

**LETTER REPORT**

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## I. INTRODUCTION

The work in this report has been performed in support of the Yucca Mountain Project (YMP), and the objective of this work is to determine the impact on predictions in system multiplication due to perturbations in cross-section temperature. Moreover, the study is intended to investigate the impact of cross-section perturbations on LWR spent fuel isotopics at various levels of burnup. This letter report provides the current status of the temperature-effects work and documents the work that has been completed during the 2001 fiscal year.

The work scope for the temperature-effects study is outlined in Table 1. The tasks that are presented in Table 1 are organized in a sequential fashion. As a result, the completion of each task is dependent upon the completion of the preceding tasks. The majority of effort during the fiscal year has been devoted to completion of the first task. In addition, some effort has been devoted to the second task. Therefore, this report summarizes the efforts related to the completion of Tasks 1 and 2.

Table 1. Work scope for temperature effects study

Task	Description
1	Generate an ENDF/B-VI <sup>1</sup> multigroup library for SCALE <sup>2</sup> using the AMPX-2000 <sup>3</sup> cross-section processing system.
2	Use the 1-D discrete ordinates code XSDRNPM <sup>2</sup> to calculate changes in reactivity due to temperature perturbations for each isotope/nuclide over a range of temperature (to be determined). The XSDRNPM calculations will be performed with the ENDF/B-VI multigroup library developed in Task 1. The isotopes/nuclides that exhibit significant changes in reactivity will be considered the "relevant isotopes." Note that the XSDRNPM calculations will consist of infinite lattice models of LWR assemblies at different levels of burnup.
3	Use the criticality safety code KENO V.a <sup>4</sup> with the ENDF/B-VI library from Task 1 to evaluate reactor and laboratory criticals. Specifically, the criticality calculations for the criticals will examine the temperature effects on the relevant isotopes that are identified in Task 2.
4	Use NJOY <sup>4</sup> to generate MCNP <sup>5</sup> temperature-dependent continuous-energy cross section for relevant isotopes identified in Task 2.
5	Use MCNP with cross sections from Task 4 to "spot check" KENO calculations from Task 3.
6	Document temperature effects work in ORNL/TM document.

## II. TASK 1: CROSS-SECTION LIBRARY GENERATION

In the United States, the Evaluated Nuclear Data File (ENDF) system is a repository for evaluated nuclear data that are obtained from cross-section measurements. The objective of this work is to use the most up-to-date cross-section information that is available, and the latest cross-section information that is available to the nuclear analyst is ENDF/B-VI. Because of the vast amount of nuclear data that is available in a cross-section evaluation, radiation transport codes do not access the ENDF/B data directly. As a result, a cross-section processing code system must be used to access the ENDF data and generate cross-section libraries for radiation transport codes. At the Oak Ridge National Laboratory (ORNL), the AMPX code system is used to process ENDF evaluations and generate cross-section libraries.<sup>3</sup> Moreover, the SCALE (Standardized Computer Analyses for Licensing Evaluations) system, which is also developed and maintained at ORNL, is used throughout the world to investigate technical issues related to the nuclear fuel cycle.<sup>2</sup> The objective of the first task is to use AMPX to process the latest ENDF cross-section data (ENDF/B-VI) and generate a multigroup library that can be used in the subsequent temperature-effects study.

For the purposes of this task, the latest AMPX code system (i.e., AMPX-2000) which is prototypic in nature is being used to generate a 238-group cross-section library for use in the SCALE system. The energy-group structure for the ENDF/B-VI library is identical to the ENDF/B-V 238-group structure<sup>2</sup> that is currently available in SCALE.

In ENDF/B-VI, there are currently cross-section evaluations for 325 different isotopes/nuclides. In addition, there are thermal evaluations [i.e.,  $S(\alpha,\beta)$  scattering kernels] for 15 different materials (e.g., hydrogen in water, etc.). Each cross-section evaluation contains a variety of data that are used to model the radiation transport through each material. As a result, the cross-section processing requirements vary between isotopes. Moreover, the different types of data that are available in a cross-section evaluation require different AMPX modules to process the data. Consequently, an AMPX input file must be generated for each individual isotope/nuclide.

Although there are cross-section evaluations for more than 300 different isotopes/nuclides, there may be multiple ENDF/B-VI evaluations for each different isotope/nuclide. For the purposes of this task, a series of FORTRAN programs were developed to scan the entire ENDF/B-VI database and compile a concise directory information for each isotope/nuclide. Subsequently, an additional FORTRAN program (MAKEINPUTS) was developed to read the cross-section database and select the most recent cross-section evaluation for each isotope/nuclide. Because the cross-section processing requirements vary between isotopes, MAKEINPUTS was also used to generate AMPX input files for the 325 isotopes/nuclides and 15 thermal scattering evaluations. A brief summary of each material that has been processed with AMPX is presented in the Appendix A. Note that the series of FORTRAN programs that were developed as part of this task were used to generate the listing in Appendix A.

As indicated previously, the type of data that are present in a cross-section evaluation dictates the specific procedures that must be used to process the evaluation (e.g., the evaluation may have resolved-resonance parameters specified with the Reich-Moore formalism, the evaluation may not have resonance information, etc.). Because the AMPX code system is very modular in nature, each AMPX module performs a specific cross-section task by reaction type and format specification. This information varies for the different nuclide evaluations. As a result, all modules are not executed for each cross-section evaluation. As part of the cross-section library production effort, MAKEINPUTS selects the appropriate AMPX modules needed to process each nuclide.

In order to illustrate the logic for processing a nonthermal evaluation, Figure 1 provides a flow diagram for selecting the appropriate AMPX modules to process an evaluation. MAKEINPUTS performs the decision-making steps as indicated in Figure 1 for a nonthermal cross-section evaluation. The definitions for each symbol are provided in Table 2, and the functional description of each AMPX module is provided in Table 3. Although different AMPX modules may be executed for different cross-section evaluations, the final product of the processing task is an AMPX-formatted master file for each material which is denoted by the letter "A" in Figure 1. The flow logic in Figure 1 has been applied to each of the 325 nonthermal evaluations in ENDF/B-VI.

After processing all of the cross-section evaluations, the AJAX module in AMPX was used to combine the master-formatted crosssections into a single 238-group ENDF/B-VI library. The contents of the multigroup library that has been generated in this task is provided in Appendix B. Although the 238-group ENDF/B-VI library has been generated, efforts are currently in progress to test the library for accuracy. Once the library is tested, the subsequent tasks that are provided in Table 1 of Section 1 can be completed.

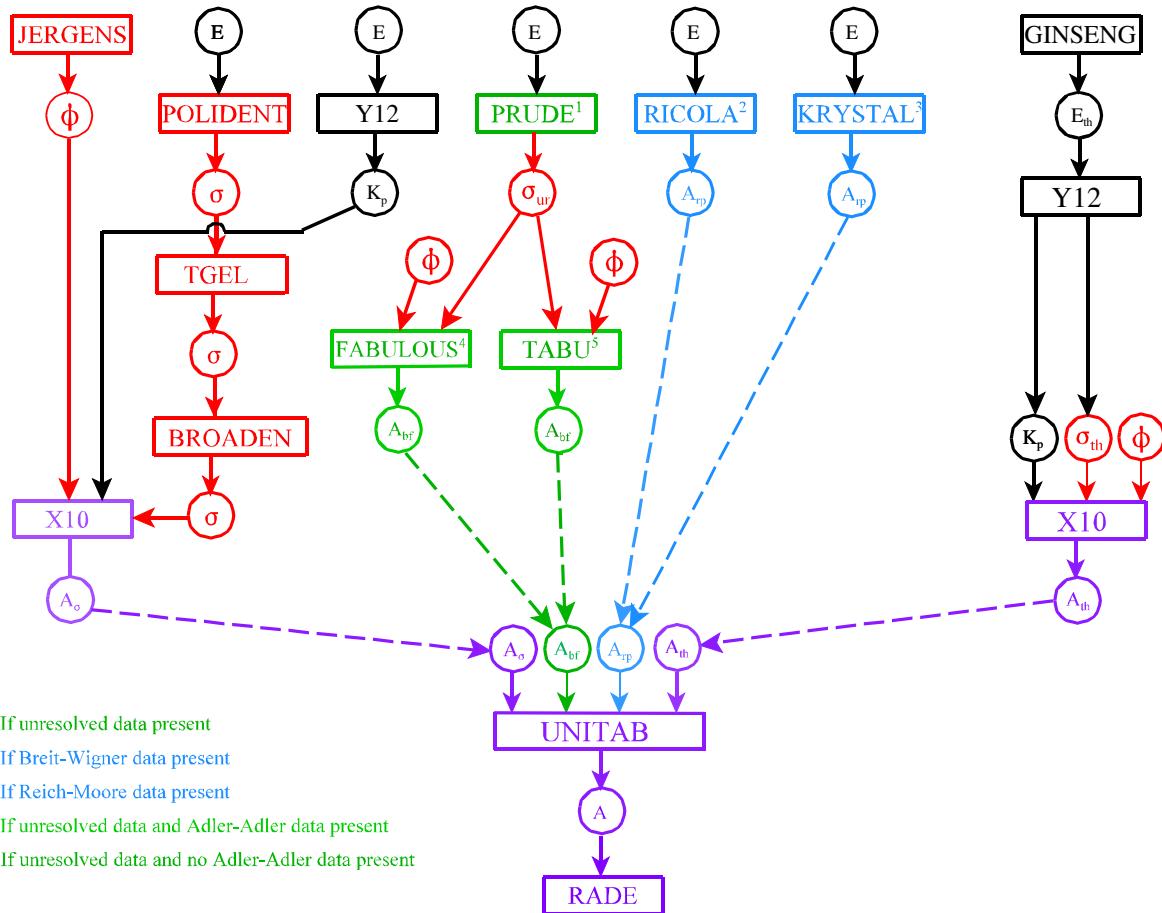


Fig. 1. AMPX flow diagram for processing a nonthermal cross-section evaluation

Table 2. AMPX flow diagram for processing nonthermal cross-section evaluations

Task	Description
A	AMPX master-formatted cross-section library
$A_{bf}$	AMPX master-formatted cross-section library containing only Bondarenko factors
$A_{rp}$	AMPX master-formatted cross-section library containing only resonance parameters
$A_{th}$	AMPX master-formatted cross-section library containing only thermal cross-sections
$A_o$	AMPX master-formatted cross-section library containing only 1-D and 2-D cross-sections
E	ENDF evaluation
$E_{th}$	Free-gas thermal data in ENDF format
$K_p$	Collision kinematics (i.e., secondary energy and angle) data for each reaction that emits secondary neutron(s)
$\phi$	Weighting spectrum
$\sigma$	Continuous-energy cross sections
$\sigma_{th}$	Continuous-energy cross sections at thermal energies (i.e., < 5 eV)
$\sigma_{ur}$	Continuous-energy cross sections in the unresolved-resonance region

Table 3. Functional description of AMPX modules used to process nonthermal cross-section evaluations

Module	Description
BROADEN	Doppler broadens continuous-energy cross-section data
FABULOUS	Generates Bondarenko self-shielding factors for the entire resonance region
GINSENG	Generates free-gas collision data at thermal energies for nonthermal evaluations
JERGENS	Calculates a weighting spectrum for use in generating a multigroup library
KRYSTAL	Converts Reich-Moore resonance parameters to the multipole formalism
POLIDENT	Calculates continuous-energy cross-sections at 0 K
PRUDE	Reads unresolved resonance parameters and constructs continuous-energy cross sections in the unresolved-resonance region
RADE	Performs consistency checks on an AMPX master library
RICOLA	Extracts single- and multi-level Breit-Wigner resonance parameters from an ENDF evaluation and writes to an AMPX master library
TGEL	Ensures that the sum of the partial reactions equals the total cross section
UNITAB	Assembles a complete AMPX master library
X10	Performs integrations to calculate group-averaged cross sections and scattering matrices
Y12	Calculates collision-kinematics (i.e., secondary energy and angle) data for each reaction that emits secondary neutron(s)

### **III. TASK 2: 1-D DISCRETE ORDINATES SENSITIVITY CALCULATIONS**

The objective of the second task is to develop 1-D discrete ordinates (DO) models for LWR spent fuel at different levels of burnup. The XSDRNPM module, which is in the SCALE package, will be used to perform the 1-D DO calculations using the ENDF/B-VI multigroup library developed in Task 1. As noted in Section I, the majority of effort during the fiscal year has been devoted to the library production task that is discussed in Section II. However, some effort has been devoted to the development of XSDRNPM models for the temperature perturbation calculations.

One of the essential tasks for the XSDRNPM model development activities is the identification of isotopic-concentration specifications for the various isotopes that are to be included in the calculational models. In an effort to identify the appropriate isotopic concentrations, a FORTRAN program (CRCREAD) has been developed to read the MCNP input files for the commercial reactor criticals (CRC) benchmark models and extract information that will be used to create the XSDRNPM models. The YMP has designated 130 different isotopes, which are documented in Appendix C, that are of interest for the temperature-effects study. CRCREAD has the capability to search a CRC benchmark model for the 130 different isotopes and determine which isotopes are in the model. If one of the designated isotopes is present, the code determines the physical location of each isotope (i.e., in the fuel, in the structure outside of the fuel region or in both locations). In addition, CRCREAD determines the weight fraction of the isotope in the respective material location. As work continues on Task 2, CRCREAD will be expanded to calculate the atomic-number densities for isotopes that will be used in the XSDRNPM models. In an effort to demonstrate the capabilities of CRCREAD, the benchmark case cr3i12a was processed with CRCREAD, and a summary of the output is also provided in Appendix C.

## IV. SUMMARY

The objective of the current work is to calculate changes in system multiplication due to perturbations in cross-section temperature. Moreover, the study is intended to investigate cross-section perturbations using ENDF/B-VI data which are the most up-to-date cross-section information currently available in the United States. The purpose of this letter report is to document the work that has been completed during the 2001 fiscal year. In addition, the report provides the current status of the temperature-effects study.

During the fiscal year, the majority of effort has focused on the development of a 238-group ENDF/B-VI library using the AMPX cross-section processing system. At this point, 340 ENDF/B-VI evaluations have been processed (i.e., 15 thermal and 325 nonthermal evaluations), and a prototypic 238-group library has been developed. Efforts are currently in progress to test the cross-section library for accuracy. Once the library is determined to be suitable for radiation transport calculations, the library will be used to perform reactivity calculations to assess the impact of cross-section temperature perturbations.

Regarding the temperature perturbation studies, a FORTRAN program (CRCREAD) has been developed to read the CRC benchmark models (i.e., MCNP input files) and search for the 130 different isotopes that have been designated by the YMP for further study. Currently, CRCREAD determines if an isotope is present in the CRC benchmark model and determines the physical location of the isotope within the model. In addition, CRCREAD determines the weight fraction of the isotope in a material within the MCNP model. In the future, CRCREAD will be used as a tool to aide in the development of 1-D XSDRNPM input models that will be used in the temperature-effects calculations.

The work that has been completed during the 2001 fiscal year has provided the necessary foundation for completing the temperature effects study. During the 2002 fiscal year, the 238-group ENDF/B-VI library that was developed in Task 1 will be tested for accuracy. Subsequently, XSDRNPM models of LWR spent fuel assemblies will be developed, and the new 238-group library will be used with XSDRNPM to calculate reactivity changes due to cross-section temperature perturbations for the LWR models. The XSDRNPM models will be used to identify the important or relevant isotopes requiring further study. Moreover, these relevant isotopes will be evaluated by using KENO V.a with the new 238-group library to calculate specific reactor and laboratory criticals. The 3-D KENO V.a calculations will be used to examine reactivity effects due to temperature changes of the relevant isotopes. Finally, MCNP will be used to "spot check" the KENO V.a calculations in order to verify the results of the temperature-effects study.

## V. REFERENCES

1. "ENDF-102 Data Formats and Procedures for the Evaluated Nuclear Data File ENDF-6," BNL-NCS-44945, Rev. 10/91 (ENDF/B-VI), Brookhaven National Laboratory, October 1991.
2. *SCALE: A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation*, NUREG/CR-0200, Rev. 6 (ORNL/NUREG/CSD-2/R6), Vols. I, II, and III, May 2000. Available from Radiation Safety Information Computational Center at Oak Ridge National Laboratory as CCC-545.
3. N. M. Greene and M. E. Dunn, *AMPX-2000: A Modular Code System for Processing ENDF/B Evaluations*, NUREG/CR-6659 (ORNL/TM-1999/265), September 2001, Draft for NRC review.
4. R. E. MacFarlane and D. W. Muir, "NJOY99.0 Code System for Producing Pointwise and Multigroup Neutron and Photon Cross Sections from ENDF/B Data," PSR-480/NJOY99.0, Los Alamos National Laboratory, March 2000.
5. "MCNP 4C: Monte Carlo N-Particle Transport Code System," Los Alamos National Laboratory LA-3709-M (April 2000).

# APPENDIX A

## SUMMARY OF ENDF/B-VI EVALUATIONS PROCESSED WITH AMPX-2000

The following is a summary of the 340 ENDF/B-VI evaluations that have been processed with AMPX. For each evaluation, the symbol and 4-digit ENDF material identifier are provided for each isotope along with the appropriate ENDF tape information. The tape information provides the ENDF mod number, release number, ZA number and evaluation date (evdt) for the cross-section evaluation. In addition, the name of the evaluator along with the organization that performed the evaluation is provided (e.g., LANL, ORNL, etc.). Following the organization information is the ENDF filename (i.e., source), distribution date and rev number.

The remaining information for each evaluation describes the neutron resolved-resonance formalism that is used in File 2 of the ENDF evaluation. The possible resonance formalisms are as follows:

slbw	Single-level Breit-Wigner
mlbw	Multi-level Breit-Wigner
rm	Reich-Moore
aa	Adler-Adler
grm	General R Matrix
hrf	Hybrid R Function

Following the resonance information is the File 3 data that are provided for each ENDF evaluation. The File 3 information provides the neutron induced reactions that are available for the specific isotope. If the evaluation is a thermal evaluation [i.e., S( $\alpha, \beta$ ) data], the evaluation has an ENDF File 7 (i.e., MF=7).

ENDF Tape Information										File 2 RRR										File 3 MTs										MF
symbol	mat	mod	rel	za	evdt	evaluators	org	source	dist	rv	slbw	mlbw	rm	aa	grm	hrf	1	2	4	16	17	18	19-21&38	51-91	102					
ag107	4725	0	0	47107	jun83	a.prince,	bnl, hedl	t104		jan90	0	m		x	x	x	x	x	x	x	x	x	x	x	x	x	x	-		
ag109	4731	0	0	47109	jun83	a.prince,	bnl, hedl	t104		jan90	0	m		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	
ag111	4737	0	0	47111	apr74	schenter	hedl	t104		jan90	0			x	x	x								x	x	x	x	x	-	
a127	1325	3	0	13027	feb97	m.b.chadw	7 lanl	rev6/tape.145	aug99	r2				x	x	x	x	x	x	x	x	x	x	x	x	x	x	-		
am241	9543	3	0	95241	feb94	young, mad	lanl, cndc	rev3/tape.135	apr95	r2	s			x	x	x	x	x	x	x	x	x	x	x	x	x	x	-		
am242	9546	2	0	95242	aug75	benjamin	srl	t121	sep91	r1	s			x	x	x	x	x	x	x	x	x	x	x	x	x	x	-		
am242m	9547	2	0	95242	apr78	mann, benj	mhedl, srl,	t121	sep91	r1	s			x	x	x	x	x	x	x	x	x	x	x	x	x	x	-		
am243	9549	2	0	95243	sep96	p. g. you	3 lanl,orn	rev5/tape.143	sep98	r1	s			x	x	x	x	x	x	x	x	x	x	x	x	x	-			
ar40	1837	0	0	18040	jan79	mann	hedl	t101	jan90	0	s																x	-		
as75	3325	0	0	33075	apr74	r.e.schen	hedl	t102	jan90	0	s			x	x	x									x	x	-			
au197	7925	2	0	79197	jan84	p.g.young	lanl	t120	sep91	r1		m		x	x	x	x	x	x	x	x	x	x	x	x	x	-			
b10	525	2	0	5010	nov89	g.m.hale,	lanl	t120	sep91	r1				x	x	x								x	x	x	-			
b11	528	1	0	5011	may89	p.g.young	lanl	t100	jan90	0				x	x	x	x	x	x	x	x	x	x	x	x	-				
ba134	5637	2	0	56134	jul98	wright,jn	ornl, jndc	rev7/tape.154	apr	0	0	r		x	x	x	x	x	x	x	x	x	x	x	x	x	-			
ba135	5640	1	0	56135	dec88	wright, s	ornl, hed	t103	jan90	0		m		x	x	x								x	x	-				
ba136	5643	1	0	56136	dec88	wright, s	ornl, hed	t103	jan90	0		m		x	x	x							x	x	-					
ba137	5646	1	0	56137	dec88	wright, s	ornl, hed	t103	jan90	0		m		x	x	x							x	x	-					
ba138	5649	2	0	56138	aug78	wright, h	ornl, llnl	rev3/tape.134	jan90	r1		m		x	x	x	x	x	x	x	x	x	x	x	-					
ba140	5655	0	0	56140	apr74	schenter	hedl	t105	feb90	0				x	x	x							x	x	-					
be9	425	1	0	4009	jan86	perkins,	llnl	t100	jan90	0				x	x	x							x	x	-					
bemetal	26	1	0	126	apr93	macfarlan	lanl	rev3/tape.133	apr95	0															x	-				
benzine	40	0	0	140	dec69	koppel,ho	ga	t119	may90	0															x	-				
beo	27	1	0	127	apr93	macfarlan	lanl	rev3/tape.133	apr95	0															x	-				
bi209	8325	2	0	83209	jul98	m.chadwic	lanl,anl	rev7/tape.155	apr	0	0	m		x	x	x	x	x	x	x	x	x	x	x	x	-				
bk249	9752	1	0	97249	jun86	zhou deli	cndc	t108	feb90	0		m		x	x	x	x	x	x	x	x	x	x	x	x	-				
br79	3525	0	0	35079	apr74	r.e.schen	hedl	t102	jan90	0	s			x	x	x							x	x	-					
br81	3531	0	0	35081	apr74	r.e.schen	hedl	t102	jan90	0	s			x	x	x							x	x	-					
c	600	3	0	6000	jun96	m.b.chadw	lanl,ornl	rev6/tape.145	aug99	r2				x	x	x							x	x	-					
ca	2000	1	0	20000	mar97	m.b.chadw	0 lanl,orn	rev6/tape.146	aug99	r1				x	x	x							x	x	-					
cd	4800	0	0	48000	may74	s.pearlst	bnl	t104	jan90	0				x	x	x							x	x	-					
cd106	4825	4	0	48106	aug94	j.mccabe,	ua,anl,+	rev4/tape.137	apr95	r2		m		x	x	x							x	x	-					
cd108	4831	4	0	48108	aug94	j.mccabe,	ua,anl,+	rev4/tape.137	apr95	r2		m		x	x	x	x	x	x	x	x	x	x	-						
cd110	4837	4	0	48110	aug94	j.mccabe,	ua,anl	rev4/tape.137	apr95	r3		m		x	x	x	x	x	x	x	x	x	x	-						
cd111	4840	1	0	48111	aug94	j.mccabe,	ua,anl	rev3/tape.134	apr95	0	s			x	x	x	x	x	x	x	x	x	x	-						

## ENDF Tape Information

## File 2 RRR

## File 3 MTs

## MF

symbol	mat	mod	rel	za	evdt	evaluators	org	source	dist	rv	slbw	mlbw	rm	aa	grm	hrl	1	2	4	16	17	18	19+21&38	51-91	102	7	
cd112	4843	4	0	48112	aug94	j.mccabe,	ua,anl,	+ rev4/tape.137	apr95	r2	m		x	x	x	x		x	x								
cd113	4846	1	0	48113	aug94	j.mccabe,	ua,anl,	rev3/tape.134	apr95	0	s		x	x	x	x		x	x								
cd114	4849	4	0	48114	aug94	j.mccabe,	ua,anl,	+ rev4/tape.137	apr95	r2	m		x	x	x	x		x	x								
cd115m	4853	0	0	48115	apr74	schenter	mhedl	t104		jan90	0			x	x	x			x	x							
cd116	4855	4	0	48116	aug94	j.mccabe,	ua,anl,	+ rev4/tape.137	apr95	r2	m		x	x	x	x		x	x								
ce140	5837	0	0	58140	apr74	r.e.schen	hedl	t105		feb90	0			x	x	x			x	x							
ce141	5840	0	0	58141	apr74	schenter	hedl	t105		feb90	0			x	x	x			x	x							
ce142	5843	0	0	58142	apr74	r.e.schen	hedl	t105		feb90	0			x	x	x			x	x							
ce143	5846	0	0	58143	apr74	schenter	hedl	t105		feb90	0			x	x	x			x	x							
ce144	5849	0	0	58144	apr74	schenter	hedl	t105		feb90	0			x	x	x			x	x							
cf249	9852	1	0	98249	apr89	zhou deli	cndc	t108		feb90	0	m		x	x	x	x		x	x							
cf250	9855	2	0	98250	jul76	kinsey-as	bnl,srl,+ rev2/tape.129		jun93	r1	s		x	x	x	x	x		x	x							
cf251	9858	2	0	98251	jul76	kinsey-as	bnl,srl,+ rev2/tape.129		jun93	r1	s		x	x	x	x	x		x	x							
cf252	9861	3	0	98252	jul76	kinsey-as	bnl,srl,+ rev2/tape.129		jun93	r2	s		x	x	x	x	x		x	x							
cf253	9864	2	0	98253	dec75	benjamin	srl	rev2/tape.129		jun93	r1	s		x	x	x	x		x	x							
c1	1700	0	0	17000	feb67	m.s.allen	gga	t101		jan90	0			x	x	x	x		x	x							
cm241	9628	0	0	96241	apr78	mann and	hedl	t110		feb90	0			x	x	x	x	x	x	x	x						
cm242	9631	1	0	96242	apr78	mann,benj	hedl,srl,	t109		feb90	0	s		x	x	x	x	x	x	x	x						
cm243	9634	1	0	96243	jul95	v.maslov	minsk	rev7/tape.155	apr	0	0	s		x	x	x	x	x	x	x	x						
cm244	9637	0	0	96244	apr78	mann,benj	hedl,srl,	t110		feb90	0	s		x	x	x	x	x	x	x	x						
cm245	9640	3	0	96245	nov95	v.maslov	minsk	rev7/tape.155	apr	0	0	s		x	x	x	x	x	x	x	x						
cm246	9643	3	0	96246	nov95	v.maslov	minsk	rev7/tape.155	apr	0	0	m		x	x	x	x	x	x	x	x						
cm247	9646	2	0	96247	jul76	kinsey-as	bnl,srl,+ rev2/tape.129		jun93	r1	s		x	x	x	x	x		x	x							
cm248	9649	0	0	96248	apr78	mann,benj	hedl,srl,	t110		feb90	0	s		x	x	x	x	x	x	x	x						
co59	2725	2	0	27059	jul89	a.smith+	anl,ornl	rev2/tape.129		jun93	r1	r		x	x	x	x		x	x							
cr50	2425	4	0	24050	oct97	s.chiba,m	0 lanl,ornl	rev6/tape.147		aug99	r3	r		x	x	x	x		x	x							
cr52	2431	3	0	24052	oct97	s.chiba,m	2 lanl,ornl	rev6/tape.147		aug99	r2	r		x	x	x	x		x	x							
cr53	2434	3	0	24053	oct97	s.chiba,m	3 lanl,ornl	rev6/tape.147		aug99	r2	r		x	x	x	x		x	x							
cr54	2437	4	0	24054	oct97	s.chiba,m	4 lanl,ornl	rev6/tape.147		aug99	r3	r		x	x	x	x		x	x							
cs133	5525	1	0	55133	aug99	s.y.oh,s.	bni,kaeri	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
cs134	5528	2	0	55134	aug98	wright, s	ornl,hedl	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
cs135	5531	1	0	55135	aug98	wright, s	ornl,hedl	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
cs136	5534	0	0	55136	apr74	schenter	hedl	t105		feb90	0	s		x	x	x	x		x	x							
cs137	5537	0	0	55137	apr74	schenter	hedl	t105		feb90	0			x	x	x	x		x	x							
cu63	2925	4	0	29063	feb98	a.koning,	3 lanl,ornl	rev6/tape.150		aug99	r3	r		x	x	x	x		x	x							
cu65	2931	4	0	29065	feb98	a.koning,	5 lanl,ornl	rev6/tape.150		aug99	r3	r		x	x	x	x		x	x							
d(d20)	11	0	0	111	dec69	koppel,ho	ga	t118		may90	0																x
dy160	6637	1	0	66160	oct74	wright, s	ornl, hed	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
dy161	6640	1	0	66161	oct74	wright, s	ornl, hed	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
dy162	6643	1	0	66162	oct74	wright, s	ornl, hed	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
dy163	6646	1	0	66163	oct74	wright, s	ornl, hed	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
dy164	6649	1	0	66164	jun67	wright, l	ornl, bnw	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
er166	6837	1	0	68166	dec88	r.q.wri	ornl, hed	t103		jan90	0	m		x	x	x	x		x	x							
er167	6840	1	0	68167	dec88	r.q.wrig	ornl, hed	t103		jan90	0	m		x	x	x	x		x	x							
es253	9913	0	0	99253	jul76	kinsey,be	bni,srl	t110		feb90	0	s		x	x	x	x		x	x							
eui51	6325	1	0	63151	apr86	p.g.young	lanl	t103		jan90	0	m		x	x	x	x		x	x							
eui52	6328	1	0	63152	dec88	r.q.wri	ornl, bnl	t103		jan90	0	m		x	x	x	x		x	x							
eui53	6331	2	0	63153	aug99	s.y.oh an	bni+kaeri	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
eui54	6334	2	0	63154	may89	r.q.wrig	ornl,bnl	rev7/tape.154	apr	0	r1	m		x	x	x	x		x	x							
eui55	6337	3	0	63155	dec88	wright,pr	ornl, hed	rev7/tape.154	apr	0	0	m		x	x	x	x		x	x							
eui56	6340	0	0	63156	apr74	schenter	hedl	t106		feb90	0			x	x	x	x		x	x							
eui57	6343	0	0	63157	apr74	r.e.schen	hedl	t106		feb90	0			x	x	x	x		x	x							
f19	925	1	0	9019	jun90	z.x.zhao,	cndc,ornl	t115		jun90	0			x	x	x	x		x	x							
fe54	2625	5	0	26054	sep96	m.b.chadw	4 lanl,ornl	rev6/tape.148		aug99	r3	r		x	x	x	x		x	x							
fe56	2631	3	0	26056	sep96	m.b.chadw	6 lanl,ornl	rev6/tape.148		aug99	r2	r		x	x	x	x		x	x							
fe57	2634	3	0	26057	sep96	m.b.chadw	7 lanl,ornl	rev6/tape.148		aug99	r2	r		x	x	x	x		x	x							
fe58	2637	3	0	26058	nov89	hetrick,f	ornl	rev5/tape.140		sep98	r2	r		x	x	x	x		x	x							
ga	3100	0	0	31000	may80	howerton,	1lnl,lanl	t102		jan90	0			x	x	x	x		x	x							
gd152	6425	1	0	64152	dec94	r.q.wrig	ornl,jndc	rev4/tape.137		0		m		x	x	x	x		x	x							
gd154	6431	1	0	64154	dec74	r.q.wrig	ornl,jndc	rev4/tape.137		0		m		x	x	x	x		x	x							
gd155	6434	0	0	64155	jan77	b.a.magur	bnl	t106		feb90	0			x	x	x	x		x	x							
gd156	6437	0	0	64156	jan77	b.a.magur	bnl	t106		feb90	0			x	x	x	x		x	x							
gd157	6440	0	0	64157	jan77	b.a.magur	bnl	t106		feb90	0			x	x	x	x		x	x							
gd158	6443	0	0	64158	jan77	b.a.magur	bnl	t106		feb90	0			x	x</												

## ENDF Tape Information

## File 2 RRR

## File 3 MTs

## MF

symbol	mat	mod	rel	za	evdt	evaluators	org	source	dist	rv	slbw	mlbw	rm	aa	grm	hrf	1	2	4	16	17	18	19	21&38	51-91	102	7
i127	5325	1	0	53127	mar91	p.g.young	lanl	rev2/tape.127	jun93	0	m		x	x	x	x		x	x								
i129	5331	0	0	53129	feb80	schenter	hedl,rcn	t105	feb90	0	s		x	x	x			x	x								
i130	5334	0	0	53130	apr74	schenter	hedl	t105	feb90	0			x	x	x			x	x								
i131	5337	0	0	53131	apr74	schenter	hedl	t105	feb90	0			x	x	x			x	x								
i135	5349	0	0	53135	apr74	schenter	hedl	t105	feb90	0			x	x	x			x	x								
in	4900	1	0	49000	feb90	a.smith,d	anl	t116	jun90	0	s		x	x	x	x		x	x								
in113	4925	0	0	49113	apr74	r.e.schen	hedl	t116	jun90	0	s		x	x	x			x	x								
in115	4931	1	0	49115	mar90	f.schmitt	hedl,anl	t116	jun90	0	s																
ir191	7725	1	0	77191	mar95	r.q.wright	ornl	rev4/tape.137	0		m		x	x	x	x		x	x								
ir193	7731	1	0	77193	mar95	r.q.wright	ornl	rev4/tape.137	0		m		x	x	x	x		x	x								
k	1900	0	0	19000	feb67	m.k.drake	gga	t101	jan90	0			x	x	x			x	x								
k41	1931	0	0	19041	jan79	mann	hedl	t101	jan90	0																	
kr78	3625	0	0	36078	apr78	a.prince	bnl	t102	jan90	0	s		x	x	x			x	x								
kr80	3631	0	0	36080	apr78	a.prince	bnl	t102	jan90	0	s		x	x	x			x	x								
kr82	3637	0	0	36082	apr78	a.prince	bnl	t102	jan90	0	s		x	x	x			x	x								
kr83	3640	0	0	36083	apr78	a.prince	bnl	t102	jan90	0	s		x	x	x			x	x								
kr84	3643	0	0	36084	apr78	a.prince	bnl	t102	jan90	0	s		x	x	x			x	x								
kr85	3646	0	0	36085	apr74	schenter	hedl	t102	jan90	0	s		x	x	x			x	x								
kr86	3649	0	0	36086	jul72	a.prince	bnl	t102	jan90	0	s		x	x	x			x	x								
la139	5728	2	0	57139	feb80	r.e.schen	hedl,rcn	t120	sep91	r1	s		x	x	x			x	x								
la140	5731	0	0	57140	apr74	schenter	hedl	t105	feb90	0			x	x	x			x	x								
lch4	33	1	0	133	apr93	macfarlan	lanl	rev3/tape.133	apr95	0																x	
l16	325	2	0	3006	apr89	g.m.hale,	lanl	t120	sep91	r1			x	x	x			x	x								
l17	328	1	0	3007	aug88	p.g.young	lanl	t100	jan90	0			x	x	x	x		x	x								
lu175	7125	1	0	71175	mar98	r.q.wrig	ornl,bnw	rev7/tape.154	apr	0	r1		m		x	x	x	x	x								
lu176	7128	1	0	71176	mar98	r.q.wrig	ornl,bnw	rev7/tape.154	apr	0	r1		m		x	x	x	x	x								
mg	1200	0	0	12000	feb78	d.c.larso	ornl	t101	jan90	0			x	x	x			x	x								
mg24	1225	0	0	12024	nov79	mann,lars	hedl,ornl	t101	jan90	0																	
mn55	2525	2	0	25055	mar88	k.shibata	jaeri,orn	rev5/tape.140	sep98	r1		m		x	x	x	x		x	x							
mo	4200	0	0	42000	feb79	howerton,	llnl,hedl	t104	jan90	0	s		x	x	x	x		x	x								
mo100	4249	0	0	42100	feb80	schenter	hedl,rcn	t104	jan90	0	s																
mo92	4225	0	0	42092	feb80	schenter	hedl,rcn	t104	jan90	0	s																
mo94	4231	0	0	42094	feb80	r.e.schen	hedl,rcn	t104	jan90	0	s		x	x	x			x	x								
mo95	4234	0	0	42095	feb80	r.e.schen	hedl,rcn	t104	jan90	0	s		x	x	x			x	x								
mo96	4237	0	0	42096	feb80	r.e.schen	hedl,rcn	t104	jan90	0	s		x	x	x			x	x								
mo97	4240	0	0	42097	feb80	r.e.schen	hedl,rcn	t104	jan90	0	s		x	x	x			x	x								
mo98	4243	0	0	42098	feb80	schenter	hedl,rcn	t104	jan90	0	s																
mo99	4246	0	0	42099	apr74	schenter	hedl	t104	jan90	0			x	x	x			x	x								
n14	725	4	0	7014	jun97	m.b.chadw	4	lanl	rev6/tape.145	aug99	r3			x	x	x	x		x	x							
n15	728	1	0	7015	sep83	e.arthur,	lanl	t116	jun90	0			x	x	x	x		x	x								
na23	1125	2	0	11023	dec77	d.c.lar	ornl	t120	sep91	r1		m		x	x	x	x		x	x							
nb93	4125	3	0	41093	dec97	m.chadwick	3	lanl,anl	rev6/tape.150	aug99	r2	s		x	x	x	x		x	x							
nb94	4128	0	0	41094	apr74	schenter	hedl	t104	jan90	0	s		x	x	x	x		x	x								
nb95	4131	0	0	41095	apr74	schenter	hedl	t104	jan90	0			x	x	x	x		x	x								
nd142	6025	0	0	60142	apr74	r.e.schen	hedl	t105	feb90	0	s		x	x	x	x		x	x								
nd143	6028	2	0	60143	oct74	r.q.wright	ornl,hedl	rev2/tape.127	jun93	r1			x	x	x	x		x	x								
nd144	6031	0	0	60144	feb80	schenter	hedl	t105	feb90	0	s		x	x	x	x		x	x								
nd145	6034	2	0	60145	feb80	r.q.wright	ornl,hedl	rev2/tape.127	jun93	r1		m		x	x	x	x		x	x							
nd146	6037	0	0	60146	feb80	schenter	hedl,lnl+	t105	feb90	0	s		x	x	x	x		x	x								
nd147	6040	2	0	60147	dec88	wright, s	ornl, hed	t120	sep91	r1	s		x	x	x	x		x	x								
nd148	6043	0	0	60148	feb80	schenter	hedl,lnl+	t105	feb90	0	s		x	x	x	x		x	x								
nd150	6049	0	0	60150	feb80	schenter	hedl,lnl+	t105	feb90	0	s		x	x	x	x		x	x								
n158	2825	3	0	28058	sep97	s.chiba,m	8	lanl,orn	rev6/tape.149	aug99	r2	r		x	x	x	x		x	x							
n159	2828	1	0	28059	jan83	f.m.mann	hedl	t113	apr90	0																	
n160	2831	3	0	28060	sep97	s.chiba,m	0	lanl,orn	rev6/tape.149	aug99	r2	r		x	x	x	x		x	x							
n161	2834	4	0	28061	sep97	s.chiba,m	1	lanl,orn	rev6/tape.149	aug99	r3	r		x	x	x	x		x	x							
n162	2837	4	0	28062	sep97	s.chiba,m	2	lanl,orn	rev6/tape.149	aug99	r3	r		x	x	x	x		x	x							
n164	2843	3	0	28064	sep97	s.chiba,m	4	lanl,orn	rev6/tape.149	aug99	r2	r		x	x	x	x		x	x							
np237	9346	2	0	93237	apr90	p.young,	lanl	t121	sep91	r1	s		x	x	x	x	x	x	x	x	x	x	x	x	x	x	
np238	9349	2	0	93238	aug75	benjamin	srl	rev2/tape.129	jun93	r1	s		x	x	x	x	x	x	x	x	x	x	x	x	x	x	
np239	9352	1	0	93239	dec88	r.q.wri	ornl	t108	feb90	0			x	x	x	x	x	x	x	x	x	x	x	x	x	x	
o16	825	2	0	8016	jun96	m.b.chadw	6	lanl	rev6/tape.145	aug99	r1			x	x	x	x		x	x							
o17	828	0	0	8017	jan78	b.a.magur	bnl	t101	jan90	0			x	x	x	x		x	x								
orthod	13	1	0	113	apr93	macfarlan	lanl	rev3/tape.132	apr95	0															x		
orthoh	3	1	0	103	apr93	macfarlan	lanl	rev3/tape.132	apr95	0															x		
p31	1525	1	0	15031	dec97	m.chadwick	1	lanl,lnl	rev6/tape.146	aug99	r1			x	x	x	x		x	x							
pa231	9131	1	0	91																							

## ENDF Tape Information

symbol	mat	mod	rel	za	evdt	evaluators	org	source	dist	rv	slbw	mlbw	rm	aa	grm	hrl	File 2 RRR										File 3 MTs										MF
																	1	2	4	16	17	18	19+21&38	51-91	102	7											
pr141	5925	1	0	59141	aug99	s.y.oh,s.	bni,kaeri	rev7/tape.154	apr 0	0	m			x	x	x	x		x	x																	
pr142	5928	0	0	59142	apr74	schenter	hedl	t105		feb90	0			x	x	x			x	x																	
pr143	5931	0	0	59143	apr74	schenter	hedl	t105		feb90	0			x	x	x			x	x																	
pu236	9428	1	0	94236	sep95	r. q. wri	ornl,mapi	rev4/tape.137		0	m			x	x	x	x	x	x	x	x	x															
pu237	9431	0	0	94237	apr78	mann and	hedl	t110		feb90	0			x	x	x	x	x	x	x	x	x															
pu238	9434	1	0	94238	apr78	mann,sche	hedl,ai,+	t109		feb90	0	s		x	x	x	x	x	x	x	x	x															
pu239	9437	3	0	94239	apr89	p.young,	lanl	rev5/tape.142	sep98	r2			r		x	x	x	x	x	x	x	x															
pu240	9440	3	0	94240	aug86	l.w. west	ornl	rev2/tape.128	jun93	r2		m		x	x	x	x	x	x	x	x	x															
pu241	9443	3	0	94241	oct88	l.weston,	ornl	rev3/tape.135	sep91	r2		r		x	x	x	x	x	x	x	x	x															
pu242	9446	1	0	94242	oct78	mann,benj	hedl,srl,	t109		feb90	0	s		x	x	x	x	x	x	x	x	x															
pu243	9449	2	0	94243	jul76	kinsey-as	bnl,srl,+	rev2/tape.129	jun93	r1	s			x	x	x	x	x	x	x	x	x															
pu244	9452	0	0	94244	apr78	mann,sche	hedl,srl	t110		feb90	0	s		x	x	x	x	x	x	x	x	x															
rb85	3725	0	0	37085	oct79	a. prince	bni-brc	t102		jan90	0	m		x	x	x			x	x	x																
rb86	3728	0	0	37086	apr74	schenter	hedl	t102		jan90	0			x	x	x			x	x	x																
rb87	3731	0	0	37087	oct79	a. prince	bni-brc	t102		jan90	0	m		x	x	x			x	x	x																
re185	7525	1	0	75185	mar90	l.w.westo	ornl,lanl	t115		jun90	0	m		x	x	x	x		x	x	x																
re187	7531	1	0	75187	mar90	l.w.westo	ornl,lanl	t115		jun90	0	m		x	x	x	x		x	x	x																
rh103	4525	0	0	45103	nov78	schenter,	hedl,baw	t104		jan90	0	s		x	x	x			x	x	x																
rh105	4531	0	0	45105	apr74	schenter	hedl	t104		jan90	0			x	x	x			x	x	x																
ru100	4437	0	0	44100	feb80	r.e.schen	hedl,rcn	t104		jan90	0	s		x	x	x			x	x	x																
ru101	4440	2	0	44101	feb80	r.q.wright	ornl,hedl	rev2/tape.127	jun93	r1	m			x	x	x			x	x	x																
ru102	4443	2	0	44102	feb80	r.q.wright	ornl,hedl	rev2/tape.127	jun93	r1	m			x	x	x			x	x	x																
ru103	4446	0	0	44103	apr74	schenter	hedl	t104		jan90	0			x	x	x			x	x	x																
ru104	4449	0	0	44104	feb80	r.e.schen	hedl,rcn	t104		jan90	0	s		x	x	x			x	x	x																
ru105	4452	0	0	44105	apr74	schenter	hedl	t104		jan90	0			x	x	x			x	x	x																
ru106	4455	0	0	44106	apr74	schenter	hedl	t104		jan90	0			x	x	x			x	x	x																
ru96	4425	0	0	44096	feb80	f.m.mann	hedl	t104		jan90	0			x	x	x			x	x	x																
ru98	4431	0	0	44098	feb80	f.m.mann	hedl	t104		jan90	0			x	x	x			x	x	x																
ru99	4434	0	0	44099	apr74	r.e.schen	hedl	t104		jan90	0	s		x	x	x			x	x	x																
s	1600	0	0	16000	apr79	divadeena	bni	t101		jan90	0	m		x	x	x	x		x	x	x																
s32	1625	0	0	16032	oct77	howerton	llnl	t101		jan90	0			x	x	x			x	x	x																
sb121	5125	0	0	51121	feb80	r.e.schen	hedl,rcn	t105		feb90	0	s		x	x	x			x	x	x																
sb123	5131	0	0	51123	feb80	r.e.schen	hedl,rcn	t105		feb90	0	s		x	x	x			x	x	x																
sb124	5134	0	0	51124	apr74	schenter	hedl	t105		feb90	0			x	x	x			x	x	x																
sb125	5137	0	0	51125	apr74	schenter	hedl	t105		feb90	0			x	x	x			x	x	x																
sb126	5140	0	0	51126	apr74	schenter	hedl	t105		feb90	0			x	x	x			x	x	x																
sc45	2125	1	0	21045	jul92	a.b.smith	anl,linl	rev2/tape.127	jun93	r1	m			x	x	x			x	x	x											x					
sch4	34	1	0	134	apr93	macfarlan	lanl	rev3/tape.133	apr95	0																											
se74	3425	0	0	34074	feb80	f.m.mann	hedl	t102		jan90	0	s		x	x	x			x	x	x																
se76	3431	0	0	34076	apr74	r.e.schen	hedl	t102		jan90	0	s		x	x	x			x	x	x																
se77	3434	0	0	34077	apr74	r.e.schen	hedl	t102		jan90	0	s		x	x	x			x	x	x																
se78	3437	0	0	34078	apr74	r.e.schen	hedl	t102		jan90	0	s		x	x	x			x	x	x																
se80	3443	0	0	34080	apr74	r.e.schen	hedl	t102		jan90	0	s		x	x	x			x	x	x																
se82	3449	0	0	34082	apr74	r.e.schen	hedl	t102		jan90	0	s		x	x	x			x	x	x																
si	1400	0	0	14000	feb74	larson,pe	ornl	t116		jun90	0			x	x	x			x	x	x																
si28	1425	3	0	14028	may96	d.herrick	ornl	rev5/tape.139	sep98	0	r			x	x	x			x	x	x																
si29	1428	2	0	14029	jun97	m.b.chadw	9 lanl,ornl	rev6/tape.146	aug99	r1	r			x	x	x			x	x	x																
si30	1431	2	0	14030	jun97	m.b.chadw	0 lanl,ornl	rev6/tape.146	aug99	r1	r			x	x	x			x	x	x																
sm144	6225	2	0	62144	feb80	r.q.wrig	ornl,hedl	rev3/tape.134	apr95	r1	m			x	x	x			x	x	x																
sm147	6234	1	0	62147	apr89	wright,sc	ornl,hedl	t103		jan90	0	m		x	x	x	x		x	x	x																
sm148	6237	0	0	62148	apr74	schenter	hedl	t106		feb90	0			x	x	x			x	x	x																
sm149	6240	1	0	62149	aug99	j.h.chang	bnl+kaeri	rev7/tape.154	apr	0	0	m		x	x	x			x	x	x																
sm150	6243	2	0	62150	apr74	r.q.wright	ornl,hedl	rev2/tape.127	jun93	r0	m			x	x	x			x	x	x																
sm151	6246	2	0	62151	mar89	wright, s	ornl,hedl	t120		sep91	r1	m		x	x	x	x		x	x	x																
sm152	6249	2	0	62152	feb80	r.q.wright</td																															

## ENDF Tape Information

## File 2 RRR

## File 3 MTs

## MF

symbol	mat	mod	rel	za	evdt	evaluators	org	source	dist	rv	slbw	mlbw	rm	aa	grm	hrf	1	2	4	16	17	18	19-21&38	51-91	102	7
te124	5237	0	0	52124	apr74	r.e.schen	hedl	t105	feb90	0	s			x	x	x		x	x							
te125	5240	0	0	52125	apr74	r.e.schen	hedl	t105	feb90	0	s			x	x	x		x	x							
te126	5243	0	0	52126	apr74	r.e.schen	hedl	t105	feb90	0	s			x	x	x		x	x							
te127m	5247	0	0	52127	apr74	schenter	mhedl	t105	feb90	0				x	x	x		x	x							
te128	5249	0	0	52128	apr74	r.e.schen	hedl	t105	feb90	0	s			x	x	x		x	x							
te129m	5253	0	0	52129	apr74	schenter	mhedl	t105	feb90	0				x	x	x		x	x							
te130	5255	0	0	52130	apr74	r.e.schen	hedl	t105	feb90	0	s			x	x	x		x	x							
te132	5261	0	0	52132	apr74	schenter	hedl	t105	feb90	0				x	x	x		x	x							
th230	9034	0	0	90230	nov77	mann	hedl	t110	feb90	0	s			x	x	x	x	x	x				x	x		
th232	9040	1	0	90232	dec77	bhat, smit	bnl, anl+	t109	feb90	0	m			x	x	x	x	x	x				x	x		
ti	2200	0	0	22000	aug77	c.philis,	brc, anl+	t102	jan90	0				x	x	x	x	x	x				x	x		
ti46	2225	0	0	22046	jan77	c.philis,	brc, anl	t102	jan90	0																
ti47	2228	0	0	22047	jan77	c.philis,	brc, anl	t102	jan90	0																
ti48	2231	0	0	22048	jan77	c.philis,	brc, anl+	t102	jan90	0																
ti50	2237	0	0	22050	may79	e.arthur	lanl	t102	jan90	0																
u232	9219	1	0	92232	nov77	mann	hedl	t109	feb90	0	s			x	x	x	x	x	x				x	x		
u233	9222	1	0	92233	dec78	stewart e	lanl, ornl	t109	feb90	0				a	x	x	x	x	x	x			x	x		
u234	9225	1	0	92234	jul78	divadeena	bnl, gga	t109	feb90	0	m			x	x	x	x	x	x			x	x			
u235	9228	6	0	92235	nov89	weston, y	ornl, lanl	rev5/tape.144	nov98	r5				r	x	x	x	x	x	x			x	x		
u236	9231	1	0	92236	oct89	f.m. mann	hedl	t108	feb90	0	m			x	x	x	x	x	x			x	x			
u237	9234	2	0	92237	jul76	kinsey-as	bnl, srl+	rev2/tape.129	jun93	r1	s			x	x	x	x	x	x			x	x			
u238	9237	4	0	92238	nov89	l.w.westo	ornl, lanl	rev5/tape.142	sep98	r3				r	x	x	x	x	x	x			x	x		
v	2300	1	0	23000	jun88	a.smith,d	anl, llnl	t103	jan90	0	m			x	x	x	x	x	x			x	x			
w	7400	2	0	74000	mar82	e.d.artu	lanl	t120	sep91	r1	m			x	x	x	x	x	x			x	x			
w182	7431	1	0	74182	oct96	m.b.chadw	2 lanl, anl	rev6/tape.151	aug99	r1	m			x	x	x	x	x	x			x	x			
w183	7434	1	0	74183	oct96	m.b.chadw	3 lanl, anl	rev6/tape.151	aug99	r1	m			x	x	x	x	x	x			x	x			
w184	7437	1	0	74184	oct96	m.b.chadw	4 lanl, anl	rev6/tape.151	aug99	r1	m			x	x	x	x	x	x			x	x			
w186	7443	1	0	74186	oct96	m.b.chadw	6 lanl, anl	rev6/tape.151	aug99	r1	m			x	x	x	x	x	x			x	x			
xe124	5425	0	0	54124	mar78	m.r.bhat	bnl	t105	feb90	0	m			x	x	x	x	x	x			x	x			
xe126	5431	0	0	54126	mar78	m.r.bhat	bnl	t105	feb90	0	m			x	x	x	x	x	x			x	x			
xe128	5437	0	0	54128	mar78	m.r.bhat	bnl	t105	feb90	0	m			x	x	x	x	x	x			x	x			
xe129	5440	0	0	54129	mar78	m.r.bhat	bnl	t105	feb90	0	m			x	x	x	x	x	x			x	x			
xe130	5443	0	0	54130	mar78	m.r.bhat	bnl	t105	feb90	0	m			x	x	x	x	x	x			x	x			
xe131	5446	0	0	54131	mar78	m.r.bhat	bnl	t105	feb90	0	m			x	x	x	x	x	x			x	x			
xe132	5449	0	0	54132	mar78	m.r.bhat	bnl	t105	feb90	0	m			x	x	x	x	x	x			x	x			
xe133	5452	0	0	54133	apr74	schenter	hedl	t105	feb90	0				x	x	x	x	x	x			x	x			
xe134	5455	0	0	54134	mar78	m.r.bhat	bnl	t105	feb90	0				x	x	x	x	x	x			x	x			
xe135	5458	0	0	54135	apr74	b.leonard	bnw, hedl	t105	feb90	0				x	x	x	x	x	x			x	x			
xe136	5461	0	0	54136	mar78	m.r.bhat	bnl	t105	feb90	0				x	x	x	x	x	x			x	x			
y89	3925	2	0	39089	jan86	r.howerto	anl, llnl	rev4/tape.137	jan90	r1	s			x	x	x	x	x	x			x	x			
y90	3928	0	0	39090	apr74	schenter	hedl	t102	jan90	0				x	x	x	x	x	x			x	x			
y91	3931	0	0	39091	apr74	schenter	hedl	t102	jan90	0				x	x	x	x	x	x			x	x			
zr	4000	2	0	40000	apr76	m.drake,d	sai, bnl	t120	sep91	r1	m			x	x	x	x	x	x			x	x		x	
zr(zrh)	58	1	0	158	apr93	macfarlan	lanl	rev3/tape.133	apr95	0															x	
zr90	4025	0	0	40090	apr76	m.drake,d	sai, bnl	t104	jan90	0	m			x	x	x	x	x	x			x	x			
zr91	4028	0	0	40091	apr76	m.drake,d	sai, bnl	t104	jan90	0	m			x	x	x	x	x	x			x	x			
zr92	4031	0	0	40092	apr76	m.drake,d	sai, bnl	t104	jan90	0	m			x	x	x	x	x	x			x	x			
zr93	4034	0	0	40093	apr74	schenter	hedl	t104	jan90	0				x	x	x	x	x	x			x	x			
zr94	4037	0	0	40094	apr76	m.drake,d	sai, bnl	t104	jan90	0				x	x	x	x	x	x			x	x			
zr95	4040	0	0	40095	apr74	schenter	hedl	t104	jan90	0				x	x	x	x	x	x			x	x			
zr96	4043	0	0	40096	apr76	m.drake,d	sai, bnl	t104	jan90	0				x	x	x	x	x	x			x	x			

# APPENDIX B

## CONTENTS OF 238-GROUP ENDF/B-VI LIBRARY

### GENERATED WITH AMPX-2000

The following is the directory of the 238-group ENDF/B-VI library that has been generated in support of the temperature-effects study. For each entry in the directory, the SCALE-identifier number is provided for each material followed by a descriptive title card. The first entry for each title card is the symbol associated with the material. Following the symbol information is the 4-digit ENDF material number and ZA number. The remaining information in the title card is a condensed description of the ENDF/B source information.

Oentry	identifier	t i t l e	source
1	47107	ag107 4725 47107 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t104	25
2	47109	ag109 4731 47109 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t104	25
3	47111	ag111 4737 47111 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t104	25
4	13027	a127 1325 13027 ENDFB V6 REL0 REV2 MOD3 AMPX 06/08/01 rev6/tape.145	25
5	95241	am241 9543 95241 ENDFB V6 REL0 REV2 MOD3 AMPX 06/08/01 rev3/tape.135	25
6	95242	am242 9546 95242 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 t121	25
7	95601	am242m 9547 95601 endfb v6 rel0 rev1 mod2 ampx 06/08/01 t121	25
8	95243	am243 9549 95243 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 rev5/tape.143	25
9	18040	ar40 1837 18040 ENDFB V6 REL0 REV0 MOD0 AMPXINCOMPLETEt101	25
10	33075	as75 3325 33075 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t102	25
11	79197	au197 7925 79197 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 t120	25
12	5010	b10 525 5010 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 t120	25
13	5011	b11 528 5011 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 t100	25
14	56134	ba134 5637 56134 ENDFB V6 REL0 REV0 MOD2 AMPX 06/08/01 rev7/tape.154	25
15	56135	ba135 5640 56135 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 t103	25
16	56136	ba136 5643 56136 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 t103	25
17	56137	ba137 5646 56137 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 t103	25
18	56138	ba138 5649 56138 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 rev3/tape.134	25
19	56140	ba140 5655 56140 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t105	25
20	4009	be9 425 4009 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 t100	25
21	4309	bemetal 26 4309 endfb v6 rel0 rev0 mod1 ampx 08/06/01 rev3/tape.133	25
22	1601	benzine 40 1601 endfb v6 rel0 rev0 mod0 ampx 08/06/01 t119	25
23	6612	c_benzine 40 6612 endfb v6 rel rev mod ampx 08/06/01 t119	25
24	4509	beo 27 4509 endfb v6 rel0 rev0 mod1 ampx 08/06/01 rev3/tape.133	25
25	8516	o_beo 27 8516 endfb v6 rel rev mod ampx 08/06/01 rev3/tape.133	25
26	83209	bi209 8325 83209 ENDFB V6 REL0 REV0 MOD2 AMPX 06/08/01 rev7/tape.155	25
27	97249	bk249 9752 97249 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 t108	25
28	35079	br79 3525 35079 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t102	25
29	35081	br81 3531 35081 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t102	25
30	6012	c 600 6012 endfb v6 rel0 rev2 mod3 ampx 08/06/01 rev6/tape.145	25
31	20000	ca 2000 20000 endfb v6 rel0 rev1 mod1 ampx 08/06/01 rev6/tape.146	25
32	48000	cd 4800 48000 endfb v6 rel0 rev0 mod0 ampx 08/06/01 t104	25
33	48106	cd106 4825 48106 ENDFB V6 REL0 REV2 MOD4 AMPX 06/08/01 rev4/tape.137	25
34	48108	cd108 4831 48108 ENDFB V6 REL0 REV2 MOD4 AMPX 06/08/01 rev4/tape.137	25
35	48110	cd110 4837 48110 ENDFB V6 REL0 REV3 MOD4 AMPX 06/08/01 rev4/tape.137	25
36	48111	cd111 4840 48111 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 rev3/tape.134	25
37	48112	cd112 4843 48112 ENDFB V6 REL0 REV2 MOD4 AMPX 06/08/01 rev4/tape.137	25
38	48113	cd113 4846 48113 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 rev3/tape.134	25
39	48114	cd114 4849 48114 ENDFB V6 REL0 REV2 MOD4 AMPX 06/08/01 rev4/tape.137	25
40	48601	cd115m 4853 48601 endfb v6 rel0 rev0 mod0 ampx 08/06/01 t104	25
41	48116	cd116 4855 48116 ENDFB V6 REL0 REV2 MOD4 AMPX 06/08/01 rev4/tape.137	25
42	58140	ce140 5837 58140 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t105	25
43	58141	ce141 5840 58141 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t105	25
44	58142	ce142 5843 58142 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t105	25
45	58143	ce143 5846 58143 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t105	25
46	58144	ce144 5849 58144 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t105	25
47	98249	cf249 9852 98249 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 t108	25
48	98250	cf250 9855 98250 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.129	25
49	98251	cf251 9858 98251 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.129	25
50	98252	cf252 9861 98252 ENDFB V6 REL0 REV2 MOD3 AMPX 06/08/01 rev2/tape.129	25
51	98253	cf253 9864 98253 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.129	25
52	17000	cl 1700 17000 endfb v6 rel0 rev0 mod0 ampx 08/06/01 t101	25
53	96241	cm241 9628 96241 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t110	25
54	96242	cm242 9631 96242 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 t109	25
55	96243	cm243 9634 96243 ENDFB V6 REL0 REV0 MOD1 AMPX 06/08/01 rev7/tape.155	25
56	96244	cm244 9637 96244 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t110	25
57	96245	cm245 9640 96245 ENDFB V6 REL0 REV0 MOD3 AMPX 06/08/01 rev7/tape.155	25
58	96246	cm246 9643 96246 ENDFB V6 REL0 REV0 MOD3 AMPX 06/08/01 rev7/tape.155	25
59	96247	cm247 9646 96247 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.129	25
60	96248	cm248 9649 96248 ENDFB V6 REL0 REV0 MOD0 AMPX 06/08/01 t110	25
61	27059	co59 2725 27059 ENDFB V6 REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.129	25

Oentry	identifier	t	i	t	l	e	source	
62	24050	cr50	2425	24050	ENDFB	V6	REL0 REV3 MOD4 AMPX 06/08/01 rev6/tape.147	25
63	24052	cr52	2431	24052	ENDFB	V6	REL0 REV2 MOD3 AMPX 06/08/01 rev6/tape.147	25
64	24053	cr53	2434	24053	ENDFB	V6	REL0 REV2 MOD3 AMPX 06/08/01 rev6/tape.147	25
65	24054	cr54	2437	24054	ENDFB	V6	REL0 REV3 MOD4 AMPX 06/08/01 rev6/tape.147	25
66	55133	cs133	5525	55133	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev7/tape.154	25
67	55134	cs134	5528	55134	ENDFB	V6	REL0 REV0 MOD2 AMPX 06/08/01 rev7/tape.154	25
68	55135	cs135	5531	55135	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev7/tape.154	25
69	55136	cs136	5534	55136	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t105	25
70	55137	cs137	5537	55137	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t105	25
71	29063	cu63	2925	29063	ENDFB	V6	REL0 REV3 MOD4 AMPX 06/08/01 rev6/tape.150	25
72	29065	cu65	2931	29065	ENDFB	V6	REL0 REV3 MOD4 AMPX 06/08/01 rev6/tape.150	25
73	1002	d_d2o	11	1002	endfb	v6	rel0 rev0 mod0 ampx 08/06/01 t118	25
74	66160	dy160	6637	66160	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev7/tape.154	25
75	66161	dy161	6640	66161	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev7/tape.154	25
76	66162	dy162	6643	66162	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev7/tape.154	25
77	66163	dy163	6646	66163	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev7/tape.154	25
78	66164	dy164	6649	66164	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev7/tape.154	25
79	68166	er166	6837	68166	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 t103	25
80	68167	er167	6840	68167	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 t103	25
81	99253	es253	9913	99253	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t110	25
82	63151	eu151	6325	63151	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 t103	25
83	63152	eu152	6328	63152	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 t103	25
84	63153	eu153	6331	63153	ENDFB	V6	REL0 REV0 MOD2 AMPX 06/08/01 rev7/tape.154	25
85	63154	eu154	6334	63154	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 rev7/tape.154	25
86	63155	eu155	6337	63155	ENDFB	V6	REL0 REV0 MOD3 AMPX 06/08/01 rev7/tape.154	25
87	63156	eu156	6340	63156	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t106	25
88	63157	eu157	6343	63157	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t106	25
89	9019	f19	925	9019	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 t115	25
90	26054	fe54	2625	26054	ENDFB	V6	REL0 REV3 MOD5 AMPX 06/08/01 rev6/tape.148	25
91	26056	fe56	2631	26056	ENDFB	V6	REL0 REV2 MOD3 AMPX 06/08/01 rev6/tape.148	25
92	26057	fe57	2634	26057	ENDFB	V6	REL0 REV2 MOD3 AMPX 06/08/01 rev6/tape.148	25
93	26058	fe58	2637	26058	ENDFB	V6	REL0 REV2 MOD3 AMPX 06/08/01 rev5/tape.140	25
94	31000	ga	3100	31000	endfb	v6	rel0 rev0 mod0 ampx 08/06/01 t102	25
95	64152	gd152	6425	64152	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev4/tape.137	25
96	64154	gd154	6431	64154	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev4/tape.137	25
97	64155	gd155	6434	64155	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t106	25
98	64156	gd156	6437	64156	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t106	25
99	64157	gd157	6440	64157	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t106	25
100	64158	gd158	6443	64158	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t106	25
101	64160	gd160	6449	64160	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t106	25
102	32072	ge72	3231	32072	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25
103	32073	ge73	3234	32073	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.129	25
104	32074	ge74	3237	32074	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25
105	32076	ge76	3243	32076	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25
106	6312	graphite	31	6312	endfb	v6	rel0 rev0 mod1 ampx 08/06/01 rev3/tape.133	25
107	1901	h_ch2	37	1901	endfb	v6	rel0 rev0 mod0 ampx 08/06/01 t118	25
108	1001	h_h2o	1	1001	endfb	v6	rel0 rev0 mod1 ampx 08/06/01 rev3/tape.132	25
109	1701	h_zrh	7	1701	endfb	v6	rel0 rev0 mod1 ampx 08/06/01 rev3/tape.132	25
110	1801	h1	125	1801	endfb	v6	rel0 rev3 mod4 ampx 08/06/01 rev6/tape.145	25
111	1802	h2	128	1802	endfb	v6	rel0 rev3 mod4 ampx 08/06/01 rev6/tape.145	25
112	2003	he3	225	2003	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 t120	25
113	2004	he4	228	2004	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t101	25
114	72000	hf	7200	72000	endfb	v6	rel0 rev0 mod0 ampx 08/06/01 t106	25
115	72174	hf174	7225	72174	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.127	25
116	72176	hf176	7231	72176	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.127	25
117	72177	hf177	7234	72177	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.127	25
118	72178	hf178	7237	72178	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.127	25
119	72179	hf179	7240	72179	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.127	25
120	72180	hf180	7243	72180	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 rev2/tape.127	25
121	67165	ho165	6725	67165	ENDFB	V6	REL0 REV1 MOD2 AMPX 06/08/01 rev5/tape.143	25
122	53127	i127	5325	53127	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev2/tape.127	25
123	53129	i129	5331	53129	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t105	25
124	53130	i130	5334	53130	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t105	25
125	53131	i131	5337	53131	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t105	25
126	53135	i135	5349	53135	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t105	25
127	49000	in	4900	49000	endfb	v6	rel0 rev0 mod1 ampx 08/06/01 t116	25
128	49113	in113	4925	49113	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t116	25
129	49115	in115	4931	49115	ENDFB	V6	REL0 REV0 MOD1 AMPXINCOMPLETEt116	25
130	77191	ir191	7725	77191	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev4/tape.137	25
131	77193	ir193	7731	77193	ENDFB	V6	REL0 REV0 MOD1 AMPX 06/08/01 rev4/tape.137	25
132	19000	k	1900	19000	endfb	v6	rel0 rev0 mod0 ampx 08/06/01 t101	25
133	19041	k41	1931	19041	ENDFB	V6	REL0 REV0 MOD0 AMPXINCOMPLETEt101	25
134	36078	kr78	3625	36078	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25
135	36080	kr80	3631	36080	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25
136	36082	kr82	3637	36082	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25
137	36083	kr83	3640	36083	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25
138	36084	kr84	3643	36084	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25
139	36085	kr85	3646	36085	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25
140	36086	kr86	3649	36086	ENDFB	V6	REL0 REV0 MOD0 AMPX 06/08/01 t102	25

0entry	identifier	t	i	t	l	e	source
141	57139	5728	57139	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 t120
142	57140	5731	57140	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t105
143	1101	33	1101	endfb	v6	rel0 rev0 mod1 ampx	08/06/01 rev3/tape.133
144	3006	325	3006	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 t120
145	3007	328	3007	ENDFB	V6	REL0 REV0 MOD1 AMPX	06/08/01 t100
146	71175	7125	71175	ENDFB	V6	REL0 REV1 MOD1 AMPX	06/08/01 rev7/tape.154
147	71176	7128	71176	ENDFB	V6	REL0 REV1 MOD1 AMPX	06/08/01 rev7/tape.154
148	12000	1200	12000	endfb	v6	rel0 rev0 mod0 ampx	08/06/01 t101
149	12024	1225	12024	ENDFB	V6	REL0 REV0 MODO AMPXINCOMPLETEt101	
150	25055	2525	25055	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 rev5/tape.140
151	42000	4200	42000	endfb	v6	rel0 rev0 mod0 ampx	08/06/01 t104
152	42100	4249	42100	ENDFB	V6	REL0 REV0 MODO AMPXINCOMPLETEt104	
153	42092	4225	42092	ENDFB	V6	REL0 REV0 MODO AMPXINCOMPLETEt104	
154	42094	4231	42094	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t104
155	42095	4234	42095	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t104
156	42096	4237	42096	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t104
157	42097	4240	42097	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t104
158	42098	4243	42098	ENDFB	V6	REL0 REV0 MODO AMPXINCOMPLETEt104	
159	42099	4246	42099	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t104
160	7014	725	7014	ENDFB	V6	REL0 REV3 MOD4 AMPX	06/08/01 rev6/tape.145
161	7015	728	7015	ENDFB	V6	REL0 REV0 MOD1 AMPX	06/08/01 t116
162	11023	1125	11023	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 t120
163	41093	4125	41093	ENDFB	V6	REL0 REV2 MOD3 AMPX	06/08/01 rev6/tape.150
164	41094	4128	41094	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t104
165	41095	4131	41095	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t104
166	60142	6025	60142	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t105
167	60143	6028	60143	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 rev2/tape.127
168	60144	6031	60144	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t105
169	60145	6034	60145	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 rev2/tape.127
170	60146	6037	60146	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t105
171	60147	6040	60147	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 t120
172	60148	6043	60148	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t105
173	60150	6049	60150	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t105
174	28058	2825	28058	ENDFB	V6	REL0 REV2 MOD3 AMPX	06/08/01 rev6/tape.149
175	28059	2828	28059	ENDFB	V6	REL0 REV0 MOD1 AMPXINCOMPLETEt113	
176	28060	2831	28060	ENDFB	V6	REL0 REV2 MOD3 AMPX	06/08/01 rev6/tape.149
177	28061	2834	28061	ENDFB	V6	REL0 REV3 MOD4 AMPX	06/08/01 rev6/tape.149
178	28062	2837	28062	ENDFB	V6	REL0 REV3 MOD4 AMPX	06/08/01 rev6/tape.149
179	28064	2843	28064	ENDFB	V6	REL0 REV2 MOD3 AMPX	06/08/01 rev6/tape.149
180	93237	9346	93237	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 t121
181	93238	9349	93238	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 rev2/tape.129
182	93239	9352	93239	ENDFB	V6	REL0 REV0 MOD1 AMPX	06/08/01 t108
183	8016	825	8016	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 rev6/tape.145
184	8017	828	8017	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t101
185	1402	1402	orthod			1402 endfb v6 rel0 rev0 mod1 ampx	08/06/01 rev3/tape.132
186	1401	1401	orthoh			1401 endfb v6 rel0 rev0 mod1 ampx	08/06/01 rev3/tape.132
187	15031	1525	15031	ENDFB	V6	REL0 REV1 MOD1 AMPX	06/08/01 rev6/tape.146
188	91231	9131	91231	ENDFB	V6	REL0 REV0 MOD1 AMPX	06/08/01 t109
189	91233	9137	91233	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t110
190	1502	1502	parad			1502 endfb v6 rel0 rev0 mod1 ampx	08/06/01 rev3/tape.132
191	1501	1501	parah			1501 endfb v6 rel0 rev0 mod1 ampx	08/06/01 rev3/tape.132
192	82206	8231	82206	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 rev6/tape.152
193	82207	8234	82207	ENDFB	V6	REL0 REV2 MOD3 AMPX	06/08/01 rev6/tape.152
194	82208	8237	82208	ENDFB	V6	REL0 REV2 MOD3 AMPX	06/08/01 rev6/tape.152
195	46102	4625	46102	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 rev5/tape.141
196	46104	4631	46104	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 rev5/tape.141
197	46105	4634	46105	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 rev5/tape.141
198	46106	4637	46106	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 rev5/tape.141
199	46107	4640	46107	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t103
200	46108	4643	46108	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 rev5/tape.141
201	46110	4649	46110	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 rev5/tape.141
202	61147	6149	61147	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 t120
203	61148	6152	61148	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t106
204	61601	6153	61601	endfb	v6	rel0 rev0 mod0 ampx	08/06/01 t106
205	61149	6155	61149	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t106
206	61151	6161	61151	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t106
207	59141	5925	59141	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 rev7/tape.154
208	59142	5928	59142	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t105
209	59143	5931	59143	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t105
210	94236	9428	94236	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 rev4/tape.137
211	94237	9431	94237	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t110
212	94238	9434	94238	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t109
213	94239	9437	94239	ENDFB	V6	REL0 REV2 MOD3 AMPX	06/08/01 rev5/tape.142
214	94240	9440	94240	ENDFB	V6	REL0 REV2 MOD3 AMPX	06/08/01 rev2/tape.128
215	94241	9443	94241	ENDFB	V6	REL0 REV2 MOD3 AMPX	06/08/01 rev3/tape.135
216	94242	9446	94242	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t109
217	94243	9449	94243	ENDFB	V6	REL0 REV1 MOD2 AMPX	06/08/01 rev2/tape.129
218	94244	9452	94244	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t110
219	37085	3725	37085	ENDFB	V6	REL0 REV0 MODO AMPX	06/08/01 t102

0entry	identifier		t	i	t	l	e	source					
220	37086	rb86	3728	37086	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
221	37087	rb87	3731	37087	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
222	75185	re185	7525	75185	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t115	25
223	75187	re187	7531	75187	ENDFB	V6	REL0	REVO	MOD1	AMPX	06/08/01	t115	25
224	45103	rh103	4525	45103	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
225	45105	rh105	4531	45105	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
226	44100	ru100	4437	44100	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
227	44101	ru101	4440	44101	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	rev2/tape.127	25
228	44102	ru102	4443	44102	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	rev2/tape.127	25
229	44103	ru103	4446	44103	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
230	44104	ru104	4449	44104	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
231	44105	ru105	4452	44105	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
232	44106	ru106	4455	44106	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
233	44096	ru96	4425	44096	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
234	44098	ru98	4431	44098	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
235	44099	ru99	4434	44099	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
236	16000	s	1600	16000	endfb	v6	rel0	rev0	mod0	ampx	08/06/01	t101	25
237	16032	s32	1625	16032	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t101	25
238	51121	sb121	5125	51121	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
239	51123	sb123	5131	51123	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
240	51124	sb124	5134	51124	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
241	51125	sb125	5137	51125	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
242	51126	sb126	5140	51126	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
243	21045	sc45	2125	21045	ENDFB	V6	REL0	REVO	MOD1	AMPX	06/08/01	rev2/tape.127	25
244	1201	sch4	34	1201	endfb	v6	rel0	rev0	mod1	ampx	08/06/01	rev3/tape.133	25
245	34074	se74	3425	34074	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
246	34076	se76	3431	34076	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
247	34077	se77	3434	34077	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
248	34078	se78	3437	34078	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
249	34080	se80	3443	34080	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
250	34082	se82	3449	34082	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
251	14000	si	1400	14000	endfb	v6	rel0	rev0	mod0	ampx	08/06/01	t116	25
252	14028	si28	1425	14028	ENDFB	V6	REL0	REVO	MOD3	AMPX	06/08/01	rev5/tape.139	25
253	14029	si29	1428	14029	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	rev6/tape.146	25
254	14030	si30	1431	14030	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	rev6/tape.146	25
255	62144	sm144	6225	62144	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	rev3/tape.134	25
256	62147	sm147	6234	62147	ENDFB	V6	REL0	REVO	MOD1	AMPX	06/08/01	t103	25
257	62148	sm148	6237	62148	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t106	25
258	62149	sm149	6240	62149	ENDFB	V6	REL0	REVO	MOD1	AMPX	06/08/01	rev7/tape.154	25
259	62150	sm150	6243	62150	ENDFB	V6	REL0	REVO	MOD2	AMPX	06/08/01	rev2/tape.127	25
260	62151	sm151	6246	62151	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	t120	25
261	62152	sm152	6249	62152	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	rev2/tape.127	25
262	62153	sm153	6252	62153	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t106	25
263	62154	sm154	6255	62154	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t106	25
264	50112	sn112	5025	50112	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	t120	25
265	50114	sn114	5031	50114	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	t120	25
266	50115	sn115	5034	50115	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
267	50116	sn116	5037	50116	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
268	50117	sn117	5040	50117	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
269	50118	sn118	5043	50118	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
270	50119	sn119	5046	50119	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
271	50120	sn120	5049	50120	ENDFB	V6	REL0	REVO	MODO	AMPXINCOMPLETEt105		25	
272	50122	sn122	5055	50122	ENDFB	V6	REL0	REVO	MODO	AMPXINCOMPLETEt105		25	
273	50123	sn123	5058	50123	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
274	50124	sn124	5061	50124	ENDFB	V6	REL0	REVO	MODO	AMPXINCOMPLETEt105		25	
275	50125	sn125	5064	50125	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
276	50126	sn126	5067	50126	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
277	38084	sr84	3825	38084	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
278	38086	sr86	3831	38086	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
279	38087	sr87	3834	38087	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
280	38088	sr88	3837	38088	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
281	38089	sr89	3840	38089	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
282	38090	sr90	3843	38090	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	25
283	1003	t3	131	1003	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t101	25
284	73181	ta181	7328	73181	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t106	25
285	73182	ta182	7331	73182	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t106	25
286	65159	tb159	6525	65159	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t106	25
287	65160	tb160	6528	65160	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t106	25
288	43099	tc99	4325	43099	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	25
289	52120	te120	5225	52120	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
290	52122	te122	5231	52122	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
291	52123	te123	5234	52123	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
292	52124	te124	5237	52124	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
293	52125	te125	5240	52125	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
294	52126	te126	5243	52126	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
295	52601	te127m	5247	52601	endfb	v6	rel0	rev0	mod0	ampx	08/06/01	t105	25
296	52128	te128	5249	52128	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
297	52611	te129m	5253	52611	endfb	v6	rel0	rev0	mod0	ampx	08/06/01	t105	25
298	52130	te130	5255	52130	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25

0entry	identifier		t	i	t	l	e	source					
299	52132	te132	5261	52132	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	25
300	90230	th230	9034	90230	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t110	30
301	90232	th232	9040	90232	ENDFB	V6	REL0	REVO	MOD1	AMPX	06/08/01	t109	31
302	22000	ti	2200	22000	endfb	v6	rel0	rev0	mod0	ampx	08/06/01	t102	32
303	22046	ti46	2225	22046	ENDFB	V6	REL0	REVO	MODO	AMPXINCOMPLETEt102			33
304	22047	ti47	2228	22047	ENDFB	V6	REL0	REVO	MODO	AMPXINCOMPLETEt102			34
305	22048	ti48	2231	22048	ENDFB	V6	REL0	REVO	MODO	AMPXINCOMPLETEt102			35
306	22050	ti50	2237	22050	ENDFB	V6	REL0	REVO	MODO	AMPXINCOMPLETEt102			36
307	92232	u232	9219	92232	ENDFB	V6	REL0	REVO	MOD1	AMPX	06/08/01	t109	37
308	92233	u233	9222	92233	ENDFB	V6	REL0	REVO	MOD1	AMPX	06/08/01	t109	38
309	92234	u234	9225	92234	ENDFB	V6	REL0	REVO	MOD1	AMPX	06/08/01	t109	39
310	92235	u235	9228	92235	ENDFB	V6	REL0	REV5	MOD6	AMPX	06/08/01	rev5/tape.144	40
311	92236	u236	9231	92236	ENDFB	V6	REL0	REVO	MOD1	AMPX	06/08/01	t108	41
312	92237	u237	9234	92237	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	rev2/tape.129	42
313	92238	u238	9237	92238	ENDFB	V6	REL0	REV3	MOD4	AMPX	06/08/01	rev5/tape.142	43
314	23000	v	2300	23000	endfb	v6	rel0	rev0	mod1	ampx	08/06/01	t103	44
315	74000	w	7400	74000	endfb	v6	rel0	rev1	mod2	ampx	08/06/01	t120	45
316	74182	w182	7431	74182	ENDFB	V6	REL0	REV1	MOD1	AMPX	06/08/01	rev6/tape.151	46
317	74183	w183	7434	74183	ENDFB	V6	REL0	REV1	MOD1	AMPX	06/08/01	rev6/tape.151	47
318	74184	w184	7437	74184	ENDFB	V6	REL0	REV1	MOD1	AMPX	06/08/01	rev6/tape.151	48
319	74186	w186	7443	74186	ENDFB	V6	REL0	REV1	MOD1	AMPX	06/08/01	rev6/tape.151	49
320	54124	xe124	5425	54124	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	50
321	54126	xe126	5431	54126	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	51
322	54128	xe128	5437	54128	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	52
323	54129	xe129	5440	54129	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	53
324	54130	xe130	5443	54130	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	54
325	54131	xe131	5446	54131	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	55
326	54132	xe132	5449	54132	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	56
327	54133	xe133	5452	54133	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	57
328	54134	xe134	5455	54134	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	58
329	54135	xe135	5458	54135	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	59
330	54136	xe136	5461	54136	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t105	60
331	39089	y89	3925	39089	ENDFB	V6	REL0	REV1	MOD2	AMPX	06/08/01	rev4/tape.137	61
332	39090	y90	3928	39090	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	62
333	39091	y91	3931	39091	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t102	63
334	40000	zr	4000	40000	endfb	v6	rel0	rev1	mod2	ampx	08/06/01	t120	64
335	40701	zr_zrh	58	40701	endfb	v6	rel0	rev0	mod1	ampx	08/06/01	rev3/tape.133	65
336	40090	zr90	4025	40090	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	66
337	40091	zr91	4028	40091	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	67
338	40092	zr92	4031	40092	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	68
339	40093	zr93	4034	40093	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	69
340	40094	zr94	4037	40094	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	70
341	40095	zr95	4040	40095	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	71
342	40096	zr96	4043	40096	ENDFB	V6	REL0	REVO	MODO	AMPX	06/08/01	t104	72

## APPENDIX C

### EXAMPLE OUTPUT OF PROCESSING CRC BENCHMARKS WITH CRCREAD

The following information has been obtained by processing the CRC benchmark model cr3i12a with the CRCREAD program. The first two columns (i.e., symbol and ZA number) of the output correspond to the 130 isotopes as specified by the YMP for the evaluation of temperature effects. The remaining columns identify whether the specific isotope is present in the model. If an isotope is present, CRCREAD identifies the location of the specific isotope in the MCNP model.

Symbol	ZA	Not Present	Fuel	Structure	Both
ag107	47107			x	
ag109	47109				x
a127	13027			x	
am241	95241		x		
am242m	95242		x		
am243	95243		x		
as75	33075		x		
b10	5010				x
b11	5011				x
ba138	56138		x		
be9	4009	x			
c	6000			x	
cd	48000			x	
cm242	96242		x		
cm243	96243		x		
cm244	96244		x		
cm245	96245		x		
cm246	96246		x		
cm247	96247	x			
cm248	96248		x		
co59	27059				x
cr50	24050				x
cr52	24052				x
cr53	24053				x
cr54	24054				x
cs133	55133		x		
cs135	55135		x		
cu63	29063			x	
cu65	29065			x	
eu151	63151		x		
eu152	63152		x		
eu153	63153		x		
eu154	63154		x		
eu155	63155		x		
fe54	26054			x	
fe56	26056			x	
fe57	26057			x	
fe58	26058			x	
gd152	64152		x		
gd154	64154		x		
gd155	64155		x		
gd156	64156		x		

Symbol	ZA	Not Present	Fuel	Structure	Both
gd157	64157		x		
gd158	64158		x		
gd160	64160		x		
h1	1001				x
he4	2004		x		
ho165	67165		x		
in	49000				x
kr80	36080		x		
kr82	36082		x		
kr83	36083		x		
kr84	36084		x		
kr86	36086		x		
li6	3006		x		
li7	3007	x			
mn55	25055			x	
mo	42000			x	
mo95	42095		x		
n14	7014			x	
nb93	41093			x	
nd143	60143		x		
nd145	60145		x		
nd147	60147		x		
nd148	60148		x		
ni58	28058				x
ni60	28060				x
ni61	28061				x
ni62	28062				x
ni64	28064				x
np237	93237		x		
np238	93238		x		
o16	8016				x
p31	15031			x	
pa233	91233	x			
pd105	46105		x		
pd108	46108		x		
pm147	61147		x		
pm148	61148		x		
pm149	61149		x		
pr141	59141		x		
pu237	94237	x			
pu238	94238		x		
pu239	94239		x		
pu240	94240		x		
pu241	94241		x		
pu242	94242		x		
rh103	45103		x		
rh105	45105		x		
ru101	44101		x		
ru103	44103		x		
s32	16032			x	
si	14000			x	
sm147	62147		x		
sm149	62149		x		
sm150	62150		x		
sm151	62151		x		

Symbol	ZA	Not Present	Fuel	Structure	Both
sm152	62152		x		
sn	50000			x	
sn112	50112	x			
sn114	50114	x			
sn115	50115	x			
sn116	50116	x			
sn117	50117	x			
sn118	50118	x			
sn119	50119	x			
sn120	50120	x			
sn122	50122	x			
sn123	50123	x			
sn124	50124	x			
sn125	50125	x			
sn126	50126	x			
t3	1003		x		
ta181	73181			x	
tc99	43099		x		
th232	90232	x			
ti	22000			x	
u233	92233		x		
u234	92234		x		
u235	92235		x		
u236	92236		x		
u237	92237		x		
u238	92238		x		
xe131	54131		x		
xe134	54134		x		
xe135	54135		x		
y89	39089		x		
zr	40000			x	
zr93	40093		x		

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