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THE WIMSLIB LIBRARY - NEUTRON DATA LIBRARY FOR WIMS-D

Liu Ping
China Nuclear Data Center

May 1998

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Abstract

During a visit to the IAEA Nuclear Data Section from 13 June to 12 December 1997, the author processed the Chinese Evaluated Nuclear Data Library (CENDL), Version 2.1, using the NJOY Nuclear Data Processing System, Version 94.105, to generate the working library WIMSLIB for input to WIMS-D/4 and WIMS-D/5A. The WIMSLIB libary was then used to perform benchmark testing of CENDL-2.1.

I. Introduction

WIMS-D/4 is a general lattice cell program (Ref. 1), which has been widely used around the world. However, the associated 69-group library, released earlier, is very old and is based on ENDF/B-IV data. Because of the need to update the WIMS library, we have processed Version 2.1 of the Chinese Evaluated Nuclear Data Library (CENDL) (Ref. 2) into WIMS format. To ensure that the new WIMS working library is reliable, it was decided to perform benchmark tests using the WIMS-D/4 code. The WIMS data processing was performed using the latest version of NJOY, NJOY94.105 (Ref. 3). A list of the contents of the WIMS library based on CENDL-2.1 is given in **Table I**.

II. Processing Code and Selection of Parameters

Several modules of NJOY were executed: MODER, RECONR, BROADR, UNRESR, THERMR, GROUPR and WIMSR.

Some of the key input parameters are the following: the fractional reconstruction tolerance in RECONR is 0.002 (0.2%); the fractional tolerance for thinning in BROADR is also 0.002; the upper boundary of thermal energy group is 4.0 eV; a new weighting spectrum based on the spectrum from an MCNP calculation for a typical PWR fuel cell in the fast and thermal region and 1/E shape in the resonance region was used.

In this work, sigma-zero was derived from calculation according to normal reactor cells; for most materials, we selected three temperatures 300K, 600K, 900K, for some important materials, such as H, O, U-235, U-238, Pu-239, etc., we selected more than three temperatures. For hydrogen bound in water, the temperature list was extended to include 350 K and 450 K, which are present in the thermal scattering law data.

Regarding the selection of resonance-group Goldstein LAMBDAs, we referenced the old WIMS (WIMS "1981") library for some materials, and selected the recommended values for some materials.

The group constants of hydrogen bound in water and deuterium in heavy water were calculated by using the scatting law data of ENDF/B-VI.

Table I . The WIMS Library

Material	ID	
H-1	2001	New
D	6002	New
D	7002	Old
He-3	3	New
He-4	4	New
Li-6	6	New
Li-7	7	New
Be-9	9	New
B-10	10	New
B-11	11	New
C-12	12	Old
C-12	6012	Old
N-14	14	New
O-16	16	New
F-19	19	New
Na-23	23	New
Al-27	27	New
Si	29	New
Cr-52	52	New
Mn-55	55	New
Fe-56	56	New
Fe-56	1056	New
Ni-58	58	New
Cu-63	63	New
Zr	91	New

Table I (cont.) The WIMS Library

Material	ID	
Cd-112	112	Old
Dy-164	164	Old
Lu-176	176	Old
Hf-178	178	New
Kr-83	83	Old
Mo-95	95	Old
Tc-99	99	Old
Ru-101	101	Old
Ru-103	1103	Old
Rh-103	103	Old
Rh-105	105	Old
Pd-105	1105	Old
Pd-108	108	Old
Ag-109	109	New
Cd-113	113	Old
In-115	115	Old
I-127	127	Old
Xe-131	131	Old
Cs-133	133	Old
Cs-134	134	Old
Xe-135	135	Old
Cs-135	1135	Old
Nd-143	143	Old
Nd-145	145	Old
Pm-147	147	Old

Table I (cont.) The WIMS Library

Material	ID	
Pm-147	1147	Old
Sm-147	2147	Old
Pm-148	148	Old
Pm-148	1148	Old
Sm-149	149	Old
Sm-150	150	Old
Sm-151	151	Old
Sm-152	152	Old
Eu-153	153	Old
Eu-154	154	Old
Eu-155	155	Old
Gd-155	1155	Old
Gd-157	157	Old
Pd	902	Old
Pb-207	207	New
U-232	232	Old
Th-232	1232	New
Th-232	2232	Old
U-233	233	New
U-233	9233	Old
Pa-233	1233	New
U-234	234	New
U-235	235	New
U-236	236	New
U-238	2238	New

Table I (cont.) The WIMS Library

Material	ID	
Pu-239	3239	New
Pu-240	1240	New
Pu-241	241	New
Pu-242	242	New
Sb-121	121	Old
Sb-123	123	Old
Cu-63	1063	Old
Er-167	167	Old
H-1	4001	Old
Ag-107	4107	New
Ag-109	4109	New
Cd-112	4112	Old
In-115	4115	Old
U-234	4234	Old
U-235	4235	Old
Pu-239	4239	Old
Pu-240	4240	Old
Pu-241	4241	Old
U-238	4238	Old
Mg	24	New
H-3	1003	New
P-31	31	New
S	32	New
Cl	35	New
K	1900	New

Table I (cont.) The WIMS Library

Material	ID	
Ti	2200	New
V	2300	New
Co-59	2759	New
Nb-93	4193	New
In	4900	New
Sn	5000	New
Sb	5100	New
Ta-181	73181	New
W	7400	New
Hg	8000	New
Tl	8100	New
Pu-238	9428	New
Am-241	9521	New
Bk-249	9729	New
Cf-249	9829	New
	1000	Old
	2000	Old
	1999	Old
	3000	Old

III. Modification of WIMSR of NJOY94.66

When processing a resonance nuclide, such as U-235, execution stopped at subroutine RSIOUT of WIMSR module, which is used to write resonance integrals. The responsible variables were located using the OpenVMS Fortran debugger, and it turned out that the variable IGEB is used before its value has been defined. We added the line call findex ('egb',iegb,a) at the beginning of subroutine RSIOUT, and this allowed WIMSR to run.

In general, U-235 fission source spectrum was used in WIMS library, because only less than 10% fission neutron derived from U-238 for most uranium-fueled thermal reactor. When processing U-235 using NJOY94.66, we found the fission source spectrum of U-235 is different from old WIMS library, especially the value of the 69th group (energy range is from 6.0655 MeV to 10 MeV) is about 30 times of the fission spectrum of old WIMS library but for other groups, the values are lower than those of old WIMS library. We changed the statement

```
locc=locchi+ngnd-ig2
```

to read

```
locc=locchi+ngnd-k
```

in the subroutine XSECS of WIMSR. Then we got a reasonable result for the fission source spectrum.

IV. Data testing

In order to test the WIMS library based on CENDL-2.1, we did some benchmark testing on reactor-relevant benchmark assemblies. In order to be able to compare the performance of CENDL-2.1 with other available data libraries, certain evaluations from ENDF/B-VI, JEF-2.2 and JENDL-3.2 were processed with NJOY94.105, using the same NJOY input instructions as in the processing of CENDL-2.1.

IV.1 TRX-1,2 BAPL-1,2,3 and DIMPLE-S01 benchmarks

We did the benchmarks calculation based on CENDL-2.1, ENDF/B-VI, Rev. 4, JEF-2.2 and JENDL-3.2 data. A comparison of the results is shown in **Table II.1**.

Conclusions:

The DIMPLE-S01 case should be excluded from the comparison, because it involves some materials which were not processed for ENDF/B-VI, JEF-2.2, JENDL-3.2.

The cross sections for Zr-nat from JENDL-3.2 behave rather strangely and are negative just above the unresolved resonance range. For JENDL-3.2, this material was not replaced in the original WIMS library.

Table II.1

SMRDIF Integral parameter comparison

Reference file :refexp.smr
Compared file :bnce6.smr
Compared file :bncc2.smr
Compared file :bncf2.smr
Compared file :bncj3.smr

LATTICE	K-eff	Rho28	Del25	Del28	ConvR
TRX-1	1.00000(~.30)	1.320(~1.6)	0.0987(~1.0)	0.0946(~4.3)	0.797(~1.0)
	0.98853(-1.2)	1.377(+4.3)	0.0977(-1.1)	0.0974(+3.0)	0.808(+1.3)
	0.99717(-.28)	1.379(+4.5)	0.0974(-1.3)	0.0930(-1.7)	0.800(+.34)
	0.99153(-.86)	1.370(+3.8)	0.0982(-.54)	0.0966(+2.1)	0.809(+1.6)
	0.99242(-.77)	1.370(+3.8)	0.0972(-1.5)	0.0944(-.18)	0.807(+1.2)
TRX-2	1.00000(~.10)	0.837(~1.9)	0.0614(~1.3)	0.0693(~5.1)	0.647(~.93)
	0.99113(-.90)	0.863(+3.1)	0.0600(-2.4)	0.0690(-.42)	0.650(+.49)
	0.99842(-.16)	0.866(+3.5)	0.0599(-2.4)	0.0667(-3.7)	0.644(-.43)
	0.99256(-.75)	0.860(+2.7)	0.0603(-1.7)	0.0688(-.79)	0.653(+.87)
	0.99474(-.53)	0.860(+2.7)	0.0598(-2.6)	0.0674(-2.8)	0.650(+.46)
BAPL-1	1.00000(~.10)	1.390(~.72)	0.0840(~2.4)	0.0780(~5.1)	0.000
	0.99431(-.57)	1.429(+2.8)	0.0824(-1.9)	0.0751(-3.7)	0.819
	1.00205(+.20)	1.435(+3.3)	0.0823(-2.1)	0.0714(-8.5)	0.812
	0.99730(-.27)	1.421(+2.2)	0.0827(-1.5)	0.0748(-4.1)	0.821
	0.99880(-.12)	1.422(+2.3)	0.0822(-2.1)	0.0734(-5.9)	0.818
BAPL-2	1.00000(~.10)	1.120(~.89)	0.0680(~1.5)	0.0700(~5.7)	0.000
	0.99459(-.54)	1.188(+6.1)	0.0672(-1.2)	0.0645(-7.8)	0.746
	1.00215(+.21)	1.195(+6.7)	0.0671(-1.3)	0.0617(- 12)	0.740
	0.99710(-.29)	1.183(+5.6)	0.0675(-.69)	0.0644(-8.0)	0.748
	0.99893(-.11)	1.183(+5.6)	0.0671(-1.3)	0.0632(-9.7)	0.745
BAPL-3	1.00000(~.10)	0.906(~1.1)	0.0520(~1.9)	0.0570(~5.3)	0.000
	0.99565(-.44)	0.933(+3.0)	0.0516(-.67)	0.0528(-7.3)	0.666
	1.00235(+.23)	0.939(+3.6)	0.0516(-.67)	0.0509(- 11)	0.661
	0.99744(-.26)	0.929(+2.5)	0.0519(-.13)	0.0528(-7.4)	0.668
	0.99966(-.03)	0.929(+2.6)	0.0516(-.75)	0.0519(-9.0)	0.665
DIMP1A	1.00000(~.10)	0.000	0.0000	0.0962(~3.3)	0.647(~.46)
	0.99265(-.74)	4.045	0.2341	0.0862(- 10)	0.658(+1.7)
	1.00246(+.24)	4.060	0.2340	0.0836(- 13)	0.653(+.90)
	0.99782(-.22)	4.025	0.2351	0.0852(- 11)	0.658(+1.7)
	0.99989(-.01)	4.019	0.2328	0.0836(- 13)	0.656(+1.4)
Average	0.15	1.32	1.69	4.86	0.83
	-0.73(~0.25)	3.85(~1.25)	-1.44(~0.62)	-4.45(~4.60)	1.16(~0.49)
	0.08(~0.21)	4.30(~1.26)	-1.54(~0.63)	-8.27(~4.19)	0.27(~0.54)
	-0.44(~0.26)	3.38(~1.22)	-0.92(~0.60)	-4.94(~4.57)	1.36(~0.35)
	-0.26(~0.28)	3.40(~1.23)	-1.66(~0.65)	-6.78(~4.35)	1.02(~0.40)

We find that CENDL-2.1 performs with better results for k-eff than other evaluated libraries by comparing with the experimental results.

For other integral parameters, such as Rho28, Del25, and Convr, CENDL-2.1 performs with good results, but the Del28 is lower than those of ENDF/B-VI, JEF-2.2 and JENDL-3.2, we find that CENDL-2.1 underestimates the fission of U-238 in the resonance energy range.

We find that the U-235, U-238, H-1, and O-16 of CENDL-2.1 produces good results for thermal reactor calculations.

IV.2 Rowlands Pin-cell benchmarks

The Rowlands pin-cell benchmarks input was converted to WIMS-D format and optimised for WIMS-D/5A code. Because zirconium represents the cladding in the Rowlands pin-cell benchmarks, it was processed using JEF-2.2 and CENDL-2.1. The results were compared to those results presented in the JEF/DOC-532 (calculated with LWR-WIMS and WIMS6) to those results presented by ECN Petten (calculated with MCNP-4A).

IV.3 Rowlands Uranium Pin-cell benchmarks

The comparisons of results for Rowlands Uranium pin-cell benchmarks using CENDL-2.1 and JEF-2.2 are shown in **Table II.2 - Table II.3**.

Conclusions:

Because the reference calculations were done on JEF-2.2, and the Rowlands Pin-cell benchmark is a numerical benchmark which is aimed at verifying the data processing methods, the actual results based on CENDL-2.1 are not very important.

JEF-2.2 performs better results of k-inf value and reaction rates of U-235 and U-238 than those results of CENDL-2.1.

IV.4 Rowlands Plutonium Pin-cell benchmarks. The listing of procedure for processing the plutonium data from JEF-2.2 is shown in **Table II.4**. The comparisons of results are shown in **Table II.5 to Table II.9**.

Conclusions:

The JEF-2.2 appears results as good as the results of MCNP4A (calculated by ECN, Petten, and quoted in JEF/DOC-532), and better results than LWR-WIMS.

CENDL-2.1 also gives similar results to those of JEF-2.2.

Table II.2

* **************************************
* Rowlands Pin-cell Benchmark - Case 1
* PWR fuel pin in water (normal density)
* **************************************

	k-inf	k-eff
MCNP(ECN)	1.38774(~.03)	
WIMS(AEA)	1.38797(+.02)	0.98390
WLUP(JEF-2)	1.38411(-.26)	0.98446(+.06)
WLUP(CENDL)	1.38551(-.22)	0.98906(+.50)

U-235 Capture Reactions

Group	1	2	3	Fast	Total
MCNP(ECN)	0.00114(~.05)	0.02264(~.13)	0.08519(~.08)	0.02378	0.10897
WIMS(AEA)	0.00110(-3.5)	0.02258(-.26)	0.08527(+.09)	0.02368	0.10895
WLUP(JEF-2)	0.00113(-.88)	0.02318(+2.4)	0.08518(-.01)	0.02431	0.10949
WLUP(CENDL)	0.00112(-1.75)	0.02346(+3.6)	0.08505(-.16)	0.02458	0.10963

U-235 Fission Reactions

Group	1	2	3	Fast	Total
MCNP(ECN)	0.00685(~.05)	0.04135(~.10)	0.48860(~.08)	0.04820	0.53680
WIMS(AEA)	0.00687(+.29)	0.04078(-1.4)	0.48895(+.07)	0.04765	0.53660
WLUP(JEF-2)	0.00681(-.58)	0.04064(-1.7)	0.48868(+.02)	0.04745	0.53613
WLUP(CENDL)	0.00674(-1.6)	0.04073(-1.5)	0.49039(+.37)	0.04747	0.53786

U-238 Capture Reactions

Group	1	2	3	Fast	Total
MCNP(ECN)	0.02239(~.06)	0.15440(~.15)	0.08254(~.07)	0.17844	0.25933
WIMS(AEA)	0.02152(-3.9)	0.15428(-.08)	0.08249(-.06)	0.17580	0.25829
WLUP(JEF-2)	0.02231(-.36)	0.15544(+.67)	0.08268(+.17)	0.17775	0.26043
WLUP(CENDL)	0.02197(-1.88)	0.15547(+.69)	0.08179(-.91)	0.17744	0.25923

U-238 Fission Reactions

Group	1	2	3	Fast	Total
MCNP(ECN)	0.02777(~.12)	0.00001	0.00000	0.02717	0.02777
WIMS(AEA)	0.02829(+1.9)	0.00001	0.00000	0.02829	0.02829
WLUP(JEF-2)	0.02738(-1.4)	0.00000	0.00000	0.02738	0.02738
WLUP(CENDL)	0.02708(-2.48)	0.00000	0.00000	0.02708	0.02708

Table II.3

* *************************************
* Rowlands Pin-cell Benchmark - Case 2
* PWR fuel pin in water (reduced density)
* *************************************

	k-inf	k-eff
MCNP(ECN)	1.33452(~.03)	
WLUP(CENDL)	1.33283(~.22)	0.80307(+.06)

U-235 Capture Reactions

Group	1	2	3	Fast	Total
MCNP(ECN)	0.00156(~.05)	0.02921(~.12)	0.07817(~.08)	0.03077	0.10894
WLUP(CENDL)	0.00154(-1.28)	0.03039(+4.0)	0.07810(-.09)	0.03193	0.11003

U-235 Fission Reactions

Group	1	2	3	Fast	Total
MCNP(ECN)	0.00910(~.05)	0.05400(~.09)	0.44440(~.08)	0.06310	0.50750
WLUP(CENDL)	0.00895(-1.65)	0.05334(-1.2)	0.44668(+.51)	0.06230	0.50897

U-238 Capture Reactions

Group	1	2	3	Fast	Total
MCNP(ECN)	0.03106(~.05)	0.19310(~.13)	0.07733(~.08)	0.22416	0.30149
WLUP(CENDL)	0.02999(-3.4)	0.19350(+.21)	0.07681(-.67)	0.22349	0.30030

U-238 Fission Reactions

Group	1	2	3	Fast	Total
MCNP(ECN)	0.03417(~.11)	0.00000	0.00000	0.03417	0.03417
WLUP(CENDL)	0.03336(-2.37)	0.00000	0.00000	0.03336	0.03336

Table II.4

```
$ SET VERIFY
$ SET DEF    UD1:[LIUPING.WLUP.PU]
$ !
$ PU8:
$   IF P1.NES."" .AND. P1.NES."PU8" THEN GOTO PU9
$   SET DEF [.PU8]
$ !
$ ! Process PU-238 from JEF-2.2
$ ! ******************************************************
$      ASS/USER    UD4:[SCR.LIU]PU238JF.DAT     TAPE20
$      ASS/USER                 PU238JF.XSG     TAPE25
$      ASS/USER                 PU238JF.XSW     TAPE27
$      ASS/USER                 PU238JF.OUT     OUTPUT
$ ! Begin calculations
$      RUN          UD8:[TMP.WIENKE.NJOY94]XNJOY_TRKOV
0 / Batch mode input
6 / ENDF-6 formatted library processed
*moder*  / Convert data to binary to Unit-21
1 -21
*JEF-2.2 PU-238* /
20 9434
0 /
*reconr* / Reconstruct x-sect from resonance parameters to Unit-22
-21 -22
*PENDF TAPE FOR PU-238 FROM JEF-2.2  */
9434 2 /
0.002 0. 9 0.005/ Reconstruction 0.1% (0.5% max), 9 digits
*94-PU-238 FROM JEF-2.2 */
* PROCESSED BY NJOY94.105 */
0 /
*broadr* / Doppler broaden to Unit-23
-21 -22  -23
9434 4  0  1  0 /
0.002 /
293. 600. 900. 1100.
0 /
*unresr* / Doppler broaden & self-shield URP data to Unit-24
-21 -23 -24
9434 4 6 1
293. 600. 900. 1100.
1.E10 1.E5  3.5E4 1.E4 1.E3 1.E2 / Revised Sig0 mesh
0 /
*thermr* / Add thermal scattering data to Unit-26
0 -24 -26
0 9434 12 4 1 0 1 221 1
293. 600. 900. 1100.
0.005  4.0
*groupr* / Generate group averaged data on Unit-25
-21  -26  0  -25
9434 9 0 -1  1  4  6  1
*94-PU-238 FROM JEF-2.2 */
293. 600. 900. 1100.
1.E10 1.E5 3.5E4 1.E4 1.E3 1.E2 / Revised Sig0 mesh
906.9 11.0 10000 / Homogeneous
      .0000      .0000          0          0          1         89
         89          5
```

```
 1.0000E-5  5.250E-04  9.0000E-3  3.550E-01  1.6000E-2  5.520E-01
 2.4000E-2  7.120E-01  2.9000E-2  7.850E-01  3.3000E-2  8.290E-01
 4.3000E-2  8.980E-01  5.0000E-2  9.180E-01  5.4000E-2  9.210E-01
 5.9000E-2  9.180E-01  7.0000E-2  8.920E-01  9.0000E-2  7.990E-01
 1.1200E-1  6.860E-01  1.4000E-1  5.200E-01  1.7000E-1  3.830E-01
 2.1000E-1  2.520E-01  3.0000E-1  1.080E-01  4.0000E-1  6.870E-02
 4.9000E-1  5.100E-02  5.7000E-1  4.370E-02  6.0000E-1  4.130E-02
 1.0000E+0  2.491E-02  4.0000E+0  6.786E-03  9.1180E+3  2.977E-06
 2.0000E+4  1.413E-06  3.0700E+4  9.884E-07  6.0700E+4  5.814E-07
 1.2000E+5  3.677E-07  2.0100E+5  2.770E-07  2.8300E+5  2.432E-07
 3.5600E+5  2.344E-07  3.7700E+5  2.160E-07  3.9900E+5  1.738E-07
 4.4200E+5  6.395E-08  4.7400E+5  1.381E-07  5.0200E+5  1.672E-07
 5.4000E+5  1.936E-07  6.5000E+5  1.872E-07  7.7000E+5  1.587E-07
 9.0000E+5  1.363E-07  9.4100E+5  1.134E-07  1.0000E+6  7.268E-08
 1.0500E+6  9.139E-08  1.1200E+6  1.083E-07  1.1900E+6  1.228E-07
 1.2100E+6  1.192E-07  1.3100E+6  5.451E-08  1.4000E+6  9.666E-08
 2.2200E+6  4.684E-08  2.3500E+6  5.814E-08  2.6300E+6  3.807E-08
 3.0000E+6  2.965E-08  4.0000E+6  1.626E-08  5.0000E+6  8.634E-09
 6.0000E+6  4.490E-09  8.0000E+6  1.169E-09  1.0000E+7  2.947E-10
 1.2570E+7  2.344E-10  1.2600E+7  3.307E-10  1.2700E+7  9.861E-10
 1.2800E+7  2.708E-09  1.2900E+7  6.847E-09  1.3000E+7  1.597E-08
 1.3100E+7  3.439E-08  1.3200E+7  6.843E-08  1.3300E+7  1.259E-07
 1.3400E+7  2.143E-07  1.3500E+7  3.381E-07  1.3600E+7  4.946E-07
 1.3700E+7  6.711E-07  1.3800E+7  8.458E-07  1.3900E+7  9.910E-07
 1.4070E+7  1.099E-06  1.4200E+7  1.035E-06  1.4300E+7  9.118E-07
 1.4400E+7  7.408E-07  1.4500E+7  5.751E-07  1.4600E+7  4.124E-07
 1.4700E+7  2.765E-07  1.4800E+7  1.734E-07  1.4900E+7  1.019E-07
 1.5000E+7  5.602E-08  1.5100E+7  2.890E-08  1.5200E+7  1.398E-08
 1.5300E+7  6.350E-09  1.5400E+7  2.709E-09  1.5500E+7  1.086E-09
 1.5676E+7  1.883E-10  2.0000E+7  1.474E-10 /
3 /          Temperature 293.K
3 221 /
3 252 /
3 452 /
6 /
6 221 /
0 /
3 /          Temperature 600.K
3 221 /
3 252 /
3 452 /
6 /
6 221 /
0 /
3 /          Temperature 900.K
3 221 /
3 252 /
3 452 /
6 /
6 221 /
0 /
3 /          Temperature 1100.K
3 221 /
3 252 /
3 452 /
6 /
6 221 /


0 /
```

```
0 /
*wimsr* / Process data for WIMS
-25 27
2 4 9
69 14 13 10
9434  0 9428 -1
0 0 3.5E4 0 11.0 221 0 1 1 0 0 27 / J1, Fixed SigP, All x-sect at Sig0=3.5E4 b
 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 / Const (WIMS-D"1986")
1.18   2.763  4.922  3.964  2.517  2.121  1.199  .964  .7172 .5436
 .4331  .3631  .3168  .2871  .2677  .231   .2214 .2143 .2105 .4124
 .4056  .3008  .2002  .2432  .2416  .2094  .3891 / British current spectrum
*stop*
$ !
$   DEL/NOCON  TAPE*.DAT;*
$ !
$   SET DEF [-]
$   GOTO PU9
$ !
$ PU9:
$   IF P1.NES."" .AND. P1.NES."PU9" THEN GOTO PU240
$   SET DEF [.PU9]
$ !
$ !
$ ! Process PU-239 from JEF-2.2
$ ! ******************************************************
$      ASS/USER    UD4:[SCR.LIU]PU9JF.DAT   TAPE20
$      ASS/USER                 PU9JF.XSG   TAPE25
$      ASS/USER                 PU9JF.XSW   TAPE27
$      ASS/USER                 PU9JF.OUT   OUTPUT
$ ! Begin calculations
$      RUN          UD8:[TMP.WIENKE.NJOY94]XNJOY_TRKOV
0 / Batch mode input
6 / ENDF-6 formatted library processed
*moder*  / Convert data to binary to Unit-21
1 -21
*JEF-2.2 PU-239* /
20 9437
0 /
*reconr* / Reconstruct x-sect from resonance parameters to Unit-22
-21 -22
*PENDF TAPE FOR PU-239 FROM JEF-2.2  */
9437 2 /
0.001 0. 9 0.005/ Reconstruction 0.1% (0.5% max), 9 digits
*94-PU-239 FROM JEF-2.2 */
* PROCESSED BY NJOY94.105 */
0 /
*broadr* / Doppler broaden to Unit-23
-21 -22  -23
9437 3 0  1  0 /
0.003 /
293. 600. 1100.
0 /
*unresr* / Doppler broaden & self-shield URP data to Unit-24
-21 -23 -24
9437 3 8 1
293. 600. 1100.
1.E10 1.E4 2.E3  1563. 1117. 800. 350. 100. / Revised Sig0 mesh
0 /
```

```
*thermr* / Add thermal scattering data to Unit-26
0 -24 -26
0 9437 12 3 1 0 1 221 1
293. 600. 1100.
0.005  4.0
*groupr* / Generate group averaged data on Unit-25
-21  -26  0  -25
9437 9 0 -1  1  3  8  1
*94-PU-239 FROM JEF-2.2 */
293. 600. 1100.
1.E10 1.E4 2.E3 1563. 1117. 800. 350. 100. / Revised Sig0 mesh
906.9 11.246 15000 / Homogeneous
      .0000      .0000          0          0          1         89
        89          5
  1.0000E-5  5.250E-04  9.0000E-3  3.550E-01  1.6000E-2  5.520E-01
  2.4000E-2  7.120E-01  2.9000E-2  7.850E-01  3.3000E-2  8.290E-01
  4.3000E-2  8.980E-01  5.0000E-2  9.180E-01  5.4000E-2  9.210E-01
  5.9000E-2  9.180E-01  7.0000E-2  8.920E-01  9.0000E-2  7.990E-01
  1.1200E-1  6.860E-01  1.4000E-1  5.200E-01  1.7000E-1  3.830E-01
  2.1000E-1  2.520E-01  3.0000E-1  1.080E-01  4.0000E-1  6.870E-02
  4.9000E-1  5.100E-02  5.7000E-1  4.370E-02  6.0000E-1  4.130E-02
  1.0000E+0  2.491E-02  4.0000E+0  6.786E-03  9.1180E+3  2.977E-06
  2.0000E+4  1.413E-06  3.0700E+4  9.884E-07  6.0700E+4  5.814E-07
  1.2000E+5  3.677E-07  2.0100E+5  2.770E-07  2.8300E+5  2.432E-07
  3.5600E+5  2.344E-07  3.7700E+5  2.160E-07  3.9900E+5  1.738E-07
  4.4200E+5  6.395E-08  4.7400E+5  1.381E-07  5.0200E+5  1.672E-07
  5.4000E+5  1.936E-07  6.5000E+5  1.872E-07  7.7000E+5  1.587E-07
  9.0000E+5  1.363E-07  9.4100E+5  1.134E-07  1.0000E+6  7.268E-08
  1.0500E+6  9.139E-08  1.1200E+6  1.083E-07  1.1900E+6  1.228E-07
  1.2100E+6  1.192E-07  1.3100E+6  5.451E-08  1.4000E+6  9.666E-08
  2.2200E+6  4.684E-08  2.3500E+6  5.814E-08  2.6300E+6  3.807E-08
  3.0000E+6  2.965E-08  4.0000E+6  1.626E-08  5.0000E+6  8.634E-09
  6.0000E+6  4.490E-09  8.0000E+6  1.169E-09  1.0000E+7  2.947E-10
  1.2570E+7  2.344E-10  1.2600E+7  3.307E-10  1.2700E+7  9.861E-10
  1.2800E+7  2.708E-09  1.2900E+7  6.847E-09  1.3000E+7  1.597E-08
  1.3100E+7  3.439E-08  1.3200E+7  6.843E-08  1.3300E+7  1.259E-07
  1.3400E+7  2.143E-07  1.3500E+7  3.381E-07  1.3600E+7  4.946E-07
  1.3700E+7  6.711E-07  1.3800E+7  8.458E-07  1.3900E+7  9.910E-07
  1.4070E+7  1.099E-06  1.4200E+7  1.035E-06  1.4300E+7  9.118E-07
  1.4400E+7  7.408E-07  1.4500E+7  5.751E-07  1.4600E+7  4.124E-07
  1.4700E+7  2.765E-07  1.4800E+7  1.734E-07  1.4900E+7  1.019E-07
  1.5000E+7  5.602E-08  1.5100E+7  2.890E-08  1.5200E+7  1.398E-08
  1.5300E+7  6.350E-09  1.5400E+7  2.709E-09  1.5500E+7  1.086E-09
  1.5676E+7  1.883E-10  2.0000E+7  1.474E-10 /
3 /          Temperature 293.K
3 221 /
3 252 /
3 452 /
3 455 /
5 455 /
6 /
6 221 /
0 /
3 /          Temperature 600.K
3 221 /
3 252 /
3 452 /
3 455 /
```

```
5 455 /
6 /
6 221 /
0 /
3 /          Temperature 1100.K
3 221 /
3 252 /
3 452 /
3 455 /
5 455 /
6 /
6 221 /
0 /
0 /
*wimsr* / Process data for WIMS
-25 27
2 4 9
69 14 13 10
9437  0 3239.1 -1
0 0 1117. 3 11.246 221 0 1 0 0 0 27 /J1, Fixed SigP, All x-sect at Sig0=1117 b
 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 / Const (WIMS-D"1986")
1.18   2.763  4.922  3.964  2.517  2.121  1.199  .964  .7172 .5436
 .4331  .3631  .3168  .2871  .2677  .231   .2214 .2143 .2105 .4124
 .4056  .3008  .2002  .2432  .2416  .2094  .3891 / British current spectrum
*stop*
$ !
$   DEL/NOCON TAPE*.DAT;*
$ !
$   SET DEF [-]
$   GOTO PU240
$ !
$ !
$ PU240:
$   IF P1.NES."" .AND.P1.NES."PU240" THEN GOTO PU241
$   SET DEF [.PU240]
$ !
$ ! Process PU-240 from JEF-2.2
$ ! ******************************************************
$      ASS/USER     UD4:[SCR.LIU]PU0.DAT   TAPE20
$      ASS/USER                 PU0jf.XSG   TAPE25
$      ASS/USER                 PU0jf.XSW   TAPE27
$      ASS/USER                 PU0jf.OUT   OUTPUT
$ ! Begin calculations
$      RUN          UD8:[TMP.WIENKE.NJOY94]XNJOY_TRKOV
0 / Batch mode input
6 / ENDF-6 formatted library processed
*moder*  / Convert data to binary to Unit-21
1 -21
*JEF-2.2 PU-240* /
20 9440
0 /
*reconr* / Reconstruct x-sect from resonance parameters to Unit-22
-21 -22
*PENDF TAPE FOR PU-240 FROM JEF-2.2  */
9440 2 /
0.001 0. 9 0.005/ Reconstruction 0.1% (0.5% max), 9 digits
*94-PU-240 FROM JEF-2.2 */
* PROCESSED BY NJOY94.105 */
```

```
0 /
*broadr* / Doppler broaden to Unit-23
-21 -22  -23
9440 4  0  1  0 /
0.001 /
293. 600. 900. 1100.
0 /
*unresr* / Doppler broaden & self-shield URP data to Unit-24
-21 -23 -24
9440 4 10 1
293. 600. 900. 1100.
1.E10 1.E5 1.E4 3600. 2800. 2000. 260. 140. 56. 28. / Revised Sig0 mesh
0 /
*thermr* / Add thermal scattering data to Unit-26
0 -24 -26
0 9440 12 4 1 0 1 221 1
293. 600. 900. 1100.
0.005  4.0
*groupr* / Generate group averaged data on Unit-25
-21  -26  0  -25
9440 9 0 -1  1  4  10  1
*94-PU-240 FROM JEF-2.2 */
293. 600. 900. 1100.
1.E10 4.E4 1.E4 3600. 2800. 2000. 260. 140. 56. 28. / Revised Sig0 mesh
906.9 10.6 15000 / Homogeneous
      .0000      .0000          0          0          1         89
        89          5
  1.0000E-5  5.250E-04  9.0000E-3  3.550E-01  1.6000E-2  5.520E-01
  2.4000E-2  7.120E-01  2.9000E-2  7.850E-01  3.3000E-2  8.290E-01
  4.3000E-2  8.980E-01  5.0000E-2  9.180E-01  5.4000E-2  9.210E-01
  5.9000E-2  9.180E-01  7.0000E-2  8.920E-01  9.0000E-2  7.990E-01
  1.1200E-1  6.860E-01  1.4000E-1  5.200E-01  1.7000E-1  3.830E-01
  2.1000E-1  2.520E-01  3.0000E-1  1.080E-01  4.0000E-1  6.870E-02
  4.9000E-1  5.100E-02  5.7000E-1  4.370E-02  6.0000E-1  4.130E-02
  1.0000E+0  2.491E-02  4.0000E+0  6.786E-03  9.1180E+3  2.977E-06
  2.0000E+4  1.413E-06  3.0700E+4  9.884E-07  6.0700E+4  5.814E-07
  1.2000E+5  3.677E-07  2.0100E+5  2.770E-07  2.8300E+5  2.432E-07
  3.5600E+5  2.344E-07  3.7700E+5  2.160E-07  3.9900E+5  1.738E-07
  4.4200E+5  6.395E-08  4.7400E+5  1.381E-07  5.0200E+5  1.672E-07
  5.4000E+5  1.936E-07  6.5000E+5  1.872E-07  7.7000E+5  1.587E-07
  9.0000E+5  1.363E-07  9.4100E+5  1.134E-07  1.0000E+6  7.268E-08
  1.0500E+6  9.139E-08  1.1200E+6  1.083E-07  1.1900E+6  1.228E-07
  1.2100E+6  1.192E-07  1.3100E+6  5.451E-08  1.4000E+6  9.666E-08
  2.2200E+6  4.684E-08  2.3500E+6  5.814E-08  2.6300E+6  3.807E-08
  3.0000E+6  2.965E-08  4.0000E+6  1.626E-08  5.0000E+6  8.634E-09
  6.0000E+6  4.490E-09  8.0000E+6  1.169E-09  1.0000E+7  2.947E-10
  1.2570E+7  2.344E-10  1.2600E+7  3.307E-10  1.2700E+7  9.861E-10
  1.2800E+7  2.708E-09  1.2900E+7  6.847E-09  1.3000E+7  1.597E-08
  1.3100E+7  3.439E-08  1.3200E+7  6.843E-08  1.3300E+7  1.259E-07
  1.3400E+7  2.143E-07  1.3500E+7  3.381E-07  1.3600E+7  4.946E-07
  1.3700E+7  6.711E-07  1.3800E+7  8.458E-07  1.3900E+7  9.910E-07
  1.4070E+7  1.099E-06  1.4200E+7  1.035E-06  1.4300E+7  9.118E-07
  1.4400E+7  7.408E-07  1.4500E+7  5.751E-07  1.4600E+7  4.124E-07
  1.4700E+7  2.765E-07  1.4800E+7  1.734E-07  1.4900E+7  1.019E-07
  1.5000E+7  5.602E-08  1.5100E+7  2.890E-08  1.5200E+7  1.398E-08
  1.5300E+7  6.350E-09  1.5400E+7  2.709E-09  1.5500E+7  1.086E-09
  1.5676E+7  1.883E-10  2.0000E+7  1.474E-10 /
 3 /          Temperature 293.K
```

```
3 221 /
3 252 /
3 452 /
3 455 /
6 /
6 221 /
0 /
3 /          Temperature 600.K
3 221 /
3 252 /
3 452 /
3 455 /
6 /
6 221 /
0 /
3 /          Temperature 900.K
3 221 /
3 252 /
3 452 /
3 455 /
6 /
6 221 /
0 /
3 /          Temperature 1100.K
3 221 /
3 252 /
3 452 /
3 455 /
6 /
6 221 /
0 /
0 /
*wimsr* / Process data for WIMS
-25 27
2 4 9
69 14 13 10
9440  0 1240 -1
0 0 2800. 0 10.6 221 0 1 1 0 0 27/J1, Fixed SigP, All x-sect at Sig0=2800 b
 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 / Const (WIMS-D"1986")
1.18   2.763  4.922  3.964  2.517  2.121  1.199  .964  .7172 .5436
 .4331  .3631  .3168  .2871  .2677  .231   .2214 .2143 .2105 .4124
 .4056  .3008  .2002  .2432  .2416  .2094  .3891 / British current spectrum
*stop*
$ !
$   DEL/NOCON  TAPE*.DAT;*
$ !
$   SET DEF [-]
$   GOTO PU241
$ !
$ !
$ PU241:
$   IF P1.NES."" .AND. P1.NES."PU241" THEN GOTO PU242
$   SET DEF [.PU241]
$ !.
$ ! Process PU-241 from JEF-2.2
$ ! ******************************************************
$      ASS/USER    UD4:[SCR.LIU]PU241JF.DAT   TAPE20
$      ASS/USER                 PU241JF.XSG   TAPE25
```

```
$       ASS/USER                PU241JF.XSW   TAPE27
$       ASS/USER                PU241JF.OUT   OUTPUT
$ ! Begin calculations
$       RUN          UD8:[TMP.WIENKE.NJOY94]XNJOY_TRKOV
0 / Batch mode input
6 / ENDF-6 formatted library processed
*moder*  / Convert data to binary to Unit-21
1 -21
*JEF-2.2 PU-241* /
20 9443
0 /
*reconr* / Reconstruct x-sect from resonance parameters to Unit-22
-21 -22
*PENDF TAPE FOR PU-241 FROM JEF-2.2  */
9443 2 /
0.001 0. 9 0.005/ Reconstruction 0.1% (0.5% max), 9 digits
*94-PU-241 FROM JEF-2.2 */
* PROCESSED BY NJOY94.105 */
0 /
*broadr* / Doppler broaden to Unit-23
-21 -22  -23
9443 4 0  1  0 /
0.001 /
293. 600. 900. 1100.
0 /
*unresr* / Doppler broaden & self-shield URP data to Unit-24
-21 -23 -24
9443 4 9 1
293. 600. 900. 1100.
1.E10 1.E4 6044. 5305. 3136. 1563. 700. 350. 100. / Revised Sig0 mesh
0 /
*thermr* / Add thermal scattering data to Unit-26
0 -24 -26
0 9443 12 4 1 0 1 221 1
293. 600. 900. 1100.
0.005  4.0
*groupr* / Generate group averaged data on Unit-25
-21  -26  0  -25
9443 9 0 -1  1  4  9  1
*94-PU-241 FROM JEF-2.2 */
293. 600. 900. 1100.
1.E10 1.E4 6044. 5305. 3136. 1563. 700. 350. 100. / Revised Sig0 mesh
906.9 11.437 15000 / Homogeneous
      .0000      .0000          0          0          1         89
         89          5
  1.0000E-5  5.250E-04  9.0000E-3  3.550E-01  1.6000E-2  5.520E-01
  2.4000E-2  7.120E-01  2.9000E-2  7.850E-01  3.3000E-2  8.290E-01
  4.3000E-2  8.980E-01  5.0000E-2  9.180E-01  5.4000E-2  9.210E-01
  5.9000E-2  9.180E-01  7.0000E-2  8.920E-01  9.0000E-2  7.990E-01
  1.1200E-1  6.860E-01  1.4000E-1  5.200E-01  1.7000E-1  3.830E-01
  2.1000E-1  2.520E-01  3.0000E-1  1.080E-01  4.0000E-1  6.870E-02
  4.9000E-1  5.100E-02  5.7000E-1  4.370E-02  6.0000E-1  4.130E-02
  1.0000E+0  2.491E-02  4.0000E+0  6.786E-03  9.1180E+3  2.977E-06
  2.0000E+4  1.413E-06  3.0700E+4  9.884E-07  6.0700E+4  5.814E-07
  1.2000E+5  3.677E-07  2.0100E+5  2.770E-07  2.8300E+5  2.432E-07
  3.5600E+5  2.344E-07  3.7700E+5  2.160E-07  3.9900E+5  1.738E-07
  4.4200E+5  6.395E-08  4.7400E+5  1.381E-07  5.0200E+5  1.672E-07
  5.4000E+5  1.936E-07  6.5000E+5  1.872E-07  7.7000E+5  1.587E-07
```

```
  9.0000E+5  1.363E-07  9.4100E+5  1.134E-07  1.0000E+6  7.268E-08
  1.0500E+6  9.139E-08  1.1200E+6  1.083E-07  1.1900E+6  1.228E-07
  1.2100E+6  1.192E-07  1.3100E+6  5.451E-08  1.4000E+6  9.666E-08
  2.2200E+6  4.684E-08  2.3500E+6  5.814E-08  2.6300E+6  3.807E-08
  3.0000E+6  2.965E-08  4.0000E+6  1.626E-08  5.0000E+6  8.634E-09
  6.0000E+6  4.490E-09  8.0000E+6  1.169E-09  1.0000E+7  2.947E-10
  1.2570E+7  2.344E-10  1.2600E+7  3.307E-10  1.2700E+7  9.861E-10
  1.2800E+7  2.708E-09  1.2900E+7  6.847E-09  1.3000E+7  1.597E-08
  1.3100E+7  3.439E-08  1.3200E+7  6.843E-08  1.3300E+7  1.259E-07
  1.3400E+7  2.143E-07  1.3500E+7  3.381E-07  1.3600E+7  4.946E-07
  1.3700E+7  6.711E-07  1.3800E+7  8.458E-07  1.3900E+7  9.910E-07
  1.4070E+7  1.099E-06  1.4200E+7  1.035E-06  1.4300E+7  9.118E-07
  1.4400E+7  7.408E-07  1.4500E+7  5.751E-07  1.4600E+7  4.124E-07
  1.4700E+7  2.765E-07  1.4800E+7  1.734E-07  1.4900E+7  1.019E-07
  1.5000E+7  5.602E-08  1.5100E+7  2.890E-08  1.5200E+7  1.398E-08
  1.5300E+7  6.350E-09  1.5400E+7  2.709E-09  1.5500E+7  1.086E-09
  1.5676E+7  1.883E-10  2.0000E+7  1.474E-10 /
3 /          Temperature 293.K
3 221 /
3 252 /
3 452 /
3 455 /
5 455 /
6 /
6 221 /
0 /
3 /          Temperature 600.K
3 221 /
3 252 /
3 452 /
3 455 /
5 455 /
6 /
6 221 /
0 /
3 /          Temperature 900.K
3 221 /
3 252 /
3 452 /
3 455 /
5 455 /
6 /
6 221 /
0 /
3 /          Temperature 1100.K
3 221 /
3 252 /
3 452 /
3 455 /
5 455 /
6 /
6 221 /
0 /
0 /
*wimsr* / Process data for WIMS
-25 27
2 4 9
69 14 13 10
```

```
9443  0 241 -1
0 0 6044. 0 11.437 221 0 1 1 0 0 27/J1, Fixed SigP, All x-sect at Sig0=6044 b
 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 / Const (WIMS-D"1986")
1.18   2.763  4.922  3.964  2.517  2.121  1.199  .964  .7172 .5436
 .4331  .3631  .3168  .2871  .2677  .231   .2214 .2143 .2105 .4124
 .4056  .3008  .2002  .2432  .2416  .2094  .3891 / British current spectrum
*stop*
$ !
$   DEL/NOCON  TAPE*.DAT;*
$ !
$   SET DEF [-]
$   GOTO PU242
$ !
$ PU242:
$   IF P1.NES."" .AND. P1.NES."PU242" THEN GOTO AM241
$   SET DEF [.PU242]
$ !
$ ! Process PU-242 from JEF-2.2
$ ! ******************************************************
$      ASS/USER      UD4:[SCR.LIU]PU242JF.DAT   TAPE20
$      ASS/USER                   PU242JF.XSG   TAPE25
$      ASS/USER                   PU242JF.XSW   TAPE27
$      ASS/USER                   PU242JF.OUT   OUTPUT
$ ! Begin calculations
$      RUN          UD8:[TMP.WIENKE.NJOY94]XNJOY_TRKOV
0 / Batch mode input
6 / ENDF-6 formatted library processed
*moder*  / Convert data to binary to Unit-21
1 -21
*JEF-2.2 PU-242* /
20 9446
0 /
*reconr* / Reconstruct x-sect from resonance parameters to Unit-22
-21 -22
*PENDF TAPE FOR PU-242 FROM JEF-2.2  */
9446 2 /
0.001 0. 9 0.005/ Reconstruction 0.1% (0.5% max), 9 digits
*94-PU-242 FROM JEF-2.2 */
* PROCESSED BY NJOY94.105 */
0 /
*broadr* / Doppler broaden to Unit-23
-21 -22  -23
9446 3 0  1  0 /
0.001 /
293. 600. 1100.
0 /
*unresr* / Doppler broaden & self-shield URP data to Unit-24
-21 -23 -24
9446 3 9 1
293. 600. 1100.
1.E10 1.E4 6480. 5305. 3136. 1563. 700. 350. 100. / Revised Sig0 mesh
0 /
*thermr* / Add thermal scattering data to Unit-26
0 -24 -26
0 9446 12 3 1 0 1 221 1
293. 600. 1100.
0.005  4.0
*groupr* / Generate group averaged data on Unit-25
```

```
-21  -26  0  -25
9446 9 0 1  1  1  9  1
*94-PU-242 FROM JEF-2.2 */
293. 600. 1100.
1.E10 1.E4 6480. 5305. 3136. 1563. 700. 350. 100. / Revised Sig0 mesh
      .0000      .0000          0          0          1         89
        89          5
  1.0000E-5  5.250E-04  9.0000E-3  3.550E-01  1.6000E-2  5.520E-01
  2.4000E-2  7.120E-01  2.9000E-2  7.850E-01  3.3000E-2  8.290E-01
  4.3000E-2  8.980E-01  5.0000E-2  9.180E-01  5.4000E-2  9.210E-01
  5.9000E-2  9.180E-01  7.0000E-2  8.920E-01  9.0000E-2  7.990E-01
  1.1200E-1  6.860E-01  1.4000E-1  5.200E-01  1.7000E-1  3.830E-01
  2.1000E-1  2.520E-01  3.0000E-1  1.080E-01  4.0000E-1  6.870E-02
  4.9000E-1  5.100E-02  5.7000E-1  4.370E-02  6.0000E-1  4.130E-02
  1.0000E+0  2.491E-02  4.0000E+0  6.786E-03  9.1180E+3  2.977E-06
  2.0000E+4  1.413E-06  3.0700E+4  9.884E-07  6.0700E+4  5.814E-07
  1.2000E+5  3.677E-07  2.0100E+5  2.770E-07  2.8300E+5  2.432E-07
  3.5600E+5  2.344E-07  3.7700E+5  2.160E-07  3.9900E+5  1.738E-07
  4.4200E+5  6.395E-08  4.7400E+5  1.381E-07  5.0200E+5  1.672E-07
  5.4000E+5  1.936E-07  6.5000E+5  1.872E-07  7.7000E+5  1.587E-07
  9.0000E+5  1.363E-07  9.4100E+5  1.134E-07  1.0000E+6  7.268E-08
  1.0500E+6  9.139E-08  1.1200E+6  1.083E-07  1.1900E+6  1.228E-07
  1.2100E+6  1.192E-07  1.3100E+6  5.451E-08  1.4000E+6  9.666E-08
  2.2200E+6  4.684E-08  2.3500E+6  5.814E-08  2.6300E+6  3.807E-08
  3.0000E+6  2.965E-08  4.0000E+6  1.626E-08  5.0000E+6  8.634E-09
  6.0000E+6  4.490E-09  8.0000E+6  1.169E-09  1.0000E+7  2.947E-10
  1.2570E+7  2.344E-10  1.2600E+7  3.307E-10  1.2700E+7  9.861E-10
  1.2800E+7  2.708E-09  1.2900E+7  6.847E-09  1.3000E+7  1.597E-08
  1.3100E+7  3.439E-08  1.3200E+7  6.843E-08  1.3300E+7  1.259E-07
  1.3400E+7  2.143E-07  1.3500E+7  3.381E-07  1.3600E+7  4.946E-07
  1.3700E+7  6.711E-07  1.3800E+7  8.458E-07  1.3900E+7  9.910E-07
  1.4070E+7  1.099E-06  1.4200E+7  1.035E-06  1.4300E+7  9.118E-07
  1.4400E+7  7.408E-07  1.4500E+7  5.751E-07  1.4600E+7  4.124E-07
  1.4700E+7  2.765E-07  1.4800E+7  1.734E-07  1.4900E+7  1.019E-07
  1.5000E+7  5.602E-08  1.5100E+7  2.890E-08  1.5200E+7  1.398E-08
  1.5300E+7  6.350E-09  1.5400E+7  2.709E-09  1.5500E+7  1.086E-09
  1.5676E+7  1.883E-10  2.0000E+7  1.474E-10 /
3 /          Temperature 293.K
3 221 /
3 252 /
3 452 /
6 /
6 221 /
0 /
3 /          Temperature 600.K
3 221 /
3 252 /
3 452 /
6 /
6 221 /
0 /
3 /          Temperature 1100.K
3 221 /
3 252 /
3 452 /
6 /
6 221 /
0 /
```

```
0 /
*wimsr* / Process data for WIMS
-25 27
2 4 9
69 14 13 10
9446  0 242 -1
0 0 1.e4 0 0. 221 0 1 1 0 0 27 /J1, Fixed SigP, All x-sect at Sig0=1.E4 b
 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 / Const (WIMS-D"1986")
1.18   2.763  4.922  3.964  2.517  2.121  1.199  .964  .7172 .5436
 .4331  .3631  .3168  .2871  .2677  .231   .2214 .2143 .2105 .4124
 .4056  .3008  .2002  .2432  .2416  .2094  .3891 / British current spectrum
*stop*
$ !
$   DEL/NOCON  TAPE*.DAT;*
$ !
$   SET DEF [-]
$   GOTO AM241
$ !
$ !
$ AM241:
$   IF P1.NES."" .AND. P1.NES."AM241" THEN GOTO END
$   SET DEF [.AM241]
$ !
$ ! Process AM-241 from JEF-2.2
$ ! *******************************************************
$      ASS/USER     UD4:[SCR.LIU]AM241JF.DAT   TAPE20
$      ASS/USER                  AM241JF.XSG   TAPE25
$      ASS/USER                  AM241JF.XSW   TAPE27
$      ASS/USER                  AM241JF.OUT   OUTPUT
$ ! Begin calculations
$      RUN          UD8:[TMP.WIENKE.NJOY94]XNJOY_TRKOV
0 / Batch mode input
6 / ENDF-6 formatted library processed
*moder*  / Convert data to binary to Unit-21
1 -21
*JEF-2.2 AM-241* /
20 9543
0 /
*reconr* / Reconstruct x-sect from resonance parameters to Unit-22
-21 -22
*PENDF TAPE FOR AM-241 FROM JEF-2.2  */
9543 2 /
0.001 0. 9 0.005/ Reconstruction 0.1% (0.5% max), 9 digits
*95-AM-241 FROM JEF-2.2 */
* PROCESSED BY NJOY94.105 */
0 /
*broadr* / Doppler broaden to Unit-23
-21 -22  -23
9543 3 0  1  0 /
0.001 /
293. 600. 1100.
0 /
*unresr* / Doppler broaden & self-shield URP data to Unit-24
-21 -23 -24
9543 3 10 1
293. 600. 1100.
1.E10 4.E4 1.E4 3600. 1000. 260. 140. 56. 28. 10. / Revised Sig0 mesh II
0 /
```

```
*thermr* / Add thermal scattering data to Unit-26
0 -24 -26
0 9443 12 3 1 0 1 221 1
293. 600. 1100.
0.005  4.0
*groupr* / Generate group averaged data on Unit-25
-21  -26  0  -25
9443 9 0 -1  1  3  10  1
*95-AM-241 FROM JEF-2.2 */
293. 600. 1100.
1.E10 4.E4 1.E4 3600. 1000. 260. 140. 56. 28. 10. / Revised Sig0 mesh II
906.9 10.8687 15000 / Homogeneous
      .0000      .0000          0          0          1         89
        89          5
  1.0000E-5  5.250E-04  9.0000E-3  3.550E-01  1.6000E-2  5.520E-01
  2.4000E-2  7.120E-01  2.9000E-2  7.850E-01  3.3000E-2  8.290E-01
  4.3000E-2  8.980E-01  5.0000E-2  9.180E-01  5.4000E-2  9.210E-01
  5.9000E-2  9.180E-01  7.0000E-2  8.920E-01  9.0000E-2  7.990E-01
  1.1200E-1  6.860E-01  1.4000E-1  5.200E-01  1.7000E-1  3.830E-01
  2.1000E-1  2.520E-01  3.0000E-1  1.080E-01  4.0000E-1  6.870E-02
  4.9000E-1  5.100E-02  5.7000E-1  4.370E-02  6.0000E-1  4.130E-02
  1.0000E+0  2.491E-02  4.0000E+0  6.786E-03  9.1180E+3  2.977E-06
  2.0000E+4  1.413E-06  3.0700E+4  9.884E-07  6.0700E+4  5.814E-07
  1.2000E+5  3.677E-07  2.0100E+5  2.770E-07  2.8300E+5  2.432E-07
  3.5600E+5  2.344E-07  3.7700E+5  2.160E-07  3.9900E+5  1.738E-07
  4.4200E+5  6.395E-08  4.7400E+5  1.381E-07  5.0200E+5  1.672E-07
  5.4000E+5  1.936E-07  6.5000E+5  1.872E-07  7.7000E+5  1.587E-07
  9.0000E+5  1.363E-07  9.4100E+5  1.134E-07  1.0000E+6  7.268E-08
  1.0500E+6  9.139E-08  1.1200E+6  1.083E-07  1.1900E+6  1.228E-07
  1.2100E+6  1.192E-07  1.3100E+6  5.451E-08  1.4000E+6  9.666E-08
  2.2200E+6  4.684E-08  2.3500E+6  5.814E-08  2.6300E+6  3.807E-08
  3.0000E+6  2.965E-08  4.0000E+6  1.626E-08  5.0000E+6  8.634E-09
  6.0000E+6  4.490E-09  8.0000E+6  1.169E-09  1.0000E+7  2.947E-10
  1.2570E+7  2.344E-10  1.2600E+7  3.307E-10  1.2700E+7  9.861E-10
  1.2800E+7  2.708E-09  1.2900E+7  6.847E-09  1.3000E+7  1.597E-08
  1.3100E+7  3.439E-08  1.3200E+7  6.843E-08  1.3300E+7  1.259E-07
  1.3400E+7  2.143E-07  1.3500E+7  3.381E-07  1.3600E+7  4.946E-07
  1.3700E+7  6.711E-07  1.3800E+7  8.458E-07  1.3900E+7  9.910E-07
  1.4070E+7  1.099E-06  1.4200E+7  1.035E-06  1.4300E+7  9.118E-07
  1.4400E+7  7.408E-07  1.4500E+7  5.751E-07  1.4600E+7  4.124E-07
  1.4700E+7  2.765E-07  1.4800E+7  1.734E-07  1.4900E+7  1.019E-07
  1.5000E+7  5.602E-08  1.5100E+7  2.890E-08  1.5200E+7  1.398E-08
  1.5300E+7  6.350E-09  1.5400E+7  2.709E-09  1.5500E+7  1.086E-09
  1.5676E+7  1.883E-10  2.0000E+7  1.474E-10 /
3 /          Temperature 293.K
3 221 /
3 252 /
3 452 /
3 455 /
5 455 /
6 /
6 221 /
0 /
3 /          Temperature 600.K
3 221 /
3 252 /
3 452 /
3 455 /
```

```
5 455 /
6 /
6 221 /
0 /
3 /          Temperature 1100.K
3 221 /
3 252 /
3 452 /
3 455 /
5 455 /
6 /
6 221 /
0 /
0 /
*wimsr* / Process data for WIMS
-25 27
2 4 9
69 14 13 10
9543  0 9521 -1
0 0 4.e4 3 10.8687 221 0 1 1 0 0 27 /J1, Fixed SigP, All x-sect at Sig0=4.E4 b
 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 .2 / Const (WIMS-D"1986")
1.18   2.763  4.922  3.964  2.517  2.121  1.199  .964  .7172 .5436
 .4331  .3631  .3168  .2871  .2677  .231   .2214 .2143 .2105 .4124
 .4056  .3008  .2002  .2432  .2416  .2094  .3891 / British current spectrum
*stop*
$ !
$   SET DEF [-]
$   GOTO END
$ !
$ !
$ END:
$ !
$ EXIT
```

Table II.5

VALUES OF K-INFINITY FOR THE PLUTONIUM PIN CELL BENCHMARK

	Fuel 1		Fuel 2	
	300K	560K	300K	560K
APPOLLO-2	1.22143	1.20640	1.26342	1.24929
ECCO	1.22323 H'	1.20863 H'	1.26419 H'	1.25033 H'
WIMS	1.21656 L	1.20371 L	1.25862 L	1.24510 L
WLUP(JEF-2.2)	1.21813	1.20466	1.260112	1.246762
WLUP(CENDL-2.1)	1.216395	1.20269	1.26061	1.247198
MCNP4A(ECN) (~0.0005)	1.21784	1.20048	1.26106	1.24564
SCALE4.2(Delft)	1.21939	1.20439	1.26088	1.24663
KENO (~0.0002)	1.2258 H	1.2106 H	1.2668 H	1.2529 H
SCALE4.1(Petten)	1.22217	1.20773	1.26404	1.24999

Table II.6

PU benchmark Fuel 1; Case A:

RRTDIF - Reaction Rate Comparison

Reference RRT file: :MCNP4A(ECN)

Compared RRT file: :WIMSD5A(NDS)

Case-A Lattice Reaction Rates

	RR-Gr1	er %	RR-Gr2	er %	RR-Gr3	er %	RR-Gr4	er %
U235Capt								
Ref.	0.000110	0.06	0.001850	0.15	0.000630	0.14		
WLUP	0.000110	0.00	0.001860	0.54	0.000630	0.00		
U235Fiss								
Ref.	0.000620	0.05	0.003400	0.12	0.003190	0.15		
WLUP	0.000620	0.00	0.003290	-3.24	0.003230	1.25		
U238Capt								
Ref.	0.026130	0.06	0.151000	0.15	0.009880	0.12		
WLUP	0.025740	-1.49	0.150680	-0.21	0.009980	1.01		
U238Fiss								
Ref.	0.030300	0.12						
WLUP	0.029430	-2.87						
PU238Capt								
Ref.	0.000090	0.06	0.00161	0.42	0.00240	0.43		
WLUP	0.000090	0.00	0.00153	-4.96	0.00236	-1.66		
PU238Fiss								
Ref.	0.000630	0.06	0.00038	0.26	0.00008	0.19		
WLUP	0.000630	0.00	0.00038	0.00	0.00008	0.00		
PU239Capt								
Ref.	0.002350	0.06	0.05732	0.16	0.10020	0.14		
WLUP	0.002330	-0.85	0.05451	-4.90	0.10146	1.26		
PU239Fiss								
Ref.	0.022080	0.05	0.07985	0.13	0.19600	0.13		
WLUP	0.021960	-0.54	0.07764	-2.76	0.19851	1.28		
PU240Capt								
Ref.	0.001170	0.06	0.01936	0.30	0.12920	0.19		
WLUP	0.001160	-0.85	0.02062	6.51	0.13041	0.94		
PU240Fiss								
Ref.	0.004390	0.08	0.00038	0.24	0.00003	0.18		
WLUP	0.004350	-0.91	0.00039	2.63	0.00003	0.00		
PU241Capt								
Ref.	0.000780	0.05	0.01151	0.21	0.01195	0.15		
WLUP	0.000760	-2.56	0.01155	0.35	0.01217	1.84		
PU241Fiss								
Ref.	0.004400	0.05	0.03833	0.11	0.03666	0.15		
WLUP	0.004390	-0.23	0.03983	3.91	0.03723	1.55		

Table II.6 (cont.)

PU242Capt						
Ref.	0.000260	0.06	0.00261	0.47	0.01726	0.53
WLUP	0.000250	-3.84	0.00248	-4.98	0.01790	3.71
PU242Fiss						
Ref.	0.000870	0.08	0.00001	0.52	0.00001	0.53
WLUP	0.000870	0.00	0.00001	0.00	0.00001	0.00
AM241Capt						
Ref.	0.000240	0.06	0.00303	0.15	0.00916	0.19
WLUP	0.000240	0.00	0.00309	1.98	0.00903	-1.42
AM241Fiss						
Ref.	0.000210	0.09	0.00002	0.24	0.00006	0.20
WLUP	0.000210	0.00	0.00000		0.00006	0.00

Table II.7

PU benchmark Fuel 1;case B

RRTDIF - Reaction Rate Comparison
==========
Reference RRT file: :MCNP4A(ECN)

Compared RRT file: :WIMSD5A(NDS)
Case-B Lattice Reaction Rates

	RR-Gr1	er %	RR-Gr2	er %	RR-Gr3	er %	RR-Gr4	er %
U235Capt								
Ref.	0.000110	0.06	0.001810	0.14	0.000610	0.14		
WLUP	0.000110	0.00	0.001830	1.10	0.000620	1.64		
U235Fiss								
Ref.	0.000620	0.05	0.003340	0.11	0.003100	0.15		
WLUP	0.000620	0.00	0.003250	-2.69	0.003140	1.29		
U238Capt								
Ref.	0.026170	0.06	0.158500	0.15	0.009600	0.12		
WLUP	0.025740	-1.64	0.157610	-0.56	0.009720	1.25		
U238Fiss								
Ref.	0.030360	0.12						
WLUP	0.029430	-3.06						
PU238Capt								
Ref.	0.000090	0.06	0.00158	0.37	0.00239	0.20		
WLUP	0.000090	0.00	0.00151	-4.43	0.00230	-3.76		
PU238Fiss								
Ref.	0.000630	0.06	0.00038	0.23	0.00008	0.19		
WLUP	0.000630	0.00	0.00037	-2.63	0.00008	0.00		
PU239Capt								
Ref.	0.002349	0.06	0.05893	0.15	0.09780	0.14		
WLUP	0.002330	-0.81	0.05629	-4.48	0.09938	1.61		
PU239Fiss								
Ref.	0.022110	0.05	0.08047	0.13	0.19090	0.14		
WLUP	0.021960	-0.68	0.07838	-2.59	0.19413	1.69		
PU240Capt								
Ref.	0.001173	0.06	0.02014	0.28	0.12740	0.19		
WLUP	0.001160	-1.11	0.02037	1.14	0.12828	0.69		
PU240Fiss								
Ref.	0.004399	0.08	0.00039	0.21	0.00003	0.19		
WLUP	0.004350	-1.11	0.00039	0.00	0.00003	0.00		
PU241Capt								
Ref.	0.000786	0.05	0.01141	0.20	0.01164	0.15		
WLUP	0.000760	-3.31	0.01136	-0.44	0.01188	2.06		
PU241Fiss								
Ref.	0.004409	0.05	0.03773	0.11	0.03568	0.15		
WLUP	0.004390	-0.43	0.03920	3.89	0.03635	1.88		

Table II.7(cont.)

PU242Capt						
Ref.	0.000259	0.06	0.00264	0.43	0.01836	0.51
WLUP	0.000250	-3.47	0.00245	-7.19	0.01874	2.07
PU242Fiss						
Ref.	0.000876	0.08	0.00001	0.45	0.00001	0.51
WLUP	0.000870	0.00	0.00001	0.00	0.00001	0.00
AM241Capt						
Ref.	0.000238	0.06	0.00300	0.14	0.00893	0.18
WLUP	0.000240	0.84	0.00305	1.66	0.00886	-0.78
AM241Fiss						
Ref.	0.000211	0.09	0.00002	0.22	0.00006	0.20
WLUP	0.000210	-0.47	0.00000		0.00006	0.00

Table II.8

PU benchmark Fuel 2; case A.

RRTDIF - Reaction Rate Comparison

Reference RRT file: : MCNP4A(ECN)

Compared RRT file: : WIMSD5A(NDS)

Case-A Lattice Reaction Rates

	RR-Gr1	er %	RR-Gr2	er %	RR-Gr3	er %	RR-Gr4	er %
U235Capt								
Ref.	0.000110	0.06	0.001860	0.15	0.000640	0.14		
WLUP	0.000110	0.00	0.001900	2.15	0.000650	1.56		
U235Fiss								
Ref.	0.000620	0.05	0.003430	0.12	0.003210	0.14		
WLUP	0.000620	0.00	0.003340	-2.62	0.003260	1.56		
U238Capt								
Ref.	0.026170	0.06	0.152800	0.15	0.010300	0.11		
WLUP	0.025780	-1.49	0.154680	1.23	0.010420	1.17		
U238Fiss								
Ref.	0.030490	0.12						
WLUP	0.029480	-3.31						
PU238Capt								
Ref.	0.000054	0.06	0.00094	0.42	0.00140	0.43		
WLUP	0.000050	-7.41	0.00089	-5.32	0.00142	1.43		
PU238Fiss								
Ref.	0.000367	0.06	0.00022	0.26	0.00005	0.19		
WLUP	0.000360	-1.91	0.00022	0.00	0.00005	0.00		
PU239Capt								
Ref.	0.003157	0.06	0.07222	0.15	0.12810	0.13		
WLUP	0.003140	-0.54	0.06823	-5.52	0.12996	1.45		
PU239Fiss								
Ref.	0.029720	0.05	0.10240	0.12	0.25420	0.13		
WLUP	0.029530	-0.64	0.09923	-3.09	0.25798	1.49		
PU240Capt								
Ref.	0.000876	0.06	0.01524	0.32	0.11750	0.20		
WLUP	0.000870	-0.68	0.01547	1.51	0.11861	0.94		
PU240Fiss								
Ref.	0.003289	0.08	0.00029	0.24	0.00002	0.19		
WLUP	0.003250	-1.18	0.00029	0.00	0.00002	0.00		
PU241Capt								
Ref.	0.000103	0.05	0.00169	0.24	0.00153	0.15		
WLUP	0.000100	-2.91	0.00157	-7.10	0.00156	1.96		
PU241Fiss								
Ref.	0.000581	0.05	0.00533	0.12	0.00474	0.14		
WLUP	0.000580	-0.17	0.00542	1.69	0.00483	1.89		

Table II.8(cont.)

PU242Capt						
Ref.	0.00002	0.06	0.00027	0.59	0.00350	0.64
WLUP	0.00002	0.00	0.00022	-1.85	0.00191	10.5
PU242Fiss						
Ref.	0.000076	0.08	0.00000		0.00000	
WLUP	0.000080	5.26	0.00000		0.00000	
AM241Capt						
Ref.	0.000110	0.06	0.00143	0.16	0.00458	0.19
WLUP	0.000110	0.00	0.00147	2.79	0.00446	-2.62
AM241Fiss						
Ref.	0.000098	0.09	0.00001	0.25	0.00003	0.21
WLUP	0.000100	2.04	0.00000		0.00003	0.00

Table II.9

Pu benchmark Fuel 2; case B.

RRTDIF - Reaction Rate Comparison

Reference RRT file: : MCNP4A(ECN)

Compared RRT file: : WIMSD5A(NDS)S)

Case-B Lattice Reaction Rates

	RR-Gr1	er %	RR-Gr2	er %	RR-Gr3	er %	RR-Gr4	er %
U235Capt								
Ref.	0.000110	0.06	0.001820	0.14	0.000620	0.14		
WLUP	0.000110	0.00	0.001870	2.75	0.000630	1.61		
U235Fiss								
Ref.	0.000620	0.05	0.003380	0.12	0.003110	0.14		
WLUP	0.000620	0.00	0.003290	-2.66	0.003180	2.25		
U238Capt								
Ref.	0.026190	0.06	0.160100	0.15	0.010010	0.12		
WLUP	0.025780	-1.57	0.161470	0.86	0.010190	1.80		
U238Fiss								
Ref.	0.030580	0.12						
WLUP	0.029480	-3.60						
PU238Capt								
Ref.	0.000054	0.06	0.00093	0.37	0.00136	0.43		
WLUP	0.000052	-3.70	0.00088	-5.37	0.00139	2.20		
PU238Fiss								
Ref.	0.000367	0.06	0.00022	0.23	0.00005	0.19		
WLUP	0.000363	-1.08	0.00022	0.00	0.00005	0.00		
PU239Capt								
Ref.	0.003157	0.06	0.07458	0.14	0.12520	0.13		
WLUP	0.003143	-0.44	0.07062	-5.30	0.12752	1.85		
PU239Fiss								
Ref.	0.029750	0.05	0.10310	0.12	0.24790	0.13		
WLUP	0.029534	-0.73	0.10013	-2.88	0.25274	1.95		
PU240Capt								
Ref.	0.000876	0.06	0.01578	0.29	0.11600	0.20		
WLUP	0.000874	-0.23	0.01526	-3.29	0.11736	1.17		
PU240Fiss								
Ref.	0.003294	0.08	0.00029	0.22	0.00002	0.20		
WLUP	0.003253	-1.24	0.00029	0.00	0.00002	0.00		
PU241Capt								
Ref.	0.000103	0.05	0.00165	0.22	0.00149	0.15		
WLUP	0.000102	-0.97	0.00154	-6.66	0.00152	2.01		
PU241Fiss								
Ref.	0.000581	0.05	0.00520	0.12	0.00462	0.14		
WLUP	0.000580	-0.17	0.00532	2.31	0.00472	2.16		

Table II.9(cont.)

PU242Capt						
Ref.	0.000020	0.06	0.00026	0.53	0.00354	0.59
WLUP	0.000020	0.00	0.00021	-11.9	0.00202	-4.20
PU242Fiss						
Ref.	0.000077	0.08	0.00000		0.00000	
WLUP	0.000076	-1.29	0.00000		0.00000	
AM241Capt						
Ref.	0.000110	0.06	0.00141	0.14	0.00446	0.18
WLUP	0.000110	0.00	0.00145	2.83	0.00438	-1.79
AM241Fiss						
Ref.	0.000098	0.09	0.00001	0.23	0.00003	0.20
WLUP	0.000100	2.04	0.00000		0.00003	0.00

IV.5 Data testing for structural materials

We replaced the structural materials Fe-56, Cr-52, Cu-63, Mn-55, Ni-58 in the "1981" WIMS library with the newly calculated cross sections from ENDF/B-VI, Rev. 4, and CENDL-2.1 respectively.

We did the DIMPLE-S01 benchmark calculation. The comparisons are shown in **Table II.10 - Table II.12**.

Conclusions:

ENDF/B-VI performs better results than those results of the "1981" WIMS library.

When only the Fe-56 data in "1981" WIMS library is replaced with data from CENDL-2.1, the results are better than those results of "1981" WIMS library, and are in good agreement with those results of ENDF/B-VI.

When replaced all structural materials in "1981" WIMS library from CENDL-2.1, the results of CENDL-2.1 are not good. According to our analysis, CENDL-2.1 underestimates the capture cross section of Cr-52 in the resonance energy region. Further improvement will be needed for Cr-52.

V. Building a library including PENDF files and print files

A library of cross sections containing all processed data of CENDL-2.1 were performed on AlphaServer 2100 of NDS. All files of the library include intermediate PENDF files (the result of RECONR module) and print files with complete diagnostics. The PENDF files are binary. Each PENDF file is named FILE.RCN, standing for RECONR. For example the PENDF file for H-1 is named H01.RCN. The print files are named with a file extension of "OUT", such as H01.OUT. The list of files thus prepared is given in **Table III**. The fractional reconstruction tolerance in RECONR is 0.002 (0.2%).

Results:

When processing H-3, Li-6 and He-4 from CENDL-2 using NJOY94.105, it stops at the BROADR module. In the output of BROADR, we found the thermal capture integral is 0.0, and then stopped. It seems that this version of the BROADR module is not protected against cases in which the capture cross section is not defined at thermal energies. For the mentioned materials, NJOY94.66 was used to generate the PENDF files.

Table II.10

SMRDIF Integral parameter comparison

Reference file :refexp.smr
Compared file :bnce6.smr
Compared file :bncnewe6.smr(New structural materials)

LATTICE	K-eff	Rho28	Del25	Del28	ConvR
TRX-1	1.00000(~.30)	1.320(~1.6)	0.0987(~1.0)	0.0946(~4.3)	0.797(~1.0)
	0.98853(-1.2)	1.377(+4.3)	0.0977(-1.1)	0.0974(+3.0)	0.808(+1.3)
TRX-2	1.00000(~.10)	0.837(~1.9)	0.0614(~1.3)	0.0693(~5.1)	0.647(~.93)
	0.99113(-.90)	0.863(+3.1)	0.0600(-2.4)	0.0690(-.42)	0.650(+.49)
BAPL-1	1.00000(~.10)	1.390(~.72)	0.0840(~2.4)	0.0780(~5.1)	0.000
	0.99431(-.57)	1.429(+2.8)	0.0824(-1.9)	0.0751(-3.7)	0.819
BAPL-2	1.00000(~.10)	1.120(~.89)	0.0680(~1.5)	0.0700(~5.7)	0.000
	0.99459(-.54)	1.188(+6.1)	0.0672(-1.2)	0.0645(-7.8)	0.746
BAPL-3	1.00000(~.10)	0.906(~1.1)	0.0520(~1.9)	0.0570(~5.3)	0.000
	0.99565(-.44)	0.933(+3.0)	0.0516(-.67)	0.0528(-7.3)	0.666
DIMP1A	1.00000(~.10)	0.000	0.0000	0.0962(~3.3)	0.647(~.46)
	0.99265(-.74)	4.045	0.2341	0.0862(- 10)	0.658(+1.7)
	0.99932(-.07)	4.012	0.2321	0.0857(- 11)	0.654(+1.1)
Average	0.15	1.32	1.69	4.86	0.83
	-0.73(~0.25)	3.85(~1.25)	-1.44(~0.62)	-4.45(~4.60)	1.16(~0.49)
	-0.61(~0.35)	3.85(~1.25)	-1.44(~0.62)	-4.54(~4.72)	0.98(~0.36)

Table II.11

SMRDIF Integral parameter comparison

Reference file :REFEXP.SMR
Compared file :BNCC2.SMR
Compared file :BNCFEC2.SMR(New Fe-56 only)

LATTICE	K-eff	Rho28	Del25	Del28	ConvR
TRX-1	1.00000(~.30)	1.320(~1.6)	0.0987(~1.0)	0.0946(~4.3)	0.797(~1.0)
	0.99717(-.28)	1.379(+4.5)	0.0974(-1.3)	0.0930(-1.7)	0.800(+.34)
TRX-2	1.00000(~.10)	0.837(~1.9)	0.0614(~1.3)	0.0693(~5.1)	0.647(~.93)
	0.99842(-.16)	0.866(+3.5)	0.0599(-2.4)	0.0667(-3.7)	0.644(-.43)
BAPL-1	1.00000(~.10)	1.390(~.72)	0.0840(~2.4)	0.0780(~5.1)	0.000
	1.00205(+.20)	1.435(+3.3)	0.0823(-2.1)	0.0714(-8.5)	0.812
BAPL-2	1.00000(~.10)	1.120(~.89)	0.0680(~1.5)	0.0700(~5.7)	0.000
	1.00215(+.21)	1.195(+6.7)	0.0671(-1.3)	0.0617(- 12)	0.740
BAPL-3	1.00000(~.10)	0.906(~1.1)	0.0520(~1.9)	0.0570(~5.3)	0.000
	1.00235(+.23)	0.939(+3.6)	0.0516(-.67)	0.0509(- 11)	0.661
DIMP1A	1.00000(~.10)	0.000	0.0000	0.0962(~3.3)	0.647(~.46)
	1.00246(+.24)	4.060	0.2340	0.0836(- 13)	0.653(+.90)
	1.00105(+.10)	4.065	0.2342	0.0839(- 13)	0.653(+.99)
Average	0.15	1.32	1.69	4.86	0.83
	0.19(~0.38)	4.30(~1.26)	-1.54(~0.63)	-8.27(~4.19)	0.27(~0.54)
	0.05(~0.20)	4.30(~1.26)	-1.54(~0.63)	-8.22(~4.14)	0.30(~0.58)

Table II.12

SMRDIF Integral parameter comparison

Reference file :refexp.smr
Compared file :bncc2.smr(old structural materials)
Compared file :bncnewc2.smr(new structural materials)

LATTICE	K-eff	Rho28	Del25	Del28	ConvR
TRX-1	1.00000(~.30)	1.320(~1.6)	0.0987(~1.0)	0.0946(~4.3)	0.797(~1.0)
	0.99717(-.28)	1.379(+4.5)	0.0974(-1.3)	0.0930(-1.7)	0.800(+.34)
TRX-2	1.00000(~.10)	0.837(~1.9)	0.0614(~1.3)	0.0693(~5.1)	0.647(~.93)
	0.99842(-.16)	0.866(+3.5)	0.0599(-2.4)	0.0667(-3.7)	0.644(-.43)
BAPL-1	1.00000(~.10)	1.390(~.72)	0.0840(~2.4)	0.0780(~5.1)	0.000
	1.00205(+.20)	1.435(+3.3)	0.0823(-2.1)	0.0714(-8.5)	0.812
BAPL-2	1.00000(~.10)	1.120(~.89)	0.0680(~1.5)	0.0700(~5.7)	0.000
	1.00215(+.21)	1.195(+6.7)	0.0671(-1.3)	0.0617(- 12)	0.740
BAPL-3	1.00000(~.10)	0.906(~1.1)	0.0520(~1.9)	0.0570(~5.3)	0.000
	1.00235(+.23)	0.939(+3.6)	0.0516(-.67)	0.0509(- 11)	0.661
DIMP1A	1.00000(~.10)	0.000	0.0000	0.0962(~3.3)	0.647(~.46)
	1.00246(+.24)	4.060	0.2340	0.0836(- 13)	0.653(+.90)
	1.00925(+.91)	4.029	0.2320	0.0828(- 14)	0.650(+.42)
Average	0.15	1.32	1.69	4.86	0.83
	0.08(~0.21)	4.30(~1.26)	-1.54(~0.63)	-8.27(~4.19)	0.27(~0.54)
	0.19(~0.38)	4.30(~1.26)	-1.54(~0.63)	-8.42(~4.37)	0.11(~0.38)

Table III. The List of PENDF Files

Material	Filename	Type	Format
H-1	H01.RCN	PENDF	Binary
H-1	H01.OUT	OUTPUT	BCD
H-2	H02.RCN	PENDF	Binary
H-2	H02.OUT	OUTPUT	BCD
H-3	H03.RCN	PENDF	Binary
H-3	H03.OUT	OUTPUT	BCD
He-3	HE3.RCN	PENDF	Binary
He-3	HE3.OUT	OUTPUT	BCD
He-4	HE4.RCN	PENDF	Binary
He-4	HE4.OUT	OUTPUT	BCD
Li-6	LI6.RCN	PENDF	Binary
Li-6	LI6.OUT	OUTPUT	BCD
Li-7	LI7.RCN	PENDF	Binary
Li-7	LI7.OUT	OUTPUT	BCD
Be-9	BE9.RCN	PENDF	Binary
Be-9	BE9.OUT	OUTPUT	BCD
B-10	B10.RCN	PENDF	Binary
B-10	B10.OUT	OUTPUT	BCD
B-11	B11.RCN	PENDF	Binary
B-11	B11.OUT	OUTPUT	BCD
N-14	N14.RCN	PENDF	Binary
N-14	N14.OUT	OUTPUT	BCD
O-16	O16.RCN	PENDF	Binary
O-16	O16.OUT	OUTPUT	BCD
F-19	F19.RCN	PENDF	Binary
F-19	F19.OUT	OUTPUT	BCD

Table III(cont.)The List of PENDF Files

Material	Filename	Type	Format
Na-23	NA23.RCN	PENDF	Binary
Na-23	NA23.OUT	OUTPUT	BCD
Mg	MG.RCN	PENDF	Binary
Mg	MG.OUT	OUTPUT	BCD
Al-27	AL.RCN	PENDF	Binary
Al-27	AL.OUT	OUTPUT	BCD
Si	SI.RCN	PENDF	Binary
Si	SI.OUT	OUTPUT	BCD
P-31	P31.RCN	PENDF	Binary
P-31	P31.OUT	OUTPUT	BCD
S	S.RCN	PENDF	Binary
S	S.OUT	OUTPUT	BCD
Cl	CL.RCN	PENDF	Binary
Cl	CL.OUT	OUTPUT	BCD
K	K.RCN	PENDF	Binary
K	K.OUT	OUTPUT	BCD
Ca	CA.RCN	PENDF	Binary
Ca	CA.OUT	OUTPUT	BCD
Ti	TI.RCN	PENDF	Binary
Ti	TI.OUT	OUTPUT	BCD
V	V.RCN	PENDF	Binary
V	V.OUT	OUTPUT	BCD
Cr	CR.RCN	PENDF	Binary
Cr	CR.OUT	OUTPUT	BCD
Cr-50	CR50.RCN	PENDF	Binary
Cr-50	CR50.OUT	OUTPUT	BCD

Table III(cont.)The List of PENDF Files

Material	Filename	Type	Format
Cr-52	CR52.RCN	PENDF	Binary
Cr-52	CR52.OUT	OUTPUT	BCD
Cr-53	CR53.RCN	PENDF	Binary
Cr-53	CR53.OUT	OUTPUT	BCD
Cr-54	CR54.RCN	PENDF	Binary
Cr-54	CR54.OUT	OUTPUT	BCD
Mn-55	MN55.RCN	PENDF	Binary
Mn-55	MN55.OUT	OUTPUT	BCD
Fe	FE.RCN	PENDF	Binary
Fe	FE.OUT	OUTPUT	BCD
Fe-54	FE54.RCN	PENDF	Binary
Fe-54	FE54.OUT	OUTPUT	BCD
Fe-56	FE56.RCN	PENDF	Binary
Fe-56	FE56.OUT	OUTPUT	BCD
Fe-57	FE57.RCN	PENDF	Binary
Fe-57	FE57.OUT	OUTPUT	BCD
Fe-58	FE58.RCN	PENDF	Binary
Fe-58	FE58.OUT	OUTPUT	BCD
Co-59	CO59.RCN	PENDF	Binary
Co-59	CO59.OUT	OUTPUT	BCD
Ni	NI.RCN	PENDF	Binary
Ni	NI.OUT	OUTPUT	BCD
Cu	CU.RCN	PENDF	Binary
Cu	CU.OUT	OUTPUT	BCD
Cu-63	CU63.RCN	PENDF	Binary
Cu-63	CU63.OUT	OUTPUT	BCD

Table III(cont.)The List of PENDF Files

Material	Filename	Type	Format
Cu-65	CU65.RCN	PENDF	Binary
Cu-65	CU65.OUT	OUTPUT	BCD
Zn	ZN.RCN	PENDF	Binary
Zn	ZN.OUT	OUTPUT	BCD
Zr	ZR.RCN	PENDF	Binary
Zr	ZR.OUT	OUTPUT	BCD
Nb-93	NB93.RCN	PENDF	Binary
Nb-93	NB93.OUT	OUTPUT	BCD
Mo	MO.RCN	PENDF	Binary
Mo	MO.OUT	OUTPUT	BCD
Ag-107	AG107.RCN	PENDF	Binary
Ag-107	AG107.OUT	OUTPUT	BCD
Ag-109	AG109.RCN	PENDF	Binary
Ag-109	AG109.OUT	OUTPUT	BCD
In	IN.RCN	PENDF	Binary
In	IN.OUT	OUTPUT	BCD
Sn	SN.RCN	PENDF	Binary
Sn	SN.OUT	OUTPUT	BCD
Sb	SB.RCN	PENDF	Binary
Sb	SB.OUT	OUTPUT	BCD
Hf	HF.RCN	PENDF	Binary
Hf	HF.OUT	OUTPUT	BCD
Ta-181	TA.RCN	PENDF	Binary
Ta-181	TA.OUT	OUTPUT	BCD
W	W.RCN	PENDF	Binary
W	W.OUT	OUTPUT	BCD

Table III(cont.)The List of PENDF Files

Material	Filename	Type	Format
Au-197	AU.RCN	PENDF	Binary
Au-197	AU.OUT	OUTPUT	BCD
Hg	HG.RCN	PENDF	Binary
Hg	HG.OUT	OUTPUT	BCD
Tl	TL.RCN	PENDF	Binary
Tl	TL.OUT	OUTPUT	BCD
Pb	PB.RCN	PENDF	Binary
Pb	PB.OUT	OUTPUT	BCD
Th-232	TH232.RCN	PENDF	Binary
Th-232	TH232.OUT	OUTPUT	BCD
U-234	U234.RCN	PENDF	Binary
U-234	U234.OUT	OUTPUT	BCD
U-235	U235.RCN	PENDF	Binary
U-235	U235.OUT	OUTPUT	BCD
U-238	U238.RCN	PENDF	Binary
U-238	U238.OUT	OUTPUT	BCD
Np-237	NP.RCN	PENDF	Binary
Np-237	NP.OUT	OUTPUT	BCD
Pu-239	PU239.RCN	PENDF	Binary
Pu-239	PU239.OUT	OUTPUT	BCD
Pu-240	PU240.RCN	PENDF	Binary
Pu-240	PU240.OUT	OUTPUT	BCD
Pu-241	PU241.RCN	PENDF	Binary
Pu-241	PU241.OUT	OUTPUT	BCD
Pu-242	PU242.RCN	PENDF	Binary
Pu-242	PU242.OUT	OUTPUT	BCD

Table III.(cont.) The List of PENDF Files

Material	Filename	Type	Format
Am-241	AM241.RCN	PENDF	Binary
AM-241	AM241.OUT	OUTPUT	BCD
Bk-249	BK.RCN	PENDF	Binary
Bk-249	BK.OUT	OUTPUT	BCD
Cf-249	CF.RCN	PENDF	Binary
Cf-249	CF.OUT	OUTPUT	BCD

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