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**CINX: Collapsed Interpretation of
Nuclear X Sections**

MASTL

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CINX:
COLLAPSED INTERPRETATION OF
NUCLEAR X SECTIONS

by
R. B. Kidman and R. E. MacFarlane

ABSTRACT

CINX is a computer code designed to collapse multigroup cross sections in CCCC format to a subset of the original group structure and to write the results in the original CCCC format (ISOTXS, BRKOXS, and DLAYXS files only) or in the much used IDX and PERT-V formats. CINX was designed as a collapse utility code for use with the MINX/SPHINX cross-section processing system, but it can be used to collapse CCCC cross-section sets from any source. If the weighting function specified is the same as the one used to generate the original multigroup cross sections, then the resulting collapsed cross sections will be exactly the same as those which would be obtained by generating the coarse-group cross sections directly.

I. INTRODUCTION

The Committee for Computer Code Coordination (CCCC)¹ interface files were designed to facilitate the communication of nuclear data between the codes and installations involved in the national fast reactor development program. The CCCC interface system allows for the production of cross sections using the Self-Shielding Factor Method.^{2,3} CINX was designed as a collapsing code for the MINX/SPHINX implementation of this method, but it can be used with ISOTXS, BRKOXS, or DLAYXS files in CCCC Version III⁴ format from any source.

Figure 1 outlines the MINX/SPHINX procedure for producing space and energy self-shielded macroscopic cross sections for use in reactor design codes. The MINX code (a Los Alamos Scientific Laboratory report in preparation) is used to generate fine-group cross sections and Legendre components of the group-to-group scattering matrices from the ENDF/B-IV nuclear data files.⁵ These isotope cross sections are output in ISOTXS format. MINX also produces resonance self-

shielding factors for a set of temperatures (T) and background cross sections (σ_0). These f-factors and other Bondarenko constants² are written in BRKOXS format. The DLAYXS file of delayed neutron yields and spectra is produced from ENDF/B-IV using NJOY.⁶

The LINX and BINX codes⁷ are used to combine isotope cross sections from MINX into multi-isotope CCCC libraries, to list the binary libraries, and to convert files to BCD mode and back for transmission between installations.

The final code, SPHINX,⁸ interpolates for the correct T and σ_0 dependent self-shielding factors for each isotope of the desired mixture, using equivalence principles to account for some geometry effects. The fine-group macroscopic cross sections are formed and used in a one-dimensional diffusion calculation (IDX)⁹ or one-dimensional discrete ordinates calculation (ANISN).¹⁰ The resulting flux is used to collapse to the final coarse-group macroscopic space and energy self-shielded cross sections; the results are written in ISOTXS format.

Fig. 1. Outline of the CCCC interface system for generating multigroup constants for fast reactor design.

This system has advantages of economy. It allows the detailed physics effects to be included in a seldom-run MINX code and saved on a pseudo-composition-independent library. Problem-dependent features can then be added using the frequently run SPHINK code.

The role of CINX in this system can now be made clear. For some difficult problems, very fine-group structures may be required (e.g., in the region of the iron 27-keV resonance). In addition, different energy ranges may be important to different users.

The 14-MeV region so important in fusion applications is of little consequence in a fast reactor calculation. The concept of a "super-group library" has evolved to solve these two problems. The 239-group structure¹¹ contains features for fast reactors, CTR, weapons, and shielding applications which will not be needed by all users. The CINX code can be used to collapse such a super-group library into a new job-dependent library with a group structure and weighting function appropriate to a particular application. This library will be much cheaper to use with SPHINK.

The CINX code and the MINX multigroup libraries are also useful without SPHINK. Some problems do not require detailed self-shielding; in these cases, CINX can be used directly to provide group cross sections to such CCCC interfaced codes as ONETRAN.¹² In order to make MINX cross-section libraries useful for one widely used set^{13,14,15} of fast reactor design codes, CINX has been provided with optional output in the IDX⁹ and PERT-V¹⁶ formats.

The algorithms used in CINX, examples, sample problems, and operating instructions are discussed in the following sections.

II. COLLAPSING ALGORITHMS

If an element is present in a medium in low concentration, the element's particular resonance structure does not affect the neutron spectrum. In this case, cross-section processing codes (ETOX,¹⁷ MINX, etc.) use an arbitrary smooth weighting function $C(E)$ in the group-averaging process. A typical choice for $C(E)$ is a thermal spectrum at low energies followed by a $1/E$ spectrum in the mid-range and a fission spectrum at high energies. The "infinitely dilute" isotope cross section for group g and reaction x is given by

$$\sigma_{xg} = \frac{\int_E \sigma_x(E) C(E) dE}{\int_g C(E) dE} \quad (1)$$

If the infinitely dilute fine-group cross sections σ_{xg} and a weighting flux $\phi_0(E)$ are passed on to CINX, CINX can preserve reaction rates and collapse to coarse group G as follows

$$\sigma_{xG} = \frac{\sum_{g \in G} \sigma_{xg} \phi_{0g}}{\phi_{0G}} \quad (2)$$

where

$$\phi_{0g} = \int_g \phi_0(E) dE \quad (3)$$

and

$$\phi_{0G} = \sum_{g \in G} \phi_{0g} \quad (4)$$

If the weighting flux $\phi_0(E)$ is the same as the weighting function $C(E)$ used in the original averaging, the collapsed cross section will have exactly the same value which would have been obtained by running the averaging in the coarse-group structure directly. Table I shows the CCCC ISOTXS, BRKOXS, and DLAYXS quantities that are collapsed according to Eq. (2).

Several quantities must be averaged with appropriate reaction rates in order to obtain proper group-averaged numbers. Neutron and delayed neutron precursor yields/fission must be weighted with the fission rate. The average cosine of the elastic scattering angle $\bar{\mu}$ and the average elastic scattering logarithmic energy decrement ξ must be weighted with the elastic scattering rate. Let Q_x represent the quantity to be reaction-rate averaged and σ_x the appropriate cross section, and let the processing code provide

$$Q_{xG} = \frac{\int_G Q_x(E) \sigma_x(E) C(E) dE}{\int_G \sigma_x(E) C(E) dE} \quad (5)$$

TABLE I
COLLAPSING AND NOTATION GUIDE

Quantity	CCCC Notation	Collapsing Algorithm
Transport X Sec	STRPL	12
Total X Sec	STOTPL	2
(n,γ) X Sec	SNGAM	2
Fission X Sec	SFIS	2
Neutron Yield/Fission	SNUTOT	6
Fission Spectrum	CHISO	7
(n,α) X Sec	SNALF	2
(n,p) X Sec	SNP	2
(n,2n) X Sec	SN2N	2
(n,D) X Sec	SND	2
(n,T) X Sec	SNT	2
Fission Matrix	CHIISO	9
Scattering Matrices	SCAT	10
Total Self-Shielding Factor	FTOT	22
Capture Self-Shielding Factor	FCAP	19
Fission Self-Shielding Factor	FFIS	19
Transport Self-Shielding Factor	FTR	23
Elastic Self-Shielding Factor	FEL	19
Potential Scattering X Sec	XSP0	2
Inelastic X Sec	XSIN	2
Elastic X Sec	XSE	2
$\bar{\mu}$	XSMU	6
Elastic Removal X Sec	XSED	11
ξ	XSXI	6
Delayed Neutron Spectra	CHID	7
Precursor Yield/Fission	SNUDEL	6

then exact collapsing can be achieved with the following

$$Q_{xG} = \frac{\sum_{g \in G} Q_{xg} \phi_{0g}}{\phi_{0G}} \quad (6)$$

Fission and delayed neutron spectra are represented by the fractions χ_g that are born into the various fine groups. Thus, the fraction born into coarse-group G is simply

$$\chi_G = \sum_{g \in G} \chi_g \quad (7)$$

If a fission chi matrix is given in the ISOTXS file, it will have been produced by the following equation

$$\chi_{g \rightarrow g'} = \frac{\int_g dE \int_{g'} dE' \chi(E \rightarrow E') v(E) \sigma_f(E) C(E)}{\int_g v(E) \sigma_f(E) C(E) dE}, \quad (8)$$

where $\chi(E \rightarrow E')$ is the normalized fission spectrum due to a neutron captured at energy E . Preserving the reaction rate results in

$$\chi_{G \rightarrow G'} = \frac{\sum_{g \in G} \sum_{g' \in G'} \chi_{g \rightarrow g'} v_g \sigma_{fg} \phi_{0g}}{v_G \sigma_{fG} \phi_{0G}}. \quad (9)$$

The collapsing algorithm for the Legendre components of the group-to-group scattering matrices can be derived by preserving the transfer reaction rates. The result is

$$\sigma_{x2; G \rightarrow G'} = \frac{\sum_{g \in G} \sum_{g' \in G'} \sigma_{x2; g \rightarrow g'} \phi_{0g}}{\phi_{0G}}. \quad (10)$$

The coarse-group elastic removal cross section is computed from the already collapsed elastic and elastic in-group cross section

$$\sigma_{rG} = \sigma_{eG} - \sigma_{e0; G \rightarrow G}. \quad (11)$$

The coarse-group $l = 1$ transport cross section is also computed from already collapsed quantities

$$\sigma_{tr, G} = \sigma_{tG} - \bar{\mu}_G \sigma_{eG}. \quad (12)$$

The quantities considered up to this point were derived assuming the isotope was present in low concentration. When a material's concentration is not negligible, its resonance structure affects the neutron flux in the mixture. For the purpose of cross-section averaging, the weight function for the isotope being considered is taken to be

$$\phi(E, T, \sigma_0) = \frac{C(E)}{\sigma_0 + \sigma_t(E, T)}, \quad (13)$$

where σ_0 is a parameter provided to account for the environment of the isotope (mixture and geometry). The value of σ_0 is usually taken to equal the part of the total macroscopic cross section contributed by the other isotopes of the mixture divided by the density of the isotope in question; it is often modified by equivalence principles appropriate to the geometry of the system. The effective cross section at T and σ_0 is then given by

$$\sigma_{xg}(T, \sigma_0) = \frac{\int_g \frac{\sigma_{xg}(E, T) C(E)}{\sigma_0 + \sigma_t(E, T)} dE}{\int_g \frac{C(E)}{\sigma_0 + \sigma_t(E, T)} dE}. \quad (14)$$

For library purposes, it has proven to be convenient to represent the T and σ_0 dependent cross sections of Eq. (14) using the infinite dilution cross sections of Eq. (1) and a set of correction (or self-shielding) factors as follows

$$\sigma_{xg}(T, \sigma_0) = f_{xg}(T, \sigma_0) \sigma_{xg}. \quad (15)$$

Tables of f -factors are precomputed for the elastic, fission, capture, total, and transport cross sections and for an arbitrary set of T and σ_0 values. The f -factors (and the effective cross section via a multiplication) for any given T and σ_0 can then be obtained by interpolating in these tables.

The ability to exactly collapse these f -factors depends on the ability to reproduce the fine-group flux used in the original generation of the multigroup constants. First, note that the effective total cross section is given by

$$\sigma_{tg}(T, \sigma_0) = f_{tg}(T, \sigma_0) \sigma_{tg} =$$

$$\int_g \frac{\sigma_t(E, T) \phi_0(E)}{\sigma_t(E, T) + \sigma_0} dE \bigg/ \int_g \frac{\phi_0(E)}{\sigma_t(E, T) + \sigma_0} dE, \quad (16)$$

where σ_{tg} is the infinitely dilute total cross section provided by the processing codes and where

One f -factor, f_{tot} , is provided so that one can compute an effective diffusion coefficient for use in diffusion theory codes.

$$f_{tg}(T, \sigma_0) = \frac{f_{fg}(T, \sigma_0)\sigma_{fg} + f_{cg}(T, \sigma_0)\sigma_{cg} + f_{eg}(T, \sigma_0)\sigma_{eg}}{\sigma_{fg} + \sigma_{cg} + \sigma_{eg}}, \quad (17)$$

(all quantities to the right are also provided by the processing codes). Now, with just a little algebra, the original flux can be reproduced with the data provided

This requires that the total cross section be weighted by the current rather than the flux. MINX assumes that the current can be approximated by

$$\phi_g(T, \sigma_0) = \int \frac{\phi_0(E)}{\sigma_{tg}(E, T) + \sigma_0} dE = \int \phi_0(E) dE / [\sigma_{tg}(T, \sigma_0) + \sigma_0] = \phi_{0g} / [f_{tg}(T, \sigma_0)\sigma_{tg} + \sigma_0] \quad (18)$$

The exact collapsing algorithm for the "x" f -factor can now be derived by rewriting Eq. (16) in terms of the coarse group and expanding in terms of the fine-group quantities

$$\phi_1(E, \sigma_0, T) \approx \frac{\phi_0(E)}{[\sigma_{tg}(E, T) + \sigma_0]^2} \quad (20)$$

Algebra similar to that used to obtain Eq. (18) gives

$$\phi_{1g}(T, \sigma_0) = \frac{\phi_{0g}}{[f_{tg}(T, \sigma_0)\sigma_{tg} + \sigma_0][f_{totg}(T, \sigma_0)\sigma_{tg} + \sigma_0]} \quad (21)$$

The final algorithm for collapsing f_{totg} becomes

$$f_{totg}(T, \sigma_0) = \frac{\sum_{g \in G} f_{totg}(T, \sigma_0)\sigma_{tg}\phi_{1g}}{\sum_{g \in G} \phi_{1g}} \quad (22)$$

The transport self-shielding factor f_{tr} is provided so that one can compute an effective current weighted transport cross section. The collapsed transport self-shielding factors can be calculated from already collapsed quantities

$$f_{trg}(T, \sigma_0) = \frac{f_{totg}(T, \sigma_0)\sigma_{tg} - \bar{v}_G f_{eg}(T, \sigma_0)\sigma_{eg}}{\sigma_{tg} - \bar{v}_G \sigma_{eg}} \quad (23)$$

$$\begin{aligned} f_{Gx}(T, \sigma_0) &= \frac{\sigma_{xG}(T, \sigma_0)}{\sigma_{xG}} \\ &= \frac{\int \sigma_{xG}(E, T) \phi(E, T, \sigma_0) dE / \int \phi(E, T, \sigma_0) dE}{\int \sigma_{xG}(E) \phi_0(E) dE / \int \phi_0(E) dE} \\ &= \frac{\sum_{g \in G} \int \sigma_{xG}(E, T) \phi(E, T, \sigma_0) dE / \sum_{g \in G} \int \phi(E, T, \sigma_0) dE}{\sum_{g \in G} \int \sigma_{xG}(E) \phi_0(E) dE / \sum_{g \in G} \int \phi_0(E) dE} \\ &= \frac{\sum_{g \in G} f_{gx}(T, \sigma_0)\sigma_{gx}\phi_g(T, \sigma_0) / \sum_{g \in G} \phi_g(T, \sigma_0)}{\sum_{g \in G} \sigma_{gx}\phi_g / \sum_{g \in G} \phi_g} \\ &= \frac{\sum_{g \in G} \frac{f_{xg}(T, \sigma_0)\sigma_{xg}\phi_{0g}}{f_{fg}(T, \sigma_0)\sigma_{tg} + \sigma_0} / \sum_{g \in G} \frac{\phi_{0g}}{f_{tg}(T, \sigma_0)\sigma_{tg} + \sigma_0}}{\sigma_{xG}} \end{aligned}$$

for $x = c, e, f$. (19)

III. CODING ASSUMPTIONS AND LIMITATIONS

The purpose of this section is to enumerate variances, arbitrary choices, or assumptions that may affect the use of CINX results.

If any $l > 1$ transport (STRPL) or $l > 0$ total (STOTPL) cross-section arrays are provided, they will be collapsed according to Eq. (2).

If the CCCC cross sections were provided with MINX, one should be aware of the following points.

1. The total scattering matrix will be the sum of elastic and all inelastic scattering reactions times their multiplicities (for instance, $3 \times (n,3n)$ is added to the total).

2. The inelastic matrix will be the sum of all inelastic scattering reactions times their multiplicities, except $(n,2n)$ is not included.

3. The $(n,2n)$ scattering matrix will not have the $2x$ multiplicity included, i.e., the elements will sum to the $(n,2n)$ reaction cross sections (SN2N).

4. The inelastic cross section, XSIN, is the sum of all scattering reactions with secondary neutrons times their multiplicities, except $(n,2n)$ is not included, and $(n,3n)$ is added without its multiplicity.

5. The capture self-shielding factor, FCAP, is actually the self-shielding factor for only the (n,γ) reaction.

MINX normally generates all Legendre order scattering matrices using the zero-order weighting flux. Since CINX will usually be processing MINX data, CINX will also collapse all Legendre order scattering matrices with the zero-order flux [as per Eq. (10)].

Some quantities in the CCCC format are not explicitly defined. Thus, in CINX (and MINX) the total self-shielding factor FTOT is taken to be a current weighted quantity that can be used to compute an effective diffusion coefficient for use in diffusion theory calculations. FTOT is therefore collapsed according to Eq. (22). CINX and

MINX assume that the transport self-shielding factor FTR is derived from a current weighted transport cross section and can therefore be collapsed according to Eq. (23).

The CCCC definition of XSED is the elastic downscattering to the adjacent group. As Eq. (11) shows, CINX changes XSED to be the elastic removal cross section.

Some adjustment of the CCCC data is required to put it in proper LDX format. The (n,γ) , (n,α) , (n,p) , (n,D) , and (n,T) reactions are summed to form the LDX capture cross section, SIGC. Hence the capture self-shielding factors of LDX are computed in the following manner

$$FCAP_{LDX} = [SIGC_{LDX} - SNGAM_{CCCC} + FCAP_{CCCC} * SNGAM_{CCCC}] / SIGC_{LDX} \quad (24)$$

The inelastic matrix for LDX is formed by summing all the inelastic scattering reactions times their multiplicities. The LDX total inelastic cross section SIGIN is likewise a sum of all inelastic scattering reactions times their multiplicities, except the $(n,2n)$ and $(n,3n)$ reactions are added without multiplying by their multiplicities.

One of the CINX options for LDX output is the number of downscattering terms for the LDX inelastic matrix. If this number is less than the terms provided in the CCCC format, then the additional downscattering terms will be summed into the last LDX downscattering term.

IV. INPUT AND OPERATION

The CINX input and operation information has been condensed into Table II. At most, there are only four types of input cards required and, if one is only going to switch from CCCC to LDX format, just one card is required.

The major function (MF) indicator gives one the option to collapse in CCCC format, to switch from CCCC to LDX format, or to collapse and put the result in both CCCC and LDX format.

The number of coarse groups (NCG) indicator and the second card (number of fine groups per coarse group) allow one to collapse to any subset group structure.

The ICF option allows collapsing to proceed with a parameter specified (card 3) built-in collapsing flux, or with a completely arbitrary read-in flux (card 4). Collapsing will be exact if this flux is identical to the original.

The number of downscattering terms (NDT) determines the size of the inelastic scattering matrix for the 1DX format.

The neutron precursor file (NPF) indicator in conjunction with MF gives one the option to simply not process the delayed neutron data, to collapse in CCCC format, to switch from CCC to PERT-V format, or to collapse and put the results in both CCCC and PERT-V format. (Data terminators ["3"] have to be added by hand to the PERT-V cards.)

CINX running times on the CDC-7600 are relatively short. For instance, it takes 29 s to collapse 240-group ^{239}Pu to 50 groups. It takes 64 s to combine 50-group, 101-isotope ISOTXS and BRKOXS files into the 1DX format.

As a reminder, both the ISOTXS and BRKOXS files have to be supplied for any CINX run. Isotopes have to be in the same order on both files. The DLAYXS file does not have to be supplied if one does not wish to process it. Usually the DLAYXS file has fewer isotopes than the ISOTXS and BRKOXS files...which is all right as long as ISOTXS and BRKOXS contain the DLAYXS isotopes in the DLAYXS order (neglecting isotopes with no delayed neutron data).

TABLE II

CINX OPERATING INFORMATION

Input Files

- 3,4,12 - Fine-group binary CCCC-III ISOTXS, BRKOXS, and DLAYXS files, respectively.

Output Files

- 8,9,13 - Coarse-group binary CCCC-III ISOTXS, BRKOXS, and DLAYXS files, respectively.
10 - Coarse-group 1DX binary format.

System Files

- 5 - Data cards.
6 - Computer printout.
PUN - PERT-V output on cards.

Data Cards

- 1 - Run options input card (Format 516)
MF Major functions (0/1/2 = collapse/1DX/both).
NCG Number of coarse groups (omit if MF = 1).
ICF Collapsing flux (0/1 = thermal-Fermi-Watt/input) (omit if MF = 1).
NDT Number of downscattering terms (including ingroup) (omit if MF = 0).
NPF Neutron precursor file (0/1 = No/Yes) (-for PERT-V data).
- 2 - Number of fine groups per each coarse group (Format 1216) (omit if MF = 1).
- 3 - Parameters for ICF = 0 option (Format 4E12.5) (omit if MF = 1 or ICF ≠ 0).
TB Nuclear temperature (eV) for thermal spectrum region (0.025 used for LIB-IV).
EB Upper limit (eV) for thermal region (0.1 used for LIB-IV).
TC Nuclear temperature (eV) for WATT spectrum region (1.4×10^6 used for LIB-IV).
EC Lower limit (eV) for WATT region (0.8208×10^6 used for LIB-IV).
- 4 - Input flux (format 6E12.5) (omit if MF = 1 or ICF = 0).

APPENDIX A
LISTING OF CINCX CODE

LASL IDENTIFICATION
NO: LP-0509

```

PROGRAM MAIN (INP,OUT,PUN,FSET3,FSET4,FSET7,FSET8,FSET9,FSET10,FSE CINCX      2
1T11,FSET12,FSET13,FSET15=INP,FSET16=OUT) CINCX      3
C CINCX      4
C ***** CINCX      5
C MAIN PROGRAM FOR COLLAPSING FINE GROUP ISOTXS AND BROKXS FILES. CINCX      6
C FINE GROUP ISOTXS ON FSET3. CINCX      7
C FINE GROUP BROKXS ON FSET4. CINCX      8
C FINE GROUP DLAYXS ON FSET12. CINCX      9
C COURSE GROUP ISOTXS ON FSET8. CINCX     10
C COURSE GROUP BROKXS ON FSET9. CINCX     11
C COURSE GROUP DLAYXS ON FSET13. CINCX     12
C IOX OUTPUT ON FSET10. CINCX     13
C PERTV OUTPUT ON PUNCHED CARDS. CINCX     14
C ***** CINCX     15
C * * * * SUBROUTINE DESCRIPTIONS * * * * CINCX     16
C CINCX     17
C CINCX     18
C MAIN      MAIN PROGRAM CINCX     19
C CINCX     20
C INPUT     READS AND WRITES THE INPUT DATA AND FORMS THE FINE GROUP CINCX     21
C           FLUX, COURSE GROUP FLUX, AND MARKS EACH FINE GROUP AS TO CINCX     22
C           WHICH COURSE GROUP IT BELONGS. CINCX     23
C CINCX     24
C MAX       COMPUTES THE MAXIMUM NUMBER OF GROUPS DOWNSCATTER AND CINCX     25
C           UPSCATTER FOR THE COURSE GROUP STRUCTURE. CINCX     26
C CINCX     27
C FIZZ      COLLAPSES A FINE GROUP FISSION SOURCE MATRIX TO A COURSE CINCX     28
C           GROUP FISSION SOURCE MATRIX. CINCX     29
C CINCX     30
C JBIJ      COMPUTES THE SCATTERING BANDWIDTHS AND THE IN-GROUP CINCX     31
C           SCATTERING POSITIONS FOR THE COLLAPSED GROUPS. CINCX     32
C CINCX     33
C COLLAP    COLLAPSES THE FINE GROUP X-SECS. CINCX     34
C CINCX     35
C COLLFF    COLLAPSES THE FINE GROUP SELF-SHIELDING FACTORS. CINCX     36
C CINCX     37
C * * * * VARIABLE DESCRIPTIONS * * * * CINCX     38
C CINCX     39
C MF        MAJOR FUNCTION INDICATOR. CINCX     40
C CINCX     41
C ICF       FLUX OPTION INDICATOR. CINCX     42
C CINCX     43
C NDT       NUMBER OF DOWNSCATTERING TERMS. CINCX     44
C CINCX     45
C NPF       DELAYED NEUTRON PROCESSING INDICATOR. CINCX     46
C CINCX     47
C NGROUP    NUMBER OF FINE GROUPS. CINCX     48
C CINCX     49
C NCG       NUMBER OF COURSE GROUPS. CINCX     50
C CINCX     51
C NGG(I)    NUMBER OF FINE GROUPS IN COURSE GROUP I. CINCX     52
C CINCX     53
C LG(I)     COURSE GROUP NUMBER FOR FINE GROUP I. CINCX     54
C CINCX     55
C F(I)      ABSOLUTE FLUX IN FINE GROUP I. CINCX     56
C CINCX     57
C TF(I)     ABSOLUTE FLUX IN COURSE GROUP I. CINCX     58
C CINCX     59
C IBM REAL*8 HABSID,HIDENT,HMAT CINCX     60
C COMMON A(31000),X(600),JBFL(100),JBFH(100),NTABP(100),NTABT(100),J CINCX     61
C 1RL(100),JBH(100),NGG(240),LG(240),F(240),TF(240),XSED(240),XSXT(24 CINCX     62
C 20),W(240),LORD(4),XSPD(240),XSIN(240),XSE(240),XSMU(240),STOTPL(24 CINCX     63
C 30),SNGAM(240),SFIS(240),STRPL(240),JBAND(240,4),JBAN(240,4),IDSCT( CINCX     64
C 44),CAP(240),SNUTOT(240),SN2N(240),TB(300) CINCX     65
C DIMENSION HSETID(24), HISONM(200), CM1(240), VEL(240), EMAX(241), CINCX     66

```

	1 LOCA(100), G(960), IJJ(240,4), IJ(240,4), GG(240,4), FTOT(6,3,240)	CINX	67
	2, FCAP(6,3,240), FFIS(6,3,240), FTR(6,3,240), FEL(6,3,240), FT(6,3	CINX	68
	3,240)	CINX	69
	DIMENSION HABS(200), NKFAM(100), PERTV(10), FLAM(500), CHID(240,12	CINX	70
	10), NUMFAM(100), SNUDEL(240,100)	CINX	71
	EQUIVALENCE (A(1),HSETID(1)), (A(225),CHI(1)), (A(465),VEL(1)), (A	CINX	72
	1(705),EMAX(1)), (A(1346),IJJ(1,1)), (A(2306),IJ(1,1)), (A(29001),G	CINX	73
	2(1)), (A(1),FTOT(1,1,1)), (A(4321),FCAP(1,1,1)), (A(8641),FFIS(1,1	CINX	74
	3,1)), (A(12961),FTR(1,1,1)), (A(17201),FEL(1,1,1)), (A(21601),FT(1	CINX	75
	4,1,1)), (A(30041),GG(1,1))	CINX	76
	EQUIVALENCE (A(1346),FLAM(1)), (A(2001),CHID(1,1)), (A(1847),NUMFA	CINX	77
	1M(1)), (A(3001),SNUDEL(1,1))	CINX	78
C	CREATE AN END-OF-FILE-SIMULATOR FOR WRITING BETWEEN FTR ISOTOPFS.	CINX	79
	DATA EOF5/4HEOF5/	CINX	80
	DO 10 I=1,30740	CINX	81
	10 A(I)=0	CINX	82
	MULT=1	CINX	83
C IBM	MULT=2	CINX	84
	IDIM=31000	CINX	85
C	FILE IDENTIFICATION RECORDS.	CINX	86
	NWDS=1+3*MULT	CINX	87
	READ (3)(A(I),I=1,NWDS)	CINX	88
	READ (4)(A(I),I=1,NWDS)	CINX	89
	WRITE (7)(A(I),I=1,NWDS)	CINX	90
	WRITE (9)(A(I),I=1,NWDS)	CINX	91
C	FILE CONTROL RECORDS.	CINX	92
	READ (3)NGROUP,NISO,MAXUP,MAXDN,MAXORD,ICHIST,NSCMAX,NSBLOK	CINX	93
	READ (4)NGROUP,NISOSH,NSIGPT,NTEMPT	CINX	94
C	FILE DATA RECORDS.	CINX	95
	ID2=12*MULT	CINX	96
	NM1=NISO*MULT	CINX	97
	IF (ICHIST.EQ.1) READ (3)(HSETID(1),I=1,ID2),(HISONM(I),I=1,NM1),(	CINX	98
	1CHI(J),J=1,NGROUP),(VEL(J),J=1,NGROUP),(EMAX(J),J=1,NGROUP),EMIN,(	CINX	99
	2LOCA(I),I=1,NISO)	CINX	100
	IF (ICHIST.NE.1) READ (3)(HSETID(I),I=1,ID2),(HISONM(I),I=1,NM1),(	CINX	101
	1VEL(J),J=1,NGROUP),(EMAX(J),J=1,NGROUP),EMIN,(LOCA(I),I=1,NISO)	CINX	102
C	WE NOW HAVE THE FINE GROUP ENERGY STRUCTURE SO WE CAN READ THE	CINX	103
C	USER INPUT, FINISH WORKING ON THE FILE CONTROL RECORDS AND WRITE	CINX	104
C	THEM OUT.	CINX	105
	NG1=NGROUP+1	CINX	106
	EMAX(NG1)=FMIN	CINX	107
	CALL INPUT (NGROUP,NCG,NGG,LG,NG1,EMAX,F,IF,MF,NDT,NPF)	CINX	108
	IF (NPF.EQ.0) GO TO 40	CINX	109
	READ (12)(A(I),I=1,NWDS)	CINX	110
	WRITE (13)(A(I),I=1,NWDS)	CINX	111
	READ (12)NGROUP,NISOD,NFAM,IDUM	CINX	112
	WRITE (13)NCG,NISOD,NFAM,IDUM	CINX	113
	NDY=NISOD*MULT	CINX	114
	READ (12)(HABS(I),I=1,NDY),(FLAM(N),N=1,NFAM),((CHID(J,N),J=1,NGRO	CINX	115
	1UP),N=1,NFAM),(EMAX(J),J=1,NGROUP),EMIN,(NKFAM(I),I=1,NISOD),(LOCA	CINX	116
	2(I),I=1,NISOD)	CINX	117
	DO 30 N=1,NFAM	CINX	118
	L=0	CINX	119
	DO 30 JI=1,NCG	CINX	120
	J=NGG(JI)	CINX	121
	S=0,0	CINX	122
	DO 20 K=1,J	CINX	123
	L=L+1	CINX	124
	20 S=S+CHID(L,N)	CINX	125
	IF (S.LT.0.0) S=0,0	CINX	126
	30 CHID(JI,N)=S	CINX	127
	IF (NPF.GT.0) GO TO 40	CINX	128
	PUNCH 840, (FLAM(K),K=1,NFAM)	CINX	129
	PUNCH 840, ((CHID(J,K),J=1,NCG),K=1,NFAM)	CINX	130
	40 CONTINUE	CINX	131
	IF (MF.EQ.1) GO TO 50	CINX	132
	CALL MAX (MAXUP,MAXDN,MUP,MDN,NGG,NCG)	CINX	133
	WRITE (7)NCG,NISO,MUP,MDN,MAXORD,ICHIST,NSCMAX,NCG	CINX	134
	WRITE (9)NCG,NISOSH,NSIGPT,NTEMPT	CINX	135
C	RESUME WORKING WITH THE FILE DATA RECORDS.	CINX	136
	50 NM2=NISOSH*MULT	CINX	137
	READ (4)(HISONM(I),I=1,NM2),(X(K),K=1,NSIGPT),(TB(K),K=1,NTEMPT),(	CINX	138

	1EMAX(J),J=1,NGROUP),EMIN,(JBFLL(I),I=1,NISOSH),(JBFH(I),I=1,NISOSH)	CINX	139
	2,(NTABP(I),I=1,NISOSH),(NTABT(I),I=1,NISOSH)	CINX	140
	IF (MF.EQ.1) GO TO 90	CINX	141
C	DETERMINE THE LOWEST,JBL, AND THE HIGHEST,JBH, COURSE GROUPS FOR	CINX	142
C	WHICH SELF-SHIELDING FACTORS WILL BE GIVEN.	CINX	143
	DO 60 I=1,NISOSH	CINX	144
	JL=JBFLL(I)	CINX	145
	JH=JBFH(I)	CINX	146
	JBL(I)=LG(JL)	CINX	147
60	JBH(I)=LG(JH)	CINX	148
C	DETERMINE THE COURSE GROUP ENERGY BOUNDARIES (STORING THEM IN THE	CINX	149
C	ORIGINAL EMAX ARRAY) AND COLLAPSE THE SET FISSION SOURCE VECTOR.	CINX	150
	M=1	CINX	151
	DO 70 Y=1,NCG	CINX	152
	N=NGG(I)	CINX	153
	CHI(I)=0.0	CINX	154
	EMAX(I)=EMAX(M)	CINX	155
	DO 70 J=1,N	CINX	156
	CHI(I)=CHI(I)+CHI(M)	CINX	157
70	M=M+1	CINX	158
C	COMPUTE THE COURSE GROUP VELOCITIES.	CINX	159
	NCG1=NCG-1	CINX	160
	C=SQRT(1.602/(1.67482*2.))*.E6	CINX	161
	DO 80 Y=1,NCG1	CINX	162
80	VEL(I)=C*(SQRT(EMAX(I))+SQRT(EMAX(Y+1)))	CINX	163
	VEL(NCG)=C*SQRT(EMAX(NCG))	CINX	164
C	WRITE OUT THE FILE DATA RECORDS	CINX	165
	IF (ICLIST.EQ.1) WRITE (7)(HSETID(I),I=1,ID2),(HISONM(I),I=1,NM1),	CINX	166
	1(CHI(J),J=1,NCG),(VEL(J),J=1,NCG),(EMAX(J),J=1,NCG),EMIN,(LOCA(I),	CINX	167
	2I=1,NIS0)	CINX	168
	IF (ICLIST.NE.1) WRITE (7)(HSETID(I),I=1,ID2),(HISONM(I),I=1,NM1),	CINX	169
	1(VEL(J),J=1,NCG),(EMAX(J),J=1,NCG),EMIN,(LOCA(I),I=1,NIS0)	CINX	170
	WRITE (9)(HISONM(I),I=1,NM2),(X(K),K=1,NSIGPT),(TB(K),K=1,NTEMPT),	CINX	171
	1(EMAX(J),J=1,NCG),EMIN,(JBL(I),I=1,NISOSH),(JBH(I),I=1,NISOSH),(NT	CINX	172
	2ABP(I),I=1,NISOSH),(NTABT(I),I=1,NISOSH)	CINX	173
	IF (NPF.EQ.0) GO TO 90	CINX	174
	WRITE (13)(HABS(I),I=1,NBY),(FLAM(N),N=1,NFAM),(CHID(J,N),J=1,NCG	CINX	175
	1),N=1,NFAM),(EMAX(J),J=1,NCG),EMIN,(NKFAM(I),I=1,NISOD),(LOCA(I),I	CINX	176
	2=1,NISOD)	CINX	177
90	DO 100 K=1,NSIGPT	CINX	178
100	X(K)=10.**X(K)	CINX	179
	DO 110 K=1,NTEMPT	CINX	180
110	TB(K)=TB(K)+273.16	CINX	181
C	SET CHI MATRIX.	CINX	182
	IF (ICLIST.LE.1) GO TO 130	CINX	183
	NWDS=NGROUP*(ICLIST+1)	CINX	184
	IF (NWDS+NCG+NCG+2*NGROUP.GT.IDIM) GO TO 830	CINX	185
	READ (3)(A(I),I=1,NWDS)	CINX	186
	IF (MF.EQ.1) GO TO 130	CINX	187
	N2=2*NGROUP	CINX	188
	DO 120 I=1,N2	CINX	189
120	A(NWDS+I)=1.	CINX	190
	CALL FIZZ (A(I),A(ICLIST*NGROUP+1),A(NWDS+1),A(NWDS+NGROUP+1),F,NG	CINX	191
	1G,ICLIST,NGROUP,NCG,A(NWDS+2*NGROUP+1))	CINX	192
	NCGNCG=NCG*NCG	CINX	193
	WRITE (7)(A(NWDS+2*NGROUP+J),J=1,NCGNCG),(A(ICLIST*NGROUP+J),J=1,N	CINX	194
	1CG)	CINX	195
130	CONTINUE	CINX	196
C	LOOP OVER ALL ISOTOPES.	CINX	197
	NX=0	CINX	198
	KT=0	CINX	199
	NOR=0	CINX	200
	II=1	CINX	201
	DO 740 I=1,NIS0	CINX	202
	DO 140 J=1,NGROUP	CINX	203
	SFIS(J)=0	CINX	204
	SNUTOT(J)=0	CINX	205
	SN2N(J)=0	CINX	206
140	CONTINUE	CINX	207
	LOCA(I)=NOR	CINX	208
C	ISOTOPE CONTROL AND GROUP INDEPENDENT DATA.	CINX	209
	READ (3)HABSID,HIDENT,HMAT,AMASS,EFISS,ECAPT,TEMP,SIGPT,ADENS,KBR	CINX	210

	1, ICHI, IFIS, IALF, INP, IN2N, IND, INT, LTOT, LTRN, ISTRPD, (IDSET(N), N=1, NS	CINX	211
	2C MAX), (LORD(N), N=1, NSC MAX), ((JBRAND(J, N), J=1, NGROUP), N=1, NSC MAX), ((	CINX	212
	3IJJ(J, N), J=1, NGROUP), N=1, NSC MAX)	CINX	213
	IF (MF.EQ.1) GO TO 150	CINX	214
	CALL JRIJ (JBAND, IJJ, JBRN, IJ, NGG, NSC MAX, NGROUP, NCG)	CINX	215
	WRITE (7) HABSIO, HIDENT, HMAT, AMASS, EFFISS, ECAPT, TEMP, SIGPOT, ADENS, KB	CINX	216
	1R, ICHI, IFIS, IALF, INP, IN2N, IND, INT, LTOT, LTRN, ISTRPD, (IDSET(N), N=1, N	CINX	217
	2SC MAX), (LORD(N), N=1, NSC MAX), ((JBAND(J, N), J=1, NCG), N=1, NSC MAX), ((IJ	CINX	218
	3J, N), J=1, NCG), N=1, NSC MAX)	CINX	219
	NOR=NOR+1	CINX	220
C	PRINCIPAL CROSS SECTIONS.	CINX	221
	150 NWDS=(1+LTRN+LTOT+IALF+JNP+IN2N+IND+INT+ISTRPD+2*IFIS+ICHI*(2/(ICH	CINX	222
	1I+1))) *NGROUP	CINX	223
	READ (3) (A(J), J=1, NWDS)	CINX	224
C	SAVING AND COLLAPSING THE TRANSPORT X-SEC.	CINX	225
	DO 170 L=1, LTRN	CINX	226
	IF (L.GT.1) GO TO 170	CINX	227
	DO 160 J=1, NGROUP	CINX	228
	160 STRPL(J)=A(J)	CINX	229
	170 CALL COLLAP (A(NGROUP*(L-1)+1), A(NCG*(L-1)+1), F, NGG, NGROUP, NCG)	CINX	230
C	SAVING AND COLLAPSING THE TOTAL X-SEC.	CINX	231
	M=LTRN+NGROUP	CINX	232
	DO 190 L=1, LTOT	CINX	233
	IF (L.GT.1) GO TO 190	CINX	234
	DO 180 J=1, NGROUP	CINX	235
	180 STOTPL(J)=A(J+M)	CINX	236
	190 CALL COLLAP (A(M+NGROUP*(L-1)+1), A(LTRN+NCG+NCG*(L-1)+1), F, NGG, NGR	CINX	237
	10UP, NCG)	CINX	238
C	SAVING AND COLLAPSING THE N,G X-SEC.	CINX	239
	M=(LTRN+LTOT)*NGROUP	CINX	240
	DO 200 J=1, NGROUP	CINX	241
	CAP(J)=A(J+M)	CINX	242
	200 SNGAM(J)=A(J+M)	CINX	243
	CALL COLLAP (A(M+1), A(NCG*(LTRN+LTOT)+1), F, NGG, NGROUP, NCG)	CINX	244
C	SAVING AND COLLAPSING THE FISSION X-SEC.	CINX	245
	IF (IFIS.LE.0) GO TO 270	CINX	246
	M=(1+LTRN+LTOT)*NGROUP	CINX	247
	DO 210 J=1, NGROUP	CINX	248
	210 SFIS(J)=A(J+M)	CINX	249
	CALL COLLAP (A(M+1), A(1+(1+LTRN+LTOT)*NCG), F, NGG, NGROUP, NCG)	CINX	250
C	SAVING AND COLLAPSING THE NEUTRON YIELD/FISSION.	CINX	251
	M=M+NGROUP	CINX	252
	DO 220 J=1, NGROUP	CINX	253
	SNUOT(J)=A(J+M)	CINX	254
	220 W(J)=SFIS(J)*F(J)	CINX	255
	CALL COLLAP (A(M+1), A(1+(2+LTRN+LTOT)*NCG), W, NGG, NGROUP, NCG)	CINX	256
	IF (NPF.EQ.0.OR.HISONM(I*MULT).NE.HABS(I*MULT)) GO TO 270	CINX	257
	NKFAM1=NKFAM(I)	CINX	258
	READ (12) ((SNUDEL(J, K), J=1, NGROUP), K=1, NKFAM1), (NUMFAM(K), K=1, NKFA	CINX	259
	1MI)	CINX	260
	IF (NPF.GT.0) GO TO 250	CINX	261
	SUM=0.0	CINX	262
	DO 230 K=1, NKFAM1	CINX	263
	CALL COLLAP (SNUDEL(1, K), PERTV(K), W, NGROUP, NGROUP, 1)	CINX	264
	230 SUM=SUM+PERTV(K)	CINX	265
	DO 240 K=1, NKFAM1	CINX	266
	240 PERTV(K)=PERTV(K)/SUM	CINX	267
	PUNCH 840, SUM	CINX	268
	PUNCH 840, (PERTV(K), K=1, NKFAM1)	CINX	269
	250 CONTINUE	CINX	270
	DO 260 K=1, NKFAM1	CINX	271
	260 CALL COLLAP (SNUDEL(1, K), SNUDEL(1, K), W, NGG, NGROUP, NCG)	CINX	272
	WRITE (13) ((SNUDEL(J, K), J=1, NCG), K=1, NKFAM1), (NUMFAM(K), K=1, NKFAM1	CINX	273
	1)	CINX	274
	II=II+1	CINX	275
	270 IF (ICHI.LE.0) GO TO 300	CINX	276
C	COLLAPSING THE ISOTOPE FISSION SOURCE VECTOR.	CINX	277
	M=M+NGROUP	CINX	278
	L=0	CINX	279
	N=(LTRN+LTOT+1+2*IFIS)*NCG	CINX	280
	DO 290 JI=1, NCG	CINX	281
	J=NGG(JI)	CINX	282

S=0.0	CINX	283
DO 280 K=1,J	CINX	284
L=L+1	CINX	285
280 S=S+A(M+L)	CINX	286
290 A(JI+N)=S	CINX	287
C COLLAPSE THE REMAINING X=SEC.	CINX	288
300 MM=NCG*(LTRN+LTOT+2*IFIS+ICHI*(2/(ICHI+1)))	CINX	289
IF (IALF,EQ.0) GO TO 320	CINX	290
M=M+NGROUP	CINX	291
MM=MM+NCG	CINX	292
DO 310 J=1,NGROUP	CINX	293
310 CAP(J)=CAP(J)+A(J+M)	CINX	294
CALL COLLAP (A(M+1),A(MM+1),F,NGG,NGROUP,NCG)	CINX	295
320 IF (INP,EQ.0) GO TO 340	CINX	296
M=M+NGROUP	CINX	297
MM=MM+NCG	CINX	298
DO 330 J=1,NGROUP	CINX	299
330 CAP(J)=CAP(J)+A(J+M)	CINX	300
CALL COLLAP (A(M+1),A(MM+1),F,NGG,NGROUP,NCG)	CINX	301
340 IF (IN2N,EQ.0) GO TO 360	CINX	302
M=M+NGROUP	CINX	303
MM=MM+NCG	CINX	304
DO 350 J=1,NGROUP	CINX	305
350 SN2N(J)=A(M+J)	CINX	306
CALL COLLAP (A(M+1),A(MM+1),F,NGG,NGROUP,NCG)	CINX	307
360 IF (IND,EQ.0) GO TO 380	CINX	308
M=M+NGROUP	CINX	309
MM=MM+NCG	CINX	310
DO 370 J=1,NGROUP	CINX	311
370 CAP(J)=CAP(J)+A(J+M)	CINX	312
CALL COLLAP (A(M+1),A(MM+1),F,NGG,NGROUP,NCG)	CINX	313
380 IF (INT,EQ.0) GO TO 400	CINX	314
M=M+NGROUP	CINX	315
MM=MM+NCG	CINX	316
DO 390 J=1,NGROUP	CINX	317
390 CAP(J)=CAP(J)+A(J+M)	CINX	318
CALL COLLAP (A(M+1),A(MM+1),F,NGG,NGROUP,NCG)	CINX	319
400 IF (ISTRPD,EQ.0) GO TO 420	CINX	320
DO 410 L=1,ISTRPD	CINX	321
M=M+NGROUP	CINX	322
MM=MM+NCG	CINX	323
CALL COLLAP (A(M+1),A(MM+1),F,NGG,NGROUP,NCG)	CINX	324
410 CONTINUE	CINX	325
420 NWDS=((1+LTRN+LTOT+IALF+INP+IN2N+IND+INT+ISTRPD+2*IFIS+ICHI*(2/(ICHI+1))) *NCG	CINX	326
IF (MF,NE.1) WRITE (7)(A(J),J=1,NWDS)	CINX	327
NUR=NOR+1	CINX	328
C SELF-SHIELDING FACTORS.	CINX	329
NBINT=NTABP(I)	CINX	330
NBTEM=NTABT(I)	CINX	331
JBFLI=JBFL(I)	CINX	332
JBFHI=JBFH(I)	CINX	333
JBLI=JBL(I)	CINX	334
JBHI=JBH(I)	CINX	335
DO 430 J=1,NGROUP	CINX	336
DO 430 K=1,NBTEM	CINX	337
DO 430 N=1,NBINT	CINX	338
FTOT(N,K,J)=1.	CINX	339
FCAP(N,K,J)=1.	CINX	340
FFIS(N,K,J)=1.	CINX	341
FTR(N,K,J)=1.	CINX	342
430 FEL(N,K,J)=1.	CINX	343
READ (4)((FTOT(N,K,J),N=1,NBINT),K=1,NBTEM),J=JBFLI,JBFHI),((FCAP(N,K,J),N=1,NBINT),K=1,NBTEM),J=JBFLI,JBFHI),((FFIS(N,K,J),N=1,NBINT),K=1,NBTEM),J=JBFLI,JBFHI),((FTR(N,K,J),N=1,NBINT),K=1,NBTEM),J=JBFLI,JBFHI),((FEL(N,K,J),N=1,NBINT),K=1,NBTEM),J=JBFLI,JBFHI	CINX	344
4) READ (4)(XSPO(J),J=1,NGROUP),(XSIN(J),J=1,NGROUP),(XSE(J),J=1,NGROUP),(XSMU(J),J=1,NGROUP),(XSED(J),J=1,NGROUP),(XSXI(J),J=1,NGROUP)	CINX	345
DO 440 J=1,NGROUP	CINX	346
440 SN2N(J)=SN2N(J)+XSIN(J)	CINX	347
IF (MF,EQ.1) GO TO 480	CINX	348
	CINX	349
	CINX	350
	CINX	351
	CINX	352
	CINX	353
	CINX	354

	DO 450 J=1,NGROUP	CINX	355
	DO 450 K=1,NBTEM	CINX	356
	DO 450 N=1,NBINT	CINX	357
450	FT(N,K,J)=(FFIS(N,K,J)*SFIS(J)+FCAP(N,K,J)*SNGAM(J)+FEL(N,K,J)*XSE	CINX	358
	1(J)+STOTPL(J)-SFIS(J)-SNGAM(J)-XSE(J))/STOTPL(J)	CINX	359
	CALL COLLFF (FTOT,STOTPL,FT,STOTPL,F,X,NX,NGG,NBINT,NBTEM,NGROUP,N	CINX	360
	1CG,NSIGPT,1)	CINX	361
	CALL COLLFF (FCAP,SNGAM,FT,STOTPL,F,X,NX,NGG,NBINT,NBTEM,NGROUP,NC	CINX	362
	1G,NSIGPT,0)	CINX	363
	CALL COLLFF (FFIS,SFIS,FT,STOTPL,F,X,NX,NGG,NBINT,NBTEM,NGROUP,NCG	CINX	364
	1,NSIGPT,0)	CINX	365
	CALL COLLFF (FEL,XSE,FT,STOTPL,F,X,NX,NGG,NBINT,NBTEM,NGROUP,NCG,N	CINX	366
	1SIGPT,0)	CINX	367
	DO 460 J=1,NGROUP	CINX	368
460	W(J)=XSE(J)*F(J)	CINX	369
	CALL COLLAP (XSPO,XSPO,F,NGG,NGROUP,NCG)	CINX	370
	CALL COLLAP (XSIN,XSIN,F,NGG,NGROUP,NCG)	CINX	371
	CALL COLLAP (XSE,XSE,F,NGG,NGROUP,NCG)	CINX	372
	CALL COLLAP (XSMU,XSMU,W,NGG,NGROUP,NCG)	CINX	373
	CALL COLLAP (XSXI,XSXI,W,NGG,NGROUP,NCG)	CINX	374
C	COMPUTE COURSE GROUP TRANSPORT F-FACTORS.	CINX	375
	CALL COLLAP (STOTPL,STOTPL,F,NGG,NGROUP,NCG)	CINX	376
	DO 470 J=1,NCG	CINX	377
	STRPL(J)=STOTPL(J)-XSMU(J)*XSE(J)	CINX	378
	DO 470 K=1,NBTEM	CINX	379
	DO 470 N=1,NBINT	CINX	380
470	FTR(N,K,J)=(FTOT(N,K,J)*STOTPL(J)-XSMU(J)*FEL(N,K,J)*XSE(J))/STRPL	CINX	381
	1(J)	CINX	382
	WRITE (9)((FTOT(N,K,J),N=1,NBINT),K=1,NBTEM),J=JBLI,JRHT),((FCAP	CINX	383
	1(N,K,J),N=1,NBINT),K=1,NBTEM),J=JBLI,JRHI),((FFIS(N,K,J),N=1,NBINT	CINX	384
	2),K=1,NBTEM),J=JBLI,JRHI),((FTR(N,K,J),N=1,NBINT),K=1,NBTEM),J=J	CINX	385
	3BLI,JRHI),((FEL(N,K,J),N=1,NBINT),K=1,NBTEM),J=JBLI,JRHT)	CINX	386
C	WRITE OUT F-FACTORS IN FTR FORMAT.	CINX	387
480	IF (MF.EQ.0) GO TO 500	CINX	388
	IF (MF.EQ.1) WRITE (10)HABSID,AMASS,NBTEM,JBFL(I),JBFH(I),NBINT,NB	CINX	389
	INT,NBINT,NBINT,(TB(KI+K),K=1,NBTEM)	CINX	390
	IF (MF.EQ.2) WRITE (10)HABSID,AMASS,NBTEM,JBL(I),JBH(I),NBINT,NBINT	CINX	391
	1T,NBINT,NBINT,(TB(KI+K),K=1,NBTEM)	CINX	392
	NB=JBFLI	CINX	393
	NE=JBHFI	CINX	394
	IF (MF.EQ.2) NB=JBLI	CINX	395
	IF (MF.EQ.2) NE=JBHFI	CINX	396
	WRITE (10)(X(NX+K),K=1,NBINT)	CINX	397
	WRITE (10)((FFIS(N,K,J),N=1,NBINT),K=1,NBTEM),J=NB,NE)	CINX	398
	WRITE (10)(X(NX+K),K=1,NBINT)	CINX	399
	IF (MF.EQ.2) CALL COLLAP (CAP,CAP,F,NGG,NGROUP,NCG)	CINX	400
	IF (MF.EQ.2) CALL COLLAP (SNGAM,SNGAM,F,NGG,NGROUP,NCG)	CINX	401
	DO 490 N=1,NBINT	CINX	402
	DO 490 K=1,NBTEM	CINX	403
	DO 490 J=NB,NE	CINX	404
	IF (CAP(J),NE,0.0) FCAP(N,K,J)=1.+(FCAP(N,K,J)-1.)*SNGAM(J)/CAP(J)	CINX	405
490	CONTINUE	CINX	406
	WRITE (10)((FCAP(N,K,J),N=1,NBINT),K=1,NBTEM),J=NB,NE)	CINX	407
	WRITE (10)(X(NX+K),K=1,NBINT)	CINX	408
	WRITE (10)((FTOT(N,K,J),N=1,NBINT),K=1,NBTEM),J=NB,NE)	CINX	409
	WRITE (10)(X(NX+K),K=1,NBINT)	CINX	410
	WRITE (10)((FEL(N,K,J),N=1,NBINT),K=1,NBTEM),J=NB,NE)	CINX	411
500	CONTINUE	CINX	412
C	COLLAPSING THE ISOTOPE FISSION SOURCE MATRIX.	CINX	413
	IF (ICHI.LF.1) GO TO 510	CINX	414
	NWDS=NGROUP*(ICHI+1)	CINX	415
	IF (NWDS+NCG*NGC.GT.TOTM) GO TO 430	CINX	416
	READ (3)(A(J),J=1,NWDS)	CINX	417
	IF (MF.EQ.1) GO TO 510	CINX	418
	CALL FIZZ (A(1),A(ICHI*NGROUP+1),SFIS,SMUTOT,F,NGG,ICHI,NGROUP,NCG	CINX	419
	1,A(NWDS+2*NGROUP+1))	CINX	420
	NCGNGC=NCG*NGC	CINX	421
	WRITE (7)(A(NWDS+2*NGROUP+J),J=1,NCGNGC),A(ICHI*NGROUP+J),J=1,N	CINX	422
	1CG)	CINX	423
	NOR=NOR+1	CINX	424
C	COLLAPSING THE SCATTERING MATRICES.	CINX	425
510	NN=(NGROUP*2-NGROUP)/2+NGROUP	CINX	426
	DO 520 N=1,NN	CINX	427

520	A(N)=0.0	CINX	428
	DO 640 N=1, NSCHMAX	CINX	429
	LORDN=LORD(N)	CINX	430
	IF (LORDN.EQ.0) GO TO 640	CINX	431
	IDSCN=IDSCN(N)	CINX	432
	IF (MF.NE.1) GO TO 560	CINX	433
	M=0	CINX	434
	DO 550 J=1, NSBLOK	CINX	435
	M=M+NGROUP-J+1	CINX	436
	JL=JBAND(J,N)	CINX	437
	IF (JL.EQ.0) GO TO 550	CINX	438
	READ (3)(G(K),K=1,JL)	CINX	439
	IF (IDSCN.EQ.0) GO TO 550	CINX	440
	IF (IDSCN.NE.100) GO TO 530	CINX	441
	XSED(J)=XSF(J)-G(1)	CINX	442
	GO TO 550	CINX	443
530	MM=M	CINX	444
	DO 540 K=1, JL	CINX	445
	MM=MM-NGROUP-K+J	CINX	446
	A(MM+K)=A(MM+K)+G(K)	CINX	447
	IF (IDSCN.EQ.300) A(MM+K)=A(MM+K)+G(K)	CINX	448
540	CONTINUE	CINX	449
550	CONTINUE	CINX	450
	GO TO 640	CINX	451
560	CONTINUE	CINX	452
	MMM=0	CINX	453
	IFG=0	CINX	454
	DO 630 ICGP=1, NCG	CINX	455
	MMM=MMM+NCG-ICGP+1	CINX	456
	NN=NGG(ICGP)	CINX	457
	DO 570 M=1, 4	CINX	458
	DO 580 L=1, 240	CINX	459
570	GG(L,M)=0.0	CINX	460
	DO 590 M=1, NN	CINX	461
	IFG=IFG+1	CINX	462
	JBANDI=JBAND(IFG,N)	CINX	463
	JL=JBANDI*LORDN	CINX	464
	IF (JL.EQ.0) GO TO 590	CINX	465
	READ (3)(G(K),K=1,JL)	CINX	466
	DO 580 L=1, LORDN	CINX	467
	DO 580 J=1, JBANDI	CINX	468
	ICG=LG(IFG-J+1)	CINX	469
	II=ICGP+1-ICG	CINX	470
	GG(II,L)=G(J+(L-1)*JBANDI)*F(IFG-J+1)/TF(ICG)+GG(II,L)	CINX	471
580	CONTINUE	CINX	472
590	CONTINUE	CINX	473
	II=JBAND(ICGP,N)	CINX	474
	IF (II.EQ.0) GO TO 600	CINX	475
	IF (MF.NE.1) WRITE (7)((GG(J,L),J=1,II),L=1,LORDN)	CINX	476
	NOR=NOR+1	CINX	477
600	CONTINUE	CINX	478
	IF (IDSCN.EQ.0) GO TO 630	CINX	479
	IF (IDSCN.NE.100) GO TO 610	CINX	480
	XSED(ICGP)=XSE(ICGP)-GG(1,1)	CINX	481
	GO TO 630	CINX	482
610	MM=MMM	CINX	483
	DO 620 K=1, II	CINX	484
	MM=MM-NCG-K+ICGP	CINX	485
	A(MM+K)=A(MM+K)+GG(K,1)	CINX	486
	IF (IDSCN.EQ.300) A(MM+K)=A(MM+K)+GG(K,1)	CINX	487
620	CONTINUE	CINX	488
630	CONTINUE	CINX	489
640	CONTINUE	CINX	490
	IF (MF.NE.1) WRITE (9)(XSPO(J),J=1,NCG),(XSIN(J),J=1,NCG),(XSE(J),	CINX	491
	J=1,NCG),(XSMU(J),J=1,NCG),(XSED(J),J=1,NCG),(XSXI(J),J=1,NCG)	CINX	492
	NG=NGROUP	CINX	493
	IF (MF.EQ.0) GO TO 730	CINX	494
	IF (MF.EQ.1) GO TO 660	CINX	495
	NG=NCG	CINX	496
	DO 650 J=1, NGROUP	CINX	497
650	W(J)=SFIS(J)*F(J)	CINX	498
	CALL COLLAP (SNUTOT,SNUTOT,W,NGG,NGROUP,NCG)	CINX	499

CALL COLLAP (SFIS,SFIS,F,NGG,NGROUP,NGC)	CINX	500
CALL COLLAP (SN2N,SN2N,F,NGG,NGROUP,NGC)	CINX	501
660 CONTINUE	CINX	502
WRITE (10)(STOTPL(N),SFIS(N),SNUTOT(N),CAP(N),SN2N(N),XSE(N),XSMU(	CINX	503
1N),XSXI(N),XSED(N),N=1,NG)	CINX	504
Z=0,0	CINX	505
M=-NG-1	CINX	506
DO 710 J=1,NG	CINX	507
M=M+NG-J+2	CINX	508
NGJ=NG+1-J	CINX	509
NN=NDT-NGJ	CINX	510
IF (NN) 680,700,670	CINX	511
670 WRITE (11)(A(M+K),K=1,NGJ),(Z,K=1,NN)	CINX	512
GO TO 710	CINX	513
680 NDT1=NDT+1	CINX	514
DO 690 N=NDT1,NGJ	CINX	515
690 A(M+NDT)=A(M+NDT)+A(M+N)	CINX	516
700 WRITE (11)(A(M+K),K=1,NDT)	CINX	517
710 CONTINUE	CINX	518
REWIND 11	CINX	519
NGNDT=NG*NDT	CINX	520
IF (NGNDT,GT,38748) GO TO 820	CINX	521
DO 720 J=1,NG	CINX	522
NN=(J-1)*NDT	CINX	523
720 READ (11)(A(WN+N),N=1,NDT)	CINX	524
REWIND 11	CINX	525
WRITE (10)(A(J),J=1,NGNDT)	CINX	526
WRITE (10)EUF5	CINX	527
730 NX=NX+NBINT	CINX	528
KT=KT+NBTEM	CINX	529
740 CONTINUE	CINX	530
IF (MF.EQ.1) GO TO 810	CINX	531
C ACCOMODATING THE CONFOUNDED LOCA ARRAY	CINX	532
END FILE 7	CINX	533
REWIND 7	CINX	534
NWDS=1+3*MULT	CINX	535
READ (7)(A(I),I=1,NWDS)	CINX	536
WRITE (8)(A(I),I=1,NWDS)	CINX	537
READ (7)NGROUP,NISO,MAXUP,MAXDN,MAXORD,ICHIST,NSCMAX,NSBLUK	CINX	538
WRITE (8)NGROUP,NISO,MAXUP,MAXDN,MAXORD,ICHIST,NSCMAX,NSBLOK	CINX	539
IF (ICHIST.EQ.1) READ (7)(HSETID(I),I=1,ID2),(HISONM(I),I=1,NM1),(	CINX	540
1CHI(J),J=1,NGROUP),(VEL(J),J=1,NGROUP),(EMAX(J),J=1,NGROUP),EMIN,(	CINX	541
2LARK,I=1,NISO)	CINX	542
IF (ICHIST.NE.1) READ (7)(HSETID(I),I=1,ID2),(HISONM(I),I=1,NM1),(	CINX	543
1VEL(J),J=1,NGROUP),(EMAX(J),J=1,NGROUP),EMIN,(LARK,I=1,NISO)	CINX	544
IF (ICHIST.EQ.1) WRITE (8)(HSETID(I),I=1,ID2),(HISONM(I),I=1,NM1),	CINX	545
1CHI(J),J=1,NGROUP),(VEL(J),J=1,NGROUP),(EMAX(J),J=1,NGROUP),EMIN,	CINX	546
2(LOCA(I),I=1,NISO)	CINX	547
IF (ICHIST.NE.1) WRITE (8)(HSETID(I),I=1,ID2),(HISONM(I),I=1,NM1),	CINX	548
1VEL(J),J=1,NGROUP),(EMAX(J),J=1,NGROUP),EMIN,(LOCA(I),I=1,NISO)	CINX	549
IF (ICHIST.LE.1) GO TO 750	CINX	550
NWDS=NGROUP*(ICHIST+1)	CINX	551
READ (7)(A(I),I=1,NWDS)	CINX	552
WRITE (8)(A(I),I=1,NWDS)	CINX	553
750 DO 800 I=1,NISO	CINX	554
READ (7)HABSID,HIDENT,HMAT,AMASS,EFISS,ECAPY,TEMP,SIGPOT,ADENS,KBR	CINX	555
1,ICHI,IFIS,IALF,INP,IN2N,IND,INT,LTOT,LTRN,ISTRPD,(IDSC(N),N=1,NS	CINX	556
2CMAX),(LORD(N),N=1,NSCMAX),((JBAND(J,N),J=1,NGROUP),N=1,NSCMAX),((	CINX	557
3IJJ(J,N),J=1,NGROUP),N=1,NSCMAX)	CINX	558
WRITE (8)HABSID,HIDENT,HMAT,AMASS,EFISS,ECAPY,TEMP,SIGPOT,ADENS,KB	CINX	559
1R,ICHI,IFIS,IALF,INP,IN2N,IND,INT,LTOT,LTRN,ISTRPD,(IDSC(N),N=1,N	CINX	560
2SCMAX),(LORD(N),N=1,NSCMAX),((JBAND(J,N),J=1,NGROUP),N=1,NSCMAX),((	CINX	561
3(IJJ(J,N),J=1,NGROUP),N=1,NSCMAX)	CINX	562
NWDS=(1+LTRN+LTOT+IALF+INP+IN2N+IND+INT+ISTRPD)+2*IFIS+ICHI*(2/(ICH	CINX	563
1I+1))*NGROUP	CINX	564
READ (7)(A(J),J=1,NWDS)	CINX	565
DO 760 J=1,NGROUP	CINX	566
760 A(J)=STRPL(J)	CINX	567
WRITE (8)(A(J),J=1,NWDS)	CINX	568
IF (ICHI.LE.1) GO TO 770	CINX	569
NWDS=NGROUP*(ICHI+1)	CINX	570
READ (7)(A(J),J=1,NWDS)	CINX	571
WRITE (8)(A(J),J=1,NWDS)	CINX	572

770	DO 790 N=1, NSCMAX	CINX	573
	IF (LORD(N).EQ.0) GO TO 790	CINX	574
	DO 780 J=1, NSBLK	CINX	575
	LJ=LORD(N)*JRAND(J,N)	CINX	576
	IF (LJ.EQ.0) GO TO 780	CINX	577
	READ (7)(A(M),M=1,LJ)	CINX	578
	WRITE (8)(A(M),M=1,LJ)	CINX	579
780	CONTINUE	CINX	580
790	CONTINUE	CINX	581
800	CONTINUE	CINX	582
810	CONTINUE	CINX	583
	WRITE (6,850)	CINX	584
	RETURN	CINX	585
820	WRITE (6,860)	CINX	586
	RETURN	CINX	587
830	WRITE (6,870)	CINX	588
C		CINX	589
	RETURN	CINX	590
C		CINX	591
840	FORMAT (6(3X,1PE9.3))	CINX	592
850	FORMAT (1H0,96HCINX IS FINISHED. RUN UNITS 8, 9 AND 13 THROUGH HI	CINX	593
	1NX TO GET A PRINT OF YOUR COLLAPSED/2NX,68MCCC DATA AND/OR RUN UN	CINX	594
	2II 10 THROUGH PUX TO GET A PRINT OF YOUR 1DX/2NX,66HDATA. IF YOU	CINX	595
	3 CALLED FOR DELAYED NEUTRON DATA FOR PERTV IT WILL BE/2NX,23HFOUND	CINX	596
	4 ON PUNCHED CARDS.)	CINX	597
860	FORMAT (76H THIS VERSION OF CINX CANNOT HANDLE SUCH A LARGE 1DX IN	CINX	598
	!FLASTIC MATRXX RECORD)	CINX	599
870	FORMAT (66H THIS VERSION OF CINX CANNOT HANDLE SUCH A LARGE SET CH	CINX	600
	!I DATA RECORD)	CINX	601
	END	CINX	602
	SUBROUTINE COLLAP(XS,X,F,NGG,NG,NGC)	CINX	603
C	*****	CINX	604
C	COLLAPSES THE FINE GROUP X-SECS TO THE COURSE GROUP STRUCTURE.	CINX	605
C	*****	CINX	606
	DIMENSION XS(1), F(1), X(1), NGG(1)	CINX	607
	L=0	CINX	608
	DO 20 I=1,NGC	CINX	609
	J=NGG(I)	CINX	610
	S=0.0	CINX	611
	T=0.0	CINX	612
	DO 10 K=1,J	CINX	613
	L=L+1	CINX	614
	S=S+XS(L)*F(L)	CINX	615
10	T=T+F(L)	CINX	616
	IF (T.LE.0.0) X(I)=0.0	CINX	617
	IF (T.GT.0.0) X(I)=S/T	CINX	618
20	CONTINUE	CINX	619
	RETURN	CINX	620
	END	CINX	621
	SUBROUTINE JRIJ(JBAND,IJJ,JBAN,IJ,NGG,NSCMAX,NGROUP,NGC)	CINX	622
C	*****	CINX	623
C	COMPUTES THE SCATTERING BANDWIDTHS AND THE IN-GROUP SCATTERING	CINX	624
C	POSITIONS FOR THE COLLAPSED GROUPS. ASSUMES ALL IJJ=1.	CINX	625
C	*****	CINX	626
	DIMENSION JBAND(240,4), IJJ(240,4), JBAN(240,4), IJ(240,4), NGG(1)	CINX	627
	DO 40 N=1,NSCMAX	CINX	628
	M=0	CINX	629
	DO 40 I=1,NGC	CINX	630
	L=NGG(I)	CINX	631
	MIN=M+1	CINX	632
	JCK=0	CINX	633
	DO 10 J=1,L	CINX	634
	M=M+1	CINX	635
	IF (JBAND(M,N).NE.0) JCK=1	CINX	636
10	MIN=M+1	CINX	637
	MC=0	CINX	638
	DO 20 K=1,NGG	CINX	639
	MC=MC+NGG(K)	CINX	640
	IF (MC.GE.MIN) GO TO 30	CINX	641
20	CONTINUE	CINX	642
30	JBAN(I,N)=I-K+1	CINX	643
	IF (JCK.EQ.0) JBAN(I,N)=0	CINX	644

40	IJ(I,N)=1	CINX	645
	RETURN	CINX	646
	END	CINX	647
	SUBROUTINE MAX(MAXUP,MAXDN,MUP,MDN,NGG,NCG)	CINX	648
C	*****	CINX	649
C	COMPUTES THE MAXIMUM NUMBER OF GROUPS DOWNSCATTER, MDN, AND THE	CINX	650
C	MAXIMUM NUMBER OF GROUPS UPSCATTER, MUP, FOR THE COURSE GROUP	CINX	651
C	STRUCTURE.	CINX	652
C	*****	CINX	653
	DIMENSION NGG(1)	CINX	654
	NCG1=NCG-1	CINX	655
	IF (MAXDN.GT.0) GO TO 10	CINX	656
	MDN=0	CINX	657
10	MDN=1	CINX	658
	DO 40 I=1,NCG1	CINX	659
	M=0	CINX	660
	N=0	CINX	661
	DO 20 J=I,NCG1	CINX	662
	M=M+1	CINX	663
	N=N+NGG(J+1)	CINX	664
	IF (N.GE.MAXDN) GO TO 30	CINX	665
20	CONTINUE	CINX	666
30	MDN=MAX0(MDN,M)	CINX	667
40	CONTINUE	CINX	668
	IF (MAXUP.GT.0) GO TO 50	CINX	669
	MUP=0	CINX	670
	GO TO 90	CINX	671
50	MUP=1	CINX	672
	DO 80 I=1,NCG1	CINX	673
	M=0	CINX	674
	N=0	CINX	675
	DO 60 J=I,NCG1	CINX	676
	M=M+1	CINX	677
	N=N+NGG(NCG-J)	CINX	678
	IF (N.GE.MAXUP) GO TO 70	CINX	679
60	CONTINUE	CINX	680
70	MUP=MAX0(MUP,M)	CINX	681
80	CONTINUE	CINX	682
90	RETURN	CINX	683
	END	CINX	684
	SUBROUTINE FIZZ(CHI,ISSPEC,SFIS,SNUTOT,F,NGG,ICHIST,NGROUP,NCG,X)	CINX	685
C	*****	CINX	686
C	COLLAPSES THE FINE GROUP FISSION SOURCE MATRIX TO A COURSE	CINX	687
C	GROUP FISSION SOURCE MATRIX.	CINX	688
C	*****	CINX	689
	DIMENSION CHI(ICHIST,NGROUP), ISSPEC(NGROUP), SFIS(NGROUP), SNUTOT	CINX	690
	(NGROUP), F(NGROUP), NGG(NCG), X(NCG,NCG)	CINX	691
C	COLLAPSE CHI(ICHIST,NGROUP) TO CHI(ICHIST,NCG).	CINX	692
	DO 20 K=1,ICHIST	CINX	693
	M=0	CINX	694
	DO 20 J=1,NCG	CINX	695
	N=NGG(J)	CINX	696
	SUM=0.0	CINX	697
	DO 10 L=1,N	CINX	698
	M=M+1	CINX	699
10	SUM=SUM+CHI(K,M)	CINX	700
20	CHI(K,J)=SUM	CINX	701
C	COMPUTE X(I,J)=FRACTION OF NEUTRONS EMITTED IN BROAD GROUP J AS A	CINX	702
C	RESULT OF A FISSION IN BROAD GROUP I.	CINX	703
	M=0	CINX	704
	DO 50 J=1,NCG	CINX	705
	N=NGG(J)	CINX	706
	DO 30 JP=1,NCG	CINX	707
30	X(J,JP)=0.0	CINX	708
	ROT=0	CINX	709
	DO 40 L=1,N	CINX	710
	M=M+1	CINX	711
	T=ISSPEC(M)	CINX	712
	W=SNUTOT(M)*SFIS(M)*F(M)	CINX	713
	ROT=ROT+W	CINX	714
	DO 40 JP=1,NCG	CINX	715
40	Y(J,JP)=X(J,JP)+CHI(I,JP)*W	CINX	716
	DO 50 JP=1,NCG	CINX	717

50	X(J,JP)=X(J,JP)/BOT	CINX	718
C	EACH BROAD GROUP HAS ITS OWN FISSION SPECTRUM.	CINX	719
	DO 60 J=1,NCG	CINX	720
60	ISSPEC(J)=J	CINX	721
	RETURN	CINX	722
	END	CINX	723
	SUBROUTINE COLLFF(FF,XS,FT,XT,F,X,NX,NGG,NBINT,NBTEM,NG,NCG,NSIGPT	CINX	724
	1,NTOTAL)	CINX	725
C	*****	CINX	726
C	COLLAPSES THE SELF-SHIELDING FACTORS.	CINX	727
C	*****	CINX	728
	DIMENSION FF(6,3,240), XS(1), F1(6,3,240), XT(1), F(1), NGG(1), X(	CINX	729
	11)	CINX	730
	M=0	CINX	731
	DO 30 J=1,NCG	CINX	732
	LL=NGG(J)	CINX	733
	DO 20 K=1,NBTEM	CINX	734
	DO 20 N=1,NBINT	CINX	735
	SIGPO=X(NX+N)	CINX	736
	S1=0.0	CINX	737
	S2=0.0	CINX	738
	S3=0.0	CINX	739
	S4=0.0	CINX	740
	DO 10 L=1,LL	CINX	741
	ML=M+L	CINX	742
	W=F(ML)/(FT(N,K,ML)*XT(ML)+SIGPO)	CINX	743
	IF (NTOTAL.EQ.1) W=F(ML)/((FT(N,K,ML)*XT(ML)+SIGPO)*(FF(N,K,ML)*XT	CINX	744
	1(ML)+SIGPO))	CINX	745
	S1=S1+W*FF(N,K,ML)*XS(ML)	CINX	746
	S2=S2+W	CINX	747
	S3=S3+F(ML)	CINX	748
	S4=S4+XS(ML)*F(ML)	CINX	749
10	CONTINUE	CINX	750
	IF (S2.LE.0.0.OR.S4.LE.0.0) FF(N,K,J)=1.	CINX	751
	IF (S2.GT.0.0.AND.S4.GT.0.0) FF(N,K,J)=S1*S3/(S2*S4)	CINX	752
20	CONTINUE	CINX	753
30	M=M+LL	CINX	754
	RETURN	CINX	755
	END	CINX	756
	SUBROUTINE INPUT(NGROUP,NCG,NGG,LG,NG1,EMAX,F,TF,MF,NDT,NPF)	CINX	757
C	*****	CINX	758
C	READS THE INPUT DATA AND FORMS THE FINE GROUP AND COURSE GROUP	CINX	759
C	SPECTRA.	CINX	760
C	*****	CINX	761
	DIMENSION NGG(1), LG(1), F(1), TF(1), EMAX(1)	CINX	762
	READ (5,100)MF,NCG,ICF,NDT,NPF	CINX	763
	WRITE (6,110)	CINX	764
	WRITE (6,120)MF,NCG,ICF,NDT,NPF	CINX	765
	IF (MF.EQ.1) GO TO 90	CINX	766
	READ (5,100)(NGG(I),I=1,NCG)	CINX	767
	WRITE (6,130)(NGG(I),I=1,NCG)	CINX	768
	IF (ICF.EQ.1) GO TO 60	CINX	769
	READ (5,150)TB,EB,TC,EC	CINX	770
	WRITE (6,140)TB,EB,TC,EC	CINX	771
	AB=1./(EXP(-EB/TR)*EB**2.0)	CINX	772
	AC=1./(EXP(-FC/TC)*EC**1.5)	CINX	773
	P1=.5*SQRT(3.141592654)	CINX	774
	DO 50 I=1,NGROUP	CINX	775
	F(I)=0.0	CINX	776
	A=EMAX(I+1)	CINX	777
	B=EMAX(I)	CINX	778
	IF (A.GT.EC) GO TO 30	CINX	779
	IF (B.LT.EB) GO TO 40	CINX	780
	IF (EC.LE.B.AND.FC.GE.A) GO TO 10	CINX	781
	IF (EB.LE.B.AND.EB.GE.A) GO TO 20	CINX	782
	F(I)=ALOG(R/A)	CINX	783
	GO TO 50	CINX	784
10	F(I)=F(I)+ALOG(1C/A)	CINX	785
	A=EC	CINX	786
	GO TO 30	CINX	787
20	F(I)=F(I)+ALOG(H/EB)	CINX	788
	B=EB	CINX	789

	GO TO 40	CINX	790
	30 F(I)=F(I)+AC*TC**1.5*(SQRT(A/TC)*EXP(-A/TC)-SQRT(B/TC)*EXP(-B/TC)+	CINX	791
	!PI*(ERRF(SQRT(R/TC))-ERRF(SQRT(A/TC)))	CINX	792
	GO TO 50	CINX	793
	40 F(I)=F(I)+AB*TB*((A+TB)*EXP(-A/TB)-(B+TB)*EXP(-B/TB))	CINX	794
	50 CONTINUE	CINX	795
	GO TO 70	CINX	796
	60 READ (5,150)(F(I),I=1,NGROUP)	CINX	797
	70 WRITE (6,160)(F(I),I=1,NGROUP)	CINX	798
C	COMPUTE THE TOTAL FLUX IN EACH COURSE GROUP AND MARK EACH FINE	CINX	799
C	GROUP AS TO WHICH COURSE GROUP IT BELONGS.	CINX	800
	M=0	CINX	801
	DO 80 I=1, NCG	CINX	802
	TF(I)=0.0	CINX	803
	N=NGC(I)	CINX	804
	DO 80 J=1, N	CINX	805
	M=M+1	CINX	806
	LG(M)=I	CINX	807
	TF(I)=TF(I)+F(M)	CINX	808
	80 CONTINUE	CINX	809
	WRITE (6,170)(TF(I),I=1,NCG)	CINX	810
	90 CONTINUE	CINX	811
	RETURN	CINX	812
C		CINX	813
	100 FORMAT (12T6)	CINX	814
	110 FORMAT (1H1,4HX,4HCINX//)	CINX	815
	120 FORMAT (36H RUN OPTIONS INPUT CARD (FORMAT 516)/13X,2HMF,5X,41HMAJ	CINX	816
	10R FUNCTIONS (0/1/2=COLLAPSE/10X/BOTH),19X,16/12X,3HNCG,5X,23HNUMB	CINX	817
	2ER OF COURSE GROUPS,37X,16/12X,3HICF,5X,46HCOLLAPSTNG FLUX (0/1=TH	CINX	818
	3ERMAL-FERMI-WATT/INPUT),14X,16/12X,3HNDT,5X,50HNUMBER OF DOWNSCAT	CINX	819
	4ERING TERMS (INCLUDING INGROUP),14X,16/12X,3HMPF,5X,54HNEUTRON PRE	CINX	820
	5CURSOR FILE (0/1=NO/YES) (= FOR PERTV DATA),6X,16)	CINX	821
	130 FORMAT (1H0,57HNUMBER OF FINE GROUPS PER EACH COURSE GROUP (FORMAT	CINX	822
	1 1216)/(14X,12T6))	CINX	823
	140 FORMAT (44H0PARAMETERS FOR ICF=0 OPTION (FORMAT 4E12.5)/13X,2HTR,5	CINX	824
	1X,52HNUCLEAR TEMPERATURE (EV) FOR THERMAL SPECTRUM REGION,2X,E12.5	CINX	825
	2/13X,2HER,5X,35HUPPER LIMIT (EV) FOR THERMAL REGION,19X,E12.5/13X,	CINX	826
	32HTC,5X,40HNUCLEAR TEMPERATURE (EV) FOR WATT SPECTRUM REGION,5X,E1	CINX	827
	42.5/13X,2HEC,5X,32HLOWER LIMIT (EV) FOR WATT REGION,22X,E12.5)	CINX	828
	150 FORMAT (6E12.6)	CINX	829
	160 FORMAT (1H0,26HINPUT FLUX (FORMAT 6E12.5)/(14X,6E12.5))	CINX	830
	170 FORMAT (1H0,33HCOURSE GROUP FLUX (FORMAT 6E12.5)/(14X,6E12.5))	CINX	831
	END	CINX	832
	FUNCTION ERRF (Y)	CINX	833
C		CINX	834
C	**** SUBPROGRAM ****	CINX	835
C		CINX	836
C	ERRF(Y) THIS SUBPROGRAM CALCULATES THE ERROR FUNCTION OF Y.	CINX	837
C	SUBPROGRAM IS A PROGRAM OF RATIONAL APPROXIMATION 7.1	CINX	838
C	PAGE 299, OF THE NATIONAL BUREAU OF STANDARDS HANDBOOK	CINX	839
C	MATHEMATICAL FUNCTIONS, JUNE 1974.	CINX	840
C		CINX	841
	DIMENSION A(7)	CINX	842
	DATA A/1.000,70.5230784E-3,42.2820123E-3,0.2705272E-3,1.520103E-4,	CINX	843
	12.765672E-4,4.30638E-5/	CINX	844
	YY=ABS(Y)	CINX	845
	IF (YY=0.0) 20,10,10	CINX	846
	10 ERRF=1.	CINX	847
	GO TO 60	CINX	848
	20 IF (YY=.000010) 30,30,40	CINX	849
	30 ERRF=2.*YY/1.7725	CINX	850
	GO TO 60	CINX	851
	40 SDF0=0.	CINX	852
	DO 50 I=1,7	CINX	853
	50 SDF0=SDF0+(A(I))*(YY**(-I-1))	CINX	854
	ERRF=1.-SDF0**(-16)	CINX	855
	60 ERRF=SIGN(ERRF,Y)	CINX	856
	RETURN	CINX	857
	END	CINX	858

APPENDIX B

LISTING OF SAMPLE PROBLEM INPUT AND OUTPUT

CARD INPUT:

2	4	0	4	0
3	1	2	1	
	.025		.1	1.4+6 .8208+6

COMPUTER OUTPUT:

CINX

RUN OPTIONS INPUT CARD (FORMAT 5I6)

MF	MAJOR FUNCTIONS (0/1/2=COLLAPSE/10X/BOTH)	2
NCG	NUMBER OF COURSE GROUPS	4
ICF	COLLAPSING FLUX (0/1=THERMAL-FERMI-WATT/INPUT)	0
NDT	NUMBER OF DOWNSCATTERING TERMS (INCLUDING INGROUP)	4
NPF	NEUTRON PRECURSOR FILE (0/1=NO/YES) (- FOR PERTV DATA)	0

NUMBER OF FINE GROUPS PER EACH COURSE GROUP (FORMAT 12I6)

3	1	2	1
---	---	---	---

PARAMETERS FOR ICF=0 OPTION (FORMAT 4E12.5)

TB	NUCLEAR TEMPERATURE (EV) FOR THERMAL SPECTRUM REGION	.25000E+01
EB	UPPER LIMIT (EV) FOR THERMAL REGION	.10000E+00
TC	NUCLEAR TEMPERATURE (EV) FOR WATT SPECTRUM REGION	.14000E+07
EC	LOWER LIMIT (EV) FOR WATT REGION	.82080E+06

INPUT FLUX (FORMAT 6E12.5)

.50000E+00	.50000E+00	.50000E+00	.50000E+00	.50000E+00	.50000E+00
.50206E+01					

COURSE GROUP FLUX (FORMAT 6E12.5)

.15000E+01	.50000E+00	.10000E+01	.50206E+01
------------	------------	------------	------------

CINX IS FINISHED. RUN UNITS 8, 9 AND 13 THROUGH BINX TO GET A PRINT OF YOUR COLLAPSED CCCC DATA AND/OR RUN UNIT 10 THROUGH PUPX TO GET A PRINT OF YOUR 10X DATA. IF YOU CALLED FOR DELAYED NEUTRON DATA FOR PERTV IT WILL BE FOUND ON PUNCHED CARDS.

APPENDIX C

BINX LISTING OF SAMPLE PROBLEM INPUT ISOTXS AND BRKXS FILES

BINX...CONVERT MODE OF CCCC FILE

MODE=1 (1 MEANS BIN TO BCD, 2 MEANS BCD TO BIN)
 TYPE=1 (1 MEANS ISOTXS, 2 MEANS BRKXS, 3 MEANS OLAYXS)
 IRD= 1 1 1 1 1 1 1 1 1 1

*** FILEISOTXS -- VERSION 1 -- UNIT 3***
 USER IDENTIFICATIONT2LASL MINX

FILE CONTROL PARAMETERS

NGROUP	NUMBER OF ENERGY GROUPS IN SET	7
NISO	NUMBER OF ISOTOPES IN SET	1
MAXUP	MAXIMUM NUMBER OF UPSCATTER GROUPS	0
MAXDN	MAXIMUM NUMBER OF DOWNSCATTER GROUPS	7
MAXORD	MAXIMUM SCATTERING ORDER	3
ICHTST	SET FISSION SPECTRUM FLAG	0
	ICHTST=1 SET VECTOR	
	=NGROUP, SET MATRIX	
NSCMAX	MAXIMUM NUMBER OF BLOCKS OF SCATTERING DATA	2
NSBLOK	BLOCKING CONTROL FOR SCATTERING DATA	7

AM-241 7-GP FOR CINX APPENDIX

ISOTOPE	NAME
1	AM241

GROUP STRUCTURE

GROUP	NEUTRON VELOCITY (CM/SEC)	UPPER ENERGY (EV)
1	4.55483E+06	1.37096E+01
2	3.54730E+06	8.31529E+00
3	2.76264E+06	5.04348E+00
4	2.15155E+06	3.05902E+00
5	1.67563E+06	1.85539E+00
6	1.30498E+06	1.12535E+00
7	5.73538E+05	6.82560E-01
		1.00000E-05

NUMBER OF RECORDS TO BE SKIPPED

ISOTOPE	RECORDS
1	0

ISOTOPE 1

ISOTOPE CONTROL PARAMETERS

HABSID	ABSOLUTE ISOTOPE LABEL	AM241
MIDENT	LIBRARY IDENTIFIER	ENDFB
HMAT	ISOTOPE IDENTIFICATION	1056
AMASS	GRAM ATOMIC WEIGHT	.24102E+03
EFISS	THERMAL ENERGY/FISSION (W*SEC/FISS)	.33740E-10
ECAPT	THERMAL ENERGY/CAPTURE (W*SEC/CAPT)	.25060E-11
TEMP	ISOTOPE TEMPERATURE (DEG K)	0.
SIGPOT	AVE. POTENTIAL SCATTERING (BARNS/ATOM)	.10000E+11
ADENS	REFERENCE ATOM DENSITY (A/B*CM)	0.
KRR	ISOTOPE CLASSIFICATION	3
ICHI	FISSION SPECTRUM FLAG (0/1=N=SET CHI/VECTOR/MATRIX)	1
IFIS	(N,F) X-SEC FLAG (0/1=NO/YES)	1
IALF	(N,A) X-SEC FLAG (0/1=NO/YES)	0
INP	(N,P) X-SEC FLAG (0/1=NO/YES)	0
IN2N	(N,2N) X-SEC FLAG (0/1=NO/YES)	0
IND	(N,D) X-SEC FLAG (0/1=NO/YES)	0

INT	(N,T) X-SEC FLAG (0/1=NO/YES)	0
LTOT	NUMBER OF TOTAL X-SEC MOMENTS	1
LTRN	NUMBER OF TRANSPORT X-SEC MOMENTS	1
ISTRPD	NUMBER OF TRANSPORT X-SEC DIRECTIONS	0

SCATTERING BLOCKS

BLOCK	NAME	TYPE	ORDERS
1	ELASTC	100	4
2	TOTAL	0	4

SCATTERING BANDWIDTH AND IN-GROUP SCATTERING POSITION

GROUP/BLOCK	1	2	1	2
1	1	1	1	1
2	2	2	1	1
3	2	2	1	1
4	2	2	1	1
5	2	2	1	1
6	2	2	1	1
7	2	2	1	1

PRINCIPAL CROSS SECTIONS

GROUP	STRPL	STOTPL	SNGAM	SFIS	SNUTOT	CHTSO
1	9.58519E+01	9.58803E+01	8.52114E+01	4.83847E-01	3.09000E+00	5.27633E-01
2	2.10086E+02	2.14127E+02	1.98107E+02	1.51044E+00	3.09000E+00	2.49237E-01
3	1.43234E+02	1.43260E+02	1.33883E+02	2.48191E-01	3.09000E+00	1.17731E-01
4	3.61953E+02	3.61984E+02	3.50028E+02	9.79400E-01	3.09000E+00	5.56124E-02
5	1.01304E+03	1.01309E+03	9.88950E+02	6.56400E+00	3.09000E+00	2.62695E-02
6	1.69405E+02	1.69427E+02	1.60874E+02	8.83848E-01	3.09000E+00	1.24088E-02
7	7.37421E+02	7.37449E+02	7.23144E+02	4.40148E+00	3.09000E+00	1.11082E-02

BLOCK 1 ELASTC SCATTERING, ORDER 4

GROUP	1				
POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4	
1	1.00294E+01	7.95843E-02	2.95852E-04	0.	
GROUP	2				
POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4	
1	1.42812E+01	1.06639E-01	4.73289E-03	0.	
2	1.54811E-01	-5.11704E-02	-2.60178E-04	0.	
GROUP	3				
POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4	
1	0.96323E+00	7.99534E-02	2.96215E-04	0.	
2	2.27105E-01	-6.61607E-02	-4.68207E-03	0.	
GROUP	4				
POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4	
1	1.08545E+01	6.99356E-02	6.75874E-04	0.	
2	1.64795E-01	-5.44865E-02	-2.64241E-04	0.	
GROUP	5				
POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4	
1	1.74983E+01	7.56254E-02	3.13688E-04	0.	
2	1.21106E-01	-3.93138E-02	-6.37428E-04	0.	
GROUP	6				
POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4	
1	7.50000E+00	7.74826E-02	3.86423E-04	0.	
2	8.10071E+02	-2.65794E-02	-2.52111E-04	0.	
GROUP	7				
POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4	
1	9.73760E+00	2.71677E-02	3.41089E-05	0.	
2	1.70068E-01	-5.60832E-02	-3.59557E-04	0.	

BLOCK 2 TOTAL SCATTERING, ORDER 4

GROUP	1				
POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4	
1	1.00294E+01	7.95843E-02	2.95852E-04	0.	

GROUP	2	ORDER 1	ORDER 2	ORDER 3	ORDER 4
POSN	1	1.42812E+01	1.06639E-01	4.73289E-03	0.
	2	1.54811E-01	-5.11704E-02	-2.60178E-04	0.
GROUP	3	ORDER 1	ORDER 2	ORDER 3	ORDER 4
POSN	1	8.96323E+00	7.99534E-02	2.96215E-04	0.
	2	2.27105E-01	-6.61607E-02	-4.68207E-03	0.
GROUP	4	ORDER 1	ORDER 2	ORDER 3	ORDER 4
POSN	1	1.08545E+01	6.99356E-02	6.75874E-04	0.
	2	1.64795E-01	-5.44865E-02	-2.64241E-04	0.
GROUP	5	ORDER 1	ORDER 2	ORDER 3	ORDER 4
POSN	1	1.74983E+01	7.56254E-02	3.13688E-04	0.
	2	1.21106E-01	-3.93138E-02	-6.37428E-04	0.
GROUP	6	ORDER 1	ORDER 2	ORDER 3	ORDER 4
POSN	1	7.50000E+00	7.74826E-02	3.86423E-04	0.
	2	8.10071E-02	-2.65794E-02	-2.52111E-04	0.
GROUP	7	ORDER 1	ORDER 2	ORDER 3	ORDER 4
POSN	1	9.73760E+00	2.71677E-02	3.41989E-05	0.
	2	1.70068E-01	-5.60832E-02	-3.59557E-04	0.

RINX...CONVERT MODE OF CCCC FILE

MODE=1 (1 MEANS BIN TO BCD, 2 MEANS BCD TO BIN)
 TYPE=2 (1 MEANS ISOTXS, 2 MEANS BRK0XS, 3 MEANS DLAYXS)
 IRD= 1 1 1 1 1 1 1 1 1 1

*** FILEBRK0XS -- VERSION 1 -- UNIT 3***
 USER IDENTIFICATIONT2LASL MINX

FILE CONTROL PARAMETERS

NGROUP	NUMBER OF ENERGY GROUPS IN SET	7
NISOSH	NUMBER OF ISOTOPES WITH SELF-SHIELDING FACTORS	1
NSIGPT	TOTAL NUMBER OF VALUES OF VARIABLE X WHICH ARE GIVEN. NSIGPT IS EQUAL TO THE SUM FROM 1 TO NISOSH OF NTABP(I)	3
NTEMPT	TOTAL NUMBER OF VALUES OF VARIABLE TB WHICH ARE GIVEN. NTEMPT IS EQUAL TO THE SUM FROM 1 TO NISOSH OF NTABT(I)	3

ISOTOPE	NAME
1	AM241

LN(SIGPO)/LN(10) VALUES FOR ALL ISOTOPES

ISOTOPE	1ST VALUE	2ND VALUE	...
1	4.00000E+00	2.00000E+00	0.

TEMPERATURES (DEG C) FOR ALL ISOTOPES

ISOTOPE	1ST VALUE	2ND VALUE	...
1	2.68400E+01	6.26840E+02	1.82684E+03

GROUP STRUCTURE

GROUP	TOP ENERGY
1	1.37096E+01
2	8.31529E+00
3	5.04348E+00
4	3.05902E+00
5	1.85539E+00
6	1.12535E+00
7	6.82540E-01
	1.00000E-05

F-FACTOR START END GROUPS AND NUMBER OF SIGPO TEMP VALUES

ISOTOPE	JBFH	JBFL	NTABP	NTABT
1	1	7	3	3

TOTAL SELF-SHIELDING FACTORS

ISOTOPE 1	
GROUP 1	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	9.69400E-01 9.81417E-01 9.89069E-01
2	4.92773E-01 5.44876E-01 6.11973E-01
3	3.90327E-01 4.01827E-01 4.24233E-01
GROUP 2	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	8.27421E-01 8.77994E-01 9.16151E-01
2	2.62275E-01 2.70872E-01 2.82090E-01
3	2.03664E-01 2.05174E-01 2.08030E-01
GROUP 3	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	9.22047E-01 9.33662E-01 9.43920E-01
2	4.71083E-01 4.91419E-01 5.25436E-01
3	4.19915E-01 4.28098E-01 4.43877E-01
GROUP 4	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	9.19528E-01 9.35136E-01 9.34651E-01
2	3.32057E-01 3.52370E-01 3.91112E-01
3	2.55864E-01 2.59740E-01 2.73012E-01
GROUP 5	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	6.63519E-01 7.13436E-01 7.73821E-01
2	1.57295E-01 1.60409E-01 1.68650E-01
3	1.36625E-01 1.38688E-01 1.44110E-01
GROUP 6	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	1.00660E+00 1.02383E+00 1.06954E+00
2	9.57428E-01 9.67556E-01 9.89957E-01
3	9.36262E-01 9.44427E-01 9.61451E-01
GROUP 7	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	8.70755E-01 8.82599E-01 8.98557E-01
2	5.61789E-01 5.66677E-01 5.75878E-01
3	5.39833E-01 5.44381E-01 5.52730E-01

CAPTURE SELF-SHIELDING FACTORS

ISOTOPE 1	
GROUP 1	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	9.82899E-01 9.89848E-01 9.94164E-01
2	5.94264E-01 6.67457E-01 7.41453E-01
3	4.31736E-01 4.77254E-01 5.37285E-01
GROUP 2	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	9.08186E-01 9.41774E-01 9.65308E-01
2	3.36821E-01 3.64881E-01 3.97606E-01
3	2.37857E-01 2.50584E-01 2.66853E-01
GROUP 3	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	9.47310E-01 9.50403E-01 9.54486E-01
2	5.48725E-01 5.85697E-01 6.34556E-01
3	4.59785E-01 4.83517E-01 5.19868E-01
GROUP 4	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	9.56122E-01 9.60142E-01 9.50114E-01
2	4.87875E-01 5.35444E-01 5.93794E-01
3	3.80643E-01 4.12291E-01 4.60236E-01
GROUP 5	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	8.05471E-01 8.40960E-01 8.80392E-01
2	2.49429E-01 2.64592E-01 2.94899E-01
3	2.04568E-01 2.15153E-01 2.37575E-01
GROUP 6	
SIGO	TEMP 1 TEMP 2 TEMP 3
1	1.00779E+00 1.02600E+00 1.07440E+00
2	9.79698E-01 9.93544E-01 1.02713E+00
3	9.66016E-01 9.78289E-01 1.00711E+00

GROUP	7		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	9.27139E-01	9.35319E-01	9.45924E-01
2	6.60308E-01	6.68692E-01	6.83119E-01
3	6.37649E-01	6.45484E-01	6.59132E-01

FISSION SELF-SHIELDING FACTORS

ISOTOPE 1

GROUP	1		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	9.82481E-01	9.89575E-01	9.93919E-01
2	5.68920E-01	6.42456E-01	7.13684E-01
3	3.97863E-01	4.39562E-01	4.91639E-01
GROUP	2		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	8.71708E-01	9.06447E-01	9.31716E-01
2	2.41239E-01	2.60787E-01	2.88477E-01
3	1.60226E-01	1.65985E-01	1.75561E-01
GROUP	3		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	9.86762E-01	9.88767E-01	9.94851E-01
2	8.93224E-01	9.06547E-01	9.24732E-01
3	8.65708E-01	8.76603E-01	8.92590E-01
GROUP	4		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	9.65429E-01	9.70648E-01	9.66235E-01
2	5.66672E-01	6.10641E-01	6.63714E-01
3	4.67687E-01	4.97008E-01	5.40622E-01
GROUP	5		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	7.98860E-01	8.32547E-01	8.67193E-01
2	2.24827E-01	2.37852E-01	2.63502E-01
3	1.78500E-01	1.87350E-01	2.05921E-01
GROUP	6		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	1.00822E+00	1.02753E+00	1.07909E+00
2	9.77718E-01	9.92180E-01	1.02721E+00
3	9.63116E-01	9.75874E-01	1.00575E+00
GROUP	7		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	9.22075E-01	9.30503E-01	9.41672E-01
2	6.51175E-01	6.59118E-01	6.72780E-01
3	6.29762E-01	6.37160E-01	6.50007E-01

TRANSPORT SELF-SHIELDING FACTORS

ISOTOPE 1

GROUP	1		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	9.69395E-01	9.81412E-01	9.89066E-01
2	4.92632E-01	5.44749E-01	6.11864E-01
3	3.90160E-01	4.01662E-01	4.24074E-01
GROUP	2		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	8.27395E-01	8.77976E-01	9.16140E-01
2	2.62179E-01	2.70776E-01	2.81994E-01
3	2.03562E-01	2.05072E-01	2.07928E-01
GROUP	3		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	9.22033E-01	9.33650E-01	9.43909E-01
2	4.70994E-01	4.91332E-01	5.25355E-01
3	4.19818E-01	4.28001E-01	4.43782E-01
GROUP	4		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	9.19521E-01	9.35130E-01	9.34646E-01
2	3.32004E-01	3.52318E-01	3.91063E-01
3	2.55806E-01	2.59681E-01	2.72953E-01
GROUP	5		
SIGD	TEMP 1	TEMP 2	TEMP 3
1	6.63507E-01	7.13426E-01	7.73813E-01
2	1.57271E-01	1.60384E-01	1.68625E-01
3	1.36601E-01	1.38664E-01	1.44085E-01

GROUP	6			
SIG0	TEMP	1	TEMP	2
1		1.00660E+00	1.02304E+00	1.06955E+00
2		9.57423E-01	9.67551E-01	9.89955E-01
3		9.36253E-01	9.44420E-01	9.61445E-01
GROUP	7			
SIG0	TEMP	1	TEMP	2
1		8.70752E-01	8.82597E-01	8.98556E-01
2		5.61776E-01	5.66664E-01	5.75866E-01
3		5.39819E-01	5.44367E-01	5.52717E-01

ELASTIC SELF-SHIELDING FACTORS

ISOTOPE 1

GROUP	1			
SIG0	TEMP	1	TEMP	2
1		9.98573E-01	9.99566E-01	1.00063E+00
2		9.67164E-01	9.72408E-01	9.78969E-01
3		9.53941E-01	9.57030E-01	9.61341E-01
GROUP	2			
SIG0	TEMP	1	TEMP	2
1		9.61065E-01	9.70363E-01	9.77433E-01
2		7.73873E-01	7.80063E-01	7.89360E-01
3		7.43031E-01	7.44799E-01	7.45893E-01
GROUP	3			
SIG0	TEMP	1	TEMP	2
1		9.98994E-01	1.00223E+00	1.00493E+00
2		9.72727E-01	9.77990E-01	9.84070E-01
3		9.69897E-01	9.73887E-01	9.79416E-01
GROUP	4			
SIG0	TEMP	1	TEMP	2
1		9.96331E-01	9.98945E-01	9.99710E-01
2		9.55190E-01	9.63188E-01	9.70825E-01
3		9.49525E-01	9.55963E-01	9.62683E-01
GROUP	5			
SIG0	TEMP	1	TEMP	2
1		9.87279E-01	9.924713E-01	9.95373E-01
2		6.57801E-01	6.67525E-01	6.87134E-01
3		6.38286E-01	6.46006E-01	6.61982E-01
GROUP	6			
SIG0	TEMP	1	TEMP	2
1		1.00038E+00	1.00124E+00	1.00719E+00
2		1.00209E+00	1.00304E+00	1.00804E+00
3		1.00252E+00	1.00345E+00	1.00788E+00
GROUP	7			
SIG0	TEMP	1	TEMP	2
1		9.52570E-01	9.61212E-01	9.75474E-01
2		9.30429E-01	9.15493E-01	9.08931E-01
3		9.27722E-01	9.11858E-01	9.04798E-01

CROSS SECTIONS

GROUP	XSPO	XSIN	XSE	XSMU	XSFO
1	9.51136E+00	0.	1.01843E+01	2.79039E-03	1.54811E-01
2	9.51141E+00	0.	1.45083E+01	2.79039E-03	2.27105E-01
3	9.51144E+00	0.	9.12802E+00	2.79039E-03	1.64795E-01
4	9.51146E+00	0.	1.09756E+01	2.79039E-03	1.21106E-01
5	9.51147E+00	0.	1.75743E+01	2.79039E-03	8.10071E-02
6	9.51148E+00	0.	7.67007E+00	2.79039E-03	1.70068E-01
7	9.51148E+00	0.	9.73768E+00	2.79039E-03	9.17466E-02

APPENDIX D

BINX LISTING OF SAMPLE PROBLEM OUTPUT ISOTXS AND BRKXOS FILES

BINX...CONVERT MODE OF CCCC FILE

MODE=1 (1 MEANS BIN TO HCD, 2 MEANS HCD TO BIN)
 TYPE=1 (1 MEANS ISOTXS, 2 MEANS BRKXOS, 3 MEANS OLAYS)
 IRD= 1 1 1 1 1 1 1 1 1 1

*** FILEAM=241 -- VERSION 4 -- UNIT 3***
 USER IDENTIFICATION 7-GP FOR C1

FILE CONTROL PARAMETERS

NGROUP	NUMBER OF ENERGY GROUPS IN SET	4
NISO	NUMBER OF ISOTOPES IN SET	1
MAXUP	MAXIMUM NUMBER OF UPSCATTER GROUPS	0
MAXDN	MAXIMUM NUMBER OF DOWNSCATTER GROUPS	3
MAXORD	MAXIMUM SCATTERING ORDER	3
ICMIST	SET FISSION SPECTRUM FLAG	4
	ICMIST=1 SET VECTOR	
	=NGROUP, SET MATRIX	
NSCMAX	MAXIMUM NUMBER OF BLOCKS OF SCATTERING DATA	2
NSBLCK	BLOCKING CONTROL FOR SCATTERING DATA	4

AM-241 7-GP FOR BINX APPENDIX

ISOTOPE	NAME
1	AM241

GROUP STRUCTURE

GROUP	NEUTRON VELOCITY (CM/SEC)	UPPER ENERGY (eV)
1	3.77017E+06	1.37896E+01
2	2.15155E+06	3.05902E+00
3	1.51335E+06	1.05539E+00
4	5.71351E+05	6.02560E-01
		1.00000E-05

NUMBER OF RECORDS TO BE SKIPPED

ISOTOPE	RECORDS
1	0

ISOTOPE 1

ISOTOPE CONTROL PARAMETERS

HABSID	ABSOLUTE ISOTOPE LABEL	AM241
HIDENT	LIBRARY IDENTIFIER	ENDFR
HMAT	ISOTOPE IDENTIFICATION	1046
AMASS	GRAM ATOMIC WEIGHT	.24102E+03
EFISS	THERMAL ENERGY/FISSION (W*SEC/FISS)	.33740E-10
ECAPT	THERMAL ENERGY/CAPTURE (W*SEC/CAPT)	.25860E-11
TEMP	ISOTOPE TEMPERATURE (DEG K)	0.
SIGDOT	AVE. POTENTIAL SCATTERING (BARN/ATOM)	.10000E+11
ADENS	REFERENCE ATOM DENSITY (A/B*CM)	0.
KBR	ISOTOPE CLASSIFICATION	3
ICHI	FISSION SPECTRUM FLAG (0/1=SET CHI/VECTOR/MATRIX)	1
IFIS	(N,F) X-SEC FLAG (0/1=NO/YES)	1
IALF	(N,A) X-SEC FLAG (0/1=NO/YES)	0
INP	(N,P) X-SEC FLAG (0/1=NO/YES)	0
IN2N	(N,2N) X-SEC FLAG (0/1=NO/YES)	0
IND	(N,D) X-SEC FLAG (0/1=NO/YES)	0
INT	(N,T) X-SEC FLAG (0/1=NO/YES)	0
LYOT	NUMBER OF TOTAL X-SEC MOMENTS	1
LTRN	NUMBER OF TRANSPORT X-SEC MOMENTS	1
ISTRPD	NUMBER OF TRANSPORT X-SEC DIRECTIONS	0

SCATTERING BLOCKS

BLOCK	NAME	TYPE	ORDERS
1	ELASTC	100	4
2	TOTAL	0	4

SCATTERING BANDWIDTH AND IN-GROUP SCATTERING POSITION

GROUP/BLOCK	1	2	1	2
1	1	1	1	1
2	2	2	1	1
3	2	2	1	1
4	2	2	1	1

PRINCIPAL CROSS SECTIONS

GROUP	STRPL	STOTPL	SNGAM	SFIS	SNITOT	CHISO
1	1.51057E+02	1.51089E+02	1.39067E+02	7.47493E-01	3.09000E+00	8.94601E-01
2	3.61953E+02	3.61984E+02	3.50028E+02	9.79400E-01	3.09000E+00	5.56124E-02
3	5.91225E+02	5.91260E+02	5.74912E+02	3.72393E+00	3.09000E+00	3.86783E-02
4	7.37421E+02	7.37449E+02	7.23144E+02	4.40148E+00	3.09000E+00	1.11082E-02

BLOCK 1 ELASTIC SCATTERING, ORDER 4

GROUP	POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4
1	1	1.12186E+01	4.96151E-02	1.27569E-04	0.
2	1	1.08545E+01	6.99356E-02	6.75874E-04	0.
2	2	5.49317E-02	-1.81622E-02	-8.80805E-05	0.
3	1	1.25397E+01	6.32643E-02	2.24000E-04	0.
3	2	1.21106E-01	-3.93138E-02	-6.37428E-04	0.
4	1	9.73760E+00	2.71677E-02	3.41089E-05	0.
4	2	8.50338E-02	-2.80416E-02	-1.79778E-04	0.

BLOCK 2 TOTAL SCATTERING, ORDER 4

GROUP	POSN	ORDER 1	ORDER 2	ORDER 3	ORDER 4
1	1	1.12186E+01	4.96151E-02	1.27569E-04	0.
2	1	1.08545E+01	6.99356E-02	6.75874E-04	0.
2	2	5.49317E-02	-1.81622E-02	-8.80805E-05	0.
3	1	1.25397E+01	6.32643E-02	2.24000E-04	0.
3	2	1.21106E-01	-3.93138E-02	-6.37428E-04	0.
4	1	9.73760E+00	2.71677E-02	3.41089E-05	0.
4	2	8.50338E-02	-2.80416E-02	-1.79778E-04	0.

BINX...CONVERT MODF OF CCCC FILE

MODE=1 (1 MEANS BIN TO BCD, 2 MEANS BCD TO BIN)
 TYPE=2 (1 MEANS ISUTXS, 2 MEANS BRKXIS, 3 MEANS DLAYXS)
 IRD= 1 1 1 1 1 1 1 1 1 1

*** FILEAM-241 -- VERSION R -- UNIT 3***
 USER IDENTIFICATION 7-GP FOR C1

FILE CONTROL PARAMETERS

NGROUP	NUMBER OF ENERGY GROUPS IN SET	4
NISOSH	NUMBER OF ISOTOPES WITH SELF-SHIELDING FACTORS	1
NSIGHT	TOTAL NUMBER OF VALUES OF VARIABLE X WHICH ARE GIVEN. NSIGHT IS EQUAL TO THE SUM FROM 1 TO NISOSH OF NTABP(I)	3
NYEMPT	TOTAL NUMBER OF VALUES OF VARIABLE TB WHICH ARE GIVEN. NYEMPT IS EQUAL TO THE SUM FROM 1 TO NISOSH OF NTABT(I)	3

ISOTOPE	NAME
1	AM241

LN(SIGPO)/LN(10) VALUES FOR ALL ISOTOPES

ISOTOPE	1ST VALUE	2ND VALUE	...
1	4.00000E+00	2.00000E+00	0.

TEMPERATURES (DEG C) FOR ALL ISOTOPES

ISOTOPE	1ST VALUE	2ND VALUE	...
1	2.68400E+01	6.26840E+02	1.82684E+03

GROUP STRUCTURE

GROUP	TOP ENERGY
1	1.37096E+01
2	3.05902E+00
3	1.85539E+00
4	6.82560E-01
	1.00000E-05

F-FACTOR START END GROUPS AND NUMBER OF SIGPO TEMP VALUES

ISOTOPE	JBFH	JBFL	NTABP	NYABT
1	1	4	3	3

TOTAL SELF-SHIELDING FACTORS

ISOTOPE 1

GROUP	1		
SIGU	TEMP 1	TEMP 2	TEMP 3
1	8.85603E-01	9.15396E-01	9.37975E-01
2	3.71340E-01	3.94074E-01	4.24955E-01
3	2.90949E-01	2.97489E-01	3.09127E-01
GROUP	2		
SIGU	TEMP 1	TEMP 2	TEMP 3
1	9.19528E-01	9.35136E-01	9.34651E-01
2	3.32057E-01	3.52370E-01	3.91112E-01
3	2.55864E-01	2.59740E-01	2.73012E-01
GROUP	3		
SIGU	TEMP 1	TEMP 2	TEMP 3
1	6.89401E-01	7.30703E-01	7.84360E-01
2	2.72283E-01	2.76250E-01	2.85795E-01
3	2.52328E-01	2.55574E-01	2.63084E-01
GROUP	4		
SIGU	TEMP 1	TEMP 2	TEMP 3
1	8.70755E-01	8.82599E-01	8.98557E-01
2	5.61789E-01	5.66677E-01	5.75878E-01
3	5.39833E-01	5.44381E-01	5.52730E-01

CAPTURE SELF-SHIELDING FACTORS				ISOTOPE 1
GROUP	1			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	9.34850E-01	9.53056E-01	9.66306E-01	
2	9.53569E-01	4.93225E-01	5.40606E-01	
3	3.36747E-01	3.61854E-01	3.93591E-01	
GROUP	2			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	9.56122E-01	9.68142E-01	9.58114E-01	
2	9.87875E-01	5.35444E-01	5.93790E-01	
3	3.80643E-01	4.12296E-01	4.64236E-01	
GROUP	3			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	8.16766E-01	8.48107E-01	8.87848E-01	
2	3.40024E-01	3.51912E-01	3.76056E-01	
3	3.05665E-01	3.14646E-01	3.33503E-01	
GROUP	4			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	9.27139E-01	9.35319E-01	9.45924E-01	
2	6.60308E-01	6.68692E-01	6.83119E-01	
3	6.37649E-01	6.45484E-01	6.59132E-01	

FISSION SELF-SHIELDING FACTORS				ISOTOPE 1
GROUP	1			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	9.06320E-01	9.31171E-01	9.49581E-01	
2	3.84200E-01	4.15349E-01	4.53847E-01	
3	2.87193E-01	3.03159E-01	3.24561E-01	
GROUP	2			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	9.65429E-01	9.70648E-01	9.66235E-01	
2	5.66672E-01	6.10641E-01	6.63714E-01	
3	4.67687E-01	4.97008E-01	5.40622E-01	
GROUP	3			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	8.05687E-01	8.35907E-01	8.70861E-01	
2	3.01898E-01	3.12151E-01	3.32764E-01	
3	2.65875E-01	2.73475E-01	2.89019E-01	
GROUP	4			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	9.22075E-01	9.30503E-01	9.41672E-01	
2	6.51175E-01	6.59118E-01	6.72780E-01	
3	6.29762E-01	6.37160E-01	6.50007E-01	

TRANSPORT SELF-SHIELDING FACTORS				ISOTOPE 1
GROUP	1			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	8.85643E-01	9.15381E-01	9.37964E-01	
2	3.71232E-01	3.93970E-01	4.24856E-01	
3	2.90828E-01	2.97369E-01	3.09008E-01	
GROUP	2			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	9.19521E-01	9.35130E-01	9.34646E-01	
2	3.32004E-01	3.52318E-01	3.91063E-01	
3	2.55806E-01	2.59681E-01	2.72953E-01	
GROUP	3			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	6.89387E-01	7.30691E-01	7.84350E-01	
2	2.72255E-01	2.76222E-01	2.85768E-01	
3	2.52299E-01	2.55506E-01	2.63056E-01	
GROUP	4			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	8.70752E-01	8.82597E-01	8.98556E-01	
2	5.61776E-01	5.66664E-01	5.75866E-01	
3	5.39819E-01	5.44367E-01	5.52717E-01	

ELASTIC SELF-SHIELDING FACTORS				ISOTOPE 1
GROUP	1			
SIGU	TEMP 1	TEMP 2	TEMP 3	
1	9.81995E-01	9.87082E-01	9.91112E-01	
2	8.86062E-01	8.92082E-01	8.99138E-01	
3	8.71989E-01	8.74920E-01	8.78609E-01	

GROUP	2			
SIGD	TEMP	1	TEMP	2
			TEMP	3
1	0.96331E-01		0.98945E-01	0.99710E-01
2	0.55140E-01		0.63188E-01	0.70825E-01
3	0.09525E-01		0.55963E-01	0.62683E-01
GROUP	3			
SIGD	TEMP	1	TEMP	2
			TEMP	3
1	0.25056E-01		0.36978E-01	0.52259E-01
2	7.19429E-01		7.02937E-01	7.51269E-01
3	7.30283E-01		7.32689E-01	7.38619E-01
GROUP	4			
SIGD	TEMP	1	TEMP	2
			TEMP	3
1	0.52570E-01		0.01212E-01	0.35474E-01
2	0.30429E-01		0.15493E-01	0.08931E-01
3	0.27722E-01		0.11856E-01	0.04790E-01

CROSS SECTIONS

GROUP	XSPU		XSVN	XSE	XSMU	XSF0
1	0.51140E+00	0.		1.12735E+01	2.79039E-03	5.49317E-02
2	0.51146E+00	0.		1.09756E+01	2.79039E-03	1.21106E-01
3	0.51147E+00	0.		1.26247E+01	2.79039E-03	8.50338E-02
4	0.51148E+00	0.		0.73760E+00	2.79039E-03	0.17464E-00

APPENDIX E
PUPX LISTING OF SAMPLE PROBLEM 1DX OUTPUT

1 CROSS SECTION DATA FOR AM241

GROUP	SIGT	SIGF	NU	SIGC	SIGIN	SIGEL	MUEL	XT	SIGDEL
1	151.089	.747	5.090	139.067	0.000	11.274	.003	.000	.055
2	361.984	.979	3.090	350.028	0.000	10.976	.003	.000	.121
3	591.260	3.724	3.090	574.912	0.000	12.625	.003	.000	.085
4	737.449	4.401	3.090	723.144	0.000	9.738	.003	.000	.090

INELASTIC SCATTERING MATRIX FOR AM241

GROUP	GXG	GXG+1	GXG+2	. . .
1	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000

FISSION SELF-SHIELDING FACTORS FOR AM241 ARE GIVEN AT T = 300, 900, AND 2100 DEGREES KELVIN

SIG0 .1E+05 .1E+03 .1E+01 .1E+05 .1E+03 .1E+01 .1E+05 .1E+03 .1E+01
GROUP

1	.906	.384	.287	.931	.415	.303	.950	.452	.325
2	.965	.567	.468	.971	.611	.497	.966	.664	.541
3	.806	.302	.266	.836	.312	.273	.871	.333	.289
4	.922	.651	.630	.931	.659	.637	.942	.673	.650

CAPTURE SELF-SHIELDING FACTORS FOR AM241 ARE GIVEN AT T = 300, 900, AND 2100 DEGREES KELVIN

SIG0 .1E+05 .1E+03 .1E+01 .1E+05 .1E+03 .1E+01 .1E+05 .1E+03 .1E+01
GROUP

1	.935	.454	.337	.953	.494	.361	.966	.541	.394
2	.956	.488	.381	.960	.535	.412	.950	.594	.460
3	.817	.340	.306	.840	.352	.315	.887	.376	.334
4	.927	.660	.630	.935	.669	.645	.946	.683	.659

TOTAL SELF-SHIELDING FACTORS FOR AM241 ARE GIVEN AT T = 300, 900, AND 2100 DEGREES KELVIN

SIG0 .1E+05 .1E+03 .1F+01 .1E+05 .1E+03 .1E+01 .1E+05 .1E+03 .1F+01
GROUP

1	.886	.371	.201	.915	.394	.297	.938	.425	.304
2	.920	.332	.256	.935	.352	.260	.935	.391	.273
3	.689	.272	.252	.731	.276	.256	.784	.286	.263
4	.871	.562	.500	.883	.567	.544	.899	.576	.553

ELASTIC SELF-SHIELDING FACTORS FOR AM241 ARE GIVEN AT T = 300, 900, AND 2100 DEGREES KELVIN

SIG0 .1E+05 .1E+03 .1E+01 .1E+05 .1E+03 .1E+01 .1E+05 .1E+03 .1F+01
GROUP

1	.982	.886	.872	.987	.892	.875	.991	.899	.879
2	.996	.955	.950	.999	.963	.956	1.000	.971	.963
3	.925	.739	.730	.937	.743	.733	.952	.751	.739
4	.953	.939	.928	.941	.915	.912	.935	.909	.905

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