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A User's Guide for LAVA as issued with MORSE-SGC

S. K. Fraley

OAK RIDGE NATIONAL LABORATORY

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COMPUTER SCIENCES DIVISION

A USER'S GUIDE FOR LAVA AS ISSUED WITH MORSE-SGC

S. K. Fraley

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ABSTRACT

LAVA (Let ANISN Visit AMPX) is a computer code which will transform ANISN cross-section libraries to the AMPX working library format. This version of LAVA is a stand-alone program issued with the MORSE-SCC code which accepts only cross sections in the AMPX working library format.

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INTRODUCTION

LAVA (Let ANISN Visit AMPX) is a module of AMPX¹. It will take an ANISN² cross-section library (neutron, gamma, or coupled neutron-gamma) and transform it into an AMPX working library, which can be used by MORSE-SGC.³

The version of LAVA issued with MORSE-SGC contains the necessary AMPX library routines to render it operable as a stand-alone program.

A FORTRAN subroutine, ALOCAT, is used to allocate the space for data storage (see Fig. 1). The version issued allocates 30,000 words for data storage. This can be altered by changing the 30,000 on the second and third cards (Fig. 1) to whatever size is desired. The execution COSIZE must also be set to accommodate this storage space.

```
SUBROUTINE ALOCAT (PROGM)
COMMON D(30000)
CALL PROGM (D,30000)
RETURN
END
```

Figure 1. A FORTRAN ALOCAT

An IBM 360/370 assembly language subroutine ALOCAT is issued as part of MORSE-SGC. This version can also be used with LAVA instead of the FORTRAN version above. The assembly language version utilizes all storage space available within the execution COSIZE. Data storage space is then altered by changing the execution COSIZE.

The FIDO format is used for LAVA input data. An extract of the AMPX manual (Section 13.0 of Ref. 1) which explains the use of the FIDO system is included as Appendix A.

A sample problem is shown in Appendix C.

LAVA Input Data

Block 1

0\$ Logical Definitions [6]*

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

1\$ ANISN Library Parameter Data [8]

1. NNLC - 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 $\sigma_{g \rightarrow g}$
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

*Number of entries required for each array is shown in [].

Block 2

- 2\$ Identifiers of P_0 parts of nuclides on ANISN library [NNUC]
 3\$ Order of scattering by nuclides selected from ANISN library [NNUC]
 4\$ AMPX identifiers for the nuclides selected from ANISN library [NNUC]
 5\$ MT Numbers [IHT]

The MT numbers (see Fig. 2) of the 1-D cross sections above $\sigma_{g \rightarrow g}$ in the ANISN library, starting at position IHT and working back to the first position (defaults 1, 1452, 27, 18, 1018, 1001, 2, 16, 102, 103, 107)

- 6* CHI [IGM]

Needed for fissionable nuclides if MT 1018 not present in the ANISN library

- 7* Neutron energy group boundaries [IGM+1] high-to-low in energy (eV) (defaults are available[†] for 16, 22, 37, 50, 51, 100, 104, 105, 119, 123, and 231 neutron groups)

- 8* Gamma energy group boundaries [IPM+1]

High-to-low in energy (eV) (defaults are available[†] for 18, 21, 25, and 26 gamma groups)

- 9\$ CHI Forcing Flags [NNUC]

A nonzero entry for a nuclide causes chi for that nuclide to be taken from the 6* array regardless of whether there is an MT=1018 entry (defaults to zero all entries)

T - Terminate Block 2

[†]An extract of the AMPX manual (Section 11.6 of Ref. 1) which lists the built-in energy group boundaries is included as Appendix B.

<u>MT Numbers</u>	
1	σ_t
1452	$v\sigma_f$
27	σ_a
18	σ_f
1018	χ
1001	σ_{tr}
2	σ_s
16	σ_{n2n}
102	σ_{ny}
103	σ_{np}
107	$\sigma_{n\alpha}$

Figure 2. MT numbers.

LAVA Input/Output Specifications

The following devices are normally needed in running LAVA.

<u>Logical Number</u>	<u>Purpose</u>
4	AMPX working library written by LAVA
5	Card input
6	Standard output
18	Scratch device
19	Scratch device
20	ANISN library

Each P-part of each nuclide in the ANISN library must be preceded by the following:

NGPS, ILM, NF, ID, (TITLE(I), I=1, 1?)

where

NGPS is the number of groups, ILM+IPM

ILM is the table length

NF is a flag which will normally be zero.

NF=7 is used as a flag to indicate the end of the ANISN library

ID - the ID number of the P-part

TITLE(I) - alpha numeric data

For a free-form BCD or formatted BCD ANISN library, the card format will be: 1X, 2I6, I4, I6, 12A4.

APPENDIX A

FIDO (ANISN) Input System

W. A. Rhoades

The FIDO input method is especially devised to allow the entrance 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.

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 two, one, and nine 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 specifies 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.

The "+" or "-" indicates exponentiation. The data entry in the third field is entered and multiplied by 10^{+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.

The "&" 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 nonblank 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 nonblank 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", but 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 block termination 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.

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 also 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.

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 regarding 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.

				IDENTIFICATION	REMARKS (DO NOT PUNCH)
1	S				Begin the 1\$ array, fixed-field, integral
			1		Enter 1
	F		2		Fill array with 2
2	*				Begin the 2* array, fixed-field, real
		1 . 2 3 4			Enter 1.234
		1 2 . 3 4	- 1	1 0	" "
5	-	1 2 3 4	+ 0 2		" "
3	-		1 2 3 4		" "
			7		" 7.0
					A blank field is always ignored
	T				Terminate this block
				2 0	No entries may follow T on a card
3	*				Begin 3* array, fixed-field real
9	I		0		Enter 0,1,2,3,4,5,6,7,8,9,10,10,10
3	R		1 0		as real numbers
3	*	1 0 S	1 0		Repeat 3* in free-field, skip
1	1	1 2			to 11th entry, correct sequence to
				3 0	----9,10,11,12
4	*	2 I 1	4 . 0		Begin 4* array, free-field, real
2	Q				Enter 1,2,3,4, 1,2,3,4, 1,2,3,4
		E			End reading the array; remainder of array unchanged.
	T				Terminate this block
				4 0	

R - REPEAT

I - INTERPOLATE

S - SKIP

T - TERMINATE

APPENDIX B

Built-In Energy Group Structures

An AMPX user has complete flexibility in selecting the neutron and gamma energy structures in which he obtains multigroup cross sections and is limited only by considerations of time and core size. However, a large number of AMPX runs are made using group structures which can be referred to as "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.

"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 CAM-II boundaries combined with a 30 group THERMOS 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.

Table B.1. Standard 16-group neutron structure

GROUP	ENERGY		RANGE	
1	1.5000E	07	3.0300E	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

Table B.2. 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	1.1254E	00
21	1.1254E	00	4.1400E	-01
22	4.1400E	-01	1.0000E	-05

Table B.3.
STANDARD 37 GROUP NEUTRON STRUCTURE

GROUP	ENERGY RANGE			
1	1.9640E	07	1.6905E	07
2	1.6905E	07	1.4914E	07
3	1.4914E	07	1.4191E	07
4	1.4191E	07	1.3840E	07
5	1.3840E	07	1.2840E	07
6	1.2840E	07	1.2214E	07
7	1.2214E	07	1.1052E	07
8	1.1052E	07	1.0000E	07
9	1.0000E	07	9.0484E	06
10	9.0484E	06	8.1873E	06
11	8.1873E	06	7.4082E	06
12	7.4082E	06	6.3763E	06
13	6.3763E	06	4.9659E	06
14	4.9659E	06	4.7237E	06
15	4.7237E	06	4.0657E	06
16	4.0657E	06	3.0119E	06
17	3.0119E	06	2.3852E	06
18	2.3852E	06	2.3069E	06
19	2.3069E	06	1.8268E	06
20	1.8268E	06	1.1080E	06
21	1.1080E	06	5.5023E	05
22	5.5023E	05	1.5764E	05
23	1.5764E	05	1.1109E	05
24	1.1109E	05	5.2475E	04
25	5.2475E	04	2.4788E	04
26	2.4788E	04	2.1875E	04
27	2.1875E	04	1.0333E	04
28	1.0333E	04	3.3546E	03
29	3.3546E	03	1.2341E	03
30	1.2341E	03	5.8295E	02
31	5.8295E	02	1.0130E	02
32	1.0130E	02	2.9023E	01
33	2.9023E	01	1.0677E	01
34	1.0677E	01	3.0590E	00
35	3.0590E	00	1.1254E	00
36	1.1254E	00	4.1400E	-01
37	4.1400E	-01	1.0000E	-05

Table B.4.
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

Table B.5.

STANDARD 51 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	5.4861E 06
6	5.4861E 06	4.4937E 06
7	4.4937E 06	3.6788E 06
8	3.6788E 06	3.0114E 06
9	3.0114E 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
51	1.0000E-01	1.0000E-05

Table B.6.

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

Table B.7.

STANDARD 104 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE	GROUP	ENERGY	RANGE
1	1.4918E	07	55	8.6517E	04
2	1.3499E	07	56	6.7380E	04
3	1.2214E	07	57	5.2475E	04
4	1.1052E	07	58	4.0868E	04
5	1.0000E	07	59	3.1828E	04
6	9.0484E	06	60	2.4788E	04
7	8.1873E	06	61	1.9305E	04
8	7.4082E	06	62	1.5034E	04
9	7.0000E	06	63	1.1709E	04
10	6.7032E	06	64	9.1188E	03
11	6.3600E	06	65	7.1018E	03
12	6.0653E	06	66	5.5309E	03
13	5.4881E	06	67	4.3074E	03
14	4.9659E	06	68	3.3546E	03
15	4.7500E	06	69	2.6126E	03
16	4.4933E	06	70	2.0347E	03
17	4.0657E	06	71	1.846E	03
18	3.6788E	06	72	1.2341E	03
19	3.3287E	06	73	9.6112E	02
20	3.0119E	06	74	7.4852E	02
21	2.7253E	06	75	5.8295E	02
22	2.4660E	06	76	4.5400E	02
23	2.3500E	06	77	3.5358E	02
24	2.2313E	06	78	2.7537E	02
25	2.0190E	06	79	2.1445E	02
26	1.8268E	06	80	1.6702E	02
27	1.6530E	06	81	1.3007E	02
28	1.4957E	06	82	1.0130E	02
29	1.3534E	06	83	7.8893E	01
30	1.2246E	06	84	6.1442E	01
31	1.1080E	06	85	4.7851E	01
32	1.0026E	06	86	3.7267E	01
33	9.0718E	05	87	2.9023E	01
34	8.2085E	05	88	2.2603E	01
35	7.4274E	05	89	1.7604E	01
36	6.7206E	05	90	1.3710E	01
37	6.0810E	05	91	1.0677E	01
38	5.5023E	05	92	8.3153E	00
39	4.9787E	05	93	6.4760E	00
40	4.5049E	05	94	5.0435E	00
41	4.0762E	05	95	3.9279E	00
42	3.6883E	05	96	3.0590E	00
43	3.3373E	05	97	2.3824E	00
44	3.0197E	05	98	1.8554E	00
45	2.7324E	05	99	1.4450E	00
46	2.4724E	05	100	1.1254E	00
47	2.2371E	05	101	8.7644E	-01
48	2.0242E	05	102	6.8257E	-01
49	1.8316E	05	103	5.3159E	-01
50	1.6573E	05	104	4.1400E	-01
51	1.4996E	05			
52	1.3569E	05			
53	1.2277E	05			
54	1.1109E	05			

Table B.8.

STANDARD 105 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE	GROUP	ENERGY	RANGE
1	1.7000E 07	1.4918E 07	55	1.1109E 05	8.6517E 04
2	1.4918E 07	1.3499E 07	56	8.6517E 04	6.7380E 04
3	1.3499E 07	1.2214E 07	57	6.7380E 04	5.2475E 04
4	1.2214E 07	1.1052E 07	58	5.2475E 04	4.0868E 04
5	1.1052E 07	1.0000E 07	59	4.0868E 04	3.1828E 04
6	1.0000E 07	9.0484E 06	60	3.1828E 04	2.4788E 04
7	9.0484E 06	8.1873E 06	61	2.4788E 04	1.9305E 04
8	8.1873E 06	7.4082E 06	62	1.9305E 04	1.5034E 04
9	7.4082E 06	7.0000E 06	63	1.5034E 04	1.1709E 04
10	7.0000E 06	6.7032E 06	64	1.1709E 04	9.1188E 03
11	6.7032E 06	6.3600E 06	65	9.1188E 03	7.1018E 03
12	6.3600E 06	6.0653E 06	66	7.1018E 03	5.5309E 03
13	6.0653E 06	5.4881E 06	67	5.5309E 03	4.3074E 03
14	5.4881E 06	4.9659E 06	68	4.3074E 03	3.3546E 03
15	4.9659E 06	4.7500E 06	69	3.3546E 03	2.6126E 03
16	4.7500E 06	4.4933E 06	70	2.6126E 03	2.0347E 03
17	4.4933E 06	4.0657E 06	71	2.0347E 03	1.5846E 03
18	4.0657E 06	3.6788E 06	72	1.5846E 03	1.2341E 03
19	3.6788E 06	3.3287E 06	73	1.2341E 03	9.6112E 02
20	3.3287E 06	3.0119E 06	74	9.6112E 02	7.4852E 02
21	3.0119E 06	2.7253E 06	75	7.4852E 02	5.8295E 02
22	2.7253E 06	2.4660E 06	76	5.8295E 02	4.5400E 02
23	2.4660E 06	2.3500E 06	77	4.5400E 02	3.5358E 02
24	2.3500E 06	2.2313E 06	78	3.5358E 02	2.7537E 02
25	2.2313E 06	2.0190E 06	79	2.7537E 02	2.1445E 02
26	2.0190E 06	1.8268E 06	80	2.1445E 02	1.6702E 02
27	1.8268E 06	1.6530E 06	81	1.6702E 02	1.3007E 02
28	1.6530E 06	1.4957E 06	82	1.3007E 02	1.0130E 02
29	1.4957E 06	1.3534E 06	83	1.0130E 02	7.8893E 01
30	1.3534E 06	1.2246E 06	84	7.8893E 01	6.1442E 01
31	1.2246E 06	1.1080E 06	85	6.1442E 01	4.7851E 01
32	1.1080E 06	1.0026E 06	86	4.7851E 01	3.7267E 01
33	1.0026E 06	9.0718E 05	87	3.7267E 01	2.9023E 01
34	9.0718E 05	8.2085E 05	88	2.9023E 01	2.2603E 01
35	8.2085E 05	7.4274E 05	89	2.2603E 01	1.7604E 01
36	7.4274E 05	6.7206E 05	90	1.7604E 01	1.3710E 01
37	6.7206E 05	6.0810E 05	91	1.3710E 01	1.0677E 01
38	6.0810E 05	5.5023E 05	92	1.0677E 01	8.3153E 00
39	5.5023E 05	4.9787E 05	93	8.3153E 00	6.4760E 00
40	4.9787E 05	4.5049E 05	94	6.4760E 00	5.0435E 00
41	4.5049E 05	4.0762E 05	95	5.0435E 00	3.9279E 00
42	4.0762E 05	3.6883E 05	96	3.9279E 00	3.0590E 00
43	3.6883E 05	3.3373E 05	97	3.0590E 00	2.3824E 00
44	3.3373E 05	3.0197E 05	98	2.3824E 00	1.8554E 00
45	3.0197E 05	2.7324E 05	99	1.8554E 00	1.4450E 00
46	2.7324E 05	2.4724E 05	100	1.4450E 00	1.1254E 00
47	2.4724E 05	2.2371E 05	101	1.1254E 00	8.7644E-01
48	2.2371E 05	2.0242E 05	102	8.7644E-01	6.8257E-01
49	2.0242E 05	1.8316E 05	103	6.8257E-01	5.3159E-01
50	1.8316E 05	1.6573E 05	104	5.3159E-01	4.1400E-01
51	1.6573E 05	1.4996E 05	105	4.1400E-01	1.0000E-04
52	1.4996E 05	1.3569E 05			
53	1.3569E 05	1.2277E 05			
54	1.2277E 05	1.1109E 05			

Table B.9.

STANDARD 119 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE	GROUP	ENERGY	RANGE
1	1.4918E 07	1.2214E 07	62	1.9255E 05	1.8316E 05
2	1.2214E 07	1.0000E 07	63	1.8316E 05	1.7422E 05
3	1.0000E 07	8.1873E 06	64	1.7422E 05	1.6573E 05
4	8.1873E 06	6.7032E 06	65	1.6573E 05	1.5764E 05
5	6.7032E 06	5.4881E 06	66	1.5764E 05	1.4996E 05
6	5.4881E 06	4.4933E 06	67	1.4996E 05	1.4264E 05
7	4.4933E 06	3.6788E 06	68	1.4264E 05	1.3569E 05
8	3.6788E 06	3.1564E 06	69	1.3569E 05	1.2907E 05
9	3.1564E 06	3.0119E 06	70	1.2907E 05	1.2277E 05
10	3.0119E 06	2.8650E 06	71	1.2277E 05	1.1679E 05
11	2.8650E 06	2.7253E 06	72	1.1679E 05	1.1109E 05
12	2.7253E 06	2.5924E 06	73	1.1109E 05	9.8037E 04
13	2.5924E 06	2.4660E 06	74	9.8037E 04	8.6517E 04
14	2.4660E 06	2.3852E 06	75	8.6517E 04	8.2500E 04
15	2.3852E 06	2.3653E 06	76	8.2500E 04	7.9500E 04
16	2.3653E 06	2.3069E 06	77	7.9500E 04	7.2000E 04
17	2.3069E 06	2.2313E 06	78	7.2000E 04	6.7379E 04
18	2.2313E 06	2.1225E 06	79	6.7379E 04	5.6562E 04
19	2.1225E 06	2.0189E 06	80	5.6562E 04	5.2475E 04
20	2.0189E 06	1.9205E 06	81	5.2475E 04	4.6309E 04
21	1.9205E 06	1.8268E 06	82	4.6309E 04	4.0868E 04
22	1.8268E 06	1.7377E 06	83	4.0868E 04	3.4307E 04
23	1.7377E 06	1.6530E 06	84	3.4307E 04	3.1828E 04
24	1.6530E 06	1.5724E 06	85	3.1828E 04	2.8500E 04
25	1.5724E 06	1.4957E 06	86	2.8500E 04	2.7000E 04
26	1.4957E 06	1.4227E 06	87	2.7000E 04	2.6058E 04
27	1.4227E 06	1.3534E 06	88	2.6058E 04	2.4788E 04
28	1.3534E 06	1.2873E 06	89	2.4788E 04	2.3579E 04
29	1.2873E 06	1.2246E 06	90	2.3579E 04	2.1875E 04
30	1.2246E 06	1.1648E 06	91	2.1875E 04	1.9305E 04
31	1.1648E 06	1.1080E 06	92	1.9305E 04	1.5034E 04
32	1.1080E 06	1.0026E 06	93	1.5034E 04	1.1709E 04
33	1.0026E 06	9.6164E 05	94	1.1709E 04	9.1188E 03
34	9.6164E 05	9.0718E 05	95	9.1188E 03	7.1017E 03
35	9.0718E 05	8.6294E 05	96	7.1017E 03	5.5308E 03
36	8.6294E 05	8.2085E 05	97	5.5308E 03	4.3074E 03
37	8.2085E 05	7.8092E 05	98	4.3074E 03	3.7074E 03
38	7.8092E 05	7.4274E 05	99	3.7074E 03	3.3546E 03
39	7.4274E 05	7.0651E 05	100	3.3546E 03	3.0354E 03
40	7.0651E 05	6.7206E 05	101	3.0354E 03	2.7465E 03
41	6.7206E 05	6.3928E 05	102	2.7465E 03	2.6126E 03
42	6.3928E 05	6.0810E 05	103	2.6126E 03	2.0347E 02
43	6.0810E 05	5.7844E 05	104	2.0347E 03	1.5846E 03
44	5.7844E 05	5.5023E 05	105	1.5846E 03	1.2341E 03
45	5.5023E 05	5.2340E 05	106	1.2341E 03	9.6112E 02
46	5.2340E 05	4.9787E 05	107	9.6112E 02	7.4852E 02
47	4.9787E 05	4.5049E 05	108	7.4852E 02	4.5400E 02
48	4.5049E 05	4.0762E 05	109	4.5400E 02	2.1445E 02
49	4.0762E 05	3.6883E 05	110	2.1445E 02	1.0130E 02
50	3.6883E 05	3.3373E 05	111	1.0130E 02	4.7851E 01
51	3.3373E 05	3.0197E 05	112	4.7851E 01	2.2603E 01
52	3.0197E 05	2.9850E 05	113	2.2603E 01	1.0677E 01
53	2.9850E 05	2.9720E 05	114	1.0677E 01	5.0435E 00
54	2.9720E 05	2.9452E 05	115	5.0435E 00	2.3824E 00
55	2.9452E 05	2.8725E 05		2.3824E 00	1.1254E 00
56	2.8725E 05	2.7324E 05		1.1254E 00	4.1399E -01
57	2.7324E 05	2.4723E 05		4.1399E -01	1.0000E -01
58	2.4723E 05	2.2371E 05		1.0000E -01	1.0000E -05
59	2.2371E 05	2.1280E 05			
60	2.1280E 05	2.0242E 05			
61	2.0242E 05	1.9255E 05			

Table B.10.
STANDARD 123 GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE	GROUP	ENERGY	RANGE
1	1.4918E 07	1.3499E 07	62	5.5309E 03	4.3074E 03
2	1.3499E 07	1.2214E 07	63	4.3074E 03	3.3546E 03
3	1.2214E 07	1.1052E 07	64	3.3546E 03	2.6126E 03
4	1.1052E 07	1.0000E 07	65	2.6126E 03	2.0347E 03
5	1.0000E 07	9.0484E 06	66	2.0347E 03	1.5846E 03
6	9.0484E 06	8.1873E 06	67	1.5846E 03	1.2341E 02
7	8.1873E 06	7.4082E 06	68	1.2341E 03	9.6112E 02
8	7.4082E 06	6.7032E 06	69	1.2341E 02	7.4852E 02
9	6.7032E 06	6.0653E 06	70	7.4852E 02	5.9295E 02
10	6.0653E 06	5.4881E 06	71	5.8295E 02	4.5400E 02
11	5.4881E 06	4.9659E 06	72	4.5400E 02	3.5358E 02
12	4.9659E 06	4.4933E 06	73	3.5358E 02	2.7537E 02
13	4.4933E 06	4.0657E 06	74	2.7537E 02	2.1445E 02
14	4.0657E 06	3.6788E 06	75	2.1445E 02	1.6702E 02
15	3.6788E 06	3.3287E 06	76	1.6702E 02	1.3007E 02
16	3.3287E 06	3.0119E 06	77	1.3007E 02	1.0130E 02
17	3.0119E 06	2.7253E 06	78	1.0130E 02	7.8893E 01
18	2.7253E 06	2.4660E 06	79	7.8893E 01	6.1442E 01
19	2.4660E 06	2.2313E 06	80	6.1442E 01	4.7851E 01
20	2.2313E 06	2.0190E 06	81	4.7851E 01	3.7267E 01
21	2.0190E 06	1.8268E 06	82	3.7267E 01	2.9023E 01
22	1.8268E 06	1.6530E 06	83	2.9023E 01	2.2603E 01
23	1.6530E 06	1.4957E 06	84	2.2603E 01	1.7604E 01
24	1.4957E 06	1.3534E 06	85	1.7604E 01	1.3710E 01
25	1.3534E 06	1.2246E 06	86	1.3710E 01	1.0677E 01
26	1.2246E 06	1.1080E 06	87	1.0677E 01	8.3153E 00
27	1.1080E 06	1.0026E 06	88	8.3153E 00	6.4760E 00
28	1.0026E 06	9.0718E 05	89	6.4760E 00	5.0435E 00
29	9.0718E 05	8.2085E 05	90	5.0435E 00	3.9279E 00
30	8.2085E 05	7.4274E 05	91	3.9279E 00	3.0590E 00
31	7.4274E 05	6.7206E 05	92	3.0590E 00	2.3824E 00
32	6.7206E 05	6.0810E 05	93	2.3824E 00	1.8670E 00
33	6.0810E 05	5.5023E 05	94	1.8670E 00	1.7100E 00
34	5.5023E 05	4.9787E 05	95	1.7100E 00	1.5600E 00
35	4.9787E 05	4.5049E 05	96	1.5600E 00	1.4400E 00
36	4.5049E 05	4.0762E 05	97	1.4400E 00	1.2900E 00
37	4.0762E 05	3.6883E 05	98	1.2900E 00	1.1250E 00
38	3.6883E 05	3.3373E 05	99	1.1250E 00	1.0000E 00
39	3.3373E 05	3.0197E 05	100	1.0000E 00	8.7600E -01
40	3.0197E 05	2.7324E 05	101	8.7600E -01	7.7600E -01
41	2.7324E 05	2.4724E 05	102	7.7600E -01	6.5000E -01
42	2.4724E 05	2.2371E 05	103	6.5000E -01	5.5000E -01
43	2.2371E 05	2.0242E 05	104	5.5000E -01	4.5000E -01
44	2.0242E 05	1.8316E 05	105	4.5000E -01	3.5000E -01
45	1.8316E 05	1.6573E 05	106	3.5000E -01	3.0000E -01
46	1.6573E 05	1.4996E 05	107	3.0000E -01	2.5000E -01
47	1.4996E 05	1.3569E 05	108	2.5000E -01	2.0000E -01
48	1.3569E 05	1.2277E 05	109	2.0000E -01	1.8000E -01
49	1.2277E 05	1.1109E 05	110	1.8000E -01	1.6000E -01
50	1.1109E 05	1.0000E 05	111	1.6000E -01	1.4000E -01
51	1.0000E 05	8.6517E 04	112	1.4000E -01	1.2000E -01
52	8.6517E 04	6.7380E 04	113	1.2000E -01	1.0000E -01
53	6.7380E 04	5.2475E 04	114	1.0000E -01	8.0000E -02
54	5.2475E 04	4.0868E 04	115	8.0000E -02	7.0000E -02
55	4.0868E 04	3.1828E 04	116	7.0000E -02	6.0000E -02
56	3.1828E 04	2.4788E 04	117	6.0000E -02	5.0000E -02
57	2.4788E 04	1.9305E 04	118	5.0000E -02	4.0000E -02
58	1.9305E 04	1.5034E 04	119	4.0000E -02	3.0000E -02
59	1.5034E 04	1.1709E 04	120	3.0000E -02	2.0000E -02
60	1.1709E 04	9.1188E 03	121	2.0000E -02	1.5000E -02
61	9.1188E 03	7.1018E 03	122	1.5000E -02	1.0000E -02
	7.1018E 03	5.5309E 03	123	1.0000E -02	5.0000E -03

Table B.11.
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	3.4594E 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	2.2639E 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	1.8265E 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	6.5475E 06	83	1.3534E 06	1.2873E 06
34	6.5475E 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

Table B.11. (continued)

STANDARD 23! GROUP NEUTRON STRUCTURE

GROUP	ENERGY	RANGE	GROUP	ENERGY	RANGE
101	6.3928E 05	6.0810E 05	151	5.2475E 02	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

Table B.11. (continued)

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	

"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.

Table B.12.
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

Table B.13.
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

Table B.14.
STANDARD 25 GROUP GAMMA STRUCTURE

GROUP	ENERGY RANGE			
1	1.3000E	07	1.0197E	07
2	1.0157E	07	7.9983E	06
3	7.9983E	06	6.2737E	06
4	6.2737E	06	4.9210E	06
5	4.9210E	06	3.8599E	06
6	3.8599E	06	3.0277E	06
7	3.0277E	06	2.3748E	06
8	2.3748E	06	1.8628E	06
9	1.8628E	06	1.4611E	06
10	1.4611E	06	1.1461E	06
11	1.1461E	06	8.9896E	05
12	8.9896E	05	7.0513E	05
13	7.0513E	05	5.5309E	05
14	5.5309E	05	4.3383E	05
15	4.3383E	05	3.4029E	05
16	3.4029E	05	2.6692E	05
17	2.6692E	05	2.0937E	05
18	2.0937E	05	1.6422E	05
19	1.6422E	05	1.2891E	05
20	1.2891E	05	1.0104E	05
21	1.0104E	05	7.9252E	04
22	7.9252E	04	6.2164E	04
23	6.2164E	04	4.8760E	04
24	4.8760E	04	3.8247E	04
25	3.8247E	04	3.0000E	04

Table B.15.
STANDARD 26 GROUP GAMMA STRUCTURE

GROUP	ENERGY RANGE			
1	1.4000E	07	1.0000E	07
2	1.0000E	07	6.0000E	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	8.3000E	05
13	8.3000E	05	7.0000E	05
14	7.0000E	05	5.5000E	05
15	5.5000E	05	4.5000E	05
16	4.5000E	05	3.0000E	05
17	3.0000E	05	2.0000E	05
18	2.0000E	05	1.3000E	05
19	1.3000E	05	1.0000E	05
20	1.0000E	05	7.0000E	04
21	7.0000E	04	5.0000E	04
22	5.0000E	04	4.0000E	04
23	4.0000E	04	3.0000E	04
24	3.0000E	04	2.0000E	04
25	2.0000E	04	1.3000E	04
26	1.3000E	04	1.0000E	04

APPENDIX C

Sample Problem

The sample set of input data is shown in Fig. 3. The compiled LAVA program in this example is located on a 2321 data cell, DC0019, with DSN=SKF.LMP14655.CPLD.LAVA. The ANISN library is in free-form BCD and is located on the 2321 data cell, DC0019, with DSN=SKF. LMP14655.XSECS1. A listing of these cross sections is given in Fig. 4.

A listing of the output is given in Fig. 5.

```

//A EXEC FORTHLG.LIB=PORT.GOSIZE=270K
//LKED.SYSIN DD UNIT=2321.VOL=SEN=DC0019.DISP=SMR,
//  DSN=SKF.LPD14655.CULG.L4VA
//GO.FT04F001 DD UNIT=SYS04.SPACE=(TRK,(40,5)),
//  DCH=(RECFM=VRS,LDFCL=2,RLKSIZE=3520)
//GO.FT18F001 DD UNIT=SYS04.SPACE=(TRK,(40,5)),DCH=*.FT04F001
//GO.FT19F001 DD UNIT=SYS04.SPACE=(TRK,(40,5)),DCH=*.FT04F001
//GO.FT20F001 DD UNIT=2321.VOL=SEN=DC0019.DISP=SMR,
//  DSN=SKF.LPD14655.XSECS1
//GO.FT05F001 DD *
155 2 15 5 M 27 14 4 0 17
255 1 5 355 3 3 455 10010 922350
855 157 354 154 554 153 27

```

Figure 3. User Input for Sample Problem

Figure 4. Cross Sections for Sample Problem

* 20 27 0		1 P0 DATA FOR HYDROGEN FREE GAS THERMAL SCATTERIN		XSORN 10010			
*G							
22	35902-9	0	18414-4	27	84909-5	217	34617-9
202	34461-9	0	39932-4	22	73856-5	73994-5	16537-5
22	16261-4	18079-8	73994-5	16537-5	182	58757-9	2
28766-4	10348-4	44396-5	59223-6	172	20497-8	0	15816-3
79587-5	33011-5	12283-5	27452-6	162	62351-8	0	19442-3
70914-5	13424-5	50622-6	20712-6	46304-7	152	15168-7	0
76471-4	11175-4	1241-4	23453-6	28588-7	36257-7	81032-8	142
20406-3	22	16606-3	80034-4	14046-4	20526-5	22794-6	4315-6
66595-8	14883-8	132	72385-7	0	20456-3	22	8559-3
31529-6	35456-7	67122-8	25311-8	10356-8	23152-9	122	12842-6
80405-4	7927-3	19599-4	35571-5	62425-6	91225-7	10131-7	19178-8
25598-9	66148-10	112	22896-6	0	20472-3	22	85615-4
68592-5	1245-4	21849-6	71929-7	35458-8	67122-9	25311-9	10359-9
102	40617-6	0	2049-2	22	80448-4	79277-4	24819-4
62425-7	91224-8	10131-8	19178-9	72316-10	29597-10	66148-11	92
20934-3	38603-12	33265-10	81281-4	74459-4	23783-4	74459-5	23781-5
58794-6	10671-6	18728-7	27266-8	30393-9	57533-10	21695-10	88794-11
19845-11	82	12329-5	0	21903-3	0	5594-5	17145-3
3723-4	11891-5	29397-6	53357-7	93638-8	13684-8	15195-9	28767-10
44396-11	99222-12	72	30562-5	0	25943-3	22	25282-3
3924-5	12286-5	39239-6	9701-6	17608-7	30901-8	45157-9	50148-10
35798-11	14651-11	32744-12	62	85772-15	0	75384-6	22
35946-9	52	4315-13	0	15172-5	22	54585-6	25198-6
57299-6	34384-6	14419-6	73426-7	3827-8	16211-7	62877-8	61381-11
36599-9	34461-9	62	41459-11	0	31003-5	22	30629-5
13215-5	0	7403-4	22	60373-5	37422-7	192	
* 20 27 0		2 P1 DATA FOR HYDROGEN FREE GAS THERMAL SCATTERIN		XSORN 10010			
*G							
72	21298-4	262	22421-4	10578-4	252	20758-4	17259-4
41593-4	12919-4	17955-5	232	96906-4	57336-4	15324-4	47595-5
19849-3	74902-4	76167-5	20357-5	63227-6	87876-7	212	24767-3
52273-5	53155-6	14207-6	44125-7	61327-8	202	25788-3	13077-3
38568-6	3922-6	10482-7	32557-8	45249-9	192	26075-3	13591-3
63249-6	30306-7	30819-8	8237-8	25584-9	35557-10	182	21971-3
95458-5	71783-6	44422-7	21286-8	21446-9	57851-10	17968-10	24973-11
20859-3	15285-3	19551-4	15157-5	11398-6	70535-8	33799-9	34369-10
91858-11	28531-11	39654-12	162	21977-3	1675-2	30441-4	38937-5
227-5	14047-8	67312-10	68442-11	18294-11	5682-11	78973-13	152
15286-3	26566-4	48335-5	61826-6	47931-7	36044-8	22305-9	10688-10
10868-11	29349-12	90223-13	1254-12	122	66746-13	16309-10	77984-4
27213-4	47348-5	6605-5	11007-6	85331-8	64168-9	39709-10	19028-11
19349-12	51714-12	16062-13	22324-14	122	10899-5	93743-4	47526-4
87639-5	1403-4	25499-6	32615-7	25285-8	19015-9	11757-10	56385-12
57335-13	15324-13	47596-14	132	10923-3	29503-4	52648-5	63353-5
20023-6	36351-7	46547-8	36086-9	27137-10	16793-11	8047-12	81825-14
2187-13	132	56356-6	262	14219-5	60559-6	252	23294-5
6415-5	75553-8	182					
* 20 27 0		3 P2 DATA FOR HYDROGEN FREE GAS THERMAL SCATTERIN		XSORN 10010			
*G							
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10206-4	-14268-4	-31702-5	-12306-5	-50967-6	-11503-6	202	28033-3
-22662-4	-29951-5	-58154-6	-22039-6	-90385-7	-26235-7	192	2528-2
-28334-4	-49529-5	-56624-6	-10768-6	-40642-7	-1664-6	-37201-8	182
26303-3	26194-4	-24582-4	-52512-5	-79269-6	-88532-7	-16774-7	-63266-8
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-40054-4	-15171-4	-3047-4	-54411-6	-79766-7	-88633-8	-1678-7	-63276-9
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-29243-5	-73166-6	-13328-6	-23406-7	-34208-8	-37991-9	-71917-10	
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-94886-5	-30404-5	-97775-6	-24231-6	44012-7	-77249-8	-11289-8	-12537-9
-23732-10	-89495-11	-76622-11	-9186-11	112	87805-6	262	20172-5

Figure 4 (continued)

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-20844-5 22Z 14339-3 -70843-4 -21306-4 -64231-5 -20849-5 -30021-6 21Z	4	3
17563-3 -11634-3 -16019-4 -17967-5 -48888-6 -15291-6 -21377-7 20Z	4	4
18422-3 -14144-3 -24702-4 -13201-5 -13644-6 -36578-7 -11375-7 -15826-8	4	5
19Z 18489-3 -14891-3 -31255-4 -21638-5 -10565-6 -10775-7 -28814-8	4	6
-89514-9 -12443-5 18Z 21025-3 -11646-3 -28968-4 -2451-4 -1548-5 -74443-8	4	7
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-50895-5 -39596-6 -24654-7 -11827-8 -12029-9 -32149-10 -99856-11	4	9
-13879-11 16Z 21029-3 -12251-3 -78963-4 -12633-4 -10425-5 -79256-7	4	10
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-38039-11 -1C167-11 -31578-12 -43888-13 12Z -32622-13 -90285-11 40219-4	4	13
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-66568-11 -67721-12 -181-10 -56218-13 -78137-14 12Z -35003-6 26196-4	4	15
-26309-4 -10753-3 -2538-3 -47594-5 -88346-6 -11383-6 -88453-8 -66545-9	4	16
-41133-10 -15735-11 -20047-12 -53635-13 -16659-13 -23153-14 12Z 17847-4	4	17
-94748-5 -25731-5 -2663-3 -39362-5 -69594-6 -12708-6 -16281-7 -12629-8	4	18
-94976-10 -58775-11 -28164-12 -28639-13 -76547-14 -23775-14 12Z 11029-5	4	19
26Z 10419-5 26203-6 25Z 11775-5 -56325-6 -21496-6 24Z 16853-6 20492-8	4	20
18Z	4	21
20 27 0 5 P0 DATA FOR URANIUM 235 INFINITE DILUTION F		
*REE GAS THERMAL XSDRN 922350		
20934-5 12003-4 12246-4 36406-4 7651-3 2Z 49257-4 19Z 33945-5 12652-4	5	1
13195-4 33821-4 72263-4 2Z 48555-4 61317-5 18Z 16616-5 12391-4 13425-4	5	2
31771-4 67799-4 2Z 42456-4 51969-5 32171-5 17Z 18047-5 1156-3 13088-4	5	3
28911-4 76925-4 2Z 58147-4 57886-5 31926-5 49571-5 16Z 89647-6 13222-4	5	4
1:97-3 32401-4 9797-3 2Z 80628-4 53963-5 20438-5 18809-5 17961-5 15Z	5	5
138-5-6 1929-3 25781-4 46784-4 13245-3 2Z 10605-3 1352-4 296-4 82179-7	5	6
2332-5 16436-6 14Z 10055-7 35504-4 48555-4 85922-4 16545-3 2Z 11631-3	5	7
61104-6 19555-7 82011-8 30245-8 80528-8 52092-8 13Z 74684-9 82948-4	5	8
11547-3 20065-3 23693-3 2Z 12084-3 58731-6 24631-8 52612-9 20563-9	5	9
9797-9 25797-9 16444-9 2Z 58713-10 18774-3 27628-3 45411-3 40097-3 2Z	5	10
12405-3 6205-5 69149-10 51717-10 13872-10 85729-12 33194-11 87229-11	5	11
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0 22779-11 27029-12 32204-12 0 1032-11 27156-12 1724-11 10Z 62981-12	5	13
46396-3 8276-2 11222-2 54795-3 2Z 11956-3 71109-6 2Z 19635-12 0 27118-13	5	14
0 90748-14 23877-13 13657-13 9Z 12822-12 38377-3 65658-3 92826-3 7675-2	5	15
2Z 11014-3 22736-6 3Z 22913-13 C 27077-14 0 10323-14 27161-14 15535-14	5	16
8Z 18255-13 28641-3 38187-3 69277-3 50478-3 2Z 1219-2 79082-6 4Z	5	17
21773-14 13Z 32081-15 71611-3 76779-3 17321-2 93182-3 2Z 13403-3 10035-5	5	18
19Z 19553-2 23318-2 46812-2 24659-2 2Z 1341-2 20Z 5292-1 61841-2 12798-1	5	19
63183-2 2Z 13424-3 21Z 61872-5 0 18168-3 2Z 1789-3 1749-1 69791-3	5	20
21527-3 12055-3 24099-3 30993-3 21098-3 95915-4 4281-3 20773-4 41089-7	5	21
48459-5 3865-4 43143-5 36333-5 4147-4 5Z 38041-4 5 19909-3 2Z 50218-4	5	22
23182-4 12688-1 49224-2 16376-2 78301-3 13435-2 16932-2 12551-2 58201-3	5	23
2655-2 13304-3 26171-6 32632-4 26689-4 29648-4 37583-4 49486-4 4Z	5	24
23849-2 0 26701-2 2Z 28178-3 12248-3 24236-3 26396-1 10014-1 35292-2	5	25
1481-1 21427-2 26279-2 21673-2 10274-2 49449-3 24716-3 50045-6 73241-4	5	26
75822-4 94572-4 10117-3 10357-3 3Z 89069 0 89125 2Z 55544-3 34428-5 2Z	5	27
38899-3 14925-3 51077-4 22551-4 3654-3 45534-4 35317-4 16536-4 77907-5	5	28
38708-5 15241-7 55428-5 77222-5 63032-5 44776-5 39504-5	5	29
20 27 0 6 P1 DATA FOR URANIUM 235 INFINITE DILUTION F		
*REE GAS THERMAL XSDRN 922350		
7Z 11101-3 24Z 7885-3 49076-7 25Z 55808-4 -43014-7 25Z 56515-4 -12531-6	6	1
25Z 53638-4 -12672-6 25Z 16413-4 -13953-6 25Z 19871-5 -49557-6 25Z	6	2
15279-5 -58218-6 25Z 16451-5 -6166-5 25Z 35766-5 -64001-6 25Z 48871-5	6	3
-70049-6 25Z 79859-6 -82144-6 25Z 19394-5 -78595-6 25Z 39261-6 -99797-6	6	4
25Z 43228-6 26Z 46448-6 26Z 51848-4 26Z 13634-3 55715-4 25Z 2143-2	6	5
37664-4 -30265-5 24Z 59018-4 69545-6 18Z	6	6
20 27 0 7 P2 DATA FOR URANIUM 235 INFINITE DILUTION F		
*REE GAS THERMAL XSDRN 922350		
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25Z 2635-3 -73951-7 25Z 66692-5 -16943-7 25Z 16584-6 -64681-8 25Z	7	2
69832-7 -13555-8 25Z 92002-8 -39526-8 25Z 48053-6 -42385-8 25Z -51394-5	7	3
-10418-7 25Z 11701-6 -58051-8 25Z -23712-7 -4921-7 25Z 68665-8 -55568-8	7	4
25Z 4776-6 26Z 80414-7 26Z 80597-4 26Z 18513-3 55537-4 25Z 21806-3	7	5
-15639-4 -24549-4 24Z 28883-3 17759-5 18Z	7	6
20 27 0 8 P3 DATA FOR URANIUM 235 INFINITE DILUTION F		
*REE GAS THERMAL XSDRN 922350		
7Z 17791-3 24Z 10851-3 1588-5 25Z 57322-4 81301-7 25Z 29487-4 13373-6	8	1
25Z 69368-5 -64051-7 25Z 8836-5 -14371-7 25Z 24757-7 -28158-8 25Z	8	2
-2973-7 18983-9 25Z -5011-7 19104-9 25Z 11158-6 20589-9 25Z 25706-6	8	3
-18123-9 25Z 11394-6 -6533-5 25Z 93608-8 25Z 79346-8 -13448-8 25Z	8	4
49744-7 26Z 11635-7 26Z 10147-3 26Z 18785-3 24107-4 25Z 10833-3 -51819-4	8	5
-19776-4 24Z 15504-4 18852-6 18Z	8	6

```

13 ARRAY      8 ENTRIES READ
17
A STANDARD 16 NEUTRON GROUP STRUCTURE HAS BEEN INSERTED FOR YOU AND WILL BE USED UNLESS YOU OVERRIDE IT
23 ARRAY      2 ENTRIES READ
33 ARRAY      2 ENTRIES READ
43 ARRAY      2 ENTRIES READ
8* ARRAY      5 ENTRIES REAC
27
YOU ARE USING  971 LOCATIONS OF 30000 ALLOCATED

```

Figure 5. Output for Sample Problem

Figure 5 (continued)

AN AMPX WORKING INTERFACE WILL BE CREATED ON LOGICAL UNIT 4
 FROM THE ANISN LIBRARY ON LOGICAL UNIT 20
 NUMBER OF NEUTRON GRPS 16
 FIRST THERMAL NEUTRON GRP 14
 NUMBER OF GAMMA GRPS 4
 SIGMA TOTAL PSN 5
 INGROUP PSN 8
 TABLE LENGTH 27

THE INPUT ANISN LIBRARY IS IN THE
 BCD FREE-FORM FORMAT

SET	ANISN ID	SCATT ORDER	AMPX ID
1	1	3	10010
2	5	3	922350

NEUTRON GROUP BOUNDS

GRP	ENERGY	LETHARGY
1	1.50000E 07	-4.05465E-01
2	3.00000E 06	1.20397E 00
3	1.42000E 06	1.96611E 00
4	9.00000E 05	2.40755E 00
5	4.00000E 05	3.21280E 00
6	1.00000E 05	4.60517E 00
7	1.70000E 04	6.27713E 00
8	3.00000E 03	8.11173E 00
9	5.50000E 02	9.80810E 00
10	1.00000E 02	1.15129E 01
11	3.00000E 01	1.27169E 01
12	1.00000E 01	1.38155E 01
13	3.00000E 00	1.50155E 01
14	1.00000E 00	1.61181E 01
15	4.00000E-01	1.70344E 01
16	1.00000E-01	1.84207E 01
17	1.00000E-03	2.20256E 01

GAMMA GROUP BOUNDS

GRP	ENERGY	LETHARGY
1	1.00000E 07	0.0
2	3.00000E 06	1.20397E 00
3	1.00000E 06	2.30258E 00
4	5.00000E 04	5.29632E 00
5	1.00000E 03	9.21034E 00

20	27	0	1	PO DATA FOR HYDROGEN FREE GAS THERMAL SCATTERI
'G				XSDRN 10010
'G				XSDRN 10010
'G				XSDRN 10010
'G				XSDRN 10010
20	27	0	5	PO DATA FOR URANIUM 235 INFINITE DILUTION
'REE GAS THERMAL				XSDRN 922350
'REE GAS THERMAL				XSDRN 922350
'REE GAS THERMAL				XSDRN 922350
'REE GAS THERMAL				XSDRN 922350

10010
 922350

TABLE OF CONTENTS
 PO DATA FOR HYDROGEN FREE GAS THERMAL SCATTERI
 PO DATA FOR URANIUM 235 INFINITE DILUTION

Figure 5 (continued)

THIS IS A WORKING LIBRARY FORMED FROM AN ANISN LIBRARY

TAPE ID	12345	NUMBER OF NUCLIDES	2
NUMBER OF NEUTRON GROUPS	16	NUMBER OF GAMMA GROUPS	4
FIRST THERMAL GROUP	14		
	TABLE OF CONTENTS		
P0 DATA FOR HYDROGEN FREE GAS THERMAL SCATTERI		10	10010
P0 DATA FOR URANIUM 235 INFINITE DILUTION		10	922350

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