BNWL-1412
UC-32

USER'S MANUAL
FOR THE 1DX-2DB-3DB-PERT-V
CODEPACKAGE

R. W. Hardie and W. W. Little, Jr.

July 1970

AEC RESEARCH &
DEVELOPMENT REPORT

BNWL-1412

LEGAL NOTICE

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

PACIFIC NORTHWEST LABORATORY

RICHLAND, WASHINGTON

operated by

BATTELLE MEMORIAL INSTITUTE

for the

UNITED STATES ATOMIC ENERGY COMMISSION UNDER CONTRACT AT(45-1)-1830

3 3679 00061 6906

BNWL-1412

UC-32, Mathematics
and Computers

USER'S MANUAL FOR THE
1DX—2DB—3DB—PERT-V CODE
PACKAGE

By

R. W. Hardie(a)

W. W. Little, Jr.(a)

July, 1970

BATTELLE MEMORIAL INSTITUTE
PACIFIC NORTHWEST LABORATORIES
RICHLAND, WASHINGTON 99352

- (a) Now employed by WADCO Corp., a Subsidiary of Westinghouse Electric Corp., under AEC Contract No. AT(45-1)-2170

Printed in the United States of America
Available from
Clearinghouse for Federal Scientific and Technical Information
National Bureau of Standards, U.S. Department of Commerce
Springfield, Virginia 22151
Price: Printed Copy \$3.00; Microfiche \$0.65

USER'S MANUAL FOR THE
1DX—2DB—3DB—PERT-V CODE
PACKAGE

R. W. Hardie and W. W. Little, Jr.

ABSTRACT

The 1DX—2DB—3DB—PERT-V code package is a group of diffusion theory computer programs designed to:

- o Generate resonance shielded cross sections using data in the "Russian" format [1DX],
- o Calculate microscopic and/or macroscopic cross sections averaged over the spectrum in any zone of a one-dimensional calculation [1DX],
- o Compute k_{eff} and perform criticality searches on time absorption, reactor composition, reactor dimensions or buckling using either a flux or an adjoint model in one, two, or three dimensions [1DX, 2DB, 3DB],
- o Compute flux distributions for an arbitrary source in two or three dimensions [2DB, 3DB],
- o Compute material burnup in two or three dimensions using a material shuffling scheme [2DB, 3DB],
- o Compute reactivity coefficient traverses using first order perturbation theory in one or two dimensions [PERT-V],
- o Compute the effective delayed neutron fraction, the neutron generation time, and the $\text{inhour}/\delta k$ conversion factor in one or two dimensions [PERT-V] .

Although each of the above computer programs is a "stand alone" code, each will read and write specified standard interface data files containing groups of similar data (e.g., geometry specifications, mixture specifications,

etc.). Virtually all input data for all of the codes is contained in the standard files. Thus, for example, if one wishes to run a 1DX case to generate cross sections followed by 2DB flux and `adjoint` cases and finally a PERT-V case, the number of input cards is greatly reduced by writing the appropriate standard files to tape.

TABLE OF CONTENTS

ABSTRACT	
I.	INTRODUCTION 1
II.	DESCRIPTION OF STANDARD DATA FILES 2
III.	INPUT INSTRUCTIONS 5
IV.	SAMPLE CASES 15
	REFERENCES 83

USER'S MANUAL FOR THE
1DX—2DB—3DB—PERT-V CODE
PACKAGE

R. W. Hardie and W. W. Little, Jr.

1. INTRODUCTION

The 1DX,⁽¹⁾ 2DB,⁽²⁾ 3DB,⁽³⁾ and PERT-V⁽⁴⁾ codes have been programmed to read and write standard interface files containing groups of similar data. This report describes these data files and their use by the above codes and is intended as a supplement to References 1-4.

Briefly, 1DX is a one-dimensional diffusion theory program designed to compute resonance shielded multi-group cross sections using data in the "Russian" format⁽⁵⁾ and collapsed-group cross sections using flux-weighting over any specified reactor zone. 2DB and 3DB are two- and three-dimensional diffusion theory burnup codes containing a material shuffling scheme. The above codes also perform criticality searches on time absorption, reactor composition, reactor dimensions, and buckling using either a flux or adjoint model. PERT-V is a one- and two-dimensional perturbation code designed to calculate reactivity coefficient traverses, the effective delayed neutron fraction, the neutron generation time, and the inhour/ δk conversion factor. All codes are programmed in FORTRAN-IV for a 65K core and utilize variable dimensioning.

II. DESCRIPTION OF STANDARD DATA FILES

Most of the data files described in this report are nearly the same as the ones specified by the Committee on Computer Code Coordination.⁽⁶⁾ The additional files were defined so that the standard data files encompass virtually all input data for all codes. A brief description of each data file is given in Table 2.1.

TABLE 2.1. *Standard File Contents*

Standard File Name	Contents of Standard File
ADMINSTR.	control card data (e.g., # groups, # space points, etc.)
GRP FLXS	fluxes
GEO DIST	geometry specifications
EXTRA	buckling modifiers and delta search data
MULTIGRP	resonance shielded cross sections
MIX DATA	mixture specifications
COLLAP	group collapsing specifications
RESSHD	resonance self-shielding specifications
INTQUANT	integral quantities
ZONE DENS	material densities by zone
BETEFF	data for β_{eff} calculation
DELTAK	data for reactivity traverse calculations
ACTVTY	data for activity calculations
GRP ADJF	adjoint fluxes
PRTMOD	printmodifiers

Table 2.2 gives the standard files used by each code. The output sequence order is the order in which the standard files are written to tape.

To specify if input data is via cards or standard files and if standard files are to be output, immediately preceding the title card for each case, a series of cards are read in as follows:

```
      READ(5,1)      ((LFILE(I,J),      I=1,4),      J=1,JJJ)
1      FORMAT(6(I3,I3,I3,I3))      .
```

The index J corresponds to the standard file number and JJJ is equal to 10 for 1DX and 2DB, 15 for 3DB and 14 for PERT-V (see Table 2.2). If:

```
LFILE(2,J) = 0, corresponding standard file is from cards
              (ignore LFILE(1,J))
          > 0, read corresponding standard file from unit
              LFILE(2,J), file number LFILE(1,J)

LFILE(4,J) = 0, corresponding standard file is not output
              (ignore LFILE(3,J))
          > 0, write corresponding standard file to unit
              LFILE(4,J), file number LFILE(3,J).
```

Therefore, it is possible to stack all files on a single tape or to put each file on a separate unit.

TABLE 2.2. *Standard Files Used by the Various Codes*

Standard File Number	Standard File Name	1DX		2DB		3DB		PERT-V	
		Input	Output Sequence Order	Input	Output Sequence Order	Input	Output Sequence Order	Input	Output Sequence Order
1	ADMINSTR.	✓*	1	✓	1	J	1	✓	1
2	GRP FLXS	✓	2	✓	2	J	2	✓	-
3	GEO DIST	✓	3	✓	3	J	3	✓	2
4	EXTRA	✓	4	✓	4	J	4	✓	3
5	MULTIGRP	✓	10	✓	-	J		✓	-
6	MIX DATA	✓	6	✓	5	J	5	✓	4
7	COLLAP	✓	8	-	-	-		-	-
8	RESSHD	✓	5	-	-	-		-	-
9	INTQUANT	- ⁺	9	-	7			-	-
10	ZONE DENS	-	7	-	6			-	-
11	BETEFF	-	-	-	-			✓	5
12	DELTAK	-	-	-	-			✓	6
13	ACTVTY	-	-	-	-	✓	6	✓	7
14	GRP ADJF	-	-	-	-		-	✓	-
15	PRTMOD	-	-	-	-	✓	7	-	-

* a "✓" means the file is input

⁺ a "-" means the file is not used

III. INPUT INSTRUCTIONS

The following pages give simplified input instructions for data immediately following the input cards pertaining to the standard files. More detailed input instructions can be found in the write-ups on each code (additional options have been added to the generalized input subroutines REAG2 and REAI2 since the 1DX document was published, so other documents should be used for a discussion of these subroutines). The simplified input sheets also give the name of the corresponding standard file replacing the input cards **i f** the data is from tape.

1DX

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80																																																																															
ID(11) Identification Card																																																																		MAXI Max. Running Time (min)													
AQR Problem Type: - 0, Regular - 1, Adjoint		IGM Eigenvalue Type: - 1, k_{eff} - 2, Absorption k_{eff} - 3, Concentration k_{eff} - 4, Zone Thickness k_{eff} - 5, Buckling k_{eff}		SGE Parametric Eigenvalue Type: - 0, None - 1, k_{eff} - 2, k_{eff}		IGM No. of Energy Groups		NXOM No. of Down-Scattering Terms		ML - N, N Input Materials From Tape - N, N Input Materials From Cards		MDT Flux Guess From Cards: - 0, None - 1, Φ , Φ , X		NPRT Print Option: - 0, Mini - 1, Midi - 2, Maxi		NPUN Flux Punch Option: - 0, None - 1, Φ , Φ , X		NRCE No. of Mixes Used in Generating Resonance Shielded Cross Sections (If NRCE = 0, XS Data is in DTF Format)		NIFF No. of Spectrum Recalculation Iterations (in the Calculation d, e)		MMOL No. of Mix Specifications for Generating Shielded Cross Sections																																																									
GCE Geometry: 0, Plane 1, Cylinder 2, sphere		ISM No. of Space Intervals		IZM Material Zones		MT Total No. of Materials Including Mixes		MOL No. of Mixture Specifications		BOL Left Boundary Condition: - 1, Vacuum - 1, Reflective - 2, Periodic		BOD Right Boundary Condition		NCR No. of Collapsed Groups (If ICR $\geq$ IGM No Group Collapsing)		NKNP No. of Collapsed Down-Scattering Terms (If NKNP = 0, Calculated by Code)		NTR Type Weighting or Collapsed - 0, Normalized - 1, Reciprocal		NFGM No. of Collapsed Materials		IPUN 0, Print Collapsed Cross Section Data - 1, Punch Collapsed Data																																																									
V Initial Eigenvalue Guess		EVM Eigenvalue Modifier		SOS Parametric Eigenvalue		BUCK Buckling (cm ⁻²)		AL Lambda Lower		LAH Lambda Upper																																																																					
EPS Eigenvalue Convergence Criterion		EPSA Parametric Eigenvalue Convergence Criterion		EOD Parameter Oscillation Damper		ORE Over-Relaxation Factor		SOL - N, Normalize - 1's to N Mat - 4, Normalize - 4, Normalize - 4, Normalize																																																																							
IF (MDT) = 1		Flux Guess or First Mesh Point in First Group		Flux Guess for Second Mesh Point in First Group		• • •																NO(1M, 1GM)																																																									
		Spatial Position of First Mesh Boundary (cm)		Spatial Position of Second Mesh Boundary (cm)		• • •																RO(1M, 1)																																																									
		Zone No. or First Mesh Interval		Zone No. for Second Mesh Interval		• • •																MO(1M)																																																									
		Material No. for First Zone		Material No. for Second Zone		• • •																M2(1ZM)																																																									
		Buckling Modifier for First Zone		Buckling Modifier for Second Zone		• • •																GAM(1ZM)																																																									
		Fission Fraction in First Energy Group		Fission Fraction in Second Energy Group		• • •																K7(1GM)																																																									
		Neutron Velocity in First Energy Group		Neutron Velocity in Second Energy Group		• • •																V7(1GM)																																																									

1DX Continued

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
IF MODI > 0	Material Number of Mix 1				Material Number of Mix 1				Material Number of Mix 1				● ● ●				Material Number of Mix 2				● ● ●				0.0M01																																																							
	0				First Material in Mix 1				Second Material in Mix 1				● ● ●				0				● ● ●				1.1M01																																																							
	0				Density of First Material in Mix 1				Density of Second Material in Mix 1				● ● ●				0				● ● ●				1.2M01																																																							
IF D00 = 4	Dimensional Modifier for First Zone				Dimensional Modifier for Second Zone				● ● ●												R31(ZM)																																																											
	No. of Original Groups in First Collapsed Group				No. of Original Groups in Second Collapsed Group				● ● ●												NPN(INCR)																																																											
IF MODI ≤ 00H	Material No. of First Material to be Collapsed				Material No. of Second Material to be Collapsed				● ● ●												NFP(NFGM)																																																											
	Zone No. of Fluxes Used for First Collapsed Material				Zone No. of Fluxes Used for Second Collapsed Material				● ● ●												MZM(NFGM)																																																											
IF MODI > 0	Zone No. of Fluxes Used in $\sigma_{d,e}$ Iteration for First Cross Section Mix				Zone No. of Fluxes Used in $\sigma_{d,e}$ Iteration for Second Cross Section Mix				● ● ●												ZIN(NRCF)																																																											
	Heterogeneity Constant for First Cross Section Mix				Heterogeneity Constant for Second Cross Section Mix				● ● ●												HETC(NRCF)																																																											
	0				Number of First Input Isotope in First Cross Section Mix				Number of Second Input Isotope in First Cross Section Mix				● ● ●				0				● ● ●				J10M01																																																							
IF MODI > 0	0				Temperature of First Input Isotope in First Cross Section Mix				Temperature of Second Input Isotope in First Cross Section Mix				● ● ●				0				● ● ●				ATEM0M01																																																							
	0				Fuel or Moderator (01 = Fuel/Moderator) Designation of First Isotope in First Cross Section Mix				Fuel or Moderator Designation of Second Isotope in First Cross Section Mix				● ● ●				0				● ● ●				MF0M01																																																							
	Lethargy Width for First Energy Group				Lethargy Width for Second Energy Group				● ● ●												U7(IGM)																																																											
IF MODI < 0	Number of First Material in Cross Section File				Number of Second Material in Cross Section File				● ● ●												NUT(MCR)																																																											
	Cross Section Title Card																																																																															
IF MODI > 0	Cross Section Data for Above Material																																																																															
	● ● ● Repeat Above for Each Input Material																																																																															
IF FILEL(S) > 0	ISONME Material Name		AWR Atomic Weight		DCA Decay Constant (days ⁻¹)		TDC Temperature (°K)																																																																									
	Repeat Above Card for Each Material Written to Tape																																																																															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

3NWL-1472

[illegible]

ZEE Continued

IFBUCKY = 0 OR IFBU = 5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80					
	Buckling Modifier for First Zone															Buckling Modifier for Second Zone																									GAM(IZM)																																												
	Fission Fraction in First Group															Fission Fraction in Second Group																									K7(IGM)																																												
	Neutron Velocity in First Group															Neutron Velocity in Second Group																									V7(IGM)																																												
IFMCI = 0	Material Number of Mix 1															Material Number of Mix 1															Material Number of Mix 1										Material Number of Mix 2										10(M01)																																		
	0															First Material in Mix 1															Second Material in Mix 1										0										11(M01)																																		
	0															Density of First Material in Mix 1															Density of Second Material in Mix 1										0										12(M01)																																		
IFIMU = 4	Zone Number for First Radial Interval															Zone Number for Second Radial Interval																									R2(1M)																																												
	Modifier for First Radial Zone															Modifier for Second Radial Zone																									R3(IZ)																																												
	Zone Number for First Axial Interval															Zone Number for Second Axial Interval																									Z2(UM)																																												
	Modifier for First Axial Zone															Modifier for Second Axial Zone																									Z3(UZ)																																												
IFINCON = 0	NCON • 0, End of Problem • N, Take Time Step of Delt and Read Burnup Data for N Isotopes <0, Take Time Step of DELT															NPRT Print Option															NPUN Flux Punch Option															ITEMP1 • 0, No Effect • 1, Output Standard Files Now (Before Taking Time Step of DELT)															DELT 0, Length of Time Step (Days) • 0, End of Problem <0, Shuffle Mixtures																								
	MATINCON1 Material Sequence Number for First Burnable Isotope															NBRINCON1 • 0, No Effect • 1, Fertile Isotope • 2, Fissile Isotope															LDINCON1 • 0, No Decay Source • N, Decay Source from Burnable Isotope N															LCNINCON, 21 • 0, No Capture Source • N, Capture Source from Burnable Isotope N															LFWINCON, 71 • 0, No Fission Product Source • N, Fission Product Source from Burnable Isotope N																								
	• • • (Repeat Above Card for all Burnable Isotopes)																																																																																				
IFBELT = 0	ITEMP • 0, End of Shuffling Data • 1, This Card Contains Shuffling Data															ITEMP1 Mixture Number to be Replaced															ITEMP2 Mixture Number Replacing ITEMP1																																																						
	• • • (Repeat Above Card for all Mixtures to be Shuffled, Then Submit Card With 0 in Column 6 Indicating the End of Shuffling Data)																																																																																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80						

3DB

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
ID(11) Identification Card																																																																			MAXT Max. Running Time (min.)												
AGP Problem Type: • 0, Regular • 1, Adjunct				LGM Eigenvalue Type: • 0, Source (S) • 1, keff • 2, Absorption (A) • 3, Concentration (C) • 4, Zone Thickness (T) • 5, Buckling (B ²)				SGP Parametric Eigenvalue Type: • 0, None • 1, keff • 2, a				LGM Number of Energy Groups				MXCM Number of Downscattering Terms				IHT Position of Transport Cross Section in Cross Section Table				MOZ Flux Guess from Cards: • 0, None • 1, $\phi(x)^*\phi(y)^*\phi(z)$ • 2, $\phi(x,y,z)$ • 3, $\phi(E,x,y,z)$				MOE External Source Same Options as MOZ Plus: • 4, S(x,y,z) from Tape • 5, S(E,x,y,z) from Cards				DOF Maximum Number of Outer Iterations				IOZ Maximum Number of Z Iterations per Group				GOZ Maximum Number of Inner (X-Y) Iterations per Z Iteration				SOM X-Y Inversion Direction: • 0, Code Chooses • 1, Alternate Direction • 2, X • 3, Y																																			
Geometry: • 1, X-Y-Z • 1, R- ϕ -Z • 2, Triangular-Z				Number of Material Zones				Number of Material Layers				Total Number of Materials Including Mixes				MOI Number of Mixture Specifications				MCR • -N, N Input Materials from Tape • -N, N Input Materials from Cards				IM Number of Intervals in the X Direction				JM Number of Intervals in the Y Direction				KM Number of Intervals in the Z Direction				IZ Number of X Zones (0 Option Only)				JZ Number of Y Zones (0 Option Only)				KZ Number of Z Zones (0 Option Only)																																			
Left Boundary Condition: • 0, Vacuum • 1, Reflective				Right Boundary Condition: • 0, vacuum • 1, Reflective				Back Boundary Condition: • 0, Vacuum • 1, Reflective				Front Boundary Condition: • 0, Vacuum • 1, Reflective				BOF Top Boundary Condition: • 0, Vacuum • 1, Reflective				BOB Bottom Boundary Condition: • 0, Vacuum • 1, Reflective				NACT Number of Activity Traverses				NPRI Print Option: • 4, Mini				NPUL Flux Punch Option: • 1, ϕ Punch • 2, $\phi(E,x,y,z)$																																															
EV Initial Eigenvalue Guess				EVM Eigenvalue Modifier				SOB Parametric Eigenvalue				BUCK Buckling (cm ⁻²)				LAL Lambda Lower				LAH Lambda Upper																																																											
EPS Eigenvalue Convergence Criterion				EPSA Parametric Eigenvalue Convergence Criterion				GOS Inner (X-Y) Iteration Convergence Criterion (H 0, 0, Use EPS)				EPSZ Z Iteration Convergence Criterion (H 0, 0, Use EPS)				ORF Over-Relaxation Factor				SOL • -N, Normalize ϕ 's to NMwt • -N, Normalize ϕ 's to Fission Source Rate of N																																																											
Number of First Material in Cross Section File				Number of Second Material in Cross Section File																								NUT(MCR)																																																			
HOLNMCR Material Name				ATWMMCR Atomic Weight				ALAMMMCR Decay Constant (Day ⁻¹)								AAR Miscellaneous Information																																																															
Cross Section Data for Above Material																																																																			CMTL, LGM, MCR												
• • • Repeat Above for Each Input Material																																																																															
Input Flux Guess																																																																															
External Source																																																																															

IF(MOD) = 0 IF(MOD) > 0 IF(MOD) > 0 IF(MOD) > 0

ADMINSTR.

MIX DATA

MULTI SRP

GRP FLKS

3DB Continued

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80				
•	First Point in X Direction(0.0)												Second Point in X Direction												• • •																																				XO(UM+1)																							
•	First Point in Y Direction(0.0)												Second Point in Y Direction												• • •																																				YO(UM+1)																							
•	First Point in Z Direction(0.0)												Second Point in Z Direction												• • •																																				ZO(KM+1)																							
•	Material Layer Number of First XV Plane												Material Layer Number												• • •																																				LYN(KM)																							
•	Zone Number for First Mesh Interval for First Material Layer												Zone Number for Second Mesh Interval for First Material Layer												• • •																																				MO(UM, JM)																							
•	- - ■ Repeat Above Card for All Material Layers																																																MO(UM, JM)																																			
•	Material Number for First Zone												Material Number for Second Zone												• • •																																				M2(I2M)																							
•	Buckling Modifier for First Zone												Buckling Modifier for Second Zone												• • •																																				GAM(I2M)																							
•	Fission Fraction in First Group												Fission Fraction in Second Group												■ ■ ■																																				K7(IQM)																							
•	Neutron Velocity in First Group												Neutron Velocity in Second Group												■ ■ ■																																				V7(IQM)																							
•	Material Number of Mix 1												Material Number of Mix 1												Material Number of Mix 1												• • •												Material Number of Mix 2												■ ■ ■												I0(M0I)											
•	0												First Material in Mix 1												Second Material in Mix 1												• • •												0												■ ■ ■												I1(M0I)											
•	0												Density of First Material in Mix 1												Density of Second Material in Mix 1												• • •												0												■ ■ ■												I2(M0I)											
•	Delta Zone Number for First X Interval												Delta Zone Number for Second X Interval												• • •																																				IX2(IIM)																							
•	Modifier for First X Zone												Modifier for Second X Zone												■ ■ ■																																				X3(I2Z)																							
•	Delta Zone Number for First Y Interval												Delta Zone Number for Second Y Interval												• • •																																				IY2(UM)																							
•	Modifier for First Y Zone												Modifier for Second Y Zone												• • •																																				Y3(UZ)																							
•	Delta Zone Number for First Z Interval												Delta Zone Number for Second Z Interval												• • •																																				IZ2(KM)																							
•	Modifier for First Z Zone												Modifier for Second Z Zone												■ ■ ■																																				Z3(KZ)																							

IF (BUCK) ≠ 0 OR
IF (IOM) = 5

IF (M0I) > 0

IF (IOM) = 4

RED DIST

EXTRA

MULTIGRP

MIX DATA

EXTRA

11

BNWL-1412

12

BNWL-1412

PERT-V

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80																
10(12)																																																																																															
Identification Card																																																																																															
ND Input Flux Format: • 1, 1-0 ϕ 's and ϕ 's • 2, 2-0 ϕ 's and ϕ 's • 3, 1-0 ϕ 's • 4, 2-0 ϕ 's								ML Input Cross Section Format: • -N, Read N Cross Sections from Tape • +N, Read N Cross Sections from Cards								NPRT Print Option: • 1, Mini • 2, Maxi								IGM Number of Energy Groups								IST Number of Downscattering Terms								IHT Position of Transport Cross Section								NDELK Number of Reactivity Coefficient Traverses								NACT Number of Activity Traverses								NIBC Number of Fissionable Materials for β_{eff}								IPG Number of Delayed Neutron Groups in β_{eff} Calculation								IPS Format for Delayed Neutron Spectrum: • 0, One Input Delayed Spectrum • 1, Input Delayed Spectrum for Each Delay Group								NPDEL Plot Option: • 0, No Effect • 1, Plot Reactivity Coefficient Traverses							
IGE Geometry: • 0, Plane or X-Y • 1, Cylinder or R-Z • 2, Sphere or R-O • 3, Triangular								IM Number of Radial Intervals								JM Number of Axial Intervals								IJM Number of Material Zones								MT Total Number of Material Including Mixes								MOI Number of Mixture Specifications								BOL Left Boundary Condition: • 0, Vacuum • 1, Reflective • 2, Periodic								BOE Right Boundary Condition								BOB Top Boundary Condition								BOM Bottom Boundary Condition																							
ZKEFF Value of k_{eff} to be used in the Perturbation Equation--If Zero, the Calculated Value is Used								ELPO • -N, Normalize ϕ 's to N Mw • +N, Normalize ϕ 's to Fission Source Rate of N								VF Volume Factor								BUCK Buckling (cm^{-2})																																																																							
Number of First Material in Cross Section File								Number of Second Material in Cross Section File																																								NUT(IJML)																																															
HOLNML Material Name								ATWML Atomic Weight								AA(10) Miscellaneous Information																																																																															
Cross Section Data for First Material																																																																																															
■ ■ ■ Repeat Above for Each Input Material																																																																																															
Flux for First Mesh Interval in Group 1								Flux for Second Mesh Interval in Group 1																																																NO(IJMJ)																																							
• • Repeat Above Card for Each Group																																																																																															
Adjoint for First Mesh Interval in Group IGM								Adjoint for Second Mesh Interval in Group IGM																																																N1(IJMJ)																																							
■ ■ ■ Repeat Above Card for Each Group																																																																																															
First Radial Point (0,0)								Second Radial Point																																																R1(IM+1)																																							
First Axial Point (0,0)								Second Axial Point																																																Z1(IM+1)																																							
Zone Number for First Mesh Interval								Zone Number for Second Mesh Interval																																																MO(IJMJ)																																							
Material Number for First Zone								Material Number for Second Zone																																																M2(IJMJ)																																							
Buckling Modifier for First Zone								Buckling Modifier for Second Zone																																																GM(IJMJ)																																							
Fission Fraction in First Energy Group								Fission Fraction in Second Energy Group																																																K6(IGM)																																							
Neutron Velocity for First Energy Group								Neutron Velocity for Second Energy Group																																																V7(IGM)																																							

IFML < 0
IFML > 0
IFG > 0
IFND = 1 OR 2
IFND = 2 OR 4
IFBUCK = 0

ADMSTR.
MIX DATA
MULTIGRP
GRP FLXS
GRP ADJF
GEO DIST
EXTRA
MULTIGRP

IV. SAMPLE CASES

This section contains the following sample cases.

1. a 1DX run to generate 2 group collapsed cross sections,
2. a 2DB flux run,
3. a 2DB adjoint run,
4. a 3DE flux run,
5. a PERT-V run using fluxes and adjoint fluxes from 2DB.

For simplicity, all standard files are written to one data tape. The contents of the tape at the end of the runs and the code generating the data files is given in Table 4.1.

TABLE 4.1. *Contents of Data Tape Used for Sample Cases*

File Sequence Order	File Name	Source
1	MULTIGRP	1DX
2	GRP FLXS	2DB (ϕ)
3	GEODIST	2DB (ϕ)
4	MIX DATA	2DB (ϕ)
5	GRP FLXS	2DB (ϕ^+)
6	ACTVTY	3DB

LF	FILE	LF	FILE	ID
				R0
				M0
				M2
				K7
				K7
				K7
				V7
				I0
				I1
				I1
				I2
				I2
				NPN
				NFP
				NFP
				NZN
				ZN
				HETC
				J1
				J1
				ATEM
				MF
				U7


```

LFILE
LFILE
ID

NUT
NUT
R0
Z0
M0
M2
I0
I1
I1
I2
I2

LFILE
LFILE
I0

```


1
2
3
4
5
6
7
8
9
10

DATA NAME
ADMINSTR.
GRP FLXS
GEO DIST
EXTRA
MULTIGRP
MIX DATA
COLLAP
RESSHD
INTEQUANT
ZONEDENS

FILE NUMBER OF
INPUT DATA
0
0
0
0
0
0
0
0
0
0

LOGICAL UNIT NUMBER
OF INPUT DATA
0
0
0
0
0
0
0
0
0
0

FILE NUMBER OF
CLTPUT DATA
0
0
0
0
0
1
0
0
0
0

LOGICAL UNIT NUMBER
OF OUTPUT DATA
0
0
0
0
0
14
0
0
0
0

* * * * 1 D X * * * *

IDX SAMPLE CASE

2

A02	0/1=REGULAR CALCULATION/ADJUNCT CALCULATION	0
I04	EIGENVALUE TYPE (1/2/3/4/5=KEFF/ALPHA/CONCENTRATION/DELTA/BUCKLING)	1
S02	PARAMETRIC EIGENVALUE TYPE (0/1/2=NONE/KEFF/ALPHA)	0
IGM	NUMBER OF ENERGY GROUPS	26
NXCM	NUMBER OF DOWNSCATTERING TERCS	10
ML	NEGATIVE/POSITIVE=NUMBER OF MATERIALS FROM TAPE/CARDS	5
M07	FLUX GUESS FROM CARDS (0/1=NO/YES)	0
KPRT	PRINT OPTION (0/1/2=MINI/MIDI/MAXI)	0
KFUN	FLUX DUMP TO CARDS (0/1=NO/YES)	0
NPCF	NO. OF MIXES USED IN GENERATING XS DATA (IF 0, DATA IS IN DTF FORMAT)	2
NIFF	NUMBER OF ITERATIONS IN CALCULATION OF SIGE	5
NM01	NUMBER OF MIX SPECIF. FOR GENERATING SHIELDED XS	11
IGC	GEOMETRY (0/1/2=PLANE/CYLINDER/SPHERE)	2
IM	NUMBER OF SPACE INTERVALS	30
I2M	NUMBER OF MATERIAL ZONES	2
MT	TOTAL NUMBER OF MATERIALS INCLUDING MIXES	11
M01	NUMBER OF MIXTURE SPECIFICATIONS	11
B01	LEFT BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	1
B02	RIGHT BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	0
NCR	NUMBER OF COLLAPSED GROUPS (IF NCR>IGM, NO EFFECT)	2
NXINP	NUMBER OF COLLAPSED DOWNSCATTERING TERCS (IF 0, CALCULATED BY 1DX)	0
NTR	TYPE WEIGHTING FOR COLLAPSED SIGTR (0/1=NORMALIZED/RECIPROCAL)	0
NFGM	NUMBER OF COLLAPSED MATERIALS	11
IFUN	PUNCH COLLAPSED CROSS SECTIONS (0/1=NO/YES)	0
EV	FIRST EIGENVALUE GUESS	0.0000
EVM	EIGENVALUE MODIFIER	0.0000
S03	PARAMETRIC EIGENVALUE	0.0000
BUCK	BUCKLING (K _{eff} -2)	0.0000
LZL	LAMBDA LOWER	1.0000-03
LUP	LAMBDA UPPER	5.0000-01
EPC	EIGENVALUE CONVERGENCE CRITERION	1.0000-05
EPSA	PARAMETER CONVERGENCE CRITERION	1.0000-04
FCC	PARAMETER OSCILLATION DAMPER	1.0000+00
CRF	OVER-RELAXATION FACTOR	1.3000+00
S01	NEGATIVE/POSITIVE=POWER (MW)/NEUTRON SOURCE RATE	-4.0000+02

LAST 9841

MESH POINTS										
R0	31									
-.00000	.24500+01	.49000+01	.73500+01	.98000+01	.12250+02	.14700+02	.17150+02	.19600+02	.22050+02	
.24500+02	.26950+02	.29400+02	.31850+02	.34300+02	.36750+02	.39200+02	.41650+02	.44100+02	.46550+02	
.49000+02	.52000+02	.55000+02	.58000+02	.61000+02	.64000+02	.67000+02	.70000+02	.73000+02	.76000+02	
.79000+02										

ZONE NUMBERS BY MESH INTERVAL

M0	30									
1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2

MATERIAL NUMBERS BY ZONE

M2	2
10	11

FISSION FRACTIONS

K7	26									
.20000-01	.98000-01	.19000-00	.26800-00	.19600-00	.13500-00	.58000-01	.22000-01	.90000-02	.30000-02	
.10000-02	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
.00000	.00000	.00000	.00000	.00000	.00000					

NEUTRON VELOCITY

V7	26									
.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01
.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01
.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01	.10000+01

MIXTURE SPECIFICATIONS (I0/I1/I2=MIX NUMBER/MAT. NUMBER FOR MIX/MATERIAL DENSITY)

I0	11									
I1	10	10	10	10	10	11	11	11	11	
I1	11									
I1	11									
I0		1	2	3	4	5	0	6	7	8
I2	11									
.00000	.16000-02	.80000-02	.20000-01	.12000-01	.11000-01	.00000	.40000-01	.10000-01	.10000-01	
.50000-02										

NUMBER OF GROUPS PER CRUNCHED GROUP

NR	2
6	18

NUMBERS OF MATERIALS TO BE CRUNCHED

NR	11									
1	2	3	4	5	10	6	7	9	9	
11										

ZONE NUMBERS OF FLUXES USED FOR CRUNCH CALCULATION

NZN	11			
1		1	1	1
2				

ZONE NUMBERS FOR EACH CROSS SECTION MIX

ZN	2
1	2

HETEROGENEITY CONSTANT FOR EACH CROSS SECTION MIX

HETC	2
.10000+01	.10000+01

ISOTOPE NUMBER FOR EACH TERM IN XS MIX VECTOR

IS	11								
0		1	2	3	4	5	0	2	3
5									4

TEMPERATURES FOR EACH TERM IN XS MIX VECTOR

ATEM	11								
.00000	.90000+03	.90000+03	.90000+03	.90000+03	.90000+03	.00000	.80000+03	.80000+03	.80000+03
.80000+03									

FUEL OR MODERATOR DESIGNATION FOR EACH TERM IN XS MIX VECTOR (0/1=FUEL/MODERATOR)

MF	11								
0		0	0	0	1	1	0	0	0
1									1

LETHARGY WIDTHS

U7	26								
.48000-00	.48000-00	.48000-00	.57000-00	.57000-00	.69000-00	.69000-00	.69000-00	.77000-00	.77000-00
.77000-00	.77000-00	.77000-00	.77000-00	.77000-00	.77000-00	.77000-00	.77000-00	.77000-00	.77000-00
.77000-00	.77000-00	.77000-00	.77000-00	.77000-00	.10000+01				

1 CHECK M3PL49 GROUP 1 PRESUMABLY SIGMA(N,2N) = 4.200000-01

2 CHECK M1U238 GROUP 1 PRESUMABLY SIGMA(N,2N) = 8.019999-01

CROSS SECTION DATA FOR THE FOLLOWING ISOTOPES WAS GIVEN IN THE RUSSIAN FORMAT

ISOTOPE NUMBER	ISOTOPE
1	M3PU49
2	M1U238
3	C
4	M2 FE
5	NA

MIXTURE SPECIFICATIONS FOR CALCULATING SHIELDED CROSS SECTIONS

MIXTURE NUMBER	MIX COMMAND	MATERIAL DENSITY	ISOTOPE NUMBER	TEMPERATURE (DEG K)	0/1=FUEL/MOD
10	0	.00000000	0	.00000000	0
10	1	.16000000-02	1	.90000000+03	0
10	2	.79999999-02	2	.90000000+03	0
10	3	.20000000-01	3	.90000000+03	0
10	4	.12000000-01	4	.90000000+03	1
10	5	.11000000-01	5	.90000000+03	1
11	0	.00000000	0	.00000000	0
11	6	.40000000-01	2	.80000000+03	0
11	7	.99999999-02	3	.80000000+03	0
11	8	.99999999-02	4	.80000000+03	1
11	9	.49999999-02	5	.80000000+03	1

CROSS SECTION MIXTURE	ZONE FLUXES FOR XS MIX	ETC. CONST. FOR XS MIX
10	1	.10000000+01
11	2	.10000000+01

MIXTURE SPECIFICATIONS

MIXTURE NUMBER	MIX COMMAND	MATERIAL DENSITY	
1	10	0	.00000000
2	10	1	.16000000-02
3	10	2	.79999999-02
4	10	3	.20000000-01
5	10	4	.12000000-01
6	10	5	.11000000-01
7	11	0	.00000000
8	11	6	.40000000-01
9	11	7	.99999999-02
10	11	8	.99999999-02
11	11	9	.49999999-02

1DX SAMPLE CASE

TIME (MINUTES)	SIGE ITERATIONS	CUTER ITERATIONS	EIGENVALUE SLCFE	EIGENVALUE	LAMBDA
.15	0	0	.00000000	.00000000	.00000000
.16	0	1	.00000000	.92387387-00	.92387385-00
.17	0	2	.00000000	.99298658-00	.10748075+01
.18	0	3	.00000000	.10053174+01	.10124179+01
.19	0	4	.00000000	.10090993+01	.10037619+01
.20	0	5	.00000000	.10102671+01	.10011572+01
.22	0	6	.00000000	.10106127+01	.10003421+01
.23	0	7	.00000000	.10107175+01	.10001037+01
.24	0	8	.00000000	.10107485+01	.10000307+01
.26	0	9	.00000000	.10107578+01	.10000092+01
.28	1	10	.00000000	.10107578+01	.00000000
.29	1	11	.00000000	.10014101+01	.10014101+01
.30	1	12	.00000000	.10029226+01	.10015104+01
.31	1	13	.00000000	.10030583+01	.10001353+01
.32	1	14	.00000000	.10030957+01	.10000374+01
.33	1	15	.00000000	.10031050+01	.10000093+01
.35	2	16	.00000000	.10031050+01	.00000000
.36	2	17	.00000000	.10022217+01	.10022217+01
.37	2	18	.00000000	.10021726+01	.99995094-00
.38	2	19	.00000000	.10021758+01	.10000032+01
.41	3	20	.00000000	.10021758+01	.00000000
.42	3	21	.00000000	.10020321+01	.10020321+01
.43	3	22	.00000000	.10019906+01	.99995856-00
.43	3	23	.00000000	.10019886+01	.99999803-00
.46	4	24	.00000000	.10019886+01	.00000000
.47	4	25	.00000000	.10019259+01	.10019259+01
.48	4	26	.00000000	.10019115+01	.99998561-00
.48	4	27	.00000000	.10019103+01	.99999881-00
.51	5	28	.00000000	.10019103+01	.00000000
.52	5	29	.00000000	.10018718+01	.10018718+01
.53	5	30	.00000000	.10018684+01	.99999660-00

FINAL NEUTRON BALANCE TABLE

GROUP	FISS. SOURCE	FISSIONS	IN-SCATTER	OUT-SCATTER	ABSORPTION	LEFT LEAK.	RIGHT LEAK.	TOTAL LEAKAGE
1	6.764+17	1.268+17	-3.436+10	5.882+17	2.816+16	0.000	1.242+14	1.242+14
2	3.315+18	4.123+17	8.481+16	2.902+18	4.968+17	0.000	4.438+14	4.438+14
3	6.426+18	9.883+17	9.045+17	6.295+18	1.035+18	0.000	7.684+14	7.684+14
4	9.064+18	1.459+18	3.251+18	1.073+19	1.582+18	0.000	9.393+14	9.393+14
5	6.629+18	6.081+17	7.442+18	1.309+19	9.819+17	0.000	3.331+15	3.331+15
6	4.566+18	1.172+18	1.525+19	1.740+19	2.365+18	0.000	5.379+16	5.379+16
7	1.962+18	1.442+18	2.114+19	1.969+19	3.310+18	0.000	1.635+17	1.635+17
8	7.441+17	1.434+18	2.139+19	1.829+19	3.726+18	0.000	1.111+17	1.111+17
9	3.044+17	1.323+18	1.919+19	1.433+19	5.012+18	0.000	1.531+17	1.531+17
10	1.015+17	9.834+17	1.398+19	8.112+18	5.858+18	0.000	1.133+17	1.133+17
11	3.382+16	6.113+17	8.639+18	4.444+18	4.183+18	0.000	4.646+16	4.646+16
12	0.000	3.454+17	4.565+18	2.799+18	1.751+18	0.000	1.496+16	1.496+16
13	0.000	1.541+17	2.825+18	2.098+18	7.239+17	0.000	3.495+15	3.495+15
14	0.000	2.774+17	2.098+18	8.708+17	1.223+18	0.000	4.296+15	4.296+15
15	0.000	1.731+17	8.708+17	2.820+17	5.876+17	0.000	1.151+15	1.151+15
16	0.000	7.610+16	2.820+17	7.782+16	2.037+17	0.000	5.168+14	5.168+14
17	0.000	2.141+16	7.782+16	1.608+16	6.163+16	0.000	1.069+14	1.069+14
18	0.000	5.239+15	1.608+16	2.542+15	1.349+16	0.000	4.636+13	4.636+13
19	0.000	4.688+14	2.542+15	4.227+14	2.113+15	0.000	6.778+12	6.778+12
20	0.000	1.358+14	4.227+14	3.373+13	3.883+14	0.000	7.336+11	7.336+11
21	0.000	4.820+12	3.373+13	2.695+12	3.101+13	0.000	2.375+10	2.375+10
22	0.000	9.368+11	2.695+12	9.294+11	1.753+12	0.000	1.248+10	1.248+10
23	0.000	4.300+11	9.294+11	2.160+11	7.078+11	0.000	5.564+09	5.564+09
24	0.000	9.091+10	2.160+11	2.371+10	1.905+11	0.000	1.794+09	1.794+09
25	0.000	5.573+09	2.371+10	2.655+09	2.069+10	0.000	3.710+08	3.710+08
26	0.000	7.177+07	2.655+09	-1.726+02	2.629+09	0.000	2.568+07	2.568+07
27	3.382+19	1.161+19	1.220+20	1.220+20	3.321+19	0.000	6.114+17	6.114+17

ZONE		RADIUS (CM)	AVG RADIUS (CM)	AREA (CM ²)	VOLUME (CM ³)	TOTAL FLLX (N/CM ² -SEC)	POWER (MW/LITER)	FISSION SOURCE
1	1	-0.00000	1.22500+00	0.00000	6.16008+01	1.22302+16	1.41901+00	1.20485+14
2	1	2.45000+00	3.67500+00	7.54296+01	4.31206+02	1.21725+16	1.41233+00	1.19913+14
3	1	4.90000+00	6.12500+00	3.01718+02	1.17042+03	1.20576+16	1.39904+00	1.18789+14
4	1	7.35000+00	8.57500+00	6.78866+02	2.27923+03	1.18865+16	1.37924+00	1.17107+14
5	1	9.80000+00	1.10250+01	1.20687+03	3.75765+03	1.16607+16	1.35311+00	1.14883+14
6	1	1.22500+01	1.34750+01	1.88574+03	5.60567+03	1.13823+16	1.32087+00	1.12150+14
7	1	1.47000+01	1.59250+01	2.71546+03	7.82330+03	1.10537+16	1.28281+00	1.08917+14
8	1	1.71500+01	1.83750+01	3.69605+03	1.04105+04	1.06778+16	1.23924+00	1.05215+14
9	1	1.96000+01	2.08250+01	4.82749+03	1.33674+04	1.0258 0+16	1.19055+00	1.01080+14
10	1	2.20500+01	2.32750+01	6.10980+03	1.66938+04	9.79801+15	1.13713+00	9.65413+13
11	1	2.45000+01	2.57250+01	7.54296+03	2.03899+04	9.30187+15	1.07943+00	9.16399+13
12	1	2.69500+01	2.81750+01	9.12698+03	2.44555+04	8.77403+15	1.01792+00	8.64140+13
13	1	2.94000+01	3.06250+01	1.08619+04	2.88908+04	8.21919+15	9.53098-01	8.09059+13
14	1	3.18500+01	3.30750+01	1.27476+04	3.36956+04	7.64229+15	8.85465-01	7.51581+13
15	1	3.43000+01	3.55250+01	1.47842+04	3.88701+04	7.04848+15	8.15530-01	6.92133+13
16	1	3.67500+01	3.79750+01	1.69717+04	4.44142+04	6.44307+15	7.43798-01	6.31155+13
17	1	3.92000+01	4.04250+01	1.93100+04	5.03279+04	5.83146+15	6.70758-01	5.69046+13
18	1	4.16500+01	4.28750+01	2.17991+04	5.66111+04	5.21911+15	5.96871-01	5.06199+13
19	1	4.41000+01	4.53250+01	2.44392+04	6.32641+04	4.61143+15	5.22557-01	4.42967+13
20	1	4.65500+01	4.77750+01	2.72301+04	7.02865+04	4.01371+15	4.48171-01	3.79647+13
21	2	4.90000+01	5.05000+01	3.01718+04	9.61704+04	3.04694+15	1.23291-01	1.01517+13
22	2	5.14000+01	5.35000+01	3.39794+04	1.07932+05	2.07054+15	5.34395-02	4.40950+12
23	2	5.38000+01	5.65000+01	3.80132+04	1.20373+05	1.38429+15	2.33282-02	1.92839+12
24	2	5.62000+01	5.95000+01	4.22732+04	1.33492+05	9.12223+14	1.02465-02	8.48323+11
25	2	5.86000+01	6.25000+01	4.67594+04	1.47290+05	5.92934+14	4.52460-03	3.75099+11
26	2	6.10000+01	6.55000+01	5.14718+04	1.61767+05	3.79713+14	2.00713-03	1.66586+11
27	2	6.34000+01	6.85000+01	5.64104+04	1.76922+05	2.38368+14	8.93681-04	7.42471+10
28	2	6.58000+01	7.15000+01	6.15752+04	1.92755+05	1.44473+14	3.98664-04	3.31513+10
29	2	6.82000+01	7.45000+01	6.69661+04	2.09268+05	8.07756+13	1.76962-04	1.47313+10
30	2	7.06000+01	7.75000+01	7.25833+04	2.26458+05	3.50195+13	7.56746-05	6.31583+09
31		7.30000+01		7.84267+04				

1DX SAMPLE CASE

MATERIAL INVENTORY (KILOGRAMS) FOR EACH ZONE

	MATERIAL	ATOMIC WT.	ZONE 1 4.928+02 LITERS	ZONE 2 1.572+03 LITERS
1	M3PU49	239.050	3.129+02	0.000
2	M1U238	238.050	1.558+03	2.486+04
3	C	16.000	2.618+02	4.177+02
4	M2 FE	55.850	5.484+02	1.458+03
5	NA	22.990	2.069+02	3.001+02

ZONE AVERAGED FLUXES

ZONE	FLUX (N/CM2-SEC)	VOLUME (LITERS)
1	6.64621+15	4.92807+02
2	6.66817+14	1.57243+03

COLLAPSED FISSION FRACTIONS AND ZONE AVERAGED FLUXES BY GROUP

GROUP	FISSION FRACT.	ZONE 1	ZONE 2
1	9.67000-01	4.14431+15	3.47261+14
2	1.30000-02	2.50190+15	3.19556+14

COLLAPSED CROSS SECTIONS

GROUP	1		SIGF	SIGA	NLSIGF	SIGTR	GXC	G-1XG	G-2XG	. . .
MAT	1	ZONE	1	.17106+01	.18511+01	.50989+01	.71050+01	.51628+01	.00000	
MAT	2	ZONE	1	.84622-01	.21184-00	.23929-00	.70510+01	.66743+01	.00000	
MAT	3	ZONE	1	.00000	.24348-02	.00000	.29035+01	.27520+01	.00000	
MAT	4	ZONE	1	.00000	.61783-02	.00000	.25577+01	.25042+01	.00000	
MAT	5	ZONE	1	.00000	.76848-03	.00000	.31269+01	.30069+01	.00000	
MAT	10	ZONE	1	.34139-02	.47877-02	.10073-01	.19094-00	.17482-00	.00000	
MAT	6	ZONE	2	.30681-01	.17258-00	.87164-01	.76682+01	.72901+01	.00000	
MAT	7	ZONE	2	.00000	.10229-02	.00000	.32490+01	.30290+01	.00000	
MAT	8	ZONE	2	.00000	.66538-02	.00000	.26643+01	.25858+01	.00000	
MAT	9	ZONE	2	.00000	.79017-03	.00000	.35614+01	.33700+01	.00000	
MAT	11	ZONE	2	.12272-02	.69839-02	.34866-02	.38367-00	.36460-00	.00000	
GROUP	2		SIGF	SIGA	NLSIGF	SIGTR	GXC	G-1XG	G-2XG	. . .
MAT	1	ZONE	1	.20129+01	.27363+01	.57837+01	.13095+02	.10359+02	.91129-01	
MAT	2	ZONE	1	.00000	.51029-00	.00000	.12743+02	.12233+02	.16487-00	
MAT	3	ZONE	1	.00000	.00000	.00000	.34566+01	.34566+01	.14909-00	
MAT	4	ZONE	1	.00000	.17347-01	.00000	.44742+01	.44568+01	.47315-01	
MAT	5	ZONE	1	.00000	.29848-02	.00000	.48735+01	.48706+01	.11929+00	
MAT	10	ZONE	1	.32206-02	.87003-02	.92540-02	.29933-00	.29063-00	.63205-02	
MAT	6	ZONE	2	.00000	.43807-00	.00000	.12506+02	.12068+02	.20546-00	
MAT	7	ZONE	2	.00000	.00000	.00000	.34488+01	.34488+01	.21695-00	
MAT	8	ZONE	2	.00000	.15812-01	.00000	.46541+01	.46383+01	.71842-01	
MAT	9	ZONE	2	.00000	.29315-02	.00000	.52315+01	.52286+01	.19055-00	
MAT	11	ZONE	2	.00000	.17696-01	.00000	.60742-00	.58973-00	.12079-01	

DATA NAME	FILE NUMBER OF INPUT DATA	LOGICAL UNIT NUMBER OF INPUT DATA	FILE NUMBER OF OUTPUT DATA	LOGICAL UNIT NUMBER OF OUTPUT DATA
ADANST, ■	0	0	0	0
GRF FL, S	0	0	2	14
GEO DIST	0	0	3	14
EXTRA	0	0	0	0
MULTIGRF	1	14	0	0
MIX DATA	0	0	4	14
NCT USEC	0	0	0	0
NCT US D	0	0	0	0
INTGUANT	0	0	0	0
ZONEDPRS	0	0	0	0

* * * * 2 D B * * * *

2DB SAMPLE CASE

2

A02	0/1=REGULAR CALCULATION/ADJOINT CALCULATION	0
I04	EIGENVALUE TYPE (0/1/2/3/4/5=SOURCE/KEFF/ALPHA/CONCENTRATION/DELTA/BUCKLING)	1
S02	PARAMETRIC EIGENVALUE TYPE (0/1/2=NONE/KEFF/ALPHA)	0
IGM	NUMBER OF GROUPS	2
NXCM	NUMBER OF DOWNSCATTERING TERMS	1
MCR	NEGATIVE/POSITIVE=NUMBER OF MATERIALS FROM TAPE/CARDS	-9
M07	FLUX GUESS FROM CARDS (0/1/2=NONE/X(R)*Y(Z)/X(R,Z,E))	0
D05	CUTTER ITERATION MAX	100
G07	INNER ITERATION MAX PER GROUP	10
S04	INVERSION DIRECTION (0/1=NO EFFECT/ALTERNATE DIRECTIONS)	0
NPRT	PRINT OPTION (0/1/2=MINI/MIDI/MAXI PRINT)	0
NPUN	FLUX DUMP TO CARDS (0/1=NONE/X(R,Z,E))	0
IGE	GEOMETRY (0/1/2/3=X-Y/R-Z/R-THETA/TRIANGULAR)	1
IM	NUMBER OF RADIAL INTERVALS	20
JM	NUMBER OF AXIAL INTERVALS	20
IZM	NUMBER OF MATERIAL ZONES	2
MT	TOTAL NUMBER OF MATERIALS INCLUDING MIXES	11
M01	NUMBER OF MIXTURE SPECIFICATIONS	11
B01	LEFT BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	1
B02	RIGHT BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	0
B03	TOP BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	0
B04	BOTTOM BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	1
I2	RADIAL ZONES (DELTA-OPTION ONLY)	0
J2	AXIAL ZONES (DELTA-OPTION ONLY)	0
EV	FIRST EIGENVALUE GUESS	0.0000
EVM	EIGENVALUE MODIFIER	0.0000
S03	PARAMETRIC EIGENVALUE	0.0000
BUCK	BUCKLING (CR-2)	0.0000
LAL	LAMBDA LOWER	1.0000-03
LAF	LAMBDA UPPER	5.0000-01
EPS	EIGENVALUE CONVERGENCE CRITERION	1.0000-05
EPFA	PARAMETER CONVERGENCE CRITERION	1.0000-04
C06	INNER ITERATION TEST (IF ZERO, NO TEST)	0.0000
POC	PARAMETER OSCILLATION DAMPER	1.0000+00
ORF	OVER-RELAXATION FACTOR	1.4000+00
CO1	NEGATIVE/POSITIVE=POWER (PAT)/NEUTRON SOURCE RATE	-4.0000+02

NUMBERS FOR CROSS SECTION CAT4 ON TAFE

NUT

9

1

2

3

4

5

8

9

10

CROSS SECTIONS FROM 1EX (STANDARD FILE MULTIGRP)

2 GROUPS

11 ISCTCPES IN FILE

ISCTCPE NUMBER	ISCTCFE NAME	NUMBER Ch FILE	TEVPERATLRE (DEGREES K)
1	PL239	1	9.0000+02
2	U238	2	9.0000+02
3	O	3	9.0000+02
4	FE	4	9.0000+02
5	NA	5	9.0000+02
6	U235	7	8.0000+02
7	C	8	8.0000+02
8	FE	9	8.0000+02
9	NA	10	8.0000+02

[illegible]

2DB SAMPLE CASE

2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2

A
X
T

2CB SAMPLE CASE

[illegible]

AXIAL

RACIAL

T I M E = .000 D A Y S

MIXTURE NUMBER	MIX COMMAND	MATERIAL ATOMIC DENSITY	
1	10	0	.00000000
2	10	1	.16000000-02
3	10	2	.79999999-02
4	10	3	.20000000-01
5	10	4	.12000000-01
6	10	5	.11000000-01
7	11	0	.00000000
8	11	6	.40000000-01
9	11	7	.99999999-02
10	11	8	.99999999-02
11	11	9	.49999999-02

TIME (MINUTES)	OUTER ITERATIONS	IN. IT. PER LOOP	EIGENVALUE SLOPE	EIGENVALUE	LAMBDA
.03	0	0	.00000000	.00000000	.00000000
.06	1	20	.00000000	.61601280-00	.61601280-00
.08	2	20	.00000000	.97481472-00	.15824585+01
.10	3	20	.00000000	.98499789-00	.10104463+01
.12	4	20	.00000000	.99320029-00	.10083273+01
.15	5	20	.00000000	.99685068-00	.10036754+01
.17	6	20	.00000000	.99818140-00	.10013349+01
.19	7	20	.00000000	.99861567-00	.10004351+01
.22	8	20	.00000000	.99876516-00	.10001497+01
.24	9	19	.00000000	.99881490-00	.10000498+01
.25	10	12	.00000000	.99883049-00	.10000156+01
.26	11	6	.00000000	.99883528-00	.10000048+01

2CB SACPLE CASE

MATERIAL INVENTORY (KILCGRAMS) FOR EACH ZONE

MATERIAL	ATOMIC WT.	ZONE 1 .254+03 LITERS	ZONE 2 .983+03 LITERS
1 PU239	239.050	1.616+02	0.000
2 U238	238.050	8.046+02	0.000
3 O	16.000	1.352+02	0.000
4 FE	55.850	2.832+02	0.000
5 NA	22.990	1.068+02	0.000
6 U238	238.050	0.000	1.553+04
7 O	16.000	0.000	2.610+02
8 FE	55.850	0.000	9.111+02
9 NA	22.990	0.000	1.875+02

MATERIAL	ATOMIC WT.	TOTAL
1 PU239	239.050	1.616+02
2 U238	238.050	8.046+02
3 O	16.000	1.352+02
4 FE	55.850	2.832+02
5 NA	22.990	1.068+02
6 U238	238.050	1.553+04
7 O	16.000	2.610+02
8 FE	55.850	9.111+02
9 NA	22.990	1.875+02

	DATA NAME	FILE NUMBER OF INPUT DATA	LOGICAL UNIT NUMBER OF INPUT DATA	FILE NUMBER OF OUTPUT DATA	LOGICAL UNIT NUMBER OF OUTPUT DATA
1	ADMNSTR.	0	0	0	0
2	GRF FLXS	0	0	5	14
3	GEC DIST	3	14	0	0
4	EXTRA	0	0	0	0
5	MULTIGRF	1	14	0	0
6	MIX DATA	4	14	0	0
7	NCT LSEC	0	0	0	0
8	NCT LSEC	0	0	0	0
9	INTGLANT	0	0	0	0
10	ZCNEDELS	0	0	0	0

* * * * 2 D B * * * *

2DB SAMPLE CASE (ADJUCINT)

A02	0/1=REGULAR CALCULATION/ADJUCINT CALCULATION	1
I04	EIGENVALUE TYPE (0/1/2/3/4/5=SOURCE/KEFF/ALPHA/CONCENTRATION/DELTA/BUCKLING)	1
S02	PARAMETRIC EIGENVALUE TYPE (0/1/2=NONE/KEFF/ALPHA)	0
IGM	NUMBER OF GROUPS	2
NXCM	NUMBER OF DOWNSCATTERING TERMS	1
MCR	NEGATIVE/POSITIVE=NUMBER OF MATERIALS FROM TAPE/CARDS	-9
M07	FLUX GUESS FROM CARDS (0/1/2=NONE/X(R)*X(Z)/X(R,Z,F))	0
C05	OUTER ITERATION MAX	100
G07	INNER ITERATION MAX PER GROUP	10
S04	INVERSION DIRECTION (0/1=NO EFFECT/ALTERNATE DIRECTIONS)	0
NFRT	PRINT OPTIC (0/1/2=MINI/MIDI/MAXI PRINT)	0
NPUN	FLUX DUMP TO CARDS (0/1=NONE/X(R,Z,E))	0
IGE	GEOMETRY (0/1/2/3=X-Y/R-Z/R-THETA/TRIANGULAR)	1
IM	NUMBER OF RADIAL INTERVALS	20
JM	NUMBER OF AXIAL INTERVALS	20
IZM	NUMBER OF MATERIAL ZONES	2
MT	TOTAL NUMBER OF MATERIALS INCLUDING MIXES	11
M01	NUMBER OF MIXTURE SPECIFICATIONS	11
B01	LEFT BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	1
B02	RIGHT BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	0
B03	TOP BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	0
B04	BOTTOM BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	1
I2	RADIAL ZONES (DELTA-OPTION ONLY)	0
J2	AXIAL ZONES (DELTA-OPTION ONLY)	0
EV	FIRST EIGENVALUE GUESS	0.0000
EVN	EIGENVALUE MODIFIER	0.0000
S03	PARAMETRIC EIGENVALUE	0.0000
BUCK	BUCKLING (C-2)	0.0000
LAL	LAMDA LOWER	1.0000-03
LAF	LAMDA UPPER	5.0000-01
EPS	EIGENVALUE CONVERGENCE CRITERION	1.0000-05
EPFA	PARAMETER CONVERGENCE CRITERION	1.0000-04
G06	INNER ITERATION TEST (IF ZERO, NO TEST)	0.0000
F02	FORMER OSCILLATION DAMPER	1.0000+00
CRF	CYCLE-RELAXATION FACTOR	1.4000+00
B01	NEGATIVE/POSITIVE=POWER (MW)/NEUTRON SOURCE RATE	-4.0000+02

NUMBERS FOR CROSS SECTION DATA ON TAPE
(DATA IS FROM STANDARD FILE MIX DATA)

NUT 9

1

3

4

5

7

8

9

10

CROSS SECTIONS FROM MIX (STANDARD FILE MULTICRP)

2 GROUPS

11 ISOTOPES IN FILE

ISOTOPE NUMBER	ISOTOPE NAME	NUMBER Ch FILE	TEMPERATURE (DEGREES to
1	PL239	1	9.0000+02
2	U235	2	9.0000+02
3	O	3	9.0000+02
4	FE	4	9.0000+02
5	NA	5	9.0000+02
6	U238	7	8.0000+02
7	O	8	8.0000+02
8	FE	9	8.0000+02
9	NA	10	8.0000+02

2CB SAYPLE CASE (ADCCINT)

2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2

A
X
1
A
L

RADIAL

2CR SAMPLE CASE (ADJCONT)

[illegible]

**A
X**

KADIAL

T I M E = .000 D A Y S

MIXTURE NUMBER		MIX COMMAND	MATERIAL ATOMIC DENSITY
1	10	0	.00000000
2	10	1	.16000000-02
3	10	2	.79999999-02
4	10	3	.20000000-01
5	10	4	.12000000-01
6	10	5	.11000000-01
7	11	0	.00000000
8	11	6	.40000000-01
9	11	7	.99999999-02
10	11	8	.99999999-02
11	11	9	.49999999-02

TIME (MINUTES)	OUTER ITERATIONS	IN. IT. PER LCOP	EIGENVALUE SLOPE	EIGENVALUE	LAMBDA
.25	0	0	.00000000	.00000000	.00000000
.27	1	20	.00000000	.61640272-00	.61640272-00
.30	2	20	.00000000	.97730261-00	.15854936+01
.32	3	20	.00000000	.98485354-00	.10077263+01
.34	4	20	.00000000	.99327840-00	.10085544+01
.37	5	20	.00000000	.99687266-00	.10036186+01
.39	6	20	.00000000	.99818853-00	.10013200+01
.41	7	20	.00000000	.99861863-00	.10004309+01
.44	8	20	.00000000	.99876709-00	.10001487+01
.46	9	18	.00000000	.99881576-00	.10000487+01
.47	10	13	.00000000	.99883144-00	.10000157+01
.49	11	7	.00000000	.99883663-00	.10000052+01

2DB SAMPLE CASE (ADJCONT)

MATERIAL INVENTORY (KILOGRAMS) FOR EACH ZONE

MATERIAL	ATOMIC WT.	ZONE 1 .254+03 LITERS	ZONE 2 .983+03 LITERS
1 PU239	239.050	1.616+02	0.000
2 U238	238.050	8.046+02	0.000
3 O	16.000	1.352+02	0.000
4 FE	55.850	2.832+02	0.000
5 NA	22.990	1.068+02	0.000
6 U238	238.050	0.000	1.553+04
7 O	16.000	0.000	2.610+02
8 FE	55.850	0.000	9.111+02
9 NA	22.990	0.000	1.875+02

MATERIAL	ATOMIC WT.	TOTAL
1 PU239	239.050	1.616+02
2 U238	238.050	8.046+02
3 O	16.000	1.352+02
4 FE	55.850	2.832+02
5 NA	22.990	1.068+02
6 U238	238.050	1.553+04
7 O	16.000	2.610+02
8 FE	55.850	9.111+02
9 NA	22.990	1.875+02

	DATA NAME	FILE NUMBER OF INPUT DATA	LOGICAL UNIT NUMBER OF INPUT DATA	FILE NUMBER OF OUTPUT DATA	LOGICAL UNIT NUMBER OF OUTPUT DATA
1	ADMNSTR.	0	0	0	0
2	GRP FLXS	0	0	0	0
3	GEO DIST	0	0	0	0
4	EXTRA	0	0	0	0
5	MULTIGRP	1	14	0	0
6	PIX DATA	4	14	0	0
7	NOT USED	0	0	0	0
8	NOT USED	0	0	0	0
9	NOT USED	0	0	0	0
10	NOT USED	0	0	0	0
11	NOT USED	0	0	0	0
12	NOT USED	0	0	0	0
13	ACTVTY	0	0	6	14
14	NOT USED	0	0	0	0
15	PRTMCD	0	0	0	0

* * * * 3 D E * * * *

3DB SAMPLE CASE

4

A02	0/1=REGULAR CALCULATION/ADJOINT CALCULATION	0
I04	EIGENVALUE TYPE (0/1/2/3/4/5=SOURCE/KEFF/ALPHA/CONCENTRATION/DELTA/BUCKLING)	1
S02	PARAMETRIC EIGENVALUE TYPE (0/1/2=NONE/KEFF/ALPHA)	0
IGM	NUMBER OF GROUPS	2
NXCM	NUMBER OF DOWNSCATTERING TERMS	1
IHT	POSITION OF SIGMA TRANSPORT IN CROSS SECTION TABLE	4
M07	FLUX GUESS FROM CARDS (0/1/2/3=NONE/PHI(X)*PHI(Y)*PHI(Z)/ PHI(X,Y,Z)/PHI(E,X,Y,Z))	1
M08	EXTERNAL SOURCE GUESS (0/1/2/3/4/5=NONE/SAME AS M07/SAME AS M07/ SAME AS M07/S(X,Y,Z)/S(E,X,Y,Z) FROM TAPE)	0
C05	MAXIMUM NUMBER OF CLTEH ITERATIONS	30
I07	MAXIMUM NUMBER OF Z ITERATIONS PER GROUP	5
607	MAXIMUM NUMBER OF INNER (XY) ITERATIONS PER Z ITERATION	2
504	XY INVERSION DIRECTION (0/1/2/3=CODE CHOOSES/ALTERNATE/X/Y)	0
IGE	GEOMETRY (0/1/2=X-Y-Z/R-THETA-Z/TRIANGULAR-Z)	0
IZM	NUMBER OF MATERIAL ZONES	2
NLAY	NUMBER OF MATERIAL LAYERS	2
MT	TOTAL NUMBER OF MATERIALS INCLUDING MIXES	11
M01	NUMBER OF MIXTURE SPECIFICATIONS	11
MCR	NUMBER OF INPUT CROSS SECTION MATERIALS (NEG/POS=FROM TAPE/CARDS)	-9
IM	NUMBER OF INTERVALS IN THE X DIRECTION	10
JM	NUMBER OF INTERVALS IN THE Y DIRECTION	10
KM	NUMBER OF INTERVALS IN THE Z DIRECTION	10
I2	NUMBER OF ZONES IN THE X DIRECTION (DELTA OPTION ONLY)	0
J2	NUMBER OF ZONES IN THE Y DIRECTION (DELTA OPTION ONLY)	0
K2	NUMBER OF ZONES IN THE Z DIRECTION (DELTA OPTION ONLY)	0
P01	LEFT BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	1
P02	RIGHT BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	0
P03	BACK BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	0
P04	FRONT BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	1
P05	TOP BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	0
P06	BOTTOM BOUNDARY CONDITION (0/1=VACUUM/REFLECTIVE)	1
NACT	NUMBER OF ACTIVITY TRAVERSES	1
NPR1	PRINT CUT (0/1=MINI/MAXI)	0
NFLN	FLUX INPUT TO CARDS (0/1/2=NONE/PHI(X,Y,Z)/PHI(E,X,Y,Z))	0

EV	FIRST EIGENVALUE GUESS	0.0000
EVM	EIGENVALUE MODIFIER	0.0000
S03	PARAMETRIC EIGENVALUE	0.0000
BUCK	BUCKLING (CM-2)	0.0000
LAL	LAMBDA LOWER	0.0000
LAM	LAMBDA UPPER	0.0000
EPS	EIGENVALUE CONVERGENCE CRITERION	1.0000-05
EPSA	PARAMETER CONVERGENCE CRITERION	1.0000-04
G06	INNER (XY) ITERATION CONVERGENCE CRITERION (IF 0, USE EPS)	1.0000-04
LFS2	Z ITERATION CONVERGENCE CRITERION (IF 0, USE EPS)	1.0000-04
CRF	OVER-RELAXATION FACTOR	1.5000+00
501	NEGATIVE/POSITIVE=POWER (MW)/NEUTRON SOURCE RATE	-4.0000+02

LAST 2202

NUMBERS FOR CROSS SECTION DATA ON TAPE
(DATA IS FROM STANDARD FILE MIX DATA)

NUT 9 1 2 3 4 5 7 8 9 10

CROSS SECTIONS FROM 10X (STANDARD FILE MULTICRF)
2 GROUPS 11 ISOTOPIES IN FILE

ISOTOPE NUMBER	ISOTOPE NAME	NUMBER ON FILE	TEMPERATURE (DEGREES K)
1	PL239	1	9.0000+02
2	U238	2	9.0000+02
3	C	3	9.0000+02
4	FE	4	9.0000+02
5	NA	5	9.0000+02
6	U238	7	8.0000+02
7	C	8	8.0000+02
8	FE	9	8.0000+02
9	NA	10	8.0000+02

FLUX GLESS (HF/ZF/HF=X PROFILE/Y PROFILE/Z PROFILE)

RF 10									
.10000+01	.89111-00	.78222-00	.67333-00	.56444-00	.45556-00	.34667-00	.23778-00	.12889-00	.20000-01
ZF 10									
.10000+01	.89111-00	.78222-00	.67333-00	.56444-00	.45556-00	.34667-00	.23778-00	.12889-00	.20000-01
HF 10									
.10000+01	.89111-00	.78222-00	.67333-00	.56444-00	.45556-00	.34667-00	.23778-00	.12889-00	.20000-01

MESH BOUNDARIES (X0/Y0/Z0=X/Y/Z POINTS)

X0	11									
- .00000	.66667+01	.13333+02	.20000+02	.26667+02	.33333+02	.40000+02	.47500+02	.55000+02	.62500+02	
.70000+02										
Y0	11									
- .00000	.66667+01	.13333+02	.20000+02	.26667+02	.33333+02	.40000+02	.47500+02	.55000+02	.62500+02	
.70000+02										
Z0	11									
- .00000	.66667+01	.13333+02	.20000+02	.26667+02	.33333+02	.40000+02	.47500+02	.55000+02	.62500+02	
.70000+02										

LAYER NUMBERS BY XY PLANE

LYN	10									
1	1	1	1	1	1	2	2	2	2	

ZONE NUMBERS BY MESH INTERVAL FOR LAYER 1

M0	100									
1	1	1	1	1	1	2	2	2	2	
1	1	1	1	1	1	2	2	2	2	
1	1	1	1	1	1	2	2	2	2	
1	1	1	1	1	1	2	2	2	2	
1	1	1	1	1	1	2	2	2	2	
1	1	1	1	1	1	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	

ZONE NUMBERS BY MESH INTERVAL FOR LAYER 2

PO	100									
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	
2	2	2	2	2	2	2	2	2	2	

MATERIAL NUMBERS BY ZONE

M2	2	
10	11	

FISSION SPECTRUM

(DATA IS FHCV STANDARD FILE MULTIGRP)

K7	2
.98700-00	.13000-01

NEUTRON VELOCITY

(DATA IS FROM STANDARD FILE MULTIGRP)

V7 2
.31230+10 .30392+00

MIXTURE SPECIFICATIONS (I0/I1/I2=MIX NUMBER/MAT. NUMBER FOR MIX/MATERIAL DENSITY)

(DATA IS FROM STANDARD FILE MIX DATA)

I0	I1										
10		10	10	10	10	10	11	11	11	11	

(DATA IS FROM STANDARD FILE MIX DATA)

I1	I1										
0	1	2	3	4	5	0	6	7	8		

(DATA IS FROM STANDARD FILE MIX DATA)

I2	I1										
.00000	.16000-02	.80000-02	.20000-01	.12000-01	.11000-01	.00000	.40000-01	.10000-01	.10000-01		

(DATA IS FROM STANDARD FILE MIX DATA)

MATERIAL NUMBERS FOR ACTIVITY TRAVERSES

MA 1
2

CROSS SECTION POSITION FOR ACTIVITY TRAVERSES

KX 1
1

REACTION RATE PRINT MODIFIERS BY XY PLANE

KMODR 10
1 0 0

LAYER 1 FOR XY PLANES 1 2 3 4 5 6

ZONE NUMBER BY MESH INTERVAL

2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	2	2	2	2
1	1	1	1	1	1	2	2	2	2
1	1	1	1	1	1	2	2	2	2
1	1	1	1	1	1	2	2	2	2
1	1	1	1	1	1	2	2	2	2
1	1	1	1	1	1	2	2	2	2

Y
A
X
I
S

A AXIS

MATERIAL NUMBER BY MESH INTERVAL

11111111111111111111
11111111111111111111
11111111111111111111
11111111111111111111
10101010101011111111
10101010101011111111
10101010101011111111
10101010101011111111
10101010101011111111
10101010101011111111
10101010101011111111

Y

A
X
I
S

LAYER 2 FOR XY PLANES 7 8 9 10

ZONE NUMBER BY MESH INTERVAL

Y 2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2 2 2

X AXIS

MATERIAL NUMBER BY MES. INTERVAL

[illegible]

T I M E = .000 D A Y S

MIXTURE NUMBER	MIX COMMAND	MATERIAL ATOMIC DENSITY	
1	10	0	.00000000
2	10	1	.16000000-02
3	10	2	.79999999-02
4	10	3	.20000000-01
5	10	4	.12000000-01
6	10	5	.11000000-01
7	11	0	.00000000
8	11	6	.40000000-01
9	11	7	.99999999-02
10	11	8	.99999999-02
11	11	9	.49999999-02

TIME (MINUTES)	OUTER ITERATIONS	Z IT. PER OUT. IT.	IN. IT. PER OUT. IT.	EIGENVALUE SLOPE	EIGENVALUE	LAMBDA
.10		0	0	.00000000	.00000000	.00000000
.30	1	10	200	.00000000	.92599471-00	.92599470-00
.50		10	200	.00000000	.10016856+01	.10817401+01
.70	2	10	200	.00000000	.10054951+01	.10038031+01
.90	4	10	200	.00000000	.10032712+01	.99778819-00
1.10	5	10	200	.00000000	.10025912+01	.99932225-00
1.30	6	10	200	.00000000	.10023277+01	.99973718-00
1.50	7	10	200	.00000000	.10022362+01	.99990866-00
1.70	8	8	160	.00000000	.10022050+01	.99996887-00
1.90	9	2	40	.00000000	.10021960+01	.99999097-00

ACTIVITY 1 MATERIAL 2 CROSS SECTION POSITION 1

K = 1 HEIGHT = .3333+01

	1	2	3	4	5	
1	.5152361+16	.4973367+16	.4621210+16	.4107044+16	.3446122+16	.3333333+01
2	.4973341+16	.4800469+16	.4460366+16	.3963819+16	.3325624+16	.1000000+02
3	.4621145+16	.4460325+16	.4143930+16	.3682018+16	.3088451+16	.1666667+02
4	.4106940+16	.3963738+16	.3681977+16	.3270577+16	.2741953+16	.2333333+02
5	.3446000+16	.3325521+16	.3088383+16	.2741921+16	.2296410+16	.3000000+02
6	.2655385+16	.2562264+16	.2378835+16	.2110402+16	.1764131+16	.3666667+02
7	.1178777+16	.1137237+16	.1055240+16	.9345515+15	.7762157+15	.4375000+02
8	.4292412+15	.4139957+15	.3838303+15	.3392418+15	.2805530+15	.5125000+02
9	.1526442+15	.1471780+15	.1363520+15	.1203534+15	.9945627+14	.5875000+02
10	.4434438+14	.4274679+14	.3958362+14	.3492072+14	.2888630+14	.6625000+02
	6	7	8	9	10	
1	.2655503+16	.1178838+16	.4292673+15	.1526548+15	.4434817+14	.3333333+01
2	.2562386+16	.1137289+16	.4140171+15	.1471865+15	.4274948+14	.1000000+02
3	.2378905+16	.1055275+16	.3838437+15	.1363568+15	.3958451+14	.1666667+02
4	.2110438+16	.9345676+15	.3392466+15	.1203542+15	.3491973+14	.2333333+02
5	.1764138+16	.7762164+15	.2805511+15	.9945414+14	.2888402+14	.3000000+02
6	.1348367+16	.5752657+15	.2076407+15	.7432307+14	.2179542+14	.3666667+02
7	.5752697+15	.2809303+15	.1177702+15	.4578813+14	.1403021+14	.4375000+02
8	.2076449+15	.1177721+15	.5597615+14	.2378567+14	.7686565+13	.5125000+02
9	.7432606+14	.4578997+14	.2378625+14	.1085725+14	.3672761+13	.5875000+02
10	.2179794+14	.1403198+14	.7687440+13	.3673103+13	.1280473+13	.6625000+02

MAXIMUM ACTIVITY = .5152361+16 AT I = 1, J = 1, K = 1

3DB SAMPLE CASE

MATERIAL INVENTORY (KILOGRAMS) FOR EACH ZONE

MATERIAL	ATOMIC WT.	ZONE 1 .640+02 LITERS	ZONE 2 .279+03 LITERS
1 PU239	239.050	4.064+01	0.000
2 U238	238.050	2.024+02	0.000
3 C	12.000	3.400+01	0.000
4 FE	55.850	7.121+01	0.000
5 NA	22.990	2.687+01	0.000
6 U232	238.050	0.000	4.411+03
7 O	16.000	0.000	7.412+01
8 FE	55.850	0.000	2.587+02
9 NA	22.990	0.000	5.325+01

MATERIAL	ATOMIC WT.	TOTAL
1 PU239	239.050	4.064+01
2 U238	238.050	2.024+02
3 C	12.000	3.400+01
4 FE	55.850	7.121+01
5 NA	22.990	2.687+01
6 U232	238.050	4.411+03
7 O	16.000	7.412+01
8 FE	55.850	2.587+02
9 NA	22.990	5.325+01

	DATA NAME	FILE NUMBER OF INPUT DATA	LOGICAL UNIT NUMBER OF INPUT DATA	FILE NUMBER OF OUTPUT DATA	LOGICAL UNIT NUMBER OF OUTPUT DATA
1	ADMNSTR.	0	0	0	0
2	GRP FLXS	2	14	0	0
3	GEC DIST	3	14	0	0
4	EXTRA	0	0	0	0
5	MULTIGRP	1	14	0	0
6	MIX CPTA	4	14	0	0
7	NCT LSEC	0	0	0	0
8	NCT LSEC	0	0	0	0
9	NCT USED	0	0	0	0
10	NCT USED	0	0	0	0
11	BETEFF	0	0	0	0
12	DELTAK	0	0	0	0
13	ACTVTY	6	14	0	0
14	CHP ADLF	5	14	0	0

* * * * P E R T - V * * * *

PERT-V SAMPLE CASE (2-D FLUXES)

2

ND	1/2/3/4=1-D FLUXES/2-D FLUXES/1-D FLUX/2-D FLUX	2
NL	NEGATIVE/POSITIVE=NUMBER OF MATERIALS FROM TAPE/CARDS	-9
NPRT	PRINT OPTION (0/1/2=MINI/MIDI/MAXI)	0
IGM	NUMBER OF ENERGY GROUPS	2
IST	NUMBER OF BOWSCATTERING TERMS	1
IHT	POSITION OF TRANSPORT CROSS SECTION	4
NELK	NUMBER OF REACTIVITY COEFFICIENT CALCULATIONS	2
NACT	NUMBER OF ACTIVITY TRAVERSES	1
NTBC	NUMBER OF MATERIALS FOR BETA EFFECTIVE CALCULATION	3
IFC	NUMBER OF LAYER NEUTRON GROUPS	12
IFS	0/1=ONE DELAYED SPECTRUM/INPUT SPECTRUM FOR EACH GROUP	0
NDEL	0/1=NO/YES PLOT REACTIVITY COEFFICIENTS	0
IGB	GEOMETRY (0/1/2/3=PL/CYL/SPH IF 1-D, X-Y/R-Z/R-THETA/TRIANGULAR IF 2-D)	1
IM	NUMBER OF SPACIAL INTERVALS	20
CM	NUMBER OF AXIAL INTERVALS (=1 FOR 1-D PROBLEMS)	20
IM	NUMBER OF MATERIAL VONLS	2
M1	TOTAL NUMBER OF MATERIALS INCLUDING MIXES	11
M01	NUMBER OF MIXTURE SPECIFICATIONS	11
B01	LEFT BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	1
B02	RIGHT BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	0
B03	TOP BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	0
B04	BOTTOM BOUNDARY CONDITION (0/1/2=VACUUM/REFLECTIVE/PERIODIC)	1
ZKEFF	KEFF FOR PL 1 LOCATION (IF ZERO, USE CALCULATED VALUE)	0.0000
PLPC	NEGATIVE/POSITIVE=POWER (MW)/TOTAL CENTER POINT FLUX	-4.0000+02
VF	VOLUME FACTOR	2.0000+00
BLCK	LOG/LIN (0=-2)	0.0000

LAST = 0811

1 2 3 4 5 7 8 9 10

ISCTCPE NUMBER	ISCTCPE NAME	NUMBER Ch FILE	TEYPERATURE (DEGREES K)
1	PL239	1	9.0000+02
2	U238	2	9.0000+02
3	C	3	9.0000+02
4	FE	4	9.0000+02
5	hA	5	9.0000+02
6	U235	7	8.0000+02
7	C	8	8.0000+02
8	FE	9	8.0000+02
9	NA	10	8.0000+02

[illegible][illegible]

```

MIXTURE SPECIFICATIONS (10/11/12=MIX NUMBER/MAT. NUMBER FOR MIX/MATERIAL DENSITY)
(DATA IS FROM STANDARD FILE MIX DATA)
10
10      1      10      10      10      1
11
(DATA IS FROM STANDARD FILE MIX DATA)

```

	11	11	1	2	3	4	5	6	7	8
(DATA IS FROM STANDARD FILE MIX DATA)	0	9								
	12	11								
.00000	.16000-02	.80000-02	.20000-01	.12000-01	.11000-01	.00000	.40000-01	.10000-01	.10000-01	
.50000-02										

MATERIAL NUMBERS FOR BETA EFFECTIVE CALCULATION

MBET	3	1	2	6

ABSOLUTE NEUTRON YIELD PER DELAYED FISSION FOR ABOVE MATERIALS

BETA	3	1	2	6
.63000-02	.41200-01	.41200-01		

FRACTIONAL YIELDS BY GROUP FOR DELAY MATERIAL 1

AB	12	1	2	3	4	5	6	7	8
.38000-01	.28000-00	.21600-00	.32800-00	.10300+00	.35000-01	.00000	.00000	.00000	.00000
.00000	.00000								

FRACTIONAL YIELDS BY GROUP FOR DELAY MATERIAL 2

AB	12	1	2	3	4	5	6	7	8
.00000	.00000	.00000	.00000	.00000	.00000	.13000-01	.13700-00	.16200-00	.38800-00
.22500-00	.75000-01								

FRACTIONAL YIELDS BY GROUP FOR DELAY MATERIAL 3

AB	12	1	2	3	4	5	6	7	8
.00000	.00000	.00000	.00000	.00000	.00000	.13000-01	.13700-00	.16200-00	.38800-00
.22500-00	.75000-01								

DECAY CONSTANTS(SEC-1)

AL	12	1	2	3	4	5	6	7	8
.12900-01	.31100-01	.13400-00	.33100-00	.12600+01	.32100+01	.13200-01	.32100-01	.13900-00	.35800-00
.14100+01	.40200+01								

DELAYED FISSION SPECTRUM

E7	2
.80000-00	.20000-00

MATERIAL NUMBERS FOR DELTA K/K CALCULATION

CPTCK	2	1

NEG/POS=COLUMN/ROW NUMBERS FOR DELTA K/K CALCULATION

NCR	2	-1
1		

MATERIAL NUMBERS FOR ACTIVITY TRAVERSES

(DATA IS FROM STANDARD FILE ACTVITY)

MA 1
2

CROSS SECTION POSITION FOR ACTIVITY TRAVERSES

(DATA IS FROM STANDARD FILE ACTVITY)

KX 1
1

FERT-V SAMPLE CASE (DB FLUXES)

2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2

A
X
1
A
L

RADIAL

VIXTURE NUMBER		MIX COMMAND	MATERIAL ATOVIC DENSITY
1	10	0	.00000000
2	10	1	.16000000-02
3	10	2	.79999999-02
4	10	3	.20000000-01
5	10	4	.12000000-01
6	10	5	.11000000-01
7	11	0	.00000000
8	11	6	.40000000-01
9	11	7	.99999999-02
10	11	8	.99999999-02
11	11	9	.49999999-02

FERT-V SAMPLE CASE (2DB FLUXES)

MATERIAL INVENTORY (KILOGRAMS) FOR EACH ZONE

MATERIAL	ATOMIC WT.	ZONE 1 .254+03 LITERS	ZONE 2 .983+03 LITERS
1 PU239	239.050	1.616+02	0.000
2 U238	238.050	8.046+02	0.000
3 C	12.000	1.352+02	0.000
4 FE	55.850	2.832+02	0.000
5 NA	22.990	1.068+02	0.000
6 U238	238.050	0.000	1.553+04
7 C	12.000	0.000	2.610+02
8 FE	55.850	0.000	9.111+02
9 NA	22.990	0.000	1.875+02

PERT-V SAMPLE CASE (2DB FLUXES)

2

CENTER POINT FLUX (N/CM2-SEC)	-	-	-	2.43647+16
TOTAL POWER (MWt)	-	-	-	4.00000+02
DENOMINATOR OF FEHT. EQUATION	-	-	-	1.94141+19
SOURCE RATE	-	-	-	3.38841+19
ABSORPTION RATE	-	-	-	3.33117+19
LEAKAGE RATE	-	-	-	6.11815+17
CALCULATED KEFF	-	-	-	9.98837-01

FERT-V SAMPLE CASE (2DB FLUXES)

2

ZONE	ZONE VOLUME	ZONE AV. FLUX	ZONE AV. POWER
1	.254469+03	.128652+17	.148044+01
2	.962532+03	.107576+16	.236875-01

PERT-V SAMPLE CASE (2DB FLUXES)

2

BETA(1) =	6.7649-05
BETA(2) =	4.9846-04
BETA(3) =	3.8453-04
BETA(4) =	5.8392-04
BETA(5) =	1.8336-04
BETA(6) =	6.2308-05
BETA(7) =	2.4452-05
BETA(8) =	2.5769-04
BETA(9) =	3.0471-04
BETA(10) =	7.2980-04
BETA(11) =	4.2321-04
BETA(12) =	1.4107-04
TOTAL BETA =	3.6612-03
CNE INFCUR =	1.1151-05
GENERATION TIME =	1.2505-07

REACTIVITY COEFFICIENTS FOR MATERIAL 1 PL239 ROW 1

	ΔK/F FLR KG	ΔK (KUSIGF)	ΔK (SIGA)	ΔK (SIGTR)	ΔK (SIGIXJ)	ΔK (INTG)	AVG RADII	AVG AXII
1	.5302-02	.8468-02	-.3151-02	.9045-06	-.1712-04	.5302-02	.1731+01	.1538+01
2	.5265-02	.8312-02	-.3092-02	.2145-05	-.1682-04	.5229-02	.5192+01	.1538+01
3	.5017-02	.8007-02	-.2978-02	.4557-05	-.1623-04	.5112-02	.8654+01	.1538+01
4	.4745-02	.7566-02	-.2813-02	.8006-05	-.1538-04	.4951-02	.1212+02	.1538+01
5	.4408-02	.7006-02	-.2604-02	.1230-04	-.1431-04	.4753-02	.1558+02	.1538+01
6	.3998-02	.6350-02	-.2359-02	.1719-04	-.1306-04	.4521-02	.1904+02	.1538+01
7	.3551-02	.5626-02	-.2087-02	.2242-04	-.1170-04	.4264-02	.2250+02	.1538+01
8	.3072-02	.4861-02	-.1801-02	.2768-04	-.1027-04	.3986-02	.2596+02	.1538+01
9	.2600-02	.4086-02	-.1509-02	.3269-04	-.8849-05	.3695-02	.2942+02	.1538+01
10	.2133-02	.3327-02	-.1224-02	.3718-04	-.7481-05	.3398-02	.3288+02	.1538+01
11	.1692-02	.2611-02	-.9538-03	.4088-04	-.6219-05	.3102-02	.3635+02	.1538+01
12	.1292-02	.1961-02	-.7078-03	.4358-04	-.5097-05	.2813-02	.3981+02	.1538+01
13	.9440-03	.1396-02	-.4926-03	.4509-04	-.4130-05	.2536-02	.4327+02	.1538+01
14	.4622-03	.6386-03	-.2033-03	.2962-04	-.2683-05	.2191-02	.4714+02	.1538+01
15	.1632-03	.2158-03	-.6117-04	.9734-05	-.1095-05	.1880-02	.5143+02	.1538+01
16	.5517-04	.7053-04	-.1802-04	.3060-05	-.3937-06	.1620-02	.5571+02	.1538+01
17	.1792-04	.2231-04	-.5212-05	.9459-06	-.1315-06	.1406-02	.6000+02	.1538+01
18	.5509-05	.6703-05	-.1452-05	.2958-06	-.4089-07	.1231-02	.6429+02	.1538+01
19	.1488-05	.1761-05	-.3606-06	.9915-07	-.1106-07	.1087-02	.6857+02	.1538+01
20	.2624-06	.2788-06	-.5570-07	.4120-07	-.1877-08	.9662-03	.7286+02	.1538+01

PERT-V SAMPLE CASE' (2DB FLUXES)

2

REACTIVITY COEFFICIENTS FOR MATERIAL 1 PL239

COLUMN 1

	ΔK/K PER KG	ΔK (NUSIGF)	ΔK (SIGA)	ΔK (SIGTR)	ΔK (SIGIXJ)	ΔK (INTG)	AVG RADII	AVG AXII
1	.5302-02	.8468-02	-.3151-02	.9045-06	-.1712-04	.5302-02	.1731+01	.1538+01
2	.5223-02	.8340-02	-.3103-02	.1967-05	-.1688-04	.5262-02	.1731+01	.4615+01
3	.5068-02	.8089-02	-.3009-02	.4059-05	-.1640-04	.5197-02	.1731+01	.7692+01
4	.4841-02	.7721-02	-.2871-02	.7114-05	-.1570-04	.5108-02	.1731+01	.1077+02
5	.4551-02	.7249-02	-.2694-02	.1104-04	-.1480-04	.4997-02	.1731+01	.1385+02
6	.4205-02	.6687-02	-.2483-02	.1570-04	-.1375-04	.4865-02	.1731+01	.1692+02
7	.3815-02	.6052-02	-.2245-02	.2096-04	-.1258-04	.4715-02	.1731+01	.2000+02
8	.3393-02	.5365-02	-.1987-02	.2665-04	-.1134-04	.4550-02	.1731+01	.2308+02
9	.2953-02	.4647-02	-.1717-02	.3259-04	-.1006-04	.4372-02	.1731+01	.2615+02
10	.2507-02	.3919-02	-.1442-02	.3858-04	-.8808-05	.4186-02	.1731+01	.2923+02
11	.2071-02	.3205-02	-.1171-02	.4442-04	-.7618-05	.3994-02	.1731+01	.3231+02
12	.1657-02	.2527-02	-.9127-03	.4989-04	-.6528-05	.3799-02	.1731+01	.3538+02
13	.1279-02	.1903-02	-.6736-03	.5473-04	-.5558-05	.3605-02	.1731+01	.3846+02
14	.6719-03	.9376-03	-.3006-03	.3873-04	-.3880-05	.3321-02	.1731+01	.4214+02
15	.2527-03	.3369-03	-.9627-04	.1379-04	-.1694-05	.3050-02	.1731+01	.4643+02
16	.9040-04	.1164-03	-.3001-04	.4644-05	-.6459-06	.2810-02	.1731+01	.5071+02
17	.3093-04	.3876-04	-.9135-05	.1526-05	-.2275-06	.2602-02	.1731+01	.5500+02
18	.9978-05	.1222-04	-.2671-05	.5047-06	-.7428-07	.2421-02	.1731+01	.5929+02
19	.2829-05	.3366-05	-.6950-06	.1788-06	-.2109-07	.2263-02	.1731+01	.6357+02
20	.5245-06	.5615-06	-.1129-06	.7967-07	-.3767-08	.2125-02	.1731+01	.6786+02

ACTIVITY 1 MATERIAL 2 CROSS SECTION POSITION 1

1	2	3	4	5
1	.1305850+16	.1293669+16	.1269465+16	.1233565+16
2	.1295847+16	.1283757+16	.1259735+16	.1224106+16
3	.1275912+16	.1264005+16	.1240346+16	.1205256+16
4	.1246188+16	.1234553+16	.1211436+16	.1177149+16
5	.1206884+16	.1195609+16	.1173209+16	.1139984+16
6	.1158271+16	.1147443+16	.1125929+16	.1094020+16
7	.1100679+16	.1090380+16	.1069918+16	.1039569+16
8	.1034483+16	.1024793+16	.1005542+16	.9769870+16
9	.9600900+15	.9510868+15	.9331989+15	.9066653+15
10	.8779283+15	.8696851+15	.8533070+15	.8290116+15
11	.7884191+15	.7810068+15	.7662789+15	.7444297+15
12	.6919499+15	.6854364+15	.6724938+15	.6532914+15
13	.5888342+15	.5832853+15	.5722588+15	.5558976+15
14	.3807062+15	.3771116+15	.3699679+15	.3593661+15
15	.2107448+15	.2087488+15	.2047816+15	.1988922+15
16	.1164847+15	.1153775+15	.1131764+15	.1099077+15
17	.6407922+14	.6346767+14	.6225177+14	.6044573+14
18	.3470565+14	.3437311+14	.3371186+14	.3272955+14
19	.1781039+14	.1763913+14	.1729859+14	.1679269+14
20	.7320602+13	.7250040+13	.7109731+13	.6901300+13
1	.1128747+16	.1061212+16	.9847153+15	.9002184+15
2	.1120078+16	.1053052+16	.9771338+15	.8932769+15
3	.1102802+16	.1036792+16	.9620249+15	.8794428+15
4	.1077042+16	.1012546+16	.9394954+15	.8588130+15
5	.1042961+16	.9804856+15	.9097040+15	.8315313+15
6	.1000857+16	.9408353+15	.8728575+15	.7977855+15
7	.9509562+15	.8938658+15	.8292077+15	.7578044+15
8	.8936104+15	.8398696+15	.7790455+15	.7118534+15
9	.8291819+15	.7792513+15	.7226937+15	.6602286+15
10	.7580521+15	.7123148+15	.6604957+15	.6032493+15
11	.6866006+15	.6394454+15	.5928008+15	.5412459+15
12	.5971793+15	.5609842+15	.5199409+15	.4745427+15
13	.5080747+15	.4772120+15	.4421953+15	.4034263+15
14	.3203601+15	.3083313+15	.2855798+15	.2603383+15
15	.1810828+15	.1705014+15	.1578139+15	.1437057+15
16	.1003319+15	.9413088+14	.8706927+14	.7921151+14
17	.5515198+14	.5172234+14	.4781710+14	.4347622+14
18	.2984988+14	.2798476+14	.2586304+14	.2350990+14
19	.1536993+14	.1435030+14	.1326013+14	.1205414+14
20	.6290581+13	.595035+13	.5447490+13	.4952707+13
1	.7113856+15	.6090919+15	.5029413+15	.3125497+15
2	.7058514+15	.6043708+15	.4900370+15	.3101177+15
3	.6948803+15	.5940098+15	.4912538+15	.3052687+15
1	.1186450+16	.1177346+16	.1159203+16	.1132151+16
2	.1096382+16	.1052143+16	.9997380+15	.9395107+15
3	.8718395+15	.7971203+15	.7157459+15	.6280786+15
4	.5344122+15	.3454396+15	.1911521+15	.1056099+15
5	.5807028+14	.3143738+14	.1612725+14	.6627172+13
6	.6627172+13	.6785714+02	.1538462+01	.4615385+01
7	.1538462+01	.4615385+01	.7692308+01	.1076923+02
8	.1076923+02	.1384615+02	.1692308+02	.2000000+02
9	.2000000+02	.2615385+02	.2923077+02	.3230769+02
10	.3230769+02	.3538461+02	.3846154+02	.4214286+02
11	.4214286+02	.4642857+02	.5071428+02	.5500000+02
12	.5500000+02	.5928571+02	.6357143+02	.6785714+02
13	.6785714+02	.7692308+01	.4615385+01	.1538462+01
14	.1538462+01	.4615385+01	.7692308+01	.1076923+02
15	.1076923+02	.1384615+02	.1692308+02	.2000000+02
16	.2000000+02	.2615385+02	.2923077+02	.3230769+02
17	.3230769+02	.3538461+02	.3846154+02	.4214286+02
18	.4214286+02	.4642857+02	.5071428+02	.5500000+02
19	.5500000+02	.5928571+02	.6357143+02	.6785714+02
20	.6785714+02	.7692308+01	.4615385+01	.1538462+01

4	.6785165+15	.5809208+15	.4796411+15	.2980320+15	.1599558+15	.1076923+02
5	.6568691+15	.5623447+15	.4642716+15	.2884501+15	.1547873+15	.1384615+02
6	.6300808+15	.5393488+15	.4452382+15	.2765762+15	.1483769+15	.1692308+02
7	.5983242+15	.5120745+15	.4226507+15	.2624709+15	.1407519+15	.2000000+02
8	.5617993+15	.4806822+15	.3966299+15	.2461950+15	.1319377+15	.2307692+02
9	.5207294+15	.4453474+15	.3672997+15	.2277979+15	.1219503+15	.2615385+02
10	.4753595+15	.4062565+15	.3347761+15	.2072907+15	.1107860+15	.2923077+02
11	.4259565+15	.3636094+15	.2991536+15	.1845831+15	.9840480+14	.3230769+02
12	.3728166+15	.3176384+15	.2605019+15	.1593109+15	.8472068+14	.3538461+02
13	.3162758+15	.2686734+15	.2189330+15	.1303198+15	.6965601+14	.3846154+02
14	.2031208+15	.1710653+15	.1355074+15	.8686520+14	.5038633+14	.4214286+02
15	.1115750+15	.9359309+14	.7428838+14	.5172281+14	.3232953+14	.4642857+02
16	.6136484+14	.5153505+14	.4133586+14	.3010115+14	.1986465+14	.5071428+02
17	.3368728+14	.2839331+14	.2302730+14	.1725488+14	.1184264+14	.5500000+02
18	.1824824+14	.1544697+14	.1264856+14	.9667648+13	.6826507+13	.5928571+02
19	.9377921+13	.7969521+13	.6574526+13	.5094531+13	.3669289+13	.6357143+02
20	.3860427+13	.3289620+13	.2726753+13	.2130476+13	.1552783+13	.6785714+02
	16	17	18	19	20	
1	.9021179+14	.4839298+14	.2559904+14	.1283515+14	.5145779+13	.1538462+01
2	.8950441+14	.4801185+14	.2539659+14	.1273329+14	.5104852+13	.4615385+01
3	.8809339+14	.4725151+14	.2499269+14	.1253010+14	.5023210+13	.7692308+01
4	.8598600+14	.4611567+14	.2438931+14	.1222658+14	.4901280+13	.1076923+02
5	.8319253+14	.4460967+14	.2358935+14	.1182429+14	.4739725+13	.1384615+02
6	.7972549+14	.4274021+14	.2259665+14	.1132540+14	.4539487+13	.1692308+02
7	.7559852+14	.4051514+14	.2141610+14	.1073280+14	.4301883+13	.2000000+02
8	.7082494+14	.3794348+14	.2005409+14	.1005053+14	.4028774+13	.2307692+02
9	.6541635+14	.3503621+14	.1851951+14	.9284413+13	.3722855+13	.2615385+02
10	.5938276+14	.3180902+14	.1682584+14	.8443171+13	.3388093+13	.2923077+02
11	.5273806+14	.2828888+14	.1499492+14	.7540066+13	.3030274+13	.3230769+02
12	.4552208+14	.2452795+14	.1306267+14	.6594849+13	.2657541+13	.3538461+02
13	.3786311+14	.2062722+14	.1108570+14	.5635213+13	.2280619+13	.3846154+02
14	.2859482+14	.1600493+14	.8762864+13	.4511634+13	.1839889+13	.4214286+02
15	.1936672+14	.1126857+14	.6344176+13	.3330027+13	.1373737+13	.4642857+02
16	.1247826+14	.7544061+13	.4374523+13	.2345347+13	.9800387+12	.5071428+02
17	.7731420+13	.4835130+13	.2882140+13	.1577230+13	.6674677+12	.5500000+02
18	.4591837+13	.2952497+13	.1801874+13	.1003924+13	.4296552+12	.5928571+02
19	.2522004+13	.1655616+13	.1028812+13	.5812842+12	.2509853+12	.6357143+02
20	.1091410+13	.7191133+12	.4519703+12	.2576443+12	.1118751+12	.6785714+02

ZONE	ZONE VOLUME	ZONE AV. ACTIVITY
1	.254469+03	.677993+15
2	.982532+03	.474214+14

REFERENCES

1. R. W. Hardie and W. W. Little, Jr. 1DX, A One-Dimensional Diffusion Code for Generating Effective Nuclear Cross Sections, BNWL-954, Battelle-Northwest, Richland, Washington, 1969.
2. W. W. Little, Jr., and R. W. Hardie. 2DB User's Manual -- Revision 1, BNWL-831 REV1, Battelle-Northwest, Richland, Washington, 1969.
3. R. W. Hardie and W. W. Little, Jr. 3DB, A Three-Dimensional Diffusion Theory Burnup Code, BNWL-1264, Battelle-Northwest, Richland, Washington, 1970.
4. R. W. Hardie and W. W. Little, Jr. PERT-V, A Two-Dimensional Perturbation Code for Fast Reactor Analysis, BNWL-1162, Battelle-Northwest, Richland, Washington, 1969.
5. I. I. Bondarenko et al., Group Constants for Nuclear Reactor Calculations, Consultants Bureau, New York, 1964.
6. W. H. Hamm and J. W. Lewellan, "Some Thoughts on AEC Funded Coding", Proc. of the Conf. on The Effective Use of Computers in the Nuclear Industry, Knoxville, Tennessee, (1969).

DISTRIBUTION

No. of
Copies

OFFSITE

1	<u>AEC Chicago Patent Group</u> G. H. Lee
215	<u>AEC Division of Technical Information Extension</u>
26	<u>AEC Division of Reactor Development and Technology</u> Director, RDT Asst Dir for Nuclear Safety Analysis & Evaluation Br, RDT:NS Asst Dir for Plant Engrg, RDT Facilities Br, RDT:PE Components Br, RDT:PE Instrumentation & Control Br, RDT:PE Liquid Metal Systems Br, RDT:PE Asst Dir for Program Analysis, RDT Asst Dir for Project Mgmt, RDT Liquid Metals Projects Br, RDT:PM G. J. Mishko FFTF Project Manager, RDT:RE Asst Dir for Reactor Engrg, RDT Control Mechanisms Br, RDT:RE Core Design Br, RDT:RE (2) Fuel Engineering Br, RDT:RE Fuel Handling Br, RDT:RE Reactor Vessels Br, RDT:RE Coolant Chemistry Br, RDT:RT Fuel Recycle Br, RDT:RT Fuels & Materials Br, RDT:RT Reactor Physics Br, RDT:RT Special Technology Br, RDT:RT Asst Dir for Engrg Standards, RDT LMFBR Program Manager, RDT:PM
1	<u>AEC Idaho Operations Office</u> Nuclear Technology Division C. W. Bills, Director
1	<u>AEC San Francisco Operations Office</u> Director, Reactor Division
5	<u>AEC Site Representatives</u> Argonne National Laboratory-CH Argonne National Laboratory-ID Atomics International General Electric Co. Westinghouse Electric Co.

No. of
Copies

3	<u>Argonne National Laboratory</u> R. A. Jaross LMFBR Program Office N. J. Swanson
	<u>Atomic Power Development Assoc.</u> Document Librarian
5	<u>Atomics International</u> FFTF Program Office (5)
2	<u>Babcock & Wilcox Co.</u> Atomic Energy Division S. H. Esleeck G. B. Garton
10	<u>Bechtel Corporation</u> J. J. Teachnor, Project Administrator, FFTF
1	<u>Combustion Engineering</u> 1000 MWe Follow-On Study W. P. Staker Project Manager
1	<u>Combustion Engineering</u> Mrs. Nell Holder, Librarian
4	<u>General Electric Company</u> Advanced Products Operation Karl Cohen
1	<u>General Electric Company</u> Nucleonics Laboratory Dr. H. W. Alter, Mgr.
2	<u>Gulf General Atomic Inc.</u> General Atomic Div. D. Coburn
1	<u>Idaho Nuclear Corporation</u> J. A. Buckham
1	<u>Liquid Metal Information Center</u> R. W. Dickinson
2	<u>Liquid Metal Information Center</u> A. E. Miller
1	<u>Oak Ridge National Laboratory</u> W. O. Harms

No. of
Copies

1	<u>Stanford University</u> Nuclear Division Division of Mechanical Engrg R. Sher
1	<u>United Nuclear Corporation</u> Research and Engineering Center R. F. DeAngelis
11	<u>Westinghouse Electric Corporation</u> Atomic Power Division Advanced Reactor D. C. Spencer

ONSITE HANFORD

1	<u>AEC Chicago Patent Group</u> R. K. Sharp (Richland)
1	<u>AEC Richland Operations Office</u> J. M. Shivley
1	<u>Battelle Memorial Institute</u>
16	<u>Battelle Northwest</u> G. J. Busselman N. E. Carter F. G. Dawson R. H. Holeman R. C. Liikala C. W. Lindenmeier W. W. Porath K. B. Stewart BNW - Technical Information (5) Legal - ROB BNW - Technical Publications (2)
1	<u>Bechtel Corporation</u> W. A. Smith (Richland)
2	<u>RDT Asst Dir for Pacific Northwest Programs</u> T. A. Nemzek

No. of
Copies

139

WADCO Corporation

GJ Alkire	FJ Leitz
HJ Anderson	WW Little
SD Arneson	DR Marr
JM Atwood	VB McDonald
QL Baird	JS McMahon
JM Batch	JV Nelson
RA Bennett	JM Norris
WE Black	LD O'Dell
ET Boulette	RP Omberg
WL Bunch	RE Peterson
CP Cabell	EG Rieck
JR Carrell	VE Roake
JL Carter	GJ Rogers
JC Cochran	RB Rothrock
GS Cochrane	WF Sheely
SL Engstrom	JR Sheff
WH Esselman	OD Swanson
EA Evans	KG Toyoda
WM Gajewski	LD Turner
RW Hardie (75)	AE Waltar
KM Harmon	B. Wolfe
EN Heck	WR Wykoff
RE Heineman	WADCO Document Control (15)
PL Hofmann	WADCO Legal (703)
JN Judy	WADCO Tech Pubs (703)
RB Kidman	