00000E 00	4.33488E-02	1.23736E-05	4.33364E-02	1.84332E 00
8	2.50000E 00	3.00000E 00	2.65201E-02	1.69977E-05	2.65031E-02	1.56115E 00
9	2.00000E 00	2.50000E 00	1.57734E-02	2.27619E-05	1.57506E-02	1.35943E 00
10	1.50000E 00	2.00000E 00	6.40287E-03	3.44117E-05	6.36846E-03	1.13897E 00
11	1.00000E 00	1.50000E 00	4.52115E-04	6.30797E-05	3.89035E-04	8.85985E-01
12	7.00000E-01	1.00000E 00	1.45418E-04	1.45418E-04	0.0	6.46649E-01
13	4.50000E-01	7.00000E-01	4.33223E-04	4.33223E-04	0.0	4.52067E-01
14	3.00000E-01	4.50000E-01	1.45123E-03	1.45123E-03	0.0	2.92933E-01
15	1.50000E-01	3.00000E-01	7.89173E-03	7.89173E-03	0.0	1.64319E-01
16	9.99999E-02	1.50000E-01	4.19781E-02	4.19781E-02	0.0	8.02733E-02
17	6.99999E-02	9.99999E-02	1.41098E-01	1.41098E-01	0.0	5.42603E-02
18	4.50000E-02	6.99999E-02	5.21434E-01	5.21434E-01	0.0	5.15277E-02
19	3.00000E-02	4.50000E-02	2.07501E 00	2.07501E 00	0.0	8.57771E-02
20	2.00000E-02	3.00000E-02	7.84057E 00	7.84057E 00	0.0	1.93434E-01
21	9.99999E-03	2.00000E-02	4.93858E 01	4.93858E 01	0.0	6.56467E-01

10$ ARRAY 5 ENTRIES READ

0T

SMUG RUN FOR HYDROGEN AND OXYGEN

LANO	NUCLIDE ATOMIC NUMBER	1
LEMNO	ENDF/B MATERIAL NUMBER	1
LPUN	0/1 NO EFFECT/PUNCH X-SECTS	-1
LORDER	ORDER PL TO BE PRINTED	5

HYDROGEN

PHOTON INTERACTION CROSS SECTIONS

GROUP	GROUP LIMITS (MEV)		SIG ABS	SIG PE	SIG PP	ENERGY DEP
1	1.00000E 01	1.40000E 01	3.80647E-03	3.75934E-11	3.80647E-03	4.13745E-01
2	8.00000E 00	1.00000E 01	2.91025E-03	5.10629E-11	2.91025E-03	3.57840E-01
3	7.00000E 00	8.00000E 00	2.32310E-03	6.27393E-11	2.32310E-03	3.26230E-01
4	6.00000E 00	7.00000E 00	1.95515E-03	7.39797E-11	1.95515E-03	3.03612E-01
5	5.00000E 00	6.00000E 00	1.60361E-03	8.96974E-11	1.60361E-03	2.79006E-01
6	4.00000E 00	5.00000E 00	1.20935E-03	1.14444E-10	1.20935E-03	2.51195E-01
7	3.00000E 00	4.00000E 00	7.62591E-04	1.57351E-10	7.62591E-04	2.18681E-01
8	2.50000E 00	3.00000E 00	4.36222E-04	2.14886E-10	4.36222E-04	1.90105E-01
9	2.00000E 00	2.50000E 00	2.50127E-04	2.86445E-10	2.50127E-04	1.67767E-01
10	1.50000E 00	2.00000E 00	9.89497E-05	4.32055E-10	9.89493E-05	1.41816E-01
11	1.00000E 00	1.50000E 00	1.18670E-05	7.92342E-10	1.18662E-05	1.10723E-01
12	7.00000E-01	1.00000E 00	1.97341E-09	1.97341E-09	0.0	8.08160E-02
13	4.50000E-01	7.00000E-01	6.76240E-09	6.76240E-09	0.0	5.64787E-02
14	3.00000E-01	4.50000E-01	2.53929E-08	2.53929E-08	0.0	3.65513E-02
15	1.50000E-01	3.00000E-01	1.56099E-07	1.56099E-07	0.0	2.03431E-02
16	9.99999E-02	1.50000E-01	8.97631E-07	8.97631E-07	0.0	9.40602E-03
17	6.99999E-02	9.99999E-02	3.17158E-06	3.17158E-06	0.0	5.33369E-03
18	4.50000E-02	6.99999E-02	1.23380E-05	1.23380E-05	0.0	2.88566E-03
19	3.00000E-02	4.50000E-02	5.18058E-05	5.18058E-05	0.0	1.42151E-03
20	2.00000E-02	3.00000E-02	2.07748E-04	2.07748E-04	0.0	7.50245E-04
21	9.99999E-03	2.00000E-02	1.46685E-03	1.46685E-03	0.0	5.06698E-04

GROUP DOSE FACTORS

UNITS
HENDERSON--RADS/HR PER PHOTONS/CM**2/SEC
SILICON --RADS/SEC PER PHOTONS/CM**2/SEC
HCC/DKT --RADS/HR PER PHOTONS/CM**2/SEC

	HENDERSON	SILICON	HCC/DKT
1	1.1537E-05	3.8476E-09	1.0968E-05
2	8.8927E-06	2.9444E-09	8.7387E-06
3	7.4987E-06	2.4851E-09	7.6280E-06
4	6.7088E-06	2.1752E-09	6.8926E-06
5	5.9758E-06	1.8619E-09	6.1502E-06
6	5.1911E-06	1.5447E-09	5.3843E-06
7	4.3062E-06	1.2224E-09	4.5745E-06
8	3.6366E-06	9.8025E-10	3.9221E-06
9	3.1322E-06	8.2835E-10	3.4489E-06
10	2.6089E-06	6.7180E-10	2.9236E-06
11	2.0294E-06	5.0740E-10	2.3055E-06
12	1.4773E-06	3.6810E-10	1.7345E-06
13	1.0535E-06	2.6573E-10	1.2956E-06
14	6.9156E-07	1.8411E-10	8.9138E-07
15	3.9776E-07	1.1204E-10	5.9067E-07
16	1.9719E-07	7.4542E-11	3.6375E-07
17	1.3351E-07	8.3590E-11	2.6782E-07
18	1.3211E-07	1.4467E-10	2.7797E-07
19	2.2760E-07	3.2110E-10	4.2145E-07
20	5.0933E-07	7.3879E-10	8.0094E-07

****** DATA OUT OF RANGE FOR 1.0000E-02 MEV

21	1.5852E-06	2.2597E-09	2.2512E-06

```
 CCCCCCCCCCC   HH          HH    00000000000    XX          XX
CCCCCCCCCCCCC  HH          HH   0000000000000    XX        XX
CC         CC  HH          HH   00         00     XX      XX
CC             HH          HH   00         00      XX    XX
CC             HH          HH   00         00       XX  XX
CC             HHHHHHHHHHHHHH   00         00        XXX
CC             HHHHHHHHHHHHHH   00         00        XXX
CC             HH          HH   00         00       XX  XX
CC             HH          HH   00         00      XX    XX
CC         CC  HH          HH   00         00     XX      XX
CCCCCCCCCCCCC  HH          HH   0000000000000    XX        XX
 CCCCCCCCCCC   HH          HH    00000000000    XX          XX


   0000000     5555555555555             //     11      777777777777             //   777777777777   5555555555555
  000000000    5555555555555            //     111      77777777777             //    77777777777    5555555555555
 00       00   55                      //     1111      77        77           //     77        77   55
00         00  55                     //       11                77           //               77   55
00         00  55                    //        11               77           //               77    55
00         00  555555555555         //         11              77           //               77     555555555555
00         00  5555555555555       //          11              77          //                77     5555555555555
00         00             55      //           11             77          //                77                 55
00         00             55     //            11             77         //                 77                 55
 00       00   55         55    //             11            77         //                 77      55          55
  000000000    5555555555555   //           11111111         77        //                  77      5555555555555
   0000000      55555555555   //            11111111         77       //                   77       55555555555


             44                          11      777777777777                   5555555555555   777777777777
            444                         111      77777777777                    5555555555555   77777777777
           4444                        1111      77        77                   55              77        77
          44 44                          11                77                   55                       77
         44  44                          11               77                    55                      77
        44   44                          11              77                     555555555555           77
       44    44           .....          11              77        .....        5555555555555          77
      4444444444444       .....          11             77         .....                   55         77
     44444444444444       .....          11             77         .....                   55         77
             44           .....          11            77          .....        55         55        77
             44                       11111111         77                       5555555555555        77
             44                       11111111         77                        55555555555         77
```

```
1$ ARRAY      2 ENTRIES READ

0T



COUPLED NEUTRON AND GAMMA-RAY CROSS-SECTION SETS WILL BE CREATED ON LOGICAL UNIT    1

NUMBER OF COUPLED SETS                  2
MOUNT PREVIOUSLY MADE LIBRARY           NO

2$ ARRAY      2 ENTRIES READ

3$ ARRAY      2 ENTRIES READ

4$ ARRAY      2 ENTRIES READ

5$ ARRAY      2 ENTRIES READ

0T

CHOX WILL CREATE THE FOLLOWING COUPLED SETS--
                               I D E N T I F I E R S
SET  COUPLED SET   NEUTRON DATA    GAMMA PRODUCTION DATA    GAMMA DATA
 1          1269            1269                 1269                1
 2          1276            1276                 1276                8
```

READ

05/17/75

4:23:10

1$ ARRAY 4 ENTRIES READ

0T

CHECKING TOLERANCE= 1.00000E-03 PER CENT

AMPX NUCLIDE 1269 HYDROGEN 1269

HAS THE FOLLOWING DATA

0 RESOLVED RESONANCES	0 UNRESOLVED RESONANCE POINTS
6 TEMP IND 1-D NEUT PROCESSES	1 2-D NEUT PROCESSES
0 TEMP DEP 1-D NEUT PROCESSES	6 1-D GAMMA PROCESSES
2 2-D GAMMA PROCESSES	1 2-D NEUT-TO-GAMMA PROCESSES
0 FISSION YIELDS	1269 ENDF MAT OF FAST NEUT DATA
	1269 ENDF MAT OF THERMAL NEUT DATA
	1269 ENDF MAT OF YIELD DATA
20 RECORDS FOR NUCLIDE	1 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D NEUTRON PROCESSES

1. 2. 27. 101. 102. 1099.

2-D NEUT PROCESSES

	MT	LENGTH	ORDER	TEMPS
1	2	740	5	0

2-D NEUTRON TO GAMMA TRANSFERS

	MT	LENGTH	ORDER	TYPES
1	102	46	0	1

NEUTRON GROUP	ESTIMATED BINDING ENERGY (EV)	CAPTURE CROSS SECTION
1	1.199141E 07	4.686749E-05
2	1.199394E 07	2.833412E-05
3	9.000781E 06	2.934638E-05
4	8.999655E 06	2.979842E-05
5	8.999918E 06	3.006977E-05
6	9.000202E 06	3.060266E-05
7	8.998895E 06	3.135069E-05
8	7.500342E 06	3.218419E-05
9	6.499746E 06	3.294100E-05
10	6.500712E 06	3.355932E-05
11	6.499018E 06	3.421967E-05
12	5.498650E 06	3.523733E-05
13	5.500833E 06	3.599298E-05
14	4.499699E 06	3.639766E-05
15	4.499323E 06	3.632523E-05
16	3.500410E 06	3.597864E-05
17	3.499737E 06	3.523694E-05
18	3.498527E 06	3.473424E-05
19	3.499135E 06	3.437408E-05
20	2.749101E 06	3.436941E-05
21	2.743527E 06	3.536770E-05
22	2.168041E 06	5.137325E-05
23	2.243133E 06	8.719637E-05
24	2.233780E 06	1.321628E-04
25	2.246511E 06	2.218852E-04
26	2.232089E 06	2.938160E-04
27	2.207392E 06	3.899427E-04
28	2.233310E 06	6.821561E-04
29	2.132972E 06	1.189501E-03
30	1.129294E 06	1.814006E-03
31	1.161276E 06	3.487420E-03
32	2.903655E 03	7.283904E-03
33	4.312508E 03	1.271074E-02
34	1.486230E 04	2.244074E-02
35	4.044713E 04	3.915907E-02
36	1.082767E 05	6.456769E-02
37	9.541583E 05	2.660287E-01

```
2-D GAMMA PROCESSES
      MT    LENGTH     ORDER
 1   504      155        5         0
 2   516       12        0         0

NUCLIDE        1269 HAS BEEN CHECKED

AMPX NUCLIDE      1276 OXYGEN     1276
     HAS THE FOLLOWING DATA
    0 RESOLVED RESONANCES                        0 UNRESOLVED RESONANCE POINTS
   10 TEMP IND 1-D NEUT PROCESSES               39 2-D NEUT PROCESSES
    0 TEMP DEP 1-D NEUT PROCESSES                6 1-D GAMMA PROCESSES
    2 2-D GAMMA PROCESSES                        5 2-D NEUT-TO-GAMMA PROCESSES
    0 FISSION YIELDS                          1276 ENDF MAT OF FAST NEUT DATA
                                              1276 ENDF MAT OF THERMAL NEUT DATA
                                              1276 ENDF MAT OF YIELD DATA
   87 RECORDS FOR NUCLIDE                        8 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D NEUTRON PROCESSES
      1.        2.        4.       27.      101.      102.      103.      104.      107.     1099.

2-D NEUT PROCESSES
      MT    LENGTH     ORDER     TEMPS
 1     2      146        5         0
 2    51       51        0         0
 3    52       51        0         0
 4    53       47        0         0
 5    54       46        0         0
 6    55       42        0         0
 7    56       39        0         0
 8    57       37        0         0
 9    58       37        0         0
10    59       34        0         0
11    60       34        0         0
12    61       34        0         0
13    62       34        0         0
             •
             •
35    84       10        0         0
36    85       10        0         0
37    86        8        0         0
38    87        8        0         0
39    88        6        0         0
MT=  4 GROUP   1 MATRIX SUMS TO   5.784409E-01 AVERAGED VALUE=   5.784622E-01 FRACT DEV=  -3.678522E-05
MT=  4 GROUP   2 MATRIX SUMS TO   5.628478E-01 AVERAGED VALUE=   5.627182E-01 FRACT DEV=   2.303819E-04
MT=  4 GROUP   3 MATRIX SUMS TO   5.163944E-01 AVERAGED VALUE=   5.162252E-01 FRACT DEV=   3.276824E-04
MT=  4 GROUP   4 MATRIX SUMS TO   4.762793E-01 AVERAGED VALUE=   4.762217E-01 FRACT DEV=   1.207809E-04
MT=  4 GROUP   5 MATRIX SUMS TO   4.260890E-01 AVERAGED VALUE=   4.259819E-01 FRACT DEV=   2.513016E-04
MT=  4 GROUP   6 MATRIX SUMS TO   3.455014E-01 AVERAGED VALUE=   3.455049E-01 FRACT DEV=  -1.035088E-05
MT=  4 GROUP   7 MATRIX SUMS TO   3.365132E-01 AVERAGED VALUE=   3.365548E-01 FRACT DEV=  -1.234403E-04
MT=  4 GROUP   8 MATRIX SUMS TO   2.358311E-01 AVERAGED VALUE=   2.358342E-01 FRACT DEV=  -1.339520E-05
MT=  4 GROUP  10 MATRIX SUMS TO   2.731062E-01 AVERAGED VALUE=   2.731096E-01 FRACT DEV=  -1.265817E-05
MT=  4 GROUP  12 MATRIX SUMS TO   7.641506E-02 AVERAGED VALUE=   7.641333E-02 FRACT DEV=   2.262085E-05
             •
             •
             •
```

NITAWL

05/17/75

4:27:57

1$ ARRAY 12 ENTRIES READ

0T

MSCM	NUMBER OF EXTRA CROSS SECTIONS	0
MMT	NUMBER OF NUCLIDES FROM MASTER LIBRARY	2
MWT	NUMBER OF NUCLIDES FROM X-SECT LIBRARY (LOG 2)	0
MXT	NUMBER OF NUCLIDES FROM X-SECT LIBRARY (LOG 3)	0
MCR	ANISN/DOT/MORSE OUTPUT TRIGGER	1
MXX	TOTAL CROSS SECTION POSITION	0
MS	WITHIN-GROUP SCATTERING CROSS SECTION POSITION	0
IRES	NUMBER OF RESONANCE CALCULATIONS	0
IQM	TABLE LENGTH FOR CROSS SECTIONS	0
IPM	IS AN OLD ANISN LIBRARY MOUNTED ? (0/1:NO/YES)	0
IPP	OUTPUT OPTION TRIGGER	0
IFG	PRINT CONTROL - ANISN OUTPUT	0

THE STORAGE ALLOCATED FOR THIS CASE IS 74752 WORDS

2$ ARRAY 2 ENTRIES READ

0T

GENERAL INFORMATION CONCERNING CROSS SECTION LIBRARY

TAPE IDENTIFICATION NUMBER	22
NUMBER OF NUCLIDES ON TAPE	2
NUMBER OF NEUTRON ENERGY GROUPS	37
FIRST THERMAL NEUTRON ENERGY GROUP	37
NUMBER OF GAMMA ENERGY GROUPS	21

XSDRN TAPE 22

NUCLIDES FROM XSDRN TAPE

1	HYDROGEN	1269	1269
2	OXYGEN	1276	1276

HYDROGEN 1269 1269

OXYGEN 1276 1276

AN ANISN LIBRARY WILL BE MADE ON CARDS
FOR 37 NEUTRON GROUPS AND 21 GAMMA GROUPS
IHT= 3
IHS= 4 WHICH ALLOWS 57 DOWNSCATTERS
ITL= 61 0 UPSCATTERS

THE LIBRARY CONTENTS ARE

NOG	ITL	ICT	IN	TITLE		XSORN ID
58	61	0	1	PO DATA FOR HYDROGEN	1269	1269

PSN.	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	2.68675E-05	2.83341E-05	2.93464E-05	2.97984E-05	3.00698E-05	3.06027E-05	3.13507E-05	3.21842E-05
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	5.32303E-01	6.12463E-01	6.67597E-01	6.92217E-01	7.25987E-01	7.69677E-01	8.24700E-01	9.02483E-01
4	3.69754E-02	3.60038E-02	1.62667E-02	8.55910E-03	2.62491E-02	1.87714E-02	3.92816E-02	4.30342E-02
5	0.0	5.82171E-02	2.80910E-02	1.61099E-02	4.93984E-02	3.41136E-02	7.14347E-02	7.47585E-02
6	0.0	0.0	2.13005E-02	1.35622E-02	4.58935E-02	3.09200E-02	6.33226E-02	6.46753E-02
7	0.0	0.0	0.0	1.02841E-02	3.86412E-02	2.87311E-02	5.73958E-02	5.73276E-02
8	0.0	0.0	0.0	0.0	2.92991E-02	2.41884E-02	5.33320E-02	5.19631E-02
9	0.0	0.0	0.0	0.0	0.0	1.83417E-02	4.48997E-02	4.82816E-02
10	0.0	0.0	0.0	0.0	0.0	0.0	3.40452E-02	4.06493E-02
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.08231E-02
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PSN. 13 THRU PSN. 61 SAME AS ABOVE

PSN.	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	3.29410E-05	3.35593E-05	3.42197E-05	3.52373E-05	3.59930E-05	3.63977E-05	3.63252E-05	3.59786E-05
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	9.84746E-01	1.07177E 00	1.16451E 00	1.28788E 00	1.50018E 00	1.67239E 00	1.79255E 00	2.08199E 00
4	4.69609E-02	5.11344E-02	5.55750E-02	9.01576E-02	1.67781E-01	4.08992E-02	1.25810E-01	2.74697E-01
5	8.17824E-02	8.92425E-02	9.71211E-02	1.54461E-01	2.64924E-01	6.49842E-02	2.27257E-01	4.31999E-01
6	6.76236E-02	7.40041E-02	8.07438E-02	1.28634E-01	2.11119E-01	4.54942E-02	1.76544E-01	3.63961E-01
7	5.84990E-02	6.11915E-02	6.69574E-02	1.06944E-01	1.75817E-01	3.62542E-02	1.23597E-01	2.82740E-01
8	5.18573E-02	5.29382E-02	5.53662E-02	8.86828E-02	1.46170E-01	3.01923E-02	9.84944E-02	1.97941E-01
9	4.70048E-02	4.69257E-02	4.78975E-02	7.33300E-02	1.21213E-01	2.51018E-02	8.20242E-02	1.57743E-01
10	4.36745E-02	4.25328E-02	4.24563E-02	6.34362E-02	1.00226E-01	2.08146E-02	6.81928E-02	1.31366E-01
11	3.67696E-02	3.95195E-02	3.84841E-02	5.62330E-02	8.67074E-02	1.72118E-02	5.65526E-02	1.09209E-01
12	2.78805E-02	3.32733E-02	3.57563E-02	5.09724E-02	7.68598E-02	1.48899E-02	4.67572E-02	9.05625E-02
13	0.0	2.52296E-02	3.01047E-02	4.73592E-02	6.96728E-02	1.32006E-02	4.04563E-02	7.48911E-02
14	0.0	0.0	2.28272E-02	3.98726E-02	6.47272E-02	1.19638E-02	3.58530E-02	6.47744E-02
15	0.0	0.0	0.0	3.02337E-02	5.44989E-02	1.11155E-02	3.25024E-02	5.74268E-02
16	0.0	0.0	0.0	0.0	4.13232E-02	9.35869E-03	3.02004E-02	5.20521E-02
17	0.0	0.0	0.0	0.0	0.0	7.09616E-03	2.54244E-02	4.83647E-02
18	0.0	0.0	0.0	0.0	0.0	0.0	1.92791E-02	4.07188E-02
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.08755E-02
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PSN. 21 THRU PSN. 61 SAME AS ABOVE

10.2. Problem 2

This is an XLACS calculation which accesses fast and thermal ($S_{\alpha,\beta}$) ENDF/B data to make 123 group P_3 neutron cross sections. ENDF-IV data for hydrogen and nitrogen are used with the hydrogen weighted over a composite spectrum consisting of a fission spectrum tied to 1/E tied to a Maxwellian thermal spectrum; nitrogen is weighted over a $1/E\Sigma_t$ spectrum for air. A free gas kernel is calculated in the bottom 30 groups for nitrogen, and a water bound kernel is used for hydrogen. Both thermal kernels are at room temperature.

This case used 410K bytes of storage and 3.11 minutes of CPU time on the IBM 360/91.

The input data for the case are given on the following page with the abbreviated output following that.

```
THIS IS THE TOP OF AMPX

 MODULE XLACS     HAS BEEN CALLED

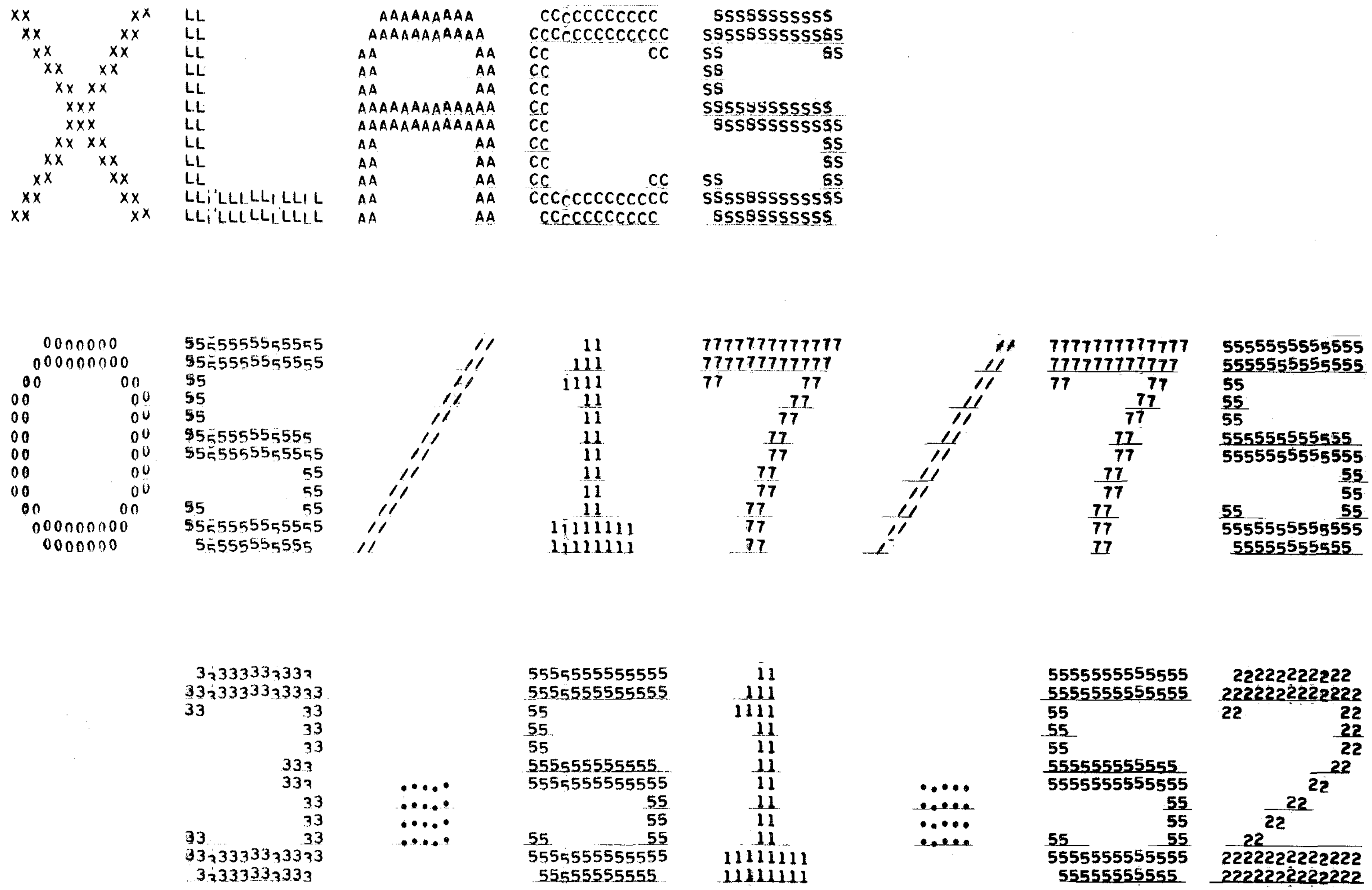
SAMPLE PROBLEM 2
ENDF/B VERSION IV
HYDROGEN AND
NITROGEN
DIFFERENT WEIGHTINGS
1$$ 1 2 123 30 2 3$$ 2R1 A4 1 E T
T   STANDARD STRUCTURE USED
HYDROGEN V4(1269)    FISS-1/E-MAX WT
70$$ 2R1269 1 3 3 0 1002 2 12 T
73** 296 T
NITROGEN-14 V4(1275)    AIR WEIGHTING
1$$ A5 6 2$$ A5 108 E
70$$ 2R1275 1 3 3 0 -2 E T
73** 296 T

 MODULE XLACS     IS FINISHED. USER CODE 0016   SYSTEM CODE 000

 MODULE RADE      HAS BEEN CALLED

1$$ 23 E T

 MODULE RADE      IS FINISHED. USER CODE 0000   SYSTEM CODE 000
```



1$ ARRAY 5 ENTRIES READ

3$ ARRAY 6 ENTRIES READ

0T

A STANDARD 123 NEUTRON GROUP STRUCTURE HAS BEEN INSERTED FOR YOU AND WILL BE USED UNLESS YOU OVERRIDE IT

0T

```
AN XSDRN TAPE WILL BE  WRITTEN WITH THE AUSPICIOUS TITLE

********************************************************************************
SAMPLE PROBLEM 2
ENDF/B VERSION IV
HYDROGEN AND
NITROGEN
DIFFERENT WEIGHTINGS

XSDRN TAPE IDENTIFICATION            1        TRANSFER INTEGRATION MESH-SRCE       0
NUMBER OF NUCLIDES                   2        TRANSFER INTEGRATION MESH-SINK       0
NUMBER OF ENERGY GROUPS            123        ENDF TAPE IDENTIFICATION             0
NUMBER OF THERMAL GROUPS            30        ENDF TAPE MODE (FAST DATA)           0
WEIGHTING OPTION                     2        PEAK TEMPERATURE (MAXWELLIAN)        0

          OUTPUT LISTING OPTIONS
RESONANCE DATA                1
1-DIMENSIONAL ARRAYS          1
ELASTIC SCATTERING            0
THERMAL SCATTERING            1
INELASTIC SCATTERING          0
N2N TRANSFERS                 0

                                   .
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         COMMENCE PROCESSING DATA FOR
    HYDROGEN V4(1269)    FISS-1/E-MAX WT

   70$ ARRAY       9 ENTRIES READ

    0T

   73* ARRAY       1 ENTRIES READ

    0T

    XSDRN IDENTIFIER                      1269    ENDF TAPE MODE (THERMAL DATA)             0
    ENDF/B MATERIAL ID (FAST DATA)        1269    ENDF/B MATERIAL ID (THERMAL DATA)      1002
    NUMBER OF THERMAL TEMPERATURES           1    NUMBER OF ATOMS/MOLECULES                 2
    ORDER OF FAST EXP COEFF                  3    LOGICAL UNIT (THERMAL DATA)              12
    ORDER OF THERMAL EXP COEFF               3
```

THE (TAPE) DESCRIPTION OF MATERIAL 1002 IS -
THERMAL SCATTERING LAW DATA COMPUTED AT BNL USING GA CODE GASKET
USING INCOHERENT APPROX WITH EXPERIMENTAL ROTATIONAL FREQUENCY
BAND ACCORDING TO HAYWOOD PLUS TWO DISCRETE VIBRATIONAL MODES.
DATA TABULATED FOR 8 TEMPERATURES %296,350,400,450,500,600,800,
1000 DEG K<

NO FILE 3 DATA FOR MATERIAL 1002 REACTION 1---TAPE SEARCHED TO MAT=1002 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1002 REACTION 2---TAPE SEARCHED TO MAT=1002 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1002 REACTION 4---TAPE SEARCHED TO MAT=1002 MF= 3 MT= 102
NO FILE 3 DATA FOR MATERIAL 1002 REACTION 18---TAPE SEARCHED TO MAT=1002 MF= 3 MT= 102
NO FILE 4 DATA FOR MATERIAL 1002 REACTION 2---TAPE SEARCHED TO MAT=1002 MF= 7 MT= 4
NO FILE 4 DATA FOR MATERIAL 1002 REACTION 4---TAPE SEARCHED TO MAT=1002 MF= 7 MT= 4

INTEGRATED THERMAL COEFFICIENTS

PT	ENERGY		P0	P1	P2	P3	P4	P5
1	7.5000E-03	FINE	7.24755E 01	5.66092E 00	7.31572E-01	5.34604E-01		
		COARSE	6.84892E 01	1.01083E 01	5.14983E 00	4.23207E 00		
2	1.2247E-02	FINE	6.51842E 01	6.88322E 00	6.54195E-01	2.83839E-01		
		COARSE	6.51394E 01	9.77453E 00	3.15881E 00	2.49226E 00		
3	1.7320E-02	FINE	5.98492E 01	7.76620E 00	7.40694E-01	1.74730E-01		
		COARSE	6.03553E 01	9.30022E 00	2.05712E 00	1.54173E 00		
4	2.4495E-02	FINE	5.41681E 01	8.66510E 00	9.75514E-01	1.40329E-01		
		COARSE	5.98173E 01	1.41382E 01	5.72180E 00	4.39854E 00		
5	3.4641E-02	FINE	4.82329E 01	9.50249E 00	1.32276E 00	1.73706E-01		
		COARSE	5.17137E 01	1.30174E 01	4.59241E 00	3.31175E 00		
6	4.4721E-02	FINE	4.39545E 01	1.00492E 01	1.64705E 00	2.41304E-01		
		COARSE	4.64453E 01	1.27411E 01	4.25482E 00	2.75343E 00		
7	5.4772E-02	FINE	4.08281E 01	1.03695E 01	1.89349E 00	3.25593E-01		
		COARSE	4.27360E 01	1.25728E 01	4.09580E 00	2.40529E 00		
8	6.4807E-02	FINE	3.85319E 01	1.05880E 01	2.11867E 00	3.79131E-01		
		COARSE	3.99822E 01	1.23662E 01	3.97367E 00	2.18027E 00		
9	7.4833E-02	FINE	3.68076E 01	1.07355E 01	2.32556E 00	4.46104E-01		
		COARSE	3.77259E 01	1.19628E 01	3.66015E 00	1.84396E 00		
10	8.9443E-02	FINE	3.49293E 01	1.08978E 01	2.53602E 00	5.18343E-01		
		COARSE	4.05036E 01	1.63719E 01	7.58220E 00	5.06114E 00		
11	1.0954E-01	FINE	3.30120E 01	1.10558E 01	2.75423E 00	5.97218E-01		
		COARSE	3.72163E 01	1.52342E 01	6.74221E 00	4.35295E 00		
12	1.2961E-01	FINE	3.15249E 01	1.11605E 01	2.92209E 00	6.47190E-01		
		COARSE	3.50263E 01	1.46626E 01	6.33271E 00	3.90690E 00		
13	1.4967E-01	FINE	3.03484E 01	1.12300E 01	3.06759E 00	7.05390E-01		
		COARSE	3.33782E 01	1.42700E 01	6.04725E 00	3.56388E 00		
14	1.6971E-01	FINE	2.93445E 01	1.12929E 01	3.17777E 00	7.49536E-01		
		COARSE	3.19735E 01	1.39429E 01	5.81648E 00	3.31752E 00		
15	1.8974E-01	FINE	2.84852E 01	1.13469E 01	3.26455E 00	7.91058E-01		
		COARSE	3.03346E 01	1.33149E 01	5.39328E 00	3.02944E 00		
16	2.2361E-01	FINE	2.73456E 01	1.14610E 01	3.40466E 00	8.28413E-01		
		COARSE	3.81212E 01	2.16880E 01	1.27810E 01	9.15800E 00		
17	2.7386E-01	FINE	2.61503E 01	1.16137E 01	3.63820E 00	8.56771E-01		
		COARSE	3.46936E 01	1.98214E 01	1.13502E 01	7.92485E 00		
18	3.2404E-01	FINE	2.51548E 01	1.16189E 01	3.82845E 00	9.08546E-01		
		COARSE	3.22423E 01	1.84854E 01	1.03780E 01	7.03130E 00		
19	3.9686E-01	FINE	2.39471E 01	1.15472E 01	3.99869E 00	1.01117E 00		
		COARSE	3.99596E 01	2.68074E 01	1.81217E 01	1.37098E 01		
20	4.9749E-01	FINE	2.28055E 01	1.14211E 01	4.13472E 00	1.12318E 00		
		COARSE	3.55354E 01	2.36481E 01	1.55630E 01	1.15958E 01		
21	5.9791E-01	FINE	2.21057E 01	1.14580E 01	4.25620E 00	1.20548E 00		
		COARSE	3.28294E 01	2.17577E 01	1.39817E 01	1.02266E 01		
22	7.1021E-01	FINE	2.16786E 01	1.16019E 01	4.42266E 00	1.27975E 00		
		COARSE	3.37084E 01	2.31893E 01	1.54269E 01	1.15481E 01		
23	8.2449E-01	FINE	2.14371E 01	1.17607E 01	4.58218E 00	1.32232E 00		
		COARSE	2.91308E 01	1.91738E 01	1.16711E 01	8.04151E 00		
24	9.3595E-01	FINE	2.12260E 01	1.18825E 01	4.69001E 00	1.34320E 00		
		COARSE	3.01722E 01	2.05030E 01	1.29445E 01	9.17470E 00		
25	1.0607E 00	FINE	2.09845E 01	1.20298E 01	4.81779E 00	1.33483E 00		

THERMAL INTEGRALS

		COARSE	2.89876E 01	1.96351E 01	1.21222E 01	8.35758E 00
26	1.2047E 00	FINE	2.09608E 01	1.20913E 01	4.86815E 00	1.32501E 00
		COARSE	3.05746E 01	2.14672E 01	1.38982E 01	9.99467E 00
27	1.3629E 00	FINE	2.07259E 01	1.22161E 01	4.93447E 00	1.30871E 00
		COARSE	2.83134E 01	1.94892E 01	1.19893E 01	8.12847E 00
28	1.4988E 00	FINE	2.06113E 01	1.22950E 01	4.99120E 00	1.28782E 00
		COARSE	2.59704E 01	1.73480E 01	9.89072E 00	6.05276E 00
29	1.6333E 00	FINE	2.05607E 01	1.23591E 01	5.04790E 00	1.27428E 00
		COARSE	2.69435E 01	1.84582E 01	1.09668E 01	7.04337E 00
30	1.7834E 00	FINE	2.05065E 01	1.24227E 01	5.06770E 00	1.26266E 00
		COARSE	2.63394E 01	1.79998E 01	1.05077E 01	6.55212E 00

A THERMAL SCATTERING CALCULATION HAS BEEN PERFORMED AT 296.0 DEGREES KELVIN

ELAPSED TIME 1.88 MIN.

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COMMENCE PROCESSING DATA FOR
NITROGEN-14 V4(1275) AIR WEIGHTING

1$ ARRAY 5 ENTRIES READ

2$ ARRAY 12 ENTRIES READ

70$ ARRAY 9 ENTRIES READ

0T

73* ARRAY 1 ENTRIES READ

0T

XSDRN IDENTIFIER	1275	ENDF TAPE MODE (THERMAL DATA)	0
ENDF/B MATERIAL ID (FAST DATA)	1275	ENDF/B MATERIAL ID (THERMAL DATA)	-2
NUMBER OF THERMAL TEMPERATURES	1	NUMBER OF ATOMS/MOLECULES	0
ORDER OF FAST EXP COEFF	3	LOGICAL UNIT (THERMAL DATA)	11
ORDER OF THERMAL EXP COEFF	3		

```
NO FILE 3 DATA FOR MATERIAL 1275 REACTION 115---TAPE SEARCHED TO MAT=1275 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1275 REACTION 116---TAPE SEARCHED TO MAT=1275 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1275 REACTION 117---TAPE SEARCHED TO MAT=1275 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1275 REACTION 118---TAPE SEARCHED TO MAT=1275 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1275 REACTION 119---TAPE SEARCHED TO MAT=1275 MF= 3 MT= 251

  ELAPSED TIME   1.99 MIN.

  ELAPSED TIME   2.64 MIN.
NO FILE 5 DATA FOR MATERIAL 1275 REACTION  17---TAPE SEARCHED TO MAT=1275 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1275 REACTION  18---TAPE SEARCHED TO MAT=1275 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1275 REACTION  22---TAPE SEARCHED TO MAT=1275 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1275 REACTION  23---TAPE SEARCHED TO MAT=1275 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1275 REACTION  24---TAPE SEARCHED TO MAT=1275 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1275 REACTION  25---TAPE SEARCHED TO MAT=1275 MF= 7 MT=   4
NO FILE 5 DATA FOR MATERIAL 1275 REACTION  28---TAPE SEARCHED TO MAT=1275 MF= 7 MT=   4

  ELAPSED TIME   2.76 MIN.

A THERMAL SCATTERING CALCULATION HAS BEEN RERFORMED AT      296.0 DEGREES KELVIN

  ELAPSED TIME   2.77 MIN.

  ELAPSED TIME   2.77 MIN.

AN XSDRN MASTER LIBRARY TAPE WILL BE CREATED ON LOGICAL UNIT   23
    * ITS IDENTIFICATION NUMBER IS    1
    *  2 NUCLIDES HAVE BEEN PROCESSED
    * 123 ENERGY GROUPS      * 94 1ST THERMAL GRP

PERTINENT INFORMATION CONCERNING THIS TAPE IS

    ***************************************************************************************
    *                                                                                     *
    *     SAMPLE PROBLEM 2                                                                *
    *     ENDF/B VERSION IV                                                               *
    *     HYDROGEN AND                                                                    *
    *     NITROGEN                                                                        *
    *     DIFFERENT WEIGHTINGS                                                            *
    *                                                                                     *
    ***************************************************************************************

                        T A B L E   O F   C O N T E N T S

                         NUCLIDE TITLE                                      IDENTIFICATION NUMBER

   1      HYDROGEN V4(1269)    FISS-1/E-MAX WT                                            1269
   2      NITROGEN-14 V4(1275)    AIR WEIGHTING                                           1275
```

XSEC ID GRP.	1	2	27	101	102	1099
1	6.89409E-01	6.89379E-01	2.96853E-05	2.96853E-05	2.96853E-05	4.80120E-03
2	7.56990E-01	7.56959E-01	3.04305E-05	3.04305E-05	3.04305E-05	1.18494E-02
3	8.29447E-01	8.29415E-01	3.14040E-05	3.14040E-05	3.14040E-05	2.64734E-02
4	9.07047E-01	9.07015E-01	3.22334E-05	3.22334E-05	3.22334E-05	5.40489E-02
5	9.89014E-01	9.88981E-01	3.29632E-05	3.29632E-05	3.29632E-05	1.01698E-01
6	1.07618E 00	1.07614E 00	3.35799E-05	3.35799E-05	3.35799E-05	1.77674E-01
7	1.16886E 00	1.16883E 00	3.42575E-05	3.42575E-05	3.42575E-05	2.90357E-01
8	1.26666E 00	1.26663E 00	3.51410E-05	3.51410E-05	3.51410E-05	4.46423E-01
9	1.36863E 00	1.36860E 00	3.55681E-05	3.55681E-05	3.55681E-05	6.49887E-01
10	1.47583E 00	1.47580E 00	3.59203E-05	3.59203E-05	3.59203E-05	8.90889E-01
11	1.58752E 00	1.58748E 00	3.62744E-05	3.62744E-05	3.62744E-05	1.19133E 00
12	1.70398E 00	1.70395E 00	3.63695E-05	3.63695E-05	3.63695E-05	1.51388E 00
13	1.82527E 00	1.82524E 00	3.63026E-05	3.63026E-05	3.63026E-05	1.85401E 00
14	1.95122E 00	1.95118E 00	3.61456E-05	3.61456E-05	3.61456E-05	2.19587E 00
15	2.08281E 00	2.08277E 00	3.59574E-05	3.59574E-05	3.59574E-05	2.52277E 00
16	2.21916E 00	2.21913E 00	3.57693E-05	3.57693E-05	3.57693E-05	2.82054E 00
17	2.36068E 00	2.36064E 00	3.54798E-05	3.54798E-05	3.54798E-05	3.07516E 00
18	2.50519E 00	2.50516E 00	3.50838E-05	3.50838E-05	3.50838E-05	3.28173E 00
19	2.65834E 00	2.65830E 00	3.47289E-05	3.47289E-05	3.47289E-05	3.42639E 00
20	2.81809E 00	2.81806E 00	3.44376E-05	3.44376E-05	3.44376E-05	3.51384E 00
21	2.98318E 00	2.98315E 00	3.42617E-05	3.42617E-05	3.42617E-05	3.54923E 00
22	3.15931E 00	3.15928E 00	3.42921E-05	3.42921E-05	3.42921E-05	3.52543E 00
23	3.34046E 00	3.34043E 00	3.42996E-05	3.42996E-05	3.42996E-05	3.45450E 00
24	3.52953E 00	3.52949E 00	3.43638E-05	3.43638E-05	3.43638E-05	3.34257E 00
25	3.72390E 00	3.72386E 00	3.44535E-05	3.44535E-05	3.44535E-05	3.20081E 00
26	3.92987E 00	3.92984E 00	3.44331E-05	3.44331E-05	3.44331E-05	3.03280E 00
27	4.14413E 00	4.14409E 00	3.44486E-05	3.44486E-05	3.44486E-05	2.84789E 00
28	4.36808E 00	4.36805E 00	3.45449E-05	3.45449E-05	3.45449E-05	2.65276E 00
29	4.60658E 00	4.60654E 00	3.47155E-05	3.47155E-05	3.47155E-05	2.45212E 00
30	4.85776E 00	4.85772E 00	3.49708E-05	3.49708E-05	3.49708E-05	2.25119E 00
31	5.11901E 00	5.11898E 00	3.54920E-05	3.54920E-05	3.54920E-05	2.05411E 00
32	5.39729E 00	5.39725E 00	3.62907E-05	3.62907E-05	3.62907E-05	1.86428E 00
33	5.69032E 00	5.69029E 00	3.70644E-05	3.70644E-05	3.70644E-05	1.68300E 00
34	5.99460E 00	5.99456E 00	3.76985E-05	3.76985E-05	3.76985E-05	1.51270E 00
35	6.31558E 00	6.31554E 00	3.87041E-05	3.87041E-05	3.87041E-05	1.35417E 00
36	6.65251E 00	6.65247E 00	4.02798E-05	4.02798E-05	4.02798E-05	1.20726E 00
37	7.00507E 00	7.00503E 00	4.21184E-05	4.21184E-05	4.21184E-05	1.07331E 00
38	7.37401E 00	7.37397E 00	4.42696E-05	4.42696E-05	4.42696E-05	9.51141E-01
39	7.76070E 00	7.76066E 00	4.67557E-05	4.67557E-05	4.67557E-05	8.40190E-01
40	8.15163E 00	8.15158E 00	4.95472E-05	4.95472E-05	4.95472E-05	7.40808E-01
41	8.55758E 00	8.55753E 00	5.27575E-05	5.27575E-05	5.27575E-05	6.51274E-01
42	8.96917E 00	8.96912E 00	5.63635E-05	5.63635E-05	5.63635E-05	5.71797E-01
43	9.39592E 00	9.39586E 00	6.04898E-05	6.04898E-05	6.04898E-05	5.00729E-01
44	9.83309E 00	9.83302E 00	6.51607E-05	6.51607E-05	6.51607E-05	4.37895E-01
45	1.02800E 01	1.02799E 01	7.03438E-05	7.03438E-05	7.03438E-05	3.82491E-01
46	1.07319E 01	1.07319E 01	7.59810E-05	7.59810E-05	7.59810E-05	3.33660E-01
47	1.11823E 01	1.11822E 01	8.20159E-05	8.20159E-05	8.20159E-05	2.90665E-01
48	1.16290E 01	1.16290E 01	8.85469E-05	8.85469E-05	8.85469E-05	2.52829E-01
49	1.20772E 01	1.20771E 01	9.56260E-05	9.56260E-05	9.56260E-05	2.19576E-01
50	1.28234E 01	1.28232E 01	1.08803E-04	1.08803E-04	1.08803E-04	4.30294E-01
51	1.38862E 01	1.38860E 01	1.30457E-04	1.30457E-04	1.30457E-04	3.00794E-01
52	1.49157E 01	1.49156E 01	1.56544E-04	1.56544E-04	1.56544E-04	2.49999E-01
53	1.58235E 01	1.58233E 01	1.86144E-04	1.86144E-04	1.86144E-04	2.50000E-01
54	1.66380E 01	1.66377E 01	2.19327E-04	2.19327E-04	2.19327E-04	2.49999E-01
55	1.73264E 01	1.73262E 01	2.60200E-04	2.60200E-04	2.60200E-04	2.50000E-01
56	1.79202E 01	1.79198E 01	3.05999E-04	3.05999E-04	3.05999E-04	2.50000E-01
57	1.84177E 01	1.84173E 01	3.58460E-04	3.58460E-04	3.58460E-04	2.50000E-01
58	1.88194E 01	1.88190E 01	4.18138E-04	4.18138E-04	4.18138E-04	2.50000E-01
59	1.91616E 01	1.91611E 01	4.86370E-04	4.86370E-04	4.86370E-04	2.50000E-01

60	1.94293E 01	1.94288E 01	5.63204E-04	5.63204E-04	5.63204E-04	2.50000E-01
61	1.96477E 01	1.96471E 01	6.49973E-04	6.49973E-04	6.49973E-04	2.50000E-01
62	1.98233E 01	1.98226E 01	7.47355E-04	7.47355E-04	7.47355E-04	2.50000E-01
63	1.99596E 01	1.99588E 01	8.55849E-04	8.55849E-04	8.55849E-04	2.49999E-01
64	2.00664E 01	2.00654E 01	9.76850E-04	9.76850E-04	9.76850E-04	2.50000E-01
65	2.01534E 01	2.01523E 01	1.11003E-03	1.11003E-03	1.11003E-03	2.50000E-01
66	2.02184E 01	2.02172E 01	1.25582E-03	1.25582E-03	1.25582E-03	2.50000E-01
67	2.02669E 01	2.02655E 01	1.41498E-03	1.41498E-03	1.41498E-03	2.50000E-01
68	2.03117E 01	2.03101E 01	1.59472E-03	1.59472E-03	1.59472E-03	2.50000E-01
69	2.03394E 01	2.03376E 01	1.80331E-03	1.80331E-03	1.80331E-03	2.50000E-01
70	2.03526E 01	2.03506E 01	2.04471E-03	2.04471E-03	2.04471E-03	2.50000E-01
71	2.03659E 01	2.03636E 01	2.31843E-03	2.31843E-03	2.31843E-03	2.50000E-01
72	2.03792E 01	2.03766E 01	2.62880E-03	2.62880E-03	2.62880E-03	2.50000E-01
73	2.03926E 01	2.03896E 01	2.98071E-03	2.98071E-03	2.98071E-03	2.50000E-01
74	2.04060E 01	2.04026E 01	3.37973E-03	3.37973E-03	3.37973E-03	2.50000E-01
75	2.04195E 01	2.04157E 01	3.83217E-03	3.83217E-03	3.83217E-03	2.50000E-01
76	2.04331E 01	2.04287E 01	4.34517E-03	4.34517E-03	4.34517E-03	2.49999E-01
77	2.04467E 01	2.04418E 01	4.92686E-03	4.92686E-03	4.92686E-03	2.50000E-01
78	2.04543E 01	2.04487E 01	5.58475E-03	5.58475E-03	5.58475E-03	2.50000E-01
79	2.04553E 01	2.04490E 01	6.32859E-03	6.32859E-03	6.32859E-03	2.50000E-01
80	2.04562E 01	2.04490E 01	7.17140E-03	7.17140E-03	7.17140E-03	2.50000E-01
81	2.04571E 01	2.04490E 01	8.12643E-03	8.12643E-03	8.12643E-03	2.50000E-01
82	2.04582E 01	2.04490E 01	9.20865E-03	9.20865E-03	9.20865E-03	2.50000E-01
83	2.04594E 01	2.04490E 01	1.04350E-02	1.04350E-02	1.04350E-02	2.50000E-01
84	2.04608E 01	2.04490E 01	1.18247E-02	1.18247E-02	1.18247E-02	2.50000E-01
85	2.04624E 01	2.04490E 01	1.33994E-02	1.33994E-02	1.33994E-02	2.49999E-01
86	2.04642E 01	2.04490E 01	1.51838E-02	1.51838E-02	1.51838E-02	2.50000E-01
87	2.04662E 01	2.04490E 01	1.72059E-02	1.72059E-02	1.72059E-02	2.49999E-01
88	2.04685E 01	2.04490E 01	1.94972E-02	1.94972E-02	1.94972E-02	2.50000E-01
89	2.04711E 01	2.04490E 01	2.20937E-02	2.20937E-02	2.20937E-02	2.50000E-01
90	2.04740E 01	2.04490E 01	2.50360E-02	2.50360E-02	2.50360E-02	2.50000E-01
91	2.04774E 01	2.04490E 01	2.83702E-02	2.83702E-02	2.83702E-02	2.50000E-01
92	2.04812E 01	2.04490E 01	3.21484E-02	3.21484E-02	3.21484E-02	2.50000E-01
93	2.04854E 01	2.04490E 01	3.64066E-02	3.64066E-02	3.64066E-02	2.47522E-01
94	2.05459E 01	2.05065E 01	3.94500E-02	3.95318E-02	3.95318E-02	8.40834E-02
95	2.06019E 01	2.05607E 01	4.12239E-02	4.13098E-02	4.13098E-02	9.18072E-02
96	2.06543E 01	2.06113E 01	4.30326E-02	4.31226E-02	4.31226E-02	8.00425E-02
97	2.07710E 01	2.07259E 01	4.51292E-02	4.52241E-02	4.52241E-02	1.10001E-01
98	2.10088E 01	2.09608E 01	4.80055E-02	4.81071E-02	4.81071E-02	1.36859E-01
99	2.09357E 01	2.08845E 01	5.11578E-02	5.12669E-02	5.12669E-02	1.17783E-01
100	2.12804E 01	2.12260E 01	5.44617E-02	5.45785E-02	5.45785E-02	1.32389E-01
101	2.14951E 01	2.14371E 01	5.80244E-02	5.81496E-02	5.81496E-02	1.21213E-01
102	2.17411E 01	2.16786E 01	6.25303E-02	6.26664E-02	6.26664E-02	1.77180E-01
103	2.21738E 01	2.21057E 01	6.81468E-02	6.82964E-02	6.82964E-02	1.67054E-01
104	2.28802E 01	2.28055E 01	7.47160E-02	7.48817E-02	7.48817E-02	2.00670E-01
105	2.40307E 01	2.39471E 01	8.36736E-02	8.38612E-02	8.38612E-02	2.51314E-01
106	2.52474E 01	2.51548E 01	9.25633E-02	9.27728E-02	9.27728E-02	1.54151E-01
107	2.62510E 01	2.61503E 01	1.00697E-01	1.00927E-01	1.00927E-01	1.82321E-01
108	2.74571E 01	2.73456E 01	1.11455E-01	1.11712E-01	1.11712E-01	2.23143E-01
109	2.86061E 01	2.84852E 01	1.20946E-01	1.21227E-01	1.21227E-01	1.05361E-01
110	2.94724E 01	2.93445E 01	1.27888E-01	1.28187E-01	1.28187E-01	1.17783E-01
111	3.04846E 01	3.03484E 01	1.36187E-01	1.36507E-01	1.36507E-01	1.33531E-01
112	3.16714E 01	3.15249E 01	1.46537E-01	1.46885E-01	1.46885E-01	1.62651E-01
113	3.31717E 01	3.30120E 01	1.59731E-01	1.60113E-01	1.60113E-01	2.80821E-01
114	3.51061E 01	3.49293E 01	1.76802E-01	1.77228E-01	1.77228E-01	4.96786E-01
115	3.70001E 01	3.68076E 01	1.92570E-01	1.93038E-01	1.93038E-01	3.67008E-01
116	3.87389E 01	3.85319E 01	2.07044E-01	2.07551E-01	2.07551E-01	4.67644E-01
117	4.10534E 01	4.08281E 01	2.25378E-01	2.25934E-01	2.25934E-01	5.82234E-01
118	4.42035E 01	4.39545E 01	2.49062E-01	2.49682E-01	2.49682E-01	7.00141E-01
119	4.85154E 01	4.82329E 01	2.82541E-01	2.83253E-01	2.83253E-01	8.00033E-01
120	5.45029E 01	5.41681E 01	3.34763E-01	3.35617E-01	3.35617E-01	8.38257E-01
121	6.02479E 01	5.98492E 01	3.98777E-01	3.99799E-01	3.99799E-01	3.93553E-01
122	6.56559E 01	6.51842E 01	4.71663E-01	4.73878E-01	4.73878E-01	3.40495E-01

	GRP. 94	GRP. 95	GRP. 96	GRP. 97	GRP. 98	GRP. 99	GRP. 100	GRP. 101
1	94098094	94099095	94100096	94101097	94103098	94104099	94106100	94109101
2	3.50350E-10	5.06443E-10	6.74466E-10	2.48705E-09	2.56922E-10	1.29604E-09	2.87034E-10	1.54102E-10
3	1.39179E-07	1.14670E-07	7.22194E-08	1.57156E-07	1.77747E-08	5.36102E-08	4.11762E-09	5.03052E-10
4	2.84757E-05	5.53338E-05	1.93372E-05	1.97878E-05	1.23701E-06	3.56244E-06	1.57004E-07	3.00704E-09
5	5.48968E-03	1.13373E-02	9.42807E-03	5.33905E-03	9.45314E-05	3.04665E-04	6.91355E-06	1.82963E-08
6	1.98460E 00	2.15327E 00	2.08249E 00	2.64167E 00	1.19452E-02	2.25469E-02	5.45468E-04	2.40469E-07
7		1.81117E 00	1.62233E 00	2.20529E 00	3.11668E 00	2.85066E 00	4.38395E-02	1.04194E-05
8			1.34436E 00	1.85209E 00	2.57072E 00	2.25736E 00	3.36774E 00	5.04147E-04
9				1.53693E 00	2.17785E 00	1.80051E 00	2.62314E 00	3.65282E-02
10					1.84801E 00	1.53706E 00	2.07834E 00	3.57949E 00
11					1.86281E 00	1.54239E 00	1.66365E 00	2.46228E 00
12						1.41237E 00	1.67005E 00	1.99080E 00
13							1.52782E 00	1.52751E 00
14							1.39235E 00	1.47871E 00
15								1.34505E 00
16								1.23058E 00
17								1.12664E 00

	GRP. 102	GRP. 103	GRP. 104	GRP. 105	GRP. 106	GRP. 107	GRP. 108	GRP. 109
1	94119102	94123103	94123104	94123105	94123106	94123107	94123108	94123109
2	1.23099E-10	5.90908E-09	2.96978E-07	1.47347E-05	1.38142E-04	1.04643E-03	8.20215E-03	1.15104E-02
3	1.58359E-10	5.57521E-09	2.80357E-07	1.40864E-05	1.31782E-04	9.98260E-04	7.81154E-03	1.08943E-02
4	2.08542E-10	5.71304E-09	2.87618E-07	1.45897E-05	1.36480E-04	1.03660E-03	8.03641E-03	1.12838E-02
5	2.79015E-10	6.34067E-09	3.19426E-07	1.63848E-05	1.53676E-04	1.17259E-03	8.86015E-03	1.27573E-02
6	3.77518E-10	7.87184E-09	3.95002E-07	2.05999E-05	1.94119E-04	1.49349E-03	1.08631E-02	1.64052E-02
7	5.95566E-10	1.01663E-08	5.07068E-07	2.68968E-05	2.53658E-04	1.98348E-03	1.38686E-02	2.18724E-02
8	1.13728E-09	1.34358E-08	6.64426E-07	3.59352E-05	3.38151E-04	2.66491E-03	1.84697E-02	2.96411E-02
9	2.20824E-09	1.80270E-08	8.83709E-07	4.86422E-05	4.57832E-04	3.61831E-03	2.51262E-02	4.06288E-02
10	4.34297E-09	2.44560E-08	1.19722E-06	6.64513E-05	6.27663E-04	4.78398E-03	3.45568E-02	5.61352E-02
11	8.59750E-09	3.85796E-08	1.89037E-06	1.06278E-04	1.01537E-03	7.26026E-03	5.55458E-02	9.12572E-02
12	1.71984E-08	7.33640E-08	3.62346E-06	2.06020E-04	2.00870E-03	1.37544E-02	1.09035E-01	1.80834E-01
13	5.56613E-08	1.40950E-07	7.09255E-06	4.03455E-04	3.76969E-03	2.74004E-02	2.20518E-01	3.40160E-01
14	3.10261E-07	2.69357E-07	1.40758E-05	8.05652E-04	7.09940E-03	5.50996E-02	4.44327E-01	6.56490E-01
15	1.88699E-06	5.22489E-07	2.82799E-05	1.66496E-03	1.43364E-02	1.13185E-01	8.40340E-01	1.87689E 00
16	2.84606E-05	1.04005E-06	5.73709E-05	3.41128E-03	2.93925E-02	2.36568E-01	1.77910E 00	7.90798E 00
17	1.35586E-03	3.42398E-06	1.91687E-04	1.03003E-02	1.02217E-01	7.43146E-01	9.96295E 00	2.27854E 00
18	5.93285E-02	2.11244E-05	1.23412E-03	6.57690E-02	6.11951E-01	8.38828E 00	4.35256E 00	1.77453E 00
19	4.45981E 00	1.34174E-04	7.12912E-03	4.44285E-01	7.22969E 00	3.69851E 00	3.61830E 00	1.33252E 00
20	3.49962E 00	2.09573E-03	1.15376E-01	7.40570E 00	3.15237E 00	2.82037E 00	2.58707E 00	1.09731E 00
21	2.93517E 00	9.29055E-02	5.95277E 00	4.75857E 00	2.08629E 00	2.18275E 00	1.98569E 00	7.61143E-01
22	2.23021E 00	4.82130E 00	3.96366E 00	3.68768E 00	1.67518E 00	1.59399E 00	1.51322E 00	5.88683E-01
23	2.10283E 00	3.23832E 00	3.15736E 00	2.73349E 00	1.28593E 00	1.27785E 00	1.34270E 00	5.31334E-01
24	1.85437E 00	2.63637E 00	2.32460E 00	2.21269E 00	1.19455E 00	1.18656E 00	1.16260E 00	4.56125E-01
25	1.68667E 00	2.03058E 00	1.96733E 00	2.12805E 00	1.05254E 00	1.04637E 00	1.02982E 00	4.04410E-01
26	1.54422E 00	1.83189E 00	1.88939E 00	1.87818E 00	9.36436E-01	9.24328E-01	9.07572E-01	3.56679E-01
27	1.41347E 00	1.65904E 00	1.66194E 00	1.65620E 00	8.22514E-01	8.12046E-01	7.98553E-01	3.11987E-01
28		1.47075E 00	1.46545E 00	1.46280E 00	7.22310E-01	7.14559E-01	7.02895E-01	2.75648E-01
29		1.33510E 00	1.32937E 00	1.32132E 00	6.57692E-01	6.49078E-01	6.39208E-01	2.49202E-01
30		1.22231E 00	1.22063E 00	1.21315E 00	6.01195E-01	5.94525E-01	5.84095E-01	2.27925E-01
31		1.12076E 00	1.11831E 00	1.11239E 00	5.48882E-01	5.44554E-01	5.33280E-01	2.08196E-01

	GRP. 110	GRP. 111	GRP. 112	GRP. 113	GRP. 114	GRP. 115	GRP. 116	GRP. 117
1	94123110	94123111	94123112	94123113	94123114	94123115	94123116	94123117
2	2.49400E-02	5.62701E-02	1.26390E-01	2.90325E-01	6.74313E-01	5.67817E-01	7.39669E-01	9.07380E-01
3	2.40709E-02	5.44276E-02	1.22900E-01	2.85193E-01	6.52380E-01	5.31288E-01	6.87904E-01	8.90658E-01
4	2.52659E-02	5.71732E-02	1.30032E-01	3.03903E-01	6.78061E-01	5.37007E-01	7.09599E-01	1.01700E 00
5	2.89520E-02	6.55594E-02	1.50809E-01	3.52470E-01	7.51184E-01	5.91497E-01	8.47682E-01	1.45914E 00
6	3.72738E-02	8.49659E-02	1.98034E-01	4.52210E-01	9.12020E-01	7.85654E-01	1.35948E 00	2.95912E 00
7	4.96745E-02	1.14421E-01	2.67009E-01	5.81197E-01	1.19033E 00	1.24820E 00	2.62932E 00	6.61457E 00
8	6.76172E-02	1.57240E-01	3.59845E-01	7.48344E-01	1.74577E 00	2.34592E 00	5.72225E 00	1.37388E 01

9	9.34476E-02	2.17457E-01	4.77181E-01	1.00101E 00	2.98177E 00	5.02791E 00	1.20545E 01	7.16767E 00
10	1.30463E-01	2.98332E-01	6.27402E-01	1.46491E 00	5.94153E 00	1.09496E 01	6.45111E 00	3.77025E 00
11	2.11929E-01	4.57304E-01	9.96876E-01	3.29979E 00	1.45696E 01	4.40741E 00	2.83796E 00	2.08127E 00
12	3.91444E-01	8.56971E-01	2.79285E 00	1.24344E 01	5.92554E 00	1.95135E 00	1.71085E 00	1.60208E 00
13	7.44532E-01	5.40726E 00	1.06540E 01	5.18481E 00	3.32328E 00	1.55152E 00	1.51405E 00	1.43015E 00
14	2.11073E 00	9.28139E 00	4.57598E 00	3.02421E 00	2.89796E 00	1.40240E 00	1.31157E 00	1.18794E 00
15	8.25926E 00	4.08397E 00	2.73839E 00	2.67280E 00	2.59853E 00	1.18661E 00	1.09053E 00	9.88409E-01
16	3.68183E 00	2.49175E 00	2.45426E 00	2.42216E 00	2.19498E 00	1.00157E 00	9.30096E-01	8.49961E-01
17	2.11123E 00	2.15991E 00	2.03769E 00	1.87044E 00	1.71108E 00	7.89656E-01	7.36678E-01	6.78297E-01
18	1.66549E 00	1.56874E 00	1.48293E 00	1.38195E 00	1.30991E 00	6.40271E-01	6.21336E-01	5.73211E-01
19	1.27497E 00	1.22161E 00	1.23305E 00	1.21976E 00	1.10720E 00	5.07704E-01	4.75157E-01	4.39594E-01
20	1.05061E 00	9.83638E-01	9.36363E-01	8.87653E-01	8.22274E-01	3.81385E-01	3.58195E-01	3.31465E-01
21	7.36002E-01	7.08802E-01	6.78913E-01	6.43904E-01	6.03230E-01	2.83395E-01	2.68398E-01	2.52769E-01
22	5.80135E-01	5.78667E-01	5.75614E-01	5.56196E-01	5.25225E-01	2.46986E-01	2.33585E-01	2.18069E-01
23	5.21046E-01	5.09268E-01	4.92224E-01	4.70621E-01	4.42563E-01	2.08097E-01	1.97334E-01	1.84749E-01
24	4.49102E-01	4.40264E-01	4.26041E-01	4.08342E-01	3.85464E-01	1.81280E-01	1.71959E-01	1.61156E-01
25	3.96784E-01	3.87913E-01	3.76954E-01	3.60523E-01	3.39871E-01	1.60515E-01	1.52727E-01	1.43491E-01
26	3.50879E-01	3.42266E-01	3.31871E-01	3.18772E-01	3.00879E-01	1.41526E-01	1.34342E-01	1.26024E-01
27	3.06708E-01	3.00270E-01	2.90651E-01	2.78261E-01	2.62455E-01	1.23981E-01	1.18030E-01	1.11057E-01
28	2.70206E-01	2.63675E-01	2.55621E-01	2.45379E-01	2.31934E-01	1.09240E-01	1.03768E-01	9.74253E-02
29	2.44515E-01	2.38834E-01	2.31741E-01	2.22633E-01	2.09729E-01	9.88464E-02	9.39549E-02	8.82679E-02
30	2.23758E-01	2.18678E-01	2.12276E-01	2.04049E-01	1.92258E-01	9.05957E-02	8.61141E-02	8.08915E-02
31	2.04435E-01	1.99821E-01	1.94003E-01	1.86511E-01	1.75659E-01	8.27948E-02	7.87062E-02	7.39333E-02

	GRP. 118	GRP. 119	GRP. 120	GRP. 121	GRP. 122	GRP. 123
1	94123118	94123119	94123120	94123121	94123122	94123123
2	1.15964E 00	2.00369E 00	5.90617E 00	7.81768E 00	1.59216E 01	3.62588E 01
3	1.35595E 00	3.03127E 00	9.79127E 00	1.20913E 01	2.39011E 01	1.17447E 01
4	1.88205E 00	4.89905E 00	1.57240E 01	1.84592E 01	1.04313E 01	4.97506E 00
5	3.32218E 00	9.43486E 00	2.40586E 01	7.36514E 00	3.95662E 00	1.76054E 00
6	7.79838E 00	1.93527E 01	9.93082E 00	2.41535E 00	1.28932E 00	6.28664E-01
7	1.60828E 01	8.96861E 00	4.02155E 00	1.06713E 00	6.63283E-01	4.18438E-01
8	8.00939E 00	4.12079E 00	2.13877E 00	6.98240E-01	5.27550E-01	3.96456E-01
9	3.98797E 00	2.37138E 00	1.55636E 00	6.10252E-01	5.10377E-01	4.04812E-01
10	2.42906E 00	1.75835E 00	1.39340E 00	5.92546E-01	5.05753E-01	3.98722E-01
11	1.71834E 00	1.51413E 00	1.31267E 00	5.55004E-01	4.60675E-01	3.51243E-01
12	1.50662E 00	1.34816E 00	1.10604E 00	4.46686E-01	3.61638E-01	2.71564E-01
13	1.28496E 00	1.09604E 00	8.78540E-01	3.54815E-01	2.89316E-01	2.19476E-01
14	1.04673E 00	8.93905E-01	7.25990E-01	2.96556E-01	2.43557E-01	1.85743E-01
15	8.79247E-01	7.58753E-01	6.20333E-01	2.53571E-01	2.08413E-01	1.59287E-01
16	7.59449E-01	6.55097E-01	5.36205E-01	2.22150E-01	1.85036E-01	1.44211E-01
17	6.16724E-01	5.55563E-01	4.76945E-01	2.02632E-01	1.69922E-01	1.31611E-01
18	5.16603E-01	4.47355E-01	3.69696E-01	1.53084E-01	1.27182E-01	9.83433E-02
19	3.99288E-01	3.51421E-01	2.92829E-01	1.21814E-01	1.01473E-01	7.84641E-02
20	3.00410E-01	2.64606E-01	2.21527E-01	9.23951E-02	7.69605E-02	5.93833E-02
21	2.33583E-01	2.09263E-01	1.78121E-01	7.51233E-02	6.31746E-02	4.93632E-02
22	1.99798E-01	1.77921E-01	1.50845E-01	6.36626E-02	5.35974E-02	4.19042E-02
23	1.69875E-01	1.51865E-01	1.29388E-01	5.48635E-02	4.64051E-02	3.64909E-02
24	1.48437E-01	1.33058E-01	1.13796E-01	4.83769E-02	4.09549E-02	3.22498E-02
25	1.32056E-01	1.18345E-01	1.01323E-01	4.31454E-02	3.66008E-02	2.88785E-02
26	1.16228E-01	1.04439E-01	8.96777E-02	3.82713E-02	3.25181E-02	2.56969E-02
27	1.02738E-01	9.22391E-02	7.91431E-02	3.37500E-02	2.86731E-02	2.26467E-02
28	8.99305E-02	8.08752E-02	6.95232E-02	2.96896E-02	2.52449E-02	1.99644E-02
29	8.15250E-02	7.33659E-02	6.31171E-02	2.69648E-02	2.29394E-02	1.81446E-02
30	7.47027E-02	6.72322E-02	5.78327E-02	2.47091E-02	2.10217E-02	1.66245E-02
31	6.82935E-02	6.14765E-02	5.28832E-02	2.26006E-02	1.92302E-02	1.52080E-02

XSEC ID GRP.	1	2	4	16	27	101	102	103
1	1.57213E 00	8.00727E-01	4.29018E-01	6.85651E-03	2.45527E-01	2.45527E-01	1.57636E-05	4.17182E-02
2	1.56972E 00	9.00326E-01	4.14071E-01	2.94567E-03	2.52384E-01	2.52384E-01	1.86271E-05	4.95784E-02
3	1.43286E 00	8.19880E-01	3.78637E-01	2.77768E-04	2.34064E-01	2.34064E-01	1.92592E-05	4.83923E-02
4	1.41109E 00	8.85011E-01	3.09933E-01	0.0	2.16146E-01	2.16146E-01	2.14112E-05	4.79678E-02
5	1.30048E 00	9.00348E-01	2.11740E-01	0.0	1.88398E-01	1.88398E-01	1.92842E-05	4.45434E-02
6	1.25864E 00	8.81298E-01	2.01911E-01	0.0	1.75432E-01	1.75432E-01	1.57338E-05	3.62511E-02
7	1.45436E 00	1.05814E 00	2.00148E-01	0.0	1.96069E-01	1.96069E-01	1.82263E-05	2.51166E-02
8	1.30545E 00	9.64166E-01	1.67266E-01	0.0	1.74024E-01	1.74024E-01	1.37692E-05	1.97396E-02
9	1.37128E 00	1.06776E 00	1.23368E-01	0.0	1.80162E-01	1.80162E-01	1.56089E-05	2.35863E-02
10	1.39206E 00	1.15916E 00	6.87945E-02	0.0	1.64102E-01	1.64102E-01	2.24318E-05	2.58843E-02
11	1.40292E 00	1.13706E 00	4.66584E-02	0.0	2.19205E-01	2.19205E-01	1.55813E-05	2.99514E-02
12	1.26478E 00	9.26728E-01	3.72302E-02	0.0	3.00825E-01	3.00825E-01	1.12693E-05	3.42097E-02
13	1.93581E 00	1.51611E 00	1.60481E-02	0.0	4.03651E-01	4.03651E-01	1.81580E-05	5.12308E-02
14	1.83208E 00	1.43656E 00	8.49411E-03	0.0	3.87022E-01	3.87022E-01	2.32094E-05	6.02908E-02
15	1.66652E 00	1.28203E 00	5.69851E-03	0.0	3.77892E-01	3.77892E-01	2.53929E-05	4.11106E-02
16	1.66045E 00	1.33336E 00	3.24221E-03	0.0	3.23851E-01	3.23851E-01	2.21449E-05	3.48455E-02
17	1.45888E 00	1.20577E 00	1.49923E-03	0.0	2.51610E-01	2.51610E-01	1.43611E-05	8.69746E-02
18	1.42017E 00	1.26403E 00	4.78887E-04	0.0	1.55660E-01	1.55660E-01	1.69600E-05	5.02656E-02
19	1.49579E 00	1.38253E 00	0.0	0.0	1.13258E-01	1.13258E-01	2.16138E-05	2.94454E-02
20	1.55009E 00	1.45118E 00	0.0	0.0	9.89090E-02	9.89090E-02	2.59867E-05	2.55774E-02
21	1.64278E 00	1.57492E 00	0.0	0.0	6.78579E-02	6.78579E-02	2.97577E-05	1.35719E-02
22	2.07968E 00	1.98573E 00	0.0	0.0	9.39497E-02	9.39497E-02	3.34125E-05	1.76797E-02
23	2.07970E 00	2.02488E 00	0.0	0.0	5.48219E-02	5.48219E-02	3.60284E-05	3.28335E-02
24	2.25167E 00	2.09061E 00	0.0	0.0	1.61054E-01	1.61054E-01	3.67209E-05	1.31120E-01
25	1.70688E 00	1.66546E 00	0.0	0.0	4.14165E-02	4.14165E-02	3.51964E-05	3.06519E-02
26	1.78573E 00	1.77405E 00	0.0	0.0	1.16803E-02	1.16803E-02	3.23943E-05	8.05245E-03
27	2.14649E 00	2.13933E 00	0.0	0.0	7.16139E-03	7.16139E-03	2.81919E-05	5.71664E-03
28	1.25140E 00	1.24183E 00	0.0	0.0	9.56683E-03	9.56683E-03	2.67991E-05	9.35233E-03
29	1.57258E 00	1.56258E 00	0.0	0.0	1.00061E-02	1.00061E-02	2.64556E-05	9.89062E-03
30	1.88797E 00	1.86922E 00	0.0	0.0	1.87461E-02	1.87461E-02	2.61274E-05	1.86415E-02
31	2.19565E 00	2.14088E 00	0.0	0.0	5.47674E-02	5.47674E-02	2.58308E-05	5.46726E-02
32	1.96566E 00	1.82446E 00	0.0	0.0	1.41198E-01	1.41198E-01	2.55475E-05	1.41112E-01
33	1.86217E 00	1.84520E 00	0.0	0.0	1.69650E-02	1.69650E-02	2.53169E-05	1.68871E-02
34	2.23193E 00	2.21327E 00	0.0	0.0	1.86603E-02	1.86603E-02	2.50981E-05	1.85897E-02
35	2.53555E 00	2.46913E 00	0.0	0.0	6.64253E-02	6.64253E-02	2.49027E-05	6.63612E-02
36	3.25093E 00	3.24863E 00	0.0	0.0	2.30319E-03	2.30319E-03	2.47071E-05	2.24544E-03
37	2.83243E 00	2.83087E 00	0.0	0.0	1.55239E-03	1.55239E-03	2.45473E-05	1.49983E-03
38	2.94133E 00	2.93978E 00	0.0	0.0	1.54773E-03	1.54773E-03	2.44044E-05	1.50000E-03
39	3.05761E 00	3.05607E 00	0.0	0.0	1.54333E-03	1.54333E-03	2.42715E-05	1.50000E-03
40	3.17784E 00	3.17630E 00	0.0	0.0	1.53894E-03	1.53894E-03	2.41441E-05	1.49960E-03
41	3.30315E 00	3.30161E 00	0.0	0.0	1.53575E-03	1.53575E-03	2.40488E-05	1.50000E-03
42	3.41848E 00	3.41695E 00	0.0	0.0	1.53328E-03	1.53328E-03	2.47428E-05	1.50000E-03
43	3.52506E 00	3.52353E 00	0.0	0.0	1.53168E-03	1.53168E-03	2.60083E-05	1.50000E-03
44	3.63503E 00	3.63350E 00	0.0	0.0	1.53045E-03	1.53045E-03	2.73392E-05	1.50003E-03
45	3.74805E 00	3.74652E 00	0.0	0.0	1.52964E-03	1.52964E-03	2.87396E-05	1.50014E-03
46	3.86044E 00	3.85891E 00	0.0	0.0	1.53021E-03	1.53021E-03	3.02069E-05	1.50000E-03
47	3.97358E 00	3.97205E 00	0.0	0.0	1.53175E-03	1.53175E-03	3.17518E-05	1.50000E-03
48	4.09005E 00	4.08851E 00	0.0	0.0	1.53337E-03	1.53337E-03	3.33758E-05	1.50000E-03
49	4.20992E 00	4.20839E 00	0.0	0.0	1.53508E-03	1.53508E-03	3.50829E-05	1.50000E-03
50	4.43728E 00	4.43573E 00	0.0	0.0	1.54211E-03	1.54211E-03	3.82807E-05	1.50383E-03
51	4.82322E 00	4.82166E 00	0.0	0.0	1.56420E-03	1.56420E-03	4.33693E-05	1.52083E-03
52	5.23895E 00	5.23736E 00	0.0	0.0	1.58511E-03	1.58511E-03	4.91239E-05	1.53598E-03
53	5.66830E 00	5.66666E 00	0.0	0.0	1.64035E-03	1.64035E-03	5.56772E-05	1.58468E-03
54	6.07515E 00	6.07340E 00	0.0	0.0	1.75641E-03	1.75641E-03	6.30545E-05	1.69335E-03
55	6.43005E 00	6.42817E 00	0.0	0.0	1.88110E-03	1.88110E-03	7.14298E-05	1.80967E-03
56	6.73160E 00	6.72952E 00	0.0	0.0	2.07841E-03	2.07841E-03	8.09165E-05	1.99749E-03
57	7.02539E 00	7.02307E 00	0.0	0.0	2.32061E-03	2.32061E-03	9.16820E-05	2.22893E-03
58	7.26063E 00	7.25801E 00	0.0	0.0	2.61684E-03	2.61684E-03	1.03859E-04	2.51298E-03
59	7.43972E 00	7.43676E 00	0.0	0.0	2.96509E-03	2.96509E-03	1.17653E-04	2.84744E-03

60	7.58992E 00	7.58656E 00	0.0	0.0	3.36010E-03	3.36010E-03	1.33288E-04	3.22681E-03
61	7.73401E 00	7.73020E 00	0.0	0.0	3.80745E-03	3.80745E-03	1.50991E-04	3.65645E-03
62	7.88087E 00	7.87656E 00	0.0	0.0	4.31435E-03	4.31435E-03	1.71044E-04	4.14331E-03
63	8.03058E 00	8.02569E 00	0.0	0.0	4.88874E-03	4.88874E-03	1.93761E-04	4.69498E-03
64	8.18318E 00	8.17764E 00	0.0	0.0	5.53960E-03	5.53960E-03	2.19495E-04	5.32010E-03
65	8.33874E 00	8.33247E 00	0.0	0.0	6.27711E-03	6.27711E-03	2.48647E-04	6.02846E-03
66	8.49734E 00	8.49023E 00	0.0	0.0	7.11282E-03	7.11282E-03	2.81670E-04	6.83115E-03
67	8.65904E 00	8.65098E 00	0.0	0.0	8.05978E-03	8.05978E-03	3.19079E-04	7.74071E-03
68	8.82251E 00	8.81337E 00	0.0	0.0	9.13699E-03	9.13699E-03	3.61629E-04	8.77536E-03
69	8.94719E 00	8.93684E 00	0.0	0.0	1.03495E-02	1.03495E-02	4.09556E-04	9.93994E-03
70	9.04876E 00	9.03703E 00	0.0	0.0	1.17275E-02	1.17275E-02	4.64057E-04	1.12634E-02
71	9.15164E 00	9.13836E 00	0.0	0.0	1.32890E-02	1.32890E-02	5.25811E-04	1.27632E-02
72	9.25587E 00	9.24081E 00	0.0	0.0	1.50583E-02	1.50583E-02	5.95782E-04	1.44625E-02
73	9.36148E 00	9.34442E 00	0.0	0.0	1.70633E-02	1.70633E-02	6.75065E-04	1.63882E-02
74	9.46851E 00	9.44918E 00	0.0	0.0	1.93352E-02	1.93352E-02	7.64898E-04	1.85703E-02
75	9.57702E 00	9.55511E 00	0.0	0.0	2.19095E-02	2.19095E-02	8.66686E-04	2.10429E-02
76	9.68707E 00	9.66224E 00	0.0	0.0	2.48267E-02	2.48267E-02	9.82018E-04	2.38447E-02
77	9.79870E 00	9.77057E 00	0.0	0.0	2.81323E-02	2.81323E-02	1.11270E-03	2.70196E-02
78	9.86833E 00	9.83645E 00	0.0	0.0	3.18873E-02	3.18873E-02	1.26114E-03	3.06262E-02
79	9.88639E 00	9.85026E 00	0.0	0.0	3.61256E-02	3.61256E-02	1.42867E-03	3.46969E-02
80	9.90459E 00	9.86366E 00	0.0	0.0	4.09355E-02	4.09355E-02	1.61879E-03	3.93168E-02
81	9.92345E 00	9.87707E 00	0.0	0.0	4.63859E-02	4.63859E-02	1.83421E-03	4.45517E-02
82	9.94306E 00	9.89050E 00	0.0	0.0	5.25620E-02	5.25620E-02	2.07829E-03	5.04837E-02
83	9.96351E 00	9.90395E 00	0.0	0.0	5.95604E-02	5.95604E-02	2.35486E-03	5.72056E-02
84	9.98490E 00	9.91741E 00	0.0	0.0	6.74905E-02	6.74905E-02	2.66822E-03	6.48223E-02
85	1.00074E 01	9.93089E 00	0.0	0.0	7.64765E-02	7.64765E-02	3.02329E-03	7.34532E-02
86	1.00310E 01	9.94439E 00	0.0	0.0	8.66590E-02	8.66590E-02	3.42561E-03	8.32334E-02
87	1.00511E 01	9.95286E 00	0.0	0.0	9.81957E-02	9.81957E-02	3.88140E-03	9.43143E-02
88	1.00663E 01	9.95500E 00	0.0	0.0	1.11272E-01	1.11272E-01	4.39798E-03	1.06874E-01
89	1.00813E 01	9.95525E 00	0.0	0.0	1.26087E-01	1.26087E-01	4.98323E-03	1.21104E-01
90	1.00984E 01	9.95550E 00	0.0	0.0	1.42875E-01	1.42875E-01	5.64637E-03	1.37228E-01
91	1.01176E 01	9.95575E 00	0.0	0.0	1.61898E-01	1.61898E-01	6.39775E-03	1.55500E-01
92	1.01395E 01	9.95601E 00	0.0	0.0	1.83454E-01	1.83454E-01	7.24913E-03	1.76205E-01
93	1.01640E 01	9.95625E 00	0.0	0.0	2.07749E-01	2.07749E-01	8.20860E-03	1.99540E-01
94	1.01820E 01	9.95642E 00	0.0	0.0	2.25583E-01	2.25583E-01	8.91288E-03	2.16670E-01
95	1.01922E 01	9.95651E 00	0.0	0.0	2.35727E-01	2.35727E-01	9.31347E-03	2.26413E-01
96	1.02027E 01	9.95659E 00	0.0	0.0	2.46069E-01	2.46069E-01	9.72189E-03	2.36347E-01
97	1.02147E 01	9.95669E 00	0.0	0.0	2.58058E-01	2.58058E-01	1.01953E-02	2.47863E-01
98	1.02313E 01	9.95681E 00	0.0	0.0	2.74505E-01	2.74505E-01	1.08448E-02	2.63661E-01
99	1.02495E 01	9.95693E 00	0.0	0.0	2.92533E-01	2.92533E-01	1.15566E-02	2.80976E-01
100	1.02684E 01	9.95699E 00	0.0	0.0	3.11422E-01	3.11422E-01	1.23031E-02	2.99119E-01
101	1.02888E 01	9.95699E 00	0.0	0.0	3.31797E-01	3.31797E-01	1.31092E-02	3.18688E-01
102	1.03146E 01	9.95700E 00	0.0	0.0	3.57559E-01	3.57559E-01	1.41284E-02	3.43430E-01
103	1.03467E 01	9.95700E 00	0.0	0.0	3.89680E-01	3.89680E-01	1.53993E-02	3.74281E-01
104	1.03843E 01	9.95700E 00	0.0	0.0	4.27261E-01	4.27261E-01	1.68865E-02	4.10374E-01
105	1.04355E 01	9.95700E 00	0.0	0.0	4.78461E-01	4.78461E-01	1.89128E-02	4.59548E-01
106	1.04863E 01	9.95700E 00	0.0	0.0	5.29319E-01	5.29319E-01	2.09259E-02	5.08394E-01
107	1.05328E 01	9.95700E 00	0.0	0.0	5.75831E-01	5.75831E-01	2.27671E-02	5.53064E-01
108	1.05943E 01	9.95700E 00	0.0	0.0	6.37347E-01	6.37347E-01	2.52026E-02	6.12144E-01
109	1.06487E 01	9.95700E 00	0.0	0.0	6.91654E-01	6.91654E-01	2.73530E-02	6.64301E-01
110	1.06884E 01	9.95700E 00	0.0	0.0	7.31358E-01	7.31358E-01	2.89253E-02	7.02433E-01
111	1.07358E 01	9.95700E 00	0.0	0.0	7.78817E-01	7.78817E-01	3.08048E-02	7.48012E-01
112	1.07956E 01	9.95757E 00	0.0	0.0	8.38021E-01	8.38021E-01	3.31496E-02	8.04871E-01
113	1.08705E 01	9.95700E 00	0.0	0.0	9.13493E-01	9.13493E-01	3.61391E-02	8.77354E-01
114	1.09681E 01	9.95699E 00	0.0	0.0	1.01113E 00	1.01113E 00	4.00070E-02	9.71122E-01
115	1.10583E 01	9.95700E 00	0.0	0.0	1.10132E 00	1.10132E 00	4.35804E-02	1.05774E 00
116	1.11372E 01	9.95313E 00	0.0	0.0	1.18410E 00	1.18410E 00	4.68607E-02	1.13724E 00
117	1.12475E 01	9.95858E 00	0.0	0.0	1.28897E 00	1.28897E 00	5.10165E-02	1.23795E 00
118	1.13814E 01	9.95700E 00	0.0	0.0	1.42444E 00	1.42444E 00	5.63854E-02	1.36806E 00
119	1.15729E 01	9.95700E 00	0.0	0.0	1.61593E 00	1.61593E 00	6.39759E-02	1.55196E 00
120	1.18715E 01	9.95686E 00	0.0	0.0	1.91464E 00	1.91464E 00	7.58148E-02	1.83882E 00
121	1.22378E 01	9.95700E 00	0.0	0.0	2.28078E 00	2.28078E 00	9.03133E-02	2.19047E 00
122	1.26547E 01	9.95700E 00	0.0	0.0	2.69767E 00	2.69767E 00	1.06818E-01	2.59085E 00
123	1.34365E 01	9.95699E 00	0.0	0.0	3.47953E 00	3.47953E 00	1.37772E-01	3.34176E 00

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1	4.01410E-02	2.03125E-02	1.08144E-01	3.41954E-02	5.97847E-01
2	4.54460E-02	3.17359E-02	1.09431E-01	1.61733E-02	6.03564E-01
3	4.34386E-02	2.98638E-02	1.08819E-01	3.53095E-03	6.42637E-01
4	3.59991E-02	2.40607E-02	1.07949E-01	1.48227E-04	6.77548E-01
5	2.46181E-02	1.30036E-02	1.06193E-01	1.99709E-05	7.37302E-01
6	1.80171E-02	1.23719E-02	1.08776E-01	0.0	7.55535E-01
7	1.82713E-02	1.64561E-02	1.36207E-01	0.0	6.79703E-01
8	1.70496E-02	2.49004E-02	1.12321E-01	0.0	7.42628E-01
9	2.34530E-03	2.33487E-02	1.30866E-01	0.0	7.33898E-01
10	7.93948E-05	1.83684E-02	1.19747E-01	0.0	6.85702E-01
11	0.0	4.09071E-03	1.85148E-01	0.0	6.85996E-01
12	0.0	6.61623E-04	2.65942E-01	0.0	7.44139E-01
13	0.0	2.57075E-05	3.52376E-01	0.0	4.93145E-01
14	0.0	0.0	3.26708E-01	0.0	4.80639E-01
15	0.0	0.0	3.36756E-01	0.0	4.86109E-01
16	0.0	0.0	2.88983E-01	0.0	5.39616E-01
17	0.0	0.0	1.64621E-01	0.0	6.76913E-01
18	0.0	0.0	1.05377E-01	0.0	6.99584E-01
19	0.0	0.0	8.37911E-02	0.0	7.19229E-01
20	0.0	0.0	7.33056E-02	0.0	6.24889E-01
21	0.0	0.0	5.42563E-02	0.0	5.45339E-01
22	0.0	0.0	7.62366E-02	0.0	4.67314E-01
23	0.0	0.0	2.19524E-02	0.0	4.53959E-01
24	0.0	0.0	2.98977E-02	0.0	4.15476E-01
25	0.0	0.0	1.07294E-02	0.0	4.48401E-01
26	0.0	0.0	3.59543E-03	0.0	4.75203E-01
27	0.0	0.0	1.41656E-03	0.0	3.48666E-01
28	0.0	0.0	1.87699E-04	0.0	4.68383E-01
29	0.0	0.0	8.89823E-05	0.0	5.15746E-01
30	0.0	0.0	7.84776E-05	0.0	4.63995E-01
31	0.0	0.0	6.89833E-05	0.0	4.10702E-01
32	0.0	0.0	5.99365E-05	0.0	4.39026E-01
33	0.0	0.0	5.26101E-05	0.0	4.45498E-01
34	0.0	0.0	4.55501E-05	0.0	3.68298E-01
35	0.0	0.0	3.92990E-05	0.0	2.63468E-01
36	0.0	0.0	3.30430E-05	0.0	1.93918E-01
37	0.0	0.0	2.80060E-05	0.0	2.84756E-01
38	0.0	0.0	2.33262E-05	0.0	3.00012E-01
39	0.0	0.0	1.90617E-05	0.0	2.97677E-01
40	0.0	0.0	1.51951E-05	0.0	2.91413E-01
41	0.0	0.0	1.17048E-05	0.0	2.83887E-01
42	0.0	0.0	8.53744E-06	0.0	2.76548E-01
43	0.0	0.0	5.67147E-06	0.0	2.69403E-01
44	0.0	0.0	3.07914E-06	0.0	2.62481E-01
45	0.0	0.0	7.64782E-07	0.0	2.55810E-01
46	0.0	0.0	0.0	0.0	2.49516E-01
47	0.0	0.0	0.0	0.0	2.43494E-01
48	0.0	0.0	0.0	0.0	2.37615E-01
49	0.0	0.0	0.0	0.0	2.31875E-01
50	0.0	0.0	0.0	0.0	5.54425E-01
51	0.0	0.0	0.0	0.0	5.16053E-01
52	0.0	0.0	0.0	0.0	4.80464E-01
53	0.0	0.0	0.0	0.0	4.48558E-01
54	0.0	0.0	0.0	0.0	4.23648E-01
55	0.0	0.0	0.0	0.0	4.04467E-01
56	0.0	0.0	0.0	0.0	3.86250E-01
57	0.0	0.0	0.0	0.0	3.72997E-01
58	0.0	0.0	0.0	0.0	3.62620E-01
59	0.0	0.0	0.0	0.0	3.52797E-01
60	0.0	0.0	0.0	0.0	3.46056E-01
61	0.0	0.0	0.0	0.0	3.40203E-01
62	0.0	0.0	0.0	0.0	3.34448E-01
63	0.0	0.0	0.0	0.0	3.28789E-01
64	0.0	0.0	0.0	0.0	3.23229E-01
65	0.0	0.0	0.0	0.0	3.17761E-01

66	0.0	0.0	0.0	0.0	3.12386E-01
67	0.0	0.0	0.0	0.0	3.07102E-01
68	0.0	0.0	0.0	0.0	3.01933E-01
69	0.0	0.0	0.0	0.0	2.98103E-01
70	0.0	0.0	0.0	0.0	2.95018E-01
71	0.0	0.0	0.0	0.0	2.91966E-01
72	0.0	0.0	0.0	0.0	2.88945E-01
73	0.0	0.0	0.0	0.0	2.85955E-01
74	0.0	0.0	0.0	0.0	2.82996E-01
75	0.0	0.0	0.0	0.0	2.80068E-01
76	0.0	0.0	0.0	0.0	2.77169E-01
77	0.0	0.0	0.0	0.0	2.74302E-01
78	0.0	0.0	0.0	0.0	2.72502E-01
79	0.0	0.0	0.0	0.0	2.71983E-01
80	0.0	0.0	0.0	0.0	2.71468E-01
81	0.0	0.0	0.0	0.0	2.70954E-01
82	0.0	0.0	0.0	0.0	2.70441E-01
83	0.0	0.0	0.0	0.0	2.69929E-01
84	0.0	0.0	0.0	0.0	2.69418E-01
85	0.0	0.0	0.0	0.0	2.68906E-01
86	0.0	0.0	0.0	0.0	2.68398E-01
87	0.0	0.0	0.0	0.0	2.67878E-01
88	0.0	0.0	0.0	0.0	2.67329E-01
89	0.0	0.0	0.0	0.0	2.66780E-01
90	0.0	0.0	0.0	0.0	2.66232E-01
91	0.0	0.0	0.0	0.0	2.65685E-01
92	0.0	0.0	0.0	0.0	2.65139E-01
93	0.0	0.0	0.0	0.0	2.61974E-01
94	0.0	0.0	0.0	0.0	8.88715E-02
95	0.0	0.0	0.0	0.0	9.69651E-02
96	0.0	0.0	0.0	0.0	8.44797E-02
97	0.0	0.0	0.0	0.0	1.16008E-01
98	0.0	0.0	0.0	0.0	1.44186E-01
99	0.0	0.0	0.0	0.0	1.23959E-01
100	0.0	0.0	0.0	0.0	1.39036E-01
101	0.0	0.0	0.0	0.0	1.26900E-01
102	0.0	0.0	0.0	0.0	1.84809E-01
103	0.0	0.0	0.0	0.0	1.73507E-01
104	0.0	0.0	0.0	0.0	2.07476E-01
105	0.0	0.0	0.0	0.0	2.58388E-01
106	0.0	0.0	0.0	0.0	1.57696E-01
107	0.0	0.0	0.0	0.0	1.85740E-01
108	0.0	0.0	0.0	0.0	2.26191E-01
109	0.0	0.0	0.0	0.0	1.06366E-01
110	0.0	0.0	0.0	0.0	1.18579E-01
111	0.0	0.0	0.0	0.0	1.34017E-01
112	0.0	0.0	0.0	0.0	1.62731E-01
113	0.0	0.0	0.0	0.0	2.80821E-01
114	0.0	0.0	0.0	0.0	4.96786E-01
115	0.0	0.0	0.0	0.0	3.67008E-01
116	0.0	0.0	0.0	0.0	4.67644E-01
117	0.0	0.0	0.0	0.0	5.82234E-01
118	0.0	0.0	0.0	0.0	7.00141E-01
119	0.0	0.0	0.0	0.0	8.00033E-01
120	0.0	0.0	0.0	0.0	8.38257E-01
121	0.0	0.0	0.0	0.0	3.93553E-01
122	0.0	0.0	0.0	0.0	3.40495E-01
123	0.0	0.0	0.0	0.0	2.46942E-01

	GRP. 94	GRP. 95	GRP. 96	GRP. 97	GRP. 98	GRP. 99	GRP. 100	GRP. 101
1	94097094	94098095	94099096	94101097	94102098	94103099	94104100	94105101
2	1.55453E-07	9.36795E-08	3.72734E-08	1.08375E-10	6.32842E-10	1.19307E-09	1.85863E-09	8.08826E-10
3	4.76817E-05	8.94493E-05	2.74175E-05	5.75520E-08	4.41678E-07	1.08744E-06	1.26126E-06	1.08419E-06
4	9.95197E-03	1.96828E-02	1.65831E-02	2.21202E-05	9.82269E-05	2.99665E-04	4.48595E-04	2.98251E-04
5	2.27146E 00	2.44463E 00	2.22383E 00	9.23166E-03	1.89141E-02	3.47812E-02	6.29531E-02	5.02243E-02
6		3.27462E 00	2.84497E 00	2.85877E 00	3.47547E 00	3.22492E 00	3.57303E 00	3.40565E 00
7			2.26775E 00	3.81549E 00	4.38124E 00	3.64316E 00	4.03109E 00	3.57304E 00
8				2.97476E 00	2.99385E 00	2.02208E 00	2.19281E 00	1.97122E 00
9				1.70108E 00	1.47855E 00	7.83957E-01	6.09744E-01	5.59623E-01
10					4.18301E-01	1.90570E-01	1.14125E-01	6.51684E-02
11						2.25827E-02	1.28020E-02	5.52770E-03
12							6.32213E-04	2.80885E-04
13								5.81210E-06

	GRP. 102	GRP. 103	GRP. 104	GRP. 105	GRP. 106	GRP. 107	GRP. 108	GRP. 109
1	94106102	95108103	96111104	98114105	99117106	100119107	101122108	102123109
2	4.18367E-09	7.51434E-10	3.71279E-10	4.35710E-10	5.30580E-10	1.20613E-09	4.01950E-10	1.48716E-09
3	1.34706E-06	9.92734E-08	4.59930E-09	9.97234E-09	3.83969E-09	1.26383E-08	2.70339E-09	1.32293E-08
4	5.89354E-04	5.47951E-06	4.38235E-08	1.45039E-07	2.23224E-08	9.33571E-08	2.59036E-08	7.28248E-08
5	6.97163E-02	6.49238E-04	1.28892E-06	1.48695E-06	2.19848E-07	5.32461E-07	3.12257E-07	5.46889E-07
6	4.53469E 00	9.95481E-02	7.43498E-05	1.15303E-05	3.07424E-06	2.48798E-06	2.37406E-06	4.98834E-06
7	4.69883E 00	4.46982E 00	2.00489E-03	7.11421E-05	2.87413E-05	1.82511E-05	1.32092E-05	2.99242E-05
8	2.38205E 00	3.85813E 00	1.00543E-01	1.06158E-03	1.97349E-04	1.78768E-04	5.83480E-05	1.35166E-04
9	6.69234E-01	1.54419E 00	4.99897E 00	2.62155E-02	1.06151E-03	1.21820E-03	2.15839E-04	4.95174E-04
10	7.50174E-02	3.70633E-01	4.21675E 00	3.54510E-01	4.68717E-03	6.30154E-03	1.15763E-03	1.54530E-03
11	2.99846E-03	4.06335E-02	1.38154E 00	5.75748E 00	4.20480E-02	2.62879E-02	7.79561E-03	6.61135E-03
12	1.01814E-04	1.47478E-03	2.37777E-01	4.10356E 00	5.71751E-01	9.24714E-02	3.82747E-02	3.41089E-02
13	2.11724E-06	1.74430E-05	2.31353E-02	1.12242E 00	4.31513E 00	5.95476E-01	1.48507E-01	1.33372E-01
14	1.66325E-08	2.14573E-07	9.15288E-04	1.28879E-01	2.61984E 00	4.51140E 00	4.82000E-01	4.26486E-01
15		1.67593E-09	1.04311E-05	7.23980E-03	6.04705E-01	3.44748E 00	1.36558E 00	1.17762E 00
16			3.64506E-08	2.35719E-04	7.00068E-02	1.16815E 00	5.01834E 00	2.94049E 00
17			1.64161E-10	2.84791E-06	2.95801E-03	1.35216E-01	3.47646E 00	1.78510E 00
18				8.67384E-09	6.18602E-05	7.64762E-03	1.48017E 00	7.05709E-01
19					7.90628E-07	1.47271E-04	2.76163E-01	2.15687E-01
20					3.52464E-09	1.44449E-06	1.36851E-02	2.41928E-02
21						9.09369E-09	3.37954E-04	6.08239E-04
22							2.68218E-06	7.89421E-06
23							1.13114E-08	3.17669E-08

	GRP. 110	GRP. 111	GRP. 112	GRP. 113	GRP. 114	GRP. 115	GRP. 116	GRP. 117
1	102123110	102123111	103123112	103123113	104123114	104123115	105123116	105123117
2	2.17843E-08	3.12307E-07	4.36781E-06	5.93409E-05	7.78838E-04	2.53286E-03	8.84053E-03	3.03993E-02
3	1.65894E-07	2.01982E-06	2.37671E-05	2.68657E-04	2.89402E-03	8.04861E-03	2.51184E-02	7.67809E-02
4	8.07117E-07	8.63126E-06	8.85675E-05	8.65650E-04	7.98099E-03	1.96344E-02	5.61519E-02	1.56653E-01
5	5.21621E-06	4.76610E-05	4.14387E-04	3.39865E-03	2.59975E-02	5.52569E-02	1.42500E-01	3.57048E-01
6	4.00912E-05	3.06277E-04	2.20703E-03	1.48550E-02	9.22228E-02	1.66743E-01	3.84008E-01	8.56725E-01
7	2.08035E-04	1.36649E-03	8.41137E-03	4.80207E-02	2.51037E-01	3.98083E-01	8.37588E-01	1.70594E 00
8	8.27568E-04	4.76516E-03	2.55873E-02	1.26821E-01	5.73172E-01	8.15002E-01	1.59296E 00	2.83063E 00
9	2.70663E-03	1.38642E-02	6.60015E-02	2.89203E-01	1.15376E 00	1.49720E 00	2.63164E 00	1.99909E 00
10	7.62375E-03	3.51576E-02	1.50373E-01	5.91351E-01	2.11913E 00	2.48585E 00	1.92505E 00	1.31506E 00
11	2.84963E-02	1.14584E-01	4.27000E-01	1.46506E 00	3.94884E 00	1.58402E 00	1.10887E 00	6.91317E-01
12	1.25703E-01	4.32379E-01	1.38248E 00	3.58760E 00	2.63317E 00	7.94460E-01	4.99563E-01	2.74919E-01
13	4.31384E-01	1.30742E 00	3.30595E 00	2.56790E 00	1.42551E 00	3.75247E-01	2.11767E-01	1.03029E-01
14	1.23932E 00	3.09146E 00	2.48588E 00	1.52704E 00	7.27331E-01	1.66813E-01	8.45799E-02	3.64819E-02
15	2.95625E 00	2.39836E 00	1.58731E 00	8.59136E-01	3.50048E-01	7.00023E-02	3.19546E-02	1.22612E-02
16	2.31039E 00	1.61926E 00	9.62821E-01	4.57369E-01	1.59335E-01	2.78381E-02	1.14695E-02	3.92897E-03
17	1.23616E 00	7.37064E-01	3.61190E-01	1.36645E-01	3.64701E-02	5.08277E-03	1.76668E-03	5.01920E-04
18	3.93601E-01	1.82591E-01	6.71144E-02	1.82939E-02	3.35682E-03	3.42050E-04	9.41220E-05	2.07099E-05
19	9.58339E-02	3.44795E-02	9.54771E-03	1.89692E-03	2.43813E-04	1.85045E-05	4.09255E-06	7.09704E-07
20	7.69276E-03	1.91986E-03	3.56061E-04	4.54731E-05	3.57090E-06	1.80760E-07	2.96383E-08	3.71229E-09

21	1.25239E-04	1.95651E-05	2.18388E-06	1.60107E-07	6.79919E-09	2.08135E-10
22	1.08221E-06	1.09385E-07	7.63657E-09	3.35989E-10		
23	2.84155E-09	1.82141E-10				

	GRP. 118	GRP. 119	GRP. 120	GRP. 121	GRP. 122	GRP. 123
1	105123118	106123119	106123120	107123121	108123122	108123123
2	1.02763E-01	3.40646E-01	1.10440E 00	1.27493E 00	2.23792E 00	4.85371E 00
3	2.29152E-01	6.65164E-01	1.86948E 00	1.93062E 00	3.46393E 00	1.68551E 00
4	4.24738E-01	1.11421E 00	2.81305E 00	2.80983E 00	1.70552E 00	8.48267E-01
5	8.65779E-01	2.02223E 00	4.00918E 00	1.33907E 00	7.86150E-01	3.49784E-01
6	1.84493E 00	3.46103E 00	2.15545E 00	5.65332E-01	2.98141E-01	1.14996E-01
7	3.09504E 00	2.13499E 00	1.06790E 00	2.49385E-01	1.18859E-01	4.01449E-02
8	2.07361E 00	1.20509E 00	5.35319E-01	1.11802E-01	4.84088E-02	1.44352E-02
9	1.27768E 00	6.77871E-01	2.68119E-01	5.02927E-02	1.98743E-02	5.26823E-03
10	7.80775E-01	3.78456E-01	1.33678E-01	2.26110E-02	8.18804E-03	1.94069E-03
11	3.68038E-01	1.56462E-01	4.70120E-02	6.87008E-03	2.20072E-03	4.46064E-04
12	1.26534E-01	4.52968E-02	1.10461E-02	1.33928E-03	3.67185E-04	6.10840E-05
13	4.11684E-02	1.25003E-02	2.50164E-03	2.54519E-04	6.03367E-05	8.35132E-06
14	1.27166E-02	3.29832E-03	5.47078E-04	4.71614E-05	9.74953E-06	1.13538E-06
15	3.74655E-03	8.35524E-04	1.15870E-04	8.53455E-06	1.54965E-06	1.53262E-07
16	1.05730E-03	2.03961E-04	2.38341E-05	1.51079E-06	2.42450E-07	2.05272E-08
17	1.09651E-04	1.66898E-05	1.47572E-06	7.33127E-08	9.62946E-09	6.34021E-10
18	3.40786E-06	3.76362E-07	2.28482E-08	8.17690E-10		
19	8.97676E-08	7.36642E-09	3.16001E-10			
20	3.28042E-10					

```
SAMPLE PROBLEM 2
ENDF/B VERSION IV
HYDROGEN AND
NITROGEN
DIFFERENT WEIGHTINGS
    TAPE ID                                   1          NUMBER OF NUCLIDES                   2
    NUMBER OF NEUTRON GROUPS                123          NUMBER OF GAMMA GROUPS               0
    FIRST THERMAL GROUP                      94
                               TABLE OF CONTENTS
  HYDROGEN V4(1269)   FISS-1/E-MAX WT                                          ID       1269
  NITROGEN-14 V4(1275)   AIR WEIGHTING                                         ID       1275

ELAPSED TIME   2.99 MIN.

IHC900I EXECUTION TERMINATING DUE TO ERROR COUNT FOR ERROR NUMBER  217

IHC217I FIOCS - END OF DATA SET ON UNIT    5

TRACEBACK  ROUTINE  CALLED FROM ISN   REG. 14    REG. 15    REG. 0     REG. 1

           IBCOM                      0015740C   001505C8   00000000   00155CD4

           FRREAD          0020       62156122   00156FD0   00000000   00155CD4

           FIOAS           0005       52150276   00155AF0   FFFFFFF8   0015021C

           FIOO            0012       52161252   001501A8   FFFFFFF8   00160F54

           UPDATE          0288       421460CE   00160A60   000045C0   00000000

           XLACS           0005       42146240   001440E8   00000000   001461FC

           MAIN                       0001576C   01146178   00000030   80140A60

ENTRY POINT=  01146178
```

```
RRRRRRRRRRRR     AAAAAAAAAA     DDDDDDDDDDDD   EEEEEEEEEEEE
RRRRRRRRRRRRR   AAAAAAAAAAAA    DDDDDDDDDDDDD  EEEEEEEEEEEE
RR         RR   AA        AA    DD        DD   EE
RR         RR   AA        AA    DD        DD   EE
RR         RR   AA        AA    DD        DD   EE
RRRRRRRRRRRRR   AAAAAAAAAAAAA   DD        DD   EEEEEEEE
RRRRRRRRRRRR    AAAAAAAAAAAAA   DD        DD   EEEEEEEE
RR      RR      AA        AA    DD        DD   EE
RR       RR     AA        AA    DD        DD   EE
RR        RR    AA        AA    DD        DD   EE
RR         RR   AA        AA    DDDDDDDDDDDDD  EEEEEEEEEEEE
RR         RR   AA        AA    DDDDDDDDDDDD   EEEEEEEEEEEE


   0000000     555555555555          //      11     777777777777        //  777777777777  555555555555
  000000000    555555555555         //      111     77777777777        //   77777777777   555555555555
 00       00   55                  //      1111     77       77       //    77       77   55
00         00  55                 //         11             77       //             77    55
00         00  55                //          11            77       //             77     55
00         00  55555555555      //           11           77       //             77      55555555555
00         00  555555555555    //            11           77      //              77      555555555555
00         00            55   //             11          77      //              77                 55
00         00            55  //              11          77     //               77                 55
 00       00   55        55 //               11         77     //               77        55        55
  000000000    555555555555//            11111111       77    //                77        555555555555
   0000000      5555555555//             11111111       77   //                 77         5555555555


          44                     22222222222   777777777777             33333333333   555555555555
         444                    222222222222   77777777777             333333333333   555555555555
        4444                    22        22   77       77             33        33   55
       44 44                              22           77                        33   55
      44  44                              22          77                         33   55
     44   44                             22          77                         333   55555555555
    44    44      .....                 22          77      .....               333   555555555555
   444444444444   .....                22          77       .....                33             55
  4444444444444   .....              22           77        .....                33             55
          44      .....             22           77         .....      33        33   55        55
          44                    2222222222222    77                    333333333333   555555555555
          44                    2222222222222    77                     3333333333     5555555555
```

1$ ARRAY   4 ENTRIES READ

0T

```
CHECKING TOLERANCE= 1.000000E-03 PER CENT

AMPX NUCLIDE      1269 HYDROGEN V4(1269)    FISS-1/E-MAX WT
     HAS THE FOLLOWING DATA
    0 RESOLVED RESONANCES                       0 UNRESOLVED RESONANCE POINTS
    6 TEMP IND 1-D NEUT PROCESSES               2 2-D NEUT PROCESSES
    0 TEMP DEP 1-D NEUT PROCESSES               0 1-D GAMMA PROCESSES
    0 2-D GAMMA PROCESSES                       0 2-D NEUT-TO-GAMMA PROCESSES
    0 FISSION YIELDS                         1269 ENDF MAT OF FAST NEUT DATA
                                             1002 ENDF MAT OF THERMAL NEUT DATA
                                                0 ENDF MAT OF YIELD DATA
   12 RECORDS FOR NUCLIDE                       0 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D NEUTRON PROCESSES
       1.        2.        27.        101.        102.       1099.

DEVIATION= 2.073322E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 3.944996E-02 SUMMED VALUE= 3.953175E-02 GROUP  94
DEVIATION= 2.082874E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 4.122391E-02 SUMMED VALUE= 4.130978E-02 GROUP  95
DEVIATION= 2.092029E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 4.303256E-02 SUMMED VALUE= 4.312258E-02 GROUP  96
DEVIATION= 2.101569E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 4.512921E-02 SUMMED VALUE= 4.522405E-02 GROUP  97
DEVIATION= 2.115721E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 4.800552E-02 SUMMED VALUE= 4.810709E-02 GROUP  98
DEVIATION= 2.131501E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 5.115783E-02 SUMMED VALUE= 5.126688E-02 GROUP  99
DEVIATION= 2.145087E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 5.446172E-02 SUMMED VALUE= 5.457854E-02 GROUP 100
DEVIATION= 2.158798E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 5.802438E-02 SUMMED VALUE= 5.814964E-02 GROUP 101
DEVIATION= 2.176182E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 6.253034E-02 SUMMED VALUE= 6.266642E-02 GROUP 102
DEVIATION= 2.196249E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 6.814677E-02 SUMMED VALUE= 6.829643E-02 GROUP 103
DEVIATION= 2.216944E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 7.471603E-02 SUMMED VALUE= 7.488167E-02 GROUP 104
DEVIATION= 2.241759E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 8.367360E-02 SUMMED VALUE= 8.386117E-02 GROUP 105
DEVIATION= 2.263427E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 9.256333E-02 SUMMED VALUE= 9.277284E-02 GROUP 106
DEVIATION= 2.283033E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 1.006972E-01 SUMMED VALUE= 1.009271E-01 GROUP 107
DEVIATION= 2.307074E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 1.114548E-01 SUMMED VALUE= 1.117119E-01 GROUP 108
DEVIATION= 2.325126E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 1.209460E-01 SUMMED VALUE= 1.212272E-01 GROUP 109
DEVIATION= 2.337328E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 1.278884E-01 SUMMED VALUE= 1.281874E-01 GROUP 110
DEVIATION= 2.351589E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 1.361970E-01 SUMMED VALUE= 1.365072E-01 GROUP 111
DEVIATION= 2.368527E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 1.465374E-01 SUMMED VALUE= 1.468845E-01 GROUP 112
DEVIATION= 2.388200E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 1.597311E-01 SUMMED VALUE= 1.601126E-01 GROUP 113
DEVIATION= 2.411133E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 1.768017E-01 SUMMED VALUE= 1.772280E-01 GROUP 114
DEVIATION= 2.430986E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 1.925700E-01 SUMMED VALUE= 1.930381E-01 GROUP 115
DEVIATION= 2.447592E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 2.070438E-01 SUMMED VALUE= 2.075505E-01 GROUP 116
DEVIATION= 2.466667E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 2.253780E-01 SUMMED VALUE= 2.259340E-01 GROUP 117
```

DEVIATION= 2.487930E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 2.490624E-01 SUMMED VALUE= 2.496820E-01 GROUP 118

DEVIATION= 2.517589E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 2.825413E-01 SUMMED VALUE= 2.832527E-01 GROUP 119

DEVIATION= 2.550399E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 3.347629E-01 SUMMED VALUE= 3.356167E-01 GROUP 120

DEVIATION= 2.563837E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 3.987767E-01 SUMMED VALUE= 3.997991E-01 GROUP 121

DEVIATION= 2.574940E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 4.716632E-01 SUMMED VALUE= 4.728777E-01 GROUP 122

DEVIATION= 2.590599E-03 EXCEEDS TOLERANCE FOR ABSORPTION CHECK AVERAGE VALUE= 6.083560E-01 SUMMED VALUE= 6.099320E-01 GROUP 123

2-D NEUT PROCESSES

	MT	LENGTH	ORDER	TEMPS
1	2	7284	3	0
2	1007	762	3	1

MT= 2 GROUP 79 MATRIX SUMS TO 2.044925E 01 AVERAGED VALUE= 2.044902E 01 FRACT DEV= 1.119280E-05

NUCLIDE 1269 HAS BEEN CHECKED

AMPX NUCLIDE 1275 NITROGEN-14 V4(1275) AIR WEIGHTING
HAS THE FOLLOWING DATA

0 RESOLVED RESONANCES	0 UNRESOLVED RESONANCE POINTS
13 TEMP IND 1-D NEUT PROCESSES	26 2-D NEUT PROCESSES
0 TEMP DEP 1-D NEUT PROCESSES	0 1-D GAMMA PROCESSES
0 2-D GAMMA PROCESSES	0 2-D NEUT-TO-GAMMA PROCESSES
0 FISSION YIELDS	1275 ENDF MAT OF FAST NEUT DATA
	-2 ENDF MAT OF THERMAL NEUT DATA
	0 ENDF MAT OF YIELD DATA
33 RECORDS FOR NUCLIDE	0 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D NEUTRON PROCESSES
1. 2. 4. 16. 27. 101. 102. 103. 104. 105.
107. 108. 109.

2-D NEUT PROCESSES

	MT	LENGTH	ORDER	TEMPS
1	2	425	3	0
2	16	239	0	0
3	51	120	0	0
4	52	116	0	0
5	53	112	0	0
6	54	110	0	0
7	55	106	0	0
8	56	106	0	0
9	57	106	0	0
10	58	103	0	0
11	59	98	0	0
12	60	95	0	0
13	61	95	0	0
14	62	92	0	0
15	63	88	0	0
16	64	86	0	0
17	65	83	0	0
18	66	81	0	0
19	67	78	0	0
20	68	72	0	0
21	69	67	0	0
22	70	61	0	0
23	71	56	0	0
24	72	44	0	0
25	73	28	0	0
26	1007	506	0	1

MT= 16 GROUP 1 MATRIX SUMS TO 6.857149E-03 AVERAGED VALUE= 6.856512E-03 FRACT DEV= 9.290797E-05
MT= 16 GROUP 2 MATRIX SUMS TO 2.945822E-03 AVERAGED VALUE= 2.945674E-03 FRACT DEV= 5.050754E-05

```
MT=  16 GROUP   3 MATRIX SUMS TO  2.777751E-04 AVERAGED VALUE=  2.777684E-04 FRACT DEV=  2.430833E-05
MT=   4 GROUP   1 MATRIX SUMS TO  4.289839E-01 AVERAGED VALUE=  4.290178E-01 FRACT DEV= -7.905276E-05
MT=   4 GROUP   2 MATRIX SUMS TO  4.140789E-01 AVERAGED VALUE=  4.140708E-01 FRACT DEV=  1.957691E-05
MT=   4 GROUP   3 MATRIX SUMS TO  3.786901E-01 AVERAGED VALUE=  3.786367E-01 FRACT DEV=  1.410475E-04
MT=   4 GROUP   4 MATRIX SUMS TO  3.099429E-01 AVERAGED VALUE=  3.099330E-01 FRACT DEV=  3.192422E-05
MT=   4 GROUP   5 MATRIX SUMS TO  2.117903E-01 AVERAGED VALUE=  2.117402E-01 FRACT DEV=  2.367406E-04
MT=   4 GROUP   6 MATRIX SUMS TO  2.019232E-01 AVERAGED VALUE=  2.019107E-01 FRACT DEV=  6.169741E-05
MT=   4 GROUP   8 MATRIX SUMS TO  1.672693E-01 AVERAGED VALUE=  1.672655E-01 FRACT DEV=  2.280623E-05
MT=   4 GROUP   9 MATRIX SUMS TO  1.233758E-01 AVERAGED VALUE=  1.233680E-01 FRACT DEV=  6.329201E-05
MT=   4 GROUP  10 MATRIX SUMS TO  6.878968E-02 AVERAGED VALUE=  6.879455E-02 FRACT DEV= -7.104604E-05
MT=   4 GROUP  11 MATRIX SUMS TO  4.665658E-02 AVERAGED VALUE=  4.665844E-02 FRACT DEV= -4.000070E-05
MT=   4 GROUP  12 MATRIX SUMS TO  3.722920E-02 AVERAGED VALUE=  3.723018E-02 FRACT DEV= -2.641611E-05
MT=   4 GROUP  13 MATRIX SUMS TO  1.604694E-02 AVERAGED VALUE=  1.604810E-02 FRACT DEV= -7.196117E-05
MT=   4 GROUP  15 MATRIX SUMS TO  5.698446E-03 AVERAGED VALUE=  5.698506E-03 FRACT DEV= -1.045970E-05
MT=   4 GROUP  16 MATRIX SUMS TO  3.242124E-03 AVERAGED VALUE=  3.242207E-03 FRACT DEV= -2.542158E-05
MT=   4 GROUP  17 MATRIX SUMS TO  1.499289E-03 AVERAGED VALUE=  1.499228E-03 FRACT DEV=  4.099929E-05
MT=   4 GROUP  18 MATRIX SUMS TO  4.788784E-04 AVERAGED VALUE=  4.788872E-04 FRACT DEV= -1.847524E-05

NUCLIDE        1275 HAS BEEN CHECKED
```

10.3. Problem 3

This case will weight sodium cross sections over two weighting functions: a $1/E\sigma_t$ function and by $1/E$. A Maxwellian spectrum will be used at thermal in both cases. A 52 group structure is used with P_3 expansions on cross sections.

Sodium is a resonance nuclide. To perform $1/E\sigma_T$ weighting in XLACS will require the running of NPTXS to generate point values of the sodium cross section.

After XLACS is run, the two sets are run through NITAWL to make an AMPX working library which can be used by the XSDRNPM module. By mixing a "fake" mixture of sodiums and displaying cross sections, the differences in the two sets are shown.

This case required 540K bytes and 1.33 minutes on the IBM 360/91.

The input data are shown on the next page with the abbreviated output following that.

```
   THIS IS THE TOP OF AMPX

 MODULE NPTXS    HAS BEEN CALLED

1$$ 1 T
2$$ 1156 E T

 MODULE NPTXS    IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE XLACS    HAS BEEN CALLED

RUN
TWO
SODIUM
CASES
FOR PROBLEM 3
1$$ 100 2 52 1 0   3$$ F1 T
T    USE AN EQUAL LETHARGY STRUCTURE
NA-23    INF DIL
71** A5 1156 31
70$$ 11230 1156 0 3 E T
NA-23    1/E-SIGMA TOTAL WEIGHTING
1$$ A5 5   71** A5 1156 31
70$$ 11231 1156 0 3 E T
11$$ E T

 MODULE XLACS    IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE NITAWL   HAS BEEN CALLED

0$$ 23 E 1$$ 0 2 E T
2$$ 11230 11231 T

 MODULE NITAWL   IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE XSDRNPM  HAS BEEN CALLED

RUN XSDRNPM AS PART OF SAMPLE PROBLEM 3
1$$ A6 3 4 A12 0 E 2$$ 3 E T
13$$ 1 2 F3 14$$ 11230 11231 Q2   15** 3R1 -1 T

 MODULE XSDRNPM  IS FINISHED. USER CODE 0016   SYSTEM CODE 000

 MODULE RADE     HAS BEEN CALLED

1$$ 23 E T

 MODULE RADE     IS FINISHED. USER CODE 0000   SYSTEM CODE 000
```

NPTXS OUTPUT

```
 1$  ARRAY        1 ENTRIES READ

 0T

 2$  ARRAY        5 ENTRIES READ

 0T
                                        .
                                        .
                                        .

THE (TAPE) DESCRIPTION OF MATERIAL    1156 IS -
    11-NA-23  WARD-ORNL  EVAL-1971  PAIK AND PITTERLE%WARD PEREY%ORNL
                             DIST-MAY74
    EXTENDED TO 20 MEV FOR ENDF/B VERSION-IV
    *         *          *          *         *          *          *
    NEUTRON CROSS SECTIONS EVALUATED BY PAIK AND PITTERLE %WARD<
    PHOTON PRODUCTION CROSS SECTIONS EVALUATED BY PEREY %ORNL<
    *         *          *          *         *          *          *
   SODIUM-23 ENDF/B V3 EVALUATION BY PAIK AND PITTERLE, WARD%1971<
   MF#1                     GENERAL INFORMATION
        ATOMIC MASS GIVEN AS 22.991 FOR NEUTRON MASS OF 1.008986 AMU
     MT#453 RADIOACTIVE DECAY DATA-REF. 1
   MF#2                     RESONANCE PARAMETERS
                                        .
                                        .
                                        .

  ELAPSED TIME    0.05 MIN.


  ELAPSED TIME    0.05 MIN.
START RESP


  ELAPSED TIME    0.05 MIN.
START RESOLVED RESONANCE CALCULATION
SUBROUTINE RESR ***** MP=    14311
SUBROUTINE RESR ***** NUMB=    942


  ELAPSED TIME    0.07 MIN.


  ELAPSED TIME    0.07 MIN.
START UNRESOLVED RESONANCE CALCULATION
```

```
ELAPSED TIME   0.07 MIN.

ELAPSED TIME   0.07 MIN.
      ****LAST=29396
  9.0000E-01     1.0000E 01     1.0000E 08     0.0

ELAPSED TIME   0.07 MIN.
START COMBR

BEFORE CROP    N2=  2753
EPS=  0.001
AFTER CROP     N2=  1955
               •
               •
    2          1955  Number of Points
  535             5
 1955             2          Total Cross Section
 1156             3          1          31
1.10230E 04    2.27923E 01     0.0             1.00000E 08

*****RESONANCE INTEGRAL= 1.36974E 02
               •
               •
    2          2045  Number of Points
  476             5
 2045             2          Elastic Scattering
 1156             3          2          31
1.10230E 04    2.27923E 01     0.0             1.00000E 08

*****RESONANCE INTEGRAL= 1.34322E 02
               •
               •
    2           814  Number of Points
  813             5
  814             2          N, gamma Capture
 1156             3        102          31
1.10230E 04    2.27923E 01     0.0             1.00000E 08

*****RESONANCE INTEGRAL= 3.45696E-01
```

```
XLACS

05/16/75

1.48.42
```

1$ ARRAY 5 ENTRIES READ

3$ ARRAY 6 ENTRIES READ

OT

A 52 EQUAL LETHARGY GROUP NEUTRON STRUCTURE HAS BEEN GENERATED AND WILL BE USED UNLESS YOU OVERRIDE IT

OT

AN XSDRN TAPE WILL BE WRITTEN WITH THE AUSPICIOUS TITLE

```
**********************************************************************************
RUN
TWO
SODIUM
CASES
FOR PROBLEM 3
```

XSDRN TAPE IDENTIFICATION	100	TRANSFER INTEGRATION MESH-SRCE	0
NUMBER OF NUCLIDES	2	TRANSFER INTEGRATION MESH-SINK	0
NUMBER OF ENERGY GROUPS	52	ENDF TAPE IDENTIFICATION	0
NUMBER OF THERMAL GROUPS	1	ENDF TAPE MODE (FAST DATA)	0
WEIGHTING OPTION	0	PEAK TEMPERATURE (MAXWELLIAN)	0

OUTPUT LISTING OPTIONS

RESONANCE DATA	1
1-DIMENSIONAL ARRAYS	1
ELASTIC SCATTERING	1
THERMAL SCATTERING	1
INELASTIC SCATTERING	1
N2N TRANSFERS	1

MULTIGROUP STRUCTURE

GROUP	ENERGY RANGE	LETHARGY RANGE	GROUP	ENERGY RANGE	LETHARGY RANGE
1	1.0676E 07 - 1.4918E 07	-0.400 - -0.065	27	1.7784E 03 - 2.4852E 03	8.300 - 8.635
2	7.6397E 06 - 1.0676E 07	-0.065 - 0.269	28	1.2727E 03 - 1.7784E 03	8.635 - 8.969
3	5.4670E 06 - 7.6397E 06	0.269 - 0.604	29	9.1073E 02 - 1.2727E 03	8.969 - 9.304
4	3.9123E 06 - 5.4670E 06	0.604 - 0.938	30	6.5173E 02 - 9.1073E 02	9.304 - 9.638
5	2.7997E 06 - 3.9123E 06	0.938 - 1.273	31	4.6638E 02 - 6.5173E 02	9.638 - 9.973
6	2.0035E 06 - 2.7997E 06	1.273 - 1.608	32	3.3375E 02 - 4.6638E 02	9.973 - 10.308
7	1.4337E 06 - 2.0035E 06	1.608 - 1.942	33	2.3884E 02 - 3.3375E 02	10.308 - 10.642
8	1.0260E 06 - 1.4337E 06	1.942 - 2.277	34	1.7091E 02 - 2.3884E 02	10.642 - 10.977
9	7.3421E 05 - 1.0260E 06	2.277 - 2.612	35	1.2231E 02 - 1.7091E 02	10.977 - 11.312
10	5.2541E 05 - 7.3421E 05	2.612 - 2.946	36	8.7526E 01 - 1.2231E 02	11.312 - 11.646
11	3.7599E 05 - 5.2541E 05	2.946 - 3.281	37	6.2635E 01 - 8.7526E 01	11.646 - 11.981
12	2.6907E 05 - 3.7599E 05	3.281 - 3.615	38	4.4822E 01 - 6.2635E 01	11.981 - 12.315
13	1.9255E 05 - 2.6907E 05	3.615 - 3.950	39	3.2075E 01 - 4.4822E 01	12.315 - 12.650
14	1.3779E 05 - 1.9255E 05	3.950 - 4.285	40	2.2953E 01 - 3.2075E 01	12.650 - 12.985
15	9.8603E 04 - 1.3779E 05	4.285 - 4.619	41	1.6426E 01 - 2.2953E 01	12.985 - 13.319
16	7.0562E 04 - 9.8603E 04	4.619 - 4.954	42	1.1755E 01 - 1.6426E 01	13.319 - 13.654
17	5.0495E 04 - 7.0562E 04	4.954 - 5.288	43	8.4117E 00 - 1.1755E 01	13.654 - 13.988
18	3.6135E 04 - 5.0495E 04	5.288 - 5.623	44	6.0195E 00 - 8.4117E 00	13.988 - 14.323
19	2.5859E 04 - 3.6135E 04	5.623 - 5.958	45	4.3076E 00 - 6.0195E 00	14.323 - 14.658
20	1.8505E 04 - 2.5859E 04	5.958 - 6.292	46	3.0826E 00 - 4.3076E 00	14.658 - 14.992
21	1.3242E 04 - 1.8505E 04	6.292 - 6.627	47	2.2060E 00 - 3.0826E 00	14.992 - 15.327
22	9.4763E 03 - 1.3242E 04	6.627 - 6.962	48	1.5786E 00 - 2.2060E 00	15.327 - 15.662
23	6.7814E 03 - 9.4763E 03	6.962 - 7.296	49	1.1297E 00 - 1.5786E 00	15.662 - 15.996
24	4.8528E 03 - 6.7814E 03	7.296 - 7.631	50	8.0841E-01 - 1.1297E 00	15.996 - 16.331
25	3.4728E 03 - 4.8528E 03	7.631 - 7.965	51	5.7851E-01 - 8.0841E-01	16.331 - 16.665
26	2.4852E 03 - 3.4728E 03	7.965 - 8.300	52	1.0000E-05 - 5.7851E-01	16.665 - 27.631

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          COMMENCE PROCESSING DATA FOR
     NA-23   1/E-SIGMA TOTAL WEIGHTING

     1$ ARRAY       5 ENTRIES READ

    71* ARRAY       6 ENTRIES READ

    70$ ARRAY       9 ENTRIES READ

     0T

     XSDRN IDENTIFIER                      11231    ENDF TAPE MODE (THERMAL DATA)          0
     ENDF/B MATERIAL ID (FAST DATA)         1156    ENDF/B MATERIAL ID (THERMAL DATA)   1156
     NUMBER OF THERMAL TEMPERATURES            0    NUMBER OF ATOMS/MOLECULES              0
     ORDER OF FAST EXP COEFF                   3    LOGICAL UNIT (THERMAL DATA)           11
     ORDER OF THERMAL EXP COEFF                0

                                             •

                                             •

                                             •

NO FILE 3 DATA FOR MATERIAL 1156 REACTION 115---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 116---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 117---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 118---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 119---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251


  ELAPSED TIME    0.12 MIN.


  ELAPSED TIME    0.36 MIN.
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  17---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  18---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  22---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  23---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  24---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  25---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  28---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91


  ELAPSED TIME    0.40 MIN.


  ELAPSED TIME    0.40 MIN.
```

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**********************************************************************************************************************************
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         COMMENCE PROCESSING DATA FOR
    NA-23   INF DIL

   71*  ARRAY       6 ENTRIES READ

   70$  ARRAY       9 ENTRIES READ

    0T

    XSDRN IDENTIFIER                       11230     ENDF TAPE MODE (THERMAL DATA)          0
    ENDF/B MATERIAL ID (FAST DATA)          1156     ENDF/B MATERIAL ID (THERMAL DATA)   1156
    NUMBER OF THERMAL TEMPERATURES             0     NUMBER OF ATOMS/MOLECULES              0
    ORDER OF FAST EXP COEFF                    3     LOGICAL UNIT (THERMAL DATA)           11
    ORDER OF THERMAL EXP COEFF                 0

                                               •

                                               •
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 110---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 111---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 112---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 113---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 114---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 115---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 116---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 117---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 118---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251
NO FILE 3 DATA FOR MATERIAL 1156 REACTION 119---TAPE SEARCHED TO MAT=1156 MF= 3 MT= 251


  ELAPSED TIME   0.59 MIN.


  ELAPSED TIME   0.82 MIN.
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  17---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  18---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  22---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  23---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  24---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  25---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1156 REACTION  28---TAPE SEARCHED TO MAT=1156 MF= 5 MT=  91


  ELAPSED TIME   0.93 MIN.


  ELAPSED TIME   0.93 MIN.


  ELAPSED TIME   0.93 MIN.
```

ONE DIMENSION AVERAGES FOR NA-23 INF DIL IDENTIFIER 11230

XSEC ID GRP.	1	2	4	16	27	101	102	103
1	1.61214E 00	7.04101E-01	6.96109E-01	8.19003E-03	2.03744E-01	2.03744E-01	1.95692E-04	5.71988E-02
2	1.59301E 00	6.07921E-01	8.52709E-01	0.0	1.32378E-01	1.32378E-01	1.73327E-04	6.28138E-02
3	1.76059E 00	8.16622E-01	9.06811E-01	0.0	3.71533E-02	3.71533E-02	1.66233E-04	3.15146E-02
4	1.96097E 00	1.08543E 00	8.73258E-01	0.0	2.28428E-03	2.28428E-03	1.60995E-04	1.81086E-03
5	2.21690E 00	1.44486E 00	7.71874E-01	0.0	1.70993E-04	1.70993E-04	1.68199E-04	2.79462E-06
6	2.86394E 00	2.21329E 00	6.50458E-01	0.0	1.83597E-04	1.83597E-04	1.83597E-04	0.0
7	2.57457E 00	2.06917E 00	5.05199E-01	0.0	2.00404E-04	2.00404E-04	2.00404E-04	0.0
8	3.35200E 00	2.76265E 00	5.89125E-01	0.0	2.18748E-04	2.18748E-04	2.18748E-04	0.0
9	4.46767E 00	4.08457E 00	3.82838E-01	0.0	2.57150E-04	2.57150E-04	2.57150E-04	0.0
10	5.05190E 00	4.83614E 00	2.15425E-01	0.0	3.38807E-04	3.38807E-04	3.38807E-04	0.0
11	3.35831E 00	3.35296E 00	5.08777E-03	0.0	2.68531E-04	2.68531E-04	2.68531E-04	0.0
12	3.20042E 00	3.19985E 00	0.0	0.0	5.65023E-04	5.65023E-04	5.65023E-04	0.0
13	4.67053E 00	4.66979E 00	0.0	0.0	7.35234E-04	7.35234E-04	7.35234E-04	0.0
14	3.36693E 00	3.36590E 00	0.0	0.0	1.03522E-03	1.03522E-03	1.03522E-03	0.0
15	3.48477E 00	3.48297E 00	0.0	0.0	1.80015E-03	1.80015E-03	1.80015E-03	0.0
16	3.57578E 00	3.57556E 00	0.0	0.0	2.22433E-04	2.22433E-04	2.22433E-04	0.0
17	6.74734E 00	6.74334E 00	0.0	0.0	4.00086E-03	4.00086E-03	4.00086E-03	0.0
18	3.86983E 00	3.86935E 00	0.0	0.0	4.75448E-04	4.75448E-04	4.75448E-04	0.0
19	3.84351E 00	3.83953E 00	0.0	0.0	3.97591E-03	3.97591E-03	3.97591E-03	0.0
20	4.01710E 00	4.01687E 00	0.0	0.0	2.28211E-04	2.28211E-04	2.28211E-04	0.0
21	4.31241E 00	4.31215E 00	0.0	0.0	2.54456E-04	2.54456E-04	2.54456E-04	0.0
22	4.83349E 00	4.83317E 00	0.0	0.0	3.23493E-04	3.23493E-04	3.23493E-04	0.0
23	5.89943E 00	5.89795E 00	0.0	0.0	1.47785E-03	1.47785E-03	1.47785E-03	0.0
24	8.77510E 00	8.77341E 00	0.0	0.0	1.69385E-03	1.69385E-03	1.69385E-03	0.0
25	2.34660E 01	2.34536E 01	0.0	0.0	1.23527E-02	1.23527E-02	1.23527E-02	0.0
26	1.87494E 02	1.87285E 02	0.0	0.0	2.09383E-01	2.09383E-01	2.09383E-01	0.0
27	2.50532E 01	2.50090E 01	0.0	0.0	4.42123E-02	4.42123E-02	4.42123E-02	0.0
28	5.76750E 00	5.75348E 00	0.0	0.0	1.40156E-02	1.40156E-02	1.40156E-02	0.0
29	3.95377E 00	3.94424E 00	0.0	0.0	9.53669E-03	9.53669E-03	9.53669E-03	0.0
30	3.54677E 00	3.53837E 00	0.0	0.0	8.40160E-03	8.40160E-03	8.40160E-03	0.0
31	3.29147E 00	3.28368E 00	0.0	0.0	7.79718E-03	7.79718E-03	7.79718E-03	0.0
32	3.22802E 00	3.22010E 00	0.0	0.0	7.91956E-03	7.91956E-03	7.91956E-03	0.0
33	3.19592E 00	3.18778E 00	0.0	0.0	8.14778E-03	8.14778E-03	8.14778E-03	0.0
34	3.17450E 00	3.16607E 00	0.0	0.0	8.42816E-03	8.42816E-03	8.42816E-03	0.0
35	3.16150E 00	3.15251E 00	0.0	0.0	8.98864E-03	8.98864E-03	8.98864E-03	0.0
36	3.15370E 00	3.14396E 00	0.0	0.0	9.74132E-03	9.74132E-03	9.74132E-03	0.0
37	3.15048E 00	3.13974E 00	0.0	0.0	1.07427E-02	1.07427E-02	1.07427E-02	0.0
38	3.15004E 00	3.13811E 00	0.0	0.0	1.19363E-02	1.19363E-02	1.19363E-02	0.0
39	3.15037E 00	3.13648E 00	0.0	0.0	1.38934E-02	1.38934E-02	1.38934E-02	0.0
40	3.15125E 00	3.13485E 00	0.0	0.0	1.63988E-02	1.63988E-02	1.63988E-02	0.0
41	3.15258E 00	3.13322E 00	0.0	0.0	1.93559E-02	1.93559E-02	1.93559E-02	0.0
42	3.15444E 00	3.13160E 00	0.0	0.0	2.28464E-02	2.28464E-02	2.28464E-02	0.0
43	3.15961E 00	3.13263E 00	0.0	0.0	2.69771E-02	2.69771E-02	2.69771E-02	0.0
44	3.17069E 00	3.13881E 00	0.0	0.0	3.18788E-02	3.18788E-02	3.18788E-02	0.0
45	3.18518E 00	3.14750E 00	0.0	0.0	3.76845E-02	3.76845E-02	3.76845E-02	0.0
46	3.20076E 00	3.15621E 00	0.0	0.0	4.45475E-02	4.45475E-02	4.45475E-02	0.0
47	3.21761E 00	3.16495E 00	0.0	0.0	5.26605E-02	5.26605E-02	5.26605E-02	0.0
48	3.23596E 00	3.17371E 00	0.0	0.0	6.22509E-02	6.22509E-02	6.22509E-02	0.0
49	3.25608E 00	3.18249E 00	0.0	0.0	7.35879E-02	7.35879E-02	7.35879E-02	0.0
50	3.28156E 00	3.19457E 00	0.0	0.0	8.69896E-02	8.69896E-02	8.69896E-02	0.0
51	3.31469E 00	3.21186E 00	0.0	0.0	1.02832E-01	1.02832E-01	1.02832E-01	0.0
52	3.70964E 00	3.29597E 00	0.0	0.0	4.13668E-01	4.13668E-01	4.13668E-01	0.0

XSEC ID GRP.	107	1099
1	1.46350E-01	3.34615E-01
2	6.93912E-02	3.34615E-01
3	5.47252E-03	3.34615E-01
4	3.12418E-04	3.34616E-01

[illegible]		
5	0.0	3.34615E-01
6	0.0	3.34615E-01
7	0.0	3.34615E-01
8	0.0	3.34615E-01
9	0.0	3.34615E-01
10	0.0	3.34615E-01
11	0.0	3.34615E-01
12	0.0	3.34615E-01
13	0.0	3.34616E-01
14	0.0	3.34615E-01
15	0.0	3.34616E-01
16	0.0	3.34616E-01
17	0.0	3.34615E-01
18	0.0	3.34615E-01
19	0.0	3.34615E-01
20	0.0	3.34615E-01
21	0.0	3.34616E-01
22	0.0	3.34616E-01
23	0.0	3.34615E-01
24	0.0	3.34615E-01
25	0.0	3.34615E-01
26	0.0	3.34615E-01
27	0.0	3.34615E-01
28	0.0	3.34615E-01
29	0.0	3.34616E-01
30	0.0	3.34615E-01
31	0.0	3.34615E-01
32	0.0	3.34616E-01
33	0.0	3.34615E-01
34	0.0	3.34615E-01
35	0.0	3.34615E-01
36	0.0	3.34615E-01
37	0.0	3.34615E-01
38	0.0	3.34615E-01
39	0.0	3.34616E-01
40	0.0	3.34616E-01
41	0.0	3.34616E-01
42	0.0	3.34615E-01
43	0.0	3.34615E-01
44	0.0	3.34615E-01
45	0.0	3.34615E-01
46	0.0	3.34615E-01
47	0.0	3.34616E-01
48	0.0	3.34616E-01
49	0.0	3.34616E-01
50	0.0	3.34615E-01
51	0.0	3.34615E-01
52	0.0	7.19315E 00

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	1001001	1002002	2003003	3004004	4005005	5006006	6007007	7008008
2	6.51903E-01	5.45527E-01	7.06969E-01	9.24133E-01	1.22617E 00	1.83940E 00	1.70430E 00	2.21997E 00
3		5.21985E-02	6.23935E-02	1.09653E-01	1.61298E-01	2.18689E-01	3.73896E-01	3.64869E-01

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	8009009	9010010	10011011	11012012	12013013	13014014	14015015	15016016
2	3.26383E 00	3.92347E 00	2.40160E 00	2.43939E 00	3.56853E 00	2.49064E 00	2.58923E 00	2.65358E 00
3	5.42685E-01	8.20749E-01	9.12671E-01	9.51356E-01	7.60461E-01	1.10125E 00	8.75256E-01	8.93741E-01

	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23	GRP. 24
1	16017017	17018018	18019019	19020020	20021021	21022022	22023023	23024024
2	3.72937E 00	2.90277E 00	2.83719E 00	2.96703E 00	3.17778E 00	3.54091E 00	4.25891E 00	6.10700E 00
3	9.21982E-01	3.01397E 00	9.66582E-01	1.00234E 00	1.04984E 00	1.13437E 00	1.29225E 00	1.63904E 00

	GRP. 25	GRP. 26	GRP. 27	GRP. 28	GRP. 29	GRP. 30	GRP. 31	GRP. 32
1	24025025	25026026	26027027	27028028	28029029	29030030	30031031	31032032
2	1.41790E 01	1.41790E 02	2.22215E 01	4.57013E 00	2.98400E 00	2.66480E 00	2.45515E 00	2.40315E 00
3	2.66640E 00	9.27461E 00	4.54950E 01	2.78754E 00	1.18335E 00	9.60236E-01	8.73574E-01	8.28529E-01

	GRP. 33	GRP. 34	GRP. 35	GRP. 36	GRP. 37	GRP. 38	GRP. 39	GRP. 40
1	32033033	33034034	34035035	35036036	36037037	37038038	38039039	39040040
2	2.37780E 00	2.36088E 00	2.35033E 00	2.34362E 00	2.34009E 00	2.33887E 00	2.33765E 00	2.33644E 00
3	8.16947E-01	8.09971E-01	8.05197E-01	8.02184E-01	8.00335E-01	7.99653E-01	7.99237E-01	7.98821E-01

	GRP. 41	GRP. 42	GRP. 43	GRP. 44	GRP. 45	GRP. 46	GRP. 47	GRP. 48
1	40041041	41042042	42043043	43044044	44045045	45046046	46047047	47048048
2	2.33523E 00	2.33402E 00	2.33424E 00	2.33853E 00	2.34501E 00	2.35150E 00	2.35800E 00	2.36453E 00
3	7.98407E-01	7.97991E-01	7.97579E-01	7.98394E-01	8.00278E-01	8.02491E-01	8.04712E-01	8.06939E-01

	GRP. 49	GRP. 50	GRP. 51	GRP. 52
1	48049049	49050050	50051051	51052052
2	2.37111E 00	2.37941E 00	2.39211E 00	3.29597E 00
3	8.09170E-01	8.11383E-01	8.15152E-01	8.19746E-01

XSEC ID GRP.	1	2	4	16	27	101	102	103
1	1.61138E 00	7.02818E-01	6.96627E-01	8.03570E-03	2.03902E-01	2.03902E-01	1.95467E-04	5.73307E-02
2	1.59220E 00	6.07028E-01	8.52561E-01	0.0	1.32614E-01	1.32614E-01	1.73342E-04	6.28700E-02
3	1.75325E 00	8.09256E-01	9.06347E-01	0.0	3.76467E-02	3.76467E-02	1.66294E-04	3.18260E-02
4	1.94874E 00	1.07338E 00	8.73021E-01	0.0	2.33791E-03	2.33791E-03	1.61016E-04	1.85734E-03
5	2.18838E 00	1.41927E 00	7.68941E-01	0.0	1.71348E-04	1.71348E-04	1.68142E-04	3.20591E-06
6	2.82997E 00	2.18045E 00	6.49334E-01	0.0	1.83245E-04	1.83245E-04	1.83245E-04	0.0
7	2.48513E 00	1.99688E 00	4.88055E-01	0.0	2.00369E-04	2.00369E-04	2.00369E-04	0.0
8	3.26025E 00	2.69008E 00	5.69952E-01	0.0	2.18036E-04	2.18036E-04	2.18036E-04	0.0
9	4.23575E 00	3.85431E 00	3.81187E-01	0.0	2.52879E-04	2.52879E-04	2.52879E-04	0.0
10	4.58421E 00	4.41307E 00	1.70801E-01	0.0	3.37302E-04	3.37302E-04	3.37302E-04	0.0
11	3.06644E 00	3.05921E 00	6.95981E-03	0.0	2.69287E-04	2.69287E-04	2.69287E-04	0.0
12	3.07655E 00	3.07597E 00	0.0	0.0	5.71755E-04	5.71755E-04	5.71755E-04	0.0
13	4.42406E 00	4.42333E 00	0.0	0.0	7.36648E-04	7.36648E-04	7.36648E-04	0.0
14	3.36356E 00	3.36273E 00	0.0	0.0	8.25531E-04	8.25531E-04	8.25531E-04	0.0
15	3.47764E 00	3.47633E 00	0.0	0.0	1.31087E-03	1.31087E-03	1.31087E-03	0.0
16	3.57543E 00	3.57521E 00	0.0	0.0	2.22324E-04	2.22324E-04	2.22324E-04	0.0
17	4.69575E 00	4.69427E 00	0.0	0.0	1.47256E-03	1.47256E-03	1.47256E-03	0.0
18	3.85680E 00	3.85634E 00	0.0	0.0	4.56302E-04	4.56302E-04	4.56302E-04	0.0
19	3.83760E 00	3.83621E 00	0.0	0.0	1.39296E-03	1.39296E-03	1.39296E-03	0.0
20	4.01623E 00	4.01600E 00	0.0	0.0	2.28126E-04	2.28126E-04	2.28126E-04	0.0
21	4.30966E 00	4.30940E 00	0.0	0.0	2.54084E-04	2.54084E-04	2.54084E-04	0.0
22	4.82514E 00	4.82482E 00	0.0	0.0	3.22876E-04	3.22876E-04	3.22876E-04	0.0
23	5.86544E 00	5.86410E 00	0.0	0.0	1.33937E-03	1.33937E-03	1.33937E-03	0.0
24	8.56031E 00	8.55873E 00	0.0	0.0	1.58290E-03	1.58290E-03	1.58290E-03	0.0
25	1.97350E 01	1.97257E 01	0.0	0.0	9.30880E-03	9.30880E-03	9.30880E-03	0.0
26	1.33151E 02	1.33008E 02	0.0	0.0	1.43829E-01	1.43829E-01	1.43829E-01	0.0
27	1.73259E 01	1.72929E 01	0.0	0.0	3.30180E-02	3.30180E-02	3.30180E-02	0.0
28	5.55688E 00	5.54330E 00	0.0	0.0	1.35752E-02	1.35752E-02	1.35752E-02	0.0
29	3.94545E 00	3.93594E 00	0.0	0.0	9.51355E-03	9.51355E-03	9.51355E-03	0.0
30	3.54412E 00	3.53573E 00	0.0	0.0	8.39395E-03	8.39395E-03	8.39395E-03	0.0
31	3.29060E 00	3.28280E 00	0.0	0.0	7.79453E-03	7.79453E-03	7.79453E-03	0.0
32	3.22797E 00	3.22005E 00	0.0	0.0	7.91976E-03	7.91976E-03	7.91976E-03	0.0
33	3.19461E 00	3.18646E 00	0.0	0.0	8.14464E-03	8.14464E-03	8.14464E-03	0.0
34	3.17291E 00	3.16448E 00	0.0	0.0	8.42832E-03	8.42832E-03	8.42832E-03	0.0
35	3.16150E 00	3.15251E 00	0.0	0.0	8.98881E-03	8.98881E-03	8.98881E-03	0.0
36	3.15245E 00	3.14271E 00	0.0	0.0	9.74145E-03	9.74145E-03	9.74145E-03	0.0
37	3.15048E 00	3.13973E 00	0.0	0.0	1.07427E-02	1.07427E-02	1.07427E-02	0.0
38	3.15004E 00	3.13810E 00	0.0	0.0	1.19363E-02	1.19363E-02	1.19363E-02	0.0
39	3.15037E 00	3.13647E 00	0.0	0.0	1.38933E-02	1.38933E-02	1.38933E-02	0.0
40	3.15124E 00	3.13484E 00	0.0	0.0	1.63987E-02	1.63987E-02	1.63987E-02	0.0
41	3.15258E 00	3.13322E 00	0.0	0.0	1.93558E-02	1.93558E-02	1.93558E-02	0.0
42	3.15444E 00	3.13160E 00	0.0	0.0	2.28463E-02	2.28463E-02	2.28463E-02	0.0
43	3.15760E 00	3.13065E 00	0.0	0.0	2.69589E-02	2.69589E-02	2.69589E-02	0.0
44	3.17068E 00	3.13881E 00	0.0	0.0	3.18764E-02	3.18764E-02	3.18764E-02	0.0
45	3.18517E 00	3.14749E 00	0.0	0.0	3.76817E-02	3.76817E-02	3.76817E-02	0.0
46	3.20075E 00	3.15621E 00	0.0	0.0	4.45442E-02	4.45442E-02	4.45442E-02	0.0
47	3.21760E 00	3.16494E 00	0.0	0.0	5.26565E-02	5.26565E-02	5.26565E-02	0.0
48	3.23594E 00	3.17370E 00	0.0	0.0	6.22462E-02	6.22462E-02	6.22462E-02	0.0
49	3.25606E 00	3.18248E 00	0.0	0.0	7.35824E-02	7.35824E-02	7.35824E-02	0.0
50	3.27962E 00	3.19264E 00	0.0	0.0	8.69812E-02	8.69812E-02	8.69812E-02	0.0
51	3.31466E 00	3.21184E 00	0.0	0.0	1.02817E-01	1.02817E-01	1.02817E-01	0.0
52	3.70745E 00	3.29536E 00	0.0	0.0	4.12096E-01	4.12096E-01	4.12096E-01	0.0

XSEC ID GRP.	107	1099
1	1.46376E-01	7.29292E-01
2	6.95708E-02	7.37854E-01
3	5.65447E-03	6.70158E-01
4	3.19557E-04	6.02975E-01

5	0.0	5.37148E-01
6	0.0	4.15464E-01
7	0.0	4.73348E-01
8	0.0	3.60473E-01
9	0.0	2.77428E-01
10	0.0	2.56331E-01
11	0.0	3.83944E-01
12	0.0	3.87551E-01
13	0.0	2.67593E-01
14	0.0	3.49578E-01
15	0.0	3.37520E-01
16	0.0	3.28563E-01
17	0.0	2.50190E-01
18	0.0	3.04563E-01
19	0.0	3.06120E-01
20	0.0	2.92514E-01
21	0.0	2.72592E-01
22	0.0	2.43482E-01
23	0.0	2.00284E-01
24	0.0	1.37231E-01
25	0.0	5.95247E-02
26	0.0	8.82248E-03
27	0.0	6.78785E-02
28	0.0	2.11423E-01
29	0.0	2.97747E-01
30	0.0	3.31466E-01
31	0.0	3.57004E-01
32	0.0	3.63930E-01
33	0.0	3.67730E-01
34	0.0	3.70238E-01
35	0.0	3.71574E-01
36	0.0	3.72607E-01
37	0.0	3.72730E-01
38	0.0	3.72629E-01
39	0.0	3.72529E-01
40	0.0	3.72428E-01
41	0.0	3.72328E-01
42	0.0	3.72227E-01
43	0.0	3.71874E-01
44	0.0	3.70113E-01
45	0.0	3.68141E-01
46	0.0	3.66180E-01
47	0.0	3.64230E-01
48	0.0	3.62290E-01
49	0.0	3.60360E-01
50	0.0	3.58066E-01
51	0.0	3.54442E-01
52	0.0	7.23585E 00

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	1001001	1002002	2003003	3004004	4005005	5006006	6007007	7008008
2	6.49665E-01	5.45981E-01	7.05755E-01	9.21476E-01	1.21458E 00	1.83465E 00	1.63014E 00	2.23802E 00
3		5.31532E-02	6.10472E-02	1.03501E-01	1.51908E-01	2.04695E-01	3.45805E-01	3.66741E-01

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	8009009	9010010	10011011	11012012	12013013	13014014	14015015	15016016
2	3.20809E 00	3.25844E 00	2.36593E 00	2.32767E 00	3.32397E 00	2.50529E 00	2.58899E 00	2.66386E 00
3	4.52060E-01	6.46213E-01	1.15463E 00	6.93283E-01	7.48304E-01	1.09936E 00	8.57438E-01	8.87342E-01

	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23	GRP. 24
1	16017017	17018018	18019019	19020020	20021021	21022022	22023023	23024024
2	3.49579E 00	2.86471E 00	2.84643E 00	2.98580E 00	3.20827E 00	3.59552E 00	4.37025E 00	6.37739E 00
3	9.11352E-01	1.19848E 00	9.91625E-01	9.89783E-01	1.03020E 00	1.10113E 00	1.22929E 00	1.49385E 00

	GRP. 25	GRP. 26	GRP. 27	GRP. 28	GRP. 29	GRP. 30	GRP. 31	GRP. 32
1	24025025	25026026	26027027	27028028	28029029	29030030	30031031	31032032
2	1.47011E 01	9.91375E 01	1.28892E 01	4.13181E 00	2.93192E 00	2.63572E 00	2.44678E 00	2.39983E 00
3	2.18134E 00	5.02461E 00	3.38701E 01	4.40376E 00	1.41148E 00	1.00402E 00	9.00011E-01	8.36026E-01

	GRP. 33	GRP. 34	GRP. 35	GRP. 36	GRP. 37	GRP. 38	GRP. 39	GRP. 40
1	32033033	33034034	34035035	35036036	36037037	37038038	38039039	39040040
2	2.37480E 00	2.35843E 00	2.34952E 00	2.34229E 00	2.34015E 00	2.33894E 00	2.33772E 00	2.33651E 00
3	8.20222E-01	8.11667E-01	8.06048E-01	8.02982E-01	8.00418E-01	7.99581E-01	7.99166E-01	7.98750E-01

	GRP. 41	GRP. 42	GRP. 43	GRP. 44	GRP. 45	GRP. 46	GRP. 47	GRP. 48
1	40041041	41042042	42043043	43044044	44045045	45046046	46047047	47048048
2	2.33530E 00	2.33409E 00	2.33366E 00	2.33991E 00	2.34640E 00	2.35290E 00	2.35942E 00	2.36596E 00
3	7.98335E-01	7.97919E-01	7.97508E-01	7.96981E-01	7.98896E-01	8.01098E-01	8.03308E-01	8.05523E-01

	GRP. 49	GRP. 50	GRP. 51	GRP. 52
1	48049049	49050050	50051051	51052052
2	2.37254E 00	2.38046E 00	2.39488E 00	3.29536E 00
3	8.07742E-01	8.09942E-01	8.12183E-01	8.16957E-01

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RUN
TWO
SODIUM
CASES
FOR PROBLEM 3
    TAPE ID                          100        NUMBER OF NUCLIDES                 2
    NUMBER OF NEUTRON GROUPS          52        NUMBER OF GAMMA GROUPS             0
    FIRST THERMAL GROUP               52
                          TABLE OF CONTENTS
  NA-23   INF DIL                                                    ID      11230
  NA-23   1/E-SIGMA TOTAL WEIGHTING                                  ID      11231

ELAPSED TIME    1.00 MIN.

 11$ ARRAY      9 ENTRIES READ

  0T

GENERAL INFORMATION CONCERNING UPDATE OPTION

NEWID     IDENTIFICATION OF NEW AMPX LIBRARY                     0
ITRGUP    UPDATE TRIGGER  0/1/2  NO/ADD 21 TO 23/COPY 21         0
IEDIT     PRODUCE EDITS OF CROSS-SECTIONS                        0
IPLOT     PLOT CROSS-SECTIONS                                    0
IPART     UPDATE PARTIAL CROSS-SECTIONS                          0
IOLD      IS AN OLD AMPX LIBRARY MOUNTED?  (0/1:NO/YES)          0


*******************************************************************************
YOU HAVE COME TO THE END OF A PERILOUS FLIGHT THROUGH THAT MAGNIFICENT
PROGRAM....X L A C S.....I TRUST IT HAS BEEN A MOVING PERFORMANCE
SEE YOU ON THE NEXT TIME THROUGH
*******************************************************************************

ELAPSED TIME    1.00 MIN.
```

NITAWL

05/16/75

1:53:31

```
   0$ ARRAY       9 ENTRIES READ

   1$ ARRAY      12 ENTRIES READ

   0T

 MSCM     NUMBER OF EXTRA CROSS SECTIONS                          0
 MMT      NUMBER OF NUCLIDES FROM MASTER LIBRARY                  2
 MWT      NUMBER OF NUCLIDES FROM X-SECT LIBRARY (LOG 2)          0
 MXT      NUMBER OF NUCLIDES FROM X-SECT LIBRARY (LOG 3)          0
 MCR      ANISN/DOT/MORSE OUTPUT TRIGGER                          0
 MXX      TOTAL CROSS SECTION POSITION                            0
 MS       WITHIN-GROUP SCATTERING CROSS SECTION POSITION          0
 IRES     NUMBER OF RESONANCE CALCULATIONS                        0
 IQM      TABLE LENGTH FOR CROSS SECTIONS                         0
 IPM      IS AN OLD ANISN LIBRARY MOUNTED ? (0/1:NO/YES)          0
 IPP      OUTPUT OPTION TRIGGER                                   0
 IFG      PRINT CONTROL - ANISN OUTPUT                            0

THE STORAGE ALLOCATED FOR THIS CASE IS 103936 WORDS

   2$ ARRAY       2 ENTRIES READ

   0T

 GENERAL INFORMATION CONCERNING CROSS SECTION LIBRARY
   TAPE IDENTIFICATION NUMBER                   100
   NUMBER OF NUCLIDES ON TAPE                     2
   NUMBER OF NEUTRON ENERGY GROUPS               52
   FIRST THERMAL NEUTRON ENERGY GROUP            52
   NUMBER OF GAMMA ENERGY GROUPS                  0


 XSDRN TAPE     100
                         RUN
                         TWO
                         SODIUM
                         CASES
                         FOR PROBLEM 3

 NUCLIDES FROM XSDRN TAPE
    1     NA-23   INF DIL                                                            11230
    2     NA-23   1/E-SIGMA TOTAL WEIGHTING                                          11231

NA-23    INF DIL                                                    11230

NA-23    1/E-SIGMA TOTAL WEIGHTING                                  11231


  ELAPSED TIME   0.01 MIN.
```

```
XX        XX    SSSSSSSSSS    DDDDDDDDDDD    RRRRRRRRRRR    NN        NN   PPPPPPPPPPP    MM        MM
 XX      XX    SSSSSSSSSSSS   DDDDDDDDDDDD   RRRRRRRRRRRR   NNN       NN   PPPPPPPPPPPP   MMM      MMM
  XX    XX     SS        SS   DD        DD   RR        RR   NNNN      NN   PP        PP   MMMM    MMMM
   XX  XX      SS             DD        DD   RR        RR   NN NN     NN   PP        PP   MM MM  MM MM
    XX XX      SS             DD        DD   RR        RR   NN  NN    NN   PP        PP   MM  MMMM  MM
     XXX       SSSSSSSSSSS    DD        DD   RRRRRRRRRRRR   NN   NN   NN   PPPPPPPPPPPP   MM   MM   MM
     XXX        SSSSSSSSSSS   DD        DD   RRRRRRRRRRR    NN    NN  NN   PPPPPPPPPPP    MM        MM
    XX XX                SS   DD        DD   RR    RR       NN     NN NN   PP             MM        MM
   XX  XX                SS   DD        DD   RR     RR      NN      NNNN   PP             MM        MM
  XX    XX     SS        SS   DD        DD   RR      RR     NN       NNN   PP             MM        MM
 XX      XX    SSSSSSSSSSSS   DDDDDDDDDDDD   RR       RR    NN        NN   PP             MM        MM
XX        XX    SSSSSSSSSS    DDDDDDDDDDD    RR        RR   NN        NN   PP             MM        MM


   0000000     555555555555             //        11       6666666666             //   777777777777   555555555555
  000000000    555555555555            //        111      666666666666           //    777777777777   555555555555
 00      00    55                     //        1111      66                    //     77        77   55
00        00   55                    //           11      66                   //              77     55
00        00   55                   //            11      66                  //              77      55
00        00   55555555555         //             11      66666666666        //              77       55555555555
00        00   555555555555       //              11      666666666666      //               77       555555555555
00        00             55      //               11      66        66     //               77                  55
00        00             55     //                11      66        66    //                77                  55
 00      00    55        55    //                 11      66        66   //                77        55        55
  000000000    555555555555   //               11111111   666666666666  //                 77        555555555555
   0000000      5555555555   //                11111111    6666666666  //                  77         5555555555


                    11                         555555555555           44                           44             44
                   111                         555555555555          444                          444            444
                  1111                         55                   4444                         4444           4444
                    11                         55                  44 44                        44 44          44 44
                    11                         55                 44  44                       44  44         44  44
                    11                         55555555555       44   44                      44   44        44   44
                    11          .....          555555555555     44    44         .....       44    44       44    44
                    11          .....                    55    44444444444       .....      44444444444    44444444444
                    11          .....                    55   444444444444       .....     444444444444   444444444444
                    11          .....          55        55         44           .....           44             44
                 11111111                      555555555555         44                           44             44
                 11111111                       5555555555          44                           44             44
```

```
                     RUN XSDRNPM AS PART OF SAMPLE PROBLEM 3

    1$ ARRAY      15 ENTRIES READ

    2$ ARRAY      10 ENTRIES READ

    0T

          THE FOLLOWING DIRECT ACCESS SPACE IS REQUIRED
    LOGICAL UNIT  8 HAS     53 BLOCKS OF LENGTH  177 WORDS
    LOGICAL UNIT  9 HAS      9 BLOCKS OF LENGTH  880 WORDS
    LOGICAL UNIT 10 HAS    156 BLOCKS OF LENGTH    1 WORDS

GENERAL PROBLEM DESCRIPTION DATA BLOCK

                           GENERAL PROBLEM DATA

IGE  1/2/3 = PLANE/CYLINDER/SPHERE        1        ISN  QUADRATURE ORDER                  0
IZM  NUMBER OF ZONES                      1        ISCT ORDER OF SCATTERING               0
IM   NUMBER OF SPACIAL INTERVALS          1        IEVT 0/1/2/3/4/5/6=Q/K/ALPHA/C/Z/R/H   1
IBL  0/1/2/3 = VACUUM/REFL/PER/WHITE      1        IIM  INNER ITERATION MAXIMUM          10
IBR  RIGHT BOUNDARY CONDITION             1        ICM  OUTER ITERATION MAXIMUM           0
MXX  NUMBER OF MIXTURES                   3        ICLC -1/0/N--FLAT RES/SN/OPT           0
MS   MIXING TABLE LENGTH                  4        ITH  0/1 = FORWARD/ADJOINT             0
IGM  NUMBER OF ENERGY GROUPS             52        IFLU 0/1/2/3/4=L-S/L/S/W/L-W           0
NNG  NUMBER OF NEUTRON GROUPS            52        IPRT -2/-1/0/N=MIXTURE XSEC PRINT      3
NGG  NUMBER OF GAMMA GROUPS               0        IDL  0/1/2/3=NO/PRT NO/PCH N/BOTH      0
IFTG NUMBER OF FIRST THERMAL GROUP       52        IPBT -1/0/1=NONE/FINE/ALL BAL. PRT     0

                              SPECIAL OPTIONS

IFG  0/1 = NONE/WEIGHTING CALCULATION     0        IPN  DUMMY PARAMETER                   0
IQM  VOLUMETRIC SOURCES (0/N=NO/YES)      0        IDFM 0/1 = NONE/DENSITY FACTORS 38*    0
IPM  BOUNDARY SOURCES (0/N=NO/YES)        0        IAZ  0/N = NONE/N ACTIVITIES BY ZONE   0
IFN  0/1/2 = INPUT 33*/34*/USE LAST       0        IAI  0/1=NONE/ACTIVITIES BY INTERVAL   0
ITMX MAXIMUM TIME (MINUTES)               0        IFCT 0/1=NO/YES UPSCATTER SCALING      0
IDT1 0/1/2/3=NO/XSECT/SRCE/FLUX--OUT      0        IPVT 0/1/2=NO/K/ALPHA PARAMETRIC SRCH  0

                          FLOATING POINT PARAMETERS

EV   EIGENVALUE GUESS          0.0                 PV   IPVT=1/2--K/ALPHA         0.0
EVM  EIGENVALUE MODIFIER       0.0                 EPS  OVERALL CONVERGENCE       1.00000E-04
BF   BUCKLING FACTOR=1.420892  1.42089E 00         PTC  POINT CONVERGENCE         1.00000E-04
DY   CYL/PLA HT FOR BUCKLING   0.0                 XNF  NORMALIZATION FACTOR      1.00000E 00
DZ   PLANE DEPTH FOR BUCKLING  0.0                 EQL  EV CHANGE EPS FOR SEARCH  1.00000E-03
VSC  VOID STREAMING CORRECTION 0.0                 XNPM NEW PARAM MOD FOR SEARCH  7.50000E-01
    THIS CASE WILL REQUIRE       2890 LOCATIONS FOR MIXING
    THIS CASE HAS BEEN ALLOCATED 109056 LOCATIONS
```

RUN XSDRNPM AS PART OF SAMPLE PROBLEM 3

13$ ARRAY 4 ENTRIES READ

14$ ARRAY 4 ENTRIES READ

15* ARRAY 4 ENTRIES READ

0T

DATA BLOCK 2 (MIXING TABLE, ETC.)

	NUCLIDES ON TAPE	CCCC IDENTIFICATION	MIXTURE	MIXING TABLE COMPONENT	ATOM DENSITY	EXTRA XSECT ID'S
1	11230		1	11230	1.00000E 00	
2	11231		2	11231	1.00000E 00	
3			3	11230	1.00000E 00	
4			3	11231	-1.00000E 00	

1/E Weighted
Na

MACROSCOPIC P0 CROSS SECTIONS FOR MIXTURE 1

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	8.19003E-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	2.03744E-01	1.32378E-01	3.71533E-02	2.28428E-03	1.70993E-04	1.83597E-04	2.00404E-04	2.18748E-04
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1.61199E 00	1.59327E 00	1.76030E 00	1.96105E 00	2.21671E 00	2.86392E 00	2.57457E 00	3.35200E 00
8	1001001	1002002	1003003	1004004	1005005	1006006	1007007	1008008
9	6.60488E-01	5.88804E-01	7.91425E-01	1.04543E 00	1.34094E 00	1.92716E 00	1.70430E 00	2.21997E 00
10		9.91018E-02	1.83558E-01	3.18184E-01	3.46102E-01	5.07204E-01	8.67338E-01	7.76194E-01
11			8.74283E-02	1.37237E-01	2.21334E-01	1.49562E-01	3.11551E-02	1.01672E-02
12				1.32867E-01	1.86578E-01	1.34934E-01	1.75600E-01	7.53487E-02
13					1.40128E-01	1.64369E-01	9.30727E-02	1.15942E-01
14						1.02773E-01	1.08457E-01	6.80466E-02
15							6.87367E-02	5.06100E-02
16								4.51772E-02

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	2.57150E-04	3.38807E-04	2.68531E-04	5.65023E-04	7.35234E-04	1.03522E-03	1.80015E-03	2.22433E-04
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	4.46767E 00	5.05190E 00	3.35831E 00	3.20041E 00	4.67052E 00	3.36693E 00	3.48477E 00	3.57578E 00
8	1009009	1010010	1011011	1012012	1013013	1014014	1015015	1016016
9	3.26383E 00	3.92347E 00	2.40160E 00	2.43939E 00	3.56853E 00	2.49064E 00	2.58923E 00	2.65358E 00
10	6.97662E-01	8.20749E-01	9.12671E-01	9.51356E-01	7.60461E-01	1.10125E 00	8.75256E-01	8.93741E-01
11	9.38731E-02	4.27218E-01	1.96030E-01	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	6.93069E-03	1.61415E-01	1.23153E-01	0.0	0.0	0.0
13	6.98807E-02	8.05848E-03	0.0	0.0	2.53917E-02	4.27931E-02	0.0	0.0
14	5.50388E-02	6.18220E-02	1.80557E-02	0.0	0.0	0.0	4.36411E-02	0.0
15	5.17651E-02	2.29978E-02	4.27188E-02	9.61649E-03	0.0	0.0	0.0	5.18579E-03
16	1.80587E-02	2.49871E-02	1.76610E-02	2.82846E-02	9.15984E-03	0.0	0.0	0.0
17	2.88448E-02	1.09134E-02	1.08829E-02	1.25675E-02	1.76513E-02	5.34195E-03	0.0	0.0
18		1.85716E-02	6.09356E-03	4.12701E-03	7.73557E-03	1.58323E-02	3.11364E-03	0.0
19			1.20961E-02	3.30106E-03	2.08057E-03	4.53657E-03	1.10526E-02	2.05523E-03
20				7.90237E-03	1.62860E-03	1.18992E-03	2.58442E-03	6.46522E-03
21					5.04901E-03	6.22704E-04	5.81954E-04	1.46883E-03
22						3.11002E-03	3.20660E-04	2.77712E-04
23							1.84261E-03	1.63626E-04
24								1.05455E-03

	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23	GRP. 24
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	4.00086E-03	4.75448E-04	3.97591E-03	2.28211E-04	2.54456E-04	3.23493E-04	1.47785E-03	1.69385E-03
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	6.74734E 00	3.86983E 00	3.84351E 00	4.01710E 00	4.31241E 00	4.83349E 00	5.89943E 00	8.77510E 00
8	1017017	1018018	1019019	1020020	1021021	1022022	1023023	1024024
9	3.72937E 00	2.90277E 00	2.83719E 00	2.96703E 00	3.17778E 00	3.54091E 00	4.25891E 00	6.10700E 00
10	9.21982E-01	3.01397E 00	9.66582E-01	1.00234E 00	1.04984E 00	1.13437E 00	1.29225E 00	1.63904E 00
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	8.66181E-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	6.52792E-04	1.51850E-03	0.0	0.0	0.0	0.0	0.0	0.0

17	0.0	0.0	2.32937E-03	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	2.85200E-04	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	8.35274E-05	0.0	0.0	0.0
20	1.56596E-03	0.0	0.0	0.0	0.0	5.03261E-06	0.0	0.0
21	3.87996E-03	1.00560E-03	0.0	0.0	0.0	0.0	0.0	0.0
22	7.24520E-04	2.03872E-03	5.53369E-04	0.0	0.0	0.0	0.0	0.0
23	1.30075E-04	4.03455E-04	1.07621E-03	2.88124E-04	0.0	0.0	0.0	0.0
24	8.54456E-05	6.65729E-05	2.24156E-04	5.73353E-04	1.40450E-04	0.0	0.0	0.0
25	5.86745E-04	4.54563E-05	3.47395E-05	1.12984E-04	3.08811E-04	6.47664E-05	0.0	0.0
26		3.19391E-04	2.43875E-05	1.82732E-05	5.19703E-05	1.69749E-04	2.96903E-05	0.0
27			1.71011E-04	1.32438E-05	9.68764E-06	2.23634E-05	9.89668E-05	1.53990E-05
28				9.04498E-05	6.56566E-06	2.61459E-06	5.43245E-06	4.12141F-05
29					4.74128E-05	1.84199E-06	0.0	0.0
30						2.46916E-05	9.45068E-07	0.0
31							1.27983E-05	4.84624E-07
32								6.61114F-06

	GRP. 25	GRP. 26	GRP. 27	GRP. 28	GRP. 29	GRP. 30	GRP. 31	GRP. 32
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1.23527E-02	2.09383E-01	4.42123E-02	1.40156E-02	9.53669E-03	8.40160E-03	7.79718E-03	7.91956E-03
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	2.34660E 01	1.87494E 02	2.50532E 01	5.76750E 00	3.95377E 00	3.54677E 00	3.29147E 00	3.228C2E 00
8	1025025	1026026	1027027	1028028	1029029	1030030	1031031	1032032
9	1.41790E 01	1.41790E 02	2.22215E 01	4.57013E 00	2.98400E 00	2.66480E 00	2.45515E 00	2.40315E 00
10	2.66640E 00	9.27461E 00	4.54950E 01	2.78754E 00	1.18335E 00	9.60236E-01	8.73574E-01	8.28529E-01
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	6.94227E-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	2.48416E-07	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	3.40670E-06	1.27302E-07	0.0	0.0	0.0	0.0	0.0	0.0
34		1.75237E-06	6.52240E-08	0.0	0.0	0.0	0.0	0.0
35			9.00267E-07	3.34132E-08	0.0	0.0	0.0	0.0
36				4.62085E-07	1.71153E-08	0.0	0.0	0.0
37					2.37023E-07	8.76635E-09	0.0	0.0
38						1.21522E-07	4.48985E-09	0.0
39							6.22841E-08	2.29948E-09
40								3.19150E-08

	GRP. 33	GRP. 34	GRP. 35	GRP. 36	GRP. 37	GRP. 38	GRP. 39	GRP. 40
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	8.14778E-03	8.42816E-03	8.98864E-03	9.74132E-03	1.07427E-02	1.19363E-02	1.38934E-02	1.63988E-02
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

7	3.19592E 00	3.17450E 00	3.16150E 00	3.15370E 00	3.15048E 00	3.15004E 00	3.15037E 00	3.15125E 00
8	1033033	1034034	1035035	1036036	1037037	1038038	1039039	39040040
9	2.37780E 00	2.36088E 00	2.35033E 00	2.34362E 00	2.34009E 00	2.33887E 00	2.33765E 00	2.33644E 00
10	8.16947E-01	8.09971E-01	8.05197E-01	8.02184E-01	8.00335E-01	7.99653E-01	7.99237E-01	7.98821E-01
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
40	1.17764E-09	0.0	0.0	0.0	0.0	0.0	0.0	
41	1.63508E-08	6.03103E-10	0.0	0.0	0.0	0.0	0.0	
42		8.37593E-09	3.08860E-10	0.0	0.0	0.0	0.0	
43			4.29023E-09	1.58172E-10	0.0	0.0	0.0	
44				2.19738E-09	0.0	0.0	0.0	
45					1.12541E-09	0.0	0.0	
46						5.76372E-10	0.0	
47							2.12237E-10	

	GRP. 41	GRP. 42	GRP. 43	GRP. 44	GRP. 45	GRP. 46	GRP. 47	GRP. 48
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1.93559E-02	2.28464E-02	2.69771E-02	3.18788E-02	3.76845E-02	4.45475E-02	5.26605E-02	6.22509E-02
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	3.15258E 00	3.15444E 00	3.15961E 00	3.17069E 00	3.18518E 00	3.20076E 00	3.21760E 00	3.23595E 00
8	40041041	41042042	42043043	43044044	44045045	45046046	46047047	47048048
9	2.33523E 00	2.33402E 00	2.33424E 00	2.33853E 00	2.34501E 00	2.35150E 00	2.35800E 00	2.36453E 00
10	7.98407E-01	7.97991E-01	7.97579E-01	7.98394E-01	8.00278E-01	8.02491E-01	8.04712E-01	8.06939E-01

	GRP. 49	GRP. 50	GRP. 51	GRP. 52
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	7.35879E-02	8.69896E-02	1.02832E-01	4.13668E-01
6	0.0	0.0	0.0	0.0
7	3.25608E 00	3.28155E 00	3.31469E 00	3.70964E 00
8	48049049	49050050	50051051	51052052
9	2.37111E 00	2.37941E 00	2.39211E 00	3.29597E 00
10	8.09170E-01	8.11383E-01	8.15152E-01	8.19746E-01

MACROSCOPIC PO CROSS SECTIONS FOR MIXTURE 2

1/$E\sigma_T$
Weighted Na

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	8.03570E-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	2.03902E-01	1.32614E-01	3.76467E-02	2.33791E-03	1.71348E-04	1.83245E-04	2.00369E-04	2.18036E-04
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1.61131E 00	1.59222E 00	1.75323E 00	1.94870E 00	2.18816E 00	2.82995E 00	2.48513E 00	3.26025E 00
8	1001001	1002002	1003003	1004004	1005005	1006006	1007007	1008008
9	6.58245E-01	5.89677E-01	7.93115E-01	1.04691E 00	1.32728E 00	1.93479E 00	1.63014E 00	2.23802E 00
10		1.00031E-01	1.82265E-01	3.11277E-01	3.32381E-01	4.91101E-01	8.21587E-01	7.55639E-01
11			8.73799E-02	1.36624E-01	2.19811E-01	1.54242E-01	3.36426E-02	1.03224E-02
12				1.33201E-01	1.86512E-01	1.33703E-01	1.73622E-01	7.34224E-02
13					1.40389E-01	1.65168E-01	9.23699E-02	1.12362E-01
14						1.02959E-01	1.08050E-01	6.82148E-02
15							6.86985E-02	4.99196E-02
16								4.51522E-02

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	2.52879E-04	3.37302E-04	2.69287E-04	5.71755E-04	7.36648E-04	8.25531E-04	1.31087E-03	2.22324E-04
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	4.23576E 00	4.58420E 00	3.06644E 00	3.07654E 00	4.42406E 00	3.36356E 00	3.47764E 00	3.57543E 00
8	1009009	1010010	1011011	1012012	1013013	1014014	1015015	1016016
9	3.20809E 00	3.25844E 00	2.36593E 00	2.32767E 00	3.32397E 00	2.50529E 00	2.58899E 00	2.66386E 00
10	6.27413E-01	6.46213E-01	1.15463E 00	6.93283E-01	7.48304E-01	1.09936E 00	8.57438E-01	8.87342E-01
11	9.91590E-02	3.88508E-01	2.24872E-01	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	6.09589E-03	1.36709E-01	7.62288E-02	0.0	0.0	0.0
13	7.21761E-02	9.24340E-03	0.0	0.0	1.96171E-02	4.31128E-02	0.0	0.0
14	5.52956E-02	6.06963E-02	2.05491E-02	0.0	0.0	0.0	4.39490E-02	0.0
15	5.26595E-02	2.33458E-02	4.11527E-02	9.52241E-03	0.0	0.0	0.0	6.26842E-03
16	1.82800E-02	2.51357E-02	1.80991E-02	2.89282E-02	9.13107E-03	0.0	0.0	0.0
17	2.88073E-02	1.08639E-02	1.08345E-02	1.27003E-02	1.81446E-02	5.76938E-03	0.0	0.0
18		1.85162E-02	6.05281E-03	4.13947E-03	7.32767E-03	1.59730E-02	3.16314E-03	0.0
19			1.20336E-02	3.28306E-03	2.05192E-03	4.30427E-03	1.08770E-02	2.11745E-03
20				7.84391E-03	1.61487E-03	1.17923E-03	2.69432E-03	6.40612E-03
21					5.00242E-03	6.29998E-04	5.68828E-04	1.51946E-03
22						3.07713E-03	3.25582E-04	2.75558E-04
23							1.82138E-03	1.66662E-04
24								1.04171E-03

	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23	GRP. 24
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1.47256E-03	4.56302E-04	1.39296E-03	2.28126E-04	2.54084E-04	3.22876E-04	1.33937E-03	1.58290E-03
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	4.69574E 00	3.85679E 00	3.83760E 00	4.01622E 00	4.30966E 00	4.82513E 00	5.86544E 00	8.56031E 00
8	1017017	1018018	1019019	1020020	1021021	1022022	1023023	1024024
9	3.49579E 00	2.86471E 00	2.84643E 00	2.98580E 00	3.20827E 00	3.59552E 00	4.37025E 00	6.37739E 00
10	9.11352E-01	1.19848E 00	9.91625E-01	9.89783E-01	1.03020E 00	1.10113E 00	1.22929E 00	1.49385E 00
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	1.32942E-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	1.24220E-03	2.13394E-03	0.0	0.0	0.0	0.0	0.0	0.0

17	0.0	0.0	3.03255E-03	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	3.57724E-04	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	1.00272E-04	0.0	0.0	0.0
20	1.57716E-03	0.0	0.0	0.0	0.0	5.87667E-06	0.0	0.0
21	3.68372E-03	9.72140E-04	0.0	0.0	0.0	0.0	0.0	0.0
22	7.35708E-04	2.01682E-03	4.88346E-04	0.0	0.0	0.0	0.0	0.0
23	1.25861E-04	4.06219E-04	1.13586E-03	2.79485E-04	0.0	0.0	0.0	0.0
24	8.67900E-05	6.55860E-05	2.30052E-04	6.38502E-04	1.39373E-04	0.0	0.0	0.0
25	5.79333E-04	4.59090E-05	3.43394E-05	1.15940E-04	3.56073E-04	6.39285E-05	0.0	0.0
26		3.15255E-04	2.44611E-05	1.81770E-05	5.25652E-05	1.98931E-04	2.89250E-05	0.0
27			1.68759E-04	1.32317E-05	9.67836E-06	2.20982E-05	1.16979E-04	1.47754E-05
28				8.92446E-05	6.54630E-06	2.50469E-06	5.25501E-06	4.87452E-05
29					4.67759E-05	1.84688E-06	0.0	0.0
30						2.43580E-05	9.47573E-07	0.0
31							1.26247E-05	4.85909E-07
32								6.52118E-06

	GRP. 25	GRP. 26	GRP. 27	GRP. 28	GRP. 29	GRP. 30	GRP. 31	GRP. 32
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	9.30880E-03	1.43829E-01	3.30180E-02	1.35752E-02	9.51355E-03	8.39395E-03	7.79453E-03	7.91976E-03
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1.97350E 01	1.33151E 02	1.73259E 01	5.55687E 00	3.94545E 00	3.54412E 00	3.29060E 00	3.22797E 00
8	1025025	1026026	1027027	1028028	1029029	1030030	1031031	1032032
9	1.47011E 01	9.91375E 01	1.28892E 01	4.13181E 00	2.93192E 00	2.63572E 00	2.44678E 00	2.39983E 00
10	2.18134E 00	5.02461E 00	3.38701E 01	4.40376E 00	1.41148E 00	1.00402E 00	9.00011E-01	8.36026E-01
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	6.60313E-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	2.49075E-07	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	3.36025E-06	1.27640E-07	0.0	0.0	0.0	0.0	0.0	0.0
34		1.72845E-06	6.53969E-08	0.0	0.0	0.0	0.0	0.0
35			8.87961E-07	3.35018E-08	0.0	0.0	0.0	0.0
36				4.55764E-07	1.71607E-08	0.0	0.0	0.0
37					2.33779E-07	8.78960E-09	0.0	0.0
38						1.19858E-07	4.50176E-09	0.0
39							6.14311E-08	2.30558E-09
40								3.14779E-08

	GRP. 33	GRP. 34	GRP. 35	GRP. 36	GRP. 37	GRP. 38	GRP. 39	GRP. 40
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	8.14464E-03	8.42832E-03	8.98881E-03	9.74145E-03	1.07427E-02	1.19363E-02	1.38933E-02	1.63987E-02
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

7	3.19461E 00	3.17291E 00	3.16150E 00	3.15245E 00	3.15048E 00	3.15004E 00	3.15037E 00	3.15124E 00
8	1033033	1034034	1035035	1036036	1037037	1038038	1039039	39040040
9	2.37480E 00	2.35843E 00	2.34952E 00	2.34229E 00	2.34015E 00	2.33894E 00	2.33772E 00	2.33651E 00
10	8.20222E-01	8.11667E-01	8.06048E-01	8.02982E-01	8.00418E-01	7.99581E-01	7.99166E-01	7.98750E-01
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
40	1.18077E-09	0.0	0.0	0.0	0.0	0.0	0.0	
41	1.61268E-08	6.04702E-10	0.0	0.0	0.0	0.0	0.0	
42		8.26107E-09	3.09680E-10	0.0	0.0	0.0	0.0	
43			4.23144E-09	1.58592E-10	0.0	0.0	0.0	
44				2.16727E-09	0.0	0.0	0.0	
45					1.10999E-09	0.0	0.0	
46						5.68474E-10	0.0	
47							2.08238E-10	

	GRP. 41	GRP. 42	GRP. 43	GRP. 44	GRP. 45	GRP. 46	GRP. 47	GRP. 48
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1.93558E-02	2.28463E-02	2.69589E-02	3.18764E-02	3.76817E-02	4.45442E-02	5.26565E-02	6.22462E-02
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	3.15257E 00	3.15444E 00	3.15760E 00	3.17068E 00	3.18517E 00	3.20075E 00	3.21759E 00	3.23594E 00
8	40041041	41042042	42043043	43044044	44045045	45046046	46047047	47048048
9	2.33530E 00	2.33409E 00	2.33366E 00	2.33991E 00	2.34640E 00	2.35290E 00	2.35942E 00	2.36596E 00
0	7.98335E-01	7.97919E-01	7.97508E-01	7.96981E-01	7.98896E-01	8.01098E-01	8.03308E-01	8.05523E-01

	GRP. 49	GRP. 50	GRP. 51	GRP. 52
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	7.35824E-02	8.69812E-02	1.02817E-01	4.12096E-01
6	0.0	0.0	0.0	0.0
7	3.25606E 00	3.27962E 00	3.31466E 00	3.70745E 00
8	48049049	49050050	50051051	51052052
9	2.37254E 00	2.38046E 00	2.39488E 00	3.29536E 00
10	8.07742E-01	8.09942E-01	8.12183E-01	8.16957E-01

MACROSCOPIC PO CROSS SECTIONS FOR MIXTURE 3

“Difference” Matrix

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.54324E-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	-1.57714E-04	-2.35796E-04	-4.93392E-04	-5.36372E-05	-3.54819E-07	3.52418E-07	3.44880E-08	7.12011E-07
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	6.77109E-04	1.04523E-03	7.06577E-03	1.23510E-02	2.85463E-02	3.39689E-02	8.94337E-02	9.17454E-02
8	1001001	1002002	1003003	1004004	1005005	1006006	1007007	1008008
9	2.24274E-03	-8.73506E-04	-1.68937E-03	-1.47533E-03	1.36585E-02	-7.63130E-03	7.41634E-02	-1.80473E-02
10		-9.28700E-04	1.29342E-03	6.90651E-03	1.37207E-02	1.61028E-02	4.57512E-02	2.05553E-02
11			4.83990E-05	6.12557E-04	1.52326E-03	-4.68028E-03	-2.48754E-03	-1.55129E-04
12				-3.34203E-04	6.61016E-05	1.23072E-03	1.97756E-03	1.92630E-03
13					-2.60353E-04	-7.99000E-04	7.02798E-04	3.58039E-03
14						-1.85907E-04	4.07636E-04	-1.68204E-04
15							3.81470E-05	6.90311E-04
16								2.50377E-05

	GRP. 9	GRP. 10	GRP. 11	GRP. 12	GRP. 13	GRP. 14	GRP. 15	GRP. 16
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	4.27128E-06	1.50572E-06	-7.56467E-07	-6.73230E-06	-1.41445E-06	2.09692E-04	4.89278E-04	1.08397E-07
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	2.31910E-01	4.67695E-01	2.91874E-01	1.23870E-01	2.46463E-01	3.37410E-03	7.12872E-03	3.50952E-04
8	1009009	1010010	1011011	1012012	1013013	1014014	1015015	1016016
9	5.57318E-02	6.65028E-01	3.56750E-02	1.11719E-01	2.44569E-01	-1.46542E-02	2.41280E-04	-1.02797E-02
10	7.02484E-02	1.74536E-01	-2.41959E-01	2.58072E-01	1.21576E-02	1.89590E-03	1.78179E-02	6.39880E-03
11	-5.28592E-03	3.87095E-02	-2.88413E-02	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	8.34793E-04	2.47052E-02	4.69245E-02	0.0	0.0	0.0
13	-2.29537E-03	-1.18491E-03	0.0	0.0	5.77464E-03	-3.19716E-04	0.0	0.0
14	-2.56762E-04	1.12565E-03	-2.49341E-03	0.0	0.0	0.0	-3.07836E-04	0.0
15	-8.94435E-04	-3.47972E-04	1.56608E-03	9.40859E-05	0.0	0.0	0.0	-1.08263E-03
16	-2.21256E-04	-1.48501E-04	-4.38109E-04	-6.43589E-04	2.87704E-05	0.0	0.0	0.0
17	3.75025E-05	4.94085E-05	4.83766E-05	-1.32877E-04	-4.93355E-04	-4.27432E-04	0.0	0.0
18		5.53615E-05	4.07510E-05	-1.24574E-05	4.07893E-04	-1.40630E-04	-4.95019E-05	0.0
19			6.25513E-05	1.80001E-05	2.86528E-05	2.32290E-04	1.75629E-04	-6.22154E-05
20				5.84573E-05	1.37310E-05	1.06893E-05	-1.09901E-04	5.91017E-05
21					4.65885E-05	-7.29389E-06	1.31256E-05	-5.06286E-05
22						3.28869E-05	-4.92181E-06	2.15415E-06
23							2.12293E-05	-3.03613E-06
24								1.28420E-05

	GRP. 17	GRP. 18	GRP. 19	GRP. 20	GRP. 21	GRP. 22	GRP. 23	GRP. 24
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	2.52830E-03	1.91457E-05	2.58295E-03	8.48813E-08	3.71598E-07	6.17933E-07	1.38489E-04	1.10949E-04
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	2.05159E 00	1.30310E-02	5.90515E-03	8.74519E-04	2.75040E-03	8.35323E-03	3.39870E-02	2.14787E-01
8	1017017	1018018	1019019	1020020	1021021	1022022	1023023	1024024
9	2.33577E-01	3.80545E-02	-9.23634E-03	-1.87674E-02	-3.04832E-02	-5.46131E-02	-1.11341E-01	-2.70381E-01
10	1.06305E-02	1.81549E 00	-2.50430E-02	1.25578E-02	1.96419E-02	3.32336E-02	6.29654E-02	1.45190E-01
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	-4.63244E-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	-5.89407E-04	-6.15440E-04	0.0	0.0	0.0	0.0	0.0	0.0

17	0.0	0.0	-7.03180E-04	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	-7.25247E-05	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	-1.67444E-05	0.0	0.0	0.0
20	-1.12015E-05	0.0	0.0	0.0	0.0	-8.44057E-07	0.0	0.0
21	1.96235E-04	3.34554E-05	0.0	0.0	0.0	0.0	0.0	0.0
22	-1.11880E-05	2.18963E-05	6.50231E-05	0.0	0.0	0.0	0.0	0.0
23	4.21412E-06	-2.76370E-06	-5.96577E-05	8.63848E-06	0.0	0.0	0.0	0.0
24	-1.34434E-06	9.86867E-07	-5.89578E-06	-6.51490E-05	1.07696E-06	0.0	0.0	0.0
25	7.41170E-06	-4.52710E-07	4.00163E-07	-2.95541E-06	-4.72623E-05	8.37957E-07	0.0	0.0
26		4.13554E-06	-7.35890E-08	9.62609E-08	-5.94868E-07	-2.91813E-05	7.65242E-07	0.0
27			2.25205E-06	1.21017E-08	9.28139E-09	2.65180E-07	-1.80123E-05	6.23612E-07
28				1.20518E-06	1.93613E-08	1.09897E-07	1.77445E-07	-7.53111E-06
29					6.36937E-07	-4.88490E-09	0.0	0.0
30						3.33617E-07	-2.50589E-09	0.0
31							1.73638E-07	-1.28506E-09
32								8.99536E-08

	GRP. 25	GRP. 26	GRP. 27	GRP. 28	GRP. 29	GRP. 30	GRP. 31	GRP. 32
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	3.04390E-03	6.55538E-02	1.11943E-02	4.40437E-04	2.31415E-05	7.64430E-06	2.64496E-06	-2.01166E-07
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	3.73094E 00	5.43429E 01	7.72731E 00	2.10625E-01	8.31985E-03	2.65121E-03	8.73566E-04	4.57764E-05
8	1025025	1026026	1027027	1028028	1029029	1030030	1031031	1032032
9	-5.22103E-01	4.26523E 01	9.33232E 00	4.38319E-01	5.20773E-02	2.90804E-02	8.36849E-03	3.32165E-03
10	4.85056E-01	4.25000E 00	1.16250E 01	-1.61622E 00	-2.28135E-01	-4.37795E-02	-2.64370E-02	-7.49683E-03
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	3.39146E-07	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	-6.58702E-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	4.64488E-08	-3.37536E-10	0.0	0.0	0.0	0.0	0.0	0.0
34		2.39270E-08	-1.72918E-10	0.0	0.0	0.0	0.0	0.0
35			1.23057E-08	-8.85940E-11	0.0	0.0	0.0	0.0
36				6.32082E-09	-4.53859E-11	0.0	0.0	0.0
37					3.24383E-09	-2.32490E-11	0.0	0.0
38						1.66381E-09	-1.19087E-11	0.0
39							8.52992E-10	-6.09668E-12
40								4.37161E-10

	GRP. 33	GRP. 34	GRP. 35	GRP. 36	GRP. 37	GRP. 38	GRP. 39	GRP. 40
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	3.13669E-06	-1.60187E-07	-1.63913E-07	-1.22935E-07	4.84288E-08	4.84288E-08	6.33299E-08	8.19564E-08
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

7	1.31321E-03	1.58978E-03	4.76837E-06	1.24836E-03	3.81470E-06	1.90735E-06	9.53674E-07	3.81470E-06
8	1033033	1034034	1035035	1036036	1037037	1038038	1039039	39040040
9	3.00694E-03	2.44045E-03	8.02994E-04	1.33228E-03	-6.77109E-05	-6.96182E-05	-6.96182E-05	-6.77109E-05
10	-3.27545E-03	-1.69629E-03	-8.51154E-04	-7.98345E-04	-8.38041E-05	7.19428E-05	7.11679E-05	7.07507E-05
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
40	-3.12261E-12	0.0	0.0	0.0	0.0	0.0	0.0	
41	2.24002E-10	-1.59939E-12	0.0	0.0	0.0	0.0	0.0	
42		1.14760E-10	-8.19123E-13	0.0	0.0	0.0	0.0	
43			5.87868E-11	-4.19415E-13	0.0	0.0	0.0	
44				3.01110E-11	0.0	0.0	0.0	
45					1.54217E-11	0.0	0.0	
46						7.89835E-12	0.0	
47							3.99911E-12	

	GRP. 41	GRP. 42	GRP. 43	GRP. 44	GRP. 45	GRP. 46	GRP. 47	GRP. 48
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	9.68575E-08	1.15484E-07	1.81682E-05	2.38046E-06	2.80887E-06	3.31178E-06	3.95253E-06	4.71622E-06
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	3.81470E-06	2.86102E-06	2.00176E-03	4.76837E-06	6.67572E-06	5.72205E-06	8.58307E-06	1.04904E-05
8	40041041	41042042	42043043	43044044	44045045	45046046	46047047	47048048
9	-6.77109E-05	-6.86646E-05	5.71251E-04	-1.37997E-03	-1.38950E-03	-1.40190E-03	-1.41144E-03	-1,42193E-03
10	7.15852E-05	7.15852E-05	7.12872E-05	1.41275E-03	1.38140E-03	1.39296E-03	1.40381E-03	1.41609E-03

	GRP. 49	GRP. 50	GRP. 51	GRP. 52
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	5.54323E-06	8.34465E-06	1.51396E-05	1.57183E-03
6	0.0	0.0	0.0	0.0
7	1.52588E-05	1.93501E-03	3.52859E-05	2.18582E-03
8	48049049	49050050	50051051	51052052
9	-1.43147E-03	-1.04332E-03	-2.76852E-03	6.13213E-04
10	1.42789E-03	1.44082E-03	2.96938E-03	2.78842E-03

```
RRRRRRRRRRR       AAAAAAAA     DDDDDDDDDDD    EEEEEEEEEEEE
RRRRRRRRRRRR     AAAAAAAAAA    DDDDDDDDDDDD   EEEEEEEEEEEE
RR        RR    AA        AA   DD        DD   EE
RR        RR    AA        AA   DD        DD   EE
RR        RR    AA        AA   DD        DD   EE
RRRRRRRRRRRR    AAAAAAAAAAAA   DD        DD   EEEEEEEEE
RRRRRRRRRRR     AAAAAAAAAAAA   DD        DD   EEEEEEEEE
RR    RR        AA        AA   DD        DD   EE
RR     RR       AA        AA   DD        DD   EE
RR      RR      AA        AA   DD        DD   EE
RR       RR     AA        AA   DDDDDDDDDDDD   EEEEEEEEEEEE
RR        RR    AA        AA   DDDDDDDDDDD    EEEEEEEEEEEE


   00000000     555555555555            //       11        6666666666             //   777777777777   555555555555
  0000000000    555555555555           //       111       666666666666           //    777777777777   555555555555
 00        00   55                    //       1111       66                    //     77        77   55
00          00  55                   //          11       66                   //               77    55
00          00  55                  //           11       66                  //               77     55
00          00  55555555555        //            11       66666666666        //               77      55555555555
00          00  555555555555      //             11       666666666666      //                77      555555555555
00          00            55     //              11       66        66     //                77                 55
00          00            55    //               11       66        66    //                 77                 55
 00        00   55        55   //                11       66        66   //                  77       55        55
  0000000000    555555555555  //           11111111       666666666666  //                   77       555555555555
   00000000      5555555555  //            11111111        6666666666  //                    77        5555555555


      11                555555555555   555555555555               2222222222        11
     111                555555555555   555555555555              222222222222      111
    1111                55             55                        22        22     1111
      11                55             55                                  22       11
      11                55             55                                  22       11
      11                55555555555    55555555555                        22        11
      11       .....    555555555555   555555555555     .....            22         11
      11       .....              55             55     .....          22           11
      11       .....              55             55     .....        22             11
      11       .....    55        55   55        55     .....      22               11
    11111111            555555555555   555555555555              222222222222     11111111
    11111111             5555555555     5555555555               222222222222     11111111
```

1$ ARRAY 4 ENTRIES READ

OT

```
CHECKING TOLERANCE= 1.00000E-03 PER CENT

AMPX NUCLIDE      11230 NA-23   INF DIL
     HAS THE FOLLOWING DATA
    0 RESOLVED RESONANCES                          0 UNRESOLVED RESONANCE POINTS
   10 TEMP IND 1-D NEUT PROCESSES                 21 2-D NEUT PROCESSES
    0 TEMP DEP 1-D NEUT PROCESSES                  0 1-D GAMMA PROCESSES
    0 2-D GAMMA PROCESSES                          0 2-D NEUT-TO-GAMMA PROCESSES
    0 FISSION YIELDS                            1156 ENDF MAT OF FAST NEUT DATA
                                                1156 ENDF MAT OF THERMAL NEUT DATA
                                                   0 ENDF MAT OF YIELD DATA
   27 RECORDS FOR NUCLIDE                          0 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D NEUTRON PROCESSES
       1.        2.        4.        16.        27.        101.       102.       103.       107.      1099.

2-D NEUT PROCESSES
       MT     LENGTH      ORDER      TEMPS
 1      2       155          3          0
 2     16        62          0          0
 3     51        51          0          0
 4     52        50          0          0
 5     53        48          0          0
 6     54        46          0          0
 7     55        47          0          0
 8     56        47          0          0
 9     57        45          0          0
10     58        44          0          0
11     59        42          0          0
12     60        40          0          0
13     61        42          0          0
14     62        40          0          0
15     63        42          0          0
16     64        40          0          0
17     65        38          0          0
18     66        30          0          0
19     67        40          0          0
20     68        37          0          0
21     91       111          0          0
MT=    4 GROUP   1 MATRIX SUMS TO   6.959558E-01 AVERAGED VALUE=   6.961095E-01 FRACT DEV=  -2.207423E-04
MT=    4 GROUP   2 MATRIX SUMS TO   8.529740E-01 AVERAGED VALUE=   8.527094E-01 FRACT DEV=   3.103572E-04
MT=    4 GROUP   3 MATRIX SUMS TO   9.065285E-01 AVERAGED VALUE=   9.068110E-01 FRACT DEV=  -3.114941E-04
MT=    4 GROUP   4 MATRIX SUMS TO   8.733417E-01 AVERAGED VALUE=   8.732578E-01 FRACT DEV=   9.610373E-05
MT=    4 GROUP   5 MATRIX SUMS TO   7.716854E-01 AVERAGED VALUE=   7.718745E-01 FRACT DEV=  -2.449437E-04
MT=    4 GROUP   6 MATRIX SUMS TO   6.504395E-01 AVERAGED VALUE=   6.504578E-01 FRACT DEV=  -2.813191E-05

NUCLIDE        11230 HAS BEEN CHECKED

AMPX NUCLIDE      11231 NA-23   1/E-SIGMA TOTAL WEIGHTING
     HAS THE FOLLOWING DATA
    0 RESOLVED RESONANCES                          0 UNRESOLVED RESONANCE POINTS
   10 TEMP IND 1-D NEUT PROCESSES                 21 2-D NEUT PROCESSES
    0 TEMP DEP 1-D NEUT PROCESSES                  0 1-D GAMMA PROCESSES
    0 2-D GAMMA PROCESSES                          0 2-D NEUT-TO-GAMMA PROCESSES
    0 FISSION YIELDS                            1156 ENDF MAT OF FAST NEUT DATA
                                                1156 ENDF MAT OF THERMAL NEUT DATA
                                                   0 ENDF MAT OF YIELD DATA
   27 RECORDS FOR NUCLIDE                          0 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D NEUTRON PROCESSES
       1.        2.        4.        16.        27.        101.       102.       103.       107.      1099.

2-D NEUT PROCESSES
```

	MT	LENGTH	ORDER	TEMPS
1	2	155	3	0
2	16	62	0	0
3	51	51	0	0
4	52	50	0	0
5	53	48	0	0
6	54	46	0	0
7	55	47	0	0
8	56	47	0	0
9	57	45	0	0
10	58	44	0	0
11	59	42	0	0
12	60	40	0	0
13	61	42	0	0
14	62	40	0	0
15	63	42	0	0
16	64	40	0	0
17	65	38	0	0
18	66	30	0	0
19	67	40	0	0
20	68	37	0	0
21	91	111	0	0

```
MT=   4 GROUP    1 MATRIX SUMS TO   6.965587E-01 AVERAGED VALUE=   6.965267E-01 FRACT DEV=  -9.762602E-05
MT=   4 GROUP    2 MATRIX SUMS TO   8.525857E-01 AVERAGED VALUE=   8.525611E-01 FRACT DEV=   2.887384E-05
MT=   4 GROUP    3 MATRIX SUMS TO   9.063352E-01 AVERAGED VALUE=   9.063474E-01 FRACT DEV=  -1.348153E-05
MT=   4 GROUP    4 MATRIX SUMS TO   8.729850E-01 AVERAGED VALUE=   8.730206E-01 FRACT DEV=  -4.075959E-05
MT=   4 GROUP    5 MATRIX SUMS TO   7.687243E-01 AVERAGED VALUE=   7.689409E-01 FRACT DEV=  -2.816904E-04
MT=   4 GROUP    6 MATRIX SUMS TO   6.493129E-01 AVERAGED VALUE=   6.493341E-01 FRACT DEV=  -3.267848E-05
MT=   4 GROUP    9 MATRIX SUMS TO   3.811982E-01 AVERAGED VALUE=   3.811872E-01 FRACT DEV=   2.892766E-05

NUCLIDE       11231 HAS BEEN CHECKED
```

10.4. Problem 4

This problem will produce P_5 cross sections for carbon in a 50 neutron group, 25 gamma group structure. The neutron weighting is 1/E tied to a Maxwellian; the gamma weighting is flat. The RADE module will be run to check the master interfaces written by XLACS, SMUG, LAPHNGAS, and CHOX, though checking the CHOX interface would be sufficient since it is a combination of the other three. The CHOX master coupled library will be fed to MALOCS where it will be reduced to a 5 neutron group, 5 gamma group set, using an input weighting spectrum. This set is then run through NITAWL to make an ANISN binary library. And, for a grand finale, the 50 group XLACS library, which has been carefully preserved during this run, will be fed into the VASELINE module which will make several plots of multigroup versus point data from ENDF/B.

This calculation required 410K bytes of core and 1.30 minutes on the IBM 360/91.

The input data are shown on the next two pages. Following this is an abbreviated and annotated output listing from the run. The VASELINE plots are also shown.

```
   THIS IS THE TOP OF AMPX

 MODULE SMUG      HAS BEEN CALLED

PRODUCE P5 CARBON LIBRARY IN 25 GROUPS
1$$ 25 1 5 T
T    STD 25 USED
10$$ 6 5 40 2 E T

 MODULE SMUG      IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE LAPHNGAS HAS BEEN CALLED

PRODUCE P5 CARBON GAMMA PRODUCTION DATA
1$$ 1 50 25 5 T
T  STD 50 AND 25 USED
14$$ 1274 5 E T

 MODULE LAPHNGAS IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE XLACS     HAS BEEN CALLED

RUN XLACS IN STANDARD
50 GROUP STRUCTURE
FOR ENDF V4(1274)
C A R B O N
--------------------
1$$ 1 1 50 1 0 3$$ F1 T
T   USE STD 50 GROUP STRUCTURE
CARBON V4 (1274)
70$$ 2R1274 0 5 E T
11$$ F0 T

 MODULE XLACS     IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE RADE      HAS BEEN CALLED

1$$ 23 E T

 MODULE RADE      IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE RADE      HAS BEEN CALLED

1$$ 24 E T

 MODULE RADE      IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE RADE      HAS BEEN CALLED

1$$ 26 E T

 MODULE RADE      IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE CHOX      HAS BEEN CALLED

1$$ 1 0 T
2$$ 1274 3$$ 1274 4$$ 6 5$$ 1274 T

 MODULE CHOX      IS FINISHED. USER CODE 0000   SYSTEM CODE 000

 MODULE RADE      HAS BEEN CALLED

1$$ 1 E T
```

```
MODULE RADE     IS FINISHED. USER CODE 0000   SYSTEM CODE 000

MODULE MALOCS   HAS BEEN CALLED

1$$ 50 5 25 5 0 C 2$$ 1 15 T
4$$ 10R1 10R2 10R3 10R4 10R5 5** F1 6$$ 5R1 5R2 5R3 5R4 5R5 7** F1 T

MODULE MALOCS   IS FINISHED. USER CODE 0000   SYSTEM CODE 000

MODULE RADE     HAS BEEN CALLED

1$$ 15 E T

MODULE RADE     IS FINISHED. USER CODE 0000   SYSTEM CODE 000

MODULE NITAWL   HAS BEEN CALLED

0$$ 15 A8 1 16
1$$ 0 1 A5 2 E T
2$$ 1274 T

MODULE NITAWL   IS FINISHED. USER CODE 0000   SYSTEM CODE 000

MODULE VASELINE HAS BEEN CALLED

1$$ 5 0 T
4$$ 23 E
3$$ 1 1 1274 0 1274 T
4$$ 23 E
5** 1+6 1+8
3$$ 2 1 1274 0 1274 T
4$$ 23 E
3$$ 3 4 1274 0 1274 T
4$$ 23 E
3$$ 4 4 1274 0 1274 5** 1+6 1+8 T
4$$ 23 E
3$$ 5 107 1274 0 1274 5** 1+6 1+8 T

MODULE VASELINE IS FINISHED. USER CODE 0000   SYSTEM CODE 000
```

```
 SSSSSSSSSS    MM         MM   UU        UU    GGGGGGGGGG
SSSSSSSSSSSS   MMM       MMM   UU        UU   GGGGGGGGGGGG
SS        SS   MMMM     MMMM   UU        UU   GG        GG
SS             MM MM   MM MM   UU        UU   GG
SS             MM  MM MM  MM   UU        UU   GG
SSSSSSSSSSS    MM   MMM   MM   UU        UU   GG    GGGGGG
 SSSSSSSSSSS   MM    M    MM   UU        UU   GG    GGGGGG
          SS   MM         MM   UU        UU   GG        GG
          SS   MM         MM   UU        UU   GG        GG
SS        SS   MM         MM   UU        UU   GG        GG
SSSSSSSSSSSS   MM         MM   UUUUUUUUUUUU   GGGGGGGGGGGG
 SSSSSSSSSS    MM         MM    UUUUUUUUUU     GGGGGGGGGG



  0000000      555555555555             //       11          6666666666              //   777777777777   555555555555
 000000000     555555555555            //       111         666666666666            //    77777777777    555555555555
00       00    55                     //       1111         66                     //     77        77   55
00       00    55                    //          11         66                    //               77    55
00       00    55                   //           11         66                   //               77     55
00       00    55555555555         //            11         66666666666         //               77      55555555555
00       00    555555555555       //             11         666666666666       //                77      555555555555
00       00              55      //              11         66        66      //                77                 55
00       00              55     //               11         66        66     //                 77                 55
00       00    55        55    //                11         66        66    //                 77        55        55
 000000000     555555555555   //               11111111     666666666666   //                  77        555555555555
  0000000       5555555555    //               11111111      6666666666    //                  77         5555555555



 2222222222      0000000                      2222222222    777777777777                      11                  44
222222222222    000000000                    222222222222   77777777777                      111                 444
22        22   00       00                   22        22   77        77                    1111                4444
          22   00       00                             22            77                       11               44 44
          22   00       00                             22           77                        11              44  44
         22    00       00                            22           77                         11             44   44
       22      00       00      .....               22            77             .....        11            44    44
     22        00       00      .....             22              77             .....        11          44444444444
   22          00       00      .....           22                77             .....        11         444444444444
 22            00       00      .....         22                 77              .....        11                  44
222222222222    000000000                    222222222222        77                         11111111              44
222222222222     0000000                     222222222222        77                         11111111              44
```

PRODUCE P5 CARBON LIBRARY IN 25 GROUPS

LANO	NUCLIDE ATOMIC NUMBER	6
LEMNO	ENDF/B MATERIAL NUMBER	6
LPUN	0/1 NO EFFECT/PUNCH X-SECTS	-1
LORDER	ORDER PL TO BE PRINTED	5

PHOTON INTERACTION CROSS SECTIONS

GROUP	GROUP LIMITS (MEV)		SIG ABS	SIG PE	SIG PP	ENERGY DEP
1	1.01970E 01	1.30000E 01	9.24969E-02	6.87641E-07	9.24962E-02	3.18662E 00
2	7.99830E 00	1.01970E 01	7.63187E-02	8.96387E-07	7.63178E-02	2.63488E 00
3	6.27370E 00	7.99830E 00	5.97475E-02	1.18499E-06	5.97463E-02	2.19496E 00
4	4.92100E 00	6.27370E 00	4.68656E-02	1.56676E-06	4.68641E-02	1.85899E 00
5	3.85990E 00	4.92100E 00	3.50633E-02	2.10780E-06	3.50612E-02	1.58268E 00
6	3.02770E 00	3.85990E 00	2.38036E-02	2.87361E-06	2.38007E-02	1.34811E 00
7	2.37480E 00	3.02770E 00	1.43041E-02	3.98947E-06	1.43001E-02	1.14809E 00
8	1.86280E 00	2.37480E 00	7.45894E-03	5.67240E-06	7.45327E-03	9.75121E-01
9	1.46110E 00	1.86280E 00	2.70713E-03	8.51626E-06	2.69862E-03	8.22621E-01
10	1.14610E 00	1.46110E 00	2.29864E-04	1.30219E-05	2.16842E-04	6.87340E-01
11	8.98960E-01	1.14610E 00	2.22011E-05	2.03291E-05	1.87199E-06	5.67244E-01
12	7.05130E-01	8.98960E-01	3.70126E-05	3.70126E-05	0.0	4.61409E-01
13	5.53090E-01	7.05130E-01	7.08279E-05	7.08279E-05	0.0	3.69828E-01
14	4.33830E-01	5.53090E-01	1.38707E-04	1.38707E-04	0.0	2.92045E-01
15	3.40290E-01	4.33830E-01	2.77927E-04	2.77927E-04	0.0	2.27162E-01
16	2.66920E-01	3.40290E-01	5.67932E-04	5.67932E-04	0.0	1.73961E-01
17	2.09370E-01	2.66920E-01	1.18426E-03	1.18426E-03	0.0	1.31095E-01
18	1.64220E-01	2.09370E-01	2.49695E-03	2.49695E-03	0.0	9.71981E-02
19	1.28810E-01	1.64220E-01	5.35921E-03	5.35921E-03	0.0	7.09970E-02
20	1.01040E-01	1.28810E-01	1.16559E-02	1.16559E-02	0.0	5.13428E-02
21	7.92519E-02	1.01040E-01	2.55567E-02	2.55567E-02	0.0	3.72360E-02
22	6.21640E-02	7.92519E-02	5.67077E-02	5.67077E-02	0.0	2.79617E-02
23	4.87600E-02	6.21640E-02	1.26615E-01	1.26615E-01	0.0	2.31578E-02
24	3.82470E-02	4.87600E-02	2.84504E-01	2.84504E-01	0.0	2.30359E-02
25	3.00000E-02	3.82470E-02	6.41841E-01	6.41841E-01	0.0	2.87928E-02

GROUP DOSE FACTORS

UNITS
HENDERSON--RADS/HR PER PHOTONS/CM**2/SEC
SILICON --RADS/SEC PER PHOTONS/CM**2/SEC
HCC/DKT --RADS/HR PER PHOTONS/CM**2/SEC

	HENDERSON	SILICON	HCC/DKT
1	1.1206E-05	3.7282E-09	1.0664E-05
2	8.9861E-06	2.9740E-09	8.8111E-06
3	7.2096E-06	2.3724E-09	7.3601E-06
4	6.0427E-06	1.8924E-09	6.2227E-06
5	5.1031E-06	1.5096E-09	5.2981E-06
6	4.2517E-06	1.2042E-09	4.5280E-06
7	3.5873E-06	9.6565E-10	3.8765E-06
8	2.9919E-06	7.8788E-10	3.3176E-06
9	2.5187E-06	6.4362E-10	2.8240E-06
10	2.1000E-06	5.2577E-10	2.3791E-06
11	1.7274E-06	4.2950E-10	1.9924E-06
12	1.4059E-06	3.5086E-10	1.6617E-06
13	1.1458E-06	2.8661E-10	1.3884E-06
14	9.1297E-07	2.3413E-10	1.1921E-06
15	7.1438E-07	1.9011E-10	9.1886E-07
16	5.5548E-07	1.5030E-10	7.3379E-07
17	4.2395E-07	1.1847E-10	6.1605E-07
18	3.2086E-07	9.3383E-11	5.2255E-07
19	2.3976E-07	7.7050E-11	4.3403E-07
20	1.7735E-07	7.3687E-11	3.2904E-07
21	1.3780E-07	7.8539E-11	2.7192E-07
22	1.2468E-07	1.0187E-10	2.6023E-07
23	1.3085E-07	1.4983E-10	2.7823E-07
24	1.7230E-07	2.3092E-10	3.4543E-07
25	2.6430E-07	3.7930E-10	4.6869E-07

LAPHNGAS

05/16/75

20:28:11

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LAPHNGAS

PRODUCE P5 CARBON GAMMA PRODUCTION DATA

    1$ ARRAY       4 ENTRIES READ

     T

INTEGER PARAMETERS (1$ AND 2$ ARRAYS)
MCR     NUMBER OF NUCLIDES                                 1
NFG     NO. NEUT FINE GPS.                                50
NGG     NO. GAMMA GPS.                                    25
IM      NON RES WT. FUNCTION 1/2/3/4/5/6 -
        1.0/(1/E)/(1/E-FISS)/EXACT (1/E)/
        (1/E*SIG-1)/ARBITRARY/                             5
LCSM    NO. INTERPOLATION REGIONS                          0
MCSM    NO. PTS. IN ARB. WT. FCTN.                         0
IZM     0/1 CAL SGRPXS/CAL SGREPXS                         0
MS      0/1 NO EFF/MAXWELLIAN THERMAL DIST                 1
MM      NO. REACTION TYPES                                 1
IWD     1/2/3 MIDPOINT/YIELD FCT/E(BAR) INPUT              1
IOO     0/1 PRINT (Y OR SIG)/DO NOT PRINT                  0
IAM     0/1 NO EFFECT/PUNCH SGRP DATA                      0
ICK     0/1 NO EFFECT/DETAIL CK.                          -9
NNBDGP  0/N NO EFFECT/COLLAPSE TO N BROAD GPS.             0

A STANDARD  50 NEUTRON GROUP STRUCTURE HAS BEEN INSERTED FOR YOU AND WILL BE USED UNLESS YOU OVERRIDE IT
A STANDARD  25 GAMMA GROUP STRUCTURE HAS BEEN INSERTED FOR YOU AND WILL BE USED UNLESS YOU OVERRIDE IT

     T

MEAN TEMPERATURE OF MAXWELLIAN DISTRIBUTION (DEG K)    2.93600E 02

UPPER ENERGY FOR THERMAL (N,G) CORRECTION (EV)    1.26390E-01

NON 1/V FACTOR    1.00000E 00
```

GAMMA-RAY AND NEUTRON ENERGY MESHES (EV)

	GAMMA EFF. AVG. ENERGY	GAMMA MESH	NEUTRON FINE GP
1	1.15985E 07	1.30000E 07	1.49183E 07
2	9.09765E 06	1.01970E 07	1.22140E 07
3	7.13600E 06	7.99830E 06	1.00000E 07
4	5.59735E 06	6.27370E 06	8.18731E 06
5	4.39045E 06	4.92100E 06	6.70320E 06
6	3.44380E 06	3.85990E 06	5.48812E 06
7	2.70125E 06	3.02770E 06	4.49329E 06
8	2.11880E 06	2.37480E 06	3.67880E 06
9	1.66195E 06	1.86280E 06	3.01195E 06
10	1.30360E 06	1.46110E 06	2.46597E 06
11	1.02253E 06	1.14610E 06	2.01897E 06
12	8.02045E 05	8.98960E 05	1.65299E 06
13	6.29110E 05	7.05130E 05	1.35336E 06
14	4.93460E 05	5.53090E 05	1.10803E 06
15	3.87060E 05	4.33830E 05	9.07182E 05
16	3.03605E 05	3.40290E 05	7.42738E 05
17	2.38145E 05	2.66920E 05	6.08102E 05
18	1.86795E 05	2.09370E 05	4.97872E 05
19	1.46515E 05	1.64220E 05	4.07623E 05
20	1.14925E 05	1.28810E 05	3.33733E 05
21	9.01459E 04	1.01040E 05	2.73238E 05
22	7.07079E 04	7.92519E 04	2.23708E 05
23	5.54620E 04	6.21640E 04	1.83157E 05
24	4.35035E 04	4.87600E 04	1.49956E 05
25	3.41235E 04	3.82470E 04	1.22774E 05
26		3.00000E 04	8.65171E 04
27			5.24753E 04
28			4.08678E 04
29			3.18279E 04
30			2.47876E 04
31			1.93046E 04
32			1.50344E 04
33			7.10176E 03
34			4.30743E 03
35			3.35464E 03
36			2.61259E 03
37			2.03469E 03
38			1.58462E 03
39			1.23410E 03
40			9.61119E 02
41			4.54000E 02
42			2.14455E 02
43			1.01301E 02
44			4.78513E 01
45			2.26033E 01
46			1.06771E 01
47			5.04349E 00
48			2.38238E 00
49			1.12535E 00
50			4.14000E-01
51			1.00000E-05

14$ ARRAY 6 ENTRIES READ

T

```
MATERIAL                                                  1274
IQA     ORDER P(N)                                           5
NDFB    LOG. UNIT FOR ENDF DATA                             11
MODE    1/2 ENDF BINARY/BCD                                  1
REACTION TYPES
  -1
IN PHOTON AFTER IMATL    6.0120E 03    1.1897E 01        0        0        0       29     1274        1      451
   UNDER THE OPTION PROVIDED WHEN INPUT MT#-1 IS USED, THERE WILL BE    2 REACTION TYPES USED AS FOLLOWS -
    MTNO%I<# 102  51
FILE  3      6.0120E 03      1.1897E 01        0       99        0        0     1274        3        1
FILE 12      6.0120E 03      1.1897E 01        1        0        3        0     1274       12      102
FILE 13      6.0120E 03      1.1897E 01        0        0        1        0     1274       13       51
FILE 14      6.0120E 03      1.1897E 01        0        1        1        0     1274       14       51
READ/COPY ENDF/B MASTER LIBRARY COMPLETE FILES PROC.     3     12     13     14

FOR MAT  1274 THE FOLLOWING MT NO.S HAD ANISOTROPIC FILE 14 DATA
    51
   648 POINT NEUTRON ENERGIES PROCESSED
MATT       0       19********     648      401        5        0        0        0    36432    43481    65000      648        2
PSO     50      49  1.2639E-01   4.9000E 01  1.0000E-05  2.9360E 02  1.9617E 03
SPOT 3         5         25         50         57          1      36428      39391
```

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          **********          ***********

THE PHOTON PRODUCTION MATRIX, MATERIAL  1274 REACTION TYPE   1 P  0 COMPONENT

 G GP    N GP  1      N GP  2      N GP  3      N GP  4      N GP  5      N GP  6      N GP  7      N GP  8
    1  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP    2 THRU G GP    4 SAME AS ABOVE
    5  2.47352E-01  3.57937E-01  2.85163E-01  2.38131E-01  2.09099E-01  4.61654E-02  0.0          0.0
    6  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP    7 THRU G GP   25 SAME AS ABOVE

 G GP    N GP  9      N GP 10      N GP 11      N GP 12      N GP 13      N GP 14      N GP 15      N GP 16
    1  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP    2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 17      N GP 18      N GP 19      N GP 20      N GP 21      N GP 22      N GP 23      N GP 24
    1  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP    2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 25      N GP 26      N GP 27      N GP 28      N GP 29      N GP 30      N GP 31      N GP 32
    1  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP    2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 33      N GP 34      N GP 35      N GP 36      N GP 37      N GP 38      N GP 39      N GP 40
    1  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP    2 THRU G GP    3 SAME AS ABOVE
    4  0.0          7.95623E-07  2.68803E-06  4.25177E-06  5.97974E-06  8.06830E-06  8.32552E-06  7.08662E-07
    5  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
    6  0.0          3.74410E-07  1.26495E-06  2.00083E-06  2.81399E-06  3.79685E-06  3.91789E-06  3.33488E-07
    7  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP    8 THRU G GP    9 SAME AS ABOVE
   10  0.0          3.74410E-07  1.26495E-06  2.00083E-06  2.81399E-06  3.79685E-06  3.91789E-06  3.33488E-07
   11  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP   12 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 41      N GP 42      N GP 43      N GP 44      N GP 45      N GP 46      N GP 47      N GP 48
    1  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP    2 THRU G GP    3 SAME AS ABOVE
    4  1.00000E-06  2.64198E-06  7.86689E-06  2.32527E-05  7.02822E-05  8.02434E-06  8.94713E-06  2.28019E-05
    5  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
    6  4.70589E-07  1.24328E-06  3.70207E-06  1.09425E-05  3.30739E-05  3.77616E-06  4.21042E-06  1.07303E-05
    7  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP    8 THRU G GP    9 SAME AS ABOVE
   10  4.70589E-07  1.24328E-06  3.70207E-06  1.09425E-05  3.30739E-05  3.77616E-06  4.21042E-06  1.07303E-05
   11  0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
       G GP   12 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 49      N GP 50
    1  0.0          0.0
       G GP    2 THRU G GP    3 SAME AS ABOVE
    4  8.84448E-05  1.55527E-03
    5  0.0          0.0
    6  4.16211E-05  7.31891E-04
    7  0.0          0.0
       G GP    8 THRU G GP    9 SAME AS ABOVE
   10  4.16211E-05  7.31891E-04
   11  0.0          0.0
       G GP   12 THRU G GP   25 SAME AS ABOVE

THE PHOTON PRODUCTION MATRIX, MATERIAL  1274 REACTION TYPE   1 P  1 COMPONENT
           ALL ZERO

THE PHOTON PRODUCTION MATRIX, MATERIAL  1274 REACTION TYPE   1 P  2 COMPONENT
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```
 G GP    N GP  1       N GP  2       N GP  3       N GP  4       N GP  5       N GP  6       N GP  7       N GP  8
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP    4 SAME AS ABOVE
    5  3.11801E-01  4.53837E-01  1.42400E-01  2.12786E-02  4.86028E-02  3.99336E-02  0.0           0.0
    6  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     7 THRU G GP   25 SAME AS ABOVE

 G GP    N GP  9       N GP 10       N GP 11       N GP 12       N GP 13       N GP 14       N GP 15       N GP 16
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 17       N GP 18       N GP 19       N GP 20       N GP 21       N GP 22       N GP 23       N GP 24
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 25       N GP 26       N GP 27       N GP 28       N GP 29       N GP 30       N GP 31       N GP 32
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 33       N GP 34       N GP 35       N GP 36       N GP 37       N GP 38       N GP 39       N GP 40
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 41       N GP 42       N GP 43       N GP 44       N GP 45       N GP 46       N GP 47       N GP 48
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 49       N GP 50
    1  0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

THE PHOTON PRODUCTION MATRIX, MATERIAL  1274 REACTION TYPE   1 P  3 COMPONENT
           ALL ZERO

THE PHOTON PRODUCTION MATRIX, MATERIAL  1274 REACTION TYPE   1 P  4 COMPONENT

 G GP    N GP  1       N GP  2       N GP  3       N GP  4       N GP  5       N GP  6       N GP  7       N GP  8
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP    4 SAME AS ABOVE
    5  1.01033E-01  1.21546E-01 -7.58730E-02 -4.89005E-02 -1.05195E-01 -2.48317E-02  0.0           0.0
    6  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     7 THRU G GP   25 SAME AS ABOVE

 G GP    N GP  9       N GP 10       N GP 11       N GP 12       N GP 13       N GP 14       N GP 15       N GP 16
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 17       N GP 18       N GP 19       N GP 20       N GP 21       N GP 22       N GP 23       N GP 24
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 25       N GP 26       N GP 27       N GP 28       N GP 29       N GP 30       N GP 31       N GP 32
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 33       N GP 34       N GP 35       N GP 36       N GP 37       N GP 38       N GP 39       N GP 40
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 41       N GP 42       N GP 43       N GP 44       N GP 45       N GP 46       N GP 47       N GP 48
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       G GP     2 THRU G GP   25 SAME AS ABOVE

 G GP    N GP 49       N GP 50
    1  0.0           0.0
```

```
XX         XX   LL             AAAAAAAAA     CCCCCCCCCCC     SSSSSSSSSSS
 XX       XX    LL            AAAAAAAAAAA   CCCCCCCCCCCCC   SSSSSSSSSSSSS
  XX     XX     LL           AA         AA  CC         CC   SS         SS
   XX   XX      LL           AA         AA  CC              SS
    XX XX       LL           AA         AA  CC              SS
     XXX        LL           AAAAAAAAAAAAA  CC              SSSSSSSSSSSS
     XXX        LL           AAAAAAAAAAAAA  CC               SSSSSSSSSSSS
    XX XX       LL           AA         AA  CC                         SS
   XX   XX      LL           AA         AA  CC                         SS
  XX     XX     LL           AA         AA  CC         CC   SS         SS
 XX       XX    LLLLLLLLLLLLL AA         AA  CCCCCCCCCCCCC   SSSSSSSSSSSSS
XX         XX   LLLLLLLLLLLLL AA         AA   CCCCCCCCCCC     SSSSSSSSSSS


   0000000    5555555555555            //      11      66666666666            //  7777777777777  5555555555555
  000000000   5555555555555           //      111     6666666666666          //   777777777777   5555555555555
 00       00  55                     //      1111     66                    //    77        77   55
00         00 55                    //         11     66                   //             77     55
00         00 55                   //          11     66                  //             77      55
00         00 555555555555        //           11     666666666666       //             77       555555555555
00         00 5555555555555      //            11     6666666666666     //             77        5555555555555
00         00            55     //             11     66         66    //             77                    55
00         00            55    //              11     66         66   //             77                     55
 00       00  55         55   //               11     66         66  //             77         55          55
  000000000   5555555555555  //            11111111   6666666666666 //              77         5555555555555
   0000000     55555555555  //             11111111    66666666666 //               77          55555555555


 22222222222     0000000              33333333333    0000000              33333333333    22222222222
2222222222222   000000000            3333333333333  000000000            3333333333333  2222222222222
22         22  00       00           33         33  00       00          33         33  22         22
           22  00       00                      33  00       00                     33             22
           22  00       00                      33  00       00                     33             22
          22   00       00                     333  00       00                    333            22
        22     00       00   .....             333  00       00   .....            333          22
      22       00       00   .....              33  00       00   .....             33        22
    22         00       00   .....              33  00       00   .....             33      22
  22           00       00   .....  33         33   00       00   .....  33        33    22
2222222222222   000000000            3333333333333  000000000            3333333333333  2222222222222
2222222222222    0000000              33333333333    0000000              33333333333   2222222222222
```

1$ ARRAY 5 ENTRIES READ

3$ ARRAY 6 ENTRIES READ

0T

A STANDARD 50 NEUTRCN GROUP STRUCTURE HAS BEEN INSERTED FOR YOU AND WILL BE USED UNLESS YOU OVERRIDE IT

0T

AN XSDRN TAPE WILL BE WRITTEN WITH THE AUSPICIOUS TITLE

****
RUN XLACS IN STANDARD
50 GROUP STRUCTURE
FOR ENDF V4(1274)
C A R B O N

XSDRN TAPE IDENTIFICATION	1	TRANSFER INTEGRATION MESH-SRCE	0
NUMBER OF NUCLIDES	1	TRANSFER INTEGRATION MESH-SINK	0
NUMBER OF ENERGY GROUPS	50	ENDF TAPE IDENTIFICATION	0
NUMBER OF THERMAL GROUPS	1	ENDF TAPE MODE (FAST DATA)	0
WEIGHTING OPTION	0	PEAK TEMPERATURE (MAXWELLIAN)	0

OUTPUT LISTING OPTIONS

RESONANCE DATA	1
1-DIMENSIONAL ARRAYS	1
ELASTIC SCATTERING	1
THERMAL SCATTERING	1
INELASTIC SCATTERING	1
N2N TRANSFERS	1

MULTIGROUP STRUCTURE

GROUP	ENERGY RANGE	LETHARGY RANGE	GROUP	ENERGY RANGE	LETHARGY RANGE
1	1.2214E 07 - 1.4918E 07	-0.400 - -0.200	26	5.2475E 04 - 8.6517E 04	4.750 - 5.250
2	1.0000E 07 - 1.2214E 07	-0.200 - 0.0	27	4.0868E 04 - 5.2475E 04	5.250 - 5.500
3	8.1873E 06 - 1.0000E 07	0.0 - 0.200	28	3.1828E 04 - 4.0868E 04	5.500 - 5.750
4	6.7032E 06 - 8.1873E 06	0.200 - 0.400	29	2.4788E 04 - 3.1828E 04	5.750 - 6.000
5	5.4881E 06 - 6.7032E 06	0.400 - 0.600	30	1.9305E 04 - 2.4788E 04	6.000 - 6.250
6	4.4933E 06 - 5.4881E 06	0.600 - 0.800	31	1.5034E 04 - 1.9305E 04	6.250 - 6.500
7	3.6788E 06 - 4.4933E 06	0.800 - 1.000	32	7.1018E 03 - 1.5034E 04	6.500 - 7.250
8	3.0119E 06 - 3.6788E 06	1.000 - 1.200	33	4.3074E 03 - 7.1018E 03	7.250 - 7.750
9	2.4660E 06 - 3.0119E 06	1.200 - 1.400	34	3.3546E 03 - 4.3074E 03	7.750 - 8.000
10	2.0190E 06 - 2.4660E 06	1.400 - 1.600	35	2.6126E 03 - 3.3546E 03	8.000 - 8.250
11	1.6530E 06 - 2.0190E 06	1.600 - 1.800	36	2.0347E 03 - 2.6126E 03	8.250 - 8.500
12	1.3534E 06 - 1.6530E 06	1.800 - 2.000	37	1.5846E 03 - 2.0347E 03	8.500 - 8.750
13	1.1080E 06 - 1.3534E 06	2.000 - 2.200	38	1.2341E 03 - 1.5846E 03	8.750 - 9.000
14	9.0718E 05 - 1.1080E 06	2.200 - 2.400	39	9.6112E 02 - 1.2341E 03	9.000 - 9.250
15	7.4274E 05 - 9.0718E 05	2.400 - 2.600	40	4.5400E 02 - 9.6112E 02	9.250 - 10.000
16	6.0810E 05 - 7.4274E 05	2.600 - 2.800	41	2.1445E 02 - 4.5400E 02	10.000 - 10.750
17	4.9787E 05 - 6.0810E 05	2.800 - 3.000	42	1.0130E 02 - 2.1445E 02	10.750 - 11.500
18	4.0762E 05 - 4.9787E 05	3.000 - 3.200	43	4.7851E 01 - 1.0130E 02	11.500 - 12.250
19	3.3373E 05 - 4.0762E 05	3.200 - 3.400	44	2.2603E 01 - 4.7851E 01	12.250 - 13.000
20	2.7324E 05 - 3.3373E 05	3.400 - 3.600	45	1.0677E 01 - 2.2603E 01	13.000 - 13.750
21	2.2371E 05 - 2.7324E 05	3.600 - 3.800	46	5.0435E 00 - 1.0677E 01	13.750 - 14.500
22	1.8316E 05 - 2.2371E 05	3.800 - 4.000	47	2.3824E 00 - 5.0435E 00	14.500 - 15.250
23	1.4996E 05 - 1.8316E 05	4.000 - 4.200	48	1.1254E 00 - 2.3824E 00	15.250 - 16.000
24	1.2277E 05 - 1.4996E 05	4.200 - 4.400	49	4.1400E-01 - 1.1254E 00	16.000 - 17.000
25	8.6517E 04 - 1.2277E 05	4.400 - 4.750	50	1.0000E-05 - 4.1400E-01	17.000 - 27.631

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**********************************************************************************************************************************
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     COMMENCE PROCESSING DATA FOR
 CARBON V4 (1274)

 70$ ARRAY      9 ENTRIES READ

 0T

 XSDRN IDENTIFIER                      1274     ENDF TAPE MODE (THERMAL DATA)            0
 ENDF/B MATERIAL ID (FAST DATA)        1274     ENDF/B MATERIAL ID (THERMAL DATA)     1274
 NUMBER OF THERMAL TEMPERATURES           0     NUMBER OF ATOMS/MOLECULES                0
 ORDER OF FAST EXP COEFF                  5     LOGICAL UNIT (THERMAL DATA)             11
 ORDER OF THERMAL EXP COEFF               0

                                         .
                                         .
                                         .
                                         .

NO FILE 5 DATA FOR MATERIAL 1274 REACTION  17---TAPE SEARCHED TO MAT=1274 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1274 REACTION  18---TAPE SEARCHED TO MAT=1274 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1274 REACTION  22---TAPE SEARCHED TO MAT=1274 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1274 REACTION  23---TAPE SEARCHED TO MAT=1274 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1274 REACTION  24---TAPE SEARCHED TO MAT=1274 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1274 REACTION  25---TAPE SEARCHED TO MAT=1274 MF= 5 MT=  91
NO FILE 5 DATA FOR MATERIAL 1274 REACTION  28---TAPE SEARCHED TO MAT=1274 MF= 5 MT=  91

  ELAPSED TIME   0.49 MIN.

  ELAPSED TIME   0.49 MIN.

  ELAPSED TIME   0.49 MIN.
```

ONE DIMENSION AVERAGES FOR CARBON V4 (1274) IDENTIFIER 1274

XSEC ID GRP.	1	2	4	27	101	102	107	1099
1	1.32327E 00	7.78293E-01	4.56947E-01	8.80274E-02	8.80274E-02	0.0	8.80274E-02	2.00000E-01
2	1.30337E 00	7.57501E-01	4.43883E-01	1.01986E-01	1.01986E-01	0.0	1.01986E-01	2.00000E-01
3	1.19081E 00	7.18735E-01	3.01935E-01	1.70141E-01	1.70141E-01	0.0	1.70141E-01	2.00000E-01
4	1.42010E 00	1.08293E 00	2.80381E-01	5.67829E-02	5.67829E-02	0.0	5.67829E-02	2.00000E-01
5	1.16085E 00	9.46433E-01	2.14130E-01	2.86575E-04	2.86575E-04	0.0	2.86575E-04	2.00000E-01
6	1.30794E 00	1.26421E 00	4.37248E-02	0.0	0.0	0.0	0.0	1.99999E-01
7	2.05248E 00	2.05248E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
8	2.18619E 00	2.18619E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
9	1.92901E 00	1.92901E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
10	1.74642E 00	1.74642E 00	0.0	0.0	0.0	0.0	0.0	1.99999E-01
11	1.78814E 00	1.78814E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
12	2.03661E 00	2.03661E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
13	2.29018E 00	2.29018E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
14	2.55424E 00	2.55424E 00	0.0	0.0	0.0	0.0	0.0	1.99999E-01
15	2.80597E 00	2.80597E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
16	3.05294E 00	3.05294E 00	0.0	0.0	0.0	0.0	0.0	2.00001E-01
17	3.26995E 00	3.26995E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
18	3.47541E 00	3.47541E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
19	3.65807E 00	3.65807E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
20	3.82149E 00	3.82149E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
21	3.96447E 00	3.96447E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
22	4.08771E 00	4.08771E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
23	4.19283E 00	4.19283E 00	0.0	0.0	0.0	0.0	0.0	2.00000E-01
24	4.28179E 00	4.28179E 00	0.0	0.0	0.0	0.0	0.0	2.00001E-01
25	4.38274E 00	4.38274E 00	0.0	0.0	0.0	0.0	0.0	3.50000E-01
26	4.49777E 00	4.49777E 00	0.0	0.0	0.0	0.0	0.0	4.99999E-01
27	4.56999E 00	4.56999E 00	0.0	0.0	0.0	0.0	0.0	2.50000E-01
28	4.60517E 00	4.60517E 00	0.0	0.0	0.0	0.0	0.0	2.49999E-01
29	4.63225E 00	4.63225E 00	0.0	0.0	0.0	0.0	0.0	2.50000E-01
30	4.65308E 00	4.65308E 00	0.0	0.0	0.0	0.0	0.0	2.50000E-01
31	4.66948E 00	4.66948E 00	0.0	0.0	0.0	0.0	0.0	2.50000E-01
32	4.69028E 00	4.69028E 00	0.0	0.0	0.0	0.0	0.0	7.50000E-01
33	4.70822E 00	4.70822E 00	0.0	0.0	0.0	0.0	0.0	5.00000E-01
34	4.71437E 00	4.71437E 00	0.0	1.33300E-06	1.33300E-06	1.33300E-06	0.0	2.49999E-01
35	4.71726E 00	4.71726E 00	0.0	5.88285E-06	5.88285E-06	5.88285E-06	0.0	2.50000E-01
36	4.71951E 00	4.71950E 00	0.0	9.61968E-06	9.61968E-06	9.61968E-06	0.0	2.50000E-01
37	4.72126E 00	4.72125E 00	0.0	1.25465E-05	1.25465E-05	1.25465E-05	0.0	2.50000E-01
38	4.72263E 00	4.72261E 00	0.0	1.48024E-05	1.48024E-05	1.48024E-05	0.0	2.50000E-01
39	4.72371E 00	4.72370E 00	0.0	1.65805E-05	1.65805E-05	1.65805E-05	0.0	2.50000E-01
40	4.72550E 00	4.72548E 00	0.0	2.11656E-05	2.11656E-05	2.11656E-05	0.0	7.50000E-01
41	4.72740E 00	4.72736E 00	0.0	3.07958E-05	3.07958E-05	3.07958E-05	0.0	7.50000E-01
42	4.72830E 00	4.72826E 00	0.0	4.48076E-05	4.48076E-05	4.48076E-05	0.0	7.49999E-01
43	4.72874E 00	4.72868E 00	0.0	6.51947E-05	6.51947E-05	6.51947E-05	0.0	7.50000E-01
44	4.72897E 00	4.72888E 00	0.0	9.48577E-05	9.48577E-05	9.48577E-05	0.0	7.50000E-01
45	4.72910E 00	4.72897E 00	0.0	1.38017E-04	1.38017E-04	1.38017E-04	0.0	7.49999E-01
46	4.72920E 00	4.72900E 00	0.0	2.00814E-04	2.00814E-04	2.00814E-04	0.0	7.49999E-01
47	4.72930E 00	4.72900E 00	0.0	2.92182E-04	2.92182E-04	2.92182E-04	0.0	7.50000E-01
48	4.72943E 00	4.72900E 00	0.0	4.25122E-04	4.25122E-04	4.25122E-04	0.0	7.50000E-01
49	4.72966E 00	4.72900E 00	0.0	6.61438E-04	6.61438E-04	6.61438E-04	0.0	9.99986E-01
50	4.73152E 00	4.72882E 00	0.0	2.70634E-03	2.70634E-03	2.70634E-03	0.0	6.85856E 00

```
RRRRRRRRRRR      AAAAAAAA     DDDDDDDDDDD    EEEEEEEEEEEE
RRRRRRRRRRRR    AAAAAAAAAA    DDDDDDDDDDDD   EEEEEEEEEEEE
RR        RR   AA        AA   DD        DD   EE
RR        RR   AA        AA   DD        DD   EE
RR        RR   AA        AA   DD        DD   EE
RRRRRRRRRRRR   AAAAAAAAAAAA   DD        DD   EEEEEEEEE
RRRRRRRRRRR    AAAAAAAAAAAA   DD        DD   EEEEEEEEE
RR    RR       AA        AA   DD        DD   EE
RR     RR      AA        AA   DD        DD   EE
RR      RR     AA        AA   DD        DD   EE
RR       RR    AA        AA   DDDDDDDDDDDD   EEEEEEEEEEEE
RR        RR   AA        AA   DDDDDDDDDDD    EEEEEEEEEEEE
```

```
   000000      555555555555             //        11         6666666666              //   777777777777   555555555555
  00000000     555555555555            //        111        666666666666            //    777777777777   555555555555
 00      00    55                     //        1111        66                     //     77        77   55
00        00   55                    //           11        66                    //              77     55
00        00   55                   //            11        66                   //              77      55
00        00   55555555555         //             11        66666666666         //              77       55555555555
00        00   555555555555       //              11        666666666666       //               77       555555555555
00        00             55      //               11        66        66      //               77                        55
00        00             55     //                11        66        66     //                77                        55
 00      00    55        55    //                 11        66        66    //                 77        55        55
  00000000     555555555555   //               11111111     666666666666   //                  77        555555555555
   000000       5555555555    //               11111111      6666666666    //                  77         5555555555
```

```
 2222222222       000000                      3333333333     3333333333                      000000              44
222222222222     00000000                    333333333333   333333333333                    00000000            444
22        22    00      00                   33        33   33        33                   00      00          4444
          22   00        00                            33             33                  00        00        44 44
          22   00        00                            33             33                  00        00       44  44
         22    00        00                          333            333                   00        00      44   44
       22      00        00      .....               333            333       .....       00        00     44    44
     22        00        00      .....                 33             33      .....       00        00   44444444444
   22          00        00      .....                 33             33      .....       00        00   444444444444
 22             00      00       .....       33        33   33        33      .....        00      00            44
222222222222     00000000                    333333333333   333333333333                    00000000             44
222222222222      000000                      3333333333     3333333333                      000000              44
```

1$ ARRAY 4 ENTRIES READ

OT

```
 CHECKING TOLERANCE= 1.00000E-03 PER CENT

AMPX NUCLIDE       1274 CARBON V4 (1274)
     HAS THE FOLLOWING DATA
    0 RESOLVED RESONANCES                           0 UNRESOLVED RESONANCE POINTS
    8 TEMP IND 1-D NEUT PROCESSES                   3 2-D NEUT PROCESSES
    0 TEMP DEP 1-D NEUT PROCESSES                   0 1-D GAMMA PROCESSES
    0 2-D GAMMA PROCESSES                           0 2-D NEUT-TO-GAMMA PROCESSES
    0 FISSION YIELDS                             1274 ENDF MAT OF FAST NEUT DATA
                                                 1274 ENDF MAT OF THERMAL NEUT DATA
                                                    0 ENDF MAT OF YIELD DATA
   11 RECORDS FOR NUCLIDE                           0 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D NEUTRON PROCESSES
       1.         2.         4.        27.       101.       102.       107.      1099.

2-D NEUT PROCESSES
       MT    LENGTH      ORDER      TEMPS
 1      2       183          5          0
 2     51        59          0          0
 3     91       168          0          0
MT=    4 GROUP    1 MATRIX SUMS TO   4.570332E-01 AVERAGED VALUE=    4.569468E-01 FRACT DEV=   1.890092E-04
MT=    4 GROUP    2 MATRIX SUMS TO   4.438447E-01 AVERAGED VALUE=    4.438827E-01 FRACT DEV=  -8.567073E-05
MT=    4 GROUP    3 MATRIX SUMS TO   3.019570E-01 AVERAGED VALUE=    3.019351E-01 FRACT DEV=   7.244901E-05
MT=    4 GROUP    4 MATRIX SUMS TO   2.803766E-01 AVERAGED VALUE=    2.803810E-01 FRACT DEV=  -1.573125E-05
MT=    4 GROUP    6 MATRIX SUMS TO   4.372250E-02 AVERAGED VALUE=    4.372485E-02 FRACT DEV=  -5.384542E-05

NUCLIDE         1274 HAS BEEN CHECKED
```

```
RRRRRRRRRRRR      AAAAAAAAA     DDDDDDDDDDDD    EEEEEEEEEEEEE
RRRRRRRRRRRRR    AAAAAAAAAAA    DDDDDDDDDDDDD   EEEEEEEEEEEEE
RR         RR   AA         AA   DD         DD   EE
RR         RR   AA         AA   DD         DD   EE
RR         RR   AA         AA   DD         DD   EE
RRRRRRRRRRRRR   AAAAAAAAAAAAA   DD         DD   EEEEEEEEE
RRRRRRRRRRRR    AAAAAAAAAAAAA   DD         DD   EEEEEEEEE
RR      RR      AA         AA   DD         DD   EE
RR       RR     AA         AA   DD         DD   EE
RR        RR    AA         AA   DD         DD   EE
RR         RR   AA         AA   DDDDDDDDDDDDD   EEEEEEEEEEEEE
RR         RR   AA         AA   DDDDDDDDDDDD    EEEEEEEEEEEEE



   0000000     5555555555555           //      11       666666666666           //  777777777777   5555555555555
  000000000    5555555555555          //      111      666666666666           //   77777777777    5555555555555
 00       00   55                    //      1111     66                     //    77       77    55
00         00  55                   //         11     66                    //            77      55
00         00  55                  //          11     66                   //            77       55
00         00  555555555555       //           11     66666666666         //            77        555555555555
00         00  5555555555555     //            11     666666666666       //            77         5555555555555
00         00             55    //             11     66        66      //            77                     55
00         00             55   //              11     66        66     //             77                     55
 00       00   55         55  //               11     66        66    //              77          55         55
  000000000    5555555555555 //             11111111  666666666666   //               77          5555555555555
   0000000      55555555555 //              11111111   6666666666   //                77           55555555555



 22222222222     0000000                      33333333333   33333333333                  11       33333333333
2222222222222   000000000                    3333333333333 3333333333333                111      3333333333333
22         22  00       00                   33         33 33         33               1111      33         33
           22  00       00                              33            33                 11                 33
           22  00       00                              33            33                 11                 33
          22   00       00                             333           333                 11                333
        22     00       00     .....                   333           333      .....      11                333
      22       00       00     .....                    33            33      .....      11                 33
    22         00       00     .....                    33            33      .....      11                 33
  22            00     00      .....             33     33 33         33      .....      11       33        33
2222222222222   000000000                        3333333333333 3333333333333          11111111   3333333333333
2222222222222    0000000                          33333333333   33333333333           11111111    33333333333

  1$ ARRAY      4 ENTRIES READ

  OT
```

CHECKING TOLERANCE= 1.00000E-03 PER CENT

AMPX NUCLIDE 1274 PRODUCE P5 CARBON GAMMA PRODUCTION DATA D:
HAS THE FOLLOWING DATA

0 RESOLVED RESONANCES	0 UNRESOLVED RESONANCE POINTS
0 TEMP IND 1-D NEUT PROCESSES	0 2-D NEUT PROCESSES
0 TEMP DEP 1-D NEUT PROCESSES	0 1-D GAMMA PROCESSES
0 2-D GAMMA PROCESSES	2 2-D NEUT-TO-GAMMA PROCESSES
0 FISSION YIELDS	0 ENDF MAT OF FAST NEUT DATA
	0 ENDF MAT OF THERMAL NEUT DATA
	1274 ENDF MAT OF YIELD DATA
14 RECORDS FOR NUCLIDE	0 ENDF MAT OF GAMMA DATA

2-D NEUTRON TO GAMMA TRANSFERS

	MT	LENGTH	ORDER	TYPES
1	102	62	5	1
2	51	7	5	1

NUCLIDE 1274 HAS BEEN CHECKED

```
RRRRRRRRRRRR      AAAAAAAAA     DDDDDDDDDDDD    EEEEEEEEEEEEE
RRRRRRRRRRRRR    AAAAAAAAAAA    DDDDDDDDDDDDD   EEEEEEEEEEEEE
RR          RR  AA         AA   DD         DD   EE
RR          RR  AA         AA   DD         DD   EE
RR          RR  AA         AA   DD         DD   EE
RRRRRRRRRRRRR   AAAAAAAAAAAAA   DD         DD   EEEEEEEEE
RRRRRRRRRRRR    AAAAAAAAAAAAA   DD         DD   EEEEEEEEE
RR      RR      AA         AA   DD         DD   EE
RR       RR     AA         AA   DD         DD   EE
RR        RR    AA         AA   DD         DD   EE
RR         RR   AA         AA   DDDDDDDDDDDDD   EEEEEEEEEEEEE
RR          RR  AA         AA   DDDDDDDDDDDD    EEEEEEEEEEEEE


   0000000     5555555555555            //      11     666666666666           //   7777777777777   5555555555555
  000000000    5555555555555           //      111    6666666666666          //    777777777777    5555555555555
 00       00   55                     //      1111    66                    //     77        77    55
00         00  55                    //         11    66                   //               77     55
00         00  55                   //          11    66                  //               77      55
00         00  555555555555        //           11    666666666666       //               77       555555555555
00         00  5555555555555      //            11    6666666666666     //               77        5555555555555
00         00             55     //             11    66         66    //               77                    55
00         00             55    //              11    66         66   //               77                     55
 00       00   55         55   //               11    66         66  //               77         55          55
  000000000    5555555555555  //             11111111 6666666666666 //               77          5555555555555
   0000000      55555555555  //              11111111  66666666666 //                77           55555555555


  22222222222      0000000              33333333333   33333333333         22222222222       0000000
 2222222222222    000000000            3333333333333 3333333333333       2222222222222     000000000
22          22   00       00           33         33 33         33       22         22    00       00
            22  00         00                     33            33                  22   00         00
            22  00         00                     33            33                  22   00         00
           22   00         00                   333           333                  22    00         00
         22     00         00   .....           333           333   .....        22      00         00
       22       00         00   .....             33            33  .....      22        00         00
     22         00         00   .....             33            33  .....    22          00         00
   22            00       00    .....      33     33   33       33  .....   22            00       00
2222222222222     000000000            3333333333333 3333333333333       2222222222222     000000000
2222222222222      0000000              33333333333   33333333333        2222222222222      0000000
```

1$ ARRAY   4 ENTRIES READ

OT

```
 CHECKING TOLERANCE= 1.00000E-03 PER CENT

AMPX NUCLIDE          6            PHOTON INTERACTION DATA FOR  6000.0                    6 1
     HAS THE FOLLOWING DATA
    0 RESOLVED RESONANCES                        0 UNRESOLVED RESONANCE POINTS
    0 TEMP IND 1-D NEUT PROCESSES                0 2-D NEUT PROCESSES
    0 TEMP DEP 1-D NEUT PROCESSES                6 1-D GAMMA PROCESSES
    2 2-D GAMMA PROCESSES                        0 2-D NEUT-TO-GAMMA PROCESSES
    0 FISSION YIELDS                             0 ENDF MAT OF FAST NEUT DATA
                                                 0 ENDF MAT OF THERMAL NEUT DATA
                                                 0 ENDF MAT OF YIELD DATA
   10 RECORDS FOR NUCLIDE                        6 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D GAMMA PROCESSES
     602.      516.      504.      527.      501.     1527.

2-D GAMMA PROCESSES
       MT    LENGTH     ORDER
 1    504       211         5         0
 2    516        12         0         0

NUCLIDE           6 HAS BEEN CHECKED
```

CHOX

05/16/75

20:33:27

```
1$ ARRAY      2 ENTRIES READ

OT



COUPLED NEUTRON AND GAMMA-RAY CROSS-SECTION SETS WILL BE CREATED ON LOGICAL UNIT   1

NUMBER OF COUPLED SETS              1
MOUNT PREVIOUSLY MADE LIBRARY       NO

2$ ARRAY      1 ENTRIES READ

3$ ARRAY      1 ENTRIES READ

4$ ARRAY      1 ENTRIES READ

5$ ARRAY      1 ENTRIES READ

OT

CHUX WILL CREATE THE FOLLOWING COUPLED SETS--
                                 I D E N T I F I E R S
SET  COUPLED SET   NEUTRON DATA    GAMMA PRODUCTION DATA    GAMMA DATA
 1         1274           1274                1274                   6
```

```
RRRRRRRRRRRR       AAAAAAAAA      DDDDDDDDDDDD    EEEEEEEEEEEEE
RRRRRRRRRRRRR     AAAAAAAAAAA     DDDDDDDDDDDDD   EEEEEEEEEEEEE
RR          RR   AA         AA    DD         DD   EE
RR          RR   AA         AA    DD         DD   EE
RR          RR   AA         AA    DD         DD   EE
RRRRRRRRRRRRR    AAAAAAAAAAAAA    DD         DD   EEEEEEEEE
RRRRRRRRRRRR     AAAAAAAAAAAAA    DD         DD   EEEEEEEEE
RR      RR       AA         AA    DD         DD   EE
RR       RR      AA         AA    DD         DD   EE
RR        RR     AA         AA    DD         DD   EE
RR          RR   AA         AA    DDDDDDDDDDDDD   EEEEEEEEEEEEE
RR          RR   AA         AA    DDDDDDDDDDDD    EEEEEEEEEEEEE


   0000000     5555555555555          //      11       666666666666          //   777777777777   5555555555555
  000000000    5555555555555         //      111      6666666666666         //    77777777777    5555555555555
 00       00   55                   //      1111      66                   //     77        77   55
00         00  55                  //         11      66                  //               77    55
00         00  55                 //          11      66                 //               77     55
00         00  555555555555      //           11      666666666666      //               77      555555555555
00         00  5555555555555    //            11      6666666666666    //               77       5555555555555
00         00             55   //             11      66          66  //               77                   55
00         00             55  //              11      66          66 //               77                    55
 00       00   55         55 //               11      66          66//               77        55           55
  000000000    5555555555555//             11111111   6666666666666//               77         5555555555555
   0000000      55555555555//              11111111    6666666666 //               77           55555555555


22222222222      0000000             33333333333         44                0000000      0000000
2222222222222   000000000           3333333333333       444               000000000    000000000
22         22  00       00          33         33      4444              00       00  00       00
           22  00       00                     33     44 44             00         00 00        00
           22  00       00                     33    44  44             00         00 00        00
          22   00       00                    333   44   44             00         00 00        00
        22     00       00   .....            333  44    44     .....   00         00 00        00
      22       00       00   .....             33 444444444444  .....   00         00 00        00
    22         00       00   .....             33 444444444444  .....   00         00 00        00
  22            00     00    .....    33       33        44     .....    00       00   00      00
2222222222222   000000000             3333333333333      44               000000000    000000000
2222222222222    0000000               33333333333       44                0000000      0000000
```

IS ARRAY   4 ENTRIES READ

OT

CHECKING TOLERANCE= 1.00000E-03 PER CENT

AMPX NUCLIDE 1274 CARBON V4 (1274)
HAS THE FOLLOWING DATA

0 RESOLVED RESONANCES	0 UNRESOLVED RESONANCE POINTS
8 TEMP IND 1-D NEUT PROCESSES	3 2-D NEUT PROCESSES
0 TEMP DEP 1-D NEUT PROCESSES	6 1-D GAMMA PROCESSES
2 2-D GAMMA PROCESSES	2 2-D NEUT-TO-GAMMA PROCESSES
0 FISSION YIELDS	1274 ENDF MAT OF FAST NEUT DATA
	1274 ENDF MAT OF THERMAL NEUT DATA
	1274 ENDF MAT OF YIELD DATA
33 RECORDS FOR NUCLIDE	6 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D NEUTRON PROCESSES
1. 2. 4. 27. 101. 102. 107. 1099.

2-D NEUT PROCESSES

	MT	LENGTH	ORDER	TEMPS
1	2	183	5	0
2	51	59	0	0
3	91	166	0	0

MT= 4 GROUP 1 MATRIX SUMS TO 4.570332E-01 AVERAGED VALUE= 4.569468E-01 FRACT DEV= 1.890092E-04
MT= 4 GROUP 2 MATRIX SUMS TO 4.438447E-01 AVERAGED VALUE= 4.438827E-01 FRACT DEV= -8.567073E-05
MT= 4 GROUP 3 MATRIX SUMS TO 3.019570E-01 AVERAGED VALUE= 3.019351E-01 FRACT DEV= 7.244901E-05
MT= 4 GROUP 4 MATRIX SUMS TO 2.803766E-01 AVERAGED VALUE= 2.803810E-01 FRACT DEV= -1.573125E-05
MT= 4 GROUP 6 MATRIX SUMS TO 4.372250E-02 AVERAGED VALUE= 4.372485E-02 FRACT DEV= -5.384542E-05

2-D NEUTRON TO GAMMA TRANSFERS

	MT	LENGTH	ORDER	TYPES
1	102	62	5	1
2	51	7	5	1

NEUTRON GROUP	ESTIMATED BINDING ENERGY (EV)	CAPTURE CROSS SECTION
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0
10	0.0	0.0
11	0.0	0.0
12	0.0	0.0
13	0.0	0.0
14	0.0	0.0
15	0.0	0.0
16	0.0	0.0
17	0.0	0.0
18	0.0	0.0
19	0.0	0.0
20	0.0	0.0
21	0.0	0.0
22	0.0	0.0
23	0.0	0.0
24	0.0	0.0
25	0.0	0.0
26	0.0	0.0
27	0.0	0.0
28	0.0	0.0
29	0.0	0.0

30	0.0	0.0
31	0.0	0.0
32	0.0	0.0
33	0.0	0.0
34	4.674317E 06	1.332997E-06
35	3.578379E 06	5.882851E-06
36	3.461382E 06	9.619677E-06
37	3.732487E 06	1.254653E-05
38	4.268645E 06	1.480241E-05
39	3.932361E 06	1.658052E-05
40	2.622101E 05	2.116559E-05
41	2.543021E 05	3.079577E-05
42	4.617609E 05	4.480760E-05
43	9.449979E 05	6.519472E-05
44	1.919735E 06	9.485768E-05
45	3.987978E 06	1.380170E-04
46	3.129367E 05	2.008136E-04
47	2.398118E 05	2.921822E-04
48	4.200459E 05	4.251224E-04
49	1.047186E 06	6.614379E-04
50	4.500527E 06	2.706341E-03

THIS NUCLIDE HAS THE FOLLOWING 1-D GAMMA PROCESSES
602. 516. 504. 527. 501. 1527.

2-D GAMMA PROCESSES

	MT	LENGTH	ORDER	
1	504	211	5	0
2	516	12	0	C

NUCLIDE 1274 HAS BEEN CHECKED

```
MM        MM     AAAAAAAA     LL              OOOOOOOOOO     CCCCCCCCCC     SSSSSSSSSS
MMM      MMM    AAAAAAAAAA    LL             OOOOOOOOOOOO   CCCCCCCCCCCC   SSSSSSSSSSSS
MMMM    MMMM   AA        AA   LL             OO        OO   CC        CC   SS        SS
MM MM  MM MM   AA        AA   LL             OO        OO   CC             SS
MM  MMMM  MM   AA        AA   LL             OO        OO   CC             SS
MM   MM   MM   AAAAAAAAAAAA   LL             OO        OO   CC             SSSSSSSSSSS
MM        MM   AAAAAAAAAAAA   LL             OO        OO   CC              SSSSSSSSSSS
MM        MM   AA        AA   LL             OO        OO   CC                       SS
MM        MM   AA        AA   LL             OO        OO   CC                       SS
MM        MM   AA        AA   LL             OO        OO   CC        CC   SS        SS
MM        MM   AA        AA   LLLLLLLLLLLL   OOOOOOOOOOOO   CCCCCCCCCCCC   SSSSSSSSSSSS
MM        MM   AA        AA   LLLLLLLLLLLL    OOOOOOOOOO     CCCCCCCCCC     SSSSSSSSSS


  00000000     555555555555             //        11         6666666666              //   777777777777   555555555555
 0000000000    555555555555            //        111        666666666666            //    77777777777    555555555555
00        00   55                     //        1111        66                     //     77       77    55
00        00   55                    //           11        66                    //             77      55
00        00   55                   //            11        66                   //             77       55
00        00   55555555555         //             11        66666666666         //             77        55555555555
00        00   555555555555       //              11        666666666666       //              77        555555555555
00        00             55      //               11        66        66      //              77                   55
00        00             55     //                11        66        66     //               77                   55
00        00   55        55    //                 11        66        66    //                77         55        55
 0000000000    555555555555   //               11111111     666666666666   //             77         555555555555
  00000000      5555555555    //               11111111      6666666666    //             77          5555555555


 2222222222      00000000                     3333333333            44                    2222222222     2222222222
222222222222    0000000000                   333333333333          444                   222222222222   222222222222
22        22   00        00                  33        33         4444                   22        22   22        22
          22   00        00                            33        44 44                             22             22
          22   00        00                            33       44  44                             22             22
         22    00        00                           333      44   44                            22            22
        22     00        00       .....               333     44    44         .....             22            22
      22       00        00       .....                33   444444444444       .....           22            22
    22         00        00       .....                33   444444444444       .....         22            22
  22           00        00       .....      33        33           44         .....       22            22
222222222222    0000000000                   333333333333           44                   222222222222   222222222222
222222222222     00000000                     3333333333            44                   222222222222   222222222222
```

```
1$ ARRAY       6 ENTRIES READ
2$ ARRAY       2 ENTRIES READ
0T
4$ ARRAY      50 ENTRIES READ
5* ARRAY      50 ENTRIES READ
6$ ARRAY      25 ENTRIES READ
7* ARRAY      25 ENTRIES READ
0T


AMPX MASTER LIBRARY NUMBER   26
NUMBER OF NUCLIDES    1
NUMBER OF NEUTRON GROUPS   50
FIRST THERMAL GROUP   50
NUMBER OF GAMMA GROUPS   25
```

NEUTRON GROUP DEFINITIONS AND WEIGHTING FLUXES

FINE GROUP	UPPER ENERGY	UPPER LETHARGY	GROUP FLUX	BROAD GROUP
1	1.491825E 07	-4.000003E-01	1.000000E 00	1
2	1.221403E 07	-2.000003E-01	1.000000E 00	1
3	1.000000E 07	0.0	1.000000E 00	1
4	8.187308E 06	1.999995E-01	1.000000E 00	1
5	6.703202E 06	3.999996E-01	1.000000E 00	1
6	5.488117E 06	5.999995E-01	1.000000E 00	1
7	4.493294E 06	7.999988E-01	1.000000E 00	1
8	3.678799E 06	9.999986E-01	1.000000E 00	1
9	3.011945E 06	1.199999E 00	1.000000E 00	1
10	2.465972E 06	1.399999E 00	1.000000E 00	1
11	2.018968E 06	1.599998E 00	1.000000E 00	2
12	1.652991E 06	1.799998E 00	1.000000E 00	2
13	1.353355E 06	1.999998E 00	1.000000E 00	2
14	1.108033E 06	2.199999E 00	1.000000E 00	2
15	9.071815E 05	2.399998E 00	1.000000E 00	2
16	7.427376E 05	2.599998E 00	1.000000E 00	2
17	6.081016E 05	2.799997E 00	1.000000E 00	2
18	4.978716E 05	2.999998E 00	1.000000E 00	2
19	4.076229E 05	3.199997E 00	1.000000E 00	2
20	3.337334E 05	3.399997E 00	1.000000E 00	2
21	2.732379E 05	3.599998E 00	1.000000E 00	3
22	2.237083E 05	3.799997E 00	1.000000E 00	3
23	1.831569E 05	3.999997E 00	1.000000E 00	3
24	1.499562E 05	4.199997E 00	1.000000E 00	3
25	1.227736E 05	4.399998E 00	1.000000E 00	3
26	8.651713E 04	4.749998E 00	1.000000E 00	3
27	5.247533E 04	5.249997E 00	1.000000E 00	3
28	4.086781E 04	5.499997E 00	1.000000E 00	3
29	3.182790E 04	5.749997E 00	1.000000E 00	3
30	2.478759E 04	5.999997E 00	1.000000E 00	3
31	1.930459E 04	6.249997E 00	1.000000E 00	4
32	1.503443E 04	6.499997E 00	1.000000E 00	4
33	7.101762E 03	7.249997E 00	1.000000E 00	4
34	4.307434E 03	7.749998E 00	1.000000E 00	4
35	3.354635E 03	7.999997E 00	1.000000E 00	4
36	2.612593E 03	8.249997E 00	1.000000E 00	4
37	2.034689E 03	8.499997E 00	1.000000E 00	4
38	1.584618E 03	8.749997E 00	1.000000E 00	4
39	1.234101E 03	8.999997E 00	1.000000E 00	4
40	9.611191E 02	9.249997E 00	1.000000E 00	4
41	4.540005E 02	9.999998E 00	1.000000E 00	5
42	2.144546E 02	1.075000E 01	1.000000E 00	5
43	1.013012E 02	1.150000E 01	1.000000E 00	5
44	4.785130E 01	1.225000E 01	1.000000E 00	5
45	2.260335E 01	1.300000E 01	1.000000E 00	5
46	1.067707E 01	1.375000E 01	1.000000E 00	5
47	5.043490E 00	1.450000E 01	1.000000E 00	5
48	2.382376E 00	1.525000E 01	1.000000E 00	5
49	1.125354E 00	1.600000E 01	1.000000E 00	5
50	4.140001E-01	1.699998E 01	1.000000E 00	5
51	1.000000E-05	2.763101E 01		

BROAD GROUP	UPPER ENERGY	UPPER LETHARGY	GROUP FLUX
1	1.491825E 07	-4.000003E-01	1.000000E 01
2	2.018968E 06	1.599998E 00	1.000000E 01
3	2.732379E 05	3.599998E 00	1.000000E 01
4	1.930459E 04	6.249997E 00	1.000000E 01
5	4.540005E 02	9.999998E 00	1.000000E 01
6	1.000000E-05	2.763101E 01	

GAMMA GROUP DEFINITIONS AND WEIGHTING FLUXES

FINE GROUP	UPPER ENERGY	UPPER LETHARGY	GROUP FLUX	BROAD GROUP
1	1.300000E 07	-2.623643E-01	1.000000E 00	1
2	1.019700E 07	-1.950841E-02	1.000000E 00	1
3	7.998299E 06	2.233557E-01	1.000000E 00	1
4	6.273699E 06	4.662184E-01	1.000000E 00	1
5	4.920999E 06	7.090734E-01	1.000000E 00	1
6	3.859899E 06	9.519441E-01	1.000000E 00	2
7	3.027699E 06	1.194781E 00	1.000000E 00	2
8	2.374799E 06	1.437672E 00	1.000000E 00	2
9	1.862799E 06	1.680505E 00	1.000000E 00	2
10	1.461099E 06	1.923356E 00	1.000000E 00	2
11	1.146099E 06	2.166221E 00	1.000000E 00	3
12	8.989599E 05	2.409101E 00	1.000000E 00	3
13	7.051299E 05	2.651958E 00	1.000000E 00	3
14	5.530899E 05	2.894819E 00	1.000000E 00	3
15	4.338299E 05	3.137688E 00	1.000000E 00	3
16	3.402899E 05	3.380542E 00	1.000000E 00	4
17	2.669199E 05	3.623391E 00	1.000000E 00	4
18	2.093699E 05	3.866238E 00	1.000000E 00	4
19	1.642199E 05	4.109134E 00	1.000000E 00	4
20	1.288099E 05	4.352002E 00	1.000000E 00	4
21	1.010399E 05	4.594825E 00	1.000000E 00	5
22	7.925194E 04	4.837708E 00	1.000000E 00	5
23	6.216400E 04	5.080564E 00	1.000000E 00	5
24	4.876000E 04	5.323430E 00	1.000000E 00	5
25	3.824700E 04	5.566275E 00	1.000000E 00	5
26	3.000000E 04	5.809143E 00		

BROAD GROUP	UPPER ENERGY	UPPER LETHARGY	GROUP FLUX
1	1.300000E 07	-2.623643E-01	5.000000E 00
2	3.859899E 06	9.519441E-01	5.000000E 00
3	1.146099E 06	2.166221E 00	5.000000E 00
4	3.402899E 05	3.380542E 00	5.000000E 00
5	1.010399E 05	4.594825E 00	5.000000E 00
6	3.000000E 04	5.809143E 00	

CARBON V4 (1274) 1274

XSEC ID GRP.	1	2	4	27	101	102	107	1099
1	1.56204E 00	1.34622E 00	1.74100E-01	4.17223E-02	4.17223E-02	0.0	4.17223E-02	2.00000E 00
2	2.87529E 00	2.87529E 00	0.0	0.0	0.0	0.0	0.0	1.99999E 00
3	4.38677E 00	4.38677E 00	0.0	0.0	0.0	0.0	0.0	2.64999E 00
4	4.71122E 00	4.71121E 00	0.0	8.19306E-06	8.19306E-06	8.19306E-06	0.0	3.74999E 00
5	4.72916E 00	4.72869E 00	0.0	4.65957E-04	4.65957E-04	4.65957E-04	0.0	1.38585E 01

PO ELASTIC (MT= 2)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	2003003	3004004	4005005
2	1.20038E 00	2.58354E 00	4.09154E 00	4.61097E 00	4.72869E 00
3		1.45836E-01	2.91752E-01	2.95226E-01	1.00229E-01

P1 ELASTIC (MT= 2)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	2003003	3004004	4005005
2	1.04517E 00	1.17261E 00	1.15075E 00	8.89725E-01	8.02632E-01
3		-1.66128E-01	-2.33464E-01	-2.59313E-01	-8.86644E-02

P2 ELASTIC (MT= 2)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	2003003	3004004	4005005
2	1.78140E 00	2.30687E-01	9.49656E-02	4.60626E-02	3.42438E-02
3		8.28331E-02	-5.40005E-02	-3.45349E-02	-1.11665E-02

P3 ELASTIC (MT= 2)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	2003003	3004004	4005005
2	1.22959E 00	5.55234E-03	3.59546E-03	1.78447E-04	3.12916E-05
3		-7.63046E-02	-4.18311E-03	-1.41429E-03	-3.95866E-04

P4 ELASTIC (MT= 2)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	2003003	3004004	4005005
2	6.92084E-01	-3.32974E-03	7.18760E-04	8.51367E-04	-3.72168E-05
3		1.27728E-02	-5.45502E-05	1.45653E-04	1.33181E-05

P5 ELASTIC (MT= 2)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	2003003	3004004	4005005
2	2.59818E-01	-1.13107E-03	-2.21149E-03	-2.96711E-03	1.39481E-04
3		-4.79294E-03	-1.00356E-04	-3.88062E-04	6.02467E-05

P0 (N,N') LEVEL 1 (MT= 51)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3
1	1001001	1001002	1001003
2	1.12494E-01	2.98290E-02	8.71916E-04

P0 (N,N') EVAP (MT= 91)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1001002	1001003	1001004	1001005
2	9.95055E-03	1.97335E-02	1.21997E-03	7.33447E-06	4.09041E-09

P0 (MT= 102)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	4005001	4005002	3003003	4004004	5005005
2	1.78853E-04	1.68332E-04	0.0	0.0	0.0
3	3.08176E-06	2.90048E-06			

P1 (MT= 102)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	0.0	0.0	0.0	0.0	0.0

P2 (MT= 102)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	0.0	0.0	0.0	0.0	0.0

P3 (MT= 102)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	0.0	0.0	0.0	0.0	0.0

P4 (MT= 102)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	0.0	0.0	0.0	0.0	0.0

P5 (MT= 102)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	0.0	0.0	0.0	0.0	0.0

P0 (N,N') LEVEL 1 (MT= 51)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	1.38384E-01	0.0	0.0	0.0	0.0

P1 (N,N') LEVEL 1 (MT= 51)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	0.0	0.0	0.0	0.0	0.0

P2 (N,N') LEVEL 1 (MT= 51)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	1.01785E-01	0.0	0.0	0.0	0.0

P3 (N,N') LEVEL 1 (MT= 51)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	0.0	0.0	0.0	0.0	0.0

P4 (N,N') LEVEL 1 (MT= 51)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	-3.22210E-03	0.0	0.0	0.0	0.0

P5 (N,N') LEVEL 1 (MT= 51)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	2002002	3003003	4004004	5005005
2	0.0	0.0	0.0	0.0	0.0

XSEC ID	602	516	504	527	501	1527
GRP.						
1	1.28872E-06	6.20971E-02	3.99767E-01	1.28872E-06	4.61866E-01	2.29163E 00
2	6.81473E-06	9.69390E-03	8.61715E-01	6.81473E-06	8.71416E-01	9.96256E-01
3	1.08961E-04	3.74398E-07	1.58211E 00	1.08961E-04	1.58222E 00	3.83537E-01
4	4.25284E-03	0.0	2.48963E 00	4.25284E-03	2.49389E 00	1.04919E-01
5	2.27045E-01	0.0	3.14003E 00	2.27045E-01	3.52553E 00	2.80368E-02

P0 (MT= 504)--CARBCN V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	1003003	1004004	4005005
2	8.53026E-02	2.73619E-01	8.00637E-01	2.03809E 00	3.14003E 00
3		1.49736E-01	4.39085E-01	7.81468E-01	4.51543E-01
4			1.28111E-01	1.49009E-01	
5				3.66186E-02	

P1 (MT= 504)--CARBCN V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	1003003	1004004	4005005
2	2.49555E-01	7.54489E-01	1.79150E 00	1.79389E 00	9.23818E-01
3		3.77035E-01	6.03854E-01	-3.35978E-01	-4.75383E-01
4			8.16439E-02	-2.62816E-01	
5				-7.62376E-02	

P2 (MT= 504)--CARBCN V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	1003003	1004004	4005005
2	3.95555E-01	1.05892E 00	1.63405E 00	1.39125E 00	1.64590E 00
3		4.26778E-01	-6.16330E-02	-2.53165E-01	1.51444E-01
4			-1.88193E-01	7.56122E-02	
5				4.86128E-02	

P3 (MT= 504)--CARBCN V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	1003003	1004004	4005005
2	5.13208E-01	1.13564E 00	9.16961E-01	5.92238E-01	2.52561E-01
3		2.87307E-01	-3.92680E-01	-1.04061E-01	-1.13551E-01
4			-1.57298E-01	1.37005E-01	
5				1.40874E-02	

P4 (MT= 504)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	1003003	1004004	4005005
2	5.95179E-01	1.00499E 00	4.17495E-01	1.29308E-01	2.14179E-02
3		4.07035E-02	-2.32489E-01	-9.16773E-03	-9.55401E-03
4			1.19826E-02	-1.12622E-01	
5				-4.93551E-02	

P5 (MT= 504)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5
1	1001001	1002002	1003003	1004004	4005005
2	6.37786E-01	7.44298E-01	2.54130E-01	3.09449E-02	9.77533E-04
3		-1.89479E-01	-2.19151E-01	-6.30138E-02	-3.14026E-03
4			5.00109E-02	-5.58826E-02	
5				2.84203E-02	

P0 (MT= 516)--CARBON V4 (1274) IDENTIFIER 1274

	GRP. 3
1	1003003
2	7.48797E-07
3	1.93878E-02
4	1.24194E-01

WELL I'LL BE DAMNED---YOU HAVE COLLAPSED A WHOLE MASTER INTERFACE

```
RRRRRRRRRRRR       AAAAAAAAA      DDDDDDDDDDDD     EEEEEEEEEEEEE
RRRRRRRRRRRRR     AAAAAAAAAAA     DDDDDDDDDDDDD    EEEEEEEEEEEEE
RR         RR    AA         AA    DD         DD    EE
RR         RR    AA         AA    DD         DD    EE
RR         RR    AA         AA    DD         DD    EE
RRRRRRRRRRRRR    AAAAAAAAAAAAA    DD         DD    EEEEEEEEE
RRRRRRRRRRRR     AAAAAAAAAAAAA    DD         DD    EEEEEEEEE
RR     RR        AA         AA    DD         DD    EE
RR       RR      AA         AA    DD         DD    EE
RR         RR    AA         AA    DD         DD    EE
RR          RR   AA         AA    DDDDDDDDDDDDD    EEEEEEEEEEEEE
RR          RR   AA         AA    DDDDDDDDDDDD     EEEEEEEEEEEEE
```

```
   0000000     5555555555555             //      11      666666666666              //   7777777777777   5555555555555
  000000000    5555555555555            //      111     6666666666666             //    777777777777    5555555555555
 00       00   55                      //      1111     66                       //     77         77   55
00         00  55                     //         11     66                      //              77     55
00         00  55                    //          11     66                     //              77      55
00         00  555555555555         //           11     666666666666          //              77       555555555555
00         00  5555555555555       //            11     6666666666666        //               77       5555555555555
00         00             55      //             11     66         66       //               77                   55
00         00             55     //              11     66         66      //                77                   55
 00       00   55         55    //               11     66         66     //                 77        55         55
  000000000    5555555555555   //          11111111     6666666666666    //                  77        5555555555555
   0000000      55555555555   //           11111111      6666666666     //                   77         55555555555
```

```
 22222222222      0000000                    33333333333    5555555555555                0000000         11
2222222222222    000000000                  3333333333333   5555555555555               000000000       111
22         22   00       00                 33         33   55                         00       00     1111
           22   00       00                            33   55                        00         00      11
           22   00       00                            33   55                        00         00      11
          22    00       00                           333   555555555555              00         00      11
        22      00       00     .....                 333   5555555555555    .....    00         00      11
      22        00       00     .....                  33              55    .....    00         00      11
    22          00       00     .....                  33              55    .....    00         00      11
  22             00     00      .....       33         33   55         55    .....     00       00       11
2222222222222    000000000                  3333333333333   5555555555555               000000000    11111111
2222222222222     0000000                    33333333333     55555555555                 0000000     11111111
```

1$ ARRAY   4 ENTRIES READ

CT

```
CHECKING TOLERANCE= 1.00000E-03 PER CENT

AMPX NUCLIDE      1274 CARBON V4 (1274)
     HAS THE FOLLOWING DATA
    0 RESOLVED RESONANCES                              0 UNRESOLVED RESONANCE POINTS
    8 TEMP IND 1-D NEUT PROCESSES                      3 2-D NEUT PROCESSES
    0 TEMP DEP 1-D NEUT PROCESSES                      6 1-D GAMMA PROCESSES
    2 2-D GAMMA PROCESSES                              2 2-D NEUT-TO-GAMMA PROCESSES
    0 FISSION YIELDS                                1274 ENDF MAT OF FAST NEUT DATA
                                                    1274 ENDF MAT OF THERMAL NEUT DATA
                                                    1274 ENDF MAT OF YIELD DATA
   33 RECORDS FOR NUCLIDE                              6 ENDF MAT OF GAMMA DATA

THIS NUCLIDE HAS THE FOLLOWING 1-D NEUTRON PROCESSES
       1.         2.         4.        27.       101.       102.       107.      1099.

2-D NEUT PROCESSES
       MT    LENGTH     ORDER     TEMPS
 1      2        14         5         0
 2     51         6         0         0
 3     91        10         0         0
MT=   4 GROUP   1 MATRIX SUMS TO   1.741064E-01 AVERAGED VALUE=   1.740999E-01 FRACT DEV=   3.731711E-05

2-D NEUTRON TO GAMMA TRANSFERS
       MT    LENGTH     ORDER     TYPES
 1    102        12         5         1
 2     51        10         5         1

                          ESTIMATED               CAPTURE
NEUTRON GROUP       BINDING ENERGY (EV)      CROSS SECTION
       1                0.0                     0.0
       2                0.0                     0.0
       3                0.0                     0.0
       4                4.056966E 06            8.153057E-06
       5                4.139996E 06            4.655565E-04

THIS NUCLIDE HAS THE FOLLOWING 1-D GAMMA PROCESSES
     602.       516.       504.       527.       501.      1527.

2-D GAMMA PROCESSES
       MT    LENGTH     ORDER
 1    504       211         5         0
 2    516        12         0         0

NUCLIDE        1274 HAS BEEN CHECKED
```

```
NN         NN  IIIIIIIIIIII   TTTTTTTTTTTT     AAAAAAAA     WW         WW  LL
NNN        NN  IIIIIIIIIIII   TTTTTTTTTTTT    AAAAAAAAAA    WW         WW  LL
NNNN       NN       II             TT         AA        AA  WW         WW  LL
NN NN      NN       II             TT         AA        AA  WW         WW  LL
NN  NN     NN       II             TT         AA        AA  WW         WW  LL
NN   NN    NN       II             TT         AAAAAAAAAAAA  WW    W    WW  LL
NN    NN   NN       II             TT         AAAAAAAAAAAA  WW   WWW   WW  LL
NN     NN  NN       II             TT         AA        AA  WW  WW WW  WW  LL
NN      NN NN       II             TT         AA        AA  WW WW   WW WW  LL
NN       NNNN       II             TT         AA        AA  WWWW     WWWW  LL
NN        NNN  IIIIIIIIIIII        TT         AA        AA  WWW       WWW  LLLLLLLLLLLL
NN         NN  IIIIIIIIIIII        TT         AA        AA  WW         WW  LLLLLLLLLLLL
```

```
   0000000     5555555555555             //       11        66666666666              //  7777777777777  5555555555555
  000000000    5555555555555            //       111       6666666666666            //   777777777777   5555555555555
 00       00   55                      //       1111       66                      //    77        77   55
00         00  55                     //         11        66                     //              77    55
00         00  55                    //          11        66                    //              77     55
00         00  555555555555         //           11        666666666666         //              77      555555555555
00         00  5555555555555       //            11        6666666666666       //               77      5555555555555
00         00             55      //             11        66         66      //               77                  55
00         00             55     //              11        66         66     //                77                  55
 00       00   55         55    //               11        66         66    //                77       55         55
  000000000    5555555555555   //              11111111    6666666666666   //                 77       5555555555555
   0000000      55555555555   //               11111111     66666666666   //                  77        55555555555
```

```
 22222222222      0000000                    33333333333   5555555555555                   22222222222    22222222222
2222222222222    000000000                  3333333333333  5555555555555                  2222222222222  2222222222222
22         22   00       00                 33         33  55                             22         22  22         22
           22  00         00                           33  55                                        22             22
           22  00         00                           33  55                                        22             22
          22   00         00                          333  555555555555                             22             22
        22     00         00      .....               333  5555555555555      .....               22             22
      22       00         00      .....                33             55      .....             22             22
    22         00         00      .....                33             55      .....           22             22
  22            00       00       .....     33         33  55         55      .....         22             22
2222222222222    000000000                  3333333333333  5555555555555                  2222222222222  2222222222222
2222222222222     0000000                    33333333333    55555555555                   2222222222222  2222222222222
```

10-131

```
    0$ ARRAY      9 ENTRIES READ

    1$ ARRAY     12 ENTRIES READ

    0T

 MSCM     NUMBER OF EXTRA CROSS SECTIONS                          0
 MMT      NUMBER OF NUCLIDES FROM MASTER LIBRARY                  1
 MWT      NUMBER OF NUCLIDES FROM X-SECT LIBRARY (LOG 2)          0
 MXT      NUMBER OF NUCLIDES FROM X-SECT LIBRARY (LOG 3)          0
 MCR      ANISN/DOT/MORSE OUTPUT TRIGGER                          2
 MXX      TOTAL CROSS SECTION POSITION                            0
 MS       WITHIN-GROUP SCATTERING CROSS SECTION POSITION          0
 IRES     NUMBER OF RESONANCE CALCULATIONS                        0
 IQM      TABLE LENGTH FOR CROSS SECTIONS                         0
 IPM      IS AN OLD ANISN LIBRARY MOUNTED ? (0/1:NO/YES)          0
 IPP      OUTPUT OPTION TRIGGER                                   0
 IFG      PRINT CONTROL - ANISN OUTPUT                            0

THE STORAGE ALLOCATED FOR THIS CASE IS  74240 WORDS

    2$ ARRAY      1 ENTRIES READ

    0T

 GENERAL INFORMATION CONCERNING CROSS SECTION LIBRARY
   TAPE IDENTIFICATION NUMBER                 26
   NUMBER OF NUCLIDES ON TAPE                  1
   NUMBER OF NEUTRON ENERGY GROUPS             5
   FIRST THERMAL NEUTRON ENERGY GROUP          5
   NUMBER OF GAMMA ENERGY GROUPS               5


 XSDRN TAPE      26




 NUCLIDES FROM XSDRN TAPE
    1    CARBON V4 (1274)                                                            1274

CARBON V4 (1274)                                                    1274
```

AN ANISN LIBRARY WILL BE MADE ON TAPE 20
FOR 5 NEUTRON GROUPS AND 5 GAMMA GROUPS
IHT= 3
IHS= 4 WHICH ALLOWS 9 DOWNSCATTERS
ITL= 13 0 UPSCATTERS

THE LIBRARY CONTENTS ARE

NOG	ITL	ICT	ID	TITLE		
10	13	0	1	PO DATA FOR CARBON V4 (1274)	XSDRN ID	1274

PSN.	GRP. 1	GRP. 2	GRP. 3	GRP. 4	GRP. 5	GRP. 6	GRP. 7	GRP. 8
1	4.17223E-02	0.0	0.0	8.19306E-06	4.65957E-04	1.28872E-06	6.81473E-06	1.08961E-04
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1.56205E 00	2.87529E 00	4.38677E 00	4.71121E 00	4.72916E 00	4.61866E-01	8.71416E-01	1.58222E 00
4	1.32283E 00	2.58354E 00	4.09154E 00	4.61097E 00	4.72869E 00	8.53026E-02	2.73619E-01	8.00638E-01
5	0.0	1.95399E-01	2.91752E-01	2.95226E-01	1.00229E-01	1.78853E-04	1.49736E-01	4.58473E-01
6	0.0	0.0	2.09189E-03	0.0	0.0	3.08176E-06	1.68332E-04	2.52305E-01
7	0.0	0.0	0.0	7.33447E-06	0.0	0.0	2.90048E-06	0.0
8	0.0	0.0	0.0	0.0	4.09041E-09	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	1.38384E-01	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PSN. 11 THRU PSN. 13 SAME AS ABOVE

PSN.	GRP. 9	GRP. 10
1	4.25284E-03	2.27045E-01
2	0.0	0.0
3	2.49389E 00	3.52553E 00
4	2.03809E 00	3.14003E 00
5	7.81468E-01	4.51543E-01
6	1.49009E-01	0.0
7	3.66186E-02	0.0
8	0.0	0.0

PSN. 9 THRU PSN. 13 SAME AS ABOVE

```
THE LIBRARY CONTENTS ARE
  NOG    ITL  ICT     ID                  TITLE
   10     13    0      5 P4 DATA FOR CARBON V4 (1274)                                                                XSDRN ID         1274

 PSN.   GRP.  1       GRP.  2       GRP.  3       GRP.  4       GRP.  5       GRP.  6       GRP.  7       GRP.  8
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       PSN.    2 THRU PSN.    3 SAME AS ABOVE
    4  6.92084E-01 -3.32974E-03  7.18760E-04  8.51367E-04 -3.72168E-05  5.95179E-01  1.00499E 00  4.17495E-01
    5  0.0          1.27728E-02 -5.45502E-05  1.45853E-04  1.33181E-05  0.0          4.07035E-02 -2.32489E-01
    6  0.0           0.0           0.0           0.0           0.0           0.0           0.0          1.19826E-02
    7  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
    8  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
    9  0.0           0.0           0.0           0.0           0.0         -3.22210E-03   0.0           0.0
   10  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       PSN.   11 THRU PSN.   13 SAME AS ABOVE

 PSN.   GRP.  9       GRP. 10
    1  0.0           0.0
       PSN.    2 THRU PSN.    3 SAME AS ABOVE
    4  1.29308E-01  2.14179E-02
    5 -9.16773E-03 -9.55401E-03
    6 -1.12622E-01  0.0
    7 -4.93551E-02  0.0
    8  0.0           0.0
       PSN.    9 THRU PSN.   13 SAME AS ABOVE


THE LIBRARY CONTENTS ARE
  NOG    ITL  ICT     ID                  TITLE
   10     13    0      6 P5 DATA FOR CARBON V4 (1274)                                                                XSDRN ID         1274

 PSN.   GRP.  1       GRP.  2       GRP.  3       GRP.  4       GRP.  5       GRP.  6       GRP.  7       GRP.  8
    1  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       PSN.    2 THRU PSN.    3 SAME AS ABOVE
    4  2.59818E-01 -1.13107E-03 -2.21149E-03 -2.96711E-03  1.39481E-04  6.37786E-01  7.44298E-01  2.54130E-01
    5  0.0         -4.79294E-03 -1.00356E-04 -3.88062E-04  6.02467E-05  0.0         -1.89479E-01 -2.19151E-01
    6  0.0           0.0           0.0           0.0           0.0           0.0           0.0          5.00109E-02
    7  0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
       PSN.    8 THRU PSN.   13 SAME AS ABOVE

 PSN.   GRP.  9       GRP. 10
    1  0.0           0.0
       PSN.    2 THRU PSN.    3 SAME AS ABOVE
    4  3.09449E-02  9.77533E-04
    5 -6.30138E-02 -3.14026E-03
    6 -5.58826E-02  0.0
    7  2.84203E-02  0.0
    8  0.0           0.0
       PSN.    9 THRU PSN.   13 SAME AS ABOVE
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VV         VV     AAAAAAAAA     SSSSSSSSSSS    EEEEEEEEEEEEE   LL               IIIIIIIIIIII     NN         NN   EEEEEEEEEEEEE
VV         VV    AAAAAAAAAAA   SSSSSSSSSSSSS   EEEEEEEEEEEEE   LL               IIIIIIIIIIII     NNN        NN   EEEEEEEEEEEEE
VV         VV   AA         AA  SS         SS   EE              LL                    II          NNNN       NN   EE
VV         VV   AA         AA  SS              EE              LL                    II          NN NN      NN   EE
VV         VV   AA         AA  SS              EE              LL                    II          NN  NN     NN   EE
VV         VV   AAAAAAAAAAAAA  SSSSSSSSSSSS    EEEEEEEEE       LL                    II          NN   NN    NN   EEEEEEEEE
 VV       VV    AAAAAAAAAAAAA   SSSSSSSSSSSS   EEEEEEEEE       LL                    II          NN    NN   NN   EEEEEEEEE
  VV     VV     AA         AA             SS   EE              LL                    II          NN     NN  NN   EE
   VV   VV      AA         AA             SS   EE              LL                    II          NN      NN NN   EE
    VV VV       AA         AA  SS         SS   EE              LL                    II          NN       NNNN   EE
     VVV        AA         AA  SSSSSSSSSSSSS   EEEEEEEEEEEEE   LLLLLLLLLLLLL    IIIIIIIIIIII     NN        NNN   EEEEEEEEEEEEE
      V         AA         AA   SSSSSSSSSSS    EEEEEEEEEEEEE   LLLLLLLLLLLLL    IIIIIIIIIIII     NN         NN   EEEEEEEEEEEEE


   0000000      5555555555555             //        11          666666666666              //     7777777777777   5555555555555
  000000000     5555555555555            //        111         6666666666666             //      777777777777    5555555555555
 00       00    55                      //        1111         66                       //       77        77    55
00         00   55                     //           11         66                      //                77      55
00         00   55                    //            11         66                     //                77       55
00         00   555555555555         //             11         666666666666          //                77        555555555555
00         00   5555555555555       //              11         6666666666666        //                 77        5555555555555
00         00              55      //               11         66         66       //                 77                    55
00         00              55     //                11         66         66      //                  77                    55
 00       00    55         55    //                 11         66         66     //                  77        55         55
  000000000     5555555555555   //               11111111      6666666666666    //                   77        5555555555555
   0000000       55555555555   //                11111111       66666666666    //                    77         55555555555


 22222222222       0000000                      3333333333      88888888888                       22222222222            44
2222222222222     000000000                    3333333333333   8888888888888                     2222222222222          444
22         22    00       00                   33         33   88         88                     22         22         4444
           22   00         00                             33   88         88                                22        44 44
           22   00         00                             33   88         88                                22       44  44
          22    00         00                           333     88888888888                                22       44   44
        22      00         00      .....                333     88888888888          .....               22        44    44
      22        00         00      .....                  33   88         88         .....             22         44444444444
    22          00         00      .....                  33   88         88         .....           22          4444444444444
  22             00       00       .....       33         33   88         88         .....         22                    44
2222222222222     000000000                    3333333333333   8888888888888                     2222222222222             44
2222222222222      0000000                      3333333333      88888888888                      2222222222222             44
```

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1$ ARRAY 2 ENTRIES READ

OT

3$ ARRAY 5 ENTRIES READ

OT

3$ ARRAY 5 ENTRIES READ

OT

3$ ARRAY 5 ENTRIES READ

OT

3$ ARRAY 5 ENTRIES READ

5* ARRAY 2 ENTRIES READ

OT

3$ ARRAY 5 ENTRIES READ

5* ARRAY 2 ENTRIES READ

OT

THESE PLOTS HAVE BEEN REQUESTED

	PLOT	MT	IDM	IDW	IDE	MMT	MWT	NDFB	MODE	MF	ELO	EHI
1	1	1	1274	0	1274	23	0	11	1	3	0.0	0.0
2	2	1	1274	0	1274	23	0	11	1	3	1.0000000E 06	1.0000000E 08
3	3	4	1274	0	1274	23	0	11	1	3	0.0	0.0
4	4	4	1274	0	1274	23	0	11	1	3	1.0000000E 06	1.0000000E 08
5	5	107	1274	0	1274	23	0	11	1	3	1.0000000E 06	1.0000000E 08

THE FOLLOWING CROSS SECTIONS WERE FOUND TO PLOT

	IDENT	MT	PLT	SRC	NP	NR	ELO	EHI	XLO	XHI	TITLE	
1	1274	1	1	1	51	51	1.000E-05	1.492E 07	1.161E 00	4.732E 00	CARBON V4 (1274)	
2	1274	1	2	1	15	15	1.000E 06	1.492E 07	1.161E 00	2.554E 00	CARBON V4 (1274)	
3	1274	4	3	1	51	51	1.000E-05	1.492E 07	4.372E-02	4.569E-01	CARBON V4 (1274)	
4	1274	4	4	1	15	15	1.000E 06	1.492E 07	4.372E-02	4.569E-01	CARBON V4 (1274)	
5	1274	107	5	1	15	15	1.000E 06	1.492E 07	2.866E-04	1.701E-01	CARBON V4 (1274)	
6	1274	1	1	3	401	2	1.000E-05	2.000E 07	7.300E-01	6.023E 00	6- C- 12 ORNL	EVAL-DEC73 F.G.PEREY AND C.Y.F
7	1274	1	2	3	364	1	1.000E 06	1.000E 08	7.300E-01	6.023E 00	6- C- 12 ORNL	EVAL-DEC73 F.G.PEREY AND C.Y.F
8	1274	4	3	3	97	1	4.800E 06	2.000E 07	8.000E-03	4.802E-01	6- C- 12 ORNL	EVAL-DEC73 F.G.PEREY AND C.Y.F
9	1274	4	4	3	99	1	1.000E 06	1.000E 08	8.000E-03	4.802E-01	6- C- 12 ORNL	EVAL-DEC73 F.G.PEREY AND C.Y.F
10	1274	107	5	3	33	1	1.000E 06	1.000E 08	1.000E-03	3.288E-01	6- C- 12 ORNL	EVAL-DEC73 F.G.PEREY AND C.Y.F

PLOT	SEQ	MT	SYMBOL	SOURCE
1	1	1	0	MAST
1	6	1	1	ENDF
2	2	1	0	MAST
2	7	1	1	ENDF
3	3	4	0	MAST
3	8	4	1	ENDF
4	4	4	0	MAST
4	9	4	1	ENDF
5	5	107	0	MAST
5	10	107	1	ENDF

11.0 MISCELLANEOUS USEFUL INFORMATION

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This catch-all section is intended for more detailed descriptions of certain AMPX features which may require some user knowledge for very specialized applications. Included are material describing:

1. AMPX Input/Output Assignments,
2. AMPX Operating Instructions with the IBM 360,
3. AMPX Master Library Interface,
4. AMPX Working Library Interface,
5. Built-In Response Functions,
6. Built-In Energy Group Structures,
7. Weighting Function Library.

11.1 AMPX Input/Output Assignments

An execution of AMPX can require a variable number of I/Ø devices to be assigned, depending on what modules are executed, what operations are performed, and how many ENDF/B libraries are mounted. Several modules have override provisions on logical assignments such that it is impossible to absolutely specify all the devices which might be used. However, most operations will use default assignments. Table 11.1 is an attempt to give some idea as to the interactions of the various modules in their use of logical assignments. The following abbreviations are used:

W - device is written by this module

S - scratch device

R - device is read by this module

D - must be direct-access scratch device

A - AMPX standard multigroup interface

P - card punch

* - override provision in this module.

Combinations of these symbols should be read as follows: AW* -- AMPX interface written by this module with override provision, etc.

MODULE

Logical Number	DRIVER	XIACS	IAPHINGAS	SMUG	CHOX	NITAWL	XSDRNPM	NPTXS	LAVA	OCTAGN	COMAND	ARID	MALOCS	RADE	VASELINE	CONVERT	REVERT
1					AW*	AR*							AR*	AR*	AR*	W*	
2						AR*					W*				AR*	AR*	
3						AR*	AW			AR*							
4						AW*	AR		AW*								
5	W	Card Input															
6		Standard Output															
7			P	P		P	P				P	P					
8							D										
9						D	D										
10							D										
11		R*	R*	R*				R*							R*		
12		R*															
13																	
14		S	S	S				S									S
15		S	S	S		S*		S									S
16		S	S				W	S									S
17		S	S		S*		W	S									S
18		S	S		S*	S*	S	S	S*	S		W*	S	S	S	S*	S
19			S			S*	S	S	S*				S	S		S*	S
20						W*	W		R*		R*	R*		R*			
21		AR															
22		AW								W*			AW*				R*
23		AW			AR*												AW*
24			AW		AR*												
26				AW	AR*												
27																	
28					AR*												
31		R	R					W									
40				R*													
46		R*	R														

11.2 AMPX Operating Instructions with the IBM 360

An IBM 360 procedure for executing AMPX has been developed and catalogued in the ORNL IBM 360 operating system. The procedure defines the job control language needed to execute a prevalent class of AMPX problems and incorporates enough flexibility to permit a user to adjust the procedure to accommodate other jobs of interest.

Familiarity with the contents of the procedure will be especially useful in designing the job control language needed for executing AMPX on computing systems external to ORNL. A sample procedure is listed in Fig. 11.1.

11.2.1. Use of the AMPX Catalogued Procedure

A number of symbolic parameters are established in the procedure with default values defined. By overriding these default values and including additional DD cards as required, the user designs a set of JCL required to solve a particular problem.

Execution of AMPX in the simplest mode via the catalogued procedure is accomplished by the use of the following job control language cards:

```
accounting card
// EXEC AMPX
//GØ.SYSIN DD *
(AMPX case data)
/*
```

These cards execute the procedure with all symbolic parameter default values intact and with no DD statements added or replaced. In general, the simplest mode limits the problem to one that requires no compilation, uses no tapes, and executes with the default allocation of disk space. Adjusting the procedure to accommodate other types of problems will be illustrated first by defining the symbolic parameters and their default values followed by several specific examples which override default values and add or replace DD cards.

```
//AMPX PROC FT13=NULLFILE,FT20=NULLFILE,FT21=NULLFILE,FT22=NULLFILE,
// FT28=NULLFILE,F13=1,DCB='DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)',
// TAPE='UNIT=TAPE9,LABEL=(,NL),DISP=OLD,VOL=SER=',BLKS=921,BLKL=4000,
// SPC='UNIT=SYSDA,DISP=(MOD,DELETE),SPACE=(TRK,0)',
// XLACS=XLACS,LAPH=LAPH,NPTXS=NPTXS,LOAD=LOAD,ANISO=ENDFILE,
// DCBV='DCB=(RECFM=VBS,LRECL=X,BLKSIZE=',UPDATE=ENDFILE
//*
//*   L. M. PETRIE       BLDG 6002B     EXT 3-1910
//*
//LKED EXEC PGM=IEWL,REGION=150K,PARM=OVLY
//SYSLIB DD DSN=LMP.LIB,UNIT=2314,VOL=SER=NUCLIB,DISP=SHR
//   DD  DSN=SYS1.FORTLIB,DISP=SHR
//   DD  DSN=SYS1.LOGLIB,DISP=SHR
//SYSLIN DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=LMP.AMPX.OVLY(INPUT)
//   DD  &SPC,&DCB,DSN=&&&LOAD
//   DD  DSN=LMP.AMPX.OVLY(&UPDATE),UNIT=2314,VOL=SER=NUCLIB,DISP=SHR
//   DD  DDNAME=SYSIN
//SYSLMOD DD DSN=&&LIBRARY,UNIT=SYSDA,DISP=(NEW,PASS),
//     SPACE=(TRK,(300,20,5),RLSE)
//SYSPRINT DD SYSOUT=A
//SYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(6,1))
//MODULES DD DSN=LMP.LIBRARY,UNIT=2314,VOL=SER=NUCLIB,DISP=SHR
//OVLY DD DSN=LMP.AMPX.OVLY,UNIT=2314,VOL=SER=NUCLIB,DISP=SHR
//*
//*            DEFAULT SIZE FOR LAPHNGAS IS 65000
//*
//LAPHOR DD &SPC,&DCB,DSN=&&&LAPH
// DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=JLL.AMPX.LAGAS
//*
//*            DEFAULT SIZE FOR NPTXS IS 87000
//*
//NPTXS  DD &SPC,&DCB,DSN=&&&NPTXS
// DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=LMP.AMPX.NPTXS
//*
//*            DEFAULT SIZE FOR XLACS IS 45000
//*
//XLACS DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=NMG.AMPX.XLACS
//*
//*        THESE XLACS DD CARDS WILL BE CHANGED WHEN ANISOTROPIC
//*        INELASTIC BECOMES THE STANDARD VERSION
//*
//ANISO DD &SPC,&DCB,DSN=&&&XLACS
// DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=LMP.AMPX.OVLY(&ANISO)
//XLACSP DD VOL=REF=*.MODULES,DISP=SHR,DSN=JEW.NMG13270.ANIS.SCAT
//*
//*       END OF XLACS CARDS
//*
//GO EXEC PGM=AMPX,REGION=270K
//AMPXPRNT DD SYSOUT=A
//STEPLIB DD DSN=&&LIBRARY,DISP=(OLD,DELETE)
// DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=LMP.LIBRARY
```

Figure 11.1. AMPX 360 procedure in use at ORNL.

```
//*
//*       FT01F001 SHARES SPACE WITH FT14F001
//*       FT03F001 SHARES SPACE WITH FT15F001
//*       FT04F001 SHARES SPACE WITH FT31F001
//*
//SHARE1 DD DSN=&&SHR1,SPACE=(TRK,(50,05)),UNIT=SYSDA,DISP=(,DELETE)
//SHARE3 DD DSN=&&SHR3,SPACE=(TRK,(50,05)),UNIT=SYSDA,DISP=(,DELETE)
//SHARE4 DD DSN=&&SHR4,SPACE=(TRK,(50,05)),UNIT=SYSDA,DISP=(,DELETE)
//*
//FT01F001 DD DSN=&&SHR1,&DCBV&BLKS),VOL=REF=*.SHARE1,DISP=(OLD,DELETE)
//FT03F001 DD DSN=&&SHR3,&DCBV&BLKS),VOL=REF=*.SHARE3,DISP=(OLD,DELETE)
//FT04F001 DD DSN=&&SHR4,&DCBV&BLKS),VOL=REF=*.SHARE4,DISP=(OLD,DELETE)
//FT05F001 DD UNIT=SYSDA,SPACE=(480,(20,10)),DCB=BLKSIZE=480
//FT06F001 DD SYSOUT=A
//FT08F001 DD UNIT=SYSDA,SPACE=(3520,(200,20))
//FT09F001 DD UNIT=SYSDA,SPACE=(3520,(200,20))
//FT10F001 DD UNIT=SYSDA,SPACE=(3520,(200,20))
//FT11F001 DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=LMP.ENDFB4
//FT12F001 DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=LMP.THERMAL.DATA
//FT13F001 DD DSN=&FT13,UNIT=TAPE9,LABEL=(&F13,NL),DISP=OLD,
//  VOL=SER=13,&DCB
//FT14F001 DD DSN=&&SHR1,&DCBV&BLKS),VOL=REF=*.SHARE1,DISP=(OLD,DELETE)
//FT15F001 DD DSN=&&SHR3,&DCBV&BLKS),VOL=REF=*.SHARE3,DISP=(OLD,DELETE)
//FT16F001 DD UNIT=SYSDA,&DCBV&BLKS),SPACE=(TRK,(10,05))
//FT17F001 DD UNIT=SYSDA,&DCBV&BLKS),SPACE=(TRK,(10,05))
//FT18F001 DD UNIT=SYSDA,&DCBV&BLKS),SPACE=(TRK,(400,5))
//FT19F001 DD UNIT=SYSDA,&DCBV&BLKS),SPACE=(TRK,(10,05))
//FT20F001 DD DSN=&FT20,&TAPE.20,&DCBV&BLKL)
//FT21F001 DD DSN=&FT21,&TAPE.21,&DCBV&BLKL)
//FT22F001 DD DSN=&FT22,&TAPE.22,&DCBV&BLKL)
//FT23F001 DD UNIT=SYSDA,&DCBV&BLKS),SPACE=(TRK,(10,05))
//FT24F001 DD UNIT=SYSDA,&DCBV&BLKS),SPACE=(TRK,(10,05))
//FT26F001 DD UNIT=SYSDA,&DCBV&BLKS),SPACE=(TRK,(15,2))
//FT28F001 DD DSN=&FT28,&TAPE.28,&DCBV&BLKL)
//FT31F001 DD DSN=&&SHR4,&DCBV&BLKS),VOL=REF=*.SHARE4,DISP=(OLD,DELETE)
//FT40F001 DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=JLL.AMPX.MUG.DATA
//FT41F001 DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=LMP.HRXSECS
//FT42F001 DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=LMP.ALBEDOS
//FT43F001 DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=LMP.WEIGHTS
//FT46F001 DD UNIT=2314,VOL=SER=NUCLIB,DISP=SHR,DSN=JEW.WTFN.LIB
//  PEND
```

Figure 11.1 (continued)

Symbolic Parameters

1. FT13
2. FT20 These symbolic parameters are used to activate DD cards for
3. FT21 tape units with logical numbers 13, 20, 21, 22, and 28,
4. FT22 respectively. Default values are NULLFILE.
5. FT28

   Example: // EXEC AMPX,FT13=NAME

   NAME consists of from one to eight alphameric characters, the first of which must be alphabetic. Any name will suffice.

6. F13 This is used with FT13 to define the file of interest on logical tape 13. The default value is 1. The following makes file 6 available.

   Example: // EXEC AMPX,FT13=NAME,F13=6

7. DCB This is used with FT13 to describe the DCB parameters. The default is DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200).

   Example: // EXEC AMPX,FT13=NAME,
   // DCB='DCB=(RECFM=FB,LRECL=80,BLKSIZE=400)'

8. TAPE This is used to define the tape DD parameters: UNIT, LABEL, DISP, VØL for logical numbers 20, 21, 22, and 28. The default is UNIT=TAPE9,LABEL=(,NL),DISP=ØLD,VØL=SER=

   Example: // EXEC AMPX,TAPE='UNIT=TAPE9,LABEL=(3,NL),DISP=ØLD,VØL=SER='

   NOTE: This defines the affected DD parameters for all of the units (20, 21, 22, 28) to be the same. Uniqueness for a particular unit may be achieved by inserting a DD card for the unit in the GØ STEP of the procedure.

9. LAPH These define temporary DSNAMES in the linkage editor for these
10. XLACS three modules. The default values are the same as the param-
11. NPTXS eter names. This impacts on the user only when it is necessary
    to compile routines to be executed with one of the modules.

   Example: // EXEC AMPX,XLACS=LØADSET

   LØADSET is the data set name assigned by default to the SYSLIN data set in the FØRTHC step.

   NOTE: Only one module may have compilation without some additional effort. A method for compilation in two or more modules will be illustrated in later examples.

12. LØAD — This allows one to compile a new module and execute it in the AMPX system. It requires that the new module be given a name in the LKED step.

```
// EXEC FØRTHC
//SYSIN DD *
  (FØRTRAN for the new module)
```

Example:

```
// EXEC AMPX,LØAD=LØADSET
then in the LKED step
//LKED.SYSIN DD *
  NAME FRESH    (Note: Starts in column 2 of card)
//GØ.SYSIN DD *
=FRESH
```

13. UPDATE — This parameter is provided to allow overriding computer routines in NITAWL, XSDRNPM, and KENØ (these modules are accessed as load modules by AMPX).

	NITLUPDT		NITAWL
Set UPDATE =	XSDNUPDT	to UPDATE	XSDRNPM
	KENØUPDT		KENØ

One also must set LØAD=LØADSET.

14. ANISØ — This is used to select a version of XLACS which provides anisotropic processing for the inelastic scattering reaction. The default of ENDFILE selects the standard XLACS version with isotropic processing for inelastic scattering.

Example: // EXEC AMPX,ANISØ=ANISØ

15. BLKS — This defines the BLKSIZE for the scratch disks used in AMPX. The default is 921 bytes; the overriding value must be specified in bytes.

Example: // EXEC AMPX,BLKS=400

16. BLKL — This defines the BLKSIZE for the tape data sets, logical units 20, 21, 22, and 28. The default is 4000 bytes.

Example: // EXEC AMPX,BLKL=3000

17. SPC — This implements a special set of DD parameters used to facilitate the flexibility of the procedure. Procedure designers may encounter a need to change the default of

UNIT=SYSDA,DISP=(MØD,DELETE),SPACE(TRK,0). Procedure users should not be concerned with this parameter.

18. DCBV This is used in partial definition of DCB parameters for scratch devices and tapes in the AMPX procedure. As with SPC the user should not override the default for this parameter.

The following examples illustrate procedure adjustments. Symbolic parameter default values are overridden by entering the new values on the EXEC AMPX card.

Example 1. Routines are to be compiled for execution in XLACS.

```
accounting card
// EXEC FØRTHC
//SYSIN DD *
  (FØRTRAN SØURCE CARDS)
/*
// EXEC AMPX,XLACS=LØADSET
//GØ.SYSIN DD *
=XLACS
   (XLACS DATA)
/*
```

Example 2. Routines are to be compiled for execution in both the XLACS and LAPHNGAS modules.

```
accounting card
// EXEC FØRTHC
//SYSLIN DD DSN=&&PILE
//SYSIN DD *
  (XLACS FØRTRAN SØURCE CARDS)
/*
// EXEC FØRTHC
// SYSIN DD *
   (LAPHNGAS FØRTRAN SØURCE CARDS)
/*
```

```
// EXEC AMPX,XLACS=PILE,LAPH=LØADSET
//GØ.SYSIN DD *
=XLACS
  (XLACS DATA CARDS)
=LAPHNGAS
  (LAPHNGAS DATA CARDS)
/*
```

Example 3. Activate logical tape number 13 and process the ENDF/B materials located in file 7. The procedure defines logical 13 as a nine track tape and the default DCB describes the typical BCD mode ENDF/B library in use at ORNL.

```
accounting card
// EXEC AMPX,FT13=ATAPE,F13=7
//GØ.SYSIN DD *
  (PRØBLEM DATA)
/*
```

Example 4. The addition of a DD card to make an extra ENDF/B library available on logical unit 47.

```
accounting card
// EXEC AMPX
//SYSIN DD *
//GØ.FT47F001 DD UNIT=TAPE9,VØL=SER=47,DISP=(ØLD,PASS),
// LABEL=(1,NL),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//GØ.SYSIN DD *
  (PRØBLEM DATA)
/*
```

Example 5. Update an existing library located on a 9 track tape, logical 28, and create a new library on another 9 track tape, logical 22.

```
accounting card
// EXEC AMPX,FT22=ANEW,FT28=AØLD
//GØ.SYSIN DD *
  (PRØBLEM DATA)
/*
```

11.2.2. AMPX Core Storage Allocation

A default allocation of 270K bytes of core storage is sufficient to run problems in the 100-150 group class for all modules except LAPH, NPXTS and XLACS. LAPH and XLACS require 410K bytes for that class of problem and NPTXS requires 524K bytes.

If a module produces a message to the effect that insufficient storage is available for execution, additional core must be provided. How this is accomplished depends on the module affected. Many of the modules use a dynamic core allocation scheme where the amount of core available for data storage is automatically the core remaining in the region allocated after the program instructions are loaded. Providing additional data storage for these modules is accomplished by increasing the region allocation on the EXEC card. The modules LAPH, NPTXS, SMUG, amd XLACS do not use the dynamic allocation scheme. For these modules, the number of core storage words available for data storage is specified by program statements in the main programs. Providing additional data storage requires changing the program statements and recompiling the affected MAIN programs. Increasing the region size on the EXEC card may also be necessary. Data storage available in the standard versions of these is 65000 words for LAPH, 87000 words for NTPXS, 35000 words for SMUG, and 45000 words for XLACS. The following example illustrates the JCL requirements and a main program to specify nnnn words of data storage for XLACS.

```
accounting card
// EXEC FØRTHC
//SYSIN DD *
       CØMMØN /DATA/D(nnnn)
       CALL XLACS (nnnn)        (Note: Should start in column 7.)
       STØP
       END
/*
// EXEC AMPX,XLACS=LØADSET,REGIØN.GO=(Based on nnnn)
//GØ.SYSIN DD *
   (PRØBLEM DATA)
/*
```

11.2.3. Addition of a New Module to the AMPX System

This section is intended to convey to a potential designer of an AMPX module some basic information about a module and its interaction with the system.

General characteristics of a module:

1. Each module reads the problem descriptive input required for its execution.
2. Any module requiring ENDF/B data accesses the ENDF/B library directly and independently.
3. Each module may have a unique overlay structure.
4. Subroutines with the same name may appear in more than one module. Such routines may have either identical or unique functions.

Although the AMPX system is quite flexible, a module must meet the following requirements to efficiently operate in the system:

1. Logical 5 should be the input unit.
2. Logical 6 should be the unit for printed output.
3. Certain input/output logical units are reserved for designated functions. These are described in Section 11.1 and new modules should not use these reserved units for another purpose.
4. Multigroup data generated by a module to be passed to another module should be formatted according to the specifications of the general interface described in this chapter.

Although not absolute requirements, the following features are recommended for every AMPX module:

1. Input data should be entered in the ANISN formats described in Section 13.0 of this document.
2. Flexible dimensioning should be used for core storage allocation.
3. The module should execute in 410K bytes of core or less.
4. Scratch devices should be assigned logical numbers consistent with those designated in Section 11.1.

JCL requirements for executing a new module in AMPX are illustrated by the following examples:

Example 1. The HEX cards for a module named GRIME are located on a 9 track tape.

```
accounting card
// EXEC AMPX
//LKED.GRIME DD UNIT=TAPE9,VØL=SER=47,
// DISP=ØLD,LABEL=(1,NL),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//SYSIN DD *
  INCLUDE GRIME
  NAME GRIME      (Note:  Starts in column 2 of card.)
//GØ.SYSIN DD *
=GRIME
  (GRIME DATA)
/*
```

Example 2. The module GRIT is a member of a partitioned data set named NMG.CØDES located on the NUCLIB disk.

```
accounting card
// EXEC AMPX
//GØ.STEPLIB DD
// DD
// DD DSN=NMG.CØDES,UNIT=2314,VØL=SER=NUCLIB,DISP=SHR
//GØ.SYSIN DD *
=GRIT
  (GRIT DATA)
/*
```

The AMPX system includes a library of the following general purpose subroutines:

ALOCAT	DA	FIDO	MGCWRD
ANIS	DATIM	FREAD	MWLIST
AREAD	ECHECK	FSIGP	PRT1D
A1DX	ENERGY	GNERGY	READSG
CLEAR	ERRO	Iϕ	RECTRY, COPY, JGET
CLOCK, ITIME	FFPUN, FLTFX	IREAD	SNST
CMPS	FHLPR, LETTER	JLL1	TIMFAC
	FIDAS, FFREAD	LABL	WOT
		MESAGE	WTO8

RANDNUM, RNDIN, RNDØUT, FLTRN, AZIRN, GTISØ, SFLRA, ANØRM

The library routines can be called by any module in AMPX. They are provided to perform the types of operations common to several modules. For example, several of these routines are for reading or writing multigroup data. Others allocate core, clear storage and interrogate the "computer clock". Interested parties should seek out advice from persons directly involved in the AMPX development for a detailed discussion of their function.

11.3. AMPX Master Library Interface

The AMPX multigroup library formats have been designed with a generality paralleling that of the ENDF/B point data libraries. For example:

1. The formats will allow for neutron libraries, gamma libraries, or coupled neutron-gamma libraries.
2. Resonance parameters can be passed.
3. Any number of reaction cross sections is allowed. ENDF/B identifications are retained where possible.
4. Any scattering process can be represented anisotropically to any order.
5. Any process can have a transfer matrix. For example, XLACS produces a transfer matrix for each inelastic level.
6. Temperature dependence is allowed on thermal scattering kernels.

Special arrays designated "magic-word" arrays are used to compact the potentially very lengthy transfer arrays on the interfaces. These formats effectively eliminate zero and impossible elements from the transfer arrays.

Four types of arrays are used in the formats:

1. The aforementioned "magic-word" array,
2. Temperature dependent 1-D arrays,
3. Temperature independent 1-D arrays, and
4. The resonance parameter array.

11.3.1. Magic-Word Array

The structure of a magic-word array is as follows:

1. length of magic-word string which follows,
2. magic word for first non-zero group (note that this is not necessarily the first energy group),

3. string of transfer elements for this group,
4. magic word for next group,
5. string for next group,

.
.
.
.

etc., etc., until the length specified in the first word is satisfied.

A read statement for this array would contain a list:

```
L,(X(I),I=1,L)
```

A magic word is a 9 digit integer consisting of three 3-digit integers (IIIJJJKKK). The number of the group scattered into is KKK. III is the lowest numbered (highest energied) group which scatters to KKK. JJJ is the highest numbered group which scatters to KKK. After the magic word, the transfer string to group KKK is in reverse order:

IIIJJJKKK

σ(JJJ→KKK)

σ(JJJ-1→KKK)

.
.
.
.

σ(KKK→KKK)

σ(KKK-1→KKK)

.
.
.
.

σ(III→KKK)

Note that the within group term does not necessarily fall in the string.

11.3.2. Temperature-Dependent 1-D Arrays

These arrays are structured as follows:

1. ENDF/B Process ID (MT),
2. Temperature in °K,
3. Average cross section for each energy group,
4. etc., etc.

11.3.3. Temperature-Independent 1-D Arrays

Temperature independent 1-D arrays are structured:

1. ENDF/B Process ID for 1st process,
2. Average cross sections for 1st process for all groups,
3. ENDF/B Process ID for 2nd process,
4. Average cross sections for 2nd process for all groups,
5. etc., etc.

11.3.4. Resonance Array Structure

The make up of this data array is as follows:

1. Mass ratio (A) for the isotope.
2. σ_{po}, potential scattering cross section.
3. Average statistical factor, g, in the unresolved region.
4. Number of resolved resonances.
5. s-factor. This factor is used to determine the region over which the Nordheim Integral Treatment is applied for a resolved resonance.
6. Average energy level spacing, $\langle D \rangle$, for the $\ell = 0$ unresolved sequence passed.
7. $\langle \Gamma_n^\circ \rangle$, average unresolved neutron width.
8. $\langle \Gamma_\gamma \rangle$, average unresolved gamma width.
9. $\langle \Gamma_f \rangle$, average unresolved fission width.
10. Energy of first resolved resonance.
11. Γ_n, neutron width of first resolved resonance.
12. Γ_γ, gamma width of first resonance.
13. Γ_f, fission width of first resonance.
14. r-factor (used in Nordheim Treatment).
15. Statistical factor, g.

16.
17.
18.
19. As for 10-15 for second resolved resonance.
20.
21.
.
.
.
.
.

10+6(number of resolved resonances) - Energies at which to evaluate the unresolved "averaged" cross sections - low-to-high (eV). These energies will span the unresolved energy range.

.
.
.
.
.

11.3.5. Master Interface Specification

The format of the master cross section interface is specified below. Reference is made to the array definitions made immediately prior to this section.

Record	Length (Words)	Contents
1	110	IDT - Interface identification number
		NNUC - Number of nuclides in this interface
		NG - Number of neutron energy groups
		IFTG - First thermal neutron group
		MSN - Zero
		I1 - Number of gamma energy groups
		I2 - Zero
		I3 - Zero
		I4 - Zero
		I5 - Zero
		A(1→100) Hollerith information describing the interface
2	50	ID(1→50) Information

.		describing the first nuclide on
.		the interface
.		
.		(see the description of record R1 below for a specification of the ID array.)
NNUC+1	50	As for record 2 for NNUCth nuclide
NNUC+2	2x(NG+1)	Neutron energy group boundaries (high-to-low in eV) followed by corresponding lethargy boundaries.
NNUC+3	2x(I1+1)	Gamma energy group boundaries (high-to-low in eV) followed by corresponding lethargy boundaries.

NOTE: Records 2 through NNUC+1 constitute a Table of Contents for the interface. Record NNUC+2 or NNUC+3 is omitted when NG=0 or I1=0, respectively.

The following set of records is repeated NNUC times, one nuclide after the other.

Record	Length	Contents
R1	50	ID(1-18) - Hollerith information describing the nuclide
		ID(19) - Nuclide identification number
		ID(20) - Number of resolved resonances
		ID(21) - Number of points at which to evaluate unresolved "averaged" cross sections
		ID(22) - Number of one-dimensional neutron arrays (temperature-independent)
		ID(23) - Number of two-dimensional neutron processes; i.e., a process which requires a neutron-neutron transfer array

ID(24) - Number of temperature-dependent one-dimensional neutron arrays

ID(25) - Number of one-dimensional gamma arrays

ID(26) - Number of two-dimensional gamma processes

ID(27) - Number of neutron to gamma production processes

ID(28) - Not used

ID(29) - Mass number (neutron equivalent)

ID(30) - ZA

ID(31) - Neutron (XLACS) weighting option

ID(32) - Identifier of neutron weighting

ID(33) - Gamma (SMUG) weighting option

ID(34) - Power per fission (watt-sec/fission)

ID(35) - Energy released per capture (watt-sec/capture)

ID(36) - Zero

ID(37) - Number of processes with Bondarenko factors

ID(38) - Number of σ_0's

ID(39) - Number of temperatures

ID(40) - Maximum number of groups with Bondarenko factors

ID(41) - Zero

ID(42) - Identifier of gamma production weighting function

ID(43) - Zero

ID(44) - Gamma production (LAPHNGAS) weighting option

ID(45) - ENDF material number for fast neutron data

Record	Length	Contents
		ID(46) - ENDF material number for thermal neutron data ID(47) - ENDF material number for gamma data ID(48) - ENDF material number for gamma production data ID(49) - Standard CITATION identification number ID(50) - Number of records for this nuclide
R2	ID(38)+ID(39)+2	$(\sigma_0(i)$,i=1,ID(38)), (T(j),j=1,ID(39)), ELØ,EHI where ELØ and EHI define the range over where the Bondarenko factors apply
R3	6 * ID(37)	$(MT_i$,i=1,ID(37)), $(NF_i$,i=1,ID(37)), $(NL_i$,i=1,ID(37)), $(NX_i$,i=1,ID(37)), $(NY_i$,i=1,ID(37)), $(NZ_i$,i=1,ID(37)), where MT is the MT number of the process, NF is the first group with Bondarenko factors for the process, NL is the last group with Bondarenko factors, and NX, NY, NZ are zeroes, presently.

The following 2 records are repeated ID(37) times:

Record	Length	Contents
R4	NL_i-NF_i+1	$(\sigma_{MT}(i)$,i=NF,NL) Infinite dilution values for the cross section of process MT
R5	(NL_i-NF_i+1)*ID(38)*ID(39)	(((BF(i,j,k),i=1,ID(38)), j=1,ID(39)),k=NF,NL)

Record	Length	Contents
R6	6xID(20)+9+ID(21)	Resonance data array
R7	ID(22)x(NG+1)	Temperature-independent one-dimensional arrays
R8	ID(24)x(NG+2)	Temperature dependent one dimensional arrays
R9	ID(23)x4	(MTX(I), I = 1, ID(23)), (LX(I), I = 1, ID(23)), (NLX(I), I = 1, ID(23)), (NTX(I), I = 1, ID(23)), where MTX = the ENDF/B process identification (MT), LX = the maximum length of a single matrix for the ith process, NLX = the expansion order of the cross sections for the ith process, NTX = the number of temperatures at which the cross section for the process are evaluated

The following arrays are repeated for each two-dimensional neutron process, through ID(23) processes.

R10(a)	T(i)	The temperature (eV) at which the transfer arrays are given for the MT_i process NOTE: NT = 0 will not require this array
R10(b)	L(i)max	The P_0 array for the MT_i process at T_1, written (X(I), I = 1, LX)
R10(b+1)	L(i)max	The P_1 array for the MT_i process at T_1
R10(b+NL)	L(i)max	The P_{NL_i} array for the MT_i process at T_1
R10( )	Li(i)max	The P_0 array for the MT_i process at T_2
R10( )	Li(i)max	The P_{NL_i} array for the MT_i process at T_{NT_i}

****Repeat this pattern until all neutron processes are exhausted.

Record	Length	Contents
Gamma Production Arrays		
P1	ID(27)x4	(MTY_i, i = 1, ID(27)), (LY_i, i = 1, ID(27)), (NLY_i, i = 1, ID(27)), (NNY_i, i = 1, ID(27)), where MTY_i, LY_i, and NLY_i have meanings as stated in record R9. NNY_i is a data type identifier. An NNY_i of zero identifies the production arrays for the ith process as fractional yield data. A value of one (1) designates that the arrays are in cross section units.

The following records are repeated for ID(27) processes.

P2	L(i)max	P_0 neutron to gamma transfer matrix, written L, (X(I), I = 1, L)
.		.
.		.
.		.
.		.
P(2+NL_i)	L(i)max	P_{NL_i} neutron to gamma transfer matrix
.		
.		
.		
.		

****Repeat until the two-dimensional gamma processes are exhausted.

Gamma Arrays

G1	ID(25)x(I1+1)	One-dimensional gamma interaction arrays
G2	ID(26)x4	(MTZ_i, i = 1, ID(26)), (LZ_i, i = 1, ID(26)), (NLZ_i, i = 1, ID(26)), (NTZ_i, i = 1, ID(26)) [***NT_i will always have all zeroes] These terms are defined as for record R9 except that they apply to gammas.

Repeat the following records for each process.

G3	L(i)	The P_0 array for the MTZ_i gamma process, written (X(I), I = 1, LZ)
	.	
	.	
	.	
G(3+NL_i)	L(i)	The P_{NLZ_i} array for the MTZ_i gamma process

****This concludes the data for a nuclide.

11.4. AMPX Working Library Interface

The transport calculation provided by the XSDRNPM module requires its cross sections in "collected" working libraries with resonance self-shielding effects already included. An XSDRNPM calculation can collapse its basic data into so-called weighted libraries. The format of these libraries is identical to the working library format.

The format description follows. The array formats as described in 11.4 are used.

Record	Length	Contents
1	110	IDT - Library identification number
		NNUC - Number of nuclides on this library
		NG - Number of neutron energy groups
		IFTG - First thermal neutron group
		MSN - Zero
		I1 - Number of gamma energy groups
		I2 - Zero
		I3 - 0 working library 1 weighted library
		I4 - Zero
		I5 - Zero
		A(1→100) Hollerith information describing the library
2	2x(NG+1)	Neutron energy group boundaries (high-to-low in eV) followed by corresponding lethargy boundaries
3	2x(I1+1)	Gamma energy group boundaries (high-to-low in eV) followed by corresponding lethargy boundaries
4	50	(ID(I), I = 1, 50) - Information describing the first nuclide on the library
5	50	As with record 2 for second nuclide
. . . .		
NNUC+3	50	As with record 2 for nuclide NNUC

NOTE: Records 4 through NNUC+3 constitute a Table of Contents for the library. If NG or I1 is zero, record 2 or 3 is omitted, respectively.

The following block of records is repeated for each of NNUC nuclides.

Record	Length	Contents
R1	50	ID(1-18) - Nuclide Hollerith descriptive information
		ID(19) - Nuclide identification number
		ID(20) - Identification of working set from which this set is derived (weighted library only)
		ID(21) - Zone number in which this nuclide occurred (weighted library only)
		ID(22) - Number of zones in problem which produced this set (zone weighted library only)
		ID(23) - Length of P_0 array for this nuclide
		ID(24) - Order of expansion of cross sections
		ID(25) - Sequence of this set in ID(26) sets for this nuclide (weighted library only)
		ID(26) - Number of sets of zone weighted data for this nuclide (weighted library only)
		ID(27) - Maximum length of P_ℓ arrays for this nuclide
		ID(28) - Number of one-dimensional neutron arrays for this nuclide
		ID(29) - Mass number (neutron equivalent)
		ID(30) - ZA
		ID(31) - Neutron (XLACS) weighting option
		ID(32) - Identifier of neutron weighting function
		ID(33) - Gamma (SMUG) weighting option

Record	Length	Contents
		ID(34) - Power per fission (watt-sec/ fission)
		ID(35) - Energy release per capture (eV) (watt-sec/capture)
		ID(36) - Zero
		ID(37) - Zero
		ID(38) - Zero
		ID(39) - Zero
		ID(40) - Zero
		ID(41) - Number of one-dimensional gamma cross sections
		ID(42) - Identifier of gamma production weighting function
		ID(43) - Temperature associated with thermal scattering kernel, if any
		ID(44) - Gamma production (LAPHNGAS) weighting option
		ID(45) - ENDF material number for fast neutron data
		ID(46) - ENDF material number for thermal neutron data
		ID(47) - ENDF material number for gamma data
		ID(48) - ENDF material number for gamma production data
		ID(49) - Standard CITATION identification
		ID(50) - Number of records for this nuclide

Record	Length	Contents
R2	ID(28)x(NG+1)	One-dimensional neutron cross sections
R3	ID(41)x(I1+1)	One-dimensional gamma cross sections
R4	ID(23)	P_0 array, a magic word array written ID(23), (X(I), I = 1, ID(23))
R5	ID(27)	P_1 array, written L, (X(I), I = 1, L)
.		
.		
.		
.		
	ID(27)max	$P_{ID(24)}$ array, written L, (X(I), I = 1, L)

This concludes the data for a nuclide.

11.5. Built-in Response Functions

Many shielding calculations require standard sources and response functions in the multigroup structure of the problem. Several commonly used functions are built into XLACS (for neutrons) and SMUG (for gammas).

The XLACS parameter NDNP (2$$ array, 12th entry) can be used to produce a set of 29 sources and response functions in a specified group structure. The sources are output as integrated values by group. Response functions are averaged over the weighting function selected for the problem. When NDNP is input non-zero, the complete set of the sources and response functions are included as part of the master neutron interface which XLACS produces. The identification of the set is 100000. Its contents are listed below:

Identifier	Function
9001	Hurst dose factors
9002	Snyder-Neufeld dose factors
9003	Conversion factors for neutron displacement in silicon
9004	Conversion factors for neutron ionization in silicon
9005	Unclassified thermonuclear source spectrum
9006	S.S. 304 damage function (10% uniform elongation at 700 F)
9007	S.S. 304 damage function (10% uniform elongation at 900 F)
9008	S.S. 304 damage function (10% uniform elongation at 1100 F)
9009	S.S. 316 damage function (10% uniform elongation at 750 F)
9010	S.S. 316 damage function (10% uniform elongation at 950 F)
9011	S.S. 316 damage function (10% uniform elongation at 1100 F)
9012	TSR-II source spectrum at end of collimator
9013	14 MeV source spectrum
9014	Response function for 2.06 inch diameter Bonner sphere
9015	Response function for 3.00 inch diameter Bonner sphere
9016	Response function for 3.09 inch diameter Bonner sphere
9017	Response function for 3.94 inch diameter Bonner sphere
9018	Response function for 4.03 inch diameter Bonner sphere
9019	Response function for 5.02 inch diameter Bonner sphere
9020	Response function for 5.88 inch diameter Bonner sphere

Identifier	Function
9021	Response function for 6.00 inch diameter Bonner sphere
9022	Response function for 7.86 inch diameter Bonner sphere
9023	Response function for 9.86 inch diameter Bonner sphere
9024	Response function for 11.84 inch diameter Bonner sphere
9025	Response function for modified 3-in Bonner sphere
9026	Snyder-Neufeld conversion from flux to biological dose
9027	Henderson conversion from neutron flux to absorbed dose rate in tissue

For gammas, SMUG produces (listings only) group averaged values of the following functions:

1. Henderson response,
2. Silicon response, and
3. Claiborne, Trubey response.

Any SMUG run will produce these values.

11.6. Built-in Energy Group Structures

An AMPX user has complete flexibility in selecting neutron and gamma energy structures, in which he obtains multigroup cross sections, is limited only by considerations of time and core size. However, a large fraction of AMPX runs are made in group structures which can be referred to a "standard" group structures, because they are so widely employed.

In an effort to relieve the user from the chore of inputting these structures -- sometimes several times in a single AMPX run -- many of these "standard" structures are built into AMPX.

11.6.1. "Standard" Neutron Boundaries

The available neutron group structures are listed on the following pages. They include:

1. A 16 group Hansen-Roach structure,
2. A 22 group structure widely used for air transport calculations,

3. A 37 group Defense Nuclear Agency structure,
4. A 50 group structure derived from the GAM-II structure and intended for fast reactor applications,
5. A 51 group structure identical to the 50 group structure, but having one extra thermal group,
6. A 100 group structure consisting of the GAM-II structure with one thermal group,
7. A 104 group structure formed by adding 4 groups to the 100 group structure to include important variations in air cross sections,
8. A 105 group structure which is the 104 group structure with one group above 15 MeV,
9. A 119 group structure tailored for fast reactor, air transport, and several shielding applications,
10. A 123 group structure which consists of the GAM-II boundaries combined with a 30 group THERMØS structure below 1.86 eV,
11. A 231 group structure based on the 238 group CSEWG structure but which has more thermal groups and no groups above 15 MeV.

These 11 structures are shown on the following pages.

STANDARD 16 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE	
1	1.5000E 07	3.0000E 06
2	3.0000E 06	1.4000E 06
3	1.4000E 06	9.0000E 05
4	9.0000E 05	4.0000E 05
5	4.0000E 05	1.0000E 05
6	1.0000E 05	1.7000E 04
7	1.7000E 04	3.0000E 03
8	3.0000E 03	5.5000E 02
9	5.5000E 02	1.0000E 02
10	1.0000E 02	3.0000E 01
11	3.0000E 01	1.0000E 01
12	1.0000E 01	3.0000E 00
13	3.0000E 00	1.0000E 00
14	1.0000E 00	4.0000E-01
15	4.0000E-01	1.0000E-01
16	1.0000E-01	1.0000E-03

STANDARD 22 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE	
1	1.4918E 07	1.2214E 07
2	1.2214E 07	1.0000E 07
3	1.0000E 07	8.1873E 06
4	8.1873E 06	6.3600E 06
5	6.3600E 06	4.9659E 06
6	4.9659E 06	4.0657E 06
7	4.0657E 06	3.0119E 06
8	3.0119E 06	2.4660E 06
9	2.4660E 06	2.3500E 06
10	2.3500E 06	1.8268E 06
11	1.8268E 06	1.1080E 06
12	1.1080E 06	5.5023E 05
13	5.5023E 05	1.1109E 05
14	1.1109E 05	3.3546E 03
15	3.3546E 03	5.8295E 02
16	5.8295E 02	1.0130E 02
17	1.0130E 02	2.9023E 01
18	2.9023E 01	1.0677E 01
19	1.0677E 01	3.0590E 00
20	3.0590E 00	5.3159E-01
21	5.3159E-01	4.1400E-01
22	4.1400E-01	1.0000E-05

STANDARD 37 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE	
1	1.9640E 07	1.6905F 07
2	1.6905E 07	1.4918F 07
3	1.4918E 07	1.4191F 07
4	1.4191E 07	1.3840F 07
5	1.3840E 07	1.2840F 07
6	1.2840E 07	1.2214F 07
7	1.2214E 07	1.1052F 07
8	1.1052E 07	1.0000F 07
9	1.0000E 07	9.0484F 06
10	9.0484E 06	8.1873F 06
11	8.1873E 06	7.4082F 06
12	7.4082E 06	6.3763F 06
13	6.3763E 06	4.9659F 06
14	4.9659E 06	4.7237F 06
15	4.7237E 06	4.0657F 06
16	4.0657E 06	3.0119F 06
17	3.0119E 06	2.3852F 06
18	2.3852E 06	2.3069F 06
19	2.3069E 06	1.8268F 06
20	1.8268E 06	1.1080F 06
21	1.1080E 06	5.5023F 05
22	5.5023E 05	1.5764F 05
23	1.5764E 05	1.1109F 05
24	1.1109E 05	5.2475F 04
25	5.2475E 04	2.4788F 04
26	2.4788E 04	2.1875F 04
27	2.1875E 04	1.0333F 04
28	1.0333E 04	3.3546F 03
29	3.3546E 03	1.2341F 03
30	1.2341E 03	5.8295F 02
31	5.8295E 02	1.0130F 02
32	1.0130E 02	2.9023F 01
33	2.9023E 01	1.0677F 01
34	1.0677E 01	3.0590F 00
35	3.0590E 00	1.1254F 00
36	1.1254E 00	4.1400F-01
37	4.1400E-01	1.0000F-05

STANDARD 50 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE
1	1.4918E 07	1.2214E 07
2	1.2214E 07	1.0000E 07
3	1.0000E 07	8.1873E 06
4	8.1873E 06	6.7032E 06
5	6.7032E 06	5.4881E 06
6	5.4881E 06	4.4933E 06
7	4.4933E 06	3.6788E 06
8	3.6788E 06	3.0119E 06
9	3.0119E 06	2.4660E 06
10	2.4660E 06	2.0190E 06
11	2.0190E 06	1.6530E 06
12	1.6530E 06	1.3534E 06
13	1.3534E 06	1.1080E 06
14	1.1080E 06	9.0718E 05
15	9.0718E 05	7.4274E 05
16	7.4274E 05	6.0810E 05
17	6.0810E 05	4.9787E 05
18	4.9787E 05	4.0762E 05
19	4.0762E 05	3.3373E 05
20	3.3373E 05	2.7324E 05
21	2.7324E 05	2.2371E 05
22	2.2371E 05	1.8316E 05
23	1.8316E 05	1.4996E 05
24	1.4996E 05	1.2277E 05
25	1.2277E 05	8.6517E 04
26	8.6517E 04	5.2475E 04
27	5.2475E 04	4.0868E 04
28	4.0868E 04	3.1828E 04
29	3.1828E 04	2.4788E 04
30	2.4788E 04	1.9305E 04
31	1.9305E 04	1.5034E 04
32	1.5034E 04	7.1018E 03
33	7.1018E 03	4.3074E 03
34	4.3074E 03	3.3546E 03
35	3.3546E 03	2.6126E 03
36	2.6126E 03	2.0347E 03
37	2.0347E 03	1.5846E 03
38	1.5846E 03	1.2341E 03
39	1.2341E 03	9.6112E 02
40	9.6112E 02	4.5400E 02
41	4.5400E 02	2.1445E 02
42	2.1445E 02	1.0130E 02
43	1.0130E 02	4.7851E 01
44	4.7851E 01	2.2603E 01
45	2.2603E 01	1.0677E 01
46	1.0677E 01	5.0435E 00
47	5.0435E 00	2.3824E 00
48	2.3824E 00	1.1254E 00
49	1.1254E 00	4.1400E-01
50	4.1400E-01	1.0000E-05

STANDARD 51 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE		GROUP	ENERGY RANGE	
1	1.4918E 07	1.2214E 07	51	1.0000E-01	1.0000E-05
2	1.2214E 07	1.0000E 07			
3	1.0000E 07	8.1873E 06			
4	8.1873E 06	6.7032E 06			
5	6.7032E 06	5.4881E 06			
6	5.4881E 06	4.4933E 06			
7	4.4933E 06	3.6788E 06			
8	3.6788E 06	3.0119E 06			
9	3.0119E 06	2.4660E 06			
10	2.4660E 06	2.0190E 06			
11	2.0190E 06	1.6530E 06			
12	1.6530E 06	1.3534E 06			
13	1.3534E 06	1.1080E 06			
14	1.1080E 06	9.0718E 05			
15	9.0718E 05	7.4274E 05			
16	7.4274E 05	6.0810E 05			
17	6.0810E 05	4.9787E 05			
18	4.9787E 05	4.0762E 05			
19	4.0762E 05	3.3373E 05			
20	3.3373E 05	2.7324E 05			
21	2.7324E 05	2.2371E 05			
22	2.2371E 05	1.8316E 05			
23	1.8316E 05	1.4996E 05			
24	1.4996E 05	1.2277E 05			
25	1.2277E 05	8.6517E 04			
26	8.6517E 04	5.2475E 04			
27	5.2475E 04	4.0868E 04			
28	4.0868E 04	3.1828E 04			
29	3.1828E 04	2.4788E 04			
30	2.4788E 04	1.9305E 04			
31	1.9305E 04	1.5034E 04			
32	1.5034E 04	7.1018E 03			
33	7.1018E 03	4.3074E 03			
34	4.3074E 03	3.3546E 03			
35	3.3546E 03	2.6126E 03			
36	2.6126E 03	2.0347E 03			
37	2.0347E 03	1.5846E 03			
38	1.5846E 03	1.2341E 03			
39	1.2341E 03	9.6112E 02			
40	9.6112E 02	4.5400E 02			
41	4.5400E 02	2.1445E 02			
42	2.1445E 02	1.0130E 02			
43	1.0130E 02	4.7851E 01			
44	4.7851E 01	2.2603E 01			
45	2.2603E 01	1.0677E 01			
46	1.0677E 01	5.0435E 00			
47	5.0435E 00	2.3824E 00			
48	2.3824E 00	1.1254E 00			
49	1.1254E 00	4.1400E-01			
50	4.1400E-01	1.0000E-01			

STANDARD 100 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE		GROUP	ENERGY RANGE	
1	1.4918E 07	1.3499E 07	51	8.6517E 04	6.7380E 04
2	1.3499E 07	1.2214E 07	52	6.7380E 04	5.2475E 04
3	1.2214E 07	1.1052E 07	53	5.2475E 04	4.0868E 04
4	1.1052E 07	1.0000E 07	54	4.0868E 04	3.1828E 04
5	1.0000E 07	9.0484E 06	55	3.1828E 04	2.4788E 04
6	9.0484E 06	8.1873E 06	56	2.4788E 04	1.9305E 04
7	8.1873E 06	7.4082E 06	57	1.9305E 04	1.5034E 04
8	7.4082E 06	6.7032E 06	58	1.5034E 04	1.1709E 04
9	6.7032E 06	6.0653E 06	59	1.1709E 04	9.1188E 03
10	6.0653E 06	5.4881E 06	60	9.1188E 03	7.1018E 03
11	5.4881E 06	4.9659E 06	61	7.1018E 03	5.5309E 03
12	4.9659E 06	4.4933E 06	62	5.5309E 03	4.3074E 03
13	4.4933E 06	4.0657E 06	63	4.3074E 03	3.3546E 03
14	4.0657E 06	3.6788E 06	64	3.3546E 03	2.6126E 03
15	3.6788E 06	3.3287E 06	65	2.6126E 03	2.0347E 03
16	3.3287E 06	3.0119E 06	66	2.0347E 03	1.5846E 03
17	3.0119E 06	2.7253E 06	67	1.5846E 03	1.2341E 03
18	2.7253E 06	2.4660E 06	68	1.2341E 03	9.6112E 02
19	2.4660E 06	2.2313E 06	69	9.6112E 02	7.4852E 02
20	2.2313E 06	2.0190E 06	70	7.4852E 02	5.8295E 02
21	2.0190E 06	1.8268E 06	71	5.8295E 02	4.5400E 02
22	1.8268E 06	1.6530E 06	72	4.5400E 02	3.5358E 02
23	1.6530E 06	1.4957E 06	73	3.5358E 02	2.7537E 02
24	1.4957E 06	1.3534E 06	74	2.7537E 02	2.1445E 02
25	1.3534E 06	1.2246E 06	75	2.1445E 02	1.6702E 02
26	1.2246E 06	1.1080E 06	76	1.6702E 02	1.3007E 02
27	1.1080E 06	1.0026E 06	77	1.3007E 02	1.0130E 02
28	1.0026E 06	9.0718E 05	78	1.0130E 02	7.8893E 01
29	9.0718E 05	8.2085E 05	79	7.8893E 01	6.1442E 01
30	8.2085E 05	7.4274E 05	80	6.1442E 01	4.7851E 01
31	7.4274E 05	6.7206E 05	81	4.7851E 01	3.7267E 01
32	6.7206E 05	6.0810E 05	82	3.7267E 01	2.9023E 01
33	6.0810E 05	5.5023E 05	83	2.9023E 01	2.2603E 01
34	5.5023E 05	4.9787E 05	84	2.2603E 01	1.7604E 01
35	4.9787E 05	4.5049E 05	85	1.7604E 01	1.3710E 01
36	4.5049E 05	4.0762E 05	86	1.3710E 01	1.0677E 01
37	4.0762E 05	3.6883E 05	87	1.0677E 01	8.3153E 00
38	3.6883E 05	3.3373E 05	88	8.3153E 00	6.4760E 00
39	3.3373E 05	3.0197E 05	89	6.4760E 00	5.0435E 00
40	3.0197E 05	2.7324E 05	90	5.0435E 00	3.9279E 00
41	2.7324E 05	2.4724E 05	91	3.9279E 00	3.0590E 00
42	2.4724E 05	2.2371E 05	92	3.0590E 00	2.3824E 00
43	2.2371E 05	2.0242E 05	93	2.3824E 00	1.8554E 00
44	2.0242E 05	1.8316E 05	94	1.8554E 00	1.4450E 00
45	1.8316E 05	1.6573E 05	95	1.4450E 00	1.1254E 00
46	1.6573E 05	1.4996E 05	96	1.1254E 00	8.7644E-01
47	1.4996E 05	1.3569E 05	97	8.7644E-01	6.8257E-01
48	1.3569E 05	1.2277E 05	98	6.8257E-01	5.3159E-01
49	1.2277E 05	1.1109E 05	99	5.3159E-01	4.1400E-01
50	1.1109E 05	8.6517E 04	100	4.1400E-01	1.0000E-04

STANDARD 104 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE		GROUP	ENERGY RANGE	
1	1.4918E 07	1.3499F 07	51	1.4996E 05	1.3569E 05
2	1.3499E 07	1.2214F 07	52	1.3569E 05	1.2277E 05
3	1.2214E 07	1.1052F 07	53	1.2277E 05	1.1109E 05
4	1.1052E 07	1.0000F 07	54	1.1109E 05	8.6517E 04
5	1.0000E 07	9.0484F 06	55	8.6517E 04	6.7380E 04
6	9.0484E 06	8.1873F 06	56	6.7380E 04	5.2475E 04
7	8.1873E 06	7.4082F 06	57	5.2475E 04	4.0868E 04
8	7.4082E 06	7.0000F 06	58	4.0868E 04	3.1828E 04
9	7.0000E 06	6.7032F 06	59	3.1828E 04	2.4788E 04
10	6.7032E 06	6.3600F 06	60	2.4788E 04	1.9305E 04
11	6.3600E 06	6.0653F 06	61	1.9305E 04	1.5034E 04
12	6.0653E 06	5.4881F 06	62	1.5034E 04	1.1709E 04
13	5.4881E 06	4.9659F 06	63	1.1709E 04	9.1188E 03
14	4.9659E 06	4.7500F 06	64	9.1188E 03	7.1018E 03
15	4.7500E 06	4.4933F 06	65	7.1018E 03	5.5309E 03
16	4.4933E 06	4.0657F 06	66	5.5309E 03	4.3074E 03
17	4.0657E 06	3.6788F 06	67	4.3074E 03	3.3546E 03
18	3.6788E 06	3.3287F 06	68	3.3546E 03	2.6126E 03
19	3.3287E 06	3.0119F 06	69	2.6126E 03	2.0347E 03
20	3.0119E 06	2.7253F 06	70	2.0347E 03	1.5846E 03
21	2.7253E 06	2.4660F 06	71	1.5846E 03	1.2341E 03
22	2.4660E 06	2.3500F 06	72	1.2341E 03	9.6112E 02
23	2.3500E 06	2.2313F 06	73	9.6112E 02	7.4852E 02
24	2.2313E 06	2.0190F 06	74	7.4852E 02	5.8295E 02
25	2.0190E 06	1.8268F 06	75	5.8295E 02	4.5400E 02
26	1.8268E 06	1.6530F 06	76	4.5400E 02	3.5358E 02
27	1.6530E 06	1.4957F 06	77	3.5358E 02	2.7537E 02
28	1.4957E 06	1.3534F 06	78	2.7537E 02	2.1445E 02
29	1.3534E 06	1.2246F 06	79	2.1445E 02	1.6702E 02
30	1.2246E 06	1.1080F 06	80	1.6702E 02	1.3007E 02
31	1.1080E 06	1.0026F 06	81	1.3007E 02	1.0130E 02
32	1.0026E 06	9.0718F 05	82	1.0130E 02	7.8893E 01
33	9.0718E 05	8.2085F 05	83	7.8893E 01	6.1442E 01
34	8.2085E 05	7.4274F 05	84	6.1442E 01	4.7851E 01
35	7.4274E 05	6.7206F 05	85	4.7851E 01	3.7267E 01
36	6.7206E 05	6.0810F 05	86	3.7267E 01	2.9023E 01
37	6.0810E 05	5.5023F 05	87	2.9023E 01	2.2603E 01
38	5.5023E 05	4.9787F 05	88	2.2603E 01	1.7604E 01
39	4.9787E 05	4.5049F 05	89	1.7604E 01	1.3710E 01
40	4.5049E 05	4.0762F 05	90	1.3710E 01	1.0677E 01
41	4.0762E 05	3.6883F 05	91	1.0677E 01	8.3153E 00
42	3.6883E 05	3.3373F 05	92	8.3153E 00	6.4760E 00
43	3.3373E 05	3.0197F 05	93	6.4760E 00	5.0435E 00
44	3.0197E 05	2.7324F 05	94	5.0435E 00	3.9279E 00
45	2.7324E 05	2.4724F 05	95	3.9279E 00	3.0590E 00
46	2.4724E 05	2.2371F 05	96	3.0590E 00	2.3824E 00
47	2.2371E 05	2.0242F 05	97	2.3824E 00	1.8554E 00
48	2.0242E 05	1.8316F 05	98	1.8554E 00	1.4450E 00
49	1.8316E 05	1.6573F 05	99	1.4450E 00	1.1254E 00
50	1.6573E 05	1.4996F 05	100	1.1254E 00	8.7644E-01

STANDARD 104 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE
101	8.7644E-01	6.8257F-01
102	6.8257E-01	5.3159F-01
103	5.3159E-01	4.1400F-01
104	4.1400E-01	1.0000F-04

STANDARD 105 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE	GROUP	ENERGY	RANGE
1	1.7000E 07	1.4918F 07	51	1.6573E 05	1.4996E 05
2	1.4918E 07	1.3499F 07	52	1.4996E 05	1.3569E 05
3	1.3499E 07	1.2214F 07	53	1.3569E 05	1.2277E 05
4	1.2214E 07	1.1052F 07	54	1.2277E 05	1.1109E 05
5	1.1052E 07	1.0000F 07	55	1.1109E 05	8.6517E 04
6	1.0000E 07	9.0484F 06	56	8.6517E 04	6.7380E 04
7	9.0484E 06	8.1873F 06	57	6.7380E 04	5.2475E 04
8	8.1873E 06	7.4082F 06	58	5.2475E 04	4.0868E 04
9	7.4082E 06	7.0000F 06	59	4.0868E 04	3.1828E 04
10	7.0000E 06	6.7032F 06	60	3.1828E 04	2.4788E 04
11	6.7032E 06	6.3600F 06	61	2.4788E 04	1.9305E 04
12	6.3600E 06	6.0653F 06	62	1.9305E 04	1.5034E 04
13	6.0653E 06	5.4881F 06	63	1.5034E 04	1.1709E 04
14	5.4881E 06	4.9659F 06	64	1.1709E 04	9.1188E 03
15	4.9659E 06	4.7500F 06	65	9.1188E 03	7.1018E 03
16	4.7500E 06	4.4933F 06	66	7.1018E 03	5.5309E 03
17	4.4933E 06	4.0657F 06	67	5.5309E 03	4.3074E 03
18	4.0657E 06	3.6788F 06	68	4.3074E 03	3.3546E 03
19	3.6788E 06	3.3287F 06	69	3.3546E 03	2.6126E 03
20	3.3287E 06	3.0119F 06	70	2.6126E 03	2.0347E 03
21	3.0119E 06	2.7253F 06	71	2.0347E 03	1.5846E 03
22	2.7253E 06	2.4660F 06	72	1.5846E 03	1.2341E 03
23	2.4660E 06	2.3500F 06	73	1.2341E 03	9.6112E 02
24	2.3500E 06	2.2313F 06	74	9.6112E 02	7.4852E 02
25	2.2313E 06	2.0190F 06	75	7.4852E 02	5.8295E 02
26	2.0190E 06	1.8268F 06	76	5.8295E 02	4.5400E 02
27	1.8268E 06	1.6530F 06	77	4.5400E 02	3.5358E 02
28	1.6530E 06	1.4957F 06	78	3.5358E 02	2.7537E 02
29	1.4957E 06	1.3534F 06	79	2.7537E 02	2.1445E 02
30	1.3534E 06	1.2246F 06	80	2.1445E 02	1.6702E 02
31	1.2246E 06	1.1080F 06	81	1.6702E 02	1.3007E 02
32	1.1080E 06	1.0026F 06	82	1.3007E 02	1.0130E 02
33	1.0026E 06	9.0718F 05	83	1.0130E 02	7.8893E 01
34	9.0718E 05	8.2085F 05	84	7.8893E 01	6.1442E 01
35	8.2085E 05	7.4274F 05	85	6.1442E 01	4.7851E 01
36	7.4274E 05	6.7206F 05	86	4.7851E 01	3.7267E 01
37	6.7206E 05	6.0810F 05	87	3.7267E 01	2.9023E 01
38	6.0810E 05	5.5023F 05	88	2.9023E 01	2.2603E 01
39	5.5023E 05	4.9787F 05	89	2.2603E 01	1.7604E 01
40	4.9787E 05	4.5049F 05	90	1.7604E 01	1.3710E 01
41	4.5049E 05	4.0762F 05	91	1.3710E 01	1.0677E 01

42	4.0762E 05	3.6883E 05	92	1.0677E 01	8.3153E 00
43	3.6883E 05	3.3373E 05	93	8.3153E 00	6.4760E 00
44	3.3373E 05	3.0197E 05	94	6.4760E 00	5.0435E 00
45	3.0197E 05	2.7324E 05	95	5.0435E 00	3.9279E 00
46	2.7324E 05	2.4724E 05	96	3.9279E 00	3.0590E 00
47	2.4724E 05	2.2371E 05	97	3.0590E 00	2.3824E 00
48	2.2371E 05	2.0242E 05	98	2.3824E 00	1.8554E 00
49	2.0242E 05	1.8316E 05	99	1.8554E 00	1.4450E 00
50	1.8316E 05	1.6573E 05	100	1.4450E 00	1.1254E 00

STANDARD 105 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE
101	1.1254E 00	8.7644E-01
102	8.7644E-01	6.8257E-01
103	6.8257E-01	5.3159E-01
104	5.3159E-01	4.1400E-01
105	4.1400E-01	1.0000E-04

STANDARD 119 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE	GROUP	ENERGY	RANGE
1	1.4918E 07	1.2214E 07	51	3.3373E 05	3.0197E 05
2	1.2214E 07	1.0000E 07	52	3.0197E 05	2.9850E 05
3	1.0000E 07	8.1873E 06	53	2.9850E 05	2.9720E 05
4	8.1873E 06	6.7032E 06	54	2.9720E 05	2.9452E 05
5	6.7032E 06	5.4881E 06	55	2.9452E 05	2.8725E 05
6	5.4881E 06	4.4933E 06	56	2.8725E 05	2.7324E 05
7	4.4933E 06	3.6788E 06	57	2.7324E 05	2.4723E 05
8	3.6788E 06	3.1664E 06	58	2.4723E 05	2.2371E 05
9	3.1664E 06	3.0119E 06	59	2.2371E 05	2.1280E 05
10	3.0119E 06	2.8650E 06	60	2.1280E 05	2.0242E 05
11	2.8650E 06	2.7253E 06	61	2.0242E 05	1.9255E 05
12	2.7253E 06	2.5924E 06	62	1.9255E 05	1.8316E 05
13	2.5924E 06	2.4660E 06	63	1.8316E 05	1.7422E 05
14	2.4660E 06	2.3852E 06	64	1.7422E 05	1.6573E 05
15	2.3852E 06	2.3653E 06	65	1.6573E 05	1.5764E 05
16	2.3653E 06	2.3069E 06	66	1.5764E 05	1.4996E 05
17	2.3069E 06	2.2313E 06	67	1.4996E 05	1.4264E 05
18	2.2313E 06	2.1225E 06	68	1.4264E 05	1.3569E 05
19	2.1225E 06	2.0189E 06	69	1.3569E 05	1.2907E 05
20	2.0189E 06	1.9205E 06	70	1.2907E 05	1.2277E 05
21	1.9205E 06	1.8268E 06	71	1.2277E 05	1.1679E 05
22	1.8268E 06	1.7377E 06	72	1.1679E 05	1.1109E 05
23	1.7377E 06	1.6530E 06	73	1.1109E 05	9.8037E 04
24	1.6530E 06	1.5724E 06	74	9.8037E 04	8.6517E 04
25	1.5724E 06	1.4957E 06	75	8.6517E 04	8.2500E 04
26	1.4957E 06	1.4227E 06	76	8.2500E 04	7.9500E 04
27	1.4227E 06	1.3534E 06	77	7.9500E 04	7.2000E 04
28	1.3534E 06	1.2873E 06	78	7.2000E 04	6.7379E 04

29	1.2873E 06	1.2246E 06	79	6.7379E 04	5.6562E 04
30	1.2246E 06	1.1648E 06	80	5.6562E 04	5.2475E 04
31	1.1648E 06	1.1080E 06	81	5.2475E 04	4.6309E 04
32	1.1080E 06	1.0026E 06	82	4.6309E 04	4.0868E 04
33	1.0026E 06	9.6164E 05	83	4.0868E 04	3.4307E 04
34	9.6164E 05	9.0718E 05	84	3.4307E 04	3.1828E 04
35	9.0718E 05	8.6294E 05	85	3.1828E 04	2.8500E 04
36	8.6294E 05	8.2085E 05	86	2.8500E 04	2.7000E 04
37	8.2085E 05	7.8082E 05	87	2.7000E 04	2.6058E 04
38	7.8082E 05	7.4274E 05	88	2.6058E 04	2.4788E 04
39	7.4274E 05	7.0651E 05	89	2.4788E 04	2.3579E 04
40	7.0651E 05	6.7206E 05	90	2.3579E 04	2.1875E 04
41	6.7206E 05	6.3928E 05	91	2.1875E 04	1.9305E 04
42	6.3928E 05	6.0810E 05	92	1.9305E 04	1.5034E 04
43	6.0810E 05	5.7844E 05	93	1.5034E 04	1.1709E 04
44	5.7844E 05	5.5023E 05	94	1.1709E 04	9.1188E 03
45	5.5023E 05	5.2340E 05	95	9.1188E 03	7.1017E 03
46	5.2340E 05	4.9787E 05	96	7.1017E 03	5.5308E 03
47	4.9787E 05	4.5049E 05	97	5.5308E 03	4.3074E 03
48	4.5049E 05	4.0762E 05	98	4.3074E 03	3.7074E 03
49	4.0762E 05	3.6883E 05	99	3.7074E 03	3.3546E 03
50	3.6883E 05	3.3373E 05	100	3.3546E 03	3.0354E 03

STANDARD 119 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE
101	3.0354E 03	2.7465E 03
102	2.7465E 03	2.6126E 03
103	2.6126E 03	2.0347E 03
104	2.0347E 03	1.5846E 03
105	1.5846E 03	1.2341E 03
106	1.2341E 03	9.6112E 02
107	9.6112E 02	7.4852E 02
108	7.4852E 02	4.5400E 02
109	4.5400E 02	2.1445E 02
110	2.1445E 02	1.0130E 02
111	1.0130E 02	4.7851E 01
112	4.7851E 01	2.2603E 01
113	2.2603E 01	1.0677E 01
114	1.0677E 01	5.0435E 00
115	5.0435E 00	2.3824E 00
116	2.3824E 00	1.1254E 00
117	1.1254E 00	4.1399E-01
118	4.1399E-01	1.0000E-01
119	1.0000E-01	1.0000E-05

STANDARD 123 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE		GROUP	ENERGY RANGE	
1	1.4918E 07	1.3499E 07	51	8.6517E 04	6.7380E 04
2	1.3499E 07	1.2214E 07	52	6.7380E 04	5.2475E 04
3	1.2214E 07	1.1052E 07	53	5.2475E 04	4.0868E 04
4	1.1052E 07	1.0000E 07	54	4.0868E 04	3.1828E 04
5	1.0000E 07	9.0484E 06	55	3.1828E 04	2.4788E 04
6	9.0484E 06	8.1873E 06	56	2.4788E 04	1.9305E 04
7	8.1873E 06	7.4082E 06	57	1.9305E 04	1.5034E 04
8	7.4082E 06	6.7032E 06	58	1.5034E 04	1.1709E 04
9	6.7032E 06	6.0653E 06	59	1.1709E 04	9.1188E 03
10	6.0653E 06	5.4881E 06	60	9.1188E 03	7.1018E 03
11	5.4881E 06	4.9659E 06	61	7.1018E 03	5.5309E 03
12	4.9659E 06	4.4933E 06	62	5.5309E 03	4.3074E 03
13	4.4933E 06	4.0657E 06	63	4.3074E 03	3.3546E 03
14	4.0657E 06	3.6788E 06	64	3.3546E 03	2.6126E 03
15	3.6788E 06	3.3287E 06	65	2.6126E 03	2.0347E 03
16	3.3287E 06	3.0119E 06	66	2.0347E 03	1.5846E 03
17	3.0119E 06	2.7253E 06	67	1.5846E 03	1.2341E 03
18	2.7253E 06	2.4660E 06	68	1.2341E 03	9.6112E 02
19	2.4660E 06	2.2313E 06	69	9.6112E 02	7.4852E 02
20	2.2313E 06	2.0190E 06	70	7.4852E 02	5.8295E 02
21	2.0190E 06	1.8268E 06	71	5.8295E 02	4.5400E 02
22	1.8268E 06	1.6530E 06	72	4.5400E 02	3.5358E 02
23	1.6530E 06	1.4957E 06	73	3.5358E 02	2.7537E 02
24	1.4957E 06	1.3534E 06	74	2.7537E 02	2.1445E 02
25	1.3534E 06	1.2246E 06	75	2.1445E 02	1.6702E 02
26	1.2246E 06	1.1080E 06	76	1.6702E 02	1.3007E 02
27	1.1080E 06	1.0026E 06	77	1.3007E 02	1.0130E 02
28	1.0026E 06	9.0718E 05	78	1.0130E 02	7.8893E 01
29	9.0718E 05	8.2085E 05	79	7.8893E 01	6.1442E 01
30	8.2085E 05	7.4274E 05	80	6.1442E 01	4.7851E 01
31	7.4274E 05	6.7206E 05	81	4.7851E 01	3.7267E 01
32	6.7206E 05	6.0810E 05	82	3.7267E 01	2.9023E 01
33	6.0810E 05	5.5023E 05	83	2.9023E 01	2.2603E 01
34	5.5023E 05	4.9787E 05	84	2.2603E 01	1.7604E 01
35	4.9787E 05	4.5049E 05	85	1.7604E 01	1.3710E 01
36	4.5049E 05	4.0762E 05	86	1.3710E 01	1.0677E 01
37	4.0762E 05	3.6883E 05	87	1.0677E 01	8.3153E 00
38	3.6883E 05	3.3373E 05	88	8.3153E 00	6.4760E 00
39	3.3373E 05	3.0197E 05	89	6.4760E 00	5.0435E 00
40	3.0197E 05	2.7324E 05	90	5.0435E 00	3.9279E 00
41	2.7324E 05	2.4724E 05	91	3.9279E 00	3.0590E 00
42	2.4724E 05	2.2371E 05	92	3.0590E 00	2.3824E 00
43	2.2371E 05	2.0242E 05	93	2.3824E 00	1.8600E 00
44	2.0242E 05	1.8316E 05	94	1.8600E 00	1.7100E 00
45	1.8316E 05	1.6573E 05	95	1.7100E 00	1.5600E 00
46	1.6573E 05	1.4996E 05	96	1.5600E 00	1.4400E 00
47	1.4996E 05	1.3569E 05	97	1.4400E 00	1.2900E 00
48	1.3569E 05	1.2277E 05	98	1.2900E 00	1.1250E 00
49	1.2277E 05	1.1109E 05	99	1.1250E 00	1.0000E 00
50	1.1109E 05	8.6517E 04	100	1.0000E 00	8.7600E-01

STANDARD 123 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE	
101	8.7600E-01	7.7600E-01
102	7.7600E-01	6.5000E-01
103	6.5000E-01	5.5000E-01
104	5.5000E-01	4.5000E-01
105	4.5000E-01	3.5000E-01
106	3.5000E-01	3.0000E-01
107	3.0000E-01	2.5000E-01
108	2.5000E-01	2.0000E-01
109	2.0000E-01	1.8000E-01
110	1.8000E-01	1.6000E-01
111	1.6000E-01	1.4000E-01
112	1.4000E-01	1.2000E-01
113	1.2000E-01	1.0000E-01
114	1.0000E-01	9.0000E-02
115	8.0000E-02	7.0000E-02
116	7.0000E-02	6.0000E-02
117	6.0000E-02	5.0000E-02
118	5.0000E-02	4.0000E-02
119	4.0000E-02	3.0000E-02
120	3.0000E-02	2.0000E-02
121	2.0000E-02	1.5000E-02
122	1.5000E-02	1.0000E-02
123	1.0000E-02	5.0000E-03

STANDARD 231 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE		GROUP	ENERGY RANGE	
1	1.4918E 07	1.4550E 07	51	3.8674E 06	3.6788E 06
2	1.4550E 07	1.4191E 07	52	3.6788E 06	3.4994E 06
3	1.4191E 07	1.3840E 07	53	3.4994E 06	3.3287E 06
4	1.3840E 07	1.3499E 07	54	3.3287E 06	3.2465E 06
5	1.3499E 07	1.3165E 07	55	3.2465E 06	3.1664E 06
6	1.3165E 07	1.2840E 07	56	3.1664E 06	3.0882E 06
7	1.2840E 07	1.2523E 07	57	3.0882E 06	3.0119E 06
8	1.2523E 07	1.2214E 07	58	3.0119E 06	2.8650E 06
9	1.2214E 07	1.1912E 07	59	2.8650E 06	2.7253E 06
10	1.1912E 07	1.1618E 07	60	2.7253E 06	2.5924E 06
11	1.1618E 07	1.1331E 07	61	2.5924E 06	2.4660E 06
12	1.1331E 07	1.1052E 07	62	2.4660E 06	2.4251E 06
13	1.1052E 07	1.0779E 07	63	2.4251E 06	2.3852E 06
14	1.0779E 07	1.0513E 07	64	2.3852E 06	2.3653E 06
15	1.0513E 07	1.0253E 07	65	2.3653E 06	2.3457E 06
16	1.0253E 07	1.0000E 07	66	2.3457E 06	2.3069E 06
17	1.0000E 07	9.7531E 06	67	2.3069E 06	2.2689E 06
18	9.7531E 06	9.5123E 06	68	2.2689E 06	2.2313E 06
19	9.5123E 06	9.2774E 06	69	2.2313E 06	2.1225E 06
20	9.2774E 06	9.0484E 06	70	2.1225E 06	2.0190E 06
21	9.0484E 06	8.8250E 06	71	2.0190E 06	1.9691E 06
22	8.8250E 06	8.6071E 06	72	1.9691E 06	1.9205E 06
23	8.6071E 06	8.3946E 06	73	1.9205E 06	1.8731E 06
24	8.3946E 06	8.1873E 06	74	1.8731E 06	1.8268E 06
25	8.1873E 06	7.9852E 06	75	1.8268E 06	1.7377E 06
26	7.9852E 06	7.7880E 06	76	1.7377E 06	1.6530E 06
27	7.7880E 06	7.5957E 06	77	1.6530E 06	1.6122E 06
28	7.5957E 06	7.4082E 06	78	1.6122E 06	1.5724E 06
29	7.4082E 06	7.2253E 06	79	1.5724E 06	1.5335E 06
30	7.2253E 06	7.0469E 06	80	1.5335E 06	1.4957E 06
31	7.0469E 06	6.8729E 06	81	1.4957E 06	1.4227E 06
32	6.8729E 06	6.7032E 06	82	1.4227E 06	1.3534E 06
33	6.7032E 06	6.6476E 06	83	1.3534E 06	1.2873E 06
34	6.6476E 06	6.5924E 06	84	1.2873E 06	1.2246E 06
35	6.5924E 06	6.5377E 06	85	1.2246E 06	1.1943E 06
36	6.5377E 06	6.3763E 06	86	1.1943E 06	1.1648E 06
37	6.3763E 06	6.2189E 06	87	1.1648E 06	1.1080E 06
38	6.2189E 06	6.0653E 06	88	1.1080E 06	1.0540E 06
39	6.0653E 06	5.9156E 06	89	1.0540E 06	1.0026E 06
40	5.9156E 06	5.7695E 06	90	1.0026E 06	9.7783E 05
41	5.7695E 06	5.4881E 06	91	9.7783E 05	9.6164E 05
42	5.4881E 06	5.2205E 06	92	9.6164E 05	9.5369E 05
43	5.2205E 06	4.9659E 06	93	9.5369E 05	9.0718E 05
44	4.9659E 06	4.8432E 06	94	9.0718E 05	8.6294E 05
45	4.8432E 06	4.7237E 06	95	8.6294E 05	8.2085E 05
46	4.7237E 06	4.6070E 06	96	8.2085E 05	7.8082E 05
47	4.6070E 06	4.4933E 06	97	7.8082E 05	7.4274E 05
48	4.4933E 06	4.2741E 06	98	7.4274E 05	7.0651E 05
49	4.2741E 06	4.0657E 06	99	7.0651E 05	6.7206E 05
50	4.0657E 06	3.8674E 06	100	6.7206E 05	6.3928E 05

STANDARD 231 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE		GROUP	ENERGY RANGE	
101	6.3928E 05	6.0810E 05	151	5.2475E 04	4.6309E 04
102	6.0810E 05	5.7844E 05	152	4.6309E 04	4.0868E 04
103	5.7844E 05	5.5023E 05	153	4.0868E 04	3.6066E 04
104	5.5023E 05	5.3665E 05	154	3.6066E 04	3.5175E 04
105	5.3665E 05	5.2340E 05	155	3.5175E 04	3.4307E 04
106	5.2340E 05	5.1047E 05	156	3.4307E 04	3.1828E 04
107	5.1047E 05	4.9787E 05	157	3.1828E 04	2.8088E 04
108	4.9787E 05	4.7359E 05	158	2.8088E 04	2.6058E 04
109	4.7359E 05	4.5049E 05	159	2.6058E 04	2.4788E 04
110	4.5049E 05	4.2852E 05	160	2.4788E 04	2.4176E 04
111	4.2852E 05	4.0762E 05	161	2.4176E 04	2.3579E 04
112	4.0762E 05	3.8774E 05	162	2.3579E 04	2.1875E 04
113	3.8774E 05	3.6883E 05	163	2.1875E 04	2.1335E 04
114	3.6883E 05	3.5084E 05	164	2.1335E 04	1.9305E 04
115	3.5084E 05	3.3373E 05	165	1.9305E 04	1.7036E 04
116	3.3373E 05	3.1746E 05	166	1.7036E 04	1.5034E 04
117	3.1746E 05	3.0962E 05	167	1.5034E 04	1.3268E 04
118	3.0962E 05	3.0197E 05	168	1.3268E 04	1.1709E 04
119	3.0197E 05	2.9452E 05	169	1.1709E 04	1.0333E 04
120	2.9452E 05	2.8725E 05	170	1.0333E 04	9.1188E 03
121	2.8725E 05	2.8015E 05	171	9.1188E 03	8.0473E 03
122	2.8015E 05	2.7324E 05	172	8.0473E 03	7.1017E 03
123	2.7324E 05	2.5991E 05	173	7.1017E 03	6.2673E 03
124	2.5991E 05	2.4724E 05	174	6.2673E 03	5.5308E 03
125	2.4724E 05	2.3518E 05	175	5.5308E 03	5.0045E 03
126	2.3518E 05	2.2371E 05	176	5.0045E 03	4.5283E 03
127	2.2371E 05	2.1280E 05	177	4.5283E 03	4.3074E 03
128	2.1280E 05	2.0242E 05	178	4.3074E 03	4.0973E 03
129	2.0242E 05	1.9255E 05	179	4.0973E 03	3.7074E 03
130	1.9255E 05	1.8316E 05	180	3.7074E 03	3.3546E 03
131	1.8316E 05	1.7422E 05	181	3.3546E 03	3.0354E 03
132	1.7422E 05	1.6992E 05	182	3.0354E 03	2.8635E 03
133	1.6992E 05	1.6573E 05	183	2.8635E 03	2.7465E 03
134	1.6573E 05	1.6163E 05	184	2.7465E 03	2.6126E 03
135	1.6163E 05	1.5764E 05	185	2.6126E 03	2.4852E 03
136	1.5764E 05	1.4996E 05	186	2.4852E 03	2.2487E 03
137	1.4996E 05	1.4264E 05	187	2.2487E 03	2.0347E 03
138	1.4264E 05	1.3569E 05	188	2.0347E 03	1.8411E 03
139	1.3569E 05	1.2907E 05	189	1.8411E 03	1.6659E 03
140	1.2907E 05	1.2277E 05	190	1.6659E 03	1.5846E 03
141	1.2277E 05	1.1679E 05	191	1.5846E 03	1.5073E 03
142	1.1679E 05	1.1109E 05	192	1.5073E 03	1.3639E 03
143	1.1109E 05	9.8037E 04	193	1.3639E 03	1.2341E 03
144	9.8037E 04	8.6517E 04	194	1.2341E 03	9.6112E 02
145	8.6517E 04	7.6351E 04	195	9.6112E 02	7.4852E 02
146	7.6351E 04	6.7379E 04	196	7.4852E 02	5.8295E 02
147	6.7379E 04	6.2511E 04	197	5.8295E 02	4.5400E 02
148	6.2511E 04	5.9462E 04	198	4.5400E 02	3.5358E 02
149	5.9462E 04	5.6562E 04	199	3.5358E 02	2.7536E 02
150	5.6562E 04	5.2475E 04	200	2.7536E 02	2.1445E 02

STANDARD 231 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE
201	2.1445E 02	1.6702E 02
202	1.6702E 02	1.3007E 02
203	1.3007E 02	1.0130E 02
204	1.0130E 02	7.8893E 01
205	7.8893E 01	6.1442E 01
206	6.1442E 01	4.7851E 01
207	4.7851E 01	3.7267E 01
208	3.7267E 01	2.9023E 01
209	2.9023E 01	2.2603E 01
210	2.2603E 01	1.7603E 01
211	1.7603E 01	1.3710E 01
212	1.3710E 01	1.0677E 01
213	1.0677E 01	8.3153E 00
214	8.3153E 00	6.4760E 00
215	6.4760E 00	5.0435E 00
216	5.0435E 00	3.9279E 00
217	3.9279E 00	3.0590E 00
218	3.0590E 00	2.3824E 00
219	2.3824E 00	1.8554E 00
220	1.8554E 00	1.4450E 00
221	1.4450E 00	1.1254E 00
222	1.1254E 00	8.7642E-01
223	8.7642E-01	8.3368E-01
224	8.3368E-01	6.8256E-01
225	6.8256E-01	6.2506E-01
226	6.2506E-01	5.3158E-01
227	5.3158E-01	4.1399E-01
228	4.1399E-01	3.0000E-01
229	3.0000E-01	2.0000E-01
230	2.0000E-01	1.0000E-01
231	1.0000E-01	1.0000E-05

11.6.2. "Standard" Gamma Boundaries

The following gamma energy group structures are built into AMPX:

1. An 18 group structure widely used for air transport calculations,
2. A 21 group structure, which is a Defense Nuclear Agency structure,
3. A 25 group structure,
4. A 26 group structure.

These structures are defined on the following pages.

STANDARD 18 GROUP GAMMA STRUCTURE

GROUP	ENERGY	RANGE
1	1.4000E 07	1.0000E 07
2	1.0000E 07	8.0000E 06
3	8.0000E 06	7.0000E 06
4	7.0000E 06	6.0000E 06
5	6.0000E 06	5.0000E 06
6	5.0000E 06	4.0000E 06
7	4.0000E 06	3.0000E 06
8	3.0000E 06	2.5000E 06
9	2.5000E 06	2.0000E 06
10	2.0000E 06	1.5000E 06
11	1.5000E 06	1.0000E 06
12	1.0000E 06	7.0000E 05
13	7.0000E 05	4.5000E 05
14	4.5000E 05	3.0000E 05
15	3.0000E 05	1.5000E 05
16	1.5000E 05	6.0000E 04
17	6.0000E 04	3.0000E 04
18	3.0000E 04	1.0000E 04

STANDARD 21 GROUP GAMMA STRUCTURE

GROUP	ENERGY	RANGE
1	1.4000E 07	1.0000E 07
2	1.0000E 07	8.0000E 06
3	8.0000E 06	7.0000E 06
4	7.0000E 06	6.0000E 06
5	6.0000E 06	5.0000E 06
6	5.0000E 06	4.0000E 06
7	4.0000E 06	3.0000E 06
8	3.0000E 06	2.5000E 06
9	2.5000E 06	2.0000E 06
10	2.0000E 06	1.5000E 06
11	1.5000E 06	1.0000E 06
12	1.0000E 06	7.0000E 05
13	7.0000E 05	4.5000E 05
14	4.5000E 05	3.0000E 05
15	3.0000E 05	1.5000E 05
16	1.5000E 05	1.0000E 05
17	1.0000E 05	7.0000E 04
18	7.0000E 04	4.5000E 04
19	4.5000E 04	3.0000E 04
20	3.0000E 04	2.0000E 04
21	2.0000E 04	1.0000E 04

STANDARD 25 GROUP GAMMA STRUCTURE

GROUP	ENERGY	RANGE
1	1.3000E 07	1.0197F 07
2	1.0197E 07	7.9983F 06
3	7.9983E 06	6.2737F 06
4	6.2737E 06	4.9210F 06
5	4.9210E 06	3.8599F 06
6	3.8599E 06	3.0277F 06
7	3.0277E 06	2.3748F 06
8	2.3748E 06	1.8628F 06
9	1.8628E 06	1.4611F 06
10	1.4611E 06	1.1461F 06
11	1.1461E 06	8.9896F 05
12	8.9896E 05	7.0513F 05
13	7.0513E 05	5.5309F 05
14	5.5309E 05	4.3383F 05
15	4.3383E 05	3.4029F 05
16	3.4029E 05	2.6692F 05
17	2.6692E 05	2.0937F 05
18	2.0937E 05	1.6422F 05
19	1.6422E 05	1.2881F 05
20	1.2881E 05	1.0104F 05
21	1.0104E 05	7.9252F 04
22	7.9252E 04	6.2164F 04
23	6.2164E 04	4.8760F 04
24	4.8760E 04	3.8247F 04
25	3.8247E 04	3.0000F 04

STANDARD 26 GROUP GAMMA STRUCTURE

GROUP	ENERGY	RANGE
1	1.4000E 07	1.0000F 07
2	1.0000E 07	8.0000F 06
3	8.0000E 06	7.0000F 06
4	7.0000E 06	6.0000F 06
5	6.0000E 06	5.0000F 06
6	5.0000E 06	4.0000F 06
7	4.0000E 06	3.0000F 06
8	3.0000E 06	2.5000F 06
9	2.5000E 06	2.0000F 06
10	2.0000E 06	1.5000F 06
11	1.5000E 06	1.0000F 06
12	1.0000E 06	8.3000F 05
13	8.3000E 05	7.0000F 05
14	7.0000E 05	5.5000F 05
15	5.5000E 05	4.5000F 05
16	4.5000E 05	3.0000F 05
17	3.0000E 05	2.0000F 05
18	2.0000E 05	1.3000F 05
19	1.3000E 05	1.0000F 05
20	1.0000E 05	7.0000F 04
21	7.0000E 04	5.0000F 04
22	5.0000E 04	4.0000F 04
23	4.0000E 04	3.0000F 04
24	3.0000E 04	2.0000F 04
25	2.0000E 04	1.3000F 04
26	1.3000E 04	1.0000F 04

11.7. AMPX Weighting Function Library

The XLACS and LAPHNGAS modules in AMPX can select pre-calculated weighting functions which have been provided in library form. An ENDF-like scheme is used as a format. At ORNL, one commonly used library contains the following functions:

Identifier	Function
101	Inconel ($1/E\Sigma_t$)
102	Concrete ($1/E\Sigma_t$)
103	Air ($I/E\Sigma_t$)
104	SS-304 ($1/E\Sigma_t$)

These are written as follows: (ENDF format definitions are used),

[8000,3,MT/ZA,AWR,LIS,LFS,0,0]HEAD

[8000,3,MT/T,Q,LT,0,NR,NP/E_{int}/σ(E)]Tabl

[8000,3,0/0.0,0.0,0,0,0,0]SEND

on logical 46 one after the other.

13.0. FIDO (ANISN) INPUT SYSTEM

W. A. Rhoades

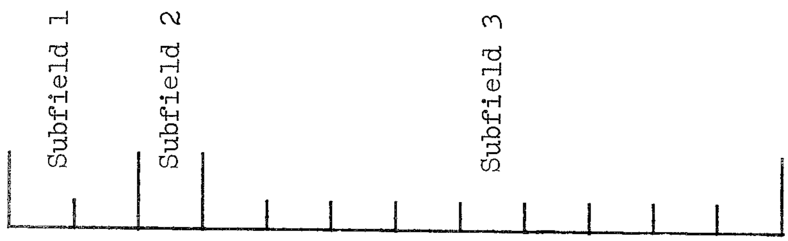
The FIDO input method is especially devised to allow the entering or modifying of large data arrays with minimum effort. Special advantage is taken of patterns of repetition or symmetry wherever possible. The FIDO system was patterned after the input method used with the FLOCO coding system at Los Alamos, and was first applied to the DTF-II code. Since that time, numerous features requested by users have been added, a free-field option has been developed, and the application of FIDO has spread to innumerable codes.

The data are entered in units called "arrays". An array comprises a group of contiguous storage locations which are to be filled with data at one time. These arrays usually correspond on a one-to-one basis with FORTRAN arrays used in the program. A group of one or more arrays read with a single call to the FIDO package forms a "block", and a special delimiter is required to signify the end of each block. Arrays within a block may be read in any order with respect to each other, but an array belonging to one block must not be shifted to another. The same array can be entered repeatedly within the same block. For example, an array could be filled with "0" using a special option, and then a few scattered locations could be changed by reading in a new set of data for that array. If no entries to the arrays in a block are required, the delimiter alone satisfies the input requirement.

Three major types of input are available: fixed-field input, free-field input, and user-field input.

13.1. Fixed-Field Input

Each card is divided into six 12-column data fields, each of which is divided into three subfields. The following sketch illustrates a typical data field. The three subfields always comprise 2, 1, and 9 columns, respectively.



To begin the first array of a block, an array originator field is placed in any field on a card:

Subfield 1: An integer array identifier < 100 specifying the data array to be read in.

Subfield 2: An array-type indicator:

"$" if the array is integer data

"*" if the array is real data

Subfield 3: Blank

Data are then placed in successive fields until the required number of entries has been accounted for. A sample data sheet shown below illustrates this input.

In entering data, it is convenient to think of an "index" or "pointer" which is under control of the user, and which specifies the position in the array into which the next data entry is to go. The pointer is always positioned at array location #1 by entering the array originator field. The pointer subsequently moves according to the data operator chosen. Blank fields are a special case, in that they do not cause any data modification and do not move the pointer.

A data field has the following form:

Subfield 1: The data numerator, an integer < 100. We refer to this entry as N_1 in the following discussion.

Subfield 2: One of the special data operators listed below.

Subfield 3: A nine-character data entry, to be read in F9.0 format. It will be converted to an integer if the array is a "$" array or if a special array operator such as Q is being used. Note that an exponent is permissible but not required. Likewise, a decimal is permissible but not required. If no decimal is supplied it is assumed to be immediately to the left of the exponent, if any; and otherwise to the right of the last column. This entry is referred to as N_3 in the following discussion.

A list of data operators and their effect on the array being input follows:

"Blank" indicates a single entry of data. The data entry in the third subfield is entered in the location indicated by the pointer, and the pointer is advanced by one. However, an entirely blank field is ignored.

"+" or "-" indicates exponentiation. The data entry in the third field is entered and multiplied by $10^{\pm N_1}$, where N_1 is the data numerator in the first subfield, given the sign indicated by the data operator itself. The pointer advances by one. In cases where an exponent is needed, this option allows the entering of more significant figures than the blank option.

"&" has the same effect as "+".

"R" indicates that the data entry is to be repeated N_1 times. The pointer advances by N_1.

"I" indicates linear interpolation. The data numerator, N_1, indicates the number of interpolated points to be supplied. The data entry in the third subfield is entered, followed by N_1 interpolated entries equally spaced between that value and the data entry found in the third subfield of the next non-blank field. The pointer is advanced by $N_1 + 1$. The field following an "I" field is then processed normally, according to its own data operator. The "I" entry is especially valuable for specifying a spatial mesh. In "$" arrays, interpolated values will be rounded to the nearest integer.

"L" indicates logarithmic interpolation. The effect is the same as that of "I" except that the resulting data are evenly separated in log-space. This is especially convenient for specifying an energy mesh.

"Q" is used to repeat sequences of numbers. The length of the sequence is given by the third subfield, N_3. The sequence of N_3 entries is to be repeated N_1 times. The pointer advances by N_1*N_3. If either N_1 or N_3 is 0, then a sequence of $N_1 + N_3$ is repeated one time only, and the pointer advances by $N_1 + N_3$. This feature is especially valuable for geometry specification.

The "N" option has the same effect as "Q", except that the order of the sequence is reversed each time it is entered. This is valuable for the type of symmetry possessed by S_n quadrature coefficients.

"M" has the same effect as "N" except that the sign of each entry in the sequence is reversed each time the sequence is entered. For example, the entries:

1 2 3 2M2

would be equivalent to

1 2 3 -3 -2 2 3.

This option is also useful in entering quadrature coefficients.

"Z" causes $N_1 + N_3$ locations to be set to 0. The pointer is advanced by $N_1 + N_3$.

"C" causes the position of the last array item entered to be printed. This is the position of the pointer, less 1. The pointer is not moved.

"Ø" causes the print trigger to be changed. The trigger is originally off. Successive "Ø" fields turn it on and off alternately. When the trigger is on, each card image is listed as it is read.

"S" indicates that the pointer is to skip N_1 positions leaving those array positions unchanged. If the third subfield is blank, the pointer is advanced by N_1. If the third subfield is non-blank that data entry is entered following the skip, and the pointer is advanced by $N_1 + 1$.

"A" moves the pointer to the position, N_3, specified in the third subfield.

"F" fills the remainder of the array with the datum entered in the third subfield.

"E" skips over the remainder of the array. The array length criterion is always satisfied by an E, no matter how many entries have been specified. No more entries to an array may be given following an "E", except that data entry may be restarted with an "A".

The reading of data to an array is terminated when a new array origin field is supplied, or when the block is terminated. If an incorrect number of positions has been filled, an error edit is given, and a flag is set which will later abort execution of the problem. FIDO then continues with the next array if an array origin was read. Otherwise, it returns control to the calling program.

A <u>block termination</u> consists of a field having "T" in the second subfield. All entries following "T" on a card are ignored, and control is returned from FIDO to the calling program.

Comment cards can be entered within a block by placing an apostrophe (') in column 1. Then columns 2-80 will be listed, with column 2 being used for printer carriage control. Such cards have no effect on the data array or pointer.

13.2. Free-Field Input

With free-field input, data are written without fixed restrictions as to field and subfield size and positioning on the card. The options used with fixed-field input are available, although some are slightly restricted in form. In general, fewer data cards are required for a problem, the interpreting print is easier to read, a card listing is more intelligible, the cards are easier to keypunch, and certain common keypunch errors are tolerated without affecting the problem. Data arrays using fixed- and free-field input can be intermingled at will within a given block.

The concept of three subfields per field is still applicable to free-field input, but if no entry for a field is required, no space for it need be left. Only columns 1-72 may be used, as with fixed-field input.

The array originator field can begin in any position. The array identifiers and type indicators are used as in fixed-field input. The type indicator is entered twice, to designate free-field input (i.e., "$$" or "**"). The blank third subfield required in fixed-field input is not required. For example:

31**

indicates that array 31, a real-data array, will follow in free-field format.

Data fields may follow the array origin field immediately. The data field entries are identical to the fixed-field entries with the following restrictions:

(1) Any number of blanks may separate fields, but at least one blank must follow a third subfield entry if one is used.

(2) If both first- and second-subfield entries are used, no blanks may separate them, i.e., 24S, but not 24 S.

(3) Numbers written with exponents must not have imbedded blanks, i.e., 1.0E+4, 1.0E4, 1.0+4, or even 1+4, but not 1.0 E4.

(4) In third-subfield data entries, only 9 digits, including the decimal but not including the exponent field, can be used, i.e., 123456.89E07, but not 123456.789E07.

(5) The Z entry must be of the form: 738Z, not Z738 or 738 Z.

(6) The + or - data operators are not needed and are not available.

(7) The Q, N, and M entries are restricted: 3Q4, 1N4, or M4, but not 4Q, 4N, or 4M.

13.3. User-Field Input

If the user follows the array identifier in the array originator field with the character "U" or "V", the input format is to be specified by the user. If "U" is specified, the FORTRAN FORMAT to be used must be supplied in columns 1-72 of the next card. The format must be enclosed by the usual parentheses. Then the data for the entire array must follow on successive cards. The rules of ordinary FORTRAN input as to exponents, blanks, etc., apply. If the array data do not fill the last card, the remainder must be left blank.

"V" has the same effect as "U" except that the format read in the last preceding "U" array is used.

Name General Example of Fido Input Charge Date Page

Col			IDENTIFICATION	REMARKS (DO NOT PUNCH)
1	1 $			Begin the 1$ array, fixed-field, integral
13		1		Enter 1
25	F	2		Fill array with 2
37	2 *			Begin the 2* array, fixed-field, real
49		1 . 2 3 4	73 80	Enter 1.234
61		1 2 . 3 4 - 1	1 0	" "
1	5 -	1 2 3 4 + 0 2		" "
13	3 -	1 2 3 4		" "
25		7		" 7.0
37				A blank field is always ignored
49	T		73 80	Terminate this block
61			2 0	No entries may follow T on a card
1	3 *			Begin 3* array, fixed-field real
13	9 I	0		Enter 0,1,2,3,4,5,6,7,8,9,10,10,10
25	3 R	1 0		as real numbers
37	3 * *	1 0 S 1 0		Repeat 3* in free-field, skip
49	1 1	1 2	73 80	to 11th entry, correct sequence to
61			3 0	----9,10,11,12
1	4 * *	2 I 1 4 . 0		Begin 4* array, free-field, real
13	2 Q 4			Enter 1,2,3,4, 1,2,3,4, 1,2,3,4
25		E		End reading this array; remainder of array unchanged.
37		T		Terminate this block
49			73 80	
61			4 0	

R - REPEAT I - INTERPOLATE S - SKIP T - TERMINATE

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