



INTERNATIONAL ATOMIC ENERGY AGENCY

Rev. 0

NUCLEAR DATA SERVICES

DOCUMENTATION SERIES OF THE IAEA NUCLEAR DATA SECTION

SUMMARY OF ENDF/B PRE-PROCESSING CODES

Enclosed is the summary documentation for the ENDF/B Pre-processing Codes

LINEAR
RECENT
SIGMA1
GROUPIE
EVALPLOT
MERGER
DICTION
CONVERT

This summary documentation is merely a copy of the comment cards that appear at the beginning of each programme; these comment cards always reflect the latest status of input options, etc. For the latest published documentation on the methods used in these codes see UCRL-50400, Vol.17 parts A-E, Lawrence Livermore Laboratory (1979).

Please report any compiler diagnostics, conversion or operating problems to the author at,

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International Atomic Energy Agency

To: Distribution

18 December 1981

From: D. E. Cullen *D. E. Cullen*
Nuclear Data Section

J.J. Schmidt
Clearance: J.J. Schmidt

Subject: ENDF/B Pre-processing Codes

At the present time a new version of the system of computer codes which is used to process ENDF/B evaluated data into: energy dependent form, Doppler broadened and multigroup is scheduled to be released by the end of January, 1982. In order to insure that this new version is as compatible with use on the widest variety of computers possible we are asking a selected group of users to compile these programs on their computers and time permitting to try some simple applications and to report all compiler diagnostics and/or operating difficulties to the author of these codes. All such user feedback will be incorporated into the final version of the codes before their distribution at the end of January, 1982.

In the hope that you have time to contribute to this effort I have taken the liberty of forwarding to you a copy of the summary documentation and a magnetic tape containing eight programs and example input decks.

If you need to modify these programs in any manner in order to make them operational on your computer one of the simplest ways to notify the author is to simply put your modified version of the code back onto the original tape and return it to the author. Since these codes are used on a wide variety of computers it would also help if you included a description of the compiler diagnostic or operating problem that led you to modify the code. In this way the author can accommodate your problem in the most computer-independent manner possible. Please also identify your computer, compiler and operating system, as appropriate.

We realize that at this time of year it may be difficult to test these programs before the end of January, 1982. The end of January, 1982 is merely a target date for distribution of these codes; we are in no rush to distribute codes with which there are problems. Therefore if your compiler diagnostics or operating experience indicates that there is a problem with one or more of these codes contact us immediately (telex) and we will delay distribution until we receive documentation of the problem from you.

Hopefully, with your help the final release, and any future versions of these codes, will be completely compatible for use on your computer.

Thank you in advance for your help in this matter.

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ENDF/B Pre-processing codes

The enclosed tape contains sixteen files: eight programs and eight Job Control Language (JCL) input decks (describing all required files and showing example input).

The first eight files are the programs,

- (1) LINEAR - converts all cross sections (MF=3) to linearly interpolable form.
- (2) RECENT - reconstructs the resonance parameter (MF=2) contribution to the cross section, adds the background cross section (MF=3) and outputs the combination.
- (3) SIGMA1 - Doppler broadens cross sections
- (4) GROUPIE - Group averages cross sections
- (5) EVALPLOT - Plots cross sections, angular distributions and/or energy distributions.
- (6) MERGER - Retrieve ENDF/B data.
- (7) DICTION - Creates an up-to-date reaction index in MF=1, MT=451.
- (8) CONVERT - Automatically converts any of these programs for use on one of a variety of computers.

These programs can process data in any version of the ENDF/B format.

The next eight files are JCL decks for the above mentioned programs, in the same order as the programs.

C		PAGE 0001
C	PROGRAM LINEAR(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,	LIN00010
C	1 TAPE20,TAPE21,TAPE22)	LIN00020
C		LIN00030
C	PROGRAM LINEAR	LIN00040
C	VERSION 74-1 (MAY 1974)	LIN00050
C	VERSION 75-1 (APRIL 1975)	LIN00060
C	VERSION 76-2 (OCTOBER 1976)	LIN00070
C	VERSION 77-1 (JANUARY 1977)	LIN00080
C	VERSION 78-1 (JULY 1978)	LIN00090
C	VERSION 79-1 (JULY 1979) CDC-7600 AND CRAY-1 VERSION.	LIN00100
C	VERSION 80-1 (MAY 1980) IBM, CDC AND CRAY VERSION	LIN00110
C	VERSION 80-2 (DECEMBER 1980)	LIN00120
C	VERSION 81-1 (MARCH 1981)	LIN00130
C	VERSION 82-1 (JANUARY 1982) IMPROVED COMPUTER COMPATIBILITY	LIN00140
C		LIN00150
C	REPORT UCRL-50400, VOL.17, PART A (1979)	LIN00160
C	LAWRENCE LIVERMORE LABORATORY	LIN00170
C		LIN00180
C	WRITTEN BY DERMOTT E. CULLEN	LIN00190
C	NUCLEAR DATA SECTION	LIN00200
C	INTERNATIONAL ATOMIC ENERGY AGENCY	LIN00210
C	P.O. BOX 200	LIN00220
C	VIENNA, AUSTRIA	LIN00230
C	TELEPHONE 23-60-1718	LIN00240
C		LIN00250
C	AUTHORS MESSAGE	LIN00260
C	-----	LIN00270
C	THE REPORT DESCRIBED ABOVE IS THE LATEST PUBLISHED DOCUMENTATION	LIN00280
C	FOR THIS PROGRAM. HOWEVER, THE COMMENTS BELOW SHOULD BE CONSIDERED	LIN00290
C	THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASE	LIN00300
C	READ ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY	LIN00310
C	THE COMMENTS CONCERNING MACHINE DEPENDENT CODING.	LIN00320
C		LIN00330
C	AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTER	LIN00340
C	INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE	LIN00350
C	OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT	LIN00360
C	IT WOULD BE APPRECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY	LIN00370
C	COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO	LIN00380
C	IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF	LIN00390
C	THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR	LIN00400
C	COMPUTER.	LIN00410
C		LIN00420
C	PURPOSE	LIN00430
C	-----	LIN00440
C	THIS PROGRAM IS DESIGNED TO CONVERT ENDF/B FILE 3 CROSS SECTIONS	LIN00450
C	TO LINEAR-LINEAR INTERPOLABLE FORM. ANY SECTION THAT IS ALREADY	LIN00460
C	LINEAR-LINEAR INTERPOLABLE WILL BE THINNED.	LIN00470
C		LIN00480
C	IN THE FOLLOWING DISCUSSION FOR SIMPLICITY THE ENDF/B TERMINOLOGY	LIN00490
C	---ENDF/B TAPE---WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE	LIN00500
C	TAPE, CARDS, DISK OR ANY OTHER MEDIUM.	LIN00510
C		LIN00520
C	ENDF/B FORMAT	LIN00530
C	-----	LIN00540
C	THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS	LIN00550
C	OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION	LIN00560
C	OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II,III, IV OR V FORMAT).	LIN00570
C		LIN00580
C	IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B	LIN00590

C FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS LINO0600
 C ASSUMED THAT THE MAT, MF AND MT ON EACH CARD IS CORRECT. SEQUENCE LINO0610
 C NUMBERS (COLUMNS 76-80) ARE IGNORED ON INPUT, BUT WILL BE LINO0620
 C CORRECTLY OUTPUT ON ALL CARDS. THE FORMAT OF SECTION MF=1, MT=451 LINO0630
 C AND ALL SECTIONS OF MF=3 MUST BE CORRECT. THE PROGRAM COPIES ALL LINO0640
 C OTHER SECTION OF DATA AS HOLLERITH AND AS SUCH IS INSENSITIVE TO LINO0650
 C THE CORRECTNESS OR INCORRECTNESS OF ALL OTHER SECTIONS. LINO0660
 C LINO0670
 C LINO0680
 C LINO0690
 C
 C OUTPUT FORMAT LINO0700
 C
 C IN THIS VERSION OF LINEAR ALL FILE 3 ENERGIES WILL BE OUTPUT IN LINO0710
 C F (INSTEAD OF E) FORMAT IN ORDER TO ALLOW ENERGIES TO BE WRITTEN LINO0720
 C WITH UP TO 9 DIGITS OF ACCURACY. IN PREVIOUS VERSIONS THIS WAS AN LINO0730
 C OUTPUT OPTION. HOWEVER USE OF THIS OPTION TO COMPARE THE RESULTS LINO0740
 C OF ENERGIES WRITTEN IN THE NORMAL ENDF/B CONVENTION OF 6 DIGITS LINO0750
 C TO THE 9 DIGIT OUTPUT FROM THIS PROGRAM DEMONSTRATED THAT FAILURE LINO0760
 C TO USE THE 9 DIGIT OUTPUT CAN LEAD TO LARGE ERRORS IN THE DATA LINO0770
 C JUST DUE TO TRANSLATION OF THE ENERGIES TO THE ENDF/B FORMAT. LINO0780
 C LINO0790
 C
 C CONTENTS OF OUTPUT LINO0800
 C
 C ENTIRE EVALUATIONS ARE OUTPUT, NOT JUST THE LINEARIZED FILE 3 LINO0810
 C CROSS SECTIONS, E.G. ANGULAR AND ENERGY DISTRIBUTIONS ARE ALSO LINO0820
 C INCLUDED. LINO0830
 C LINO0840
 C LINO0850
 C LINO0860
 C
 C DOCUMENTATION LINO0870
 C
 C THE FACT THAT THIS PROGRAM HAS OPERATED ON THE DATA IS DOCUMENTED LINO0880
 C BY THE ADDITION OF TWO COMMENT CARDS AT THE END OF EACH HOLLERITH LINO0890
 C SECTION IN THE FORM LINO0900
 C
 C ***** PROGRAM LINEAR (82-1) ***** LINO0910
 C DATA LINEARIZED USING A MAXIMUM ERROR OF 0.1 PER-CENT LINO0920
 C LINO0930
 C
 C THE ORDER OF ALL SIMILAR COMMENTS (FROM RECENT, SIGMA1 AND GROUPY) LINO0940
 C REPRESENTS A COMPLETE HISTORY OF ALL OPERATIONS PERFORMED ON LINO0950
 C THE DATA. LINO0960
 C LINO0970
 C
 C THESE COMMENT CARDS ARE ONLY ADDED TO EXISTING HOLLERITH SECTIONS, LINO0980
 C I.E., THIS PROGRAM WILL NOT CREATE A HOLLERITH SECTION, THE FORMAT LINO0990
 C OF THE HOLLERITH SECTION IN ENDF/B-V DIFFERS FROM THE THAT OF LINO1000
 C EARLIER VERSIONS OF ENDF/B. BY READING AN EXISTING MF=1, MT=451 LINO1010
 C IT IS POSSIBLE FOR THIS PROGRAM TO DETERMINE WHICH VERSION OF LINO1020
 C THE ENDF/B FORMAT THE DATA IS IN. WITHOUT HAVING A SECTION OF LINO1030
 C MF=1, MT=451 PRESENT IT IS IMPOSSIBLE FOR THIS PROGRAM TO LINO1040
 C DETERMINE WHICH VERSION OF THE ENDF/B FORMAT THE DATA IS IN, AND LINO1050
 C AS SUCH IT IS IMPOSSIBLE FOR THE PROGRAM TO DETERMINE WHAT FORMAT LINO1060
 C SHOULD BE USED TO CREATE A HOLLERITH SECTION. LINO1070
 C LINO1080
 C LINO1090
 C
 C REACTION INDEX LINO1100
 C
 C THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN LINO1110
 C SECTION MF=1, MT=451 OF EACH EVALUATION. LINO1120
 C LINO1130
 C
 C THIS PROGRAM DOES NOT UPDATE THE REACTION INDEX IN MF=1, MT=451. LINO1140
 C THIS CONVENTION HAS BEEN ADOPTED BECAUSE MOST USERS DO NOT LINO1150
 C REQUIRE A CORRECT REACTION INDEX FOR THEIR APPLICATIONS AND IT WAS LINO1160
 C NOT CONSIDERED WORTHWHILE TO INCLUDE THE OVERHEAD OF CONSTRUCTING LINO1170
 C A CORRECT REACTION INDEX IN THIS PROGRAM. HOWEVER, IF YOU REQUIRE LINO1180

C A REACTION INDEX FOR YOUR APPLICATIONS, AFTER RUNNING THIS PROGRAM. LIN01190
 C YOU MAY USE PROGRAM DICTION TO CREATE A CORRECT REACTION INDEX. LIN01200
 C
 C SECTION SIZE LIN01210
 C----- LIN01220
 C SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT LIN01230
 C TO THE NUMBER OF POINTS IN ANY SECTION. E.G., THE TOTAL CROSS LIN01240
 C SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS. LIN01250
 C----- LIN01260
 C SELECTION OF DATA LIN01270
 C----- LIN01280
 C THE PROGRAM SELECTS MATERIALS TO BE LINEARIZED BASED EITHER ON LIN01290
 C MAT (ENDF/B MAT NO.) OR ZA. THE PROGRAM ALLOWS UP TO 100 MAT OR LIN01300
 C ZA RANGES TO BE SPECIFIED. THE PROGRAM WILL ASSUME THAT THE LIN01310
 C ENDF/B TAPE IS IN EITHER MAT OR ZA ORDER, WHICHEVER CRITERIA IS LIN01320
 C USED TO SELECT MATERIALS, AND WILL TERMINATE WHEN A MAT OR ZA LIN01330
 C IS FOUND THAT IS ABOVE THE RANGE OF ALL REQUESTS. LIN01340
 C----- LIN01350
 C PROGRAM OPERATION LIN01360
 C----- LIN01370
 C EACH SECTION OF FILE 3 IS CONSIDERED SEPERATELY. EACH SECTION OF LIN01380
 C ENDF/B FILE 3 CROSS SECTIONS IS REPRESENTED BY A TABLE OF ENERGY LIN01390
 C CROSS SECTION AND ANY ONE OF FIVE ALLOWABLE INTERPOLATION LAWS LIN01400
 C BETWEEN ANY TWO TABULATED POINTS. THIS PROGRAM WILL REPLACE EACH LIN01410
 C SECTION OF FILE 3 CROSS SECTIONS BY A NEW TABLE OF ENERGY VS. LIN01420
 C CROSS SECTION IN WHICH THE INTERPOLATION LAW IS ALWAYS LINEAR IN LIN01430
 C ENERGY AND CROSS SECTION BETWEEN ANY TWO TABULATED POINTS. LIN01440
 C----- LIN01450
 C DATA IS READ AND LINEARIZED A PAGE AT A TIME (ONE PAGE CONTAINS LIN01460
 C 1002 DATA POINTS). IF THE FINAL LINEARIZED SECTION CONTAINS ONE LIN01470
 C PAGE, OR FEWER, DATA POINTS IT WILL BE ENTIRELY CORE RESIDENT LIN01480
 C AFTER IT HAS BEEN LINEARIZED AND WILL BE WRITTEN DIRECTLY FROM LIN01490
 C CORE TO THE OUTPUT TAPE. IF THE LINEARIZED SECTION IS LARGER THAN LIN01500
 C A SECTION, AFTER EACH PAGE IS LINEARIZED IT WILL BE WRITTEN TO LIN01510
 C SCRATCH. AFTER THE ENTIRE SECTION HAS BEEN LINEARIZED IT WILL LIN01520
 C BE READ BACK FROM SCRATCH, A PAGE AT A TIME, AND WRITTEN TO LIN01530
 C THE OUTPUT TAPE. LIN01540
 C----- LIN01550
 C ALLOWABLE ERROR LIN01560
 C----- LIN01570
 C THE CONVERSION OF THE DATA FROM THE GENERAL INTERPOLATION FORM TO LIN01580
 C LINEARLY INTERPOLABLE FORM CANNOT BE PERFORMED EXACTLY. HOWEVER, IT LIN01590
 C CAN BE PERFORMED TO VIRTUALLY ANY REQUIRED ACCURACY AND MOST LIN01600
 C IMPORTANTLY CAN BE PERFORMED TO A TOLERANCE THAT IS SMALL COMPARED LIN01610
 C TO THE UNCERTAINTY IN THE CROSS SECTIONS THEMSELVES. AS SUCH THE LIN01620
 C CONVERSION OF CROSS SECTIONS TO LINEARLY INTERPOLABLE FORM CAN BE LIN01630
 C PERFORMED WITH ESSENTIALLY NO LOSE OF INFORMATION. LIN01640
 C----- LIN01650
 C THE ALLOWABLE ERROR MAY BE ENERGY INDEPENDENT (CONSTANT) OR ENERGY LIN01660
 C DEPENDENT. THE ALLOWABLE ERROR IS DESCRIBED BY A TABULATED LIN01670
 C FUNCTION OF UP TO 20 (ENERGY,ERROR) PAIRS AND LINEAR INTERPOLATION LIN01680
 C BETWEEN TABULATED POINTS. IF ONLY ONE TABULATED POINT IS GIVEN THE LIN01690
 C ERROR WILL BE CONSIDERED CONSTANT OVER THE ENTIRE ENERGY RANGE. LIN01700
 C WITH THIS ENERGY DEPENDENT ERROR ONE MAY OPTIMIZE THE OUTPUT FOR LIN01710
 C ANY GIVEN APPLICATION BY USING A SMALL ERROR IN THE ENERGY RANGE LIN01720
 C OF INTEREST AND A LESS STRINGENT ERROR IN OTHER ENERGY RANGES. LIN01730
 C----- LIN01740
 C INPUT FILES LIN01750
 C----- LIN01760
 C----- LIN01770

C	UNIT	DESCRIPTION	LIN01780
C	---	-----	LIN01790
C	5	INPUT CARDS (BCD - 80 CHARACTERS/RECORD)	LIN01800
C	20	ORIGINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)	LIN01810
C			LIN01820
C			LIN01830
C	OUTPUT FILES		LIN01840
C	---	-----	LIN01850
C	UNIT	DESCRIPTION	LIN01860
C	---	-----	LIN01870
C	6	OUTPUT REPORT (BCD - 120 CHARACTERS/RECORD)	LIN01880
C	21	FINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)	LIN01890
C			LIN01900
C	SCRATCH FILES		LIN01910
C	---	-----	LIN01920
C	UNIT	DESCRIPTION	LIN01930
C	---	-----	LIN01940
C	22	SCRATCH FILE (BINARY - 1002 WORDS/RECORD)	LIN01950
C			LIN01960
C	INPUT CARDS		LIN01970
C	---	-----	LIN01980
C	CARD	COLS. DESCRIPTION	LIN01990
C	---	-----	LIN02000
C	1	1-11 SELECTION CRITERIA (0=MAT, 1=ZA)	LIN02010
C		12-22 THIS OPTION IS NO LONGER USED. THE PREVIOUS MEANING	LIN02020
C		OF THIS OPTION WAS.....	LIN02030
C		MINIMUM ENERGY SPACING SELECTOR	LIN02040
C		= 0 - 6 DIGIT MINIMUM ENERGY SPACING CALCULATIONS.	LIN02050
C		STANDARD 6 DIGIT E11.4 OUTPUT.	LIN02060
C		= 1 - 8 DIGIT MINIMUM ENERGY SPACING CALCULATIONS.	LIN02070
C		STANDARD 6 DIGIT E11.4 OUTPUT.	LIN02080
C		= 2 - 8 DIGIT MINIMUM ENERGY SPACING CALCULATIONS.	LIN02090
C		VARIABLE 9 DIGIT F FORMAT OUTPUT.	LIN02100
C		EXPERIENCE HAS DEMONSTRATED THAT FAILURE TO SET THIS	LIN02110
C		OPTION TO 2 CAN RESULT IN SIGNIFICANT ERRORS IN THE	LIN02120
C		FINAL DATA. THEREFORE INTERNALLY THIS OPTION IS	LIN02130
C		ALWAYS SET TO 2.	LIN02140
C	23-33	MINIMUM CROSS SECTION OF INTEREST (BARNS).	LIN02150
C		(IF 1.0E-10 OR LESS IS INPUT THE PROGRAM WILL	LIN02160
C		USE 1.0E-10). ENERGY INTERVALS WILL NOT BE	LIN02170
C		SUB-DIVIDED IF THE ABSOLUTE VALUE OF THE CROSS	LIN02180
C		SECTION WITHIN THE INTERVAL IS LESS THAN THIS VALUE.	LIN02190
C	2-N	1-11 LOWER MAT OR ZA LIMIT	LIN02200
C		12-22 UPPER MAT OR ZA LIMIT	LIN02210
C		UP TO 100 MAT OR ZA RANGES MAY BE SPECIFIED, ONE	LIN02220
C		RANGE PER CARD. THE LIST OF RANGES IS TERMINATED BY	LIN02230
C		A BLANK CARD. IF THE UPPER LIMIT IS LESS THAN THE	LIN02240
C		LOWER LIMIT THE UPPER LIMIT WILL BE SET EQUAL TO THE	LIN02250
C		LOWER LIMIT.	LIN02260
C	VARY	1-11 ENERGY FOR ERROR LAW	LIN02270
C		12-22 ERROR FOR ERROR LAW	LIN02280
C		THE ACCEPTABLE LINEARIZING ERROR CAN BE GIVEN AS AN	LIN02290
C		ENERGY DEPENDENT FUNCTION SPECIFIED BY UP TO 20	LIN02300
C		(ENERGY,ERROR) PAIRS AND LINEAR INTERPOLATION	LIN02310
C		TABULATE POINTS. ERRORS MUST BE POSITIVE AND	LIN02320
C		ENERGIES MUST BE IN ASCENDING ORDER.	LIN02330
C			LIN02340
C	EXAMPLE INPUT		LIN02350
C	---	-----	LIN02360
C		LINEARIZE ALL URANIUM ISOTOPE AND THORIUM-232. FROM 0 TO 100 EV	

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C LINEARIZE TO 0.1 PER-CENT ACCURACY. FROM 100 EV TO 1 KEV VARY LIN02370
C THE ERROR BETWEEN 0.1 AND 1 PER-CENT. ABOVE 1 KEV USE 1 PER-CENT LIN02380
C ACCURACY. CALCULATION WILL USE 8 DIGIT MINIMUM ENERGY SPACING LIN02390
C FOR CALCULATIONS, AND 9 DIGIT VARIABLE F OUTPUT FORMAT (NOTE THAT LIN02400
C THIS IS NO LONGER AN INPUT OPTION. SEE COMMENTS ABOVE). SUBDIVIDE LIN02410
C INTERVALS WITHIN WHICH THE ABSOLUTE VALUE OF THE CROSS SECTION IS LIN02420
C MORE THAN 1 MICRO-BARN (1.0E-6 BARNS). LIN02430
C LIN02440
C THE FOLLOWING NINE INPUT CARDS ARE REQUIRED LIN02450
C LIN02460
C 1 0 1.00000- 6 LIN02470
C 92000 92999 (UPPER LIMIT WILL AUTOMATICALLY BE DEFINED) LIN02480
C 90232 (BLANK CARD INDICATES END OF REQUEST LIST) LIN02490
C LIN02500
C 0.00000+ 0 1.00000-03 LIN02510
C 1.00000+ 2 1.00000-03 LIN02520
C 1.00000+ 3 1.00000-02 LIN02530
C 1.00000+ 9 1.00000-02 LIN02540
C (BLANK CARD INDICATES END OF ERROR LAW) LIN02550
C LIN02560
C***** MACHINE DEPENDENT CODING ***** LIN02570
C LIN02580
C THE ONLY MACHINE DEPENDENT CODING IN THIS PROGRAM IS IN LIN02590
C SUBROUTINES DBLOCK AND IBLOCK, WHICH CONTROL I/O TO THE SCRATCH LIN02600
C FILE. AS DISTRIBUTED THIS PROGRAM WILL PERFORM NORMAL FORTRAN LIN02610
C BINARY I/O AND NEED NOT BE MODIFIED FOR USE ON ANY COMPUTER. LIN02620
C HOWEVER IF YOU WISH TO OPTIMIZE THIS PROGRAM FOR USE AT YOUR LIN02630
C INSTALLATION YOU MAY REPLACE THESE TWO ROUTINES WITH THE LIN02640
C MOST EFFICIENT TYPE OF I/O FOR YOUR COMPUTER. EQUIVALENT LIN02650
C CODING IS PROVIDED TO USE BUFFERED I/O ON THE LIVERMORE CDC-7600 LIN02660
C OR CRAY-1. LIN02670
C LIN02680
C***** MACHINE DEPENDENT CODING ***** LIN02690

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C	PROGRAM RECENT (INPUT, OUTPUT, TAPES=INPUT, TAPES=OUTPUT, TAPE20,	PAGE 0001
C	1 TAPE21, TAPE22, TAPE23)	REC00010
C		REC00020
C	PROGRAM RECENT	REC00030
C	VERSION 79-1 (OCTOBER 1979) CDC-7600 AND CRAY-1 VERSION.	REC00040
C	VERSION 80-1 (MAY 1980) IBM, CDC AND CRAY VERSION	REC00050
C	VERSION 80-2 (DECEMBER 1980) IMPROVED TREATMENT OF UNRESOLVED	REC00060
C	REGION TO COMPUTE ALL REACTIONS AT	REC00070
C	THE SAME TIME	REC00080
C	VERSION 81-1 (MARCH 1981)	REC00090
C	VERSION 81-2 (AUGUST 1981) ADDED MONITOR MODE, ADDED SPEED OPTION	REC00100
C	TO BYPASS BACKWARDS THINNING IF FILE 3	REC00110
C	ALLOWABLE ERROR = 0.0	REC00120
C	VERSION 82-1 (JANUARY 1982) IMPROVED COMPUTER COMPATIBILITY	REC00130
C		REC00140
C	REPORT UCRL-50400, VOL. 17, PART C (1979)	REC00150
C	LAWRENCE LIVERMORE LABORATORY	REC00160
C		REC00170
C	WRITTEN BY DERMOTT E. CULLEN	REC00180
C	NUCLEAR DATA SECTION	REC00190
C	INTERNATIONAL ATOMIC ENERGY AGENCY	REC00200
C	P.O. BOX 200	REC00210
C	VIENNA, AUSTRIA	REC00220
C	TELEPHONE 23-60-1718	REC00230
C		REC00240
C		REC00250
C	AUTHORS MESSAGE	REC00260
C	-----	REC00270
C	THE REPORT DESCRIBED ABOVE IS THE LATEST PUBLISHED DOCUMENTATION	REC00280
C	FOR THIS PROGRAM. HOWEVER, THE COMMENTS BELOW SHOULD BE CONSIDERED	REC00290
C	THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASE	REC00300
C	READ ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY	REC00310
C	THE COMMENTS CONCERNING MACHINE DEPENDENT CODING.	REC00320
C		REC00330
C	AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTER	REC00340
C	INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE	REC00350
C	OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT	REC00360
C	IT WOULD BE APPRECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY	REC00370
C	COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO	REC00380
C	IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF	REC00390
C	THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR	REC00400
C	COMPUTER.	REC00410
C		REC00420
C	PURPOSE	REC00430
C	-----	REC00440
C	THIS PROGRAM IS DESIGNED TO RECONSTRUCT THE RESONANCE CONTRIBUTION	REC00450
C	TO THE CROSS SECTION IN LINEARLY INTERPOLABLE FORM, ADD IN ANY	REC00460
C	LINEARLY INTERPOLABLE BACKGROUND CROSS SECTION AND OUTPUT THE	REC00470
C	RESULT IN THE ENDF/B FORMAT. THE CROSS SECTIONS OUTPUT BY THIS	REC00480
C	PROGRAM WILL BE LINEARLY INTERPOLABLE OVER THE ENTIRE ENERGY RANGE	REC00490
C		REC00500
C	IN THE FOLLOWING FOR SIMPLICITY THE ENDF/B TERMINOLOGY--ENDF/B	REC00510
C	TAPE--WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE TAPE, CARDS,	REC00520
C	DISK OR ANY OTHER MEDIUM.	REC00530
C		REC00540
C	ENDF/B FORMAT	REC00550
C	-----	REC00560
C	THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS	REC00570
C	OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION	REC00580
C	OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II, III, IV OR V FORMAT).	REC00590

C IT IS ASSUMED THAT THE DATA IS CORRECTLY COPIED IN THE ENDF/B
 C FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS
 C ASSUMED THAT THE MAT, MF AND MT ON EACH CARD IS CORRECT. SEQUENCE
 C NUMBERS (COLUMNS 76-80) ARE IGNORED ON INPUT, BUT WILL BE
 C CORRECTLY OUTPUT ON ALL CARDS. THE FORMAT OF SECTION MF=1, MT=451
 C AND ALL SECTIONS OF MF=2 AND 3 MUST BE CORRECT. THE PROGRAM COPIES
 C ALL OTHER SECTION OF DATA AS HOLLERITH AND AS SUCH IS INSENSITIVE
 C TO THE CORRECTNESS OR INCORRECTNESS OF ALL OTHER SECTIONS.
 C
 C ALL FILE 3 BACKGROUND CROSS SECTIONS THAT ARE USED BY THIS PROGRAM
 C MUST BE LINEARLY INTERPOLABLE IN ENERGY AND CROSS SECTION (ENDF/B
 C INTERPOLATION LAW 2). FILE 3 CROSS SECTIONS MAY BE MADE LINEARLY
 C INTERPOLABLE BY USING PROGRAM LINEAR (USRL-50400, VOL.17, PART A).
 C IF THIS PROGRAM FINDS THAT THE FILE 3 CROSS SECTIONS ARE NOT
 C LINEARLY INTERPOLABLE THIS PROGRAM WILL TERMINATE EXECUTION. SINCE
 C THIS WILL NOT OCCUR UNTIL AFTER THE RESONANCE CONTRIBUTION HAS
 C BEEN RECONSTRUCTED FAILURE TO HEED THIS WARNING CAN RESULT IN
 C WASTING A GREAT DEAL OF COMPUTER TIME.
 C
 C OUTPUT FORMAT
 C
 C IN THIS VERSION OF RECENT ALL FILE 3 ENERGIES WILL BE OUTPUT IN
 C F (INSTEAD OF E) FORMAT IN ORDER TO ALLOW ENERGIES TO BE WRITTEN
 C WITH UP TO 9 DIGITS OF ACCURACY. IN PREVIOUS VERSIONS THIS WAS AN
 C OUTPUT OPTION. HOWEVER USE OF THIS OPTION TO COMPARE THE RESULTS
 C OF ENERGIES WRITTEN IN THE NORMAL ENDF/B CONVENTION OF 6 DIGITS
 C TO THE 9 DIGIT OUTPUT FROM THIS PROGRAM DEMONSTRATED THAT FAILURE
 C TO USE THE 9 DIGIT OUTPUT CAN LEAD TO LARGE ERRORS IN THE DATA
 C JUST DUE TO TRANSLATION OF THE ENERGIES TO THE ENDF/B FORMAT.
 C
 C CONTENTS OF OUTPUT
 C
 C ENTIRE EVALUATIONS ARE OUTPUT, NOT JUST THE RECONSTRUCTED FILE
 C 3 CROSS SECTIONS, E.G. ANGULAR AND ENERGY DISTRIBUTIONS ARE
 C ALSO INCLUDED.
 C
 C DOCUMENTATION
 C
 C THE FACT THAT THIS PROGRAM HAS OPERATED ON THE DATA IS DOCUMENTED
 C BY THE ADDITION OF TWO COMMENT CARDS AT THE END OF EACH HOLLERITH
 C SECTION IN THE FORM
 C
 C ***** RECENT (VERSION 82-1) *****
 C DATA RECONSTRUCTED USING A MAXIMUM ERROR OF 0.1 PER-CENT
 C
 C THE ORDER OF ALL SIMILAR COMMENTS (FROM LINEAR, SIGMA1 AND GROUPY)
 C REPRESENTS A COMPLETE HISTORY OF ALL OPERATIONS PERFORMED ON
 C THE DATA.
 C
 C THESE COMMENT CARDS ARE ONLY ADDED TO EXISTING HOLLERITH SECTIONS,
 C I.E., THIS PROGRAM WILL NOT CREATE A HOLLERITH SECTION. THE FORMAT
 C OF THE HOLLERITH SECTION IN ENDF/B-V DIFFERS FROM THE THAT OF
 C EARLIER VERSIONS OF ENDF/B. BY READING AN EXISTING MF=1, MT=451
 C IT IS POSSIBLE FOR THIS PROGRAM TO DETERMINE WHICH VERSION OF
 C THE ENDF/B FORMAT THE DATA IS IN. WITHOUT HAVING A SECTION OF
 C MF=1, MT=451 PRESENT IT IS IMPOSSIBLE FOR THIS PROGRAM TO
 C DETERMINE WHICH VERSION OF THE ENDF/B FORMAT THE DATA IS IN, AND
 C AS SUCH IT IS IMPOSSIBLE FOR THE PROGRAM TO DETERMINE WHAT FORMAT

C	SHOULD BE USED TO CREATE A HOLLERITH SECTION.	PAGE 0003 REC01190
C		REC01200
C	<u>REACTION INDEX</u>	REC01210
C		REC01220
C	THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN	REC01230
C	SECTION MF=1, MT=451 OF EACH EVALUATION.	REC01240
C		REC01250
C	THIS PROGRAM DOES NOT UPDATE THE REACTION INDEX IN MF=1, MT=451.	REC01260
C	THIS CONVENTION HAS BEEN ADOPTED BECAUSE MOST USERS DO NOT	REC01270
C	REQUIRE A CORRECT REACTION INDEX FOR THEIR APPLICATIONS AND IT WAS	REC01280
C	NOT CONSIDERED WORTHWHILE TO INCLUDE THE OVERHEAD OF CONSTRUCTING	REC01290
C	A CORRECT REACTION INDEX IN THIS PROGRAM. HOWEVER, IF YOU REQUIRE	REC01300
C	A REACTION INDEX FOR YOUR APPLICATIONS, AFTER RUNNING THIS PROGRAM	REC01310
C	YOU MAY USE PROGRAM DICTION TO CREATE A CORRECT REACTION INDEX.	REC01320
C		REC01330
C	<u>SECTION SIZE</u>	REC01340
C		REC01350
C	SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT	REC01360
C	TO THE NUMBER OF POINTS IN ANY SECTION, E.G., THE TOTAL CROSS	REC01370
C	SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS.	REC01380
C		REC01390
C	<u>SELECTION OF DATA</u>	REC01400
C		REC01410
C	THE PROGRAM SELECTS MATERIALS TO BE PROCESSED BASED EITHER ON	REC01420
C	MAT (ENDF/B MAT NO.) OR ZA. THE PROGRAM ALLOWS UP TO 100 MAT OR	REC01430
C	ZA RANGES TO BE SPECIFIED. THE PROGRAM WILL ASSUME THAT THE	REC01440
C	ENDF/B TAPE IS IN EITHER MAT OR ZA ORDER, WHICHEVER CRITERIA IS	REC01450
C	USED TO SELECT MATERIALS, AND WILL TERMINATE WHEN A MAT OR ZA	REC01460
C	IS FOUND THAT IS ABOVE THE RANGE OF ALL REQUESTS.	REC01470
C		REC01480
C	<u>OUTPUT OF RESONANCE PARAMETERS</u>	REC01490
C		REC01500
C	A SPECIAL CONVENTION HAS BEEN INTRODUCED REGARDING RESONANCE	REC01510
C	PARAMETERS. IN ORDER TO ALLOW THE USER TO DOPPLER BROADEN AND/OR	REC01520
C	SELF-SHIELD CROSS SECTIONS THE RESONANCE PARAMETERS ARE ALSO	REC01530
C	INCLUDED IN THE OUTPUT WITH THE EVALUATION. IN ORDER TO INDICATE	REC01540
C	THAT THE RESONANCE CONTRIBUTION HAS ALREADY BEEN ADDED INTO THE	REC01550
C	FILE 3 CROSS SECTIONS, THE LRU FLAG IN EACH SECTION OF FILE 2	REC01560
C	DATA IS CHANGED TO LRU=LRU+3. FOR EXAMPLE WHEN READING AN ENDF/B	REC01570
C	EVALUATION LRU=0 (NO RESONANCES), =1 (RESOLVED) OR =2	REC01580
C	(UNRESOLVED) INDICATE THAT THE DATA IS IN THE ORIGINAL ENDF/B	REC01590
C	FORMAT. LRU=4 (NO RESONANCES), =5 (RESOLVED) OR =6 (UNRESOLVED)	REC01600
C	INDICATES THAT THE RESONANCE CONTRIBUTION HAS ALREADY BEEN ADDED	REC01610
C	INTO FILE 3 DATA. THIS CONVENTION INSURES THAT THIS PROGRAM WILL	REC01620
C	NOT ADD THE RESONANCE CONTRIBUTION TO FILE 3 TWICE AND ALSO	REC01630
C	ALLOWS THE USER THE OPTION OF EITHER DOPPLER BROADENING AND	REC01640
C	SELF-SHIELDING THE TABULATED CROSS SECTIONS DIRECTLY OR TO USE	REC01650
C	THE RESONANCE PARAMETERS TO DEFINE THE EFFECTS OF DOPPLER	REC01660
C	BROADENING AND SELF-SHIELDING AS THE DIFFERENCE BETWEEN THE	REC01670
C	ZERO KELVIN, INFINITELY TABULATED VALUES AND THE CROSS SECTION	REC01680
C	FOR ANY OTHER TEMPERATURE AND VALUE OF SIGMA-0.	REC01690
C		REC01700
C	<u>ALLOWABLE ERROR</u>	REC01710
C		REC01720
C	THE RECONSTRUCTION OF LINEARLY INTERPOLABLE CROSS SECTIONS FROM	REC01730
C	RESONANCE PARAMETERS CANNOT BE PERFORMED EXACTLY. HOWEVER IT CAN	REC01740
C	BE PERFORMED TO VIRTUALLY ANY REQUIRED ACCURACY AND MOST	REC01750
C	IMPORTANTLY CAN BE PERFORMED TO A TOLERANCE THAT IS SMALL COMPARED	REC01760
C	TO THE UNCERTAINTY IN THE CROSS SECTIONS THEMSELVES. AS SUCH THE	REC01770

CONVERSION OF CROSS SECTIONS TO LINEARLY INTERPOLABLE FORM CAN BE PERFORMED WITH ESSENTIALLY NO LOSE OF INFORMATION.

THE ALLOWABLE ERROR MAY BE ENERGY INDEPENDENT (CONSTANT) OR ENERGY DEPENDENT. THE ALLOWABLE ERROR IS DESCRIBED BY A TABULATED FUNCTION OF UP TO 20 (ENERGY,ERROR) PAIRS AND LINEAR INTERPOLATION BETWEEN TABULATED POINTS. IF ONLY ONE TABULATED POINT IS GIVEN ERROR WILL BE CONSIDERED CONSTANT OVER THE ENTIRE ENERGY RANGE. WITH THIS ENERGY DEPENDENT ERROR ONE MAY OPTIMIZE THE OUTPUT FOR ANY GIVEN APPLICATION BY USING A SMALL ERROR IN THE ENERGY RANGE OF INTEREST AND A LESS STRINGENT ERROR IN OTHER ENERGY RANGES.

RESOLVED RESONANCE REGION

IN THE RESOLVED RESONANCE REGION THE RESOLVED PARAMETERS ARE USED TO CALCULATE COLD (ZERO KELVIN) ENERGY DEPENDENT CROSS SECTIONS. THE RESOLVED PARAMETERS MAY BE SINGLE OR MULTI-LEVEL BREIT-WIGNER, OR ADLER-ADLER PARAMETERS. REICH-MOORE PARAMETERS WILL BE READ, A WARNING MESSAGE PRINTED AND THE PARAMETERS IGNORED.

UNRESOLVED RESONANCE REGION

IN THE UNRESOLVED RESONANCE REGION THE UNRESOLVED PARAMETERS ARE USED TO CALCULATE INFINITELY DILUTE AVERAGE CROSS SECTIONS. IN THE UNRESOLVED RESONANCE REGION THE ENDF/B CONVENTION OF INTERPOLATING CROSS SECTIONS, NOT PARAMETERS IS USED. THAT IS, INFINITELY DILUTE CROSS SECTIONS ARE CALCULATED AT THE ENERGIES AT WHICH PARAMETERS ARE GIVEN AND THE CROSS SECTIONS ARE THEN INTERPOLATED TO DEFINE THE CROSS SECTIONS AT OTHER ENERGIES.

BACKGROUND CROSS SECTIONS

AFTER A ZERO KELVIN RESONANCE CONTRIBUTION HAS BEEN RECONSTRUCTED IF THERE IS A ZERO KELVIN BACKGROUND CROSS SECTION IT WILL BE ADDED TO THE RESONANCE CONTRIBUTION AND THE SUM WILL BE OUTPUT. IF THERE IS NO BACKGROUND ONLY THE RESONANCE CONTRIBUTION WILL BE OUTPUT. IF THE BACKGROUND CROSS SECTION IS NOT AT ZERO KELVIN AN ERROR MESSAGE WILL BE PRINTED OUT, THE BACKGROUND CROSS SECTION WILL BE SKIPPED (I.E. NOT ADDED TO THE RESONANCE CONTRIBUTION) AND ONLY THE RESONANCE CONTRIBUTION WILL BE OUTPUT. IN THIS CASE THE USER USE PROGRAM SIGMA1 (UCRL-50400, VOL. 17, PART C) TO DOPPLER BROADEN THE RESONANCE CONTRIBUTION TO THE SAME TEMPERATURE AS THE BACKGROUND AND THEN ADD THE RESONANCE AND BACKGROUND CONTRIBUTIONS TOGETHER USING PROGRAM MIXER.

PROGRAM OPERATION

ALL OF THE FILE 2 RESONANCE PARAMETERS ARE FIRST READ AND THE LINEARLY INTERPOLABLE CONTRIBUTION OF THE RESONANCE PARAMETERS TO THE TOTAL, ELASTIC, CAPTURE AND FISSION CROSS SECTIONS IS CALCULATED SIMULTANEOUSLY USING A COMMON ENERGY GRID FOR ALL FOUR REACTIONS. AFTER THE RESONANCE CONTRIBUTION HAS BEEN RECONSTRUCTED EACH OF THE FOUR REACTIONS IS CONSIDERED SEPERATELY. IF THERE IS A ZERO KELVIN FILE 3 BACKGROUND CROSS SECTION IT IS COMBINED WITH THE RESONANCE CONTRIBUTION, THE SUM IS THINNED AND OUTPUT. IF THERE IS NO FILE 3 BACKGROUND TO ADD (EITHER NO BACKGROUND OR NO ZERO KELVIN BACKGROUND) THE CONTRIBUTION OF THE

PAGE 0005

RESONANCES TO A REACTION IS THINNED AND OUTPUT.

IF YOU WISH TO OBTAIN THE RECONSTRUCTED RESONANCE CONTRIBUTION FOR ALL FOUR REACTIONS ON THE COMMON ENERGY GRID USED DURING THE RECONSTRUCTION PROCESS MERELY SPECIFY ZERO ALLOWABLE ERROR FOR COMBINING THE FILE 2 AND FILE 3 CONTRIBUTIONS TO THE CROSS SECTIONS. THIS WILL PREVENT THINNING OF THE INDIVIDUAL REACTIONS. BUT CAN RESULT IN MANY MORE POINTS THAN ARE REQUIRED TO REPRESENT ANY ONE REACTION TO THE REQUESTED RECONSTRUCTION ACCURACY.

INPUT FILES

UNIT	DESCRIPTION	
5	INPUT CARD (BCD - 80 CHARACTERS/RECORD)	REC02370
20	ORIGINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)	REC02380

OUTPUT FILES

UNIT	DESCRIPTION	
6	OUTPUT REPORT (BCD - 120 CHARACTERS/RECORD)	REC02390
21	FINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)	REC02400
		REC02410
		REC02420
		REC02430
		REC02440
		REC02450
		REC02460
		REC02470
		REC02480
		REC02490
		REC02500
		REC02510
		REC02520
		REC02530
		REC02540
		REC02550
		REC02560
		REC02570
		REC02580
		REC02590
		REC02600
		REC02610
		REC02620
		REC02630
		REC02640
		REC02650
		REC02660
		REC02670
		REC02680
		REC02690
		REC02700
		REC02710
		REC02720
		REC02730
		REC02740
		REC02750
		REC02760
		REC02770
		REC02780
		REC02790
		REC02800
		REC02810
		REC02820
		REC02830
		REC02840
		REC02850
		REC02860
		REC02870
		REC02880
		REC02890
		REC02900
		REC02910
		REC02920
		REC02930
		REC02940
		REC02950

SCRATCH FILES

UNIT	DESCRIPTION	
22	SCRATCH FILE FOR DATA RECONSTRUCTED FROM RESONANCE PARAMETERS (BINARY - 1002 WORDS/RECORD)	REC02600
23	SCRATCH FILE FOR COMBINED FILE 2 AND 3 DATA (BINARY - 2004 WORDS/RECORD)	REC02610

INPUT CARDS

CARD	COLS.	FORMAT	DESCRIPTION	
1	1-11	I11	RETRIEVAL CRITERIA (0=MAT, 1=ZA)	REC02700
	12-22	E11.4	FILE 2 MINIMUM ABSOLUTE CROSS SECTION (IF 1.0E-10 OR LESS IN INPUT THE PROGRAM WILL USE 1.0E-10)	REC02710
	23-33		THIS OPTION IS NO LONGER USED. THE FORMER DEFINITION OF THIS OPTION WAS...	REC02720
		I11	MINIMUM ENERGY SPACING FLAG	REC02730
			= 0 - 6 DIGIT MINIMUM ENERGY SPACING. STANDARD 6 DIGIT E11.4 OUTPUT.	REC02740
			= 1 - 8 DIGIT MINIMUM ENERGY SPACING. STANDARD 6 DIGIT E11.4 OUTPUT.	REC02750
			= 2 - 8 DIGIT MINIMUM ENERGY SPACING. VARIABLE 9 DIGIT F FORMAT OUTPUT.	REC02760
			FROM EXPERIENCE IT HAS BEEN FOUND THAT FAILURE TO SET THIS OPTION TO 2 CAN RESULT IN LARGE ERRORS IN THE FINAL DATA. THEREFORE INTERNALLY THIS OPTION IS SET TO 2.	REC02770
	34-44	I11	OPERATING MODE	REC02780
			= 0 - OUTPUT MODE	REC02790
			= 1 - EDIT MODE	REC02800
	45-55	I11	DISTANT RESONANCE TREATMENT.	REC02810
			= 0 - EXACT	REC02820

C HOWEVER IF YOU WISH TO OPTIMIZE THIS PROGRAM FOR USE AT YOUR
C INSTALLATION YOU MAY REPLACE THESE TWO ROUTINES WITH THE
C MOST EFFICIENT TYPE OF I/O FOR YOUR COMPUTER. AS AN EXAMPLE
C EQUIVALENT CODING IS PROVIDED TO USE BUFFERED I/O ON THE
C LIVERMORE CDC-7600 OR CRAY-1.

C***** MACHINE DEPENDENT CODING *****

PAGE 0007
REC03550
REC03560
REC03570
REC03580
REC03590
REC03600
REC03610

C		PAGE 0001
C	PROGRAM SIGMA1 (INPUT, OUTPUT, TAPES=INPUT, TAPE6=OUTPUT,	SIG00010
C	1 TAPE20, TAPE21, TAPE22)	SIG00020
C		SIG00030
C	PROGRAM SIGMA1	SIG00040
C	VERSION 73-1 (MARCH 1973)	SIG00050
C	VERSION 76-1 (FEBRUARY 1976)	SIG00060
C	VERSION 76-2 (OCTOBER 1976)	SIG00070
C	VERSION 77-1 (JANUARY 1977)	SIG00080
C	VERSION 78-1 (JULY 1978)	SIG00090
C	VERSION 79-1 (JULY 1979) CDC-7600 AND CRAY-1 VERSION.	SIG00100
C	VERSION 80-1 (MAY 1980) IBM, CDC AND CRAY VERSION	SIG00110
C	VERSION 80-2 (DECEMBER 1980)	SIG00120
C	VERSION 81-1 (MARCH 1981) DOUBLE PRECISION IBM VERSION	SIG00130
C	VERSION 81-2 (AUGUST 1981) IMPROVED IBM SPEED AND STABILITY	SIG00140
C	VERSION 82-1 (JANUARY 1982) IMPROVED COMPUTER COMPATIBILITY	SIG00150
C		SIG00160
C	REPORT UCRL-50400, VOL. 17, PART B (1979)	SIG00170
C	LAWRENCE LIVERMORE LABORATORY	SIG00180
C		SIG00190
C	WRITTEN BY DERMOTT E. CULLEN	SIG00200
C	NUCLEAR DATA SECTION	SIG00210
C	INTERNATIONAL ATOMIC ENERGY AGENCY	SIG00220
C	P.O. BOX 200	SIG00230
C	VIENNA, AUSTRIA	SIG00240
C	TELEPHONE 23-60-1718	SIG00250
C		SIG00260
C	AUTHORS MESSAGE	SIG00270
C	-----	SIG00280
C	THE REPORT DESCRIBED ABOVE IS THE LATEST PUBLISHED DOCUMENTATION	SIG00290
C	FOR THIS PROGRAM. HOWEVER, THE COMMENTS BELOW SHOULD BE CONSIDERED	SIG00300
C	THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASE	SIG00310
C	READ ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY	SIG00320
C	THE COMMENTS CONCERNING MACHINE DEPENDENT CODING.	SIG00330
C		SIG00340
C	AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTERS	SIG00350
C	INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE	SIG00360
C	OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT	SIG00370
C	IT WOULD BE APPRECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY	SIG00380
C	COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO	SIG00390
C	IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF	SIG00400
C	THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR	SIG00410
C	COMPUTER.	SIG00420
C		SIG00430
C	PURPOSE	SIG00440
C	-----	SIG00450
C	THIS PROGRAM IS DESIGNED TO DOPPLER BROADEN NEUTRON INDUCED	SIG00460
C	CROSS SECTIONS. EACH SECTION OF CROSS SECTIONS (FILE 3) IS READ	SIG00470
C	FROM THE ENDF/B FORMAT. THE DATA IS DOPPLER BROADENED, THINNED	SIG00480
C	AND OUTPUT IN THE ENDF/B FORMAT.	SIG00490
C		SIG00500
C	IN THE FOLLOWING DISCUSSION FOR SIMPLICITY THE ENDF/B TERMINOLOGY	SIG00510
C	---ENDF/B TAPE---WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE	SIG00520
C	TAPE, CARDS, DISK OR ANY OTHER MEDIUM.	SIG00530
C		SIG00540
C	ENDF/B FORMAT	SIG00550
C	-----	SIG00560
C	THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS	SIG00570
C	OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION	SIG00580
C	OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II, III, IV OR V FORMAT).	SIG00590

C IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B SIG00600
 C FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS SIG00610
 C ASSUMED THAT THE MAT, MF AND MT ON EACH CARD IS CORRECT. SEQUENCE SIG00620
 C NUMBERS (COLUMNS 76-80) ARE IGNORED ON INPUT, BUT WILL BE SIG00630
 C CORRECTLY OUTPUT ON ALL CARDS. THE FORMAT OF SECTION MF=1, MT=451 SIG00640
 C AND ALL SECTIONS OF MF=3 MUST BE CORRECT. THE PROGRAM COPIES ALL SIG00650
 C OTHER SECTION OF DATA AS HOLLERITH AND AS SUCH IS INSENSITIVE TO SIG00660
 C THE CORRECTNESS OR INCORRECTNESS OF ALL OTHER SECTIONS. SIG00670
 C SIG00680
 C SIG00690
 C ALL CROSS SECTIONS THAT ARE USED BY THIS PROGRAM MUST BE TABULATED SIG00700
 C AND LINEARLY INTERPOLABLE IN ENERGY AND CROSS SECTION (ENDF/B SIG00710
 C INTERPOLATION LAW 2). FILE 3 CROSS SECTIONS MAY BE MADE LINEARLY SIG00720
 C INTERPOLABLE BY USING PROGRAM LINEAR (UCRL-50400, VOL. 17, PART A). SIG00730
 C FILE 2 RESONANCE PARAMETERS MAY BE USED TO RECONSTRUCT ENERGY SIG00740
 C DEPENDENT CROSS SECTIONS AND ADD IN FILE 3 BACKGROUND CROSS SIG00750
 C SECTIONS TO DEFINE LINEARLY INTERPOLABLE CROSS SECTIONS BY USING SIG00760
 C PROGRAM RECENT (UCRL-50400, VOL. 17, PART C). IF THIS PROGRAM SIG00770
 C FINDS THAT THE FILE 3 CROSS SECTIONS ARE NOT LINEARLY INTERPOLABLE SIG00780
 C THIS PROGRAM WILL TERMINATE EXECUTION. SIG00790
 C SIG00800
 C OUTPUT FORMAT SIG00810
 C SIG00820
 C IN THIS VERSION OF SIGMA1 ALL FILE 3 ENERGIES WILL BE OUTPUT IN SIG00830
 C F (INSTEAD OF E) FORMAT IN ORDER TO ALLOW ENERGIES TO BE WRITTEN SIG00840
 C WITH UP TO 9 DIGITS OF ACCURACY. IN PREVIOUS VERSIONS THIS WAS AN SIG00850
 C OUTPUT OPTION. HOWEVER USE OF THIS OPTION TO COMPARE THE RESULTS SIG00860
 C OF ENERGIES WRITTEN IN THE NORMAL ENDF/B CONVENTION OF 6 DIGITS SIG00870
 C TO THE 9 DIGIT OUTPUT FROM THIS PROGRAM DEMONSTRATED THAT FAILURE SIG00880
 C TO USE THE 9 DIGIT OUTPUT CAN LEAD TO LARGE ERRORS IN THE DATA SIG00890
 C JUST DUE TO TRANSLATION OF THE ENERGIES TO THE ENDF/B FORMAT. SIG00900
 C SIG00910
 C CONTENTS OF OUTPUT SIG00920
 C SIG00930
 C ENTIRE EVALUATIONS ARE OUTPUT, NOT JUST THE BROADENED FILE 3 SIG00940
 C CROSS SECTIONS, E.G. ANGULAR AND ENERGY DISTRIBUTIONS ARE ALSO SIG00950
 C INCLUDED. SIG00960
 C SIG00970
 C DOCUMENTATION SIG00980
 C SIG00990
 C THE FACT THAT THIS PROGRAM HAS OPERATED ON THE DATA IS DOCUMENTED SIG01000
 C BY THE ADDITION OF THREE COMMENTS CARDS AT THE END OF EACH SIG01010
 C HOLLERITH SECTION IN THE FORM SIG01020
 C SIG01030
 C ***** PROGRAM SIGMA1 (82-1) ***** SIG01040
 C DATA DOPPLER BROADENED TO 300.0 KELVIN AND SIG01050
 C THINNED USING A MAXIMUM ERROR OF 0.1 PER-CENT SIG01060
 C SIG01070
 C THE ORDER OF ALL SIMILAR COMMENTS (FROM LINEAR, RECENT AND GROUPY) SIG01080
 C REPRESENTS A COMPLETE HISTORY OF ALL OPERATIONS PERFORMED ON SIG01090
 C THE DATA. SIG01100
 C SIG01110
 C THESE COMMENT CARDS ARE ONLY ADDED TO EXISTING HOLLERITH SECTIONS. SIG01120
 C I.E., THIS PROGRAM WILL NOT CREATE A HOLLERITH SECTION. THE FORMATS SIG01130
 C OF THE HOLLERITH SECTION IN ENDF/B-V DIFFERS FROM THE THAT OF SIG01140
 C EARLIER VERSIONS OF ENDF/B. BY READING AN EXISTING MF=1, MT=451 SIG01150
 C IT IS POSSIBLE FOR THIS PROGRAM TO DETERMINE WHICH VERSION OF SIG01160
 C THE ENDF/B FORMAT THE DATA IS IN. WITHOUT HAVING A SECTION OF SIG01170
 C MF=1, MT=451 PRESENT IT IS IMPOSSIBLE FOR THIS PROGRAM TO SIG01180

C DETERMINE WHICH VERSION OF THE ENDF/B FORMAT THE DATA IS IN, AND SIG01190
 C AS SUCH IT IS IMPOSSIBLE FOR THE PROGRAM TO DETERMINE WHAT FORMAT SIG01200
 C SHOULD BE USED TO CREATE A HOLLERITH SECTION. SIG01210
 C
 C REACTION INDEX SIG01220
 C ----- SIG01230
 C THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN SIG01240
 C SECTION MF=1, MT=451 OF EACH EVALUATION. SIG01250
 C
 C THIS PROGRAM DOES NOT UPDATE THE REACTION INDEX IN MF=1, MT=451. SIG01260
 C THIS CONVENTION HAS BEEN ADOPTED BECAUSE MOST USERS DO NOT SIG01270
 C REQUIRE A CORRECT REACTION INDEX FOR THEIR APPLICATIONS AND IT WAS SIG01280
 C NOT CONSIDERED WORTHWHILE TO INCLUDE THE OVERHEAD OF CONSTRUCTING SIG01290
 C A CORRECT REACTION INDEX IN THIS PROGRAM. HOWEVER, IF YOU REQUIRE SIG01300
 C A REACTION INDEX FOR YOUR APPLICATIONS, AFTER RUNNING THIS PROGRAM SIG01310
 C YOU MAY USE PROGRAM DIXION TO CREATE A CORRECT REACTION INDEX. SIG01320
 C
 C SECTION SIZE SIG01330
 C ----- SIG01340
 C SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT SIG01350
 C TO THE NUMBER OF POINTS IN ANY SECTION, E.G., THE TOTAL CROSS SIG01360
 C SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS. SIG01370
 C
 C SELECTION OF DATA SIG01380
 C ----- SIG01390
 C THE PROGRAM SELECTS MATERIALS TO BE BROADENED BASED EITHER ON SIG01400
 C MAT (ENDF/B MAT NO.) OR ZA. THE PROGRAM ALLOWS UP TO 100 MAT OR SIG01410
 C ZA RANGES TO BE SPECIFIED. THE PROGRAM WILL ASSUME THAT THE SIG01420
 C ENDF/B TAPE IS IN EITHER MAT OR ZA ORDER, WHICHEVER CRITERIA IS SIG01430
 C USED TO SELECT MATERIALS, AND WILL TERMINATE WHEN A MAT OR ZA SIG01440
 C IS FOUND THAT IS ABOVE THE RANGE OF ALL REQUESTS. SIG01450
 C
 C ENERGY GRID OF BROADENED DATA SIG01460
 C ----- SIG01470
 C THE ENERGY GRID FOR THE DOPPLER BROADENED CROSS SECTIONS IS SIG01480
 C SELECTED TO INSURE THAT THE BROADENED DATA IS LINEAR-LINEAR SIG01490
 C INTERPOLABLE. AS SUCH THE ENERGY GRID FOR THE BROADENED DATA SIG01500
 C MAY NOT BE THE SAME AS THE ENERGY GRID FOR THE ORIGINAL SIG01510
 C UNBROADENED DATA. GENERALLY AFTER BROADENING THERE WILL BE SIG01520
 C FEWER DATA POINTS IN THE RESONANCE REGION, BUT AT LOW ENERGY SIG01530
 C THERE MAY BE MORE POINTS, DUE TO THE 1/V LOW ENERGY EFFECT SIG01540
 C CREATED BY DOPPLER BROADENING. SIG01550
 C
 C EFFECTIVE TEMPERATURE INCREASE SIG01560
 C ----- SIG01570
 C IF THE ORIGINAL DATA IS NOT AT ZERO KELVIN THE PROGRAM WILL SIG01580
 C BROADEN THE DATA BY THE EFFECTIVE TEMPERATURE DIFFERENCE TO THE SIG01590
 C FINAL TEMPERATURE. IF THE DATA IS ALREADY AT A TEMPERATURE THAT SIG01600
 C IS HIGHER THAN THE FINAL TEMPERATURE DOPPLER BROADENING IS SIG01610
 C NATURALLY NOT PERFORMED AND THE TEMPERATURE IN THE SECTION IS LEFT SIG01620
 C AT ITS ORIGINAL VALUE. SIG01630
 C
 C MULTIPLE FINAL TEMPERATURES SIG01640
 C ----- SIG01650
 C THE PRESENT VERSION ONLY DOPPLER BROADENS TO ONE FINAL TEMPERATURE SIG01660
 C (IF THERE IS SUFFICIENT INTEREST EXPRESSED BY USERS FUTURE SIG01670
 C VERSION MAY BROADEN TO MULTIPLE TEMPERATURES. PLEASE SIG01680
 C CONTACT THE AUTHOR IF YOU ARE INTERESTED IN A MULTIPLE SIG01690
 C TEMPERATURE OPTION). SIG01700
 C
 C SIG01710
 C SIG01720
 C SIG01730
 C SIG01740
 C SIG01750
 C SIG01760
 C SIG01770

C 12-22 NO LONGER USED AS AN INPUT OPTION. THE FORMER MEANING OF THIS PARAMETER WAS.....
 C MINIMUM ENERGY SPACING SELECTOR
 C = 0 - 6 DIGIT MINIMUM ENERGY SPACING CALCULATIONS. STANDARD 6 DIGIT E11.4 OUTPUT.
 C = 1 - 8 DIGIT MINIMUM ENERGY SPACING CALCULATIONS. STANDARD 6 DIGIT E11.4 OUTPUT.
 C = 2 - 8 DIGIT MINIMUM ENERGY SPACING CALCULATIONS. VARIABLE 9 DIGIT F FORMAT OUTPUT.
 C EXPERIENCE HAS DEMONSTRATED THAT FAILURE TO USE 2 FOR THIS OPTION CAN RESULT IN SIGNIFICANT ERRORS IN THE FINAL DATA. THEREFORE INTERNALLY THIS OPTION IS ALWAYS SET TO 2.
 C 23-33 KELVIN TEMPERATURE
 C 2-N 1-11 LOWER MAT OR ZA LIMIT
 C 12-22 UPPER MAT OR ZA LIMIT
 C UP TO 100 MAT OR ZA RANGES MAY BE SPECIFIED, ONE RANGE PER CARD. THE LIST OF RANGES IS TERMINATED BY A BLANK CARD. IF THE UPPER LIMIT IS LESS THAN THE LOWER LIMIT THE UPPER LIMIT WILL BE SET EQUAL TO THE LOWER LIMIT.
 C VARY 1-11 ENERGY FOR ERROR LAW
 C 12-22 ERROR FOR ERROR LAW
 C THE ACCEPTABLE LINEARIZING ERROR CAN BE GIVEN AS AN ENERGY DEPENDENT FUNCTION SPECIFIED BY UP TO 20 (ENERGY,ERROR) PAIRS AND LINEAR INTERPOLATION TABULATE POINTS. ERRORS MUST BE POSITIVE AND ENERGIES MUST BE IN ASCENDING ORDER.
 C
 C EXAMPLE INPUT
 C BROADENED ALL URANIUM ISOTOPIES AND THORIUM-232 TO 300 KEV. FROM 0 TO 100 EV THIN OUTPUT DATA TO 0.1 PER-CENT ACCURACY. FROM 1 KEV TO 100 KEV VARY THE ERROR BETWEEN 0.1 AND 1 PER-CENT. ABOVE 1 KEV USE 1 PER-CENT ACCURACY. CALCULATIONS WILL USE 8 DIGIT MINIMUM ENERGY SPACING FOR CALCULATIONS, AND 9 DIGIT VARIABLE F OUTPUT FORMAT (NOTE THAT THIS IS NO LONGER AN INPUT OPTION. SEE COMMENTS ABOVE).
 C
 C THE FOLLOWING NINE CARDS ARE REQUIRED
 C
 C 1 0 3.00000+ 2
 C 92000 92999
 C 90232 (UPPER LIMIT WILL AUTOMATICALLY BE DEFINED)
 C (BLANK CARD INDICATES END OF REQUEST LIST)
 C 0.00000+ 0 1.00000-03
 C 1.00000+ 2 1.00000-03
 C 1.00000+ 3 1.00000-02
 C 1.00000+ 9 1.00000-02
 C (BLANK CARD INDICATES END OF ERROR LAW)
 C
 C LINEARIZING AND/OR THINNING DATA CAN BE DONE MORE EFFICIENTLY USING THE PROGRAM LINEAR (UCRL-50400,VOL.17,PART-A BY D.E.CULLEN)
 C
 C ***** MACHINE DEPENDENT CODING *****
 C
 C THE ONLY MACHINE DEPENDENT CODING IN THIS PROGRAM IS IN CONNECTION WITH THE USE OF DOUBLE PRECISION ON SHORT WORD LENGTH COMPUTERS (E.G. IBM 32 BITS/WORD COMPUTERS) AND IN SUBROUTINES

C OBLOCK AND IBLOCK, WHICH CONTROL I/O TO THE SCRATCH FILES. AS SIG02960
C DISTRIBUTED THIS PROGRAM WILL PERFORM DOUBLE PRECISION ARITHMETIC SIG02970
C AND NORMAL FORTRAN BINARY I/O AND NEED NOT BE MODIFIED FOR USE ON SIG02980
C ANY COMPUTER. HOWEVER IF YOU WISH TO OPTIMIZE THIS PROGRAM FOR SIG02990
C USE AT YOUR INSTALLATION, IF YOU HAVE A LONGER WORD LENGTH SIG03000
C COMPUTER (E.G. CDC 60 BITS/WORD COMPUTERS), YOU MAY ELIMINATE THE SIG03010
C DOUBLE PRECISION ARITHMETIC. TO OPTIMIZE SCRATCH I/O YOU MAY SIG03020
C REPLACE SUBROUTINES OBLOCK AND IBLOCK WITH THE MOST EFFICIENT TYPESIG03030
C OF I/O FOR YOUR COMPUTER. EQUIVALENT CODING IS PROVIDED TO USE SIG03040
C BUFFERED I/O ON THE LIVERMORE CDC-7600 OR CRAY-1. SIG03050
C SIG03060
C***** MACHINE DEPENDENT CODING ***** SIG03070

PAGE 0001

C PROGRAM GROUPIE(INPUT,OUTPUT,TAPES=INPUT,TAPE6=OUTPUT,TAPE20,
C 1 TAPE21,TAPE22,TAPE23,TAPE24,TAPE25,TAPE26,TAPE27,TAPE28,TAPE29,
C 2 TAPE30) GR000010
C GR000020
C GR000030
C GR000040
C GR000050
C PROGRAM GROUPIE GR000060
C VERSION 76-1 (NOVEMBER 1976) GR000070
C VERSION 79-1 (OCTOBER 1979) CDC-7600 AND CRAY-1 VERSION. GR000080
C VERSION 80-1 (MAY 1980) IBM, CDC AND CRAY VERSION GR000090
C VERSION 81-1 (JANUARY 1981) EXTENSION TO 3000 GROUPS GR000100
C VERSION 81-2 (MARCH 1981) IMPROVED SPEED GR000110
C VERSION 81-3 (AUGUST 1981) BUILT-IN 1/E WEIGHTING SPECTRUM GR000120
C VERSION 82-1 (JANUARY 1982) IMPROVED COMPUTER COMPATIBILITY GR000130
C GR000140
C WRITTEN BY DERMOTT E. CULLEN GR000150
C NUCLEAR DATA SECTION GR000160
C INTERNATIONAL ATOMIC ENERGY AGENCY GR000170
C P.O. BOX 200 GR000180
C VIENNA, AUSTRIA GR000190
C TELEPHONE 23-60-1718 GR000200
C GR000210
C REPORT UCRL-50400, VOL. 17, PART D (1979) GR000220
C LAWRENCE LIVERMORE LABORATORY GR000230
C GR000240
C GR000250
C AUTHORS MESSAGE GR000260
C ----- GR000270
C THE REPORT DESCRIBED ABOVE IS THE LATEST PUBLISHED DOCUMENTATION GR000280
C FOR THIS PROGRAM. HOWEVER, THE COMMENTS BELOW SHOULD BE CONSIDERED GR000290
C THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASE GR000300
C READ ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY GR000310
C THE COMMENTS CONCERNING MACHINE DEPENDENT CODING. GR000320
C GR000330
C AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTER GR000340
C INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE GR000350
C OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT GR000360
C IT WOULD BE APPRECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY GR000370
C COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO GR000380
C IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF GR000390
C THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR GR000400
C COMPUTER. GR000410
C GR000420
C PURPOSE GR000430
C ----- GR000440
C THIS PROGRAM IS DESIGNED TO CALCULATE ANY COMBINATION OF GR000450
C THE FOLLOWING QUANTITIES FROM LINEARLY INTERPOLABLE TABULATED GR000460
C CROSS SECTIONS IN THE ENDF/B FORMAT GR000470
C GR000480
C (1) UNSHIELDED GROUP AVERAGED CROSS SECTIONS GR000490
C (2) BONDARENKO SELF-SHIELDED GROUP AVERAGED CROSS SECTIONS GR000500
C (3) MULTI-BAND PARAMETERS GR000510
C GR000520
C IN THE FOLLOWING FOR SIMPLICITY THE ENDF/B TERMINOLOGY--ENDF/B GR000530
C TAPE--WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE TAPE, CARDS, GR000540
C DISK OR ANY OTHER MEDIUM. GR000550
C GR000560
C ENDF/B FORMAT GR000570
C ----- GR000580
C THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS GR000590
C OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION
C OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II,III, IV OR V FORMAT).

C A REACTION INDEX FOR YOUR APPLICATIONS, AFTER RUNNING THIS PROGRAM GRO01190
C YOU MAY USE PROGRAM DICTION TO CREATE A CORRECT REACTION INDEX. GRO01200
C GRO01210
C SECTION SIZE GRO01220
C GRO01230
C SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT GRO01240
C TO THE NUMBER OF POINTS IN ANY SECTION, E.G., THE TOTAL CROSS GRO01250
C SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS. GRO01260
C GRO01270
C SELECTION OF DATA GRO01280
C GRO01290
C THE PROGRAM SELECTS MATERIALS TO BE PROCESSED BASED EITHER ON GRO01300
C MAT (ENIF/B MAT NO.) OR ZA. THE PROGRAM ALLOWS UP TO 100 MAT OR GRO01310
C ZA RANGES TO BE SPECIFIED. THE PROGRAM WILL ASSUME THAT THE GRO01320
C ENDF/B TAPE IS IN EITHER MAT OR ZA ORDER, WHICHEVER CRITERIA IS GRO01330
C USED TO SELECT MATERIALS, AND WILL TERMINATE WHEN A MAT OR ZA GRO01340
C IS FOUND THAT IS ABOVE THE RANGE OF ALL REQUESTS. GRO01350
C GRO01360
C ENERGY ORDER AND UNITS GRO01370
C GRO01380
C ALL ENERGIES (FOR CROSS SECTIONS, WEIGHTING SPECTRUM OR GROUP GRO01390
C BOUNDARIES) MUST BE IN UNITS OF EV AND MUST BE IN ASCENDING GRO01400
C NUMERICAL ORDER. GRO01410
C GRO01420
C ENERGY GRID GRO01430
C GRO01440
C ALTHOUGH ALL REACTIONS MUST TO LINEARLY INTERPOLABLE, THEY DO NOT GRO01450
C ALL HAVE TO USE THE SAME ENERGY GRID. EACH REACTION CAN BE GIVEN GRO01460
C BY AN INDEPENDENT ENERGY GRID. THIS PROGRAM WILL PROCEED FROM GRO01470
C THE LOWEST TO HIGHEST ENERGY SELECTING EACH ENERGY INTERVAL OVER GRO01480
C WHICH ALL DATA, FOR ANY GIVEN CALCULATION, ARE ALL LINEARLY GRO01490
C INTERPOLABLE. GRO01500
C GRO01510
C GROUP STRUCTURE GRO01520
C GRO01530
C THIS PROGRAM IS DESIGNED TO USE AN ARBITRARY ENERGY GROUP GRO01540
C STRUCTURE WHERE THE ENERGIES ARE IN EV AND ARE IN INCREASING GRO01550
C ENERGY ORDER. IF ONLY UNSHIELDED AVERAGES ARE CALCULATED THIS GRO01560
C PROGRAM CAN HANDLE UP TO 3000 GROUPS. IF SELF-SHIELDED AVERAGES GRO01570
C AND/OR MULTI-BAND PARAMETERS ARE CALCULATED THIS PROGRAM CAN GRO01580
C HANDLE UP TO 175 GROUPS. GRO01590
C GRO01600
C THE USER MAY INPUT AN ARBITRARY GROUP STRUCTURE OR THE USER MAY GRO01610
C USE ONE OF THE FIVE BUILT-IN GROUP STRUCTURES. GRO01620
C (1) 175 GROUP (TART STRUCTURE) GRO01630
C (2) 50 GROUP (ORNL STRUCTURE) GRO01640
C (3) 126 GROUP (ORNL STRUCTURE) GRO01650
C (4) 171 GROUP (ORNL STRUCTURE) GRO01660
C (5) 620 GROUP (SAND-II STRUCTURE, UP TO 16 MEV) GRO01670
C (6) 640 GROUP (SAND-II STRUCTURE, UP TO 20 MEV) GRO01680
C GRO01690
C GROUP AVERAGES GRO01700
C GRO01710
C THIS PROGRAM DEFINES GROUP AVERAGED CROSS SECTIONS AS... GRO01720
C GRO01730
C
$$\text{AVERAGE} = \frac{(\text{INTEGRAL } E1 \text{ TO } E2) (\text{SIGMA}(E) * S(E) * \text{WT}(E) * DE)}{(\text{INTEGRAL } E1 \text{ TO } E2) (S(E) * \text{WT}(E) * DE)}$$
C GRO01740
C GRO01750
C WHERE... GRO01760
C GRO01770

C AVERAGE = GROUP AVERAGED CROSS SECTION
 C E1, E2 = ENERGY LIMITS OF THE GROUP
 C SIGMA(E) = ENERGY DEPENDENT CROSS SECTION FOR ANY GIVEN REACTION
 C S(E) = ENERGY DEPENDENT WEIGHTING SPECTRUM
 C WT(E) = ENERGY DEPENDENT SELF-SHIELDING FACTOR.

ENERGY DEPENDENT WEIGHTING SPECTRUM

C THE ENERGY DEPENDENT WEIGHTING SPECTRUM IS GIVEN BY AN ARBITRARY
 C TABULATED LINEARLY INTERPOLABLE FUNCTION WHICH CAN BE DESCRIBED
 C BY AN ARBITRARY NUMBER OF POINTS. THIS ALLOWS THE USER TO
 C SPECIFY ANY DESIRED WEIGHTING SPECTRUM TO ANY GIVEN DEGREE OF
 C ACCURACY. REMEMBER THAT THE PROGRAM WILL ASSUME THAT THE SPECTRUM
 C IS LINEARLY INTERPOLABLE BETWEEN TABULATED POINTS. THEREFORE THE
 C USER SHOULD USE ENOUGH POINTS TO INSURE AN ADEQUATE REPRESENTATION
 C OF THE SPECTRUM BETWEEN TABULATED DATA POINTS.

C THE PRESENT VERSION OF THE CODE HAS A BUILT IN CONSTANT AND 1/E
 C WEIGHTING SPECTRA.

UNSHIELDED GROUP AVERAGES

C FOR UNSHIELDED AVERAGES THE SELF-SHIELDING FACTOR (WT(E)) IS SET
 C TO UNITY. IF ONLY UNSHIELDED AVERAGES ARE CALCULATED THIS PROGRAM
 C ALLOWS UP TO 3000 GROUPS. UNSHIELDED AVERAGES ARE CALCULATED FOR
 C EVERY REACTION (EVERY ENDF/B SECTION OF FILE 3).

SELF-SHIELDED GROUP AVERAGES

C IF SELF-SHIELDED AVERAGES AND/OR MULTI-BAND PARAMETERS ARE
 C CALCULATED THIS PROGRAM ALLOWS UP TO 175 GROUPS. SELF-SHIELDED
 C AVERAGES AND/OR MULTI-BAND PARAMETERS ARE CALCULATED FOR THE
 C TOTAL, ELASTIC, CAPTURE AND FISSION.

C FOR THE TOTAL, ELASTIC, CAPTURE AND FISSION THE PROGRAM USES A
 C WEIGHTING FUNCTION THAT IS A PRODUCT OF THE ENERGY DEPENDENT
 C WEIGHTING SPECTRUM TIMES A BONDARENKO TYPE SELF-SHIELDING FACTOR.

$$WT(E) = S(E) / (TOTAL(E) + SIGMA) * N$$

WHERE...

C S(E) - ENERGY DEPENDENT WEIGHTING SPECTRUM (DEFINED BY
 C TABULATED VALUES AND LINEAR INTERPOLATION BETWEEN
 C TABULATED VALUES).
 C TOTAL(E) - ENERGY DEPENDENT TOTAL CROSS SECTION FOR ONE MATERIAL
 C (DEFINED BY TABULATED VALUES AND LINEAR INTERPOLATION
 C BETWEEN TABULATED VALUES).
 C SIGMA - CROSS SECTION TO REPRESENT THE EFFECT OF ALL OTHER
 C MATERIALS AND LEAKAGE (DEFINED WITHIN EACH GROUP TO BE
 C A MULTIPLE OF THE UNSHIELDED TOTAL CROSS SECTION WITHIN
 C THAT GROUP).
 C N - A POSITIVE INTEGER (0, 1, 2 OR 3).

C THE PROGRAM WILL USE ONE ENERGY DEPENDENT WEIGHTING SPECTRUM S(E)
 C AND 25 DIFFERENT BONDARENKO TYPE SELF-SHIELDING FACTORS (25 SIGMA
 C AND N COMBINATIONS) TO DEFINE 25 DIFFERENT AVERAGE CROSS SECTIONS,
 C FOR EACH REACTION, WITHIN EACH GROUP.

C THE 25 WEIGHTING FUNCTIONS USED ARE....
 C (1) - UNSHIELDED CROSS SECTIONS (N=0) GR002370
 C (2-22)- PARTIALLY SHIELDED CROSS SECTIONS (N=1, VARIOUS SIGMA0) GR002380
 C THE VALUES OF SIGMA0 THAT ARE USED VARY FROM 1024 TIMES GR002390
 C THE UNSHIELDED TOTAL CROSS SECTIONS IN STEPS OF 1/2 GR002400
 C DOWN TO 1/1024 TIMES THE UNSHIELDED TOTAL CROSS SECTION GR002410
 C (A RANGE OF OVER 1 MILLION, CENTERED ON THE UNSHIELDED GR002420
 C TOTAL CROSS SECTION WITHIN EACH GROUP). GR002430
 C (23) - TOTALLY SHIELDED FLUX WEIGHTED CROSS SECTION GR002440
 C (N=1, SIGMA0=0) GR002450
 C (24) - TOTALLY SHIELDED CURRENT WEIGHTED CROSS SECTION GR002460
 C (N=2, SIGMA0=0) GR002470
 C (25) - TOTALLY SHIELDED COSINE SQUARED WEIGHTED CROSS SECTION GR002480
 C (N=3, SIGMA0=0) GR002490
 C GR002500
 C GR002510
 C GR002520
 C FOR ALL OTHER REACTIONS (EXCEPT TOTAL, ELASTIC, CAPTURE AND GR002530
 C FISSION) THE PROGRAM WILL USE THE ENERGY DEPENDENT WEIGHTING GR002540
 C SPECTRUM S(E) TO DEFINE THE UNSHIELDED (BONDERENKO N=0) GR002550
 C AVERAGED CROSS SECTION WITHIN EACH GROUP. GR002560
 C GR002570
 C RESOLVED RESONANCE REGION GR002580
 C GR002590
 C IN THE RESOLVED RESONANCE REGION (ACTUALLY EVERYWHERE BUT IN THE GR002600
 C UNRESOLVED RESONANCE REGION) THE CROSS SECTIONS OUTPUT BY LINEAR- GR002610
 C RECENT-SIGMA1 WILL BE ACTUAL ENERGY DEPENDENT CROSS SECTIONS AND GR002620
 C THE CALCULATIONS BY THIS PROGRAM WILL YIELD ACTUAL SHIELDED AND GR002630
 C UNSHIELDED CROSS SECTIONS. GR002640
 C GR002650
 C UNRESOLVED RESONANCE REGION GR002660
 C GR002670
 C IN THE UNRESOLVED RESONANCE REGION PROGRAM RECENT USES THE GR002680
 C UNRESOLVED RESONANCE PARAMETERS TO CALCULATE INFINITELY DILUTE GR002690
 C AVERAGE CROSS SECTIONS. THIS PROGRAM WILL MERELY READ THIS GR002700
 C INFINITELY DILUTE DATA AS IF IT WERE ENERGY DEPENDENT DATA AND GR002710
 C GROUP AVERAGE IT. AS SUCH THIS PROGRAM WILL PRODUCE THE CORRECT GR002720
 C UNSHIELDED CROSS SECTION IN THE UNRESOLVED RESONANCE REGION, BUT GR002730
 C IT WILL NOT PRODUCE THE CORRECT SELF-SHIELDING EFFECTS. GR002740
 C GR002750
 C ACCURACY OF RESULTS GR002760
 C GR002770
 C ALL INTEGRALS ARE PERFORMED ANALYTICALLY. THEREFORE NO ERROR IS GR002780
 C INTRODUCED DUE TO THE USE OF TRAPAZOIDAL OR OTHER INTEGRATION GR002790
 C SCHEME. THE TOTAL ERROR THAT CAN BE ASSIGNED TO THE RESULTING GR002800
 C AVERAGES IS JUST THAT DUE TO THE ERROR IN THE CROSS SECTIONS GR002810
 C AND ENERGY DEPENDENT WEIGHTING SPECTRUM. GENERALLY SINCE THE GR002820
 C THE ENERGY DEPENDENT WEIGHTING SPECTRUM APPEARS IN BOTH THE GR002830
 C NUMERATOR AND THE DENOMINATOR THE AVERAGES RAPIDLY BECOME GR002840
 C INSENSITIVE TO THE WEIGHTING SPECTRUM AS MORE GROUPS ARE USED. GR002850
 C SINCE THE WEIGHTING SPECTRUM IS LOADED IN THE PAGING SYSTEM THE GR002860
 C USER CAN DESCRIBE THE SPECTRUM TO ANY REQUIRED ACCURACY USING GR002870
 C ANY NUMBER OF ENERGY VS. SPECTRUM PAIRS. GR002880
 C GR002890
 C MULTI-BAND PARAMETERS GR002900
 C GR002910
 C MULTI-BAND PARAMETERS ARE CALCULATED FOR THE TOTAL, ELASTIC, GR002920
 C CAPTURE AND FISSION REACTIONS. WITH THE NUMBER OF GROUPS THAT GR002930
 C ARE NORMALLY USED (SEE BUILT IN GROUP STRUCTURES) ALL OTHER GR002940
 C REACTIONS RESULT IN A NEGLIGIBLE AMOUNT OF SELF-SHIELDING. AS GR002950

C SUCH THEIR EQUIVALENT BAND CROSS SECTION WILL MERELY BE THEIR UNSHIELDED VALUE WITHIN EACH BAND. GRO02960
 C GRO02970
 C GRO02980
 C FOR ANY GIVEN EVALUATION, WITHIN ANY GIVEN GROUP THIS PROGRAM WILL GENERATE THE MINIMUM NUMBER OF BANDS REQUIRED WITHIN THAT GRO02990
 C GROUP. AS OUTPUT TO THE COMPUTER READABLE DISK FILE THE BAND PARAMETERS FOR EACH EVALUATION WILL BE FORMATTED TO HAVE THE GRO03000
 C SAME NUMBER OF BANDS IN ALL GROUPS (WITH ZERO WEIGHT FOR SOME BANDS WITHIN ANY GROUP). THE USER MAY DECIDE TO HAVE OUTPUT GRO03010
 C EITHER WITH THE MINIMUM NUMBER OF BANDS REQUIRED FOR EACH EVALUATION (E.G. 2 BANDS FOR HYDROGEN AND 4 BANDS FOR U-235) OR GRO03020
 C THE SAME NUMBER OF BANDS FOR ALL EVALUATIONS (E.G. 4 BANDS FOR BOTH HYDROGEN AND U-235). GRO03030
 C GRO03040
 C GRO03050
 C GRO03060
 C GRO03070
 C GRO03080
 C GRO03090
 C FOR 2 OR FEWER BANDS THE PROGRAM USES AN ANALYTIC EXPRESSION TO DEFINE ALL MULTI-BAND PARAMETERS. FOR MORE THAN 2 BANDS THE GRO03100
 C PROGRAM PERFORMS A NON-LINEAR FIT TO SELECT THE MULTI-BAND PARAMETERS THAT MINIMIZE THE MAXIMUM FRACTIONAL ERROR AT ANY GRO03110
 C POINT ALONG THE ENTIRE SELF-SHIELDING CURVE. THE NUMBER OF BANDS REQUIRED WITHIN ANY GIVEN GROUP IS DEFINED BY INSURING THAT THE GRO03120
 C MULTI-BAND PARAMETERS CAN BE USED TO ACCURATELY DEFINE SELF-SHIELDED CROSS SECTIONS ALONG THE ENTIRE SELF-SHIELDING CURVE GRO03130
 C FROM $\Sigma = 0$ TO INFINITY. THE USER MAY DEFINE THE ACCURACY REQUIRED. GRO03140
 C GRO03150
 C GRO03160
 C GRO03170
 C GRO03180
 C GRO03190
 C GRO03200
 C ENDF/B FORMATTED UNSHIELDED AVERAGES GRO03210
 C ----- GRO03220
 C UNSHIELDED MULTI-GROUP AVERAGED CROSS SECTIONS FOR ALL REACTIONS MAY BE OBTAINED IN THE ENDF/B FORTRAN IN EITHER HISTOGRAM GRO03230
 C (INTERPOLATION LAW 1) OR LINEARLY INTERPOLABLE (INTERPOLATION LAW 2) FORM. SEE INPUT BELOW FOR DETAILS. GRO03240
 C GRO03250
 C GRO03260
 C GRO03270
 C MIXTURES OF MATERIALS AND RESONANCE OVERLAP GRO03280
 C ----- GRO03290
 C THE SELF-SHIELDED CROSS SECTIONS FOR THE INDIVIDUAL CONSTITUENTS OF ANY MIXTURE CAN BE CALCULATED BY THIS PROGRAM BY REALIZING THAT THIS PROGRAM ESSENTIALLY ONLY USES THE TOTAL CROSS SECTION AS A WEIGHTING FUNCTION TO ACCOUNT FOR SELF-SHIELDING EFFECTS. FOR A MIXTURE IT IS THEREFORE ONLY NECESSARY TO USE THE TOTAL CROSS SECTION FOR THE MIXTURE IN PLACE OF THE ACTUAL TOTAL CROSS SECTION FOR EACH CONSTITUENT AND TO RUN THIS PROGRAM. THIS CAN BE DONE BY FIRST RUNNING PROGRAM MIXER TO CALCULATE THE ENERGY DEPENDENT TOTAL CROSS SECTION FOR ANY COMPOSITE MIXTURE. NEXT, SUBSTITUTE THIS COMPOSITE TOTAL CROSS SECTION FOR THE ACTUAL TOTAL CROSS SECTION OF EACH CONSTITUENT (IN EACH ENDF/B FORMATTED EVALUATION). FINALLY, RUN THIS PROGRAM TO CALCULATE THE SELF-SHIELDED CROSS SECTION FOR EACH CONSTITUENT, PROPERLY ACCOUNTING FOR RESONANCE OVERLAP BETWEEN THE RESONANCES OF ALL OF THE CONSTITUENTS OF THE MIXTURE. DURING THE SAME RUN THESE SELF-SHIELDED CROSS SECTIONS CAN IN TURN BE USED TO CALCULATE FULLY CORRELATED MULT-BAND
 C GRO03300
 C GRO03310
 C GRO03320
 C GRO03330
 C GRO03340
 C GRO03350
 C GRO03360
 C GRO03370
 C GRO03380
 C GRO03390
 C GRO03400
 C GRO03410
 C GRO03420
 C GRO03430
 C GRO03440
 C GRO03450
 C GRO03460
 C INPUT FILES DR003470
 C ----- GRO03480
 C UNIT DESCRIPTION GRO03490
 C ----- GRO03500
 C 5 INPUT DATA (BCD - 80 CHARACTERS/RECORD) GRO03510
 C 20 ORIGINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD) GRO03520
 C GRO03530
 C OUTPUT FILES GRO03540

UNIT	DESCRIPTION	
C		GR003550
C		GR003560
C		GR003570
C	6 OUTPUT REPORT (BCD - 80 CHARACTERS/RECORD)	GR003580
C	21 MULTI-GROUP ENDF/B DATA - OPTIONAL	GR003590
C	(BCD - 80 CHARACTERS/RECORD)	GR003600
C	22 MULTI-BAND PARAMETERS - COMPUTER READABLE - OPTIONAL	GR003610
C	(BINARY - 4378 WORDS/RECORD)	GR003620
C	23 SELF-SHIELDED CROSS SECTION LISTING - OPTIONAL	GR003630
C	(BCD - 120 CHARACTERS/RECORD)	GR003640
C	24 MULTI-BAND PARAMETER LISTING - OPTIONAL	GR003650
C	(BCD - 120 CHARACTERS/RECORD)	GR003660
C	25 UNSHIELDED CROSS SECTION LISTING - OPTION	GR003670
C	(BCD - 120 CHARACTERS/RECORD)	GR003680
C		GR003690
C		GR003700
C		GR003710
C		GR003720
C		GR003730
C		GR003740
C	26 ENERGY DEPENDENT WEIGHTING SPECTRUM	GR003750
C	(BINARY - 2004 WORDS/BLOCK)	GR003760
C	27 TOTAL CROSS SECTION	GR003770
C	(BINARY - 2004 WORDS/BLOCK)	GR003780
C	28 ELASTIC CROSS SECTION	GR003790
C	(BINARY - 2004 WORDS/BLOCK)	GR003800
C	29 FISSION CROSS SECTION	GR003810
C	(BINARY - 2004 WORDS/BLOCK)	GR003820
C	30 CAPTURE CROSS SECTION	GR003830
C	(BINARY - 2004 WORDS/BLOCK)	GR003840
C		GR003850
C		GR003860
C		GR003870
C		GR003880
C		GR003890
C		GR003900
C		GR003910
C		GR003920
C		GR003930
C		GR003940
C		GR003950
C		GR003960
C		GR003970
C		GR003980
C		GR003990
C		GR004000
C		GR004010
C		GR004020
C		GR004030
C		GR004040
C		GR004050
C		GR004060
C		GR004070
C		GR004080
C		GR004090
C		GR004100
C		GR004110
C		GR004120
C		GR004130

SCRATCH FILES			
UNIT	FILENAME	DESCRIPTION	
C			GR003720
C			GR003730
C			GR003740
C			GR003750
C			GR003760
C			GR003770
C			GR003780
C			GR003790
C			GR003800
C			GR003810
C			GR003820
C			GR003830
C			GR003840
C			GR003850
C			GR003860
C			GR003870
C			GR003880
C			GR003890
C			GR003900
C			GR003910
C			GR003920
C			GR003930
C			GR003940
C			GR003950
C			GR003960
C			GR003970
C			GR003980
C			GR003990
C			GR004000
C			GR004010
C			GR004020
C			GR004030
C			GR004040
C			GR004050
C			GR004060
C			GR004070
C			GR004080
C			GR004090
C			GR004100
C			GR004110
C			GR004120
C			GR004130

INPUT CARDS				
CARD	COLS.	FORMAT	DESCRIPTION	
C				GR003870
C				GR003880
C				GR003890
C				GR003900
C				GR003910
C				GR003920
C				GR003930
C				GR003940
C				GR003950
C				GR003960
C				GR003970
C				GR003980
C				GR003990
C				GR004000
C				GR004010
C				GR004020
C				GR004030
C				GR004040
C				GR004050
C				GR004060
C				GR004070
C				GR004080
C				GR004090
C				GR004100
C				GR004110
C				GR004120
C				GR004130

C INFINITY) GR004140
 C IF THE SELECTOR IS POSITIVE (1 TO 5) THE GR004150
 C MINIMUM NUMBER OF BANDS WILL BE OUTPUT FOR GR004160
 C EACH ISOTOPE INDEPENDENTLY. IF THE SELECTOR GR004170
 C IS NEGATIVE (-1 TO -5) THE SAME NUMBER OF GR004180
 C BANDS (ABS(SELECTOR)) WILL BE OUTPUT FOR GR004190
 C ALL ISOTOPES. GR004200
 C 1 34-44 I11 NUMBER OF POINTS USED TO DESCRIBE ENERGY GR004210
 C DEPENDENT WEIGHTING SPECTRUM S(E). GR004220
 C = -1 - 1/E WEIGHTING SPECTRUM. GR004230
 C = 0 OR 1- ENERGY INDEPENDENT (SO CALLED FLAT) GR004240
 C WEIGHTING SPECTRUM. NO DATA READ GR004250
 C FROM INPUT FILE. GR004260
 C = .GT.1 - READ THIS MANY POINTS FROM INPUT GR004270
 C TO DESCRIBE WEIGHTING SPECTRUM. GR004280
 C NO LIMIT TO THE NUMBER OF POINTS GR004290
 C USED TO DESCRIBE WEIGHTING. GR004300
 C 1 45-55 E11.4 MULTI-BAND CONVERGENCE CRITERIA. GR004310
 C ONLY USED FOR 3 OR MORE BANDS. THE NUMBER OF GR004320
 C BANDS IN EACH GROUPS IS SELECTED TO INSURE GR004330
 C THAT THE ENTIRE SELF-SHIELDING CURVE CAN BE GR004340
 C REPRODUCED TO WITHIN THIS FRACTIONAL ERROR. GR004350
 C = .LT. 0.0001 - USE STANDARD 0.001 GR004360
 C (0.1 PER-CENT) GR004370
 C = .GE. 0.0001 - USE AS CONVERGENCE CRITERIA GR004380
 C 1 56-66 I11 CONSTANT CROSS SECTION IN ALL BANDS SELECTOR. GR004390
 C THIS OPTION IS ONLY USED IF ONE WISHES TO GR004400
 C DETERMINE THE IMPORTANCE OF USING MULTI-BAND GR004410
 C DATA COMPARED TO MULTI-GROUP DATA. THIS CAN GR004420
 C BE ACCOMPLISHED BY RUNNING THE SAME PROBLEM GR004430
 C USING MULTI-BAND PARAMETERS AND THEN RE-RUN GR004440
 C USING SELF-SHIELDED MULTI-GROUP DATA. GR004450
 C = 1-25 - USE THE SAME SELF-SHIELDED CROSS GR004460
 C IN ALL BANDS. THE INDEX SELECTS ONE GR004470
 C OF THE 25 CROSS SECTIONS GENERATED GR004480
 C IN EACH GROUP (SEE ABOVE FOR GR004490
 C DEFINITION OF 25 WEIGHTING GR004500
 C FUNCTIONS FOR AVERAGES). GR004510
 C = NOT 1-25 - GENERATE NORMAL MULTI-BAND GR004520
 C PARAMETERS GR004530
 C GR004540
 C THE SECOND INPUT CARD IS USED TO SELECT ALL DESIRED OUTPUT MODES. GR004550
 C EACH OUTPUT DEVICE MAY BE TURNED OFF (0) OR ON (1). IF ON, EACH GR004560
 C OUTPUT MODE MAY IDENTIFY THE DATA AS EITHER ENDL +1 OR ENDF -1. GR004570
 C THEREFORE EACH OF THE FOLLOWING INPUT PARAMETERS MAY BE -1 FOR GR004580
 C OUTPUT IDENTIFIED AS ENDF DATA, 0 FOR NO OUTPUT OR 1 FOR OUTPUT GR004590
 C IDENTIFIED AS ENDL. GR004600
 C GR004610
 C 2 1-11 I11 SELF-SHIELDED CROSS SECTION LISTING GR004620
 C 2 12-22 I11 MULTI-BAND PARAMETER LISTING GR004630
 C 2 23-33 I11 MULTI-BAND PARAMETERS COMPUTER READABLE GR004640
 C 2 34-44 I11 UNSHIELDED CROSS SECTIONS IN ENDF/B FORMAT GR004650
 C = 1 - HISTOGRAM FORMAT (INTERPOLATION LAW 1) GR004660
 C = 2 - LINEAR-LINEAR (INTERPOLATION LAW 2) GR004670
 C 2 45-55 I11 UNSHIELDED CROSS SECTIONS LISTING GR004680
 C GR004690
 C 3 1-80 20A4 LIBRARY IDENTIFICATION. ANY TEXT THAT THE GR004700
 C USER WISHES TO IDENTIFY THE MULTI-BAND GR004710
 C PARAMETERS. THIS LIBRARY IDENTIFICATION IS GR004720

C		PAGE 0010
C	MULTI-BAND CALCULATION	GR005320
C	-----	GR005330
C	THERE IS MACHINE DEPENDENT CODING IN SUBROUTINE READIN AND	GR005340
C	AROUND THE DUMMY SUBROUTINE ZXSSQ BECAUSE THE NON-LINEAR	GR005350
C	SYSTEM SOLVER ZXSSQ IS A PREPRIORITY PIECE OF SOFTWARE WHICH	GR005360
C	CANNOT BE DISTRIBUTED WITH THIS PROGRAM. THE NON-LINEAR SYSTEM	GR005370
C	SOLVER IS ONLY USED TO CALCULATE MULTI-BAND PARAMETERS WITH	GR005380
C	THREE OR MORE BANDS. THEREFORE THIS VERSION OF THE PROGRAM	GR005390
C	WILL ONLY DO MULTI-BAND CALCULATIONS WITH UP TO TWO BANDS. IF	GR005400
C	YOU HAVE ZXSSQ AVAILABLE REMOVE ALL ERROR MESSAGE AND STOPS	GR005410
C	FROM SUBROUTINE ZXSSQ AND ADD TO THIS PROGRAM. FROM THIS PROGRAM	GR005420
C	REMOVE THE DUMMY SUBROUTINE ZXSSQ AND THE RESTRICTION ON THE	GR005430
C	NUMBER OF BANDS IN SUBROUTINE READIN (THE VARIABLE MBAND).	GR005440
C	THIS WILL ALLOW YOU TO DO CALCULATIONS WITH UP TO FIVE BANDS	GR005450
C	(MORE THAN IS REQUIRED IN ANY CASE NORMALLY ENCOUNTERED).	GR005460
C		GR005470
C	DOUBLE PRECISION CALCULATIONS	GR005480
C	-----	GR005490
C	THERE IS ALSO MACHINE DEPENDENT CODING IN SUBROUTINE GROUPN TO	GR005500
C	USE DOUBLE PRECISION ARITHMETIC ON SHORT WORD LENGTH MACHINES	GR005510
C	(E.G. IBM 32 BITS/WORD MACHINES) FOR THE SELF-SHIELDING	GR005520
C	CALCULATION. AS DISTRIBUTED THIS DOUBLE PRECISION ARITHMETIC	GR005530
C	WILL WORK ON ANY MACHINE. HOWEVER IF YOU HAVE A LONGER WORD	GR005540
C	LENGTH MACHINE (E.G. CDC 60 BITS/WORD MACHINE) YOU MAY OPTIMIZE	GR005550
C	THIS PROGRAM FOR USE ON YOUR MACHINE BY ELIMINATING THE USE	GR005560
C	OF DOUBLE PRECISION ARITHMETIC IN SUBROUTINE GROUPN.	GR005570
C		GR005580
C	SCRATCH I/O	GR005590
C	-----	GR005600
C	THERE IS MACHINE DEPENDENT CODING IN THE SUBROUTINES OBLOCK	GR005610
C	AND IBLOCK, WHICH CONTROL THE I/O TO THE SCRATCH FILES.	GR005620
C	AS DISTRIBUTED THIS PROGRAM WILL PERFORM NORMAL FORTRAN	GR005630
C	BINARY I/O AND NEED NOT BE MODIFIED FOR USE ON ANY COMPUTER.	GR005640
C	HOWEVER IF YOU WISH TO OPTIMIZE THIS PROGRAM FOR USE AT YOUR	GR005650
C	INSTALLATION YOU MAY REPLACE THESE TWO ROUTINES WITH THE	GR005660
C	MOST EFFICIENT TYPE OF I/O FOR YOUR COMPUTER. EQUIVALENT	GR005670
C	CODING IS PROVIDED TO USE BUFFERED I/O ON THE LIVERMORE CDC-7600	GR005680
C	OR CRAY-1.	GR005690
C		GR005700
C	MULTI-BAND OUTPUT FOR TART	GR005710
C	-----	GR005720
C	SUBROUTINE TARTUP OUTPUTS MULTI-BAND PARAMETERS FOR USE BY	GR005730
C	THE TART CODE AT LIVERMORE. IT CONTAINS MACHINE DEPENDENT	GR005740
C	CODING AND ITS USE IS NOT RECOMMENDED FOR USERS OUTSIDE OF	GR005750
C	LIVERMORE.	GR005760
C		GR005770
C	C***** MACHINE DEPENDENT CODING *****	GR005780

C		PAGE 0001
C	PROGRAM EVALPLOT (INPUT, OUTPUT, TAPES=INPUT, TAPE6=OUTPUT,	EVA00010
C	1 TAPE20, TAPE30)	EVA00020
C		EVA00030
C	PROGRAM EVALPLOT	EVA00040
C	VERSION 75-1 (AUGUST 1975)	EVA00050
C	VERSION 76-1 (JULY 1976)	EVA00060
C	VERSION 77-1 (APRIL 1977)	EVA00070
C	VERSION 78-1 (JULY 1978)	EVA00080
C	VERSION 79-1 (FEBRUARY 1979)	EVA00090
C	VERSION 80-1 (JULY 1980) IBM VERSION	EVA00100
C	VERSION 80-2 (DECEMBER 1980)	EVA00110
C	VERSION 81-1 (MARCH 1981)	EVA00120
C	VERSION 81-2 (AUGUST 1981) IMPROVED ZOOM CAPABILITY	EVA00130
C	VERSION 82-1 (JANUARY 1982) IMPROVED COMPUTER COMPATIBILITY	EVA00140
C		EVA00150
C	REPORT UCRL-50400, VOL. 17, PART E (1979)	EVA00160
C	LAWRENCE LIVERMORE LABORATORY	EVA00170
C		EVA00180
C	WRITTEN BY DERMOTT E. CULLEN	EVA00190
C	NUCLEAR DATA SECTION	EVA00200
C	INTERNATIONAL ATOMIC ENERGY AGENCY	EVA00210
C	P.O. BOX 200	EVA00220
C	VIENNA, AUSTRIA	EVA00230
C	TELEPHONE 23-60-1718	EVA00240
C		EVA00250
C	AUTHORS MESSAGE	EVA00260
C	-----	EVA00270
C	THE REPORT DESCRIBED ABOVE IS THE LATEST PUBLISHED DOCUMENTATION	EVA00280
C	FOR THIS PROGRAM. HOWEVER, THE COMMENTS BELOW SHOULD BE CONSIDERED	EVA00290
C	THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASE	EVA00300
C	READ ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY	EVA00310
C	THE COMMENTS CONCERNING MACHINE DEPENDENT CODING.	EVA00320
C		EVA00330
C	AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTERS	EVA00340
C	INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE	EVA00350
C	OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT	EVA00360
C	IT WOULD BE APPRECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY	EVA00370
C	COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO	EVA00380
C	IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF	EVA00390
C	THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR	EVA00400
C	COMPUTER.	EVA00410
C		EVA00420
C	PURPOSE	EVA00430
C	-----	EVA00440
C	THIS PROGRAM IS DESIGNED TO READ EVALUATED DATA FROM THE ENDF/B	EVA00450
C	FORMAT AND TO PLOT THE DATA. THE USER MAY SELECT CROSS SECTIONS,	EVA00460
C	PARAMETERS (E.G. NU-BAR, MU-BAR, ETC.), ANGULAR DISTRIBUTIONS	EVA00470
C	AND/OR ENERGY DISTRIBUTIONS TO BE PLOTTED.	EVA00480
C		EVA00490
C	IN THE FOLLOWING FOR SIMPLICITY THE ENDF/B TERMINOLOGY--ENDF/B	EVA00500
C	TAPE--WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE TAPE, CARDS,	EVA00510
C	DISK OR ANY OTHER MEDIUM.	EVA00520
C		EVA00530
C	ENDF/B FORMAT	EVA00540
C	-----	EVA00550
C	THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS	EVA00560
C	OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION	EVA00570
C	OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II, III, IV OR V FORMAT).	EVA00580
C		EVA00590

C IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B EVA00600
 C FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS EVA00610
 C ASSUMED THAT THE MAT, MF AND MT ON EACH CARD IS CORRECT. SEQUENCE EVA00620
 C NUMBERS (COLUMNS 76-80) ARE IGNORED. FORMAT OF SECTION MT=452, 455EVA00630
 C OF MF=1, AND ALL SECTIONS OF MF=3, 4 AND 5 MUST BE CORRECT. ALL EVA00640
 C OTHER SECTION OF DATA ARE SKIPPED AND AS SUCH THE OPERATION OF EVA00650
 C THIS PROGRAM IS INSENSITIVE TO THE CORRECTNESS OR INCORRECTNESS EVA00660
 C OF ALL OTHER SECTIONS. EVA00670
 C EVA00680
 C ALL DATA THAT IS USED BY THIS PROGRAM SHOULD BE LINEARLY EVA00690
 C INTERPOLABLE (ENDF/B INTERPOLATION LAW 2). IF THIS PROGRAM FINDS EVA00700
 C ANY DATA THAT IS NOT LINEARLY INTERPOLABLE IT WILL PRINT AN ERROR EVA00710
 C MESSAGE, BUT WILL STILL PLOT THE DATA AS IF IT WERE LINEARLY EVA00720
 C INTERPOLABLE. THE ONLY ERROR THAT WILL RESULT IN THE PLOT WILL BE EVA00730
 C IN THE CURVE FOLLOWED BETWEEN TABULATED POINTS. PROGRAM LINEAR EVA00740
 C (UCRL-50400, VOL. 17, PART A) MAY BE USED TO CONVERT CROSS EVA00750
 C SECTIONS TO LINEARLY INTERPOLABLE FORM. PROGRAM LEGEND CAN BE USEDEVA00760
 C FOR ANGULAR DISTRIBUTIONS AND PROGRAM ENERGY CAN BE USED FOR EVA00770
 C SECONDARY ENERGY DISTRIBUTIONS. EVA00780
 C EVA00790
 C REACTION INDEX EVA00800
 C ----- EVA00810
 C THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN EVA00820
 C SECTION MF=1, MT=451 OF EACH EVALUATION. EVA00830
 C EVA00840
 C SECTION SIZE EVA00850
 C ----- EVA00860
 C SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT EVA00870
 C TO THE NUMBER OF POINTS IN ANY SECTION, E.G., THE TOTAL CROSS EVA00880
 C SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS. EVA00890
 C EVA00900
 C SELECTION OF DATA EVA00910
 C ----- EVA00920
 C IN THE BATCH MODE THE FIRST INPUT CARD SPECIFIES A ZA RANGE TO EVA00930
 C PLOT. FOR ANY ZA WITHIN THE RANGE SPECIFIED ON THE FIRST CARD EVA00940
 C PLOTS OF SPECIFIC ENERGY RANGES, AND TYPES OF DATA MAY BE EVA00950
 C REQUESTED. EVA00960
 C EVA00970
 C IN THE INTERACTIVE MODE THE USER MUST SPECIFY A SPECIFIC PLOT OF EVA00980
 C OF A ZA, TYPE OF DATA AND ENERGY RANGE. EACH COMMAND IS EXECUTED EVA00990
 C IN TURN. EVA01000
 C EVA01010
 C CATEGORIES OF DATA EVA01020
 C ----- EVA01030
 C CROSS SECTIONS ARE DIVIDED INTO SIX CATEGORIES EVA01040
 C EVA01050
 C (1) TOTAL, ELASTIC, CAPTURE, FISSION AND TOTAL INELASTIC EVA01060
 C (2) TOTAL INELASTIC, INELASTIC DISCRETE LEVELS AND CONTINUUM EVA01070
 C (3) (N,2N), (N,3N) AND (N,N'CHARGED PARTICLE) EVA01080
 C (4) (N,CHARGED PARTICLE) EVA01090
 C (5) PARTICLE PRODUCTION (PROTON, DEUTERON, ETC.) AND DAMAGE EVA01100
 C (6) PARAMETERS NU-BAR, MU-BAR, XI AND GAMMA EVA01110
 C EVA01120
 C MASTER PLOTS EVA01130
 C ----- EVA01140
 C IF THE USER REQUESTS MASTER PLOTS, A PLOT OF EACH CATEGORY OF DATAEVA01150
 C IS FIRST PLOTTED OVER THE ENERGY RANGE FROM 0.01 EV (OR USER EVA01160
 C SPECIFIED LOWER ENERGY LIMIT) OR THE LOWEST THRESHOLD (WHICHEVER EVA01170
 C IS HIGHER) UP TO THE HIGHEST TABULATED ENERGY. EVA01180

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C
C ZOOM COMMANDS EVA01190
C EVA01200
C EVA01210
C IN ADDITION TO THE MASTER PLOTS THE USER MAY REQUEST MORE DETAILED EVA01220
C PLOTS OF ANY CATEGORY OF DATA, OVER ANY ENERGY RANGE BY USING ZOOM EVA01230
C COMMANDS. ZOOM COMMANDS SPECIFY EVA01240
C EVA01250
C (1) A ZA RANGE EVA01260
C (2) ONE OF THE SIX CATEGORIES OUTLINED ABOVE EVA01270
C (3) AN ENERGY RANGE EVA01280
C (4) A CROSS SECTION RANGE (OPTIONAL) EVA01290
C (5) ONE OF THREE PLOTTING MODES (SEE UCRL50400, VOL. 17, PART E) EVA01300
C EVA01310
C IDENTIFICATION OF DATA EVA01320
C EVA01330
C FOR CROSS SECTIONS CURVES FOR UP TO 12 REACTIONS MAY APPEAR ON A EVA01340
C SINGLE PLOT. REACTION IS IDENTIFIED BY A DIFFERENT LINE EVA01350
C TYPE AND A NAME. FOR INELASTIC DATA LEVELS ARE IDENTIFIED BY EVA01360
C LEVEL ENERGY (IN NO CASE IS ENDF/B JARGON USED, SUCH AS MT=56). EVA01370
C FOR ANGULAR OR ENERGY DISTRIBUTIONS EACH PLOT WILL ONLY CONTAIN EVA01380
C DATA FOR A SINGLE REACTION, BUT MAY CONTAIN CURVES FOR UP TO 5 EVA01390
C INCIDENT NEUTRON ENERGIES. REACTIONS ARE IDENTIFIED BY NAME AND EVA01400
C EACH CURVE IS IDENTIFIED BY INCIDENT NEUTRON ENERGY. FOR ANY TYPE EVA01410
C OF DATA IF THERE ARE MORE CURVES TO PLOT THEN WILL FIT ON A SINGLE EVA01420
C PLOT, THEY WILL BE DIVIDED INTO A SERIES OF PLOTS. EVA01430
C EVA01440
C BATCH MODE EVA01450
C EVA01460
C IN THE BATCH MODE THIS PROGRAM WILL READ ALL ZOOM COMMAND AT THE EVA01470
C BEGINNING OF THE PROGRAM AND PROCEED TO EXECUTE ALL COMMANDS EVA01480
C WITHOUT FURTHER INSTRUCTIONS FROM THE USER. IN THE BATCH MODE THE EVA01490
C ZA RANGE SPECIFIED ON THE FIRST INPUT CARD IS USED TO DEFINE WHICH EVA01500
C EVALUATIONS TO PLOT. PLOTTING MAY BE SPECIFIED WITH OR WITHOUT EVA01510
C MASTER PLOTS, AND WITH OR WITHOUT ZOOM COMMANDS. ZOOM COMMANDS MAY EVA01520
C BE INPUT IN ANY ORDER, I.E., THEY NEED NOT BE IN THE ORDER IN EVA01530
C WHICH THEY WILL BE EXECUTED. IF MASTER PLOTS ARE REQUESTED DATA EVA01540
C FOR EACH OF THE DEFINED SIX CATEGORIES WILL IN TURN BE PLOTTED. EVA01550
C IF ONE OR MORE ZOOM COMMANDS ARE SPECIFIED FOR A GIVEN CATEGORY OF EVA01560
C DATA, THE ZOOM PLOTS WILL IMMEDIATELY FOLLOW THE MASTER PLOT OF EVA01570
C THE SAME CATEGORY OF DATA. IF MASTER PLOTS ARE NOT REQUESTED ONLY EVA01580
C ZOOM PLOTS WILL BE PRODUCED. IN ALL CASES PLOTS WILL BE PRODUCED EVA01590
C IN THE ORDER IN WHICH THE EVALUATIONS APPEAR ON THE TAPE, AND EVA01600
C WITHIN EACH ZA PLOTS WILL BE PRODUCED IN CATEGORY 1 THROUGH 6 EVA01610
C ORDER. EVA01620
C EVA01630
C INTERACTIVE MODE EVA01640
C EVA01650
C IN THE INTERACTIVE MODE THIS PROGRAM WILL READ ONE ZOOM COMMAND AT EVA01660
C A TIME AND EXECUTE THE ZOOM COMMAND. IN THE INTERACTIVE MODE THE EVA01670
C ZA RANGE SPECIFIED ON THE FIRST INPUT CARD IS IGNORED AND THE NEXT EVA01680
C EVALUATION TO BE PLOTTED IS DEFINED ONLY BY THE LOWER ZA LIMIT EVA01690
C SPECIFIED WITH THE ZOOM COMMAND. EACH ZOOM COMMAND CAN ONLY EVA01700
C SPECIFY A SINGLE ZA, DEFINED BY THE LOWER ZA LIMIT OF THE ZOOM EVA01710
C COMMAND, AND THE UPPER ZA LIMIT OF THE ZOOM COMMAND IS IGNORED. EVA01720
C IN THE INTERACTIVE MODE THERE ARE NO MASTER PLOTS AND ONLY ZOOM EVA01730
C COMMANDS ARE EXECUTED. ZOOM COMMANDS MUST BE INPUT IN THE ORDER EVA01740
C THAT THEY ARE TO BE EXECUTED AND THE END OF A RUN IS INDICATED BY EVA01750
C THE END OF THE LIST OF ZOOM COMMANDS (I.E., A ZOOM COMMAND WITH A EVA01760
C LOWER ZA LIMIT OF ZERO). AFTER READING A ZOOM COMMAND THE PROGRAM EVA01770

C WILL SEARCH TO FIND THE REQUESTED ZA, IMMEDIATELY GENERATE THE EVA01780
 C REQUESTED ZOOM PLOT AND THEN PAUSE. WHEN THE PROGRAM PROCEEDS FROM EVA01790
 C THE PAUSE IT WILL TRY TO READ THE NEXT ZOOM COMMAND. HOW TO PAUSE EVA01800
 C IF MACHINE DEPENDENT AND A STANDARD INTERFACE HAS BEEN BUILT FOR EVA01810
 C THIS PROGRAM. IN THE INTERACTIVE MODE, AFTER GENERATING A PLOT EVA01820
 C THIS PROGRAM WILL CALL SUBROUTINE WAITER AS DISTRIBUTED WITH THIS EVA01830
 C PROGRAM SUBROUTINE WAITER WILL MERELY IMMEDIATELY RETURN. IF THE EVA01840
 C USER WISHES TO REALLY IMPLEMENT THE INTERACTIVE MODE OF THIS EVA01850
 C PROGRAM INSERT THE CODING IN SUBROUTINE WAITER TO PAUSE WHEN EVA01860
 C SUBROUTINE WAITER IS CALLED. EVA01870
 C EVA01880

C INPUT FILES
 C -----
 C UNIT DESCRIPTION EVA01890
 C ----- EVA01900

C 5 INPUT CARDS (BCD - 80 CHARACTERS/RECORD) EVA01910
 C 20 ENDF/B DATA (BCD - 80 CHARACTERS/RECORD) EVA01920
 C EVA01930
 C EVA01940
 C EVA01950

C OUTPUT FILES
 C -----
 C UNIT DESCRIPTION EVA01960
 C ----- EVA01970

C 6 OUTPUT REPORT (BCD - 120 CHARACTERS/RECORD) EVA01980
 C 10 PLOTTING TAPE EVA01990
 C EVA02000
 C EVA02010
 C EVA02020

C SCRATCH FILES
 C -----
 C UNIT DESCRIPTION EVA02030
 C ----- EVA02040

C 30 SCRATCH FILE (BINARY -2004 WORDS/RECORD) EVA02050
 C EVA02060
 C EVA02070
 C EVA02080
 C EVA02090

C INPUT CARDS
 C -----
 C CARD COLS. FORMAT DESCRIPTION EVA02100
 C ----- EVA02110

CARD	COLS.	FORMAT	DESCRIPTION	EVA
1	1- 5	I5	NO LONGER USED	EVA02120
	6-10	I5	PLOT FILE 3 (0=NO, 1=YES)	EVA02130
	11-15	I5	PLOT FILE 4 (0=NO, 1=YES)	EVA02140
	16-20	I5	PLOT FILE 5 (0=NO, 1=YES)	EVA02150
	21-25	I5	ZA ORDERED DATA (0=NO, 1=YES)	EVA02160
	26-30	I5	MASTER LOWER ZA LIMIT FOR PLOTS	EVA02170
	31-35	I5	MASTER UPPER ZA LIMIT FOR PLOTS	EVA02180
	36-40	I5	FLAG FOR TEMPERATURE IN PLOTS	EVA02190
			= 0 - TEMPERATURE ON PLOTS	EVA02200
			= 1 - NO TEMPERATURE ON PLOTS	EVA02210
41-45	I5		= 0 - ANY REACTION WHOSE MAXIMUM CROSS IS LESS THAN 1 MILLIBARN WILL BE IGNORED.	EVA02220
			= 1 - ALL REACTIONS WILL BE PLOTTED REGARDLESS OF THE MAGNITUDE OF THE CROSS SECTION.	EVA02230
46-55	E10.3		X LENGTH OF PLOT.	EVA02240
			= 0.0 - STANDARD 10.24 INCHES USED.	EVA02250
			= .GT. 0.0 - USED AS X LENGTH OF PLOT.	EVA02260
56-65	E10.3		Y LENGTH OF PLOT.	EVA02270
			= 0.0 - STANDARD 10.24 INCHES USED.	EVA02280
			= .GT. 0.0 - USED AS Y LENGTH OF PLOT.	EVA02290
			NORMALLY EACH PLOT IS PLOTTED WITHIN	EVA02300
			IN A SQUARE AREA THAT IS 10.24 BY	EVA02310
				EVA02320
				EVA02330
				EVA02340
				EVA02350
				EVA02360

10.24 INCHES. HOWEVER THE ABOVE INPUT
PARAMETERS MAY BE USED TO DEFINE ANY SIZE
FOR THE PLOTS (E.G. TO OBTAIN A DETAILED
PLOT OF A RESONANCE REGION INPUT 100.0 FOR
THE X LENGTH TO OBTAIN A 100.0 BY 10.24
INCH PLOT).

66-70 IS OPERATING MODE
= 0 - BATCH WITH MASTER PLOTS.
= 1 - BATCH WITHOUT MASTER PLOTS.
= 2 - INTERACTIVE WITHOUT MASTER PLOTS.
* BATCH MODE = ALL ZOOM REQUESTS ARE READ AT
THE BEGINNING OF THE PROGRAM AND MAY BE IN
ANY ORDER. EACH MATERIAL WITH A ZA BETWEEN
THE LOW AND HIGH LIMITS (SPECIFIED ON THE
FIRST INPUT CARD) WILL BE PLOTTED.
* WITH MASTER PLOTS = AS EACH NEW MATERIAL IS
READ A MASTER PLOT OF EACH TYPE WILL BE
GENERATED BEFORE GENERATING ANY ZOOMED PLOT
OF THE SAME MATERIAL AND TYPE.
* WITHOUT MASTER PLOTS = ONLY ZOOMED PLOTS
WILL BE GENERATED.
* INTERACTIVE MODE = ZOOM REQUESTS ARE READ
ONE AT A TIME AND MUST BE IN THE SAME ORDER
AS THE MATERIALS ON THE ENDF/R TAPE. THE
LOW ZA LIMIT OF THE ZOOM REQUEST WILL BE USED
TO DEFINE WHICH MATERIAL TO PLOT NEXT. THE
UPPER LIMIT OF THE ZOOM REQUEST AND THE
LOW AND HIGH ZA LIMITS (SPECIFIED ON THE
FIRST INPUT CARD) WILL BE IGNORED.

2-N 1-5 IS ZOOM LOWER ZA LIMIT
6-10 IS ZOOM UPPER ZA LIMIT
11-15 IS DATA CATEGORY (1 TO 6)
1 = TOTAL, ELASTIC, CAPTURE, FISSION
AND TOTAL INELASTIC
2 = TOTAL INELASTIC, DISCRETE LEVELS
AND CONTINUUM
3 = (N,2N), (N,3N), (N,4N), (N,N'X)
4 = (N,CHARGED PARTICLE)
5 = PARTICLE PRODUCTION AND DAMAGE
6 = NU BAR, XI AND GAMMA

16-25 E10.3 ZOOM LOWER ENERGY LIMIT (EV)
26-35 E10.3 ZOOM UPPER ENERGY LIMIT (EV)
36-45 E10.3 ZOOM LOWER CROSS SECTION LIMIT (BARNS)
46-55 E10.3 ZOOM UPPER CROSS SECTION LIMIT (BARNS)
56-60 IS ZOOM PLOT MODE (SEE UCRL50400,VOL. 17,PART E)
0 = MULTIPLE PLOTS - INDIVIDUAL SCALING
1 = MULTIPLE PLOTS - COMMON SCALING
2 = SINGLE PLOT

CROSS SECTION LIMITS OF ZOOMED PLOTS MAY BE USED TO SELECT ANY
RANGE OF CROSS SECTION REQUIRED. IF NOT SUPPLIED (I.E. LOWER =
UPPER = 0.0) ZOOMED PLOTS WILL BE AUTOMATICALLY SCALED IN CROSS
SECTION SO THAT THE PLOT CONTAINS THE ENTIRE CROSS SECTION
RANGE OVER THE ENERGY RANGE OF INTEREST.

THE MASTER ZA LIMITS ARE USED TO DEFINE WHICH ZA VALUES TO SELECT
FOR PLOTTING. OF THOSE ZA VALUES SELECTED FOR PLOTTING THE ZOOM ZA
LIMITS SPECIFY WHICH ZA VALUES TO PLOT ON AN EXPANDED ENERGY SCALE

PAGE 0006

C THE ZA ORDERED DATA FLAG ON CARD 1, COLS. 21-25 IS MERELY USED TO EVA02960
 C MINIMIZE RUNNING TIME BY ALLOWING THE PROGRAM TO TERMINATE ONCE ITEVA02970
 C HAS PLOTTED ALL REQUESTED DATA, WITHOUT SEARCHING THE REMAINDER OFEVA02980
 C THE ENDF/B FORMAT FILE. ONCE A ZA LARGER THAN THE MASTER UPPER ZA EVA02990
 C LIMIT IS FOUND, IF THE ZA ORDERED DATA FLAG IS ON THE PROGRAM CAN EVA03000
 C IMMEDIATELY TERMINATE. EVA03010
 C EVA03020
 C EXAMPLE INPUT EVA03030
 C EVA03040
 C PLOT ALL THORIUM AND URANIUM ISOTOPES FROM A ZA ORDERED FILE. EVA03050
 C TO PRODUCE ZOOMED PLOTS OF CATEGORY 1 DATA (TOTAL, ELASTIC, CAPTURE, EVA03060
 C FISSION AND TOTAL INELASTIC DATA) FOR THORIUM-232 FROM 10 EV TO EVA03070
 C 1 KEV AND FOR URANIUM-238 FROM 100 KEV TO 20 MEV THE FOLLOW INPUT EVA03080
 C IS REQUIRED... EVA03090
 C EVA03100
 C 0 1 1 1 19000092999 0 EVA03110
 C 9023290232 1 1.0000+01 1.0000+03 1 EVA03120
 C 9223892238 1 1.0000+05 2.0000+07 3 EVA03130
 C EVA03140
 C SEE UCRL-50400, VOL. 17, PART E FOR EXAMPLE OUTPUT PLOTS THAT EVA03150
 C CORRESPOND TO THE ABOVE INPUT PARAMETERS. EVA03160
 C EVA03170
 C ***** MACHINE DEPENDENT CODING ***** EVA03180
 C EVA03190
 C SCRATCH I/O EVA03200
 C EVA03210
 C THERE IS MACHINE DEPENDENT CODING IN THIS PROGRAM IN EVA03220
 C SUBROUTINES WIK AND RIK, WHICH CONTROL I/O TO THE SCRATCH EVA03230
 C FILE. AS DISTRIBUTED THIS PROGRAM WILL PERFORM NORMAL FORTRAN EVA03240
 C BINARY I/O AND NEED NOT BE MODIFIED FOR USE ON ANY COMPUTER. EVA03250
 C HOWEVER IF YOU WISH TO OPTIMIZE THIS PROGRAM FOR USE AT YOUR EVA03260
 C INSTALLATION YOU MAY REPLACE THESE TWO ROUTINES WITH THE EVA03270
 C MOST EFFICIENT TYPE OF I/O FOR YOUR COMPUTER. EQUIVALENT EVA03280
 C CODING IS PROVIDED TO USE BUFFERED I/O ON THE LIVERMORE CDC-7600 EVA03290
 C OR CRAY-1. EVA03300
 C EVA03310
 C CHARACTER PLOTTING EVA03320
 C EVA03330
 C THE ONLY MACHINE DEPENDENT PORTION OF THE GRAPHICS INTERFACE IS EVA03340
 C INVOLVED WITH PLOTTING STRINGS OF CHARACTERS. ALL CHARACTERS ARE EVA03350
 C STORED IN THIS PROGRAM FOUR PER WORD. ALL PLOTTING OF CHARACTER EVA03360
 C STRINGS IS PERFORMED WITH SUBROUTINE SYMBL4, WHICH ASSUMES FOUR EVA03370
 C CHARACTERS PER WORD AND PASSES THE CHARACTER STRINGS ON TO THE EVA03380
 C NORMAL CALCOMP-LIKE CHARACTER PLOTTING SUBROUTINE SYMBOL. FOR USE EVA03390
 C ON COMPUTERS WITH MORE THAN FOUR CHARACTERS PER WORD SUBROUTINE EVA03400
 C SYMBL4 CONTAINS CODING TO PLOT ONE WORD OF CHARACTERS AT A TIME, EVA03410
 C ADVANCING IN THE X OR Y DIRECTION (AS APPROPRIATE) BETWEEN WORDS. EVA03420
 C BY ACTIVATING THIS CODING THIS PROGRAM MAY BE USED ON MACHINES EVA03430
 C WITH MORE THAN FOUR CHARACTERS PER WORD. EVA03440
 C EVA03450
 C PAUSE BETWEEN PLOTS EVA03460
 C EVA03470
 C AFTER GENERATING A PLOT THIS PROGRAM WILL CALL SUBROUTINE WAITER EVA03480
 C BEFORE PROCEEDING TO THE NEXT PLOT. AS DISTRIBUTED IN THIS PROGRAM EVA03490
 C SUBROUTINE WAITER WILL MERELY IMMEDIATELY RETURN. IF THE USER EVA03500
 C WISHES TO IMPLEMENT THE INTERACTIVE MODE OF THIS PROGRAM INSERT EVA03510
 C CODING IN SUBROUTINE WAITER TO PAUSE WHEN SUBROUTINE WAITER IS EVA03520
 C CALLED. EVA03530
 C EVA03540

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C***** MACHINE DEPENDENT CODING ***** PAGE 0007
C***** PLOTTER INTERFACE ***** EVA03550
C EVA03560
C EVA03570
C THIS PROGRAM USES A CALCOMP-LINE PLOTTER INTERFACE CONSISTING OF EVA03580
C ONLY FOUR SUBROUTINES WHICH ARE DEFINED AS FOLLOWS... EVA03590
C EVA03600
C PLOTS(BUF,NEUF,NTAPE) - INITIALIZE PLOTTER, DEFINE BUFFER FOR EVA03610
C PLOTTER (BUF), SIZE OF BUFFER IN WORDS EVA03620
C (NEUF) AND UNIT NUMBER OF PLOTTING TAPE EVA03630
C (NTAPE). THIS ROUTINE IS ONLY CALLED EVA03640
C CALLED ONCE WITH PLOTS(BUF,1000,10). EVA03650
C PLOT(X,Y,IPEN) - MOVE PEN FROM CURRENT POSITION TO THE EVA03660
C COORDINATES (X,Y) OR TERMINATE PLOTTING EVA03670
C DEPENDING ON THE VALUE OF IPEN.. EVA03680
C = 2 - MOVE AND DRAW LINE (BEAM ON) EVA03690
C = 3 - MOVE ONLY (BEAM OFF) EVA03700
C = -3 - ADVANCE TO NEXT FRAME EVA03710
C = 999 - TERMINATE PLOTTING EVA03720
C SYMBOL(X,Y,H,BCD,A,NBCD) - PLOT CHARACTERS STARTING AT THE EVA03730
C COORDINATES (X,Y) AND MOVING AT AN EVA03740
C ANGLE (A) WITH RESPECT TO THE POSITIVE EVA03750
C X AXIS (IN THIS CODE A= 0.0 OR 90.0). EVA03760
C THE CHARACTERS ARE STORED IN (BCD) AND EVA03770
C (NBCD) DEFINES THE NUMBER OF CHARACTERSEVA03780
C TO PLOT. EACH CHARACTER WILL BE (H) IN EVA03790
C HEIGHT. EVA03800
C NUMBER(X,Y,H,Z,A,NZ) - PLOT A FLOATING POINT NUMBER STARTING EVA03810
C AT THE COORDINATES (X,Y) AND MOVING AT EVA03820
C AN ANGLE (A) WITH RESPECT TO THE EVA03830
C POSITIVE X AXIS (IN THIS CODE A=0.0 OR EVA03840
C 90.0). THE NUMBER IS (Z) AND (NZ) IS EVA03850
C THE NUMBER OF DECIMAL DIGITS TO PLOT EVA03860
C AFTER THE DECIMAL POINT ( 0=END NUMBER EVA03870
C WITH DECIMAL POINT, -1=WRITE NUMBER AS EVA03880
C AN INTEGER WITH NO FOLLOWING DECIMAL EVA03890
C POINT). EACH CHARACTER WILL BE (H) IN EVA03900
C HEIGHT. EVA03910
C EVA03920
C IN ADDITION THE PLOTTER INTERFACE USING THE FOLLOWING CONVENTIONS. EVA03930
C EVA03940
C PLOTTING AREA EVA03950
C EVA03960
C THE DEFAULT PLOTTING AREA ASSUMED BY THIS PROGRAM IS A SQUARE EVA03970
C 10.24 BY 10.24 INCHES AND IS COMPOSED A SET OF 1024 BY 1024 EVA03980
C RASTER POINTS (RASTER POINT SPACING IS 0.01 INCHES IN X OR Y). EVA03990
C THIS PLOTTING AREA IS DEFINED BY THE ARRAY (XYEDGE) IN BLOCK DATA EVA04000
C (THE LOWER AND UPPER X LIMITS FOLLOWED BY THE LOWER AND UPPER Y EVA04010
C LIMITS ARE GIVEN). THE RASTER POINT SPACING IS GIVEN BY THE ARRAY EVA04020
C (RASTER) IN BLOCK DATA (THE RASTER POINT SPACING IS GIVEN FOR THE EVA04030
C X AND Y DIRECTIONS). THE PLOTTING AREA MAY BE RE-DEFINED BY THE EVA04040
C USER BY USING INPUT CARDS, BUT THE RASTER SPACING WILL STILL EVA04050
C REMAIN THE SAME (E.G. IF THE USER DEFINES A 20.0 BY 10.0 PLOT THE EVA04060
C PLOTTING AREA WILL LOGICALLY BE COMPOSED BY 2000 BY 1000 RASTER EVA04070
C POINTS). EVA04080
C EVA04090
C CHARACTER SIZE EVA04100
C EVA04110
C THE RATIO OF WIDTH TO HEIGHT OF CHARACTERS OR NUMBERS IS ASSUMED EVA04120
C TO BE 6/7. ALL CHARACTERS WILL BE 14 RASTER POINTS HIGH AND 12 EVA04130

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C RASTER POINTS WIDE. THE HEIGHT AND WIDTH OF CHARACTERS ARE DEFINED EVA04140
C IN UNITS OF RASTER SPACINGS IN BLOCK DATA BY THE ARRAYS. (HEIGHT) EVA04150
C AND (WIDTH). TWO POSSIBLE CHARACTER SIZES ARE DEFINED. BUT IN THIS EVA04160
C VERSION OF THE CODE BOTH ARE THE SAME SIZE. EVA04170
C EVA04180
C ***** PLOTTER INTERFACE ***** EVA04190

PROGRAM MERGER (INPUT, OUTPUT, TAPES=INPUT, TAPE=OUTPUT,
 1 TAPE20, TAPE21, TAPE22, TAPE23, TAPE24, TAPE25, TAPE26,
 2 TAPE27, TAPE28, TAPE29, TAPE30, TAPE31)

PROGRAM MERGER

VERSION 80-1 (JANUARY 1980)
 VERSION 80-2 (DECEMBER 1980)
 VERSION 82-1 (JANUARY 1982)

WRITTEN BY DERMOTT E. CULLEN
 NUCLEAR DATA SECTION
 INTERNATIONAL ATOMIC ENERGY AGENCY
 P.O. BOX 200
 VIENNA, AUSTRIA
 TELEPHONE 23-60-1718

AUTHORS MESSAGE

THE COMMENTS BELOW SHOULD BE CONSIDERED THE LATEST DOCUMENTATION
 FOR THIS PROGRAM INCLUDING ALL RECENT IMPROVEMENTS. PLEASE READ
 ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY THE
 COMMENTS CONCERNING MACHINE DEPENDENT CODING.

AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTER
 INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE
 OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT
 IT WOULD BE APPRECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY
 COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO
 IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF
 THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR
 COMPUTER.

PURPOSE

THIS PROGRAM IS DESIGNED TO SELECTIVELY RETRIEVE DATA OFF OF FROM
 1 TO 10 ENDF/B DATA TAPES AND TO MERGE THE SELECTED DATA INTO A
 SINGLE MAT/MF/MT ORDERED FINAL TAPE.

IN THE DISCUSSION THAT FOLLOWS FOR SIMPLICITY THE ENDF/B
 TERMINOLOGY---ENDF/B TAPE---WILL BE USED. IN FACT THE ACTUAL
 MEDIUM USED MAY BE TAPE, CARD, DISK OR ANY OTHER MEDIUM.

ENDF/B FORMAT

THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS
 OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION
 OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II, III, IV OR V FORMAT).

THE ONLY NUMERICAL DATA THAT THIS PROGRAM READS IS THE ZA FROM THE
 FIRST CARD OF EACH SECTION AND THE MAT/MF/MT FROM EACH CARD.
 SEQUENCE NUMBERS ARE IGNORED ON INPUT AND ALL OTHER FIELDS ARE
 READ AS HOLLERITH. AS SUCH THIS PROGRAM NEED NOT DISTINGUISH
 BETWEEN DIFFERENT VERSIONS OF THE ENDF/B FORMAT.

IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B
 FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS
 ASSUMED THAT THE MAT, MF AND MT ON EACH CARD IS CORRECT. SEQUENCE
 NUMBERS (COLUMNS 76-80) ARE IGNORED ON INPUT, BUT WILL BE
 CORRECTLY OUTPUT ON ALL CARDS.

MER00010
 MER00020
 MER00030
 MER00040
 MER00050
 MER00060
 MER00070
 MER00080
 MER00090
 MER00100
 MER00110
 MER00120
 MER00130
 MER00140
 MER00150
 MER00160
 MER00170
 MER00180
 MER00190
 MER00200
 MER00210
 MER00220
 MER00230
 MER00240
 MER00250
 MER00260
 MER00270
 MER00280
 MER00290
 MER00300
 MER00310
 MER00320
 MER00330
 MER00340
 MER00350
 MER00360
 MER00370
 MER00380
 MER00390
 MER00400
 MER00410
 MER00420
 MER00430
 MER00440
 MER00450
 MER00460
 MER00470
 MER00480
 MER00490
 MER00500
 MER00510
 MER00520
 MER00530
 MER00540
 MER00550
 MER00560
 MER00570
 MER00580
 MER00590

SECTION SIZE

SINCE THIS PROGRAM ONLY READS THE DATA ONE CARD AT A TIME THERE IS NO LIMIT TO THE SIZE OF ANY GIVEN SECTION, E.G. THE TOTAL CROSS SECTION MAY BE DESCRIBED BY 200,000 DATA POINTS.

SELECTION OF DATA

THE USER MAY CHOOSE TO MERGE ALL DATA OR THE USER MAY SPECIFY THAT ONLY CERTAIN DATA SHOULD BE SELECTED. THE DATA TO BE SELECTED IS DEFINED BY SPECIFYING UP TO 100 MAT/MF/MT OR ZA/MF/MT RANGES. EACH RANGE IS DEFINED BY LOWER AND UPPER LIMITS OF MAT/MF/MT OR ZA/MF/MT.

REQUEST LIMITS

IN ORDER TO SIMPLIFY THE INPUT OF SELECTION REQUESTS THE FOLLOWING CONVENTIONS HAVE BEEN INTRODUCED IN ORDER TO DEFINE THE UPPER LIMITS OF REQUESTS IF THEY ARE NOT DEFINED BY INPUT (I.E., IF THEY ARE ZERO).

- (1) MAT OR ZA - IF THE UPPER LIMIT IS ZERO IT IS SET EQUAL TO THE LOWER LIMIT.
- (2) MF OR MT - IF THE UPPER LIMIT IS ZERO IT IS SET EQUAL TO THE MAXIMUM POSSIBLE VALUE, 99 OR 999 RESPECTIVELY.

WITH THESE CONVENTIONS AN ENTIRE EVALUATION MAY BE SELECTED BY MERELY SPECIFYING THE LOWER LIMIT OF MAT OR ZA. THE UPPER MAT OR ZA LIMIT WILL BE SET EQUAL TO THE LOWER LIMIT, THE LOWER LIMITS OF MF/MT WILL BE 0/0 AND THE UPPER LIMITS OF MF/MT WILL BE SET TO 99/999. THIS WILL CAUSE ALL SECTIONS OF A SINGLE EVALUATION TO BE SELECTED.

SATISFYING SELECTION CRITERIA

IN ORDER FOR A SECTION TO MEET THE SELECTION CRITERIA SPECIFIED BY ONE OF THE RETRIEVAL REQUESTS, EACH OF THE THREE FIELDS (MAT/MF/MT OR ZA/MF/MT) MUST INDIVIDUALLY SATISFY THE CORRESPONDING LIMITS OF THE REQUEST. IT IS NOT SUFFICIENT THAT THE MAT OF A SECTION LIE BETWEEN THE MINIMUM AND MAXIMUM MATS OF A REQUEST. THE MF AND MT WILL ALSO BE INDIVIDUALLY COMPARED TO THE MF AND MT LIMITS OF THE REQUEST. FOR EXAMPLE, A SECTION WITH MAT/MF/MT=2500/3/2 DOES NOT SATISFY A REQUEST THAT SPECIFIES A REQUEST USING THE RANGE 2000/3/1 THROUGH 3000/3/1. THIS REQUEST SPECIFIES ALL MATERIALS WITH MAT BETWEEN 2000 AND 3000, BUT ONLY THOSE SECTIONS WITH MF/MT=3/1. SIMILARLY A REQUEST FOR 2000/3/1 THROUGH 3000/99/999 WILL NOT SELECT ANY SECTIONS WITH MF=1 OR 2, SINCE THE REQUEST SPECIFIES ALL MATERIALS WITH MAT BETWEEN 2000 AND 3000, BUT ONLY THOSE SECTIONS WITH MF= 3, OR MORE.

DUPLICATE SECTIONS

IF TWO OR MORE SECTIONS WITH THE SAME MAT/MF/MT ARE FOUND EITHER ON THE SAME OR DIFFERENT TAPES, THE SECTION FROM THE TAPE DEFINED EARLIEST IN THE INPUT CARDS WILL BE COPIED TO THE FINAL TAPE AND ALL OTHER SECTIONS WITH THE SAME MAT/MF/MT WILL BE SKIPPED. THE OUTPUT REPORT WILL INDICATE WHICH SECTIONS WERE COPIED FROM WHICH TAPES, AS WELL AS WHICH SECTIONS ARE DUPLICATE AND WERE SKIPPED.

C
 C REACTION INDEX MER01190
 C MER01200
 C MER01210
 C THIS PROGRAM DOES NOT UPDATE THE REACTION INDEX IN MF=1, MT=451. MER01220
 C FOR EACH MATERIAL THE PROGRAM WILL FOLLOW THE CONVENTIONS MER01230
 C DEFINED ABOVE AND ONLY COPY ONE SECTION MF=1, MT=451 AND SKIP MER01240
 C ALL OTHERS (IF MORE THAN ONE). THIS CONVENTION HAS BEEN ADOPTED MER01250
 C BECAUSE MOST USERS DO NOT REQUIRE A CORRECT REACTION INDEX FOR MER01260
 C THERE APPLICATIONS AND IT WAS NOT CONSIDERED WORTHWHILE TO INCLUDE MER01270
 C THE OVERHEAD OF CONSTRUCTING A CORRECT REACTION INDEX IN THIS MER01280
 C PROGRAM. HOWEVER, IF YOU REQUIRE A REACTION INDEX FOR YOUR MER01290
 C APPLICATION AFTER RUNNING THIS PROGRAM YOU MAY USE PROGRAM MER01300
 C DICTION TO CREATE ONE. MER01310
 C MER01320
 C RETRIEVAL STATISTICS MER01330
 C MER01340
 C THERE WILL ALWAYS BE AN OUTPUT REPORT LISTING INDICATING WHICH MER01350
 C SECTIONS WERE SELECTED, WHICH DUPLICATE SECTIONS WERE SKIPPED, MER01360
 C WHICH TAPE THE SECTION WAS ON, WHICH REQUEST (MAT/MF/MT OR MER01370
 C ZA/MF/MT RANGE) CAUSED THE SECTION TO BE SELECTED AND HOW MANY MER01380
 C CARDS WERE IN THE SECTION. IN ADDITION THE USER MAY OPTIONALLY MER01390
 C OBTAIN A FILE CONTAINING THE SAME INFORMATION. THIS FILE MAY BE MER01400
 C COMBINED WITH OTHER SIMILAR FILES OUTPUT BY THIS PROGRAM IN ORDER MER01410
 C TO ACCUMULATE RETRIEVAL STATISTICS OVER A PERIOD OF TIME. IF MER01420
 C SPECIFIED THIS FILE WILL CONTAIN THE FOLLOWING INFORMATION IN MER01430
 C 617 FORMAT. MER01440
 C MER01450
 C (1) ZA MER01460
 C (2) MAT MER01470
 C (3) MF MER01480
 C (4) MT MER01490
 C (5) NUMBER OF CARDS IN SECTION MER01500
 C (6) REQUEST NUMBER THAT CAUSED SECTION TO BE SELECTED MER01510
 C MER01520
 C INPUT FILES MER01530
 C MER01540
 C UNIT DESCRIPTION MER01550
 C MER01560
 C 5 INPUT CARDS (BCD - 80 CHARACTERS/RECORD) MER01570
 C VARY FROM 1 TO 10 ENDF/B DATA FILES (BCD - 80 CHARACTERS/RECORD) MER01580
 C MER01590
 C OUTPUT FILES MER01600
 C MER01610
 C UNIT DESCRIPTION MER01620
 C MER01630
 C 6 OUTPUT REPORT LISTING (BCD - 120 CHARACTERS/RECORD) MER01640
 C VARY MERGED ENDF/B DATA (BCD - 80 CHARACTERS/RECORD) MER01650
 C VARY RETRIEVAL STATISTICS FILE (BCD - 80 CHARACTERS/RECORD) MER01660
 C MER01670
 C INPUT CARDS MER01680
 C MER01690
 C CARD COLUMNS FORMAT DESCRIPTION MER01700
 C MER01710
 C 1 1-11 I11 MERGED TAPE UNIT NUMBER. MER01720
 C 12-22 I11 PRIMARY RETRIEVAL CRITERIA MER01730
 C = 0 - MAT MER01740
 C = 1 - ZA MER01750
 C 23-33 I11 RETRIEVAL REPORT UNIT NUMBER (OPTIONAL) MER01760
 C =.LE.0 - NOT USED MER01770


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C          (BLANK CARD TERMINATES TAPE LIST)          MER02370
C          1103          4317 (UPPER LIMIT SET TO 1103/99/999)MER02380
C          1106          4317 (UPPER LIMIT SET TO 1106/99/999)MER02390
C          1204          1215          4317 (UPPER LIMIT SET TO 1215/99/999)MER02400
C          1219 1          1219 1          4317 (UPPER LIMIT SET TO 1219/ 1/999)MER02410
C          1219 3          1219 5          4317 (UPPER LIMIT SET TO 1219/ 5/999)MER02420
C          1304 3 1 1304 3 1          4317 (UPPER LIMIT COMPLETELY DEFINED)MER02430
C          (BLANK CARD TERMINATES REQUESTS)MER02440
C          MER02450
C ***** MACHINE DEPENDENT CODING *****          MER02460
C          MER02470
C          THERE SHOULD NOT BE ANY MACHINE DEPENDENT CODING IN THIS PROGRAM. MER02480
C          MER02490
C ***** MACHINE DEPENDENT CODING *****          MER02500
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		PAGE 0001
C	PROGRAM DICTION(TAPE20,TAPE21)	DIC00010
C		DIC00020
C	PROGRAM DICTION	DIC00030
C	VERSION 81-1 (SEPTEMBER 1981)	DIC00040
C	VERSION 82-1 (JANUARY 1982)	DIC00050
C		DIC00060
C	WRITTEN BY DERMOTT E. CULLEN	DIC00070
C	NUCLEAR DATA SECTION	DIC00080
C	INTERNATIONAL ATOMIC ENERGY AGENCY	DIC00090
C	P.O. BOX 200	DIC00100
C	A-1400, VIENNA, AUSTRIA	DIC00110
C	TELEPHONE 23-60-1718	DIC00120
C		DIC00130
C	AUTHORS MESSAGE	DIC00140
C	-----	DIC00150
C	THE COMMENTS BELOW SHOULD BE CONSIDERED THE LATEST DOCUMENTATION	DIC00160
C	FOR THIS PROGRAM INCLUDING ALL RECENT IMPROVEMENTS. PLEASE READ	DIC00170
C	ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY THE	DIC00180
C	COMMENTS CONCERNING MACHINE DEPENDENT CODING.	DIC00190
C		DIC00200
C	AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTER	DIC00210
C	INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE	DIC00220
C	OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT	DIC00230
C	IT WOULD BE APPRECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY	DIC00240
C	COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO	DIC00250
C	IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF	DIC00260
C	THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR	DIC00270
C	COMPUTER.	DIC00280
C		DIC00290
C	PURPOSE	DIC00300
C	-----	DIC00310
C	THIS PROGRAM IS DESIGNED TO CREATE A REACTION INDEX FOR EACH	DIC00320
C	MATERIAL ON AN ENDF/B FORMATTED TAPE AND TO INSERT THIS REACTION	DIC00330
C	INDEX IN FILE 1, SECTION 451 OF EACH MATERIAL.	DIC00340
C		DIC00350
C	IN THE DESCRIPTION THAT FOLLOWS FOR SIMPLICITY THE ENDF/B	DIC00360
C	TERMINOLOGY---ENDF/B TAPE---WILL BE USED. IN FACT THE ACTUAL	DIC00370
C	MEDIUM MAY BE TAPE, CARDS, DISK, OR ANY OTHER MEDIUM.	DIC00380
C		DIC00390
C	ENDF/B FORMAT	DIC00400
C	-----	DIC00410
C	THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS	DIC00420
C	OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION	DIC00430
C	OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II,III, IV OR V FORMAT).	DIC00440
C		DIC00450
C	THIS PROGRAM WILL AUTOMATICALLY DETERMINE WHICH VERSION OF THE	DIC00460
C	ENDF/B FORMAT EACH MAT IS IN AND WILL THEN PROPERLY REPLACE THE	DIC00470
C	REACTION INDEX FOR EACH MAT. DIFFERENT MATS ON THE SAME TAPE MAY	DIC00480
C	EVEN BE IN DIFFERENT VERSIONS OF THE ENDF/B FORMAT.	DIC00490
C		DIC00500
C	IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B	DIC00510
C	FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS	DIC00520
C	ASSUMED THAT THE MAT, MF AND MT ON EACH CARD IS CORRECT. SEQUENCE	DIC00530
C	NUMBERS (COLUMNS 76-80) NEED NOT BE PRESENT ON INPUT, BUT WILL BE	DIC00540
C	CORRECTLY OUTPUT ON ALL CARDS.	DIC00550
C		DIC00560
C	IN ORDER TO DISTINGUISH BETWEEN DATA IN THE ENDF/B-V AND EARLIER	DIC00570
C	VERSIONS OF THE ENDF/B FORMAT, FOR ALL DATA IN THE ENDF/B-V	DIC00580
C	FORMAT, ON THE SECOND CARD OF SECTION MF=1, MT=451 THE N1 FIELD	DIC00590

C	MUST BE ZERO. IN EARLIER VERSIONS OF THE ENDF/P FORMAT THIS N1	DIC00600
C	DEFINED THE NUMBER OF COMMENT CARDS IN THE SECTION, WHICH IS	DIC00610
C	ALWAYS POSITIVE. THEREFORE BY SIMPLY TESTING THIS N1 FIELD IT	DIC00620
C	IS POSSIBLE TO DISTINGUISH BETWEEN DATA IN THE ENDF/B-U AND	DIC00630
C	EARLIER VERSIONS OF THE ENDF/B FORMAT.	DIC00640
C		DIC00650
C	<u>SECTION SIZE</u>	DIC00660
C	-----	DIC00670
C	SINCE THIS PROGRAM ONLY READS THE DATA ONE CARD AT A TIME THERE	DIC00680
C	IS NO LIMIT TO THE SIZE OF ANY GIVEN SECTION, E.G. THE TOTAL	DIC00690
C	CROSS SECTION MAY BE DESCRIBED BY 200,000 DATA POINTS.	DIC00700
C		DIC00710
C	<u>NUMBER OF SECTIONS PER TAPE</u>	DIC00720
C	-----	DIC00730
C	IT IS ASSUMED THAT THE ENTIRE ENDF/B TAPE CONTAINS 3000 OR FEWER	DIC00740
C	SECTIONS, I.E. 3000 OR FEWER MAT,MF,MT COMBINATIONS. IF THIS LIMIT	DIC00750
C	IS EXCEEDED THIS PROGRAM WILL TERMINATE EXECUTION. IF NEED BE THIS	DIC00760
C	LIMIT CAN EASILY BE CHANGED BY CHANGING THE DIMENSION STATEMENT	DIC00770
C	BELOW AND RE-DEFINING THE VARIABLE MAXIE IN THE BELOW DATA	DIC00780
C	STATEMENT.	DIC00790
C		DIC00800
C	<u>HOLLERITH SECTION</u>	DIC00810
C	-----	DIC00820
C	EACH MAT MUST INITIALLY CONTAIN A SECTION MF=1, MT=451, ALTHOUGH	DIC00830
C	THE SECTION MAY OR MAY NOT INITIALLY CONTAIN A REACTION INDEX. IF	DIC00840
C	ANY MATERIAL DOES NOT CONTAIN A SECTION MF=1, MT=451 THIS PROGRAM	DIC00850
C	WILL TERMINATE EXECUTION. THIS CONVENTION HAS BEEN ADOPTED BECAUSE	DIC00860
C	IT IS IMPOSSIBLE FOR THIS PROGRAM TO DETERMINE WHICH VERSION OF	DIC00870
C	THE ENDF/B FORMAT THE DATA IS CODED IN WITHOUT FIRST READING MF=1,	DIC00880
C	MT=451. THEREFORE WITHOUT AN INITIAL SECTION MF=1, MT=451 THE	DIC00890
C	PROGRAM CANNOT DETERMINE HOW TO PROPERLY OUTPUT MF=1, MT=451.	DIC00900
C		DIC00910
C	<u>PROGRAM OPERATION</u>	DIC00920
C	-----	DIC00930
C	THE ENTIRE ENDF/B TAPE IS FIRST READ AND A DICTIONARY ENTRY IS	DIC00940
C	CREATED FOR EACH SECTION OF THE TAPE. THE ENDF/B TAPE IS THEN	DIC00950
C	REWOUND AND READ A SECOND TIME. DURING THIS SECOND PASS THE	DIC00960
C	DICTIONARY OF EACH MAT IS REPLACED. THIS VERSION OF DICTION	DIC00970
C	DOES NOT USE SCRATCH FILES AND IS MORE EFFICIENT THAN EARLIER	DIC00980
C	VERSIONS OF DICTION.	DIC00990
C		DIC01000
C	<u>INPUT CARDS</u>	DIC01010
C	-----	DIC01020
C	NONE	DIC01030
C		DIC01040
C	<u>INPUT FILES</u>	DIC01050
C	-----	DIC01060
C	<u>UNIT DESCRIPTION</u>	DIC01070
C	-----	DIC01080
C	20 ORIGINAL TAPE OF ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)	DIC01090
C		DIC01100
C	<u>OUTPUT FILES</u>	DIC01110
C	-----	DIC01120
C	<u>UNIT DESCRIPTION</u>	DIC01130
C	-----	DIC01140
C	6 OUTPUT REPORT (BCD - 120 CHARACTERS/RECORD)	DIC01150
C	21 FINAL TAPE OF ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)	DIC01160
C		DIC01170
C		DIC01180

C***** MACHINE DEPENDENT CODING *****

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D
C THERE SHOULD NOT BE ANY MACHINE DEPENDENT CODING IN THIS PROGRAM.
C
C ***** MACHINE DEPENDENT CODING *****

DIC01190
DIC01200
DIC01210
DIC01220

		PAGE 0001
C	PROGRAM CONVERT(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,	CON00010
C	1 TAPE20,TAPE21)	CON00020
C		CON00030
C	PROGRAM CONVERT	CON00040
C	VERSION 75-1 (APRIL 1975)	CON00050
C	VERSION 78-1 (JANUARY 1978)	CON00060
C	VERSION 80-1 (AUGUST 1980) IBM VERSION	CON00070
C	VERSION 80-2 (DECEMBER 1980)	CON00080
C	VERSION 82-1 (JANUARY 1982)	CON00090
C		CON00100
C	WRITTEN BY IERMOTT E. CULLEN	CON00110
C	NUCLEAR DATA SECTION	CON00120
C	INTERNATIONAL ATOMIC ENERGY AGENCY	CON00130
C	P.O. BOX 200	CON00140
C	VIENNA,AUSTRIA	CON00150
C	TELEPHONE 23-60-1718	CON00160
C		CON00170
C	AUTHORS MESSAGE	CON00180
C	-----	CON00190
C	THE COMMENTS BELOW SHOULD BE CONSIDERED THE LATEST DOCUMENTATION	CON00200
C	FOR THIS PROGRAM INCLUDING ALL RECENT IMPROVEMENTS. PLEASE READ	CON00210
C	ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY THE	CON00220
C	COMMENTS CONCERNING MACHINE DEPENDENT CODING.	CON00230
C		CON00240
C	AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTER	CON00250
C	INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE	CON00260
C	OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT	CON00270
C	IT WOULD BE APPRECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY	CON00280
C	COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO	CON00290
C	IMPROVE THIS PROGRAM. IN PARTICULAR IF YOUR FORTRAN COMPILER, OR	CON00300
C	COMPUTER HAS A SET OF REQUIREMENTS THAT ARE DIFFERENT FROM THOSE	CON00310
C	OF CDC, CRAY OR IBM PLEASE NOTIFY THE AUTHOR AND THIS PROGRAM WILL	CON00320
C	BE MODIFIED TO CONSIDER YOUR COMPUTER SEPARATELY. HOWEVER, IN	CON00330
C	ORDER TO PREVENT A PROLIFERATION OF CODING IT IS IMPERATIVE THAT	CON00340
C	YOU IDENTIFY EXACTLY HOW YOUR FORTRAN COMPILER OR COMPUTER DIFFERS	CON00350
C	FROM THOSE ALREADY CONSIDERED BY THIS PROGRAM. HOPEFULLY, IN THIS	CON00360
C	WAY FUTURE VERSIONS OF THIS PROGRAM WILL BE COMPLETELY COMPATIBLE	CON00370
C	FOR USE ON YOUR COMPUTER.	CON00380
C		CON00390
C	PURPOSE	CON00400
C	-----	CON00410
C	THIS PROGRAM IS DESIGNED TO AUTOMATICALLY CONVERT FORTRAN PROGRAMS	CON00420
C	FOR USE ON ANY ONE OF A VARIETY OF COMPUTERS.	CON00430
C		CON00440
C	FORTRAN CODING CONVENTIONS	CON00450
C	-----	CON00460
C	ALL FORTRAN STATEMENTS THAT ARE COMPUTER DEPENDENT AND SHOULD ONLY	CON00470
C	BE USED ON ONE TYPE OF COMPUTER SHOULD BE PRECEDED AND FOLLOWED BY	CON00480
C	A COMMENT CARD THAT SAYS	CON00490
C		CON00500
C	C***** CDC-7600 ***** INDICATING CARDS ONLY FOR USE ON CDC-7600	CON00510
C	C***** CRAY-1 ***** INDICATING CARDS ONLY FOR USE ON CRAY-1	CON00520
C	C***** EXPORT ***** INDICATING STANDARD FORTRAN	CON00530
C		CON00540
C	IN MOST CASES FORTRAN STATEMENTS WILL BE PRESENT FOR ALL THREE	CON00550
C	POSSIBILITIES, ONE WILL BE ACTIVE AND THE OTHER TWO WILL APPEAR	CON00560
C	AS COMMENT CARDS. THIS PROGRAM WILL ALLOW THE USER TO CONVERT	CON00570
C	PROGRAMS BACK AND FORTH BETWEEN ANY OF THESE MACHINES (INSTEAD	CON00580
C	OF DOING THE CHANGES BY HAND). FOR EXAMPLPS OF HDW THIS CONVENTION	CON00590

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C	IS USED SEE THE LISTING OF THIS PROGRAM AND THE COMMENTS BELOW	CON00600
C	ON MACHINE DEPENDENT CODING.	CON00610
C		CON00620
C	OPERATING INSTRUCTIONS	CON00630
C	-----	CON00640
C	THE USER INPUTS A SINGLE WORD, LEFT ADJUSTED, IN COLUMNS 1-8 OF	CON00650
C	THE SINGLE INPUT CARD. THIS SINGLE INPUT CARD MAY CONTAIN ONE OF	CON00660
C	THE FOLLOWING THREE WORDS.	CON00670
C	CDC-7600	CON00680
C	CRAY-1	CON00690
C	EXPORT	CON00700
C		CON00710
C	PROGRAM OPERATION	CON00720
C	-----	CON00730
C	THE PROGRAM WILL THEN SEARCH FOR COMMENT CARDS THAT START WITH C**	CON00740
C	IN COLUMNS 1-3 FOLLOWED BY ANY ONE OF THE THREE KEYWORDS (CDC-7600	CON00750
C	CRAY-1 OR EXPORT). IF THE KEYWORD IS THE SAME AS THE ONE INPUT BY	CON00760
C	THE USER ALL CARDS UP TO THE NEXT CARD WITH C** IN COLUMNS 1-3	CON00770
C	FOLLOWED BY THE SAME KEYWORD WILL BE SET ACTIVE BY SETTING COLUMN	CON00780
C	1 TO BLANK. IF THE KEYWORDS DIFFERS FROM THAT INPUT BY THE USER	CON00790
C	ALL CARDS UP TO THE NEXT CARD WITH C** IN COLUMNS 1-3 FOLLOWED BY	CON00800
C	THE SAME KEYWORD WILL BE SET INACTIVE BY SETTING COLUMN 1 TO C.	CON00810
C	KEYWORDS MAY NOT BE NESTED (I.E., THIS PROGRAM WILL ONLY OPERATE	CON00820
C	PROPERLY IF KEYWORDS APPEAR IN PAIRS. ONCE A CARD IS FOUND THAT	CON00830
C	CONTAINS A KEYWORD, THE NEXT CARD THAT CONTAINS A KEYWORD MUST	CON00840
C	CONTAIN THE SAME KEYWORD).	CON00850
C		CON00860
C	PROGRAM CARD	CON00870
C	-----	CON00880
C	THIS PROGRAM WILL ASSUME THAT THE FORTRAN PROGRAM STARTS WITH A	CON00890
C	PROGRAM CARD AND POSSIBLE CONTINUATIONS OF THE PROGRAM CARD. FOR	CON00900
C	USE ON CDC OR CRAY COMPUTERS THIS PROGRAM WILL AUTOMATICALLY	CON00910
C	ACTIVATE THE PROGRAM CARD AND CONTINUATION CARDS. FOR USE ON OTHER	CON00920
C	COMPUTERS THIS PROGRAM WILL AUTOMATICALLY DE-ACTIVATE THE PROGRAM	CON00930
C	CARD AND CONTINUATION CARDS. THIS CONVENTIONS HAS BEEN INTRODUCED	CON00940
C	BECAUSE SOME CDC COMPILERS CONSIDER IT AN ERROR IF THE FIRST	CON00950
C	CARD IS NOT A PROGRAM CARD. PRECEEDING COMMENT CARDS ARE NOT	CON00960
C	ALLOWED. THEREFORE THE NORMAL CONVENTION, DESCRIBED ABOVE, OF	CON00970
C	USING PRECEDING AND FOLLOWING COMMENT CARDS, CANNOT BE USED AT	CON00980
C	THE BEGINNING OF THE PROGRAM.	CON00990
C		CON01000
C	COMMENT CARDS	CON01010
C	-----	CON01020
C	COMMENT CARDS MAY APPEAR ON CARDS BETWEEN PAIRS OF KEYWORD CARDS	CON01030
C	ONLY IF THE COMMENT CARDS CONTAINS C----- IN COLUMNS 1-6. ANY	CON01040
C	CARD THAT CONTAINS ANYTHING ELSE IN COLUMNS 1-6 MAY BE ACTIVATED	CON01050
C	BY THIS PROGRAM BY SETTING COLUMN 1 BLANK AND CAN LEAD TO ERRORS	CON01060
C	DURING COMPILATION AND/OR EXECUTION.	CON01070
C		CON01080
C	INPUT FILES	CON01090
C	-----	CON01100
C	UNIT DESCRIPTION	CON01110
C	-----	CON01120
C	5 INPUT CARD (BCD - 80 CHARACTERS/RECORD)	CON01130
C	20 ORIGINAL PROGRAM (BCD - 80 CHARACTERS/RECORD)	CON01140
C		CON01150
C	OUTPUT FILES	CON01160
C	-----	CON01170
C	UNIT DESCRIPTION	CON01180

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C	-----		CON01190
C	6	OUTPUT REPORT (BCD - 120 CHARACTERS/RECORD)	CON01200
C	21	RE-FORMATTED PROGRAM (BCD - 80 CHARACTERS/RECORD)	CON01210
C			CON01220
C	INPUT CARDS		CON01230
C	-----		CON01240
C	A SINGLE INPUT CARD IS READ.		CON01250
C			CON01260
C	COLUMNS	FORMAT	DESCRIPTION
C	-----	-----	-----
C	1- 8	2A4	KEYWORD, LEFT ADJUSTED TO START IN COLUMN 1.
C			THE KEYWORD MAY BE ONE OF THE FOLLOWING THREE
C			WORDS.
C			CDC-7600
C			CRAY-1 OR
C			EXPORT
C			CON01340
C			CON01350
C	***** MACHINE DEPENDENT CODING *****		CON01360
C			CON01370
C	THE ONLY MACHINE DEPENDENT CODING IN THIS PROGRAM IS ASSOCIATED		CON01380
C	WITH HOW AN END OF FILE IS SENSED IN FORTRAN ON DIFFERENT		CON01390
C	COMPUTERS. AS DISTRIBUTED THIS PROGRAM CONTAINS THE IBM CONVENTION		CON01400
C	OF ,END= DIRECTLY IN THE READ STATEMENT, AS WELL AS THE CONVENTION		CON01410
C	USED ON THE LIVERMORE CDC-7600 AND CRAY-1. FOR USE WITH ANY OTHER		CON01420
C	COMPUTER MERELY REPLACE THE READS AND TESTS FOR END OF FILE AT		CON01430
C	THE TWO INDICATED POINTS IN THE PROGRAM.		CON01440
C			CON01450
C	***** MACHINE DEPENDENT CODING *****		CON01460

