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memorandum

Nuclear, Atomic, and EOS Data, X-1-NAD

New ACE-Formatted Neutron and Proton Libraries Based on ENDF/B-VII.0

1.0 Introduction

The ENDF/B-VII.0 nuclear data evaluations[1] contain neutron cross sections for 390 isotopes and 3 elements. All evaluations with the exception of ^{7}Be, ^{253}Cf, and ^{253}Es, which were incomplete, have been processed into ACE format at five different temperatures: 293.6, 600, 900, 1200, and 2500 K in the ENDF70 library. With the exception of ^{1}H, the processing was done using NJOY99[2] Version 248 and several pre- and post-processing and quality assurance checking codes. The ENDF70 neutron library was broken into eleven separate files of less than 900 MB each and will be compressed and released with MCNP5 1.50. The major changes to ENDF70 not present in ENDF66 were more temperatures, inclusion of substantially more nuclides including metastable states, and a new XSDIR file with atomic weights for the new nuclides.

Forty-seven ENDF/B-VII proton evaluations were also processed at room temperature using the ACER module of NJOY version 248. Forty-eight proton evaluations were available through ENDF/B-VII.0; ^{13}C could not be processed with NJOY because the evaluation was incomplete and was thus omitted from the resulting library. The resulting ACE-formatted data were run through the same checking codes as the neutron evaluations and then combined into the library ENDF70PROT, which is about 81 MB. For the moment, both of these libraries are available in the directory /usr/projects/data/nuclear/mc/new on the open ICN systems.

2.0 Background

Nuclear data is distributed as part of MCNP[3]; thus it is used extensively worldwide. The release of the ENDF66 neutron library based upon data from ENDF/B-VI.6 involved many quality assurance tests to make sure the best data possible were released. Checking codes were written and each evaluation was plotted and tested in MCNP to make sure no major problems existed. The same rigorous procedure was employed for release of the ENDF70 library based on ENDF/B-VII.0 data for both neutron and proton evaluations. Note that during the processing of the ENDF66 library,[4,5] some limitations of NJOY99 Version 50 existed that related to unresolved resonance tables (the PURR module) and the ability to process delayed neutron data. The problems in PURR contributed to the calculation of incorrect heating cross sections and factors in some probability tables and the need for more than 64 ladders for some isotopes. The delayed neutron data was simply not yet added by NJOY to the ACE file. These issues required post-processing of NJOY data to create the tables released as part of ENDF66. All of these issues have been resolved in version 248 of NJOY, which is what was used for most of ENDF70 processing. The processing of ^{1}H was done using a version of NJOY that also incorporated update 271to fix an error in deuteron production.

3.0 The Neutron Continuous Energy Library ENDF70

3.1 New Features
There are numerous factors that were considered when processing the ENDF70 library, including providing more temperature-dependent data, inclusion of metastable state isomers, and the addition of new isotopes that were not previously processed to the list of atomic weights in the XSDIR file. The next several sections discuss each of these issues.

3.1.1 Temperature-Dependence
The temperature-dependent cross sections in ENDF70 have the identifiers of .70c, .71c, .72c, .73c, and .74c respectively (see Table 1).

Table 1. Mapping of Temperatures to ZAID Identifiers

Identifier	Temperature (K)
*.70c	293.6
*.71c	600
*.72c	900
*.73c	1200
*.74c	2500

The purpose of providing more intermediate temperatures than previously released in data libraries is to make reactor-type calculations easier both directly and with the use of the Doppler code[6] released as a new feature of MAKXSF with MCNP5 1.50. Given pre-existing ACE-formatted libraries, Doppler prepares neutron cross sections for any user-specified temperature greater than a temperature in an existing library. Doppler interpolates values for the thermal scattering and unresolved-range probability tables and can do so more accurately with an "upper" and "lower" bound of the temperature range. Having multiple temperatures available aids users in obtaining more accurate results at temperatures of interest. The total size of the new type1 (i.e. uncompressed) neutron data is approximately 8.8 GB. Compressed, it comprises about 380 MB. The data is broken into eleven different files distinguished by atomic number (Z). Table 2 lists which elements/isotopes are contained in each data file.

The light elements are contained in ENDF70A, uranium, neptunium and plutonium in ENDF70J, and other actinides in ENDF70K. Intermediate-mass structural materials, fission products, and heavy non-actinides are contained in ENDF70B through ENDF70I. The wide range of fission products now available should help users avoid the need to lump fission products together.

3.1.2. Inclusion of Metastable States
Another major change to the ACE-formatted libraries is the inclusion of nuclides with metastable states and even both ground and metastable states of some isotopes. For most nuclides, the ZAID is simply the atomic number (Z) followed by the atomic mass number (A) in the format ZZAAA. If the Z number is only one digit, the first Z can be blank, but if the atomic mass number is not three digits, then zeros must be included. However, to emphasize the presence of metastable states, we have tried to form ZAID identifiers for nuclides with metastable states that involve unrealistic atomic mass numbers.

Table 2. List of Contents in Each ENDF70 file

file	Elements	Z numbers
endf70a	H, He, Li, Be, B, C, N, O, F, Na, Mg, Al, Si, P, S, Cl, Ar, K, Ca, Sc, Ti, V	1 through 23
endf70b	Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge	24 through 32
endf70c	As, Se, Br, Kr, Rb, Sr, Y, Zr, Nb, Mo	33 through 42
endf70d	Tc, Ru, Rh, Pd, Ag, Cd	43 through 48
endf70e	In, Sn, Sb, Te, I	49 through 53
endf70f	Xe, Cs, Ba, La, Ce, Pr	54 through 59
endf70g	Nd, Pm, Sm, Eu	60 through 63
endf70h	Gd, Tb, Dy, Ho, Er	64 through 68
endf70i	Lu, Hf, Ta, W, Re, Ir, Au, Hg, Pb, Bi	71 through 83
endf70j	U, Np, Pu	92 through 94
endf70k	Ra, Ac, Th, Pa, Am, Cm, Bk, Cf, Es, Fm	88 through 91 95 through 100

Table 3 contains a list of nuclides for which metastable state data are available as well as their ZAID identifiers. Note that in some cases, data for both the ground and metastable states exist; in others, only metastable state data exists, but the ZAID is formed consistently either way. If one is trying to calculate the atomic mass from the ZAID of a nuclide in a metastable state, a different formula must be used (see Equation 1) or the incorrect answer will result.

Table 3. List of Nuclides with Metastable States for ENDF70

	ZAID
^{58}Co (ground)	27058
^{58m}Co (metastable)	27458
^{110m}Ag (metastable only)	47510
^{115m}Cd (metastable only)	48515
^{127m}Te (metastable only)	52527
^{129m}Te (metastable only)	52529
^{148}Pm (ground)	61148
^{148m}Pm (metastable)	61548
^{166m}Ho (metastable only)	67566
^{242}Am (ground)	95642
^{242m}Am (metastable)	95242
^{244}Am (ground)	95244
^{244m}Am (metastable)	95644

$$\text{ZAID}_m = (\text{ZAID} + 300) + (m*100) \qquad\qquad [1]$$

Where: ZAID_m is the metastable isomer ZAID

ZAID is the ground-state ZAID

m is the excited state corresponding to m=1,2,3…

The exception to this ZAID rule is ^{242m}Am, for which the identifier for the metastable state in the past has always been 95242. Previous to this library, MCNP data for the ground state of ^{242}Am have not been distributed. To avoid backwards-compatibility issues, we have used an unusual identifier for the ground state of ^{242}Am: 95642. The ZAID of ^{242m}Am remains as 95242.

3.1.3 Changes to XSDIR For New Isotopes
To utilize the cross sections in MCNP, atomic weights of applicable isotopes must be available. The file xsdir contains information about the cross section files, including size, but also includes atomic weights (actually atomic weight ratios) for all available isotopes. Because cross sections for new isotopes are now available, atomic weights had to be added for the following isotopes:

^{22}Na, ^{58m}Co, ^{79}Se, ^{85}Kr, ^{86}Rb, ^{89}Sr, ^{90}Sr, ^{105}Ru, ^{106}Ru, ^{107}Pd, ^{110m}Ag, ^{111}Ag, ^{115m}Cd, ^{113}Sn, ^{123}Sn, ^{125}Sn, ^{126}Sn, ^{124}Sb, ^{125}Sb, ^{126}Sb, ^{127m}Te, ^{129m}Te, ^{132}Te, ^{130}I, ^{131}I, ^{123}Xe, ^{133}Xe, ^{133}Ba, ^{140}Ba, ^{140}La, ^{139}Ce, ^{141}Ce, ^{143}Ce, ^{144}Ce, ^{142}Pr, ^{143}Pr, ^{148m}Pm, ^{151}Pm, ^{153}Sm, ^{156}Eu, ^{157}Eu, ^{153}Gd, ^{160}Tb, ^{166m}Ho, ^{242m}Am, ^{244m}Am, ^{249}Cm, ^{250}Cm, ^{250}Bk, ^{253}Cf, ^{254}Cf, and ^{255}Fm.

Because we were adding a large number of new isotopes to the atomic weight ratio section of xsdir, a decision was made to completely update the section to include values from the most recent compilation[7]. As a result, the xsdir file distributed with MCNP5 1.50 not only provides new atomic weight ratios for previously-unavailable isotopes such as ^{133}Ba, it also provides updated (relative to previous xsdir) atomic weight ratios for previously-available isotopes such as ^{235}U. As a consequence, very slight differences will result in cases in which MCNP needs to convert from mass fractions and densities to atom fractions and densities. For users desiring to utilize the previous atomic weight ratios, we have included the previous xsdir file (distributed now as xsdir_old) with MCNP5 1.50.

3.2 Processing Codes
All processing of ENDF/B-VII data was done on the LINUX machine Flash in the directory /usr/projects/data/nuclear/mc/endf7 and is also stored on HPSS under /hpss/nucldata/archive/mc_data/Libs/endf70. The processing was run using a Fortran program called PRENJOY to set up a c-shell script that creates the NJOY input files, runs NJOY, stores all the data, and runs a checking script called CHECKACE.PL on the resulting ACE files. The code PRENJOY creates a c-shell script named RUNNJOY (see Appendix A for an example). PRENJOY, RUNNJOY, NJOY, and CHECKACE.PL were run separately for all evaluations in their own directory. They were named /usr/projects/data/nuclear/mc/endf7/xx*** on the ICN LINUX machine Flash and for the long-term are saved on HPSS under /hpss/nucldata/archive/mc_data/Libs/endf70/xx***. xx is the element and *** represents the atomic mass number of the isotope being requested. In cases where the element is only one character, only one 'x' is required, and in cases where the atomic mass number is less than 100, not all three '*'s are required (e.g., U235 for ^{235}U and H1 for ^{1}H). PRENJOY.F, CHECKACE.PL, and the other Fortran checking codes employed by CHECKACE.PL are

currently located in the directory: /usr/projects/data/nuclear/mc/endf7/acs and on HPSS under /hpss/nucldata/archive/mc_data/Libs/endf70/acs. Note that using the default input files, the resulting ACE-formatted data files did not have the appropriate heading, so the file addline.f under /usr/projects/data/nuclear/mc/endf7/acer was used to fix the descriptor line of the file for each isotope at each temperature.

3.2.1 PRENJOY
The code PRENJOY is run by typing "prenjoy ZZAAA" at the command line. PRENJOY first looks up the material identifier for the isotope being requested from a file called XSLIST7.VI located one directory up (i.e. /usr/projects/data/nuclear/mc/endf7 - see Appendix B for a listing). Then it creates a c-shell script called RUNNJOY with commands to copy files, create NJOY input files, run NJOY99.248, and execute the checking script CHECKACE.PL. All output from running RUNNJOY for an isotope was saved as xx***.log. Typically, numerous isotopes were run serially and/or in parallel using another c-shell program, with the following lines required for each isotope:

new run:		*repeat run for one isotope (such as evaluation change)*
mkdir U235	|	cd U235
cd U235	|	rm U235.log
../acs/prenjoy 92235	|	../acs/prenjoy 92235
csh –v runnjoy > U235.log	|	csh –v runnjoy > U235.log
cd ..	|	cd ..

The isotopes were broken into about ten different files to run on Flash; see the files in the directory /usr/projects/data/nuclear/mc/endf7/runfiles and /hpss/nucldata/archive/mc_data/Libs/endf70/runfiles for examples.

3.2.2 RUNNJOY
RUNNJOY first copies the ENDF file from the directory /usr/projects/data/nuclear/mc/endf7/endf (note that the ENDF files for which modifications were required are named xx***.mod (where xx is the element in lowercase) and RUNNJOY MUST be modified by hand to use these files). The ENDF files are also saved on HPSS under /hpss/nucldata/archive/mc_data/Libs/endf70/endf. Then it creates an NJOY input file for processing through the modules MODER, RECONR, BROADR, HEATR, PURR, THERMR, GASPR to create a PENDF file. BROADR is required to obtain temperature-dependent cross sections at all energies of interest, HEATR calculates energy deposition cross sections additional to those in the ENDF file, PURR creates unresolved resonance probability tables, and GASPR generates gas production data. THERMR is not required to generate ACE-formatted files; however, THERMR was included during this NJOY processing to avoid some photon production sum issues found by the CONSIS module of NJOY by providing more data points. Finally, RUNNJOY executes the Perl script CHECKACE.PL to perform quality assurance checking of the data generated.

The original ENDF file is named xx***.endf, and the resulting PENDF file is called xx***.pendf. The NJOY input and output files for this step are saved as xx***.njoyinput.pendf and xx***.njoyoutput.pendf. Then, for each of the five temperatures, RUNNJOY creates an

input file to run the ACER module of NJOY three times; first to process data into ACE format, second to run consistency checking, and third to determine if the ACE files produced by NJOY after consistency checking pass the consistency checking after being generated.   The final ACE files are saved as xx***.acer.%%%% where xx is the element, *** is the isotope, and %%%% (either three or four digits) is the temperature (293 is given for 293.6 K, 600 represents 600 K, etc.). The NJOY input and output files from the ACER runs are stored as xx***.njoyinput.%%%%.acer and xxx***.njoyoutput.%%%%.acer. Note that almost all problems found to be significant by the internal consistency checking within NJOY were corrected by ACER with the exception of Eu153, which requires evaluation modifications in the future to solve this problem (see Section 3.3.5).

3.2.3 CHECKACE.PL
CHECKACE.PL runs eleven checking codes written during the processing of ENDF66, providing file names for output and modifications to the ACE files, and evaluating the output to see if possible problems exist. It prints messages about such problems to the xxx***.log file. The ten Fortran checking codes along with the output files and/or new ACE files created by each are given in Table 4. CHECKACE.PL is listed in Appendix C.

Table 4. Checking Codes Used During ENDF70, Including Names of Output and Modified ACE Files

	Output file	New ACE file
check0.f	xxx***.acer.%%%%.c0	xxx***.acer.%%%%.new3
check5.f	xxx***.acer.%%%%.c5	-
check61.f	xxx***.acer.%%%%.c61	xxx***.acer.%%%%.new2
check_heat.f	xxx***.acer.%%%%.cht	-
check_iso.f	xxx***.acer.%%%%.ciso	-
checknd.f	xxx***.acer.%%%%.cnd	-
checknd_neut.f	xxx***.acer.%%%%.cnd_n	xxx***.acer.%%%%.new
checkthresh.f	xxx***.acer.%%%%.cthr	-
check_ures.f	xxx***.acer.%%%%.cures	-
checkxs.f	xxx***.acer.%%%%.cxs	-
check_lownum.pl	N/A	xxx***.acer.%%%%.new4

The Fortran programs were compiled separately and run "stand-alone" from "checkace.pl". In addition, the capabilities of the Perl checking script "check_lownum.pl," which checks for low exponent values were built into "checkace.pl".

A spreadsheet (called "evals_final.xls") was maintained that contained information about whether or not each checking code found any possible errors for all isotopes. It also contained messages produced by MCNP for each isotope and highlighted isotopes for which files were changed as a result of certain checking codes. Final ACE files are also stored individually under: /usr/projects/data/nuclear/mc/endf7/acer and /hpss/nucldata/archive/mc_data/Libs/endf70/acer.

A description of each of the checking codes generated during processing of ENDF66 and only slightly modified for ENDF70 is given below.

CHECK0: This code reads a type 1 MCNP library and checks to make sure that all threshold reactions have a leading zero in their cross-section tabulation. It checks neutron cross sections, type-13 photon-production cross sections, and other particle production cross sections. An error is printed to the output file and carried over to the log file of the isotope/element being examined by CHECKACE.PL if any problems are found.

CHECK5: This code reads in a type 1 MCNP data library and checks the information for MT=5. The code prints out the threshold energy and the first pair (energy, yield) of data for secondary neutrons. It checks to see if the threshold for MT=5 is lower than the first data pair, in which case the first yield must be zero. If no MT=5 reaction data if found there is no printed output. CHECKACE.PL reviews the output file and prints all messages to the log file. These messages must be reviewed to assure no problems exist.

CHECKND: The program checknd reads in an MCNP type 1 library file and checks various aspects of the secondary photon energy distributions which use LAW=4 or 44. It informs the user if the secondary photon energies are discrete. All "errors" printed to the output file are transmitted to the log file by CHECKACE.PL.

CHECKND_NEUT: The program reads in an MCNP type 1 library file and checks various aspects of the secondary neutron energy distributions which use LAW=4 or 44. It verifies that interpolation schemes 1 or 2 are used, and identifies any negative probability density functions. The code checks to see if any secondary neutrons are produced with energy greater than the incident neutron energy and takes corrective action with the exception of fission. It also fixes negative probabilities by setting them to zero. Errors in the output file are transmitted to the log file by CHECKACE.PL. Though no corrective action is taken for fission, one still can get a "error" message for fission MT's. Note that problems existed in the methodology checknd_neut used to correct the incident energy. A new version of checknd_neut.f (checknd_neut2.f) was written to help avoid some problems but was neither completely correct nor used. Thus, only ACE files modified by checknd_neut for negative probability density functions were included in ENDF70. Changes for outgoing neutron energy problems were small and considered insignificant.

CHECK61: The program check61 reads in an MCNP type 1 library file and checks various aspects of the secondary neutron energy distributions which use LAW=61. It verifies that interpolation schemes 1 or 2 are used, and identifies any negative probability density functions. The code checks to see if any secondary neutrons are produced with energy greater than the incident neutron energy and takes corrective action, again with the exception of fission. Though no corrective action is taken for fission, one still can get a "error" message for fission MT's. It also fixes the negative probabilities by setting them to zero. All errors given in the output file are transmitted to the log file by CHECKACE.PL. However, for consistency with checknd_neut, only ACE files corrected for errors with negative probability density functions were included in ENDF70. Changes for outgoing neutron energy problems were small and considered insignificant.

CHECK_HEAT: This code reads in a type 1 MCNP data library and checks various aspects of heating numbers. First, it checks the main heating grid for zeros or negatives. Then, it checks each of the partial particle heating arrays for the same features. Finally, it totals these partial heating arrays and does some comparisons of this total to the main grid. Again, errors found in the output file were carried over to the log file by CHECKACE.PL.

CHECK_ISO: This code reads in a type 1 MCNP data library and checks all neutron reactions that produce secondary neutrons. If the angular distributions are isotropic, it prints out the zaid, mt, and tyr. The reason for this code is that an error appeared in NJOY99.50 that gave a positive tyr for reactions with isotropic distributions, even if the isotropy is specified to be center-of-mass (an example from ENDF66 is MTs 56 and higher in ^{16}O). It also checks to make sure TYR is 19 for all fission reactions. For ENDF70, this test helped identify a problem in the evaluation for ^{242}Am (ground state) as will be discussed in Section 3.3.1. All values of TYR greater than zero plus all fission and inelastic MTs are printed to the output file and transmitted to the log file by CHECKACE.PL. These values must be verified by hand to assure they are not unreasonable.

CHECKTHRESH: This code reads in a type 1 MCNP data library and checks the reaction threshold energies with the kinematic thresholds for negative Q-value reactions. If the library threshold is lower than the kinematic threshold the codes outputs this information along with the magnitude of the discrepancy, the law specified for the secondary neutrons and the line number on the type 1 library file containing the problem energy value. If no errors are detected no print out is given. All errors given in the output file are transmitted to the log file by CHECKACE.PL.

CHECK_URES: This program analyzes the unresolved resonance probability tables generated by the PURR module of NJOY to assure that the partial cross sections or factors add up appropriately to totals and that no unrealistic heating values exist. It lists all the cross sections and factors for each incident energy and prints warning messages when partials do not add up correctly to the total within 1 and/or 5%, if some values are zero, or if unrealistic heating numbers exist. All errors given in the output file are transmitted to the log file by CHECKACE.PL as are the total number of potential problems identified by check_ures.

CHECKXS: This program reads in a Type 1 MCNP library, and for each zaid it compares the total cross section to the sum of the partials for neutrons and for photon production. This version of the code also verifies that the sum of the 600-800's series of MT's adds up to the corresponding total in MT=103-107 and checks for negative cross sections (such as MT91 for Y89). All errors given in the output file are transmitted to the log file by CHECKACE.PL.

CHECK_LOWNUM.PL: Checks an ACE file for numbers in scientific notation which are < 10^{-30}. The lines of the ACE files with such low numbers are printed to the log file and must be modified by hand if they are less than or equal to 10^{-37}. They are ignored if greater than 10^{-37}.

3.3 Results of Verification and Validation
Several issues were found with the processing/evaluations. The evaluation issues are discussed first followed by outcomes of the checking code results/changes for quality assurance.

3.3.1 Evaluation Changes

Evaluations were modified for the following seven isotopes: ^{1}H, ^{45}Sc, ^{89}Y, ^{96}Zr, ^{97}Mo, ^{242}Am (ground state), and ^{242m}Am. Detailed changes to the evaluations are given in Appendix D but are summarized here.

H1: The value for the energy of the photon from radiative capture was modified to 2.2233 MeV from 2.2246. The new value is the actual energy of the photon from thermal capture. The previous evaluations gave the total energy and did not take into account the recoil of the nucleus (hence impacting heating as well). This was found in ENDF66 and did not get changed in ENDF/B-VII.

Sc45: In ENDF66, it was found that this evaluation had to be modified because File 13, MT=3 did not have the secondary distribution for photons beginning with a zero point at the threshold. Additionally, the evaluation had the incorrect reference frame specified for angular distributions of (n,2n) and (n,n*)a, (n,n*)p, and (n,n*c) as found by CONSIS/ACER. Both of these problems still existed in the ENDF/B-VII evaluation, so the same changes were made as were made previously.

Y89: Some negative cross sections existed from 1.7 to 4.5 MeV in reaction 91 (inelastic cross section not included in other channels). Thus, reaction 91 was changed from 35 lines with numerous negative cross sections to only 14 lines with values that were the difference of MT 4 (total inelastic) and the sum of MT's 51-90 (partial inelastic).

Zr96 and Mo97:

Errors from the CONSIS checking option in the ACER module of NJOY indicated that the value of r in law44 kalbach was incorrect. It should be a fraction between 0 and 1, but values such as 9.999 were appearing. It turns out that there were type-o's in the evaluations for Zr96 and Mo97 that gave results such as 9.999… instead of 0.9999…. These two evaluations were thus modified accordingly.

Am242 (ground): The ^{242}Am ENDF file did not have an angular distribution for fission (i.e. no file 4 nor 6 for mt=18), which led to an incorrect value of TYR. We inserted an isotropic MF=4, MT=18 section.

Am242m: The inelastic cross sections (MT 4, 51, 52, 53, and 54) contained values of zero between 50 and 65 keV, whereas values above and below were non-zero. The cross sections below 100 keV were smoothed out by the evaluator.

3.3.2 Heating Problems

The checking code "check_heat" compares the sum of the partial heating numbers to the total heating reported by NJOY. Some anomalies were found. For example, there were cases where the sum of the partials was greater than the total. The checking code also found some cases of negative total heating numbers. Such anomalies are indicative of energy-balance problems in the original evaluations; we report them so users are aware of the issues, but there is nothing that can be done in processing to correct the problems. The isotopes for which these problems occur (with bolded values representing isotopes with negative heating cross sections) are:

^{47}Ti, ^{48}Ti, ^{49}Ti, ^{74}As, **^{92}Mo**, **^{94}Mo**, **^{96}Mo**, **^{97}Mo**, **^{98}Mo**, ^{101}Ru, ^{105}Pd, ^{113}Sn, ^{131}Xe, ^{133}Ba, **^{143}Ce**, **^{145}Nd, ^{147}Nd,** ^{148}Nd, ^{150}Nd, **^{147}Sm**, ^{148}Sm, **^{149}Sm**, **^{151}Sm, ^{153}Gd**, ^{154}Gd, **^{155}Gd**, ^{156}Gd, ^{157}Gd, ^{191}Ir, and ^{208}Pb.

Note that using Versions 115-224 of NJOY99 had a flaw that resulted in incorrect calculation of heating numbers in some circumstances. During early testing of the ENDF/B-VII data, several heating problems were identified by "check_heat" and substantial upgrades were made to NJOY to correct them by Version 248.

3.3.3 Unresolved Resonance Range Issues

During ENDF66 processing of ENDF/B-VI Release 6 data using NJOY99 Version 50, problems were identified with heating cross sections and factors output in the probability tables not having the right units, and a separate code was written to fix these problems. Version 76 of NJOY99 corrected most of these problems, and Version 172 of NJOY99 corrected all the problems (especially heating factors). Minor changes were also added in Version 245 to help the sampling of narrow widely spaced resonances where "check_ures" also reported warnings.

Despite these improvements, evaluated data in the unresolved resonance range can still sometimes be difficult to process into useful and self-consistent probability tables. There are still a number of isotopes for which some values in the probability tables are not summing up to the totals predicted (within 5%) and/or there are negative heating factors. We have not yet had time to determine whether these issues are caused by the evaluations or the processing methods. Thus, probability tables have been excluded (i.e. NJOY was run without PURR) for the following isotopes:

^{22}Na, ^{36}Ar, ^{38}Ar, ^{74}As, ^{79}Se, ^{82}Kr, ^{90}Zr, ^{94}Nb, ^{95}Nb, ^{99}Mo, ^{106}Cd, ^{123}Sn, ^{126}Sn, ^{125}Sb, ^{131}I, ^{136}Cs, ^{139}Ce, ^{143}Pr, ^{144}Nd, ^{148}Pm, ^{151}Pm, ^{153}Sm, ^{152}Eu, ^{153}Eu, ^{154}Eu, ^{155}Eu, ^{156}Dy, ^{158}Dy, ^{181}Ta, ^{252}Cf, ^{253}Cf, and ^{253}Es.

Such modifications to the RUNNJOY c-shell script had to be made by hand.

3.3.4 Photon Production Sum Problems in CONSIS

As mentioned previously, the THERMR module in NJOY was included during this NJOY processing to avoid some photon production sum issues found by the CONSIS module of NJOY. All isotopes were processed with THERMR, but the specific isotopes for which these issues initially existed when THERMR was not included were: ^{1}H, ^{40}Ca, ^{42}Ca, ^{43}Ca, ^{44}Ca, ^{46}Ca, ^{48}Ca, ^{70}Ge, ^{72}Ge, ^{73}Ge, ^{74}Ge, ^{76}Ge, ^{74}As, ^{75}As, ^{85}Kr, ^{86}Rb, ^{84}Sr, ^{90}Y, ^{90}Zr, ^{91}Zr, ^{92}Zr, ^{94}Zr, ^{96}Zr, ^{95}Mo, ^{99}Tc, ^{101}Ru, ^{103}Rh, ^{105}Pd, ^{109}Ag, ^{111}Ag, ^{115m}Cd, ^{113}Sn, ^{125}Sn, ^{126}Sb, ^{132}Te, ^{130}I, ^{131}Xe, ^{133}Cs, ^{133}Ba, ^{140}La, ^{136}Ce, ^{138}Ce, ^{139}Ce, ^{143}Ce, ^{141}Pr, ^{142}Pr, ^{142}Nd, ^{143}Nd, ^{144}Nd, ^{145}Nd, ^{146}Nd, ^{147}Nd, ^{148}Nd, ^{150}Nd, ^{151}Pm, ^{144}Sm, ^{147}Sm, ^{148}Sm, ^{149}Sm, ^{150}Sm, ^{151}Sm, ^{152}Sm, ^{153}Sm, ^{154}Sm, ^{153}Eu, ^{157}Eu, ^{152}Gd, ^{153}Gd, ^{154}Gd, ^{155}Gd, ^{156}Gd, ^{157}Gd, ^{158}Gd, ^{160}Gd, ^{159}Tb, ^{160}Tb, ^{156}Dy, ^{158}Dy, ^{160}Dy, ^{161}Dy, ^{162}Dy, ^{163}Dy, ^{164}Dy, ^{165}Ho, ^{166m}Ho, ^{191}Ir, ^{193}Ir, ^{232}Th, ^{231}Pa, ^{233}Pa, and ^{237}Np.

3.3.5 Modifications to the ACE file Made by CHECK61 and CHECKND_NEUT

The checking code CHECK61 checks various aspects of the secondary neutron energy distributions that use LAW=61. It verifies that interpolation schemes 1 or 2 are used, identifies any negative probability density functions, and sets them to zero. The code also checks to see if any secondary neutrons are produced with energy greater than the incident neutron energy and takes corrective action (except for fission, which it does not correct). The only isotope for which CHECK61 found negative probability density functions was ^{153}Eu (MF=6, MT=91). The negative pdf's were set to zero and the distributions were renormalized in the corrected ACE file. There were some minor problems found by CHECKND_NEUT and CHECK61 related to incident/secondary neutron energies, but the modified ACE files for neutrons were not used because the changes were 1) not significant and 2) often modified incorrectly (especially by CHECKND_NEUT, which is why the Fortran program CHECKND_NEUT2.F was created to try and solve these problems but needs more work if used in the future).

3.3.6 Modifications to the ACE file Resulting from Output from CHECK0 and CHECK_LOWNUM.PL

Changes to the ACE file resulting from the Perl script CHECK_LOWNUM.PL were made for seven isotopes with exponents less than or equal to e-37: ^{16}O, ^{40}Ca, ^{42}Ca, ^{43}Ca, ^{44}Ca, ^{46}Ca, and ^{204}Pb. The exponents were simply changed to e-35 for these cases. The checking code CHECK0 only found a problem for one isotope, ^{10}B (MCNP MT=103004). Note also that although one change was made to the ACE file by CHECK0 for a leading non-zero threshold photon-production cross section value, the total photon production cross section at that energy had to be decremented by hand in the file. For example, for isotope ^{10}B, the cross section was 1.94222e-09, but it was changed to 0.0, and the sum 0.189405100000 became 0.189405098058.

3.3.7 Problems with ^{1}H
3.3.7.1 Warning Found by CHECKND
Using the ENDF/B-VII data for ^{1}H, NJOY chose to use an MCNP Law = 4 representation for the energy distribution of the photon (now in File 6), whereas it used to represent it with Law = 2 with the ENDF/B-VI data. It has essentially tabulated the function "$E' = 2.2233 + Eneut * (AWR)/(AWR + 1)$" by using a tabulated energy distribution as a function of incident energy, where each tabulated distribution contains only the one value calculated from above (specified as discrete) with linear-linear interpolation between incident energies. This new technique gives the same result as the Law=2 one but leads to the NJOY warning message: "discrete anisotropic photon treated as simple primary photon" and warnings in the checking code CHECKND.

3.3.7.2 Deuteron Production Not Calculated Correctly
Using Version 248 of NJOY with ENDF/B-VII data for ^{1}H, there was a problem with deuteron production following neutron capture on hydrogen. ^{1}H was the only nuclide affected because in ENDF/B-VII, the 1h capture photon data were removed from MF=12 and MF=14 and put into MF=6. Basically, at 1.e-11 MeV, the cross section for neutron absorption (16.70111) equals both the MT=102 cross section and the MT=204 cross section. However, in the deuterium production portion of the file, the cross section at 1.e-11 eV is twice what it should be (33.40222). Update 271 of NJOY contains a solution to this problem, so this update by itself was added to Version 248 of NJOY and ^{1}H was reprocessed to correct it.

3.3.8 MCNP "Hoho" Test

In addition to the other quality assurance checking codes, resulting ACE files for all isotopes were run through a sample MCNP file to assure the data is read in and processed correctly. The sample file involves a source starting over a large energy range up to 20 MeV for a sphere with a density of 20 g/cc of the isotope/element being tested (see Appendix E for an example). Some warning messages from MCNP include:

"lacks gamma ray production cross sections"
"1 coincident energy grid point"
"no photon-production mt found in acegam" (looped failed no more than 2 times for any isotope)
"nubar may be prompt or total"
"material 1 has been set to a conductor"
"comment. 1 cross sections modified by free gas thermal treatment"

The messages relevant for each isotope are listed in the spreadsheet "evals_final.xls". Also, some MCNP input and output files are saved under /usr/projects/data/nuclear/mc/hoho/mcnp and long-term under /hpss/nucldata/archive/mc_data/Libs/endf70/hoho. There are five files for each isotope with extensions h1 through h5 that correspond to each of the five temperatures 293.6 K, 600 K, 900 K, 1200 K, and 2500 K respectively. Intermediate Fortran files used to set up the MCNP input files correctly and run them are found in the directory /usr/projects/data/nuclear/mc/hoho and /hpss/nucldata/archive/mc_data/Libs/endf70/hoho.

3.3.9 Plotting
The final "test" performed on the data was to plot all reactions for all isotopes using the program "xsplot." This program pulls up all available reactions for an isotope from various formats and plots it at all energies. The ENDF70 library was directly plotted at all energies on the machine "xfiles", for which the executable XSPLOT2 was valid. There were many cases where there were discontinuities in the data at a certain energy (i.e. some of the Ac isotopes and other actinides evaluations had assumed values below 0.6 eV and other models above 0.6 eV, so two very different cross sections existed at the same energy). There were also numerous cases of sharps dips in the heating cross section (MT 301) at an energy, often corresponding to negative heating values. Such anomalies were ignored at this time. However, the only major problem found thus far was the inelastic cross section of ^{242m}Am, which was modified. Most significant findings are documented in Appendix F.

3.4 Final ENDF70 Library
As described in Section 3.1.1, the neutron data tables associated with ENDF70 have been separated into 11 libraries. Characteristics of each neutron data table are provided in Appendix G.

4.0 The Proton Continuous Energy Library ENDF70PROT
The forty-seven proton evaluations processed with NJOY at room temperature (293.6 K) were given identifiers of ".70h" and combined into one file, ENDF70PROT. The list of proton tables available on ENDF70PROT is given in Table 5.

4.1 Processing

Only the ACER module of NJOY was used (again three times to allow for consistency checking and modifications), but the same procedure was used as for the neutron evaluations. The program PRENJOY2.F was created for the proton processing based on PRENJOY.F for the neutron processing except it created different NJOY input files (PRENJOY2.F is stored under /hpss/nucldata/archive/mc_data/Libs/endf70prot/acs). RUNNJOY was used to copy files to the correct places and run NJOY and CHECKACE.PL. Results from these calculations were stored in the spreadsheet "evals_pro.xls". One problem found when processing the proton evaluations with NJOY is that the ZAID was incremented by a value of 1 after ACER was run. The ZAIDs in the final files had to be modified by hand to be consistent with the incoming value.

Table 5. Proton Tables Available on ENDF70PROT

Material	ZAID
1-H - 1	1001.70h
1-H - 2	1002.70h
1-H - 3	1003.70h
2-He- 3	2003.70h
3-Li- 6	3006.70h
3-Li- 7	3007.70h
4-Be- 9	4009.70h
5-B - 10	5010.70h
6-C - 12	6012.70h
7-N - 14	7014.70h
8-O - 16	8016.70h
13-Al- 27	13027.70h
14-Si- 28	14028.70h
14-Si- 29	14029.70h
14-Si- 30	14030.70h
15-P - 31	15031.70h
20-Ca- 40	20040.70h
24-Cr- 50	24050.70h
24-Cr- 52	24052.70h
24-Cr- 53	24053.70h
24-Cr- 54	24054.70h
26-Fe- 54	26054.70h
26-Fe- 56	26056.70h
26-Fe- 57	26057.70h
28-Ni- 58	28058.70h
28-Ni- 60	28060.70h
28-Ni- 61	28061.70h
28-Ni- 62	28062.70h
28-Ni- 64	28064.70h
29-Cu- 63	29063.70h
29-Cu- 65	29065.70h
41-Nb- 93	41093.70h

74-W -182	74182.70h
74-W -183	74183.70h
74-W -184	74184.70h
74-W -186	74186.70h
80-Hg-196	80196.70h
80-Hg-198	80198.70h
80-Hg-199	80199.70h
80-Hg-200	80200.70h
80-Hg-201	80201.70h
80-Hg-202	80202.70h
80-Hg-204	80204.70h
82-Pb-206	82206.70h
82-Pb-207	82207.70h
82-Pb-208	82208.70h
83-Bi-209	83209.70h

4.2 Validation and Verification

For ^{28}Si, there were CONSIS errors related to photon production sum mismatches that were not resolved by CONSIS. In addition, the checking code CHECKND found problems with ^{2}H and ^{9}Be that were not resolved. For ^{2}H, there was a negative value of eprime at 0.1 MeV which was modified by hand to being positive in the ACE file; ^{9}Be just displayed warnings.   Additionally, CHECKND_NEUT found some negative probability density functions for ^{9}Be and set them to zero (kept separately in the file Be9.new).

Many of the resulting ACER files had numbers less than or equal to e-37. For the following isotopes, values less than or equal to e-37 were modified by hand to be e-35: ^{6}Li, ^{56}Fe, ^{182}W, ^{183}W, ^{184}W, ^{186}W, ^{200}Hg, ^{201}Hg, ^{202}Hg, ^{206}Pb, and ^{207}Pb. All isotopes in the resulting proton continuous energy library were run through an MCNPX "hoho" test similar to that run for the neutron library with no problems found.

5.0 Remaining Issues/Future Work

In comparing some ENDF/B-VII.0 ACE-formatted files with multi-group data both from LANL and from Livermore National Laboratory, Robert MacFarlane (LANL) and Red Cullen (LLNL) found some discrepancies at high energies. Comments from MacFarlane and Cullen are included verbatim in the following sections. Resolution of these issues should occur sometime in the future.

5.1 Fission spectrum interpolation

In U-235 and Pu-239, the energy grid for the fission spectra changes from 0.1 MeV below 10 MeV to 1 MeV above. Because linear-linear interpolation is specified, the deviations between the realistic exponential shape in the region above 10 MeV and the linear interpolate get quite large between the secondary-energy grid points (deviations up to 9%). Patches have been developed to alleviate this problem but were not implemented in ENDF70. Changes to these evaluations would be beneficial in the future.

5.2 Incident-energy interpolation

MF6/MT91 for the major actinides specifies linear interpolation on incident energy. Apparently, MCNP automatically changes this to some kind of a unit base interpolation in order to smooth out the shapes for energies between the incident energies given. In the future, either MCNP needs to be modified or the ENDF/B-VII evaluations should be changed to reflect an explicit int=22 interpolation law for the MF6 sections.

5.3 Histograms for continuum distributions

Most of the actinides, and many of the other materials based on model calculations, describe outgoing spectra in MF6 using histograms. The models normally use bins based on delta E. Of course, the realistic shape in the low-energy range of such spectra is sqrt(E'). The difference between sqrt(E') and the histogram shape leads to some edges in the computed flux for metallic assemblies like Godiva or Jezebel. These edges become evident when MCNP flux calculations are compared to TART, which makes an attempt to smooth out the histograms. The effect on k-eff is fairly small. A patch for ACE processing in NJOY has been developed to analyze the histograms to find the region that acts like sqrt(E') and inserts additional histogram segments using log energy spacing with small enough steps to minimize the edges in the computed flux. This patch was not implemented in the ENDF70 processing

5.4 Delayed Neutron Spectra

The delayed neutron spectra also use histograms. Since the low break is at 10 keV, the effect of that break can usually be seen as a step in the computed flux. It would be beneficial to change the shape of the spectrum so we could get very high delayed neutron sources into the low energy region in addition to the evident step in the flux at 10 keV. A patch could be applied to NJOY to do this shape changing or modified ENDF/B-VII evaluations could be prepared with smoother distributions for the MF5/MT455 sections.

6.0 Conclusions

In summary, the new neutron library ENDF70 offers more variety in the number of temperatures (5) and available isotopes (390) than in the past. The proton library ENDF70PROT contains improved data 47 isotopes. Significant effort was devoted to utilizing checking codes and other testing to assure the quality of these libraries. These data libraries should benefit many users and will be released with MCNP5 1.50.

References:

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Lubitz, T.H. Trumbull, J.P. Weinman, D.A. Brown, D.E. Cullen, D.P. Heinrichs, D.P. McNabb, H. Derrien, M.E. Dunn, N.M. Larson, L.C. Leal, A.D. Carlson, R.C. Block, J.B. Briggs, E.T. Cheng, H.C. Huria, M.L. Zerkle, K.S. Kozier, A. Courcelle, V.Pronyaev and S.C. van der Marck, "ENDF/B-VII.0: Next Generation Evaluated Nuclear Data Library for Nuclear Science and Technology", Nuclear Data Sheets, vol. 107, pp. 2931-3060 (2006).

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7. G. Audi, A.H. Wapstra, C. Thibault, J. Blachot, and O. Bersillon, "Ame2003: Atomic Mass Evaluation," (2003). [See www.nndc.bnl.gov/amdc/web/masseval.html]

Appendix A. Sample RUNNJOY c-shell script

```
date
echo processing 92235
cat>input <<EOF
 moder
 20 -21
 reconr
 -21 -22
 pendf tape for U -235  from endf b-vii njoy99.182
       9228  7 /
 .001 /
 'the following reaction types are added where available'/
 '    mt152   bondarenko unresolved'/
 '    mt153   unresolved probability tables'/
 '    mt20x   gas production'/
 '    mt221   free thermal scattering'/
 '    mt301   total heating kerma factor'/
 '    mt444   total damage energy production'/
 0 /
 broadr
 -21 -22 -23
       9228  5 0 0 /
  .001 /
 293.6  600.0  900.0 1200.0 2500.0
  0 /
 heatr
 -21 -23 -25 /
       9228  7 /
 302 303 304 318 402 443 444 /
 heatr
 -21 -23 -22 24/
       9228  7 0 1 0 2/
 302 303 304 318 402 443 444 /
 purr
 -21 -25 -26
       9228  5 1 20 64 /
 293.6  600.0  900.0 1200.0 2500.0  /
 1e10 /
 0 /
 thermr
 0 -26 -27
 0         9228  16 5 1 0 1 221 1 /
 293.6  600.0  900.0 1200.0 2500.0  /
 0.001 10. /
 gaspr
 -21 -27 -28
 moder
 -28 30
 stop
EOF
cp /usr/projects/data/nuclear/mc/endf7/endf/n-092_U_235.endf tape20
cp tape20 U235.endf
bpsh $NODES ../../../njoy/njoy248/intel-9.1.037-f-O2/xnjoy<input
cp output U235.njoyoutput.pendf
cp input U235.njoyinput.pendf
```

```
cp tape30 U235.pendf
date
echo processing 92235
cat>input <<EOF
 moder
 20 -21
 moder
 30 -31
 acer
-21 -28 0 50 51
 1 0 1 .70 /
 acer tape for U -235 at        293.6  K from endf b-vii njoy99.182
   9228      293.6 /
 /
 /
 acer
 0 50 0 54 55
  7 1 1 -1 /
 acer tape for U -235 at        293.6  K from endf b-vii njoy99.182
 acer
 0 54 0 56 57
  7 1 1 -1 /
 acer tape for U -235 at        293.6  K from endf b-vii njoy99.182
 stop
EOF
bpsh $NODES ../../../njoy/njoy248/intel-9.1.037-f-O2/xnjoy<input
date
cp output U235.njoyoutput.293.acer
cp input U235.njoyinput.293.acer
mv tape54 U235.acer.293
../acs/t24 55 U235.acer.293
cp U235.acer.293 ../acer
../acs/checkace.pl U235.acer.293
if (-e xsdir.tmp) then
cp xsdir.tmp xsdir.tmp.tmp
cat xsdir.tmp.tmp xsdir.t24 > xsdir.tmp
rm xsdir.tmp.tmp xsdir.t24
else
mv xsdir.t24 xsdir.tmp
rm xsdir.t24
endif
date
echo processing 92235
cat>input <<EOF
 moder
 20 -21
 moder
 30 -31
 acer
-21 -28 0 60 61
 1 0 1 .71 /
 acer tape for U -235 at        600.0  K from endf b-vii njoy99.182
   9228      600.0 /
 /
 /
 acer
 0 60 0 64 65
```

```
  7 1 1 -1 /
 acer tape for U -235 at        600.0  K from endf b-vii njoy99.182
 acer
 0 64 0 66 67
  7 1 1 -1 /
 acer tape for U -235 at        600.0  K from endf b-vii njoy99.182
 stop
EOF
bpsh $NODES ../../../njoy/njoy248/intel-9.1.037-f-O2/xnjoy<input
date
cp output U235.njoyoutput.600.acer
cp input U235.njoyinput.600.acer
mv tape64 U235.acer.600
../acs/t24 65 U235.acer.600
cp U235.acer.600 ../acer
../acs/checkace.pl U235.acer.600
if (-e xsdir.tmp) then
cp xsdir.tmp xsdir.tmp.tmp
cat xsdir.tmp.tmp xsdir.t24 > xsdir.tmp
rm xsdir.tmp.tmp xsdir.t24
else
mv xsdir.t24 xsdir.tmp
rm xsdir.t24
endif
date
echo processing 92235
cat>input <<EOF
 moder
 20 -21
 moder
 30 -31
 acer
-21 -28 0 70 71
 1 0 1 .72 /
 acer tape for U -235 at        900.0  K from endf b-vii njoy99.182
   9228      900.0 /
 /
 /
 acer
 0 70 0 74 75
  7 1 1 -1 /
 acer tape for U -235 at        900.0  K from endf b-vii njoy99.182
 acer
 0 74 0 76 77
  7 1 1 -1 /
 acer tape for U -235 at        900.0  K from endf b-vii njoy99.182
 stop
EOF
bpsh $NODES ../../../njoy/njoy248/intel-9.1.037-f-O2/xnjoy<input
date
cp output U235.njoyoutput.900.acer
cp input U235.njoyinput.900.acer
mv tape74 U235.acer.900
../acs/t24 75 U235.acer.900
cp U235.acer.900 ../acer
../acs/checkace.pl U235.acer.900
if (-e xsdir.tmp) then
```

```
cp xsdir.tmp xsdir.tmp.tmp
cat xsdir.tmp.tmp xsdir.t24 > xsdir.tmp
rm xsdir.tmp.tmp xsdir.t24
else
mv xsdir.t24 xsdir.tmp
rm xsdir.t24
endif
date
echo processing 92235
cat>input <<EOF
 moder
 20 -21
 moder
 30 -31
 acer
-21 -28 0 80 81
 1 0 1 .73 /
 acer tape for U -235 at       1200.0  K from endf b-vii njoy99.182
   9228     1200.0 /
 /
 /
 acer
 0 80 0 84 85
  7 1 1 -1 /
 acer tape for U -235 at       1200.0  K from endf b-vii njoy99.182
 acer
 0 84 0 86 87
  7 1 1 -1 /
 acer tape for U -235 at       1200.0  K from endf b-vii njoy99.182
 stop
EOF
bpsh $NODES ../../../njoy/njoy248/intel-9.1.037-f-O2/xnjoy<input
date
cp output U235.njoyoutput.1200.acer
cp input U235.njoyinput.1200.acer
mv tape84 U235.acer.1200
../acs/t24 85 U235.acer.1200
cp U235.acer.1200 ../acer
../acs/checkace.pl U235.acer.1200
if (-e xsdir.tmp) then
cp xsdir.tmp xsdir.tmp.tmp
cat xsdir.tmp.tmp xsdir.t24 > xsdir.tmp
rm xsdir.tmp.tmp xsdir.t24
else
mv xsdir.t24 xsdir.tmp
rm xsdir.t24
endif
date
echo processing 92235
cat>input <<EOF
 moder
 20 -21
 moder
 30 -31
 acer
-21 -28 0 90 91
 1 0 1 .74 /
```

```
 acer tape for U -235 at       2500.0  K from endf b-vii njoy99.182
   9228     2500.0 /
 /
 /
 acer
 0 90 0 94 95
  7 1 1 -1 /
 acer tape for U -235 at       2500.0  K from endf b-vii njoy99.182
 acer
 0 94 0 96 97
  7 1 1 -1 /
 acer tape for U -235 at       2500.0  K from endf b-vii njoy99.182
 stop
EOF
bpsh $NODES ../../../njoy/njoy248/intel-9.1.037-f-O2/xnjoy<input
date
cp output U235.njoyoutput.2500.acer
cp input U235.njoyinput.2500.acer
mv tape94 U235.acer.2500
../acs/t24 95 U235.acer.2500
cp U235.acer.2500 ../acer
../acs/checkace.pl U235.acer.2500
if (-e xsdir.tmp) then
cp xsdir.tmp xsdir.tmp.tmp
cat xsdir.tmp.tmp xsdir.t24 > xsdir.tmp
rm xsdir.tmp.tmp xsdir.t24
else
mv xsdir.t24 xsdir.tmp
rm xsdir.t24
endif
 rm tape*
```

Appendix B. File "xslist7.vi" – list of material identifiers used by "prenjoy.f"

```
 1001  125  1 H    1
 1002  128  1 H    2
 1003  131  1 H    3
 2003  225  2 He   3
 2004  228  2 He   4
 3006  325  3 Li   6
 3007  328  3 Li   7
 4007  419  4 Be   7
 4009  425  4 Be   9
 5010  525  5 B   10
 5011  528  5 B   11
 6000  600  6 C    0
 7014  725  7 N   14
 7015  728  7 N   15
 8016  825  8 O   16
 8017  828  8 O   17
 9019  925  9 F   19
11022 1122 11 Na  22
11023 1125 11 Na  23
12024 1225 12 Mg  24
12025 1228 12 Mg  25
12026 1231 12 Mg  26
13027 1325 13 Al  27
14028 1425 14 Si  28
14029 1428 14 Si  29
14030 1431 14 Si  30
15031 1525 15 P   31
16032 1625 16 S   32
16033 1628 16 S   33
16034 1631 16 S   34
16036 1637 16 S   36
17035 1725 17 Cl  35
17037 1731 17 Cl  37
18036 1825 18 Ar  36
18038 1831 18 Ar  38
18040 1837 18 Ar  40
19039 1925 19 K   39
19040 1928 19 K   40
19041 1931 19 K   41
20040 2025 20 Ca  40
20042 2031 20 Ca  42
20043 2034 20 Ca  43
20044 2037 20 Ca  44
20046 2043 20 Ca  46
20048 2049 20 Ca  48
21045 2125 21 Sc  45
22046 2225 22 Ti  46
22047 2228 22 Ti  47
22048 2231 22 Ti  48
22049 2234 22 Ti  49
22050 2237 22 Ti  50
23000 2300 23 V    0
24050 2425 24 Cr  50
24052 2431 24 Cr  52
24053 2434 24 Cr  53
24054 2437 24 Cr  54
25055 2525 25 Mn  55
26054 2625 26 Fe  54
26056 2631 26 Fe  56
26057 2634 26 Fe  57
26058 2637 26 Fe  58
27058 2722 27 Co  58
27458 2723 27 Co  58m
27059 2725 27 Co  59
28058 2825 28 Ni  58
28059 2828 28 Ni  59
28060 2831 28 Ni  60
28061 2834 28 Ni  61
```

```
28062 2837 28 Ni 62
28064 2843 28 Ni 64
29063 2925 29 Cu 63
29065 2931 29 Cu 65
30000 3000 30 Zn  0
31069 3125 31 Ga 69
31071 3131 31 Ga 71
32070 3225 32 Ge 70
32072 3231 32 Ge 72
32073 3234 32 Ge 73
32074 3237 32 Ge 74
32076 3243 32 Ge 76
33074 3322 33 As 74
33075 3325 33 As 75
34074 3425 34 Se 74
34076 3431 34 Se 76
34077 3434 34 Se 77
34078 3437 34 Se 78
34079 3440 34 Se 79
34080 3443 34 Se 80
34082 3449 34 Se 82
35079 3525 35 Br 79
35081 3531 35 Br 81
36078 3625 36 Kr 78
36080 3631 36 Kr 80
36082 3637 36 Kr 82
36083 3640 36 Kr 83
36084 3643 36 Kr 84
36085 3646 36 Kr 85
36086 3649 36 Kr 86
37085 3725 37 Rb 85
37086 3728 37 Rb 86
37087 3731 37 Rb 87
38084 3825 38 Sr 84
38086 3831 38 Sr 86
38087 3834 38 Sr 87
38088 3837 38 Sr 88
38089 3840 38 Sr 89
38090 3843 38 Sr 90
39089 3925 39 Y  89
39090 3928 39 Y  90
39091 3931 39 Y  91
39089 3925 39 Y  89
40090 4025 40 Zr 90
40091 4028 40 Zr 91
40092 4031 40 Zr 92
40093 4034 40 Zr 93
40094 4037 40 Zr 94
40095 4040 40 Zr 95
40096 4043 40 Zr 96
41093 4125 41 Nb 93
41094 4128 41 Nb 94
41095 4131 41 Nb 95
42092 4225 42 Mo 92
42094 4231 42 Mo 94
42095 4234 42 Mo 95
42096 4237 42 Mo 96
42097 4240 42 Mo 97
42098 4243 42 Mo 98
42099 4246 42 Mo 99
42100 4249 42 Mo100
43099 4325 43 Tc 99
44096 4425 44 Ru 96
44098 4431 44 Ru 98
44099 4434 44 Ru 99
44100 4437 44 Ru100
44101 4440 44 Ru101
44102 4443 44 Ru102
44103 4446 44 Ru103
44104 4449 44 Ru104
44105 4452 44 Ru105
```

```
44106  4455  44  Ru106
45103  4525  45  Rh103
45105  4531  45  Rh105
46102  4625  46  Pd102
46104  4631  46  Pd104
46105  4634  46  Pd105
46106  4637  46  Pd106
46107  4640  46  Pd107
46108  4643  46  Pd108
46110  4649  46  Pd110
47107  4725  47  Ag107
47109  4731  47  Ag109
47510  4735  47  Ag110m
47111  4737  47  Ag111
48106  4825  48  Cd106
48108  4831  48  Cd108
48110  4837  48  Cd110
48111  4840  48  Cd111
48112  4843  48  Cd112
48113  4846  48  Cd113
48114  4849  48  Cd114
48515  4853  48  Cd115m
48116  4855  48  Cd116
49113  4925  49  In113
49115  4931  49  In115
50112  5025  50  Sn112
50113  5028  50  Sn113
50114  5031  50  Sn114
50115  5034  50  Sn115
50116  5037  50  Sn116
50117  5040  50  Sn117
50118  5043  50  Sn118
50119  5046  50  Sn119
50120  5049  50  Sn120
50122  5055  50  Sn122
50123  5058  50  Sn123
50124  5061  50  Sn124
50125  5064  50  Sn125
50126  5067  50  Sn126
51121  5125  51  Sb121
51123  5131  51  Sb123
51124  5134  51  Sb124
51125  5137  51  Sb125
51126  5140  51  Sb126
52120  5225  52  Te120
52122  5231  52  Te122
52123  5234  52  Te123
52124  5237  52  Te124
52125  5240  52  Te125
52126  5243  52  Te126
52527  5247  52  Te127m
52128  5249  52  Te128
52529  5253  52  Te129m
52130  5255  52  Te130
52132  5261  52  Te132
53127  5325  53  I 127
53129  5331  53  I 129
53130  5334  53  I 130
53131  5337  53  I 131
53135  5349  53  I 135
54123  5422  54  Xe123
54124  5425  54  Xe124
54126  5431  54  Xe126
54128  5437  54  Xe128
54129  5440  54  Xe129
54130  5443  54  Xe130
54131  5446  54  Xe131
54132  5449  54  Xe132
54133  5452  54  Xe133
54134  5455  54  Xe134
54135  5458  54  Xe135
```

```
54136  5461  54  Xe136
55133  5525  55  Cs133
55134  5528  55  Cs134
55135  5531  55  Cs135
55136  5534  55  Cs136
55137  5537  55  Cs137
56130  5625  56  Ba130
56132  5631  56  Ba132
56133  5634  56  Ba133
56134  5637  56  Ba134
56135  5640  56  Ba135
56136  5643  56  Ba136
56137  5646  56  Ba137
56138  5649  56  Ba138
56140  5655  56  Ba140
57138  5725  57  La138
57139  5728  57  La139
57140  5731  57  La140
58136  5825  58  Ce136
58138  5831  58  Ce138
58139  5834  58  Ce139
58140  5837  58  Ce140
58141  5840  58  Ce141
58142  5843  58  Ce142
58143  5846  58  Ce143
58144  5849  58  Ce144
59141  5925  59  Pr141
59142  5928  59  Pr142
59143  5931  59  Pr143
60142  6025  60  Nd142
60143  6028  60  Nd143
60144  6031  60  Nd144
60145  6034  60  Nd145
60146  6037  60  Nd146
60147  6040  60  Nd147
60148  6043  60  Nd148
60150  6049  60  Nd150
61147  6149  61  Pm147
61148  6152  61  Pm148
61548  6153  61  Pm148m
61149  6155  61  Pm149
61151  6161  61  Pm151
62144  6225  62  Sm144
62147  6234  62  Sm147
62148  6237  62  Sm148
62149  6240  62  Sm149
62150  6243  62  Sm150
62151  6246  62  Sm151
62152  6249  62  Sm152
62153  6252  62  Sm153
62154  6255  62  Sm154
63151  6325  63  Eu151
63152  6328  63  Eu152
63153  6331  63  Eu153
63154  6334  63  Eu154
63155  6337  63  Eu155
63156  6340  63  Eu156
63157  6343  63  Eu157
64152  6425  64  Gd152
64153  6428  64  Gd153
64154  6431  64  Gd154
64155  6434  64  Gd155
64156  6437  64  Gd156
64157  6440  64  Gd157
64158  6443  64  Gd158
64160  6449  64  Gd160
65159  6525  65  Tb159
65160  6528  65  Tb160
66156  6625  66  Dy156
66158  6631  66  Dy158
66160  6637  66  Dy160
```

```
66161 6640 66 Dy161
66162 6643 66 Dy162
66163 6646 66 Dy163
66164 6649 66 Dy164
67165 6725 67 Ho165
67566 6729 67 Ho166m
68162 6825 68 Er162
68164 6831 68 Er164
68166 6837 68 Er166
68167 6840 68 Er167
68168 6843 68 Er168
68170 6849 68 Er170
71175 7125 71 Lu175
71176 7128 71 Lu176
72174 7225 72 Hf174
72176 7231 72 Hf176
72177 7234 72 Hf177
72178 7237 72 Hf178
72179 7240 72 Hf179
72180 7243 72 Hf180
73181 7328 73 Ta181
73182 7331 73 Ta182
74182 7431 74 W 182
74183 7434 74 W 183
74184 7437 74 W 184
74186 7443 74 W 186
75185 7525 75 Re185
75187 7531 75 Re187
77191 7725 77 Ir191
77193 7731 77 Ir193
79197 7925 79 Au197
80196 8025 80 Hg196
80198 8031 80 Hg198
80199 8034 80 Hg199
80200 8037 80 Hg200
80201 8040 80 Hg201
80202 8043 80 Hg202
80204 8049 80 Hg204
82204 8225 82 Pb204
82206 8231 82 Pb206
82207 8234 82 Pb207
82208 8237 82 Pb208
83209 8325 83 Bi209
88223 8825 88 Ra223
88224 8828 88 Ra224
88225 8831 88 Ra225
88226 8834 88 Ra226
89225 8925 89 Ac225
89226 8928 89 Ac226
89227 8931 89 Ac227
90227 9025 90 Th227
90228 9028 90 Th228
90229 9031 90 Th229
90230 9034 90 Th230
90232 9040 90 Th232
90233 9043 90 Th233
90234 9046 90 Th234
91231 9131 91 Pa231
91232 9134 91 Pa232
91233 9137 91 Pa233
92232 9219 92 U 232
92233 9222 92 U 233
92234 9225 92 U 234
92235 9228 92 U 235
92236 9231 92 U 236
92237 9234 92 U 237
92238 9237 92 U 238
92239 9240 92 U 239
92240 9243 92 U 240
92241 9246 92 U 241
93235 9340 93 Np235
```

```
93236 9343 93 Np236
93237 9346 93 Np237
93238 9349 93 Np238
93239 9352 93 Np239
94236 9428 94 Pu236
94237 9431 94 Pu237
94238 9434 94 Pu238
94239 9437 94 Pu239
94240 9440 94 Pu240
94241 9443 94 Pu241
94242 9446 94 Pu242
94243 9449 94 Pu243
94244 9452 94 Pu244
94246 9458 94 Pu246
95241 9543 95 Am241
95642 9546 95 Am242
95242 9547 95 Am242m
95243 9549 95 Am243
95244 9552 95 Am244
95644 9553 95 Am244m
96241 9628 96 Cm241
96242 9631 96 Cm242
96243 9634 96 Cm243
96244 9637 96 Cm244
96245 9640 96 Cm245
96246 9643 96 Cm246
96247 9646 96 Cm247
96248 9649 96 Cm248
96249 9652 96 Cm249
96250 9655 96 Cm250
97249 9752 97 Bk249
97250 9755 97 Bk250
98249 9852 98 Cf249
98250 9855 98 Cf250
98251 9858 98 Cf251
98252 9861 98 Cf252
98253 9864 98 Cf253
98254 9867 98 Cf254
99253 9913 99 Es253
99254 9914 99 Es254
99255 9915 99 Es255
00255 9936100 Fm255
```

Appendix C. Checking script "checkace.pl"

```perl
#! /usr/bin/perl

# checkace.pl
#
# Runs a series of checking codes on an ACE file.

##########################################################################

##########################################################################

use File::Copy;
use FindBin qw($Bin);            # find absolute path

#
# Usage:  perl checkace.pl
#
# Output:


# Main script starts here

my $infile;
my $outfile1;
my $outfile2;
my $tolerance = 0.001;

# Currently this is the only whale input file (whin) which can be used
#   TODO:  change script to be able to user user-specified whin
my $whin_body = <<EOF;          #print everything from here down to EOF
-1.0e-4 1.0e6 1.0e-5           ! low sigma, high sigma, repeat tolerance
34 500                          ! 34 groups  100 MTs
1.390E-04       1.520E-01       4.140E-01       1.130E+00       3.060E+00       8.320E+00
2.260E+01       6.140E+01       1.670E+02       4.540E+02       1.235E+03       3.350E+03
9.120E+03       2.480E+04       6.760E+04       1.840E+05       3.030E+05       5.000E+05
8.230E+05       1.353E+06       1.738E+06       2.232E+06       2.865E+06       3.680E+06
6.070E+06       7.790E+06       1.000E+07       1.200E+07       1.350E+07       1.500E+07
1.700E+07       2.000E+07       2.500E+07       3.000E+07       3.500E+07
48                                ! 48 energy-flux pairs
1.3900E-04 3.0190E+06   5.00E-04 1.0700E+07   1.00E-03  2.0980E+07
5.00E-03 8.9390E+07     1.00E-02 1.4638E+08   2.50E-02  2.0080E+08
4.00E-02 1.7635E+08     5.00E-02 1.4780E+08   1.00E-01  4.00E+07
1.40E-01 1.1300E+07     1.50E-01 7.60E+06     4.1400E-01  2.7900E+06
1.1300E+00 1.0200E+06   3.0600E+00 3.7700E+05     8.3200E+00 1.3900E+05
2.2600E+01 5.1100E+04   6.1400E+01 1.8800E+04     1.6700E+02 6.9100E+03
4.5400E+02 2.5400E+03   1.2350E+03 9.3500E+02     3.3500E+03 3.4500E+02
9.1200E+03 1.2660E+02   2.4800E+04 4.6500E+01     6.7600E+04 1.7100E+01
1.8400E+05 6.2700E+00   3.0300E+05 3.8800E+00     5.00E+05 3.60E+00
8.2300E+05 2.8700E+00   1.3530E+06 1.7500E+00     1.7380E+06 1.1300E+00
2.2320E+06 7.30E-01     2.8650E+06 4.00E-01  3.6800E+06 2.0500E-01
6.0700E+06 3.90E-02     7.7900E+06 1.6300E-02     1.00E+07 6.50E-03
1.20E+07 7.60E-03       1.30E+07 1.2300E-02   1.3500E+07 2.6400E-02
1.40E+07 1.1400E-01     1.4100E+07 1.1400E-01     1.4200E+07 1.0100E-01
1.4300E+07 6.50E-02     1.4600E+07 1.4900E-02     1.50E+07 4.00E-03
1.60E+07 1.5400E-03     1.70E+07 8.50E-04     4.00E+07 8.50E-04

EOF



foreach $acefile (@ARGV) {

    print "\nPROCESSING FILE $acefile.\n";

    # CHECKND
      print "*   RUNNING CHECKND........\n";
      $outfile1 = $acefile . ".cnd";
```

28

```perl
         system("$Bin/checknd $acefile $outfile1");
        &check_cnd($outfile1);

     #CHECKND_NEUT
         print "*   RUNNING CHECKND_NEUT........\n";
         $outfile1 = $acefile . ".cnd_n";
         $outfile2 = $acefile . ".new";
         system("$Bin/checknd_neut $acefile $outfile1 $outfile2");
         &check_cnd_n($outfile1);

     #CHECK_HEAT
         print "*   RUNNING CHECK_HEAT........\n";
         $outfile1 = $acefile . ".cht";
         system("$Bin/check_heat $acefile $outfile1");
         &check_cht($outfile1);

     #CHECK_ISO
         print "*   RUNNING CHECK_ISO........\n";
         $outfile1 = $acefile . ".ciso";
         system("$Bin/check_iso $acefile $outfile1");
         &check_ciso($outfile1);

     #CHECKTHRESH
         print "*   RUNNING CHECKTHRESH........\n";
         $outfile1 = $acefile . ".cthr";
         system("$Bin/checkthresh $acefile $outfile1");
         &check_cthr($outfile1);

     #CHECK0
         print "*   RUNNING CHECK0........\n";
         $outfile1 = $acefile . ".c0";
         $outfile2 = $acefile . ".new3";
         system("$Bin/check0 $acefile $outfile1 $outfile2");
         &check_c0($outfile1);

     #CHECK5
         print "*   RUNNING CHECK5........\n";
         $outfile1 = $acefile . ".c5";
         system("$Bin/check5 $acefile $outfile1");
         &check_c5($outfile1);

     #CHECK61
         print "*   RUNNING CHECK61........\n";
         $outfile1 = $acefile . ".c61";
         $outfile2 = $acefile . ".new2";
         system("$Bin/check61 $acefile $outfile1 $outfile2");
         &check_c61($outfile1);

     #CHECKXS
         print "*   RUNNING CHECKXS........\n";
         $outfile1 = $acefile . ".cxs";
         system("$Bin/checkxs $acefile $outfile1 $tolerance");
         &check_xs($outfile1);

     #CHECK_URES
         print "*   RUNNING CHECK_URES........\n";
         $outfile1 = $acefile . ".cures";
#        copy( $acefile, "tape1" );
         system("$Bin/check_ures $acefile $outfile1");
         &check_cures($outfile1);
#        copy( "tape3", $outfile1 );
#        system("rm tape1 tape3");

#        checklownum
   my $line_count = 0;

     print "\nCHECKING FILE $acefile for low numbers.\n";
     open ( INFILE, $acefile );
     $line = <INFILE>;
     @words = split " ", $line, 2;
     while (<INFILE>) {
```

29

```perl
      $line_count++;
      chomp;
      if ( ( /[0-9]\.[0-9]+(E|e)\-([3-9][0-9]+)/ ) ||
           ( /[0-9]\.[0-9]+(E|e)\-([0-9][0-9][0-9]+)/ ) ) {
        print "Line $line_count: $_\n";
      }
    }
  }
  close( INFILE );
  print "DONE CHECKING FILE $acefile.\n\n";

# WHALE
#     $whalenum  = 1;
#     $whalefile = substr ($acefile, 0, index($acefile, "_"));
##     WARNING: erasing current whin
#     open ( WHIN, ">whin" );
#     print "*   RUNNING WHALE........\n";
#     print WHIN "$whalenum \'$whalefile\'   2 \'$acefile\'        ! 1 is ENDF, 2 is ACE   0 is
ignore\n";
#     print WHIN "\'$acefile.wout\'   \'$acefile.cmp\'  \!general output, compare output\n";
#     print WHIN "$tolerance                 ! tolerance for comparing data files 1.0 = 100%
rel. diff.\n";
#     print WHIN $whin_body;
#     close WHIN;
#     system("whale");
#
#   set up MCNP input file for Ho-Ho test
     print "*   Setting up MCNP input file........\n";
     $iso[0] = $words[0];
     for ($i = 0; $i < 4; $i++) {
       $iso[i+1] = chop($iso[i]);
     }
     $mcnpfile = $iso[i-2] . h1;
     if (-e $mcnpfile) {
       $mcnpfile = $iso[i-2] . h2;
     }
     if (-e $mcnpfile) {
       $mcnpfile = $iso[i-2] . h3;
     }
     if (-e $mcnpfile) {
       $mcnpfile = $iso[i-2] . h4;
     }
     if (-e $mcnpfile) {
       $mcnpfile = $iso[i-2] . h5;
     }
     open ( MCIN, ">$mcnpfile" );
     print MCIN "test of ENDF/B-VII data   \n";
     print MCIN "1  1  .1  -1 \n";
     print MCIN "2  0       1 \n";
     print MCIN " \n";
     print MCIN "1  so 1 \n";
     print MCIN " \n";
     print MCIN "mode n p \n";
     print MCIN "sdef erg=14.0 \n";
     print MCIN "m1  $words[0] \n";
     print MCIN "imp:n 1 0 \n";
     close MCIN;

   print "\n";
  }

sub check_cnd
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile );

    while (<OUTFILE>) {
        if ( /^error/ ) {
            # Negative pdf
            $nextline = <OUTFILE>;
            print "ERROR found in cnd--\n   $_$nextline";
```

```perl
        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}    nxs\(1\)=/ ) {
            # NXS(1) > 2500000
#           print "Length of data block (nxs(1)) is too large.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  law=[ 0-9]{5}$/ ) {
            #Do nothing--normal law 4 or 44
#           print "1\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  lnw=[ 0-9]{8}$/ ) {
            #Do nothing--normal law 4 or 44
#           print "2\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  ne=[ 0-9]{5}$/ ) {
            # ne > 200
            print "Number of energies (ne) is too large.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} einc=[ eE\+\-\.0-9]{1,20}  all discrete[
0-9\-]{5}$/ ) {
            #Do nothing--all discrete
#           print "3\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  ein=[ eE\+\-\.0-9]{20}  eprime=[ eE\+\-
\.0-9]{20}$/ ) {
            # eprime < 0
             print "eprime <= 0.\n";

        } elsif ( /^                    at first energy, nd=[ 0-9\-]{5}$/ ) {
             #Do nothing--there are discrete photon lines  ( j==1 (1st energy?), nd(j) != 0 )
#           print "4\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  [ eE\+\-\.0-9]{20}  [ \-0-9]{3}  [ eE\+\-
\.0-9]{20}  [ \-0-9]{3}$/ ) {
            # nd(j+1) != nd(j)
            print "Unequal number of discrete photons at adjacent energies.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} ein\(1\)=[ eE\+\-\.0-9]{20} edisc=[ eE\+\-
\.0-9]{20} ein\(2\)=[ eE\+\-\.0-9]{20} edisc=[ eE\+\-\.0-9]{20}$/ ) {
            # e1 at e(j) != e2 at e(j+1)
            print "e1 != e2.\n";
        } else {
            print "UNKNOWN message: $_\n";
        }

    }
    close OUTFILE;

}


sub check_cnd_n
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile ) | "Unable to open file $outfile.\n";

    while (<OUTFILE>) {
        if ( /^error/ ) {
            # Negative pdf
            $nextline = <OUTFILE>;
            print "ERROR found in cnd_n--\n  $_$nextline";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}    nxs\(1\)=/ ) {
            # NXS(1) > 2500000
            print "Length of data block (nxs(1)) is too large.\n";

        } elsif ( /Secondary energies are in the (\w{2,3}) frame/ ) {
            #Energy > Emax
            $nextline = <OUTFILE>;
            chomp;
```

```perl
            chomp $nextline;
            print "ERROR found in cnd_n--\n  $nextline ($1 frame)";

        } elsif ( /^            skipping correction - fissionable - nxs\(2\)=[ 0-9]{7}$/ ) {
            #For last energy > emax, the isotope is fissionable (i.e. nxs(2)>90000)
            print " (Fis.-UNCHANGED)\n";

        } elsif ( /^      changing energy from[ eE\+\-\.0-9]{20} to[ eE\+\-\.0-9]{20}$/ ) {
            #For last energy > emax, the isotope is not fissionable
            print " (Not fis.-CHANGED)\n";

        } elsif ( /^            bad news - another eprime needs to be changed$/ ) {
            #For last energy > emax, the isotope is not fissionable
            $nextline = <OUTFILE>;
            print "Another bad eprime value -- library has been changed\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  law=[ 0-9\-]{5}$/ ) {
            #Do nothing--normal law 4 or 44
#            print "1\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  lnw=[ 0-9]{8}$/ ) {
            #Do nothing--normal law 4 or 44
#            print "2\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  ne=[ 0-9]{5}$/ ) {
            # ne > 200
            print "Number of energies (ne) is too large.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} einc=[ eE\+\-\.0-9]{20} iint=[ 0-9]{5}$/ )
{
            # iint != 1 and iint !=2
            print "Bad interpolation scheme.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} einc=[ eE\+\-\.0-9]{20} nsec\>1000[ 0-
9]{6}$/ ) {
            # nsec > 1000
            print "Checknd_neut stopped because nsec > 1000.\n";

        } elsif ( /^         renorming distribution$/ ) {
            # Do nothing -- eprimes were changed so the distribution was renormalized
#            print "2a\n";

        } elsif ( /^          renorm factor=[ eE\+\-\.0-9]{14}$/ ) {
            # Do nothing -- eprimes were changed so the distribution was renormalized
#            print "2b\n";

        } elsif ( /^[ 0-9\-]{5} replacing[ eE\+\-\.0-9]{14} with[ eE\+\-\.0-9]{14}$/ ) {
            # Do nothing -- renorming info
#            print "2c\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} einc=[ eE\+\-\.0-9]{20}  all discrete[ 0-
9\-]{5}$/ ) {
            #Do nothing--all discrete
#            print "3\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  ein=[ eE\+\-\.0-9]{20}  eprime=[ eE\+\-
\.0-9]{20}$/ ) {
            # eprime < 0
             print "eprime <= 0.\n";

        } elsif ( /^                  at first energy, nd=[ 0-9\-]{5}$/ ) {
            #Do nothing--there are discrete photon lines  ( j==1 (1st energy?), nd(j) != 0 )
            print "4\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  [ eE\+\-\.0-9]{20}  [ \-0-9]{3}  [ eE\+\-
\.0-9]{20}  [ \-0-9]{3}$/ ) {
            # nd(j+1) != nd(j)
            print "Unequal number of discrete photons at adjacent energies.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} ein\(1\)=[ eE\+\-\.0-9]{20} edisc=[ eE\+\-
\.0-9]{20} ein\(2\)=[ eE\+\-\.0-9]{20} edisc=[ eE\+\-\.0-9]{20}$/ ) {
```

```perl
                # e1 at e(j) != e2 at e(j+1)
                print "e1 != e2.\n";
        } elsif ( /^warning:/ ) {
             $nextline = <OUTFILE>;
             $nextline = <OUTFILE>;
        } else {
            print "UNKNOWN message: $_ \n";
        }

    }
    close OUTFILE;

}


sub check_cthr
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile );

    $mult_flag = 0;
    while (<OUTFILE>) {
        if ( /^          biggest change=([ eE\.0-9\+\-]{12})$/ ) {
            # Report on the biggest change -- do nothing
#           print "0:  $1\n";
            if ( $1 != 0.0 ) {
                if ($mult_flag == 1) {
                    print "CHECKTHRESH error: MULTIPLE energies found below threshold. (biggest
change: $1)\n"
                } else {
                    print "CHECKTHRESH error: Energies found below threshold. (biggest change:
$1)\n";
                }
            }
            $mult_flag = 0;

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}     nxs\(1\)=/ ) {
            # NXS(1) > 2500000
            print "Length of data block (nxs(1)) is too large.\n";

        } elsif ( /^          big trouble \-\- next energy in grid =[ eE\.0-9\+\-]{20}$/ ) {
            # Next energy is below threshold too
            #  Write this out???? -- the error's already been flagged
#           print "Multiple energies found below threshold.\n";
            $mult_flag = 1;

        } elsif  ( /^[ a-zA-Z\.0-9\+\-]{10} mt=[ 0-9]{3} q=[ \.0-9\+\-]{9} egiven=[ eE\.0-9\+\-
]{20} should be [ eE\.0-9\+\-]{20} diff=[ eE\.0-9\+\-]{8} law=[ 0-9]{2} line=[ 0-9]{7}$/ ) {
            # eact < emin
#           print "2   $1\n";

        } else {
            print "UNKNOWN message: $_\n";
        }
    }
    close OUTFILE;

 }

sub check_c0
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile );

    while (<OUTFILE>) {
        if ( /trouble -- [ a-zA-Z\.0-9\+\-]{50} / ) {
             # CHECK0 error found
             print "ERROR found in CHECK0--\n  $_ \n";
```

```perl
            }
            elsif (/^zaid/) {
            }
            else {
                print "UNKNOWN message: $_\n";
            }
        }
    }
    close OUTFILE;

}

sub check_c5
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile );

    while (<OUTFILE>) {
        if ( /^[ a-zA-Z\.0-9\+\-]{10}  MT= [ \-0-9]{5} xs thresh=[ eE\+\-\.0-9]{20} first
energy=[ eE\+\-\.0-9]{20} first mult=[ eE\+\-\.0-9]{20}$/ ) {
            # CHECK5 error found
            print "CHECK5 error found.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}     nxs\(1\)=/ ) {
            # NXS(1) > 2500000
            print "Length of data block (nxs(1)) is too large.\n";

        } else {
            print "UNKNOWN message: $_\n";
        }
    }
    close OUTFILE;

}


sub check_c61
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile );

    while (<OUTFILE>) {
        if ( /^[ a-zA-Z\.0-9\+\-]{10}  MT= [ \-0-9]{5} xs thresh=[ eE\+\-\.0-9]{20} first
energy=[ eE\+\-\.0-9]{20} first mult=[ eE\+\-\.0-9]{20}$/ ) {
            # CHECK5 error found
            print "CHECK5 error found.\n";



        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}     nxs\(1\)=/ ) {
            # NXS(1) > 2500000
            print "Length of data block (nxs(1)) is too large.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  ne=[ 0-9]{5}$/ ) {
            # ne > 200
            print "Number of energies (ne) is too large.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} einc=[ eE\+\-\.0-9]{20} iint=[ 0-9]{5}$/ )
{
            # iint != 1 and iint !=2
            print "Bad interpolation scheme.\n";

        } elsif ( /^error:[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} einc=[ eE\+\-\.0-9]{20} negative
pdf$/ ) {
            # Negative pdf
            $nextline = <OUTFILE>;
            print "Neg. pdf found in check61.\n";

# line 122 eprimemax < einc
        } elsif ( /^            skipping correction - fissionable - nxs\(2\)=[ 0-9]{7}$/ ) {
```

```perl
            #For last energy > emax, the isotope is fissionable (i.e. nxs(2)>90000)
            print " (Fis.-UNCHANGED)\n";

        } elsif ( /^      changing energy from[ eE\+\-\.0-9]{20} to[ eE\+\-\.0-9]{20}$/ ) {
            #For last energy > emax, the isotope is not fissionable
            print " (Not fis.-CHANGED)\n";

        } elsif ( /^            bad news - another eprime needs to be changed$/ ) {
            #For last energy > emax, the isotope is not fissionable
            $nextline = <OUTFILE>;
            print "Another bad eprime value -- library has been changed\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} einc=[ eE\+\-\.0-9]{20} nsec\>1000[ 0-
9]{6}$/ ) {
            # nsec > 1000
            print "Checknd_neut stopped because nsec > 1000.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  ein=[ eE\+\-\.0-9]{20}  eprime=[ eE\+\-
\.0-9]{20}$/ ) {
            # eprime < 0
             print "eprime <= 0.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} ein\(1\)=[ eE\+\-\.0-9]{20} edisc=[ eE\+\-
\.0-9]{20} ein\(2\)=[ eE\+\-\.0-9]{20} edisc=[ eE\+\-\.0-9]{20}$/ ) {
            # e1 at e(j) != e2 at e(j+1)
            print "e1 != e2.\n";

        } elsif ( /^          renorming distribution$/ ) {
            # Do nothing -- eprimes were changed so the distribution was renormalized
#           print "2a\n";

        } elsif ( /^           renorm factor=[ eE\+\-\.0-9]{14}$/ ) {
            # Do nothing -- eprimes were changed so the distribution was renormalized
#           print "2b\n";

        } elsif ( /^[ 0-9\-]{5} replacing[ eE\+\-\.0-9]{14} with[ eE\+\-\.0-9]{14}$/ ) {
            # Do nothing -- renorming info
#           print "2c\n";


        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  law=[ 0-9\-]{5}$/ ) {
            #Do nothing--normal law 61
#           print "1\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10} einc=[ eE\+\-\.0-9]{20}  all discrete[ 0-
9\-]{5}$/ ) {
            #Do nothing--all discrete
#           print "3\n";

        } elsif ( /^                   at first energy, nd=[ 0-9\-]{5}$/ ) {
             #Do nothing--there are discrete photon lines  ( j==1 (1st energy?), nd(j) != 0 )
#           print "4\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  [ eE\+\-\.0-9]{20}  [ \-0-9]{3}  [ eE\+\-
\.0-9]{20}  [ \-0-9]{3}$/ ) {
            # nd(j+1) != nd(j)
            print "Unequal number of discrete photons at adjacent energies.\n";

        } elsif ( /^[ a-zA-Z\.0-9\+\-]{10}[ 0-9\-]{10}  lnw=[ 0-9]{8}$/ ) {
            #Do nothing--normal law 4 or 44
#           print "2\n";

        } else {
            print "UNKNOWN message: $_\n";
        }
    }
    close OUTFILE;

 }

sub check_cht
```

```perl
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile );

    $blank_line = <OUTFILE>;
    $iflag = 0;
    while (<OUTFILE>) {


        if ( /^[ a-zA-Z\.0-9\+\-]{10}     nxs\(1\)=/ ) {
            # NXS(1) > 2500000
            print "Length of data block (nxs(1)) is too large.\n";
        }
        elsif ( /^[ a-zA-Z\.0-9\+\-]{10}     nxs\(3\)=/ ) {
            # NXS(3) > 250000
            print "Length of data block (nxs(3)) is too large.\n";
        }
        elsif (/^\s*[0-9]{5}.[0-9]{2}c numzero =     0 numneg=    0/) {
            # not a CHECKHT error
        }
        elsif (/^\s*[0-9]{4}.[0-9]{2}c numzero =     0 numneg=    0/) {
            # not a CHECKHT error
        }
        elsif (/^\s*[0-9]{5}.[0-9]{2}c numzero =/) {
            print "ERROR found in CHECKHT numzero/negs \n $_ ";
            # CHECKHT error found
        }
        elsif (/^\s*[0-9]{4}.[0-9]{2}c numzero =/) {
            print "ERROR found in CHECKHT numzero/negs \n $_ ";
            # CHECKHT error found
        }
        elsif ( /^\s*ipt=[ 0-9]{3} numzero =     0 numneg=    0/ ) {
            # not a CHECKHT error
        }
        elsif ( /^\s*ipt=[ 0-9]{3} numzero=[ 0-9]{5}/ ) {
            # CHECKHT error found
            print "ERROR found in CHECKHT ipt --\n  $_ ";
        }
        elsif (/^\s*num comp=/ ) {
            # CHECKHT error found
            print "ERROR found in CHECKHT total --\n  $_ ";
        }
        elsif (/^\s*no partial heating/) {
            # not a CHECKHT error
        }
        elsif (/^ $/) {
            # not a CHECKHT error
        }
        else {
            print "UNKNOWN message: $_\n";
        }
    }
    close OUTFILE;

}

sub check_ciso
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile );

    while (<OUTFILE>) {
        if (/^\s*[0-9]{5}.[0-9]{2}c mt=   18/) {
            # not a CHECKISO error
        }
        elsif (/^\s*for reaction/) {
            # not a CHECKISO error
        }
      # CHECK_ISO message found
```

```perl
        else {
            print "UNKNOWN CHECKISO ERROR -- $_ \n";
        }
    }
    close OUTFILE;

}

sub check_xs
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile );

    while (<OUTFILE>) {
      if (/^\s*[0-9]{5}.[0-9]{2}c/) {
       # not a CHECKXS error
      }
      elsif (/^\s*[0-9]{4}.[0-9]{2}c/) {
       # not a CHECKXS error
      }
      elsif (/^\s*END OF PROCESSING ZAID/) {
       # not a CHECKXS error
      }
      elsif (/^\s*No Photon Production data for this ZAID/) {
       # not a CHECKXS error
      }
      elsif (/^\s*Index      Energy/) {
       # not a CHECKXS error
      }
      elsif (/^\s*Checking/) {
       # not a CHECKXS error
      }
      elsif (/^$/) {
       # not a CHECKHT error
      }
      else {
       # CHECK_XS message found
         print "ERROR found in CHECK_XS--\n  $_   ";
      }
    }
    close OUTFILE;

}

sub check_cures
{
    my ($outfile) = @_;

    open( OUTFILE, $outfile );

    $blank_line = <OUTFILE>;
    while (<OUTFILE>) {

        if ( /^[ a-zA-Z\.0-9\+\-]{10}     nxs\(1\)=/ ) {
            # NXS(1) > 2500000
            print "Length of data block (nxs(1)) is too large.\n";
        }
        elsif ( /^\s*fatal --/ ) {
            # CHECK_CURES error found
            print "ERROR found in CHECK_CURES--\n  $_ ";
        }
        elsif (/^\s*possible problem/) {
            # CHECK_CURES error found
            print "ERROR found in CHECK_CURES with the energy grid.\n";
        }
        elsif ( /^\s*warning: at i=/ ) {
            # CHECK_CURES error found
            print "ERROR found in CHECK_CURES--\n  $_ ";
            print "The infinite total does not equal the sum of infinite partials with 1 part in
a million tolerance \n";
```

```perl
	}
	elsif ( /^\s*bad --/ ) {
	    # CHECK_CURES error found
	    print "ERROR found in CHECK_CURES--\n  $_ ";
	}
	elsif (/^\s*looks like non-physical heating value/) {
	    # CHECK_CURES error found
	    print "ERROR found in CHECK_CURES in that a heating value looks too big.\n";
	}
	elsif ( /^\s*row sum,tot disagree/ ) {
	    # CHECK_CURES error found
	    print "ERROR found in CHECK_CURES--\n  $_ ";
	}
	elsif ( /^\s*capture:/ |  /^\s*elastic:/ |  /^\s*fission:/ |  /^\s*sum:/ |  /^\s*heat:/
) {
	    # CHECK_CURES error found
	    print "ERROR found in CHECK_CURES--\n  $_ ";
	    print "pt averages don't equal infinitely dilute values (within a tolerance of 1e-4)
\n";
	}
    }
    close OUTFILE;

 }
```

Appendix D. Evaluation Changes

Evaluations were modified for the following isotopes: ^{1}H, ^{45}Sc, ^{89}Y, ^{96}Zr, ^{97}Mo, ^{242m}Am, and ^{242}Am (ground state).

H1: A new value for the energy of the photon from radiative capture was modified from 2.2233 MeV from 2.2246. The new value is the actual energy of the photon from thermal capture. The previous evaluations gave the total energy and did not take into account the recoil of the nucleus (hence impacting heating as well). This was found in ENDF66 and did not get changed in ENDF/B-VII.

```
Line 399

0.000000+0 2.224631+6          0        2        1        2 125 6102    2


Became:
0.000000+0 2.223300+6          0        2        1        2 125 6102    2
```

Sc45: In ENDF66, it was found that this evaluation had to be modified because File 13, MT=3 did not have the secondary distribution for photons beginning with a zero point at the threshold. Additionally, the evaluation had the incorrect reference frame specified for angular distributions of (n,2n) and (n,n*)a, (n,n*)p, and (n,n*)c as found by CONSIS/ACER. Both of these problems still existed in the ENDF/B-VII evaluation, so the following changes were made:

```
Reaction 16 Line 802
0.000000+0 4.456790+1          1        2        0        02125 4 16    1

Was changed to:
0.000000+0 4.456790+1          1        1        0        02125 4 16    1

Reaction 22 Line 805
0.000000+0 4.456790+1          1        2        0        02125 4 22    1

Was changed to:
0.000000+0 4.456790+1          1        1        0        02125 4 22    1

Reaction 28 Line 808
0.000000+0 0.000000+0          1        2        0        02125 4 28    1

Was changed to:
0.000000+0 0.000000+0          1        1        0        02125 4 28    1

Reaction 91 Line 853
0.000000+0 4.456790+1          1        2        0        02125 4 91

Was changed to:
0.000000+0 4.456790+1          1        1        0        02125 4 91    1


Reaction MT13   MF 3 (lines 2975 to 2982)

0.000000+0 0.000000+0          0        1        1        17212513  3    2
        17          2                                       212513  3    3
1.000000+6 9.117200-1 2.000000+6 2.750500+0 3.000000+6 3.343000+0212513  3    4
3.500000+6 3.320100+0 4.000000+6 3.295200+0 5.000000+6 3.146800+0212513  3    5
6.000000+6 3.185700+0 8.000000+6 3.675400+0 1.000000+7 4.289900+0212513  3    6
1.100000+7 4.376100+0 1.200000+7 4.165900+0 1.300000+7 3.943300+0212513  3    7
1.400000+7 3.733600+0 1.500000+7 3.444500+0 1.600000+7 3.409100+0212513  3    8
1.800000+7 3.450100+0 2.000000+7 3.299400+0                 212513  3    9
```

Was changed to:

```
0.000000+0 0.000000+0          0          1          1       18212513  3    2
        18          2                                         212513  3    3
9.999990+5 0.000000+0 1.000001+6 9.117200-1 2.000000+6 2.750500+0212513  3    4
3.000000+6 3.343000+0 3.500000+6 3.320100+0 4.000000+6 3.295200+0212513  3    5
5.000000+6 3.146800+0 6.000000+6 3.185700+0 8.000000+6 3.675400+0212513  3    6
1.000000+7 4.289900+0 1.100000+7 4.376100+0 1.200000+7 4.165900+0212513  3    7
1.300000+7 3.943300+0 1.400000+7 3.733600+0 1.500000+7 3.444500+0212513  3    8
1.600000+7 3.409100+0 1.800000+7 3.450100+0 2.000000+7 3.299400+0212513  3    9
```

Y89: Reaction 91 was changed from 35 lines with numerous negative cross sections to only 14 lines with values that were the difference of MT 4 and all MT 51-90 reactions (I summed this on a spreadsheet)

Previous Lines 1956 to 1989

```
0.000000+0-9.788940+5          0          0          1        943925  3 91    1
        94          2                                         3925  3 91    2
9.900000+5 0.000000+0 1.000000+6 5.474100-3 1.100000+6 7.030000-53925  3 91    3
1.200000+6 1.040000-4 1.500000+6 1.053600-2 1.524360+6 4.168522-23925  3 91    4
1.700000+6-1.278960-1 1.764360+6-6.510780-2 2.000000+6-2.126790-13925  3 91    5
2.200000+6-2.527910-1 2.247600+6-2.298065-1 2.500000+6-2.568390-13925  3 91    6
2.558570+6-2.268702-1 2.595355+6-2.172159-1 2.595360+6-2.172148-13925  3 91    7
2.651788+6-2.026715-1 2.651790+6-2.026712-1 2.904380+6-1.663576-13925  3 91    8
2.913888+6-1.678272-1 2.913890+6-1.678286-1 2.927540+6-1.765479-13925  3 91    9
3.000000+6-2.282748-1 3.102400+6-1.879899-1 3.142310+6-1.913324-13925  3 91   10
3.174510+6-2.086664-1 3.200000+6-2.355770-1 3.284340+6-2.257808-13925  3 91   11
3.381008+6-2.229665-1 3.381010+6-2.229665-1 3.449190+6-2.242318-13925  3 91   12
3.490355+6-2.338753-1 3.490360+6-2.338775-1 3.500000+6-2.379197-13925  3 91   13
3.543350+6-2.088434-1 3.555485+6-2.029732-1 3.555490+6-2.029722-13925  3 91   14
3.597456+6-1.912481-1 3.597460+6-1.912480-1 3.600389+6-1.913103-13925  3 91   15
3.600390+6-1.913104-1 3.662080+6-1.977303-1 3.671487+6-2.006924-13925  3 91   16
3.671490+6-2.006934-1 3.700000+6-2.106652-1 3.757450+6-1.779832-13925  3 91   17
3.790219+6-1.645979-1 3.790220+6-1.645976-1 3.795275+6-1.620672-13925  3 91   18
3.795280+6-1.620653-1 3.891758+6-1.329360-1 3.891760+6-1.329358-13925  3 91   19
3.906119+6-1.301399-1 3.906120+6-1.301398-1 3.968519+6-1.328377-13925  3 91   20
3.968520+6-1.328379-1 4.000000+6-1.389370-1 4.022019+6-1.171123-13925  3 91   21
4.022020+6-1.171114-1 4.036886+6-1.033714-1 4.036890+6-1.033681-13925  3 91   22
4.060850+6-8.353687-2 4.068440+6-7.711653-2 4.500000+6 2.379666-13925  3 91   23
5.000000+6 7.981554-1 5.500000+6 1.221206+0 6.000000+6 1.432097+03925  3 91   24
6.500000+6 1.553025+0 7.000000+6 1.620094+0 7.500000+6 1.657880+03925  3 91   25
8.000000+6 1.680306+0 8.500000+6 1.691661+0 9.000000+6 1.694888+03925  3 91   26
9.500000+6 1.692033+0 1.000000+7 1.685082+0 1.050000+7 1.668128+03925  3 91   27
1.100000+7 1.643995+0 1.150000+7 1.612189+0 1.200000+7 1.489110+03925  3 91   28
1.250000+7 1.271664+0 1.300000+7 1.048079+0 1.350000+7 8.560107-13925  3 91   29
1.400000+7 6.996135-1 1.450000+7 5.637885-1 1.500000+7 4.580743-13925  3 91   30
1.550000+7 3.779990-1 1.600000+7 3.196506-1 1.650000+7 2.776628-13925  3 91   31
1.700000+7 2.445734-1 1.750000+7 2.187781-1 1.800000+7 1.969604-13925  3 91   32
1.850000+7 1.802930-1 1.900000+7 1.660907-1 1.950000+7 1.530276-13925  3 91   33
2.000000+7 1.424113-1                                         3925  3 91   34
```

Became 1956 to 1968:

```
0.000000+0-9.788940+5          0          0          1        333925  3 91    1
        33          2                                         3925  3 91    2
4.068440+6 0.000000+0 4.500000+6 2.379666-1 5.000000+6 7.981554-13925  3 91    3
5.500000+6 1.221206+0 6.000000+6 1.432097+0 6.500000+6 1.553025+03925  3 91    4
7.000000+6 1.620094+0 7.500000+6 1.657880+0 8.000000+6 1.680306+03925  3 91    5
8.500000+6 1.691661+0 9.000000+6 1.694888+0 9.500000+6 1.692033+03925  3 91    6
1.000000+7 1.685082+0 1.050000+7 1.668128+0 1.100000+7 1.643995+03925  3 91    7
1.150000+7 1.612189+0 1.200000+7 1.489110+0 1.250000+7 1.271664+03925  3 91    8
1.300000+7 1.048079+0 1.350000+7 8.560107-1 1.400000+7 6.996135-13925  3 91    9
1.450000+7 5.637885-1 1.500000+7 4.580743-1 1.550000+7 3.779990-13925  3 91   10
1.600000+7 3.196506-1 1.650000+7 2.776628-1 1.700000+7 2.445734-13925  3 91   11
1.750000+7 2.187781-1 1.800000+7 1.969604-1 1.850000+7 1.802930-13925  3 91   12
```

```
1.900000+7 1.660907-1 1.950000+7 1.530276-1 2.000000+7 1.424113-13925 3 91   13
```

In addition, Line 281 which was:
```
                         3         91         35         13925 1451  280
```
Became:
```
                         3         91         14         13925 1451  280
```

Zr96 and Mo97:
These evaluations contained the following errors from CONSIS:
```
checking energy distributions
consis: bad law44 kalbach r for (n,xd) at   1.800000E+01 -> 6.609760E+00
consis: bad law44 kalbach r for (n,xd) at   1.900000E+01 -> 7.588980E+00
consis: bad law44 kalbach r for (n,xd) at   1.900000E+01 -> 8.568210E+00
consis: bad law44 kalbach r for (n,xd) at   1.900000E+01 -> 9.057820E+00
consis: bad law44 kalbach r for (n,xd) at   2.000000E+01 -> 8.078600E+00
consis: bad law44 kalbach r for (n,xd) at   2.000000E+01 -> 8.568210E+00
consis: bad law44 kalbach r for (n,xd) at   2.000000E+01 -> 9.057820E+00
consis: bad law44 kalbach r for (n,xd) at   2.000000E+01 -> 9.547430E+00
consis: bad law44 kalbach r for (n,xd) at   2.000000E+01 -> 1.003700E+01
```

The value r is supposed to be in the range 0-1, as a sort of fraction. Values outside 0-1 such as what NJOY found for Zr96 are therefore illegal. The reality is that the exponents on values of r equal to 0.9999… were e+1, so the numbers were 9.999… instead of 0.9999….

Zr96 was modified as follows:

```
Line 3847
6.120150+6 2.234700-7 9.999660-1 6.609760+6 2.919190-7 0.999998+14043 6204   58

Became:
6.120150+6 2.234700-7 9.999660-1 6.609760+6 2.919190-7 0.999998+04043 6204   58

Lines 3858 to 3860
7.099370+6 2.264410-7 9.999860-1 7.588980+6 2.701220-7 0.999999+14043 6204   69
8.078600+6 3.152390-7 0.999997+0 8.568210+6 2.419700-7 0.999999+14043 6204   70
9.057820+6 3.805770-7 0.999999+1 9.607040+6 0.000000+0 0.000000+04043 6204   71

Became:
7.099370+6 2.264410-7 9.999860-1 7.588980+6 2.701220-7 0.999999+04043 6204   69
8.078600+6 3.152390-7 0.999997+0 8.568210+6 2.419700-7 0.999999+04043 6204   70
9.057820+6 3.805770-7 0.999999+0 9.607040+6 0.000000+0 0.000000+04043 6204   71

Lines 3870 to 3872
8.078600+6 2.233940-7 0.999999+1 8.568210+6 2.545820-7 0.999999+14043 6204   81
9.057820+6 1.939780-7 0.999999+1 9.547430+6 2.137780-7 0.999999+14043 6204   82
1.003700+7 3.377100-7 0.999999+1 1.059660+7 0.000000+0 0.000000+04043 6204   83

Became:
8.078600+6 2.233940-7 0.999999+0 8.568210+6 2.545820-7 0.999999+04043 6204   81
9.057820+6 1.939780-7 0.999999+0 9.547430+6 2.137780-7 0.999999+04043 6204   82
1.003700+7 3.377100-7 0.999999+0 1.059660+7 0.000000+0 0.000000+04043 6204   83
```

Mo97 was modified as follows:

```
Line 6116
1.573730+7 1.558500-8 0.999998+1 1.600180+7 0.000000+0 0.000000+04240 6203  331

Became:
1.573730+7 1.558500-8 0.999998+0 1.600180+7 0.000000+0 0.000000+04240 6203  331

Line 6148
1.632600+7 1.738630-8 0.999998+1 1.660050+7 1.379760-8 1.000000+04240 6203  363

Became:
```

```
1.632600+7 1.738630-8 0.999998+0 1.660050+7 1.379760-8 1.000000+04240 6203  363
```

```
Lines 6180 and 6181
1.634620+7 1.901120-8 9.999910-1 1.663040+7 1.344000-8 0.999999+14240 6203  395
1.691470+7 7.624100-9 0.999996+0 1.719900+7 1.510560-8 0.999999+14240 6203  396
```

```
Became
1.634620+7 1.901120-8 9.999910-1 1.663040+7 1.344000-8 0.999999+04240 6203  395
1.691470+7 7.624100-9 0.999996+0 1.719900+7 1.510560-8 0.999999+04240 6203  396
```

Am242ground: This looks like it is caused by an omission (error) in the endf file - namely the 242Am file does not have an angular distribution (no file 4 nor file 6, mt=18) for fission. NJOY fills in the tyr array after reading the angular distribution data so that it knows whether to use a + or - value; if there's no data for a given mt, then the tyr value for that reaction simply retains the zero value that the array was initialized with. Skip tested this by stealing the isotropic mf4, mt18 data from the 242mAm file and inserting it into the 242Am file. This modification was also implemented in my processing.

```
Line 5
0.000000+0 0.000000+0          0          0        118       849546 1451    4
```

```
Became:
0.000000+0 0.000000+0          0          0        118       859546 1451    4
```

```
Line 124
                               1        451        206        09546 1451  123
```

```
Became:
                               1        451        207        09546 1451  123
```

```
Line 171 was added:
                               4         18          2        09546 1451  169
```

```
And lines 1477 to 1479 were added:
9.524200+4 2.399801+2          0          0          0        09546 4 18    0
0.000000+0 2.399801+2          1          1          0        09546 4 18    1
0.000000+0 0.000000+0          0          0          0        09546 4  099999
```

Am242m: The inelastic cross sections (MT 4, 51, 52, 53, and 54) contained values of zero between 50 and 65 keV, whereas values above and below were non-zero. The cross sections below 100 keV were smoothed out by the evaluator in this modification.

Lines 927 to 933:
```
1.500000+4 0.000000+0 2.000000+4 0.000000+0 2.500000+4 1.903490-39547 3  4    4

2.731335+4 1.887096-3 3.000000+4 1.967976-3 3.500000+4 1.723383-39547 3  4    5

4.000000+4 1.124790-3 4.500000+4 1.330016-4 5.000000+4 0.000000+09547 3  4    6

5.061002+4 0.000000+0 5.500000+4 0.000000+0 6.000000+4 0.000000+09547 3  4    7

6.500000+4 0.000000+0 6.567252+4 3.153566-3 7.500000+4 7.644508-29547 3  4    8

8.000000+4 6.936488-2 8.500000+4 6.248683-2 9.000000+4 5.770698-29547 3  4    9

9.500000+4 5.654312-2 9.981420+4 5.997318-2 1.000000+5 6.161738-29547 3  4   10
```

Became:

```
1.500000+4 0.000000+0 2.000000+4 0.000000+0 2.500000+4 2.003490-39547 3   4      4
2.731335+4 2.202442-3 3.000000+4 2.524756-3 3.500000+4 3.401936-39547 3   4      5
4.000000+4 4.666732-3 4.500000+4 6.350844-3 5.000000+4 8.485973-39547 3   4      6
5.061002+4 8.778871-3 5.500000+4 1.110382-2 6.000000+4 1.423608-29547 3   4      7
6.500000+4 1.791447-2 6.567252+4 1.845262-2 7.500000+4 2.703640-29547 3   4      8
8.000000+4 3.254335-2 8.500000+4 3.872322-2 9.000000+4 4.560772-29547 3   4      9
9.500000+4 5.322854-2 9.981420+4 6.129154-2 1.000000+5 6.161738-29547 3   4     10


Lines 1030 to 1034:
2.000000+4 0.000000+0 2.500000+4 1.183308-4 3.000000+4 9.640164-59547 3 51      4
3.500000+4 8.002040-5 4.000000+4 5.060946-5 4.500000+4 5.880629-69547 3 51      5
5.000000+4 0.000000+0 5.500000+4 0.000000+0 6.000000+4 0.000000+09547 3 51      6
6.500000+4 0.000000+0 7.500000+4 2.335926-4 8.000000+4 2.019060-49547 3 51      7
8.500000+4 1.762582-4 9.000000+4 1.593463-4 9.500000+4 1.542507-49547 3 51      8


Became:
2.000000+4 0.000000+0 2.500000+4 1.183308-4 3.000000+4 2.198553-59547 3 51      4
3.500000+4 3.214386-5 4.000000+4 4.230738-5 4.500000+4 5.247540-59547 3 51      5
5.000000+4 6.264722-5 5.500000+4 7.282216-5 6.000000+4 8.299951-59547 3 51      6
6.500000+4 9.317860-5 7.500000+4 1.135392-4 8.000000+4 1.237193-49547 3 51      7
8.500000+4 1.338984-4 9.000000+4 1.440758-4 9.500000+4 1.542507-49547 3 51      8


Lines 1064 to 1068:
2.000000+4 0.000000+0 2.500000+4 2.585243-6 3.000000+4 1.440153-69547 3 52      4
3.500000+4 1.316165-6 4.000000+4 9.509153-7 4.500000+4 1.252221-79547 3 52      5
5.000000+4 0.000000+0 5.500000+4 0.000000+0 6.000000+4 0.000000+09547 3 52      6
6.500000+4 0.000000+0 7.500000+4 7.804414-6 8.000000+4 7.206291-69547 3 52      7
8.500000+4 6.693263-6 9.000000+4 6.436060-6 9.500000+4 6.577657-69547 3 52      8


Became:
2.000000+4 0.000000+0 2.500000+4 1.216820-7 3.000000+4 2.000000-79547 3 52      4
3.500000+4 3.229684-7 4.000000+4 5.063105-7 4.500000+4 7.364973-79547 3 52      5
5.000000+4 1.000000-6 5.500000+4 1.306234-6 6.000000+4 1.676140-69547 3 52      6
6.500000+4 2.113481-6 7.500000+4 3.205509-6 8.000000+4 3.867720-69547 3 52      7
8.500000+4 4.612410-6 9.000000+4 5.443341-6 9.500000+4 6.364275-69547 3 52      8


Lines 1097 to 1101:
2.000000+4 0.000000+0 2.500000+4 1.782574-3 3.000000+4 1.770214-39547 3 53      4
3.500000+4 1.536417-3 4.000000+4 9.956295-4 4.500000+4 1.168439-49547 3 53      5
```

```
5.000000+4 0.000000+0 5.500000+4 0.000000+0 6.000000+4 0.000000+09547 3 53     6
6.500000+4 0.000000+0 7.500000+4 3.960658-2 8.000000+4 3.261879-29547 3 53     7
8.500000+4 2.713115-2 9.000000+4 2.337517-2 9.500000+4 2.157269-29547 3 53     8
```

Became:
```
2.000000+4 0.000000+0 2.500000+4 2.520574-3 3.000000+4 3.770214-39547 3 53     4
3.500000+4 5.063993-3 4.000000+4 6.364531-3 4.500000+4 7.670220-39547 3 53     5
5.000000+4 8.979451-3 5.500000+4 1.029062-2 6.000000+4 1.160211-29547 3 53     6
6.500000+4 1.291231-2 7.500000+4 1.552244-2 8.000000+4 1.681914-29547 3 53     7
8.500000+4 1.810813-2 9.000000+4 1.938779-2 9.500000+4 2.065651-29547 3 53     8
```

Lines 1131 to 1135
```
:
2.731335+4 0.000000+0 3.000000+4 9.992005-5 3.500000+4 1.056291-49547 3 54     3
4.000000+4 7.760021-5 4.500000+4 1.015181-5 5.000000+4 0.000000+09547 3 54     4
5.500000+4 0.000000+0 6.000000+4 0.000000+0 6.500000+4 0.000000+09547 3 54     5
7.500000+4 4.876602-3 8.000000+4 4.142531-3 8.500000+4 3.540286-39547 3 54     6
9.000000+4 3.124191-3 9.500000+4 2.945715-3 1.000000+5 3.048565-39547 3 54     7
```

Became:
```
2.731335+4 0.000000+0 3.000000+4 6.992005-5 3.500000+4 2.056291-49547 3 54     3
4.000000+4 4.082459-4 4.500000+4 6.131619-4 5.000000+4 8.204804-49547 3 54     4
5.500000+4 1.030305-3 6.000000+4 1.242739-3 6.500000+4 1.457886-39547 3 54     5
7.500000+4 1.896732-3 8.000000+4 2.120638-3 8.500000+4 2.347671-39547 3 54     6
9.000000+4 2.577934-3 9.500000+4 2.811531-3 1.000000+5 3.048565-39547 3 54     7
```

Appendix E. Sample MCNP Input File for Hoho Test (U-235)

```
test of ENDF/B-VII data
1 1 -20.0 -1
2  0       1

1  so 1

mode n p
nps 3000000
sdef pos=0 0 0 erg=d1
phys:p 100.0 1 0
si1   h 0.000139-6 0.152-6 0.414-6 1.13-6
        3.06-6 8.32-6 22.6-6 61.4-6 167.-6 454.-6 0.001235
        0.00335 0.00912 0.0248 0.0676 0.184 0.303 0.5
        0.823 1.353 1.738 2.232 2.865 3.68
        6.07 7.79 10.0 12.0 13.5 15.0 17.0 20.0 150.0
sp1   d 0 1 30r 1
tmp 2.530e-08 2.530e-08
ctme 15.0
m1  92235.42c   1.0
imp:n 1 0
imp:p  1 0
```

Appendix F. Issues Found While Plotting ENDF70 Cross Sections with XSPLOT2

All room temperature neutron cross sections were plotted using the executable program XSPLOT2 on the machine XFILES. First, the actinides were plotted from the large files ENDF70J and ENDF70K. However, since XSPLOT2 reads the files sequentially, it took a long time for it to read the cross sections at the end of the files. The remaining isotopes (activation and fission products plus a few actinides) were broken into the smaller files ENDF70AA through ENDF70BE for easier viewing. Isotopes ^{127}I, ^{206}Pb, ^{231}Pa, ^{233}Pa, ^{235}U, and ^{238}U had file sizes that were too big for XSPLOT2 to process. All reactions for these isotopes were instead viewed through the T-16 web site (using T-16 ACER files) http://t2.lanl.gov/data/neutron7.html. All reactions for these isotopes appeared to be okay.

The problems that were found included:
- There are "breaks" in the data that appear to be zero cross sections in a small energy range for reaction MT 801 in ^{16}O and MT102 (n,gamma) for ^{58}Co. These are attributed to problems in the evaluation and nothing was done to fix them at this time.

- There were many instances of breaks/drops in the data of heating plots (MT 301) for the following isotopes: ^{22}Na, ^{59}Ni, ^{96}Zr, ^{93}Nb, **^{92}Mo, ^{94}Mo, ^{96}Mo, ^{97}Mo, ^{98}Mo**, ^{115m}Cd, ^{125}Sn, ^{133}Cs, **^{143}Ce**, **^{145}Nd, ^{147}Nd, ^{147}Sm, ^{149}Sm, ^{151}Sm, ^{153}Gd, ^{155}Gd**, ^{165}Ho, ^{166m}Ho, ^{166}Er, ^{181}Ta, ^{183}W, ^{184}W, ^{197}Au, ^{196}Hg, ^{199}Hg, ^{202}Hg, and ^{209}Bi. Most of these look like small energy ranges were the cross section was small or negative. Some of these correspond to cases in which the checking program CHECK_HEAT found negative heating cross sections; the isotopes for which this is true are bolded above.

- Some isotopes have reactions for which the plot drops off at the last energy level (i.e. as a vertical line). For many cases, this occurs when there is data past 20 MeV for most but not all reactions. The reactions for which there is no data past 20 MeV often but not always show a sharp drop to zero. These include: ^{53}Cr, ^{57}Fe, ^{60}Ni, ^{196}Hg, ^{200}Hg, ^{204}Pb, and ^{209}Bi. There is also one isotope (^{176}Hf) where the data for one reaction stops at 2 MeV and data for other reactions continues to 20 MeV. The same "drop" is seen in this case as the others. All of these cases were investigated further and no problems were found.

- In only one case did the observations from the plotting result in the formation of a new evaluation: some of the inelastic scatter reactions (MTs 4, 51, 52, 53, and 54) for ^{242m}Am. From 50 to 65 keV, these inelastic cross sections were originally equal to zero whereas there was non-zero data above and below. Patrick Talou of T-16 helped smooth out the cross sections below 100 keV so that zero cross sections no longer exist in the middle.

Appendix G. Details on Neutron Tables Included on ENDF70 Library

The following table is modeled after Table G.2 from Appendix G of the MCNP manual. In this document, entries are provided only for the data tables included on the ENDF70 library. Entries in the table are described in the following:

ZAID   The nuclide identification number with the form ZZZAAA.nnX, where
                  ZZZ is the atomic number

                  AAA is the mass number (000 for elements)
                  nn is the unique table identification number
                  X = C for continuous-energy neutron tables

Atomic Weight Ratio The atomic weight ratio (AWR) is the ratio of the atomic mass of the
                  nuclide to a neutron. This is the AWR that is contained in the original
                  evaluation and that was used in the NJOY processing of the evaluation.

Library   Name of the library that contains the data file for that ZAID. In this
                  case, the library name is endf70z, where 'z' is a-k, representing one
                  of the 11 libraries described in Table 2.

Source   Indicates the originating evaluation for that data file.

                  For this library, all evaluated data originated with ENDF/B-VII
                  Release 0. Hence the entry in the table is B-VII.0. For those seven
                  evaluations that were modified before processing (see section 3.1.1)
                  the entry is B-VII.0:x.

Evaluation Date   Denotes the year that the evaluation was completed or accepted. In cases
                  where this information is not known, the date that the data library was
                  produced is given. It is rare that a completely new evaluation is produced.
                  Most often, only a section of an existing evaluation is updated, but a new
                  evaluation date is assigned. This can be misleading for the users, and we
                  encourage you to read the File 1 information for data tables important to
                  your application to understand the history of a specific evaluation. This
                  information is available from the Data Team's web site. The notation
                  "<1985" means "before" 1985.

Temperature   Indicates the temperature (°K) at which the data were processed. The
                  temperature enters into the processing of the evaluation of a data file only
                  through the Doppler broadening of cross sections. The user must be aware
                  that without the proper use of the TMP card, MCNP will attempt to correct
                  the data libraries to the default room temperature by modifying the elastic
                  and total cross sections *only*.

Length   The total length of a particular cross-section file in words. It is understood
                  that the actual storage requirement in an MCNP problem will often be less
                  because certain data that are not needed for a problem may be expunged.

Number of Energies The number of energy points (NE) on the grid used for the neutron cross

	section for that data file. In general, a finer energy grid (or greater number of points) indicates a more accurate representation of the cross sections, particularly through the resonance region.
E*max*	The maximum incident neutron energy for that data file. For all incident neutron energies greater than E*max*, MCNP assumes the last cross-section value given.
GPD	"yes" means that photon-production data are included; "no" means that such data are not included.
υ	for fissionable material, indicates the type of fission nu data υ available. "pr" indicates that only prompt nu data are given; "tot" indicates that only total nu data are given; "both" indicates that prompt and total nu are given.
CP	"yes" indicates that secondary charged-particles data are present; "no" indicates that such data are not present.
DN	"yes" indicates that delayed neutron data are present; "no" indicates that such data are not present.
UR	"yes" indicates that unresolved resonance data are present; "no" indicates that such data are not present.

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Z = 1 ********* Hydrogen **********													
** H-1 **													
1001.70c	0.999	endf70a	B-VII.0:x	2005	293.6	8177	590	20.0	yes	no	yes	no	no
1001.71c	0.999	endf70a	B-VII.0:x	2005	600.0	8177	590	20.0	yes	no	yes	no	no
1001.72c	0.999	endf70a	B-VII.0:x	2005	900.0	8177	590	20.0	yes	no	yes	no	no
1001.73c	0.999	endf70a	B-VII.0:x	2005	1200.0	8177	590	20.0	yes	no	yes	no	no
1001.74c	0.999	endf70a	B-VII.0:x	2005	2500.0	8177	590	20.0	yes	no	yes	no	no
** H-2 **													
1002.70c	1.997	endf70a	B-VII.0	1997	293.6	10452	542	150.0	yes	no	yes	no	no
1002.71c	1.997	endf70a	B-VII.0	1997	600.0	10618	557	150.0	yes	no	yes	no	no
1002.72c	1.997	endf70a	B-VII.0	1997	900.0	10683	563	150.0	yes	no	yes	no	no
1002.73c	1.997	endf70a	B-VII.0	1997	1200.0	10772	571	150.0	yes	no	yes	no	no
1002.74c	1.997	endf70a	B-VII.0	1997	2500.0	10904	583	150.0	yes	no	yes	no	no
** H-3 **													
1003.70c	2.99	endf70a	B-VII.0	2001	293.6	11208	469	20.0	no	no	no	no	no
1003.71c	2.99	endf70a	B-VII.0	2001	600.0	11308	489	20.0	no	no	no	no	no
1003.72c	2.99	endf70a	B-VII.0	2001	900.0	11363	500	20.0	no	no	no	no	no
1003.73c	2.99	endf70a	B-VII.0	2001	1200.0	11388	505	20.0	no	no	no	no	no
1003.74c	2.99	endf70a	B-VII.0	2001	2500.0	11458	519	20.0	no	no	no	no	no
Z = 2 ********* Helium **********													
** He-3 **													
2003.70c	2.989	endf70a	B-VII.0	1990	293.6	9679	668	20.0	no	no	yes	no	no
2003.71c	2.989	endf70a	B-VII.0	1990	600.0	9680	668	20.0	no	no	yes	no	no
2003.72c	2.989	endf70a	B-VII.0	1990	900.0	9679	668	20.0	no	no	yes	no	no
2003.73c	2.989	endf70a	B-VII.0	1990	1200.0	9680	668	20.0	no	no	yes	no	no
2003.74c	2.989	endf70a	B-VII.0	1990	2500.0	9679	668	20.0	no	no	yes	no	no
** He-4 **													
2004.70c	3.968	endf70a	B-VII.0	1973	293.6	5524	588	20.0	no	no	no	no	no
2004.71c	3.968	endf70a	B-VII.0	1973	600.0	5624	608	20.0	no	Nu	no	no	no
2004.72c	3.968	endf70a	B-VII.0	1973	900.0	5669	617	20.0	no	no	no	no	no
2004.73c	3.968	endf70a	B-VII.0	1973	1200.0	5709	625	20.0	no	no	no	no	no
2004.74c	3.968	endf70a	B-VII.0	1973	2500.0	5789	641	20.0	no	no	no	no	no
Z = 3 ********* lithium **********													
** Li-6 **													
3006.70c	5.963	endf70a	B-VII.0	2006	293.6	35859	847	20.0	yes	no	yes	no	no
3006.71c	5.963	endf70a	B-VII.0	2006	600.0	35805	843	20.0	yes	no	yes	no	no
3006.72c	5.963	endf70a	B-VII.0	2006	900.0	35780	841	20.0	yes	no	yes	no	no
3006.73c	5.963	endf70a	B-VII.0	2006	1200.0	35749	839	20.0	yes	no	yes	no	no

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Li-6 **													
3006.74c	5.963	endf70a	B-VII.0	2006	2500.0	35749	839	20.0	yes	no	yes	no	no
** Li-7 **													
3007.70c	6.956	endf70a	B-VII.0	1988	293.6	19687	693	20.0	yes	no	no	no	no
3007.71c	6.956	endf70a	B-VII.0	1988	600.0	19687	693	20.0	yes	no	no	no	no
3007.72c	6.956	endf70a	B-VII.0	1988	900.0	19687	693	20.0	yes	no	no	no	no
3007.73c	6.956	endf70a	B-VII.0	1988	1200.0	19703	695	20.0	yes	no	no	no	no
3007.74c	6.956	endf70a	B-VII.0	1988	2500.0	19800	707	20.0	yes	no	no	no	no
Z = 4 ********** beryllium **********													
** Be-9 **													
4009.70c	8.935	endf70a	B-VII.0	2006	293.6	579815	556	20.0	yes	no	yes	no	no
4009.71c	8.935	endf70a	B-VII.0	2006	600.0	579822	557	20.0	yes	no	yes	no	no
4009.72c	8.935	endf70a	B-VII.0	2006	900.0	579816	556	20.0	yes	no	yes	no	no
4009.73c	8.935	endf70a	B-VII.0	2006	1200.0	579815	556	20.0	yes	no	yes	no	no
4009.74c	8.935	endf70a	B-VII.0	2006	2500.0	579799	554	20.0	yes	no	yes	no	no
Z = 5 ********** boron **********													
** B-10 **													
5010.70c	9.927	endf70a	B-VII.0	2006	293.6	54514	934	20.0	yes	no	yes	no	no
5010.71c	9.927	endf70a	B-VII.0	2006	600.0	54542	935	20.0	yes	no	yes	no	no
5010.72c	9.927	endf70a	B-VII.0	2006	900.0	54513	934	20.0	yes	no	yes	no	no
5010.73c	9.927	endf70a	B-VII.0	2006	1200.0	54514	934	20.0	yes	no	yes	no	no
5010.74c	9.927	endf70a	B-VII.0	2006	2500.0	54513	934	20.0	yes	no	yes	no	no
** B-11 **													
5011.70c	10.915	endf70a	B-VII.0	1989	293.6	150161	3489	20.0	yes	no	yes	no	no
5011.71c	10.915	endf70a	B-VII.0	1989	600.0	150202	3494	20.0	yes	no	yes	no	no
5011.72c	10.915	endf70a	B-VII.0	1989	900.0	150160	3489	20.0	yes	no	yes	no	no
5011.73c	10.915	endf70a	B-VII.0	1989	1200.0	150160	3489	20.0	yes	no	yes	no	no
5011.74c	10.915	endf70a	B-VII.0	1989	2500.0	150033	3473	20.0	yes	no	yes	no	no
Z = 6 ********** carbon **********													
** C-0 **													
6000.70c	11.898	endf70a	B-VII.0	1996	293.6	79358	1303	150.0	yes	no	yes	no	no
6000.71c	11.898	endf70a	B-VII.0	1996	600.0	79357	1303	150.0	yes	no	yes	no	no
6000.72c	11.898	endf70a	B-VII.0	1996	900.0	79350	1302	150.0	yes	no	yes	no	no
6000.73c	11.898	endf70a	B-VII.0	1996	1200.0	79349	1302	150.0	yes	no	yes	no	no
6000.74c	11.898	endf70a	B-VII.0	1996	2500.0	79405	1309	150.0	yes	no	yes	no	no
Z = 7 ********** nitrogen **********													
** N-14 **													
7014.70c	13.883	endf70a	B-VII.0	2000	293.6	145379	1826	150.0	yes	no	yes	no	no

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

									Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
N-14													
7014.71c	13.883	endf70a	B-VII.0	2000	600.0	145463	1826	150.0	yes	no	yes	no	no
7014.72c	13.883	endf70a	B-VII.0	2000	900.0	145376	1826	150.0	yes	no	yes	no	no
7014.73c	13.883	endf70a	B-VII.0	2000	1200.0	145462	1826	150.0	yes	no	yes	no	no
7014.74c	13.883	endf70a	B-VII.0	2000	2500.0	145475	1826	150.0	yes	no	yes	no	no
N-15													
7015.70c	14.871	endf70a	B-VII.0	1983	293.6	31819	888	20.0	yes	no	no	no	no
7015.71c	14.871	endf70a	B-VII.0	1983	600.0	31940	903	20.0	yes	no	no	no	no
7015.72c	14.871	endf70a	B-VII.0	1983	900.0	32002	911	20.0	yes	no	no	no	no
7015.73c	14.871	endf70a	B-VII.0	1983	1200.0	32051	917	20.0	yes	no	no	no	no
7015.74c	14.871	endf70a	B-VII.0	1983	2500.0	32226	939	20.0	yes	no	no	no	no
Z = 8 ********** oxygen **********													
O-16													
8016.70c	15.858	endf70a	B-VII.0	2005	293.6	408681	2849	150.0	yes	no	yes	no	no
8016.71c	15.858	endf70a	B-VII.0	2005	600.0	408936	2865	150.0	yes	no	yes	no	no
8016.72c	15.858	endf70a	B-VII.0	2005	900.0	409004	2873	150.0	yes	no	yes	no	no
8016.73c	15.858	endf70a	B-VII.0	2005	1200.0	408912	2878	150.0	yes	no	yes	no	no
8016.74c	15.858	endf70a	B-VII.0	2005	2500.0	409028	2893	150.0	yes	no	yes	no	no
O-17													
8017.70c	16.853	endf70a	B-VII.0	1978	293.6	8169	620	20.0	no	no	no	no	no
8017.71c	16.853	endf70a	B-VII.0	1978	600.0	8169	620	20.0	no	no	no	no	no
8017.72c	16.853	endf70a	B-VII.0	1978	900.0	8169	620	20.0	no	no	no	no	no
8017.73c	16.853	endf70a	B-VII.0	1978	1200.0	8170	620	20.0	no	no	no	no	no
8017.74c	16.853	endf70a	B-VII.0	1978	2500.0	8169	620	20.0	no	no	no	no	no
Z = 9 ********** fluorine **********													
F-19													
9019.70c	18.835	endf70a	B-VII.0	2003	293.6	130477	2322	20.0	yes	no	yes	no	no
9019.71c	18.835	endf70a	B-VII.0	2003	600.0	130534	2329	20.0	yes	no	yes	no	no
9019.72c	18.835	endf70a	B-VII.0	2003	900.0	130573	2334	20.0	yes	no	yes	no	no
9019.73c	18.835	endf70a	B-VII.0	2003	1200.0	130662	2345	20.0	yes	no	yes	no	no
9019.74c	18.835	endf70a	B-VII.0	2003	2500.0	130661	2345	20.0	yes	no	yes	no	no
Z = 11 ********** sodium **********													
Na-22													
11022.70c	21.806	endf70a	B-VII.0	1992	293.6	17687	1089	20.0	no	no	no	no	no
11022.71c	21.806	endf70a	B-VII.0	1992	600.0	16895	1017	20.0	no	no	no	no	no
11022.72c	21.806	endf70a	B-VII.0	1992	900.0	16642	994	20.0	no	no	no	no	no
11022.73c	21.806	endf70a	B-VII.0	1992	1200.0	16346	967	20.0	no	no	no	no	no
11022.74c	21.806	endf70a	B-VII.0	1992	2500.0	16170	951	20.0	no	no	no	no	no

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
**** Na-23 ****													
11023.70c	22.792	endf70a	B-VII.0	2000	293.6	71674	3503	20.0	yes	no	no	no	no
11023.71c	22.792	endf70a	B-VII.0	2000	600.0	71329	3460	20.0	yes	no	no	no	no
11023.72c	22.792	endf70a	B-VII.0	2000	900.0	71281	3454	20.0	yes	no	no	no	no
11023.73c	22.792	endf70a	B-VII.0	2000	1200.0	71105	3432	20.0	yes	no	no	no	no
11023.74c	22.792	endf70a	B-VII.0	2000	2500.0	70721	3384	20.0	yes	no	no	no	no
Z = 12 ********** magnesium **********													
**** Mg-24 ****													
12024.70c	23.779	endf70a	B-VII.0	2001	293.6	49199	2665	20.0	yes	no	no	no	no
12024.71c	23.779	endf70a	B-VII.0	2001	600.0	49087	2651	20.0	yes	no	no	no	no
12024.72c	23.779	endf70a	B-VII.0	2001	900.0	48959	2635	20.0	yes	no	no	no	no
12024.73c	23.779	endf70a	B-VII.0	2001	1200.0	48918	2630	20.0	yes	no	no	no	no
12024.74c	23.779	endf70a	B-VII.0	2001	2500.0	48855	2622	20.0	yes	no	no	no	no
**** Mg-25 ****													
12025.70c	24.771	endf70a	B-VII.0	2001	293.6	47134	1688	20.0	yes	no	no	no	no
12025.71c	24.771	endf70a	B-VII.0	2001	600.0	47006	1672	20.0	yes	no	no	no	no
12025.72c	24.771	endf70a	B-VII.0	2001	900.0	46767	1642	20.0	yes	no	no	no	no
12025.73c	24.771	endf70a	B-VII.0	2001	1200.0	46630	1625	20.0	yes	no	no	no	no
12025.74c	24.771	endf70a	B-VII.0	2001	2500.0	46503	1609	20.0	yes	no	no	no	no
**** Mg-26 ****													
12026.70c	25.759	endf70a	B-VII.0	2001	293.6	37892	1235	20.0	yes	no	no	no	no
12026.71c	25.759	endf70a	B-VII.0	2001	600.0	37781	1221	20.0	yes	no	no	no	no
12026.72c	25.759	endf70a	B-VII.0	2001	900.0	37788	1222	20.0	yes	no	no	no	no
12026.73c	25.759	endf70a	B-VII.0	2001	1200.0	37765	1219	20.0	yes	no	no	no	no
12026.74c	25.759	endf70a	B-VII.0	2001	2500.0	37756	1218	20.0	yes	no	no	no	no
Z = 13 ********** aluminum **********													
**** Al-27 ****													
13027.70c	26.75	endf70a	B-VII.0	2005	293.6	235689	5563	150.0	yes	no	yes	no	no
13027.71c	26.75	endf70a	B-VII.0	2005	600.0	235031	5481	150.0	yes	no	yes	no	no
13027.72c	26.75	endf70a	B-VII.0	2005	900.0	234551	5421	150.0	yes	no	yes	no	no
13027.73c	26.75	endf70a	B-VII.0	2005	1200.0	234415	5404	150.0	yes	no	yes	no	no
13027.74c	26.75	endf70a	B-VII.0	2005	2500.0	233800	5327	150.0	yes	no	yes	no	no
Z = 14 ********** silicon **********													
**** Si-28 ****													
14028.70c	27.737	endf70a	B-VII.0	1999	293.6	270861	8255	150.0	yes	no	yes	no	no
14028.71c	27.737	endf70a	B-VII.0	1999	600.0	270397	8197	150.0	yes	no	yes	no	no
14028.72c	27.737	endf70a	B-VII.0	1999	900.0	270141	8165	150.0	yes	no	yes	no	no
14028.73c	27.737	endf70a	B-VII.0	1999	1200.0	269949	8141	150.0	yes	no	yes	no	no

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Si-28 **													
14028.74c	27.737	endf70a	B-VII.0	1999	2500.0	269126	8038	150.0	yes	no	yes	no	no
** Si-29 **													
14029.70c	28.728	endf70a	B-VII.0	2004	293.6	253907	5034	150.0	yes	no	yes	no	no
14029.71c	28.728	endf70a	B-VII.0	2004	600.0	253827	5024	150.0	yes	no	yes	no	no
14029.72c	28.728	endf70a	B-VII.0	2004	900.0	253699	5008	150.0	yes	no	yes	no	no
14029.73c	28.728	endf70a	B-VII.0	2004	1200.0	253587	4994	150.0	yes	no	yes	no	no
14029.74c	28.728	endf70a	B-VII.0	2004	2500.0	253467	4979	150.0	yes	no	yes	no	no
** Si-30 **													
14030.70c	29.716	endf70a	B-VII.0	2004	293.6	199479	6235	150.0	yes	no	yes	no	no
14030.71c	29.716	endf70a	B-VII.0	2004	600.0	199151	6194	150.0	yes	no	yes	no	no
14030.72c	29.716	endf70a	B-VII.0	2004	900.0	198776	6147	150.0	yes	no	yes	no	no
14030.73c	29.716	endf70a	B-VII.0	2004	1200.0	198767	6146	150.0	yes	no	yes	no	no
14030.74c	29.716	endf70a	B-VII.0	2004	2500.0	198311	6089	150.0	yes	no	yes	no	no
Z = 15 ********** phosphorus **********													
** P-31 **													
15031.70c	30.708	endf70a	B-VII.0	2004	293.6	71942	990	150.0	yes	no	yes	no	no
15031.71c	30.708	endf70a	B-VII.0	2004	600.0	72214	1024	150.0	yes	no	yes	no	no
15031.72c	30.708	endf70a	B-VII.0	2004	900.0	72498	1059	150.0	yes	no	yes	no	no
15031.73c	30.708	endf70a	B-VII.0	2004	1200.0	73017	1124	150.0	yes	no	yes	no	no
15031.74c	30.708	endf70a	B-VII.0	2004	2500.0	74815	1349	150.0	yes	no	yes	no	no
Z = 16 ********** sulfur **********													
** S-32 **													
16032.70c	31.697	endf70a	B-VII.0	2001	293.6	136765	9795	20.0	yes	no	no	no	no
16032.71c	31.697	endf70a	B-VII.0	2001	600.0	135565	9675	20.0	yes	no	no	no	no
16032.72c	31.697	endf70a	B-VII.0	2001	900.0	134734	9592	20.0	yes	no	no	no	no
16032.73c	31.697	endf70a	B-VII.0	2001	1200.0	134195	9538	20.0	yes	no	no	no	no
16032.74c	31.697	endf70a	B-VII.0	2001	2500.0	132515	9370	20.0	yes	no	no	no	no
** S-33 **													
16033.70c	32.688	endf70a	B-VII.0	2001	293.6	56837	2097	20.0	yes	no	no	no	no
16033.71c	32.688	endf70a	B-VII.0	2001	600.0	56633	2080	20.0	yes	no	no	no	no
16033.72c	32.688	endf70a	B-VII.0	2001	900.0	56597	2077	20.0	yes	no	no	no	no
16033.73c	32.688	endf70a	B-VII.0	2001	1200.0	56549	2073	20.0	yes	no	no	no	no
16033.74c	32.688	endf70a	B-VII.0	2001	2500.0	56357	2057	20.0	yes	no	no	no	no
** S-34 **													
16034.70c	33.676	endf70a	B-VII.0	2001	293.6	40877	1756	20.0	yes	no	no	no	no
16034.71c	33.676	endf70a	B-VII.0	2001	600.0	40837	1751	20.0	yes	no	no	no	no
16034.72c	33.676	endf70a	B-VII.0	2001	900.0	40853	1753	20.0	yes	no	no	no	no

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** S-34 **													
16034.73c	33.676	endf70a	B-VII.0	2001	1200.0	40861	1754	20.0	yes	no	no	no	no
16034.74c	33.676	endf70a	B-VII.0	2001	2500.0	40765	1742	20.0	yes	no	no	no	no
** S-36 **													
16036.70c	35.658	endf70a	B-VII.0	2001	293.6	28871	688	20.0	yes	no	no	no	no
16036.71c	35.658	endf70a	B-VII.0	2001	600.0	28904	692	20.0	yes	no	no	no	no
16036.72c	35.658	endf70a	B-VII.0	2001	900.0	28920	694	20.0	yes	no	no	no	no
16036.73c	35.658	endf70a	B-VII.0	2001	1200.0	28928	695	20.0	yes	no	no	no	no
16036.74c	35.658	endf70a	B-VII.0	2001	2500.0	28959	699	20.0	yes	no	no	no	no
Z = 17 ********** chlorine **********													
** Cl-35 **													
17035.70c	34.668	endf70a	B-VII.0	2003	293.6	715868	25782	20.0	yes	no	yes	no	no
17035.71c	34.668	endf70a	B-VII.0	2003	600.0	711422	25535	20.0	yes	no	yes	no	no
17035.72c	34.668	endf70a	B-VII.0	2003	900.0	709298	25417	20.0	yes	no	yes	no	no
17035.73c	34.668	endf70a	B-VII.0	2003	1200.0	707498	25317	20.0	yes	no	yes	no	no
17035.74c	34.668	endf70a	B-VII.0	2003	2500.0	702170	25021	20.0	yes	no	yes	no	no
** Cl-37 **													
17037.70c	36.648	endf70a	B-VII.0	2003	293.6	211102	12322	20.0	yes	no	yes	no	no
17037.71c	36.648	endf70a	B-VII.0	2003	600.0	209701	12147	20.0	yes	no	yes	no	no
17037.72c	36.648	endf70a	B-VII.0	2003	900.0	208404	11985	20.0	yes	no	yes	no	no
17037.73c	36.648	endf70a	B-VII.0	2003	1200.0	207197	11834	20.0	yes	no	yes	no	no
17037.74c	36.648	endf70a	B-VII.0	2003	2500.0	204317	11474	20.0	yes	no	yes	no	no
Z = 18 ********** argon **********													
** Ar-36 **													
18036.70c	35.658	endf70a	B-VII.0	1992	293.6	15679	921	20.0	no	no	no	no	no
18036.71c	35.658	endf70a	B-VII.0	1992	600.0	15617	912	20.0	no	no	no	no	no
18036.72c	35.658	endf70a	B-VII.0	1992	900.0	15602	910	20.0	no	no	no	no	no
18036.73c	35.658	endf70a	B-VII.0	1992	1200.0	15651	917	20.0	no	no	no	no	no
18036.74c	35.658	endf70a	B-VII.0	1992	2500.0	15813	940	20.0	no	no	no	no	no
** Ar-38 **													
18038.70c	37.637	endf70a	B-VII.0	1992	293.6	14928	954	20.0	no	no	no	no	no
18038.71c	37.637	endf70a	B-VII.0	1992	600.0	14850	943	20.0	no	no	no	no	no
18038.72c	37.637	endf70a	B-VII.0	1992	900.0	14928	954	20.0	no	no	no	no	no
18038.73c	37.637	endf70a	B-VII.0	1992	1200.0	14920	953	20.0	no	no	no	no	no
18038.74c	37.637	endf70a	B-VII.0	1992	2500.0	14822	939	20.0	no	no	no	no	no
** Ar-40 **													
18040.70c	39.619	endf70a	B-VII.0	1994	293.6	206449	23603	20.0	no	no	no	no	no
18040.71c	39.619	endf70a	B-VII.0	1994	600.0	204235	23287	20.0	no	no	no	no	no

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

** Ar-40 **

ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
18040.72c	39.619	endf70a	B-VII.0	1994	900.0	202598	23053	20.0	no	no	no	no	no
18040.73c	39.619	endf70a	B-VII.0	1994	1200.0	201484	22894	20.0	no	no	no	no	no
18040.74c	39.619	endf70a	B-VII.0	1994	2500.0	198216	22427	20.0	no	no	no	no	no

Z = 19 ********** potassium **********
** K-39 **

19039.70c	38.629	endf70a	B-VII.0	2001	293.6	90487	6332	20.0	yes	no	no	no	no
19039.71c	38.629	endf70a	B-VII.0	2001	600.0	89277	6211	20.0	yes	no	no	no	no
19039.72c	38.629	endf70a	B-VII.0	2001	900.0	88997	6183	20.0	yes	no	no	no	no
19039.73c	38.629	endf70a	B-VII.0	2001	1200.0	88598	6143	20.0	yes	no	no	no	no
19039.74c	38.629	endf70a	B-VII.0	2001	2500.0	86917	5975	20.0	yes	no	no	no	no

** K-40 **

19040.70c	39.621	endf70a	B-VII.0	2001	293.6	39638	834	20.0	yes	no	no	no	no
19040.71c	39.621	endf70a	B-VII.0	2001	600.0	39590	830	20.0	yes	no	no	no	no
19040.72c	39.621	endf70a	B-VII.0	2001	900.0	39590	830	20.0	yes	no	no	no	no
19040.73c	39.621	endf70a	B-VII.0	2001	1200.0	39590	830	20.0	yes	no	no	no	no
19040.74c	39.621	endf70a	B-VII.0	2001	2500.0	39566	828	20.0	yes	no	no	no	no

** K-41 **

19041.70c	40.61	endf70a	B-VII.0	2001	293.6	69480	5354	20.0	yes	no	no	no	no
19041.71c	40.61	endf70a	B-VII.0	2001	600.0	69240	5324	20.0	yes	no	no	no	no
19041.72c	40.61	endf70a	B-VII.0	2001	900.0	68976	5291	20.0	yes	no	no	no	no
19041.73c	40.61	endf70a	B-VII.0	2001	1200.0	68672	5253	20.0	yes	no	no	no	no
19041.74c	40.61	endf70a	B-VII.0	2001	2500.0	67993	5168	20.0	yes	no	no	no	no

Z = 20 ********** calcium **********
** Ca-40 **

20040.70c	39.619	endf70a	B-VII.0	2004	293.6	389582	9591	200.	yes	no	yes	no	no
20040.71c	39.619	endf70a	B-VII.0	2004	600.0	386567	9359	200.	yes	no	yes	no	no
20040.72c	39.619	endf70a	B-VII.0	2004	900.0	384798	9223	200.	yes	no	yes	no	no
20040.73c	39.619	endf70a	B-VII.0	2004	1200.0	383500	9123	200.	yes	no	yes	no	no
20040.74c	39.619	endf70a	B-VII.0	2004	2500.0	380133	8864	200.	yes	no	yes	no	no

** Ca-42 **

20042.70c	41.598	endf70a	B-VII.0	2004	293.6	323634	8175	200.	yes	no	yes	no	no
20042.71c	41.598	endf70a	B-VII.0	2004	600.0	321889	7957	200.	yes	no	yes	no	no
20042.72c	41.598	endf70a	B-VII.0	2004	900.0	321050	7852	200.	yes	no	yes	no	no
20042.73c	41.598	endf70a	B-VII.0	2004	1200.0	320417	7773	200.	yes	no	yes	no	no
20042.74c	41.598	endf70a	B-VII.0	2004	2500.0	318818	7573	200.	yes	no	yes	no	no

** Ca-43 **

20043.70c	42.59	endf70a	B-VII.0	2004	293.6	356357	6349	200.	yes	no	yes	no	no

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Ca-43 **													
20043.71c	42.59	endf70a	B-VII.0	2004	600.0	354565	6221	200.	yes	no	yes	no	no
20043.72c	42.59	endf70a	B-VII.0	2004	900.0	353725	6161	200.	yes	no	yes	no	no
20043.73c	42.59	endf70a	B-VII.0	2004	1200.0	353221	6125	200.	yes	no	yes	no	no
20043.74c	42.59	endf70a	B-VII.0	2004	2500.0	351612	6010	200.	yes	no	yes	no	no
** Ca-44 **													
20044.70c	43.578	endf70a	B-VII.0	2004	293.6	225990	5240	200.	yes	no	yes	no	no
20044.71c	43.578	endf70a	B-VII.0	2004	600.0	225112	5130	200.	yes	no	yes	no	no
20044.72c	43.578	endf70a	B-VII.0	2004	900.0	224567	5062	200.	yes	no	yes	no	no
20044.73c	43.578	endf70a	B-VII.0	2004	1200.0	223982	4989	200.	yes	no	yes	no	no
20044.74c	43.578	endf70a	B-VII.0	2004	2500.0	222935	4858	200.	yes	no	yes	no	no
** Ca-46 **													
20046.70c	45.559	endf70a	B-VII.0	2004	293.6	168274	1047	200.	yes	no	yes	no	no
20046.71c	45.559	endf70a	B-VII.0	2004	600.0	168242	1043	200.	yes	no	yes	no	no
20046.72c	45.559	endf70a	B-VII.0	2004	900.0	168231	1042	200.	yes	no	yes	no	no
20046.73c	45.559	endf70a	B-VII.0	2004	1200.0	168254	1044	200.	yes	no	yes	no	no
20046.74c	45.559	endf70a	B-VII.0	2004	2500.0	168270	1046	200.	yes	no	yes	no	no
** Ca-48 **													
20048.70c	47.541	endf70a	B-VII.0	2004	293.6	146911	1582	200.	yes	no	yes	no	no
20048.71c	47.541	endf70a	B-VII.0	2004	600.0	146863	1576	200.	yes	no	yes	no	no
20048.72c	47.541	endf70a	B-VII.0	2004	900.0	146847	1574	200.	yes	no	yes	no	no
20048.73c	47.541	endf70a	B-VII.0	2004	1200.0	146815	1570	200.	yes	no	yes	no	no
20048.74c	47.541	endf70a	B-VII.0	2004	2500.0	146807	1569	200.	yes	no	yes	no	no
Z = 21 ********** scandium **********													
** Sc-45 **													
21045.70c	44.568	endf70a	B-VII.0:x	2000	293.6	299254	25283	20.0	yes	no	no	no	no
21045.71c	44.568	endf70a	B-VII.0:x	2000	600.0	298145	25172	20.0	yes	no	no	no	no
21045.72c	44.568	endf70a	B-VII.0:x	2000	900.0	297375	25095	20.0	yes	no	no	no	no
21045.73c	44.568	endf70a	B-VII.0:x	2000	1200.0	297005	25058	20.0	yes	Nu	no	no	no
21045.74c	44.568	endf70a	B-VII.0:x	2000	2500.0	295496	24907	20.0	yes	no	no	no	no
Z = 22 ********** titanium **********													
** Ti-46 **													
22046.70c	45.558	endf70a	B-VII.0	2001	293.6	175861	12997	20.0	yes	no	yes	no	no
22046.71c	45.558	endf70a	B-VII.0	2001	600.0	172443	12570	20.0	yes	no	yes	no	no
22046.72c	45.558	endf70a	B-VII.0	2001	900.0	169964	12260	20.0	yes	no	yes	no	no
22046.73c	45.558	endf70a	B-VII.0	2001	1200.0	168364	12060	20.0	yes	no	yes	no	no
22046.74c	45.558	endf70a	B-VII.0	2001	2500.0	164042	11520	20.0	yes	no	yes	no	no
** Ti-47 **													

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Ti-47 **													
22047.70c	46.548	endf70a	B-VII.0	2001	293.6	142948	6896	20.0	yes	no	yes	no	no
22047.71c	46.548	endf70a	B-VII.0	2001	600.0	141982	6775	20.0	yes	no	yes	no	no
22047.72c	46.548	endf70a	B-VII.0	2001	900.0	141582	6725	20.0	yes	no	yes	no	no
22047.73c	46.548	endf70a	B-VII.0	2001	1200.0	141255	6684	20.0	yes	no	yes	no	no
22047.74c	46.548	endf70a	B-VII.0	2001	2500.0	140239	6557	20.0	yes	no	yes	no	no
** Ti-48 **													
22048.70c	47.556	endf70a	B-VII.0	2001	293.6	139249	7610	20.0	yes	no	yes	no	no
22048.71c	47.556	endf70a	B-VII.0	2001	600.0	137823	7432	20.0	yes	no	yes	no	no
22048.72c	47.556	endf70a	B-VII.0	2001	900.0	137016	7331	20.0	yes	no	yes	no	no
22048.73c	47.556	endf70a	B-VII.0	2001	1200.0	136358	7249	20.0	yes	no	yes	no	no
22048.74c	47.556	endf70a	B-VII.0	2001	2500.0	134350	6998	20.0	yes	no	yes	no	no
** Ti-49 **													
22049.70c	48.527	endf70a	B-VII.0	2001	293.6	115896	4997	20.0	yes	no	yes	no	no
22049.71c	48.527	endf70a	B-VII.0	2001	600.0	115415	4937	20.0	yes	no	yes	no	no
22049.72c	48.527	endf70a	B-VII.0	2001	900.0	115088	4896	20.0	yes	no	yes	no	no
22049.73c	48.527	endf70a	B-VII.0	2001	1200.0	114855	4867	20.0	yes	no	yes	no	no
22049.74c	48.527	endf70a	B-VII.0	2001	2500.0	114135	4777	20.0	yes	Nu	yes	no	no
** Ti-50 **													
22050.70c	49.516	endf70a	B-VII.0	2001	293.6	100283	4594	20.0	yes	no	yes	no	no
22050.71c	49.516	endf70a	B-VII.0	2001	600.0	99770	4530	20.0	yes	no	yes	no	no
22050.72c	49.516	endf70a	B-VII.0	2001	900.0	99449	4490	20.0	yes	no	yes	no	no
22050.73c	49.516	endf70a	B-VII.0	2001	1200.0	99122	4449	20.0	yes	no	yes	no	no
22050.74c	49.516	endf70a	B-VII.0	2001	2500.0	98266	4342	20.0	yes	no	yes	no	no
Z = 23 ********** vanadium **********													
** V-0 **													
23000.70c	50.504	endf70a	B-VII.0	2005	293.6	202479	10725	20.0	yes	no	no	no	no
23000.71c	50.504	endf70a	B-VII.0	2005	600.0	201334	10582	20.0	yes	no	no	no	no
23000.72c	50.504	endf70a	B-VII.0	2005	900.0	200566	10486	20.0	yes	Nu	no	no	no
23000.73c	50.504	endf70a	B-VII.0	2005	1200.0	200430	10469	20.0	yes	no	no	no	no
23000.74c	50.504	endf70a	B-VII.0	2005	2500.0	199326	10331	20.0	yes	no	no	no	no
Z = 24 ********** chromium **********													
** Cr-50 **													
24050.70c	49.517	endf70b	B-VII.0	2004	293.6	432535	33355	150.0	yes	no	yes	no	no
24050.71c	49.517	endf70b	B-VII.0	2004	600.0	420967	31909	150.0	yes	no	yes	no	no
24050.72c	49.517	endf70b	B-VII.0	2004	900.0	413312	30952	150.0	yes	no	yes	no	no
24050.73c	49.517	endf70b	B-VII.0	2004	1200.0	407327	30204	150.0	yes	no	yes	no	no
24050.74c	49.517	endf70b	B-VII.0	2004	2500.0	390816	28140	150.0	yes	no	yes	no	no

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Cr-52 **													
24052.70c	51.494	endf70b	B-VII.0	2004	293.6	367089	23617	150.0	yes	no	yes	no	no
24052.71c	51.494	endf70b	B-VII.0	2004	600.0	364000	23231	150.0	yes	no	yes	no	no
24052.72c	51.494	endf70b	B-VII.0	2004	900.0	361394	22905	150.0	yes	no	yes	no	no
24052.73c	51.494	endf70b	B-VII.0	2004	1200.0	359384	22654	150.0	yes	no	yes	no	no
24052.74c	51.494	endf70b	B-VII.0	2004	2500.0	352376	21778	150.0	yes	no	yes	no	no
** Cr-53 **													
24053.70c	52.486	endf70b	B-VII.0	2004	293.6	300551	15271	150.0	yes	no	yes	no	no
24053.71c	52.486	endf70b	B-VII.0	2004	600.0	296777	14799	150.0	yes	no	yes	no	no
24053.72c	52.486	endf70b	B-VII.0	2004	900.0	294407	14503	150.0	yes	no	yes	no	no
24053.73c	52.486	endf70b	B-VII.0	2004	1200.0	292455	14259	150.0	yes	no	yes	no	no
24053.74c	52.486	endf70b	B-VII.0	2004	2500.0	286991	13576	150.0	yes	no	yes	no	no
** Cr-54 **													
24054.70c	53.476	endf70b	B-VII.0	2004	293.6	273871	15260	150.0	yes	no	yes	no	no
24054.71c	53.476	endf70b	B-VII.0	2004	600.0	272325	15067	150.0	yes	no	yes	no	no
24054.72c	53.476	endf70b	B-VII.0	2004	900.0	271269	14935	150.0	yes	no	yes	no	no
24054.73c	53.476	endf70b	B-VII.0	2004	1200.0	270581	14849	150.0	yes	no	yes	no	no
24054.74c	53.476	endf70b	B-VII.0	2004	2500.0	266877	14386	150.0	yes	no	yes	no	no
Z = 25 ********** manganese **********													
** Mn-55 **													
25055.70c	54.466	endf70b	B-VII.0	2000	293.6	286225	12823	20.0	yes	no	yes	no	no
25055.71c	54.466	endf70b	B-VII.0	2000	600.0	281954	12289	20.0	yes	no	yes	no	no
25055.72c	54.466	endf70b	B-VII.0	2000	900.0	279154	11939	20.0	yes	no	yes	no	no
25055.73c	54.466	endf70b	B-VII.0	2000	1200.0	277490	11731	20.0	yes	no	yes	no	no
25055.74c	54.466	endf70b	B-VII.0	2000	2500.0	272265	11078	20.0	yes	no	yes	no	no
Z = 26 ********** iron **********													
** Fe-54 **													
26054.70c	53.476	endf70b	B-VII.0	2004	293.6	331467	21487	150.0	yes	no	yes	no	no
26054.71c	53.476	endf70b	B-VII.0	2004	600.0	325659	20761	150.0	yes	no	yes	no	no
26054.72c	53.476	endf70b	B-VII.0	2004	900.0	321386	20227	150.0	yes	no	yes	no	no
26054.73c	53.476	endf70b	B-VII.0	2004	1200.0	318186	19827	150.0	yes	no	yes	no	no
26054.74c	53.476	endf70b	B-VII.0	2004	2500.0	309770	18775	150.0	yes	no	yes	no	no
** Fe-56 **													
26056.70c	55.454	endf70b	B-VII.0	2004	293.6	503649	30280	150.0	yes	no	yes	no	no
26056.71c	55.454	endf70b	B-VII.0	2004	600.0	495608	29275	150.0	yes	no	yes	no	no
26056.72c	55.454	endf70b	B-VII.0	2004	900.0	490817	28676	150.0	yes	no	yes	no	no
26056.73c	55.454	endf70b	B-VII.0	2004	1200.0	486385	28122	150.0	yes	no	yes	no	no
26056.74c	55.454	endf70b	B-VII.0	2004	2500.0	475346	26742	150.0	yes	no	yes	no	no

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** Fe-57 **													
26057.70c	56.446	endf70b	B-VII.0	2004	293.6	333360	15925	150.0	yes	no	yes	no	no
26057.71c	56.446	endf70b	B-VII.0	2004	600.0	332480	15815	150.0	yes	no	yes	no	no
26057.72c	56.446	endf70b	B-VII.0	2004	900.0	332338	15797	150.0	yes	no	yes	no	no
26057.73c	56.446	endf70b	B-VII.0	2004	1200.0	332114	15769	150.0	yes	no	yes	no	no
26057.74c	56.446	endf70b	B-VII.0	2004	2500.0	331809	15731	150.0	yes	no	yes	no	no
** Fe-58 **													
26058.70c	57.436	endf70b	B-VII.0	2000	293.6	173142	12025	20.0	yes	no	yes	no	no
26058.71c	57.436	endf70b	B-VII.0	2000	600.0	170973	11754	20.0	yes	no	yes	no	no
26058.72c	57.436	endf70b	B-VII.0	2000	900.0	169214	11534	20.0	yes	no	yes	no	no
26058.73c	57.436	endf70b	B-VII.0	2000	1200.0	168029	11386	20.0	yes	no	yes	no	no
26058.74c	57.436	endf70b	B-VII.0	2000	2500.0	164718	10972	20.0	yes	no	yes	no	no
Z = 27 ********** cobalt **********													
** Co-58 **													
27058.70c	57.438	endf70b	B-VII.0	1992	293.6	20895	1303	20.0	no	no	no	no	no
27058.71c	57.438	endf70b	B-VII.0	1992	600.0	19780	1179	20.0	no	no	no	no	no
27058.72c	57.438	endf70b	B-VII.0	1992	900.0	19428	1140	20.0	no	no	no	no	no
27058.73c	57.438	endf70b	B-VII.0	1992	1200.0	19221	1117	20.0	no	no	no	no	no
27058.74c	57.438	endf70b	B-VII.0	1992	2500.0	18861	1077	20.0	no	no	no	no	no
** Co-59 **													
27059.70c	58.427	endf70b	B-VII.0	1992	293.6	281420	21569	20.0	yes	no	no	no	no
27059.71c	58.427	endf70b	B-VII.0	1992	600.0	276275	20926	20.0	yes	no	no	no	no
27059.72c	58.427	endf70b	B-VII.0	1992	900.0	273090	20528	20.0	yes	no	no	no	no
27059.73c	58.427	endf70b	B-VII.0	1992	1200.0	271523	20332	20.0	yes	no	no	no	no
27059.74c	58.427	endf70b	B-VII.0	1992	2500.0	266450	19698	20.0	yes	no	no	no	no
** Co-58m **													
27458.70c	57.438	endf70b	B-VII.0	1992	293.6	18223	926	20.0	no	no	no	no	no
27458.71c	57.438	endf70b	B-VII.0	1992	600.0	18154	919	20.0	no	no	no	no	no
27458.72c	57.438	endf70b	B-VII.0	1992	900.0	18213	925	20.0	no	no	no	no	no
27458.73c	57.438	endf70b	B-VII.0	1992	1200.0	18133	917	20.0	no	no	no	no	no
27458.74c	57.438	endf70b	B-VII.0	1992	2500.0	18163	920	20.0	no	no	no	no	no
Z = 28 ********** nickel **********													
** Ni-58 **													
28058.70c	57.438	endf70b	B-VII.0	2004	293.6	712488	47427	150.0	yes	no	yes	no	no
28058.71c	57.438	endf70b	B-VII.0	2004	600.0	702384	46164	150.0	yes	no	yes	no	no
28058.72c	57.438	endf70b	B-VII.0	2004	900.0	695673	45325	150.0	yes	no	yes	no	no
28058.73c	57.438	endf70b	B-VII.0	2004	1200.0	689863	44599	150.0	yes	no	yes	no	no
28058.74c	57.438	endf70b	B-VII.0	2004	2500.0	677352	43035	150.0	yes	no	yes	no	no

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Ni-59													
28059.70c	58.428	endf70b	B-VII.0	1992	293.6	66623	2432	20.0	yes	no	no	no	no
28059.71c	58.428	endf70b	B-VII.0	1992	600.0	66505	2423	20.0	yes	no	no	no	no
28059.72c	58.428	endf70b	B-VII.0	1992	900.0	66441	2418	20.0	yes	no	no	no	no
28059.73c	58.428	endf70b	B-VII.0	1992	1200.0	66324	2409	20.0	yes	no	no	no	no
28059.74c	58.428	endf70b	B-VII.0	1992	2500.0	65883	2375	20.0	yes	no	no	no	no
Ni-60													
28060.70c	59.416	endf70b	B-VII.0	2004	293.6	465562	25883	150.0	yes	no	yes	no	no
28060.71c	59.416	endf70b	B-VII.0	2004	600.0	455276	25025	150.0	yes	no	yes	no	no
28060.72c	59.416	endf70b	B-VII.0	2004	900.0	447914	24334	150.0	yes	no	yes	no	no
28060.73c	59.416	endf70b	B-VII.0	2004	1200.0	442240	23861	150.0	yes	no	yes	no	no
28060.74c	59.416	endf70b	B-VII.0	2004	2500.0	426520	22551	150.0	yes	no	yes	no	no
Ni-61													
28061.70c	60.408	endf70b	B-VII.0	2004	293.6	250113	7745	150.0	yes	no	yes	no	no
28061.71c	60.408	endf70b	B-VII.0	2004	600.0	249656	7688	150.0	yes	no	yes	no	no
28061.72c	60.408	endf70b	B-VII.0	2004	900.0	249432	7660	150.0	yes	no	yes	no	no
28061.73c	60.408	endf70b	B-VII.0	2004	1200.0	249048	7612	150.0	yes	no	yes	no	no
28061.74c	60.408	endf70b	B-VII.0	2004	2500.0	248345	7524	150.0	yes	no	yes	no	no
Ni-62													
28062.70c	61.396	endf70b	B-VII.0	2004	293.6	241035	9800	150.0	yes	no	yes	no	no
28062.71c	61.396	endf70b	B-VII.0	2004	600.0	240829	9774	150.0	yes	no	yes	no	no
28062.72c	61.396	endf70b	B-VII.0	2004	900.0	240588	9744	150.0	yes	no	yes	no	no
28062.73c	61.396	endf70b	B-VII.0	2004	1200.0	240363	9716	150.0	yes	no	yes	no	no
28062.74c	61.396	endf70b	B-VII.0	2004	2500.0	239899	9658	150.0	yes	no	yes	no	no
Ni-64													
28064.70c	63.379	endf70b	B-VII.0	2004	293.6	200228	8134	150.0	yes	no	yes	no	no
28064.71c	63.379	endf70b	B-VII.0	2004	600.0	199820	8083	150.0	yes	no	yes	no	no
28064.72c	63.379	endf70b	B-VII.0	2004	900.0	199676	8065	150.0	yes	no	yes	no	no
28064.73c	63.379	endf70b	B-VII.0	2004	1200.0	199444	8036	150.0	yes	Nu	yes	no	no
28064.74c	63.379	endf70b	B-VII.0	2004	2500.0	198973	7977	150.0	yes	no	yes	no	no
Z = 29 ********** copper **********													
Cu-63													
29063.70c	62.389	endf70b	B-VII.0	2004	293.6	357744	25630	150.0	yes	no	yes	no	no
29063.71c	62.389	endf70b	B-VII.0	2004	600.0	348928	24528	150.0	yes	no	yes	no	no
29063.72c	62.389	endf70b	B-VII.0	2004	900.0	342942	23780	150.0	yes	no	yes	no	no
29063.73c	62.389	endf70b	B-VII.0	2004	1200.0	338655	23244	150.0	yes	no	yes	no	no
29063.74c	62.389	endf70b	B-VII.0	2004	2500.0	327903	21900	150.0	yes	no	yes	no	no
Cu-65													

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Cu-65 **													
29065.70c	64.37	endf70b	B-VII.0	2004	293.6	314505	19692	150.0	yes	no	yes	no	no
29065.71c	64.37	endf70b	B-VII.0	2004	600.0	308775	18976	150.0	yes	no	yes	no	no
29065.72c	64.37	endf70b	B-VII.0	2004	900.0	304785	18477	150.0	yes	no	yes	no	no
29065.73c	64.37	endf70b	B-VII.0	2004	1200.0	302359	18174	150.0	yes	no	yes	no	no
29065.74c	64.37	endf70b	B-VII.0	2004	2500.0	295352	17298	150.0	yes	no	yes	no	no
Z = 30 ********** zinc **********													
** Zn-0 **													
30000.70c	64.834	endf70b	B-VII.0	1989	293.6	327274	35389	20.0	no	no	no	no	no
30000.71c	64.834	endf70b	B-VII.0	1989	600.0	302785	32668	20.0	no	no	no	no	no
30000.72c	64.834	endf70b	B-VII.0	1989	900.0	288125	31039	20.0	no	no	no	no	no
30000.73c	64.834	endf70b	B-VII.0	1989	1200.0	278476	29967	20.0	no	no	no	no	no
30000.74c	64.834	endf70b	B-VII.0	1989	2500.0	250514	26860	20.0	no	no	no	no	no
Z = 31 ********** gallium **********													
** Ga-69 **													
31069.70c	68.334	endf70b	B-VII.0	2006	293.6	90099	6410	20.0	no	no	no	no	no
31069.71c	68.334	endf70b	B-VII.0	2006	600.0	88657	6204	20.0	no	no	no	no	no
31069.72c	68.334	endf70b	B-VII.0	2006	900.0	87466	6034	20.0	no	no	no	no	no
31069.73c	68.334	endf70b	B-VII.0	2006	1200.0	86983	5965	20.0	no	no	no	no	no
31069.74c	68.334	endf70b	B-VII.0	2006	2500.0	85557	5761	20.0	no	no	no	no	no
** Ga-71 **													
31071.70c	70.315	endf70b	B-VII.0	2006	293.6	79857	6876	20.0	no	no	no	no	no
31071.71c	70.315	endf70b	B-VII.0	2006	600.0	78199	6639	20.0	no	no	no	no	no
31071.72c	70.315	endf70b	B-VII.0	2006	900.0	76678	6422	20.0	no	no	no	no	no
31071.73c	70.315	endf70b	B-VII.0	2006	1200.0	76343	6374	20.0	no	no	no	no	no
31071.74c	70.315	endf70b	B-VII.0	2006	2500.0	74355	6090	20.0	no	no	no	no	no
Z = 32 ********** germanium **********													
** Ge-70 **													
32070.70c	69.324	endf70b	B-VII.0	2004	293.6	426229	5217	20.0	yes	no	yes	no	yes
32070.71c	69.324	endf70b	B-VII.0	2004	600.0	426221	5216	20.0	yes	no	yes	no	yes
32070.72c	69.324	endf70b	B-VII.0	2004	900.0	426220	5216	20.0	yes	no	yes	no	yes
32070.73c	69.324	endf70b	B-VII.0	2004	1200.0	426220	5216	20.0	yes	no	yes	no	yes
32070.74c	69.324	endf70b	B-VII.0	2004	2500.0	426213	5215	20.0	yes	no	yes	no	yes
** Ge-72 **													
32072.70c	71.304	endf70b	B-VII.0	2004	293.6	255192	4895	20.0	yes	no	yes	no	yes
32072.71c	71.304	endf70b	B-VII.0	2004	600.0	255079	4881	20.0	yes	no	yes	no	yes
32072.72c	71.304	endf70b	B-VII.0	2004	900.0	255039	4876	20.0	yes	no	yes	no	yes
32072.73c	71.304	endf70b	B-VII.0	2004	1200.0	254967	4867	20.0	yes	no	yes	no	yes

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Ge-72 **													
32072.74c	71.304	endf70b	B-VII.0	2004	2500.0	254759	4841	20.0	yes	no	yes	no	yes
** Ge-73 **													
32073.70c	72.297	endf70b	B-VII.0	2004	293.6	631521	14507	20.0	yes	no	yes	no	yes
32073.71c	72.297	endf70b	B-VII.0	2004	600.0	630232	14346	20.0	yes	no	yes	no	yes
32073.72c	72.297	endf70b	B-VII.0	2004	900.0	629121	14207	20.0	yes	no	yes	no	yes
32073.73c	72.297	endf70b	B-VII.0	2004	1200.0	628224	14095	20.0	yes	no	yes	no	yes
32073.74c	72.297	endf70b	B-VII.0	2004	2500.0	626272	13851	20.0	yes	no	yes	no	yes
** Ge-74 **													
32074.70c	73.286	endf70b	B-VII.0	2004	293.6	130027	1874	20.0	yes	no	yes	no	yes
32074.71c	73.286	endf70b	B-VII.0	2004	600.0	129923	1861	20.0	yes	no	yes	no	yes
32074.72c	73.286	endf70b	B-VII.0	2004	900.0	129715	1835	20.0	yes	no	yes	no	yes
32074.73c	73.286	endf70b	B-VII.0	2004	1200.0	129691	1832	20.0	yes	no	yes	no	yes
32074.74c	73.286	endf70b	B-VII.0	2004	2500.0	129291	1782	20.0	yes	no	yes	no	yes
** Ge-76 **													
32076.70c	75.269	endf70b	B-VII.0	2004	293.6	133389	2981	20.0	yes	no	yes	no	yes
32076.71c	75.269	endf70b	B-VII.0	2004	600.0	132805	2908	20.0	yes	no	yes	no	yes
32076.72c	75.269	endf70b	B-VII.0	2004	900.0	132525	2873	20.0	yes	no	yes	no	yes
32076.73c	75.269	endf70b	B-VII.0	2004	1200.0	132293	2844	20.0	yes	no	yes	no	yes
32076.74c	75.269	endf70b	B-VII.0	2004	2500.0	131318	2722	20.0	yes	no	yes	no	yes
Z = 33 ********** arsenic **********													
** As-74 **													
33074.70c	73.289	endf70c	B-VII.0	2006	293.6	275879	1595	20.0	yes	no	yes	no	no
33074.71c	73.289	endf70c	B-VII.0	2006	600.0	275647	1566	20.0	yes	no	yes	no	no
33074.72c	73.289	endf70c	B-VII.0	2006	900.0	275583	1558	20.0	yes	no	yes	no	no
33074.73c	73.289	endf70c	B-VII.0	2006	1200.0	275495	1547	20.0	yes	no	yes	no	no
33074.74c	73.289	endf70c	B-VII.0	2006	2500.0	275063	1493	20.0	yes	no	yes	no	no
** As-75 **													
33075.70c	74.278	endf70c	B-VII.0	2006	293.6	423427	26652	20.0	yes	no	yes	no	yes
33075.71c	74.278	endf70c	B-VII.0	2006	600.0	408419	24776	20.0	yes	no	yes	no	yes
33075.72c	74.278	endf70c	B-VII.0	2006	900.0	399483	23659	20.0	yes	no	yes	no	yes
33075.73c	74.278	endf70c	B-VII.0	2006	1200.0	391539	22666	20.0	yes	no	yes	no	yes
33075.74c	74.278	endf70c	B-VII.0	2006	2500.0	371491	20160	20.0	yes	no	yes	no	yes
Z = 34 ********** selenium **********													
** Se-74 **													
34074.70c	73.288	endf70c	B-VII.0	2006	293.6	77050	5462	20.0	no	no	no	no	yes
34074.71c	73.288	endf70c	B-VII.0	2006	600.0	76510	5385	20.0	no	no	no	no	yes
34074.72c	73.288	endf70c	B-VII.0	2006	900.0	76308	5356	20.0	no	no	no	no	yes

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Se-74 **													
34074.73c	73.288	endf70c	B-VII.0	2006	1200.0	76125	5330	20.0	no	no	no	no	yes
34074.74c	73.288	endf70c	B-VII.0	2006	2500.0	75167	5193	20.0	no	no	no	no	yes
** Se-76 **													
34076.70c	75.267	endf70c	B-VII.0	2006	293.6	134181	7435	20.0	no	no	no	no	yes
34076.71c	75.267	endf70c	B-VII.0	2006	600.0	132884	7250	20.0	no	no	no	no	yes
34076.72c	75.267	endf70c	B-VII.0	2006	900.0	132212	7154	20.0	no	no	no	no	yes
34076.73c	75.267	endf70c	B-VII.0	2006	1200.0	131904	7110	20.0	no	no	no	no	yes
34076.74c	75.267	endf70c	B-VII.0	2006	2500.0	130427	6899	20.0	no	no	no	no	yes
** Se-77 **													
34077.70c	76.259	endf70c	B-VII.0	2006	293.6	154272	10187	20.0	no	no	no	no	yes
34077.71c	76.259	endf70c	B-VII.0	2006	600.0	151359	9771	20.0	no	no	no	no	yes
34077.72c	76.259	endf70c	B-VII.0	2006	900.0	149923	9566	20.0	no	no	no	no	yes
34077.73c	76.259	endf70c	B-VII.0	2006	1200.0	148929	9424	20.0	no	no	no	no	yes
34077.74c	76.259	endf70c	B-VII.0	2006	2500.0	145394	8919	20.0	no	no	no	no	yes
** Se-78 **													
34078.70c	77.248	endf70c	B-VII.0	2006	293.6	98758	6034	20.0	no	no	no	no	yes
34078.71c	77.248	endf70c	B-VII.0	2006	600.0	97953	5919	20.0	no	no	no	no	yes
34078.72c	77.248	endf70c	B-VII.0	2006	900.0	97274	5822	20.0	no	no	no	no	yes
34078.73c	77.248	endf70c	B-VII.0	2006	1200.0	96846	5761	20.0	no	no	no	no	yes
34078.74c	77.248	endf70c	B-VII.0	2006	2500.0	95691	5596	20.0	no	no	no	no	yes
** Se-79 **													
34079.70c	78.24	endf70c	B-VII.0	2006	293.6	106273	2680	20.0	no	no	no	no	no
34079.71c	78.24	endf70c	B-VII.0	2006	600.0	106294	2683	20.0	no	no	no	no	no
34079.72c	78.24	endf70c	B-VII.0	2006	900.0	106230	2674	20.0	no	no	no	no	no
34079.73c	78.24	endf70c	B-VII.0	2006	1200.0	106266	2679	20.0	no	no	no	no	no
34079.74c	78.24	endf70c	B-VII.0	2006	2500.0	106279	2681	20.0	no	no	no	no	no
** Se-80 **													
34080.70c	79.23	endf70c	B-VII.0	2006	293.6	110548	4734	20.0	no	no	no	no	yes
34080.71c	79.23	endf70c	B-VII.0	2006	600.0	110045	4662	20.0	no	no	no	no	yes
34080.72c	79.23	endf70c	B-VII.0	2006	900.0	109870	4637	20.0	no	no	no	no	yes
34080.73c	79.23	endf70c	B-VII.0	2006	1200.0	109632	4603	20.0	no	no	no	no	yes
34080.74c	79.23	endf70c	B-VII.0	2006	2500.0	109009	4514	20.0	no	no	no	no	yes
** Se-82 **													
34082.70c	81.213	endf70c	B-VII.0	2006	293.6	53217	3565	20.0	no	no	no	no	yes
34082.71c	81.213	endf70c	B-VII.0	2006	600.0	52958	3528	20.0	no	no	no	no	yes
34082.72c	81.213	endf70c	B-VII.0	2006	900.0	52882	3517	20.0	no	no	no	no	yes
34082.73c	81.213	endf70c	B-VII.0	2006	1200.0	52840	3511	20.0	no	no	no	no	yes

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
**** Se-82 ******													
34082.74c	81.213	endf70c	B-VII.0	2006	2500.0	52531	3467	20.0	no	no	no	no	yes
Z = 35 ********** bromine **********													
**** Br-79 ******													
35079.70c	78.24	endf70c	B-VII.0	2006	293.6	304182	29414	20.0	no	no	no	no	yes
35079.71c	78.24	endf70c	B-VII.0	2006	600.0	285190	26701	20.0	no	no	no	no	yes
35079.72c	78.24	endf70c	B-VII.0	2006	900.0	274684	25200	20.0	no	no	no	no	yes
35079.73c	78.24	endf70c	B-VII.0	2006	1200.0	266668	24055	20.0	no	no	no	no	yes
35079.74c	78.24	endf70c	B-VII.0	2006	2500.0	246537	21179	20.0	no	no	no	no	yes
**** Br-81 ******													
35081.70c	80.221	endf70c	B-VII.0	2006	293.6	281979	28636	20.0	no	no	no	no	yes
35081.71c	80.221	endf70c	B-VII.0	2006	600.0	270549	27003	20.0	no	no	no	no	yes
35081.72c	80.221	endf70c	B-VII.0	2006	900.0	263919	26056	20.0	no	no	no	no	yes
35081.73c	80.221	endf70c	B-VII.0	2006	1200.0	258236	25244	20.0	no	no	no	no	yes
35081.74c	80.221	endf70c	B-VII.0	2006	2500.0	243340	23116	20.0	no	no	no	no	yes
Z = 36 ********** krypton **********													
**** Kr-78 ******													
36078.70c	77.251	endf70c	B-VII.0	2006	293.6	110012	3948	20.0	no	no	no	no	yes
36078.71c	77.251	endf70c	B-VII.0	2006	600.0	109766	3913	20.0	no	no	no	no	yes
36078.72c	77.251	endf70c	B-VII.0	2006	900.0	109361	3855	20.0	no	no	no	no	yes
36078.73c	77.251	endf70c	B-VII.0	2006	1200.0	109165	3827	20.0	no	no	no	no	yes
36078.74c	77.251	endf70c	B-VII.0	2006	2500.0	108759	3769	20.0	no	no	no	no	yes
**** Kr-80 ******													
36080.70c	79.23	endf70c	B-VII.0	2006	293.6	109117	4019	20.0	no	no	no	no	yes
36080.71c	79.23	endf70c	B-VII.0	2006	600.0	108956	3996	20.0	no	no	no	no	yes
36080.72c	79.23	endf70c	B-VII.0	2006	900.0	108781	3971	20.0	no	no	no	no	yes
36080.73c	79.23	endf70c	B-VII.0	2006	1200.0	108669	3955	20.0	no	no	no	no	yes
36080.74c	79.23	endf70c	B-VII.0	2006	2500.0	108213	3890	20.0	no	no	no	no	yes
**** Kr-82 ******													
36082.70c	81.21	endf70c	B-VII.0	2006	293.6	70033	2875	20.0	no	no	no	no	no
36082.71c	81.21	endf70c	B-VII.0	2006	600.0	69977	2867	20.0	no	no	no	no	no
36082.72c	81.21	endf70c	B-VII.0	2006	900.0	69886	2854	20.0	no	no	no	no	no
36082.73c	81.21	endf70c	B-VII.0	2006	1200.0	69909	2857	20.0	no	no	no	no	no
36082.74c	81.21	endf70c	B-VII.0	2006	2500.0	69628	2817	20.0	no	no	no	no	no
**** Kr-83 ******													
36083.70c	82.202	endf70c	B-VII.0	2006	293.6	62286	1622	20.0	no	no	no	no	yes
36083.71c	82.202	endf70c	B-VII.0	2006	600.0	62070	1598	20.0	no	no	no	no	yes
36083.72c	82.202	endf70c	B-VII.0	2006	900.0	62007	1591	20.0	no	no	no	no	yes

								Emax					
ZAID	**AWR**	**Library Name**	**Source**	**Eval Date**	**Temp (K)**	**Length Words**	**NE**	**(MeV)**	**GPD**	**Nu**	**CP**	**DN**	**UR**
** Kr-83 **													
36083.73c	82.202	endf70c	B-VII.0	2006	1200.0	61963	1586	20.0	no	no	no	no	yes
36083.74c	82.202	endf70c	B-VII.0	2006	2500.0	61458	1530	20.0	no	no	no	no	yes
** Kr-84 **													
36084.70c	83.191	endf70c	B-VII.0	2006	293.6	134121	11916	20.0	no	no	no	no	no
36084.71c	83.191	endf70c	B-VII.0	2006	600.0	131707	11571	20.0	no	no	no	no	no
36084.72c	83.191	endf70c	B-VII.0	2006	900.0	130571	11409	20.0	no	no	no	no	no
36084.73c	83.191	endf70c	B-VII.0	2006	1200.0	129780	11296	20.0	no	no	no	no	no
36084.74c	83.191	endf70c	B-VII.0	2006	2500.0	127120	10916	20.0	no	no	no	no	no
** Kr-85 **													
36085.70c	84.183	endf70c	B-VII.0	2006	293.6	189808	2831	20.0	yes	no	yes	no	yes
36085.71c	84.183	endf70c	B-VII.0	2006	600.0	188760	2700	20.0	yes	no	yes	no	yes
36085.72c	84.183	endf70c	B-VII.0	2006	900.0	188248	2636	20.0	yes	no	yes	no	yes
36085.73c	84.183	endf70c	B-VII.0	2006	1200.0	187992	2604	20.0	yes	no	yes	no	yes
36085.74c	84.183	endf70c	B-VII.0	2006	2500.0	186880	2465	20.0	yes	no	yes	no	yes
** Kr-86 **													
36086.70c	85.173	endf70c	B-VII.0	2006	293.6	137842	14731	20.0	no	no	no	no	no
36086.71c	85.173	endf70c	B-VII.0	2006	600.0	135809	14441	20.0	no	no	no	no	no
36086.72c	85.173	endf70c	B-VII.0	2006	900.0	134696	14282	20.0	no	no	no	no	no
36086.73c	85.173	endf70c	B-VII.0	2006	1200.0	133835	14159	20.0	no	no	no	no	no
36086.74c	85.173	endf70c	B-VII.0	2006	2500.0	130469	13678	20.0	no	no	no	no	no
Z = 37 ********* rubidium *********													
** Rb-85 **													
37085.70c	84.182	endf70c	B-VII.0	2006	293.6	198114	21611	20.0	no	no	no	no	yes
37085.71c	84.182	endf70c	B-VII.0	2006	600.0	188576	20248	20.0	no	no	no	no	yes
37085.72c	84.182	endf70c	B-VII.0	2006	900.0	182911	19439	20.0	no	no	no	no	yes
37085.73c	84.182	endf70c	B-VII.0	2006	1200.0	179118	18897	20.0	no	no	no	no	yes
37085.74c	84.182	endf70c	B-VII.0	2006	2500.0	168301	17352	20.0	no	no	no	no	yes
** Rb-86 **													
37086.70c	85.173	endf70c	B-VII.0	2006	293.6	260560	11769	20.0	yes	no	yes	no	yes
37086.71c	85.173	endf70c	B-VII.0	2006	600.0	254336	10991	20.0	yes	no	yes	no	yes
37086.72c	85.173	endf70c	B-VII.0	2006	900.0	251024	10577	20.0	yes	no	yes	no	yes
37086.73c	85.173	endf70c	B-VII.0	2006	1200.0	248600	10274	20.0	yes	no	yes	no	yes
37086.74c	85.173	endf70c	B-VII.0	2006	2500.0	242224	9477	20.0	yes	no	yes	no	yes
** Rb-87 **													
37087.70c	86.163	endf70c	B-VII.0	2006	293.6	72015	4879	20.0	no	no	no	no	yes
37087.71c	86.163	endf70c	B-VII.0	2006	600.0	71624	4823	20.0	no	no	no	no	yes
37087.72c	86.163	endf70c	B-VII.0	2006	900.0	71455	4799	20.0	no	no	no	no	yes

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Rb-87 **													
37087.73c	86.163	endf70c	B-VII.0	2006	1200.0	71233	4767	20.0	no	no	no	no	yes
37087.74c	86.163	endf70c	B-VII.0	2006	2500.0	70538	4668	20.0	no	no	no	no	yes
Z = 38 ********* strontium *********													
** Sr-84 **													
38084.70c	83.193	endf70c	B-VII.0	2006	293.6	170817	4158	20.0	yes	no	yes	no	yes
38084.71c	83.193	endf70c	B-VII.0	2006	600.0	169592	4005	20.0	yes	no	yes	no	yes
38084.72c	83.193	endf70c	B-VII.0	2006	900.0	168889	3917	20.0	yes	no	yes	no	yes
38084.73c	83.193	endf70c	B-VII.0	2006	1200.0	168488	3867	20.0	yes	no	yes	no	yes
38084.74c	83.193	endf70c	B-VII.0	2006	2500.0	166928	3672	20.0	yes	no	yes	no	yes
** Sr-86 **													
38086.70c	85.171	endf70c	B-VII.0	2006	293.6	91682	7912	20.0	no	no	no	no	yes
38086.71c	85.171	endf70c	B-VII.0	2006	600.0	90556	7751	20.0	no	no	no	no	yes
38086.72c	85.171	endf70c	B-VII.0	2006	900.0	89800	7643	20.0	no	no	no	no	yes
38086.73c	85.171	endf70c	B-VII.0	2006	1200.0	89268	7567	20.0	no	no	no	no	yes
38086.74c	85.171	endf70c	B-VII.0	2006	2500.0	88210	7416	20.0	no	no	no	no	yes
** Sr-87 **													
38087.70c	86.162	endf70c	B-VII.0	2006	293.6	165096	18573	20.0	no	no	no	no	yes
38087.71c	86.162	endf70c	B-VII.0	2006	600.0	157440	17479	20.0	no	no	no	no	yes
38087.72c	86.162	endf70c	B-VII.0	2006	900.0	153295	16887	20.0	no	no	no	no	yes
38087.73c	86.162	endf70c	B-VII.0	2006	1200.0	150222	16448	20.0	no	no	no	no	yes
38087.74c	86.162	endf70c	B-VII.0	2006	2500.0	141282	15171	20.0	no	no	no	no	yes
** Sr-88 **													
38088.70c	87.15	endf70c	B-VII.0	2006	293.6	135476	9510	20.0	no	no	no	no	no
38088.71c	87.15	endf70c	B-VII.0	2006	600.0	133703	9257	20.0	no	no	no	no	no
38088.72c	87.15	endf70c	B-VII.0	2006	900.0	132213	9044	20.0	no	no	no	no	no
38088.73c	87.15	endf70c	B-VII.0	2006	1200.0	131415	8930	20.0	no	no	no	no	no
38088.74c	87.15	endf70c	B-VII.0	2006	2500.0	128698	8542	20.0	no	no	no	no	no
** Sr-89 **													
38089.70c	88.144	endf70c	B-VII.0	2006	293.6	73085	710	20.0	no	no	no	no	yes
38089.71c	88.144	endf70c	B-VII.0	2006	600.0	73044	704	20.0	no	no	no	no	yes
38089.72c	88.144	endf70c	B-VII.0	2006	900.0	73064	707	20.0	no	no	no	no	yes
38089.73c	88.144	endf70c	B-VII.0	2006	1200.0	73080	709	20.0	no	no	no	no	yes
38089.74c	88.144	endf70c	B-VII.0	2006	2500.0	73037	703	20.0	no	no	no	no	yes
** Sr-90 **													
38090.70c	89.135	endf70c	B-VII.0	2006	293.6	46951	2208	20.0	no	no	no	no	yes
38090.71c	89.135	endf70c	B-VII.0	2006	600.0	46924	2204	20.0	no	no	no	no	yes
38090.72c	89.135	endf70c	B-VII.0	2006	900.0	46938	2206	20.0	no	no	no	no	yes

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
					Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD								
** Sr-90 **													
38090.73c	89.135	endf70c	B-VII.0	2006	1200.0	46958	2209	20.0	no	no	no	no	yes
38090.74c	89.135	endf70c	B-VII.0	2006	2500.0	46915	2203	20.0	no	no	no	no	yes
Z = 39 ********* yttrium **********													
** Y-89 **													
39089.70c	88.142	endf70c	B-VII.0:x	2006	293.6	493699	26716	20.0	yes	no	yes	no	no
39089.71c	88.142	endf70c	B-VII.0:x	2006	600.0	487731	25970	20.0	yes	no	yes	no	no
39089.72c	88.142	endf70c	B-VII.0:x	2006	900.0	483563	25449	20.0	yes	no	yes	no	no
39089.73c	88.142	endf70c	B-VII.0:x	2006	1200.0	480484	25064	20.0	yes	no	yes	no	no
39089.74c	88.142	endf70c	B-VII.0:x	2006	2500.0	470731	23845	20.0	yes	no	yes	no	no
** Y-90 **													
39090.70c	89.135	endf70c	B-VII.0	2006	293.6	274027	8758	20.0	yes	no	yes	no	yes
39090.71c	89.135	endf70c	B-VII.0	2006	600.0	274027	8758	20.0	yes	no	yes	no	yes
39090.72c	89.135	endf70c	B-VII.0	2006	900.0	274028	8758	20.0	yes	no	yes	no	yes
39090.73c	89.135	endf70c	B-VII.0	2006	1200.0	274027	8758	20.0	yes	no	yes	no	yes
39090.74c	89.135	endf70c	B-VII.0	2006	2500.0	274027	8758	20.0	yes	no	yes	no	yes
** Y-91 **													
39091.70c	90.126	endf70c	B-VII.0	2006	293.6	97745	2369	20.0	no	no	no	no	yes
39091.71c	90.126	endf70c	B-VII.0	2006	600.0	97750	2370	20.0	no	no	no	no	yes
39091.72c	90.126	endf70c	B-VII.0	2006	900.0	97750	2370	20.0	no	no	no	no	yes
39091.73c	90.126	endf70c	B-VII.0	2006	1200.0	97738	2368	20.0	no	no	no	no	yes
39091.74c	90.126	endf70c	B-VII.0	2006	2500.0	97778	2374	20.0	no	no	no	no	yes
Z = 40 ********* zirconium **********													
** Zr-90 **													
40090.70c	89.132	endf70c	B-VII.0	2006	293.6	206422	4893	20.0	yes	no	yes	no	no
40090.71c	89.132	endf70c	B-VII.0	2006	600.0	205431	4769	20.0	yes	no	yes	no	no
40090.72c	89.132	endf70c	B-VII.0	2006	900.0	205087	4726	20.0	yes	no	yes	no	no
40090.73c	89.132	endf70c	B-VII.0	2006	1200.0	204670	4674	20.0	yes	no	yes	no	no
40090.74c	89.132	endf70c	B-VII.0	2006	2500.0	203598	4540	20.0	yes	no	yes	no	no
** Zr-91 **													
40091.70c	90.125	endf70c	B-VII.0	2006	293.6	220443	15603	20.0	yes	no	yes	no	yes
40091.71c	90.125	endf70c	B-VII.0	2006	600.0	214610	14874	20.0	yes	no	yes	no	yes
40091.72c	90.125	endf70c	B-VII.0	2006	900.0	210405	14348	20.0	yes	no	yes	no	yes
40091.73c	90.125	endf70c	B-VII.0	2006	1200.0	206886	13908	20.0	yes	no	yes	no	yes
40091.74c	90.125	endf70c	B-VII.0	2006	2500.0	200165	13068	20.0	yes	no	yes	no	yes
** Zr-92 **													
40092.70c	91.116	endf70c	B-VII.0	2006	293.6	259297	13996	20.0	yes	no	yes	no	yes
40092.71c	91.116	endf70c	B-VII.0	2006	600.0	255315	13499	20.0	yes	no	yes	no	yes

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Zr-92 **													
40092.72c	91.116	endf70c	B-VII.0	2006	900.0	253374	13256	20.0	yes	no	yes	no	yes
40092.73c	91.116	endf70c	B-VII.0	2006	1200.0	251703	13047	20.0	yes	no	yes	no	yes
40092.74c	91.116	endf70c	B-VII.0	2006	2500.0	247651	12541	20.0	yes	no	yes	no	yes
** Zr-93 **													
40093.70c	92.108	endf70c	B-VII.0	2006	293.6	126929	11717	20.0	no	no	no	no	yes
40093.71c	92.108	endf70c	B-VII.0	2006	600.0	123347	11205	20.0	no	no	no	no	yes
40093.72c	92.108	endf70c	B-VII.0	2006	900.0	121666	10965	20.0	no	no	no	no	yes
40093.73c	92.108	endf70c	B-VII.0	2006	1200.0	119642	10676	20.0	no	no	no	no	yes
40093.74c	92.108	endf70c	B-VII.0	2006	2500.0	116186	10182	20.0	no	no	no	no	yes
** Zr-94 **													
40094.70c	93.1	endf70c	B-VII.0	2006	293.6	230944	13824	20.0	yes	no	no	no	yes
40094.71c	93.1	endf70c	B-VII.0	2006	600.0	227767	13427	20.0	yes	no	no	no	yes
40094.72c	93.1	endf70c	B-VII.0	2006	900.0	225984	13204	20.0	yes	no	no	no	yes
40094.73c	93.1	endf70c	B-VII.0	2006	1200.0	224400	13006	20.0	yes	no	no	no	yes
40094.74c	93.1	endf70c	B-VII.0	2006	2500.0	219888	12442	20.0	yes	no	no	no	yes
** Zr-95 **													
40095.70c	94.093	endf70c	B-VII.0	2006	293.6	76930	2182	20.0	no	no	no	no	yes
40095.71c	94.093	endf70c	B-VII.0	2006	600.0	76928	2182	20.0	no	no	no	no	yes
40095.72c	94.093	endf70c	B-VII.0	2006	900.0	76936	2183	20.0	no	no	no	no	yes
40095.73c	94.093	endf70c	B-VII.0	2006	1200.0	76958	2186	20.0	no	no	no	no	yes
40095.74c	94.093	endf70c	B-VII.0	2006	2500.0	77012	2194	20.0	no	no	no	no	yes
** Zr-96 **													
40096.70c	95.084	endf70c	B-VII.0:x	2006	293.6	178950	8206	20.0	yes	no	yes	no	no
40096.71c	95.084	endf70c	B-VII.0:x	2006	600.0	178022	8090	20.0	yes	no	yes	no	no
40096.72c	95.084	endf70c	B-VII.0:x	2006	900.0	177585	8035	20.0	yes	no	yes	no	no
40096.73c	95.084	endf70c	B-VII.0:x	2006	1200.0	177350	8006	20.0	yes	no	yes	no	no
40096.74c	95.084	endf70c	B-VII.0:x	2006	2500.0	175758	7807	20.0	yes	no	yes	no	no
Z = 41 ********* niobium *********													
** Nb-93 **													
41093.70c	92.105	endf70c	B-VII.0	1997	293.6	403290	26034	150.0	yes	no	yes	no	no
41093.71c	92.105	endf70c	B-VII.0	1997	600.0	379027	24012	150.0	yes	no	yes	no	no
41093.72c	92.105	endf70c	B-VII.0	1997	900.0	365754	22906	150.0	yes	no	yes	no	no
41093.73c	92.105	endf70c	B-VII.0	1997	1200.0	355183	22025	150.0	yes	no	yes	no	no
41093.74c	92.105	endf70c	B-VII.0	1997	2500.0	328794	19826	150.0	yes	no	yes	no	no
** Nb-94 **													
41094.70c	93.101	endf70c	B-VII.0	2006	293.6	113779	3208	20.0	no	no	no	no	no
41094.71c	93.101	endf70c	B-VII.0	2006	600.0	113687	3195	20.0	no	no	no	no	no

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD														
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Nb-94 **													
41094.72c	93.101	endf70c	B-VII.0	2006	900.0	113547	3175	20.0	no	no	no	no	no
41094.73c	93.101	endf70c	B-VII.0	2006	1200.0	113351	3147	20.0	no	no	no	no	no
41094.74c	93.101	endf70c	B-VII.0	2006	2500.0	113277	3136	20.0	no	no	no	no	no
** Nb-95 **													
41095.70c	94.092	endf70c	B-VII.0	2006	293.6	85524	2650	20.0	no	no	no	no	no
41095.71c	94.092	endf70c	B-VII.0	2006	600.0	85586	2659	20.0	no	no	no	no	no
41095.72c	94.092	endf70c	B-VII.0	2006	900.0	85488	2645	20.0	no	no	no	no	no
41095.73c	94.092	endf70c	B-VII.0	2006	1200.0	85517	2649	20.0	no	no	no	no	no
41095.74c	94.092	endf70c	B-VII.0	2006	2500.0	85573	2657	20.0	no	no	no	no	no
Z = 42 ********** molybdenum **********													
** Mo-92 **													
42092.70c	91.117	endf70c	B-VII.0	2006	293.6	263186	14849	20.0	yes	no	yes	no	yes
42092.71c	91.117	endf70c	B-VII.0	2006	600.0	259354	14370	20.0	yes	no	yes	no	yes
42092.72c	91.117	endf70c	B-VII.0	2006	900.0	256010	13952	20.0	yes	no	yes	no	yes
42092.73c	91.117	endf70c	B-VII.0	2006	1200.0	254013	13702	20.0	yes	no	yes	no	yes
42092.74c	91.117	endf70c	B-VII.0	2006	2500.0	249917	13190	20.0	yes	no	yes	no	yes
** Mo-94 **													
42094.70c	93.098	endf70c	B-VII.0	2006	293.6	263373	11770	20.0	yes	no	yes	no	yes
42094.71c	93.098	endf70c	B-VII.0	2006	600.0	260706	11437	20.0	yes	no	yes	no	yes
42094.72c	93.098	endf70c	B-VII.0	2006	900.0	258109	11112	20.0	yes	no	yes	no	yes
42094.73c	93.098	endf70c	B-VII.0	2006	1200.0	256544	10916	20.0	yes	no	yes	no	yes
42094.74c	93.098	endf70c	B-VII.0	2006	2500.0	253378	10520	20.0	yes	no	yes	no	yes
** Mo-95 **													
42095.70c	94.091	endf70c	B-VII.0	2006	293.6	281251	11602	20.0	yes	no	yes	no	yes
42095.71c	94.091	endf70c	B-VII.0	2006	600.0	274542	10931	20.0	yes	no	yes	no	yes
42095.72c	94.091	endf70c	B-VII.0	2006	900.0	270191	10496	20.0	yes	no	yes	no	yes
42095.73c	94.091	endf70c	B-VII.0	2006	1200.0	267491	10226	20.0	yes	no	yes	no	yes
42095.74c	94.091	endf70c	B-VII.0	2006	2500.0	260312	9508	20.0	yes	no	yes	no	yes
** Mo-96 **													
42096.70c	95.081	endf70c	B-VII.0	2006	293.6	279000	14939	20.0	yes	no	yes	no	yes
42096.71c	95.081	endf70c	B-VII.0	2006	600.0	273978	14312	20.0	yes	no	yes	no	yes
42096.72c	95.081	endf70c	B-VII.0	2006	900.0	271466	13998	20.0	yes	no	yes	no	yes
42096.73c	95.081	endf70c	B-VII.0	2006	1200.0	269418	13742	20.0	yes	no	yes	no	yes
42096.74c	95.081	endf70c	B-VII.0	2006	2500.0	264979	13187	20.0	yes	no	yes	no	yes
** Mo-97 **													
42097.70c	96.074	endf70c	B-VII.0:x	2006	293.6	301944	15299	20.0	yes	no	yes	no	yes
42097.71c	96.074	endf70c	B-VII.0:x	2006	600.0	293859	14289	20.0	yes	no	yes	no	yes

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Mo-97 **													
42097.72c	96.074	endf70c	B-VII.0:x	2006	900.0	290150	13824	20.0	yes	no	yes	no	yes
42097.73c	96.074	endf70c	B-VII.0:x	2006	1200.0	286659	13388	20.0	yes	no	yes	no	yes
42097.74c	96.074	endf70c	B-VII.0:x	2006	2500.0	279390	12480	20.0	yes	no	yes	no	yes
** Mo-98 **													
42098.70c	97.064	endf70c	B-VII.0	2006	293.6	328768	22724	20.0	yes	no	yes	no	yes
42098.71c	97.064	endf70c	B-VII.0	2006	600.0	319528	21569	20.0	yes	no	yes	no	yes
42098.72c	97.064	endf70c	B-VII.0	2006	900.0	314288	20914	20.0	yes	no	yes	no	yes
42098.73c	97.064	endf70c	B-VII.0	2006	1200.0	311304	20541	20.0	yes	no	yes	no	yes
42098.74c	97.064	endf70c	B-VII.0	2006	2500.0	302059	19385	20.0	yes	no	yes	no	yes
** Mo-99 **													
42099.70c	98.058	endf70c	B-VII.0	2006	293.6	68519	2220	20.0	no	no	no	no	no
42099.71c	98.058	endf70c	B-VII.0	2006	600.0	68448	2210	20.0	no	no	no	no	no
42099.72c	98.058	endf70c	B-VII.0	2006	900.0	68497	2217	20.0	no	no	no	no	no
42099.73c	98.058	endf70c	B-VII.0	2006	1200.0	68518	2220	20.0	no	no	no	no	no
42099.74c	98.058	endf70c	B-VII.0	2006	2500.0	68449	2210	20.0	no	no	no	no	no
** Mo-100 **													
42100.70c	99.049	endf70c	B-VII.0	2006	293.6	192371	20801	20.0	no	no	no	no	yes
42100.71c	99.049	endf70c	B-VII.0	2006	600.0	184300	19648	20.0	no	no	no	no	yes
42100.72c	99.049	endf70c	B-VII.0	2006	900.0	180529	19109	20.0	no	no	no	no	yes
42100.73c	99.049	endf70c	B-VII.0	2006	1200.0	177582	18688	20.0	no	no	no	no	yes
42100.74c	99.049	endf70c	B-VII.0	2006	2500.0	168026	17323	20.0	no	no	no	no	yes
Z = 43 ********* technetium *********													
** Tc-99 **													
43099.70c	98.057	endf70d	B-VII.0	2006	293.6	733263	53985	20.0	yes	no	yes	no	yes
43099.71c	98.057	endf70d	B-VII.0	2006	600.0	677672	47036	20.0	yes	no	yes	no	yes
43099.72c	98.057	endf70d	B-VII.0	2006	900.0	646047	43083	20.0	yes	no	yes	no	yes
43099.73c	98.057	endf70d	B-VII.0	2006	1200.0	622783	40175	20.0	yes	no	yes	no	yes
43099.74c	98.057	endf70d	B-VII.0	2006	2500.0	563143	32720	20.0	yes	no	yes	no	yes
Z = 44 ********* ruthenium *********													
** Ru-96 **													
44096.70c	95.084	endf70d	B-VII.0	2006	293.6	81356	2691	20.0	no	no	no	no	yes
44096.71c	95.084	endf70d	B-VII.0	2006	600.0	81390	2696	20.0	no	no	no	no	yes
44096.72c	95.084	endf70d	B-VII.0	2006	900.0	81426	2701	20.0	no	no	no	no	yes
44096.73c	95.084	endf70d	B-VII.0	2006	1200.0	81432	2702	20.0	no	no	no	no	yes
44096.74c	95.084	endf70d	B-VII.0	2006	2500.0	81411	2699	20.0	no	no	no	no	yes
** Ru-98 **													
44098.70c	97.064	endf70d	B-VII.0	2006	293.6	80758	2634	20.0	no	no	no	no	yes

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Ru-98 **													
44098.71c	97.064	endf70d	B-VII.0	2006	600.0	80800	2640	20.0	no	no	no	no	yes
44098.72c	97.064	endf70d	B-VII.0	2006	900.0	80821	2643	20.0	no	no	no	no	yes
44098.73c	97.064	endf70d	B-VII.0	2006	1200.0	80837	2645	20.0	no	no	no	no	yes
44098.74c	97.064	endf70d	B-VII.0	2006	2500.0	80828	2644	20.0	no	no	no	no	yes
** Ru-99 **													
44099.70c	98.056	endf70d	B-VII.0	2006	293.6	138675	12235	20.0	no	no	no	no	yes
44099.71c	98.056	endf70d	B-VII.0	2006	600.0	134084	11579	20.0	no	no	no	no	yes
44099.72c	98.056	endf70d	B-VII.0	2006	900.0	130879	11121	20.0	no	no	no	no	yes
44099.73c	98.056	endf70d	B-VII.0	2006	1200.0	128959	10847	20.0	no	no	no	no	yes
44099.74c	98.056	endf70d	B-VII.0	2006	2500.0	123654	10089	20.0	no	no	no	no	yes
** Ru-100 **													
44100.70c	99.046	endf70d	B-VII.0	2006	293.6	176980	15773	20.0	no	no	no	no	yes
44100.71c	99.046	endf70d	B-VII.0	2006	600.0	171730	15023	20.0	no	no	no	no	yes
44100.72c	99.046	endf70d	B-VII.0	2006	900.0	169350	14683	20.0	no	no	no	no	yes
44100.73c	99.046	endf70d	B-VII.0	2006	1200.0	167502	14419	20.0	no	no	no	no	yes
44100.74c	99.046	endf70d	B-VII.0	2006	2500.0	160685	13445	20.0	no	no	no	no	yes
** Ru-101 **													
44101.70c	100.039	endf70d	B-VII.0	2006	293.6	311591	11072	20.0	yes	no	yes	no	yes
44101.71c	100.039	endf70d	B-VII.0	2006	600.0	305319	10288	20.0	yes	no	yes	no	yes
44101.72c	100.039	endf70d	B-VII.0	2006	900.0	301983	9871	20.0	yes	no	yes	no	yes
44101.73c	100.039	endf70d	B-VII.0	2006	1200.0	299735	9590	20.0	yes	no	yes	no	yes
44101.74c	100.039	endf70d	B-VII.0	2006	2500.0	291888	8609	20.0	yes	no	yes	no	yes
** Ru-102 **													
44102.70c	101.03	endf70d	B-VII.0	2006	293.6	204496	21537	20.0	no	no	no	no	yes
44102.71c	101.03	endf70d	B-VII.0	2006	600.0	196441	20386	20.0	no	no	no	no	yes
44102.72c	101.03	endf70d	B-VII.0	2006	900.0	191197	19637	20.0	no	no	no	no	yes
44102.73c	101.03	endf70d	B-VII.0	2006	1200.0	188552	19259	20.0	no	no	no	no	yes
44102.74c	101.03	endf70d	B-VII.0	2006	2500.0	178063	17761	20.0	no	no	no	no	yes
** Ru-103 **													
44103.70c	102.02	endf70d	B-VII.0	2006	293.6	112910	3269	20.0	no	no	no	no	yes
44103.71c	102.02	endf70d	B-VII.0	2006	600.0	112034	3144	20.0	no	no	no	no	yes
44103.72c	102.02	endf70d	B-VII.0	2006	900.0	111440	3059	20.0	no	no	no	no	yes
44103.73c	102.02	endf70d	B-VII.0	2006	1200.0	111096	3010	20.0	no	no	no	no	yes
44103.74c	102.02	endf70d	B-VII.0	2006	2500.0	110523	2928	20.0	no	no	no	no	yes
** Ru-104 **													
44104.70c	103.01	endf70d	B-VII.0	2006	293.6	177676	18459	20.0	no	no	no	no	yes
44104.71c	103.01	endf70d	B-VII.0	2006	600.0	172468	17715	20.0	no	no	no	no	yes

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Ru-104 **													
44104.72c	103.01	endf70d	B-VII.0	2006	900.0	168862	17200	20.0	no	no	no	no	yes
44104.73c	103.01	endf70d	B-VII.0	2006	1200.0	166539	16868	20.0	no	no	no	no	yes
44104.74c	103.01	endf70d	B-VII.0	2006	2500.0	160378	15988	20.0	no	no	no	no	yes
** Ru-105 **													
44105.70c	104.01	endf70d	B-VII.0	2006	293.6	56413	692	20.0	no	no	no	no	no
44105.71c	104.01	endf70d	B-VII.0	2006	600.0	56432	695	20.0	no	no	no	no	no
44105.72c	104.01	endf70d	B-VII.0	2006	900.0	56468	700	20.0	no	no	no	no	no
44105.73c	104.01	endf70d	B-VII.0	2006	1200.0	56482	702	20.0	no	no	no	no	no
44105.74c	104.01	endf70d	B-VII.0	2006	2500.0	56551	712	20.0	no	no	no	no	no
** Ru-106 **													
44106.70c	104.997	endf70d	B-VII.0	2006	293.6	43865	2070	20.0	no	no	no	no	yes
44106.71c	104.997	endf70d	B-VII.0	2006	600.0	43815	2063	20.0	no	no	no	no	yes
44106.72c	104.997	endf70d	B-VII.0	2006	900.0	43844	2067	20.0	no	no	no	no	yes
44106.73c	104.997	endf70d	B-VII.0	2006	1200.0	43885	2073	20.0	no	no	no	no	yes
44106.74c	104.997	endf70d	B-VII.0	2006	2500.0	43816	2063	20.0	no	no	no	no	yes
Z = 45 ********** rhodium **********													
** Rh-103 **													
45103.70c	102.021	endf70d	B-VII.0	2006	293.6	474377	33956	20.0	yes	no	yes	no	yes
45103.71c	102.021	endf70d	B-VII.0	2006	600.0	448177	30681	20.0	yes	no	yes	no	yes
45103.72c	102.021	endf70d	B-VII.0	2006	900.0	432305	28697	20.0	yes	no	yes	no	yes
45103.73c	102.021	endf70d	B-VII.0	2006	1200.0	421202	27309	20.0	yes	no	yes	no	yes
45103.74c	102.021	endf70d	B-VII.0	2006	2500.0	389785	23382	20.0	yes	no	yes	no	yes
** Rh-105 **													
45105.70c	104	endf70d	B-VII.0	2006	293.6	62576	898	20.0	no	no	no	no	yes
45105.71c	104	endf70d	B-VII.0	2006	600.0	62556	895	20.0	no	no	no	no	yes
45105.72c	104	endf70d	B-VII.0	2006	900.0	62533	892	20.0	no	no	no	no	yes
45105.73c	104	endf70d	B-VII.0	2006	1200.0	62492	886	20.0	no	no	no	no	yes
45105.74c	104	endf70d	B-VII.0	2006	2500.0	62472	883	20.0	no	no	no	no	yes
Z = 46 ********** palladium **********													
** Pd-102 **													
46102.70c	101.03	endf70d	B-VII.0	2006	293.6	202748	2102	30.	yes	no	yes	no	no
46102.71c	101.03	endf70d	B-VII.0	2006	600.0	201001	2056	30.	yes	no	yes	no	no
46102.72c	101.03	endf70d	B-VII.0	2006	900.0	198833	1999	30.	yes	no	yes	no	no
46102.73c	101.03	endf70d	B-VII.0	2006	1200.0	197885	1974	30.	yes	no	yes	no	no
46102.74c	101.03	endf70d	B-VII.0	2006	2500.0	197237	1957	30.	yes	no	yes	no	no
** Pd-104 **													
46104.70c	103.011	endf70d	B-VII.0	2006	293.6	711446	18078	30.	yes	no	yes	no	no

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Pd-104 **													
46104.71c	103.011	endf70d	B-VII.0	2006	600.0	672142	16882	30.	yes	no	yes	no	no
46104.72c	103.011	endf70d	B-VII.0	2006	900.0	653530	16318	30.	yes	no	yes	no	no
46104.73c	103.011	endf70d	B-VII.0	2006	1200.0	639175	15883	30.	yes	no	yes	no	no
46104.74c	103.011	endf70d	B-VII.0	2006	2500.0	595186	14550	30.	yes	no	yes	no	no
** Pd-105 **													
46105.70c	104.004	endf70d	B-VII.0	2006	293.6	419831	30143	20.0	yes	no	yes	no	yes
46105.71c	104.004	endf70d	B-VII.0	2006	600.0	393951	26908	20.0	yes	no	yes	no	yes
46105.72c	104.004	endf70d	B-VII.0	2006	900.0	379007	25040	20.0	yes	no	yes	no	yes
46105.73c	104.004	endf70d	B-VII.0	2006	1200.0	367839	23644	20.0	yes	no	yes	no	yes
46105.74c	104.004	endf70d	B-VII.0	2006	2500.0	337207	19815	20.0	yes	no	yes	no	yes
** Pd-106 **													
46106.70c	104.994	endf70d	B-VII.0	2006	293.6	591960	14609	30.	yes	no	yes	no	no
46106.71c	104.994	endf70d	B-VII.0	2006	600.0	569363	13924	30.	yes	no	yes	no	no
46106.72c	104.994	endf70d	B-VII.0	2006	900.0	554317	13461	30.	yes	no	yes	no	no
46106.73c	104.994	endf70d	B-VII.0	2006	1200.0	541587	13054	30.	yes	no	yes	no	no
46106.74c	104.994	endf70d	B-VII.0	2006	2500.0	515245	12234	30.	yes	no	yes	no	no
** Pd-107 **													
46107.70c	105.987	endf70d	B-VII.0	2006	293.6	178630	16132	20.0	no	no	no	no	yes
46107.71c	105.987	endf70d	B-VII.0	2006	600.0	171669	15138	20.0	no	no	no	no	yes
46107.72c	105.987	endf70d	B-VII.0	2006	900.0	167364	14523	20.0	no	no	no	no	yes
46107.73c	105.987	endf70d	B-VII.0	2006	1200.0	164208	14072	20.0	no	no	no	no	yes
46107.74c	105.987	endf70d	B-VII.0	2006	2500.0	154443	12677	20.0	no	no	no	no	yes
** Pd-108 **													
46108.70c	106.977	endf70d	B-VII.0	2006	293.6	580743	14672	30.	yes	no	yes	no	no
46108.71c	106.977	endf70d	B-VII.0	2006	600.0	554485	13876	30.	yes	no	yes	no	no
46108.72c	106.977	endf70d	B-VII.0	2006	900.0	544129	13562	30.	yes	no	yes	no	no
46108.73c	106.977	endf70d	B-VII.0	2006	1200.0	534567	13272	30.	yes	no	yes	no	no
46108.74c	106.977	endf70d	B-VII.0	2006	2500.0	510777	12471	30.	yes	no	yes	no	no
** Pd-110 **													
46110.70c	108.961	endf70d	B-VII.0	2006	293.6	531844	13415	30.	yes	no	yes	no	no
46110.71c	108.961	endf70d	B-VII.0	2006	600.0	513397	12856	30.	yes	no	yes	no	no
46110.72c	108.961	endf70d	B-VII.0	2006	900.0	502507	12526	30.	yes	no	yes	no	no
46110.73c	108.961	endf70d	B-VII.0	2006	1200.0	491058	12179	30.	yes	no	yes	no	no
46110.74c	108.961	endf70d	B-VII.0	2006	2500.0	471215	11562	30.	yes	no	yes	no	no
Z = 47 ********* silver **********													
** Ag-107 **													
47107.70c	105.987	endf70d	B-VII.0	2006	293.6	425868	45545	20.0	yes	no	no	no	yes

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Ag-107 **													
47107.71c	105.987	endf70d	B-VII.0	2006	600.0	388452	40868	20.0	yes	no	no	no	yes
47107.72c	105.987	endf70d	B-VII.0	2006	900.0	364500	37874	20.0	yes	no	no	no	yes
47107.73c	105.987	endf70d	B-VII.0	2006	1200.0	346284	35597	20.0	yes	no	no	no	yes
47107.74c	105.987	endf70d	B-VII.0	2006	2500.0	300468	29870	20.0	yes	no	no	no	yes
** Ag-109 **													
47109.70c	107.969	endf70d	B-VII.0	2006	293.6	500362	39846	20.0	yes	no	yes	no	yes
47109.71c	107.969	endf70d	B-VII.0	2006	600.0	470458	36108	20.0	yes	no	yes	no	yes
47109.72c	107.969	endf70d	B-VII.0	2006	900.0	451370	33722	20.0	yes	no	yes	no	yes
47109.73c	107.969	endf70d	B-VII.0	2006	1200.0	437170	31947	20.0	yes	no	yes	no	yes
47109.74c	107.969	endf70d	B-VII.0	2006	2500.0	401602	27501	20.0	yes	no	yes	no	yes
** Ag-111 **													
47111.70c	109.953	endf70d	B-VII.0	2006	293.6	252633	13254	20.0	yes	no	yes	no	yes
47111.71c	109.953	endf70d	B-VII.0	2006	600.0	245833	12404	20.0	yes	no	yes	no	yes
47111.72c	109.953	endf70d	B-VII.0	2006	900.0	241960	11920	20.0	yes	no	yes	no	yes
47111.73c	109.953	endf70d	B-VII.0	2006	1200.0	238584	11498	20.0	yes	no	yes	no	yes
47111.74c	109.953	endf70d	B-VII.0	2006	2500.0	231232	10579	20.0	yes	no	yes	no	yes
** Ag-110m **													
47510.70c	108.962	endf70d	B-VII.0	2006	293.6	136859	5556	20.0	no	no	no	no	yes
47510.71c	108.962	endf70d	B-VII.0	2006	600.0	136859	5556	20.0	no	no	no	no	yes
47510.72c	108.962	endf70d	B-VII.0	2006	900.0	136860	5556	20.0	no	no	no	no	yes
47510.73c	108.962	endf70d	B-VII.0	2006	1200.0	136861	5556	20.0	no	no	no	no	yes
47510.74c	108.962	endf70d	B-VII.0	2006	2500.0	136861	5556	20.0	no	no	no	no	yes
Z = 48 ********** cadmium **********													
** Cd-106 **													
48106.70c	104.996	endf70d	B-VII.0	2006	293.6	162351	11429	20.0	yes	no	no	no	no
48106.71c	104.996	endf70d	B-VII.0	2006	600.0	158318	10925	20.0	yes	no	no	no	no
48106.72c	104.996	endf70d	B-VII.0	2006	900.0	155607	10586	20.0	yes	no	no	no	no
48106.73c	104.996	endf70d	B-VII.0	2006	1200.0	153815	10362	20.0	yes	Nu	CP	DN	no
48106.74c	104.996	endf70d	B-VII.0	2006	2500.0	148663	9718	20.0	yes	no	no	no	no
** Cd-108 **													
48108.70c	106.977	endf70d	B-VII.0	2006	293.6	105800	10759	20.0	no	no	no	no	yes
48108.71c	106.977	endf70d	B-VII.0	2006	600.0	101003	10226	20.0	no	no	no	no	yes
48108.72c	106.977	endf70d	B-VII.0	2006	900.0	97542	9841	20.0	no	no	no	no	yes
48108.73c	106.977	endf70d	B-VII.0	2006	1200.0	95398	9603	20.0	no	no	no	no	yes
48108.74c	106.977	endf70d	B-VII.0	2006	2500.0	88363	8821	20.0	no	no	no	no	yes
** Cd-110 **													
48110.70c	108.959	endf70d	B-VII.0	2006	293.6	151540	15899	20.0	no	no	no	no	yes

May 29, 2008

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Cd-110 **													
48110.71c	108.959	endf70d	B-VII.0	2006	600.0	144693	15135	20.0	no	no	no	no	yes
48110.72c	108.959	endf70d	B-VII.0	2006	900.0	140205	14633	20.0	no	no	no	no	yes
48110.73c	108.959	endf70d	B-VII.0	2006	1200.0	135460	14103	20.0	no	no	no	no	yes
48110.74c	108.959	endf70d	B-VII.0	2006	2500.0	127383	13200	20.0	no	no	no	no	yes
** Cd-111 **													
48111.70c	109.951	endf70d	B-VII.0	2006	293.6	262831	24227	20.0	yes	no	no	no	yes
48111.71c	109.951	endf70d	B-VII.0	2006	600.0	247992	22372	20.0	yes	no	no	no	yes
48111.72c	109.951	endf70d	B-VII.0	2006	900.0	239831	21352	20.0	yes	no	no	no	yes
48111.73c	109.951	endf70d	B-VII.0	2006	1200.0	233471	20557	20.0	yes	no	no	no	yes
48111.74c	109.951	endf70d	B-VII.0	2006	2500.0	216368	18419	20.0	yes	no	no	no	yes
** Cd-112 **													
48112.70c	110.942	endf70d	B-VII.0	2006	293.6	182703	20483	20.0	no	no	no	no	yes
48112.71c	110.942	endf70d	B-VII.0	2006	600.0	173495	19391	20.0	no	no	no	no	yes
48112.72c	110.942	endf70d	B-VII.0	2006	900.0	168155	18787	20.0	no	no	no	no	yes
48112.73c	110.942	endf70d	B-VII.0	2006	1200.0	162808	18152	20.0	no	no	no	no	yes
48112.74c	110.942	endf70d	B-VII.0	2006	2500.0	151716	16853	20.0	no	no	no	no	yes
** Cd-113 **													
48113.70c	111.93	endf70d	B-VII.0	2006	293.6	467398	48526	20.0	no	no	no	no	yes
48113.71c	111.93	endf70d	B-VII.0	2006	600.0	439357	44520	20.0	no	no	no	no	yes
48113.72c	111.93	endf70d	B-VII.0	2006	900.0	422879	42166	20.0	no	no	no	no	yes
48113.73c	111.93	endf70d	B-VII.0	2006	1200.0	410706	40427	20.0	no	no	no	no	yes
48113.74c	111.93	endf70d	B-VII.0	2006	2500.0	372891	35025	20.0	no	no	no	no	yes
** Cd-114 **													
48114.70c	112.925	endf70d	B-VII.0	2006	293.6	116584	15205	20.0	no	no	no	no	yes
48114.71c	112.925	endf70d	B-VII.0	2006	600.0	112077	14561	20.0	no	no	no	no	yes
48114.72c	112.925	endf70d	B-VII.0	2006	900.0	109744	14228	20.0	no	no	no	no	yes
48114.73c	112.925	endf70d	B-VII.0	2006	1200.0	107638	13927	20.0	no	no	no	no	yes
48114.74c	112.925	endf70d	B-VII.0	2006	2500.0	101849	13100	20.0	no	nu	CP	no	yes
** Cd-116 **													
48116.70c	114.909	endf70d	B-VII.0	2006	293.6	77358	9677	20.0	no	no	no	no	yes
48116.71c	114.909	endf70d	B-VII.0	2006	600.0	74581	9280	20.0	no	no	no	no	yes
48116.72c	114.909	endf70d	B-VII.0	2006	900.0	73038	9060	20.0	no	no	no	no	yes
48116.73c	114.909	endf70d	B-VII.0	2006	1200.0	72221	8943	20.0	no	no	no	no	yes
48116.74c	114.909	endf70d	B-VII.0	2006	2500.0	68965	8478	20.0	no	no	no	no	yes
** Cd-115m **													
48515.70c	113.918	endf70d	B-VII.0	2006	293.6	220366	5409	20.0	yes	no	yes	no	yes
48515.71c	113.918	endf70d	B-VII.0	2006	600.0	217990	5112	20.0	yes	no	yes	no	yes

May 29, 2008

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Cd-115m **													
48515.72c	113.918	endf70d	B-VII.0	2006	900.0	216711	4952	20.0	yes	no	yes	no	yes
48515.73c	113.918	endf70d	B-VII.0	2006	1200.0	215527	4804	20.0	yes	no	yes	no	yes
48515.74c	113.918	endf70d	B-VII.0	2006	2500.0	213294	4525	20.0	yes	no	yes	no	yes
Z = 49 ********* indium *********													
** In-113 **													
49113.70c	111.934	endf70e	B-VII.0	2006	293.6	178861	13103	20.0	no	no	no	no	yes
49113.71c	111.934	endf70e	B-VII.0	2006	600.0	172610	12210	20.0	no	no	no	no	yes
49113.72c	111.934	endf70e	B-VII.0	2006	900.0	168732	11656	20.0	no	no	no	no	yes
49113.73c	111.934	endf70e	B-VII.0	2006	1200.0	166226	11298	20.0	no	no	no	no	yes
49113.74c	111.934	endf70e	B-VII.0	2006	2500.0	160513	10482	20.0	no	no	no	no	yes
** In-115 **													
49115.70c	113.917	endf70e	B-VII.0	2006	293.6	288239	33105	20.0	no	no	no	no	yes
49115.71c	113.917	endf70e	B-VII.0	2006	600.0	263992	29641	20.0	no	no	no	no	yes
49115.72c	113.917	endf70e	B-VII.0	2006	900.0	249881	27625	20.0	no	no	no	no	yes
49115.73c	113.917	endf70e	B-VII.0	2006	1200.0	239023	26074	20.0	no	no	no	no	yes
49115.74c	113.917	endf70e	B-VII.0	2006	2500.0	210343	21977	20.0	no	no	no	no	yes
Z = 50 ********* tin *********													
** Sn-112 **													
50112.70c	110.944	endf70e	B-VII.0	2006	293.6	123333	6515	20.0	no	no	no	no	yes
50112.71c	110.944	endf70e	B-VII.0	2006	600.0	122402	6382	20.0	no	no	no	no	yes
50112.72c	110.944	endf70e	B-VII.0	2006	900.0	121282	6222	20.0	no	no	no	no	yes
50112.73c	110.944	endf70e	B-VII.0	2006	1200.0	120653	6132	20.0	no	no	no	no	yes
50112.74c	110.944	endf70e	B-VII.0	2006	2500.0	119302	5939	20.0	no	no	no	no	yes
** Sn-113 **													
50113.70c	111.935	endf70e	B-VII.0	2006	293.6	555628	8131	20.0	yes	no	yes	no	yes
50113.71c	111.935	endf70e	B-VII.0	2006	600.0	555395	8102	20.0	yes	no	yes	no	yes
50113.72c	111.935	endf70e	B-VII.0	2006	900.0	554963	8048	20.0	yes	no	yes	no	yes
50113.73c	111.935	endf70e	B-VII.0	2006	1200.0	554931	8044	20.0	yes	no	yes	no	yes
50113.74c	111.935	endf70e	B-VII.0	2006	2500.0	554467	7986	20.0	yes	no	yes	no	yes
** Sn-114 **													
50114.70c	112.925	endf70e	B-VII.0	2006	293.6	127403	6230	20.0	no	no	no	no	yes
50114.71c	112.925	endf70e	B-VII.0	2006	600.0	126191	6057	20.0	no	no	no	no	yes
50114.72c	112.925	endf70e	B-VII.0	2006	900.0	125437	5949	20.0	no	no	no	no	yes
50114.73c	112.925	endf70e	B-VII.0	2006	1200.0	125072	5897	20.0	no	no	no	no	yes
50114.74c	112.925	endf70e	B-VII.0	2006	2500.0	123553	5680	20.0	no	no	no	no	yes
** Sn-115 **													
50115.70c	113.916	endf70e	B-VII.0	2006	293.6	91804	4127	20.0	no	no	no	no	yes

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Sn-115 **													
50115.71c	113.916	endf70e	B-VII.0	2006	600.0	91053	4020	20.0	no	no	no	no	yes
50115.72c	113.916	endf70e	B-VII.0	2006	900.0	91047	4019	20.0	no	no	no	no	yes
50115.73c	113.916	endf70e	B-VII.0	2006	1200.0	90907	3999	20.0	no	no	no	no	yes
50115.74c	113.916	endf70e	B-VII.0	2006	2500.0	90339	3918	20.0	no	no	no	no	yes
** Sn-116 **													
50116.70c	114.906	endf70e	B-VII.0	2006	293.6	262901	31332	20.0	no	no	no	no	yes
50116.71c	114.906	endf70e	B-VII.0	2006	600.0	251056	29640	20.0	no	no	no	no	yes
50116.72c	114.906	endf70e	B-VII.0	2006	900.0	242901	28475	20.0	no	no	no	no	yes
50116.73c	114.906	endf70e	B-VII.0	2006	1200.0	237611	27719	20.0	no	no	no	no	yes
50116.74c	114.906	endf70e	B-VII.0	2006	2500.0	221973	25485	20.0	no	no	no	no	yes
** Sn-117 **													
50117.70c	115.899	endf70e	B-VII.0	2006	293.6	146053	13050	20.0	no	no	no	no	yes
50117.71c	115.899	endf70e	B-VII.0	2006	600.0	141231	12361	20.0	no	no	no	no	yes
50117.72c	115.899	endf70e	B-VII.0	2006	900.0	138626	11989	20.0	no	no	no	no	yes
50117.73c	115.899	endf70e	B-VII.0	2006	1200.0	136519	11688	20.0	no	no	no	no	yes
50117.74c	115.899	endf70e	B-VII.0	2006	2500.0	131984	11040	20.0	no	no	no	no	yes
** Sn-118 **													
50118.70c	116.889	endf70e	B-VII.0	2006	293.6	71046	4751	20.0	no	no	no	no	yes
50118.71c	116.889	endf70e	B-VII.0	2006	600.0	70382	4656	20.0	no	no	no	no	yes
50118.72c	116.889	endf70e	B-VII.0	2006	900.0	69961	4596	20.0	no	no	no	no	yes
50118.73c	116.889	endf70e	B-VII.0	2006	1200.0	69766	4568	20.0	no	no	no	no	yes
50118.74c	116.889	endf70e	B-VII.0	2006	2500.0	69138	4478	20.0	no	no	no	no	yes
** Sn-119 **													
50119.70c	117.882	endf70e	B-VII.0	2006	293.6	122631	7315	20.0	no	no	no	no	yes
50119.71c	117.882	endf70e	B-VII.0	2006	600.0	120790	7052	20.0	no	no	no	no	yes
50119.72c	117.882	endf70e	B-VII.0	2006	900.0	119922	6928	20.0	no	no	no	no	yes
50119.73c	117.882	endf70e	B-VII.0	2006	1200.0	119314	6841	20.0	no	no	no	no	yes
50119.74c	117.882	endf70e	B-VII.0	2006	2500.0	117257	6547	20.0	no	no	no	no	yes
** Sn-120 **													
50120.70c	118.872	endf70e	B-VII.0	2006	293.6	233817	26210	20.0	no	no	no	no	yes
50120.71c	118.872	endf70e	B-VII.0	2006	600.0	223462	24731	20.0	no	no	no	no	yes
50120.72c	118.872	endf70e	B-VII.0	2006	900.0	218179	23976	20.0	no	no	no	no	yes
50120.73c	118.872	endf70e	B-VII.0	2006	1200.0	214327	23426	20.0	no	no	no	no	yes
50120.74c	118.872	endf70e	B-VII.0	2006	2500.0	203261	21845	20.0	no	no	no	no	yes
Z = 50 ********** tin **********													
** Sn-122 **													
50122.70c	120.856	endf70e	B-VII.0	2006	293.6	360443	46287	20.0	no	no	no	no	no
50122.71c	120.856	endf70e	B-VII.0	2006	600.0	344401	43995	20.0	no	no	no	no	no

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

Z = 50 ********** tin **********
** Sn-122 **

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
50122.72c	120.856	endf70e	B-VII.0	2006	900.0	335894	42780	20.0	no	no	no	no	no
50122.73c	120.856	endf70e	B-VII.0	2006	1200.0	329504	41867	20.0	no	no	no	no	no
50122.74c	120.856	endf70e	B-VII.0	2006	2500.0	311130	39242	20.0	no	no	no	no	no

** Sn-123 **

50123.70c	121.85	endf70e	B-VII.0	2006	293.6	57753	2304	20.0	no	no	no	no	no
50123.71c	121.85	endf70e	B-VII.0	2006	600.0	57830	2315	20.0	no	no	no	no	no
50123.72c	121.85	endf70e	B-VII.0	2006	900.0	57844	2317	20.0	no	no	no	no	no
50123.73c	121.85	endf70e	B-VII.0	2006	1200.0	57816	2313	20.0	no	no	no	no	no
50123.74c	121.85	endf70e	B-VII.0	2006	2500.0	57868	2320	20.0	no	no	no	no	no

** Sn-124 **

50124.70c	122.841	endf70e	B-VII.0	2006	293.6	237923	26339	20.0	no	no	no	no	no
50124.71c	122.841	endf70e	B-VII.0	2006	600.0	230939	25341	20.0	no	no	no	no	no
50124.72c	122.841	endf70e	B-VII.0	2006	900.0	227549	24857	20.0	no	no	no	no	no
50124.73c	122.841	endf70e	B-VII.0	2006	1200.0	223959	24344	20.0	no	no	no	no	no
50124.74c	122.841	endf70e	B-VII.0	2006	2500.0	215062	23073	20.0	no	no	no	no	no

** Sn-125 **

50125.70c	123.835	endf70e	B-VII.0	2006	293.6	174342	3566	20.0	yes	no	yes	no	yes
50125.71c	123.835	endf70e	B-VII.0	2006	600.0	173198	3423	20.0	yes	no	yes	no	yes
50125.72c	123.835	endf70e	B-VII.0	2006	900.0	172566	3344	20.0	yes	no	yes	no	yes
50125.73c	123.835	endf70e	B-VII.0	2006	1200.0	171814	3250	20.0	yes	no	yes	no	yes
50125.74c	123.835	endf70e	B-VII.0	2006	2500.0	171054	3155	20.0	yes	no	yes	no	yes

** Sn-126 **

50126.70c	124.826	endf70e	B-VII.0	2006	293.6	42673	1901	20.0	no	no	no	no	no
50126.71c	124.826	endf70e	B-VII.0	2006	600.0	42723	1908	20.0	no	no	no	no	no
50126.72c	124.826	endf70e	B-VII.0	2006	900.0	42717	1907	20.0	no	no	no	no	no
50126.73c	124.826	endf70e	B-VII.0	2006	1200.0	42666	1900	20.0	no	no	no	no	no
50126.74c	124.826	endf70e	B-VII.0	2006	2500.0	42716	1907	20.0	no	no	no	no	no

Z = 51 ********** antimony **********
** Sb-121 **

51121.70c	119.87	endf70e	B-VII.0	2006	293.6	287205	32796	20.0	no	no	no	no	yes
51121.71c	119.87	endf70e	B-VII.0	2006	600.0	271119	30498	20.0	no	no	no	no	yes
51121.72c	119.87	endf70e	B-VII.0	2006	900.0	261002	29053	20.0	no	no	no	no	yes
51121.73c	119.87	endf70e	B-VII.0	2006	1200.0	254389	28108	20.0	no	no	no	no	yes
51121.74c	119.87	endf70e	B-VII.0	2006	2500.0	234032	25200	20.0	no	no	no	no	yes

** Sb-123 **

51123.70c	121.85	endf70e	B-VII.0	2006	293.6	259196	30580	20.0	no	no	no	no	yes

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Sb-123 **													
51123.71c	121.85	endf70e	B-VII.0	2006	600.0	245050	28559	20.0	no	no	no	no	yes
51123.72c	121.85	endf70e	B-VII.0	2006	900.0	236937	27400	20.0	no	no	no	no	yes
51123.73c	121.85	endf70e	B-VII.0	2006	1200.0	230503	26481	20.0	no	no	no	no	yes
51123.74c	121.85	endf70e	B-VII.0	2006	2500.0	212402	23895	20.0	no	no	no	no	yes
** Sb-124 **													
51124.70c	122.842	endf70e	B-VII.0	2006	293.6	57089	2632	20.0	no	no	no	no	yes
51124.71c	122.842	endf70e	B-VII.0	2006	600.0	57061	2628	20.0	no	no	no	no	yes
51124.72c	122.842	endf70e	B-VII.0	2006	900.0	57089	2632	20.0	no	no	no	no	yes
51124.73c	122.842	endf70e	B-VII.0	2006	1200.0	57082	2631	20.0	no	no	no	no	yes
51124.74c	122.842	endf70e	B-VII.0	2006	2500.0	57049	2626	20.0	no	no	no	no	yes
** Sb-125 **													
51125.70c	123.832	endf70e	B-VII.0	2006	293.6	103975	2663	20.0	no	no	no	no	no
51125.71c	123.832	endf70e	B-VII.0	2006	600.0	103940	2658	20.0	no	no	no	no	no
51125.72c	123.832	endf70e	B-VII.0	2006	900.0	103982	2664	20.0	no	no	no	no	no
51125.73c	123.832	endf70e	B-VII.0	2006	1200.0	103967	2662	20.0	no	no	no	no	no
51125.74c	123.832	endf70e	B-VII.0	2006	2500.0	103939	2658	20.0	no	no	no	no	no
** Sb-126 **													
51126.70c	124.826	endf70e	B-VII.0	2006	293.6	293262	16632	20.0	yes	no	yes	no	yes
51126.71c	124.826	endf70e	B-VII.0	2006	600.0	281078	15109	20.0	yes	no	yes	no	yes
51126.72c	124.826	endf70e	B-VII.0	2006	900.0	274326	14265	20.0	yes	no	yes	no	yes
51126.73c	124.826	endf70e	B-VII.0	2006	1200.0	268422	13527	20.0	yes	no	yes	no	yes
51126.74c	124.826	endf70e	B-VII.0	2006	2500.0	255719	11939	20.0	yes	no	yes	no	yes
Z = 52 ********** tellurium **********													
** Te-120 **													
52120.70c	118.874	endf70e	B-VII.0	2006	293.6	71922	2727	20.0	no	no	no	no	yes
52120.71c	118.874	endf70e	B-VII.0	2006	600.0	71965	2733	20.0	no	no	no	no	yes
52120.72c	118.874	endf70e	B-VII.0	2006	900.0	71998	2738	20.0	no	no	no	no	yes
52120.73c	118.874	endf70e	B-VII.0	2006	1200.0	72012	2740	20.0	no	Nu	no	no	yes
52120.74c	118.874	endf70e	B-VII.0	2006	2500.0	71998	2738	20.0	no	no	no	no	yes
** Te-122 **													
52122.70c	120.856	endf70e	B-VII.0	2006	293.6	301100	37566	20.0	no	no	no	no	yes
52122.71c	120.856	endf70e	B-VII.0	2006	600.0	286668	35504	20.0	no	no	no	no	yes
52122.72c	120.856	endf70e	B-VII.0	2006	900.0	276629	34070	20.0	no	no	no	no	yes
52122.73c	120.856	endf70e	B-VII.0	2006	1200.0	269063	32989	20.0	no	no	no	no	yes
52122.74c	120.856	endf70e	B-VII.0	2006	2500.0	249667	30218	20.0	no	no	no	no	yes
** Te-123 **													
52123.70c	121.848	endf70e	B-VII.0	2006	293.6	187718	14347	20.0	no	no	no	no	yes

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD														
** Te-123 **														
52123.71c	121.848	endf70e	B-VII.0	2006	600.0	181741	13683	20.0	no	no	no	no	yes
52123.72c	121.848	endf70e	B-VII.0	2006	900.0	177431	13204	20.0	no	no	no	no	yes
52123.73c	121.848	endf70e	B-VII.0	2006	1200.0	174974	12931	20.0	no	no	no	no	yes
52123.74c	121.848	endf70e	B-VII.0	2006	2500.0	168044	12161	20.0	no	no	no	no	yes
** Te-124 **														
52124.70c	122.839	endf70e	B-VII.0	2006	293.6	235499	25990	20.0	no	no	no	no	yes
52124.71c	122.839	endf70e	B-VII.0	2006	600.0	224074	24358	20.0	no	no	no	no	yes
52124.72c	122.839	endf70e	B-VII.0	2006	900.0	217942	23482	20.0	no	no	no	no	yes
52124.73c	122.839	endf70e	B-VII.0	2006	1200.0	212658	22727	20.0	no	no	no	no	yes
52124.74c	122.839	endf70e	B-VII.0	2006	2500.0	199562	20856	20.0	no	no	no	no	yes
** Te-125 **														
52125.70c	123.831	endf70e	B-VII.0	2006	293.6	322126	37079	20.0	no	no	no	no	yes
52125.71c	123.831	endf70e	B-VII.0	2006	600.0	301406	34119	20.0	no	no	no	no	yes
52125.72c	123.831	endf70e	B-VII.0	2006	900.0	288289	32245	20.0	no	no	no	no	yes
52125.73c	123.831	endf70e	B-VII.0	2006	1200.0	278481	30844	20.0	no	no	no	no	yes
52125.74c	123.831	endf70e	B-VII.0	2006	2500.0	253029	27208	20.0	no	no	no	no	yes
** Te-126 **														
52126.70c	124.821	endf70e	B-VII.0	2006	293.6	134252	12402	20.0	no	no	no	no	yes
52126.71c	124.821	endf70e	B-VII.0	2006	600.0	130626	11884	20.0	no	no	no	no	yes
52126.72c	124.821	endf70e	B-VII.0	2006	900.0	129339	11700	20.0	no	no	no	no	yes
52126.73c	124.821	endf70e	B-VII.0	2006	1200.0	128029	11513	20.0	no	no	no	no	yes
52126.74c	124.821	endf70e	B-VII.0	2006	2500.0	124300	10980	20.0	no	no	no	no	yes
** Te-128 **														
52128.70c	126.805	endf70e	B-VII.0	2006	293.6	111708	10210	20.0	no	no	no	no	yes
52128.71c	126.805	endf70e	B-VII.0	2006	600.0	108719	9783	20.0	no	no	no	no	yes
52128.72c	126.805	endf70e	B-VII.0	2006	900.0	107530	9613	20.0	no	no	no	no	yes
52128.73c	126.805	endf70e	B-VII.0	2006	1200.0	106514	9468	20.0	no	no	no	no	yes
52128.74c	126.805	endf70e	B-VII.0	2006	2500.0	103666	9061	20.0	no	no	no	no	yes
** Te-130 **														
52130.70c	128.79	endf70e	B-VII.0	2006	293.6	79906	5312	20.0	no	no	no	no	yes
52130.71c	128.79	endf70e	B-VII.0	2006	600.0	79138	5202	20.0	no	no	no	no	yes
52130.72c	128.79	endf70e	B-VII.0	2006	900.0	77983	5037	20.0	no	no	no	no	yes
52130.73c	128.79	endf70e	B-VII.0	2006	1200.0	77680	4994	20.0	no	no	no	no	yes
52130.74c	128.79	endf70e	B-VII.0	2006	2500.0	76344	4803	20.0	no	no	no	no	yes
** Te-132 **														
52132.70c	130.775	endf70e	B-VII.0	2006	293.6	264084	5510	20.0	yes	no	yes	no	yes
52132.71c	130.775	endf70e	B-VII.0	2006	600.0	263052	5381	20.0	yes	no	yes	no	yes

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Te-132 **													
52132.72c	130.775	endf70e	B-VII.0	2006	900.0	262004	5250	20.0	yes	no	yes	no	yes
52132.73c	130.775	endf70e	B-VII.0	2006	1200.0	261373	5171	20.0	yes	no	yes	no	yes
52132.74c	130.775	endf70e	B-VII.0	2006	2500.0	259836	4979	20.0	yes	no	yes	no	yes
** Te-127m **													
52527.70c	125.815	endf70e	B-VII.0	2006	293.6	82091	2510	20.0	no	no	no	no	yes
52527.71c	125.815	endf70e	B-VII.0	2006	600.0	82093	2510	20.0	no	no	no	no	yes
52527.72c	125.815	endf70e	B-VII.0	2006	900.0	82091	2510	20.0	no	no	no	no	yes
52527.73c	125.815	endf70e	B-VII.0	2006	1200.0	82093	2510	20.0	no	no	no	no	yes
52527.74c	125.815	endf70e	B-VII.0	2006	2500.0	82094	2510	20.0	no	no	no	no	yes
** Te-129m **													
52529.70c	127.8	endf70e	B-VII.0	2006	293.6	95255	2491	20.0	no	no	no	no	yes
52529.71c	127.8	endf70e	B-VII.0	2006	600.0	95255	2491	20.0	no	no	no	no	yes
52529.72c	127.8	endf70e	B-VII.0	2006	900.0	95256	2491	20.0	no	no	no	no	yes
52529.73c	127.8	endf70e	B-VII.0	2006	1200.0	95255	2491	20.0	no	no	no	no	yes
52529.74c	127.8	endf70e	B-VII.0	2006	2500.0	95256	2491	20.0	no	no	no	no	yes
Z = 53 ********* iodine *********													
** I-127 **													
53127.70c	125.814	endf70e	B-VII.0	2006	293.6	1304547	54463	30.	yes	no	yes	no	no
53127.71c	125.814	endf70e	B-VII.0	2006	600.0	1257255	52211	30.	yes	no	yes	no	no
53127.72c	125.814	endf70e	B-VII.0	2006	900.0	1227162	50778	30.	yes	no	yes	no	no
53127.73c	125.814	endf70e	B-VII.0	2006	1200.0	1200870	49526	30.	yes	no	yes	no	no
53127.74c	125.814	endf70e	B-VII.0	2006	2500.0	1146165	46921	30.	yes	no	yes	no	no
** I-129 **													
53129.70c	127.798	endf70e	B-VII.0	2006	293.6	220300	22221	20.0	no	no	no	no	yes
53129.71c	127.798	endf70e	B-VII.0	2006	600.0	209609	20694	20.0	no	no	no	no	yes
53129.72c	127.798	endf70e	B-VII.0	2006	900.0	203547	19828	20.0	no	no	no	no	yes
53129.73c	127.798	endf70e	B-VII.0	2006	1200.0	198703	19136	20.0	no	no	no	no	yes
53129.74c	127.798	endf70e	B-VII.0	2006	2500.0	185794	17292	20.0	no	Nu	no	no	yes
** I-130 **													
53130.70c	128.791	endf70e	B-VII.0	2006	293.6	353051	14974	20.0	yes	no	yes	no	yes
53130.71c	128.791	endf70e	B-VII.0	2006	600.0	352171	14864	20.0	yes	no	yes	no	yes
53130.72c	128.791	endf70e	B-VII.0	2006	900.0	351483	14778	20.0	yes	no	yes	no	yes
53130.73c	128.791	endf70e	B-VII.0	2006	1200.0	351107	14731	20.0	yes	no	yes	no	yes
53130.74c	128.791	endf70e	B-VII.0	2006	2500.0	350435	14647	20.0	yes	no	yes	no	yes
** I-131 **													
53131.70c	129.781	endf70e	B-VII.0	2006	293.6	78021	2605	20.0	no	no	no	no	no
53131.71c	129.781	endf70e	B-VII.0	2006	600.0	77972	2598	20.0	no	no	no	no	no

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** I-131 **
53131.72c	129.781	endf70e	B-VII.0	2006	900.0	78014	2604	20.0	no	no	no	no	no
53131.73c	129.781	endf70e	B-VII.0	2006	1200.0	78007	2603	20.0	no	no	no	no	no
53131.74c	129.781	endf70e	B-VII.0	2006	2500.0	77966	2597	20.0	no	no	no	no	no
** I-135 **
53135.70c	133.75	endf70e	B-VII.0	2005	293.6	34224	668	20.0	no	no	no	no	no
53135.71c	133.75	endf70e	B-VII.0	2005	600.0	34224	668	20.0	no	no	no	no	no
53135.72c	133.75	endf70e	B-VII.0	2005	900.0	34222	668	20.0	no	no	no	no	no
53135.73c	133.75	endf70e	B-VII.0	2005	1200.0	34223	668	20.0	no	no	no	no	no
53135.74c	133.75	endf70e	B-VII.0	2005	2500.0	34223	668	20.0	no	no	no	no	no
Z = 54 ********** xenon **********
** Xe-123 **
54123.70c	121.85	endf70f	B-VII.0	2000	293.6	65739	589	20.0	no	no	no	no	no
54123.71c	121.85	endf70f	B-VII.0	2000	600.0	65741	589	20.0	no	no	no	no	no
54123.72c	121.85	endf70f	B-VII.0	2000	900.0	65739	589	20.0	no	no	no	no	no
54123.73c	121.85	endf70f	B-VII.0	2000	1200.0	65739	589	20.0	no	no	no	no	no
54123.74c	121.85	endf70f	B-VII.0	2000	2500.0	65740	589	20.0	no	no	no	no	no
** Xe-124 **
54124.70c	122.84	endf70f	B-VII.0	2006	293.6	67839	2371	20.0	no	no	no	no	yes
54124.71c	122.84	endf70f	B-VII.0	2006	600.0	67636	2342	20.0	no	no	no	no	yes
54124.72c	122.84	endf70f	B-VII.0	2006	900.0	67418	2311	20.0	no	no	no	no	yes
54124.73c	122.84	endf70f	B-VII.0	2006	1200.0	66986	2249	20.0	no	no	no	no	yes
54124.74c	122.84	endf70f	B-VII.0	2006	2500.0	66264	2146	20.0	no	no	no	no	yes
** Xe-126 **
54126.70c	124.822	endf70f	B-VII.0	2006	293.6	88042	4002	20.0	no	no	no	no	yes
54126.71c	124.822	endf70f	B-VII.0	2006	600.0	87504	3925	20.0	no	no	no	no	yes
54126.72c	124.822	endf70f	B-VII.0	2006	900.0	87260	3890	20.0	no	no	no	no	yes
54126.73c	124.822	endf70f	B-VII.0	2006	1200.0	87112	3869	20.0	no	no	no	no	yes
54126.74c	124.822	endf70f	B-VII.0	2006	2500.0	86636	3801	20.0	no	Nu	CP	no	yes
** Xe-128 **
54128.70c	126.804	endf70f	B-VII.0	2006	293.6	117849	6920	20.0	no	no	no	no	yes
54128.71c	126.804	endf70f	B-VII.0	2006	600.0	116604	6742	20.0	no	no	no	no	yes
54128.72c	126.804	endf70f	B-VII.0	2006	900.0	115351	6563	20.0	no	no	no	no	yes
54128.73c	126.804	endf70f	B-VII.0	2006	1200.0	114525	6445	20.0	no	no	no	no	yes
54128.74c	126.804	endf70f	B-VII.0	2006	2500.0	112720	6187	20.0	no	no	no	no	yes
** Xe-129 **
54129.70c	127.798	endf70f	B-VII.0	2006	293.6	202319	19174	20.0	no	no	no	no	yes
54129.71c	127.798	endf70f	B-VII.0	2006	600.0	194691	18084	20.0	no	no	no	no	yes

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Xe-129 **													
54129.72c	127.798	endf70f	B-VII.0	2006	900.0	190813	17530	20.0	no	no	no	no	yes
54129.73c	127.798	endf70f	B-VII.0	2006	1200.0	187277	17025	20.0	no	no	no	no	yes
54129.74c	127.798	endf70f	B-VII.0	2006	2500.0	179304	15886	20.0	no	no	no	no	yes
** Xe-130 **													
54130.70c	128.788	endf70f	B-VII.0	2006	293.6	48675	6031	20.0	no	no	no	no	no
54130.71c	128.788	endf70f	B-VII.0	2006	600.0	47184	5818	20.0	no	no	no	no	no
54130.72c	128.788	endf70f	B-VII.0	2006	900.0	46036	5654	20.0	no	no	no	no	no
54130.73c	128.788	endf70f	B-VII.0	2006	1200.0	45085	5518	20.0	no	no	no	no	no
54130.74c	128.788	endf70f	B-VII.0	2006	2500.0	43215	5251	20.0	no	no	no	no	no
** Xe-131 **													
54131.70c	129.781	endf70f	B-VII.0	2006	293.6	307168	12676	20.0	yes	no	yes	no	yes
54131.71c	129.781	endf70f	B-VII.0	2006	600.0	301079	11915	20.0	yes	no	yes	no	yes
54131.72c	129.781	endf70f	B-VII.0	2006	900.0	297056	11412	20.0	yes	no	yes	no	yes
54131.73c	129.781	endf70f	B-VII.0	2006	1200.0	295536	11222	20.0	yes	no	yes	no	yes
54131.74c	129.781	endf70f	B-VII.0	2006	2500.0	288919	10395	20.0	yes	no	yes	no	yes
** Xe-132 **													
54132.70c	130.77	endf70f	B-VII.0	2006	293.6	70798	2747	20.0	no	no	no	no	yes
54132.71c	130.77	endf70f	B-VII.0	2006	600.0	70286	2674	20.0	no	no	no	no	yes
54132.72c	130.77	endf70f	B-VII.0	2006	900.0	69972	2629	20.0	no	no	no	no	yes
54132.73c	130.77	endf70f	B-VII.0	2006	1200.0	69726	2594	20.0	no	no	no	no	yes
54132.74c	130.77	endf70f	B-VII.0	2006	2500.0	69243	2525	20.0	no	no	no	no	yes
** Xe-133 **													
54133.70c	131.764	endf70f	B-VII.0	2006	293.6	74542	2428	20.0	no	no	no	no	yes
54133.71c	131.764	endf70f	B-VII.0	2006	600.0	74536	2427	20.0	no	no	no	no	yes
54133.72c	131.764	endf70f	B-VII.0	2006	900.0	74570	2432	20.0	no	no	no	no	yes
54133.73c	131.764	endf70f	B-VII.0	2006	1200.0	74535	2427	20.0	no	no	no	no	yes
54133.74c	131.764	endf70f	B-VII.0	2006	2500.0	74522	2425	20.0	no	no	no	no	yes
** Xe-134 **													
54134.70c	132.76	endf70f	B-VII.0	2006	293.6	58024	2034	20.0	no	no	no	no	yes
54134.71c	132.76	endf70f	B-VII.0	2006	600.0	57541	1965	20.0	no	no	no	no	yes
54134.72c	132.76	endf70f	B-VII.0	2006	900.0	57317	1933	20.0	no	no	no	no	yes
54134.73c	132.76	endf70f	B-VII.0	2006	1200.0	57232	1921	20.0	no	no	no	no	yes
54134.74c	132.76	endf70f	B-VII.0	2006	2500.0	56735	1850	20.0	no	no	no	no	yes
** Xe-135 **													
54135.70c	133.748	endf70f	B-VII.0	2006	293.6	75923	2709	20.0	no	no	no	no	yes
54135.71c	133.748	endf70f	B-VII.0	2006	600.0	75922	2709	20.0	no	no	no	no	yes
54135.72c	133.748	endf70f	B-VII.0	2006	900.0	75937	2711	20.0	no	no	no	no	yes

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

**** Xe-135 ****
54135.73c	133.748	endf70f	B-VII.0	2006	1200.0	75936	2711	20.0	no	no	no	no	yes
54135.74c	133.748	endf70f	B-VII.0	2006	2500.0	75930	2710	20.0	no	no	no	no	yes

**** Xe-136 ****
54136.70c	134.74	endf70f	B-VII.0	2006	293.6	79499	4414	20.0	no	no	no	no	no
54136.71c	134.74	endf70f	B-VII.0	2006	600.0	78982	4340	20.0	no	no	no	no	no
54136.72c	134.74	endf70f	B-VII.0	2006	900.0	78801	4314	20.0	no	no	no	no	no
54136.73c	134.74	endf70f	B-VII.0	2006	1200.0	78611	4287	20.0	no	no	no	no	no
54136.74c	134.74	endf70f	B-VII.0	2006	2500.0	77602	4143	20.0	no	no	no	no	no

Z = 55 ********** cesium **********
**** Cs-133 ****
55133.70c	131.764	endf70f	B-VII.0	2006	293.6	418447	29727	20.0	yes	no	yes	no	yes
55133.71c	131.764	endf70f	B-VII.0	2006	600.0	399239	27326	20.0	yes	no	yes	no	yes
55133.72c	131.764	endf70f	B-VII.0	2006	900.0	388679	26006	20.0	yes	no	yes	no	yes
55133.73c	131.764	endf70f	B-VII.0	2006	1200.0	380423	24974	20.0	yes	no	yes	no	yes
55133.74c	131.764	endf70f	B-VII.0	2006	2500.0	357559	22116	20.0	yes	no	yes	no	yes

**** Cs-134 ****
55134.70c	132.757	endf70f	B-VII.0	2006	293.6	136879	4755	20.0	no	no	no	no	yes
55134.71c	132.757	endf70f	B-VII.0	2006	600.0	136003	4630	20.0	no	no	no	no	yes
55134.72c	132.757	endf70f	B-VII.0	2006	900.0	135675	4583	20.0	no	no	no	no	yes
55134.73c	132.757	endf70f	B-VII.0	2006	1200.0	135290	4528	20.0	no	no	no	no	yes
55134.74c	132.757	endf70f	B-VII.0	2006	2500.0	134562	4424	20.0	no	no	no	no	yes

**** Cs-135 ****
55135.70c	133.747	endf70f	B-VII.0	2006	293.6	67935	4155	20.0	no	no	no	no	yes
55135.71c	133.747	endf70f	B-VII.0	2006	600.0	67213	4052	20.0	no	no	no	no	yes
55135.72c	133.747	endf70f	B-VII.0	2006	900.0	66891	4006	20.0	no	no	no	no	yes
55135.73c	133.747	endf70f	B-VII.0	2006	1200.0	66556	3958	20.0	no	no	no	no	yes
55135.74c	133.747	endf70f	B-VII.0	2006	2500.0	66122	3896	20.0	no	no	no	no	yes

**** Cs-136 ****
55136.70c	134.739	endf70f	B-VII.0	2006	293.6	49990	2706	20.0	no	no	no	no	no
55136.71c	134.739	endf70f	B-VII.0	2006	600.0	50054	2715	20.0	no	no	no	no	no
55136.72c	134.739	endf70f	B-VII.0	2006	900.0	49955	2701	20.0	no	no	no	no	no
55136.73c	134.739	endf70f	B-VII.0	2006	1200.0	49991	2706	20.0	no	no	no	no	no
55136.74c	134.739	endf70f	B-VII.0	2006	2500.0	50033	2712	20.0	no	no	no	no	no

**** Cs-137 ****
55137.70c	135.731	endf70f	B-VII.0	2006	293.6	58989	2375	20.0	no	no	no	no	yes
55137.71c	135.731	endf70f	B-VII.0	2006	600.0	58995	2376	20.0	no	no	no	no	yes
55137.72c	135.731	endf70f	B-VII.0	2006	900.0	58983	2374	20.0	no	no	no	no	yes

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Cs-137 **													
55137.73c	135.731	endf70f	B-VII.0	2006	1200.0	58981	2374	20.0	no	no	no	no	yes
55137.74c	135.731	endf70f	B-VII.0	2006	2500.0	58975	2373	20.0	no	no	no	no	yes
Z = 56 ********* barium **********													
** Ba-130 **													
56130.70c	128.79	endf70f	B-VII.0	2006	293.6	155953	14649	20.0	no	no	no	no	yes
56130.71c	128.79	endf70f	B-VII.0	2006	600.0	151122	13959	20.0	no	no	no	no	yes
56130.72c	128.79	endf70f	B-VII.0	2006	900.0	148378	13567	20.0	no	no	no	no	yes
56130.73c	128.79	endf70f	B-VII.0	2006	1200.0	146377	13281	20.0	no	no	no	no	yes
56130.74c	128.79	endf70f	B-VII.0	2006	2500.0	140888	12497	20.0	no	no	no	no	yes
** Ba-132 **													
56132.70c	130.772	endf70f	B-VII.0	2006	293.6	74827	3097	20.0	no	no	no	no	yes
56132.71c	130.772	endf70f	B-VII.0	2006	600.0	74717	3081	20.0	no	no	no	no	yes
56132.72c	130.772	endf70f	B-VII.0	2006	900.0	74491	3049	20.0	no	no	no	no	yes
56132.73c	130.772	endf70f	B-VII.0	2006	1200.0	74420	3039	20.0	no	no	no	no	yes
56132.74c	130.772	endf70f	B-VII.0	2006	2500.0	74150	3000	20.0	no	no	no	no	yes
** Ba-133 **													
56133.70c	131.764	endf70f	B-VII.0	2006	293.6	364826	2856	20.0	yes	no	yes	no	yes
56133.71c	131.764	endf70f	B-VII.0	2006	600.0	364274	2787	20.0	yes	no	yes	no	yes
56133.72c	131.764	endf70f	B-VII.0	2006	900.0	363706	2716	20.0	yes	no	yes	no	yes
56133.73c	131.764	endf70f	B-VII.0	2006	1200.0	363425	2681	20.0	yes	no	yes	no	yes
56133.74c	131.764	endf70f	B-VII.0	2006	2500.0	362321	2543	20.0	yes	no	yes	no	yes
** Ba-134 **													
56134.70c	132.754	endf70f	B-VII.0	2006	293.6	173726	17204	20.0	no	no	no	no	yes
56134.71c	132.754	endf70f	B-VII.0	2006	600.0	169421	16589	20.0	no	no	no	no	yes
56134.72c	132.754	endf70f	B-VII.0	2006	900.0	165768	16067	20.0	no	no	no	no	yes
56134.73c	132.754	endf70f	B-VII.0	2006	1200.0	163569	15753	20.0	no	no	no	no	yes
56134.74c	132.754	endf70f	B-VII.0	2006	2500.0	158297	15000	20.0	no	no	no	no	yes
** Ba-135 **													
56135.70c	133.747	endf70f	B-VII.0	2006	293.6	208697	23042	20.0	no	no	no	no	yes
56135.71c	133.747	endf70f	B-VII.0	2006	600.0	198917	21645	20.0	no	no	no	no	yes
56135.72c	133.747	endf70f	B-VII.0	2006	900.0	193928	20932	20.0	no	no	no	no	yes
56135.73c	133.747	endf70f	B-VII.0	2006	1200.0	189767	20338	20.0	no	no	no	no	yes
56135.74c	133.747	endf70f	B-VII.0	2006	2500.0	177300	18557	20.0	no	no	no	no	yes
** Ba-136 **													
56136.70c	134.737	endf70f	B-VII.0	2006	293.6	172972	18380	20.0	no	no	no	no	yes
56136.71c	134.737	endf70f	B-VII.0	2006	600.0	167204	17556	20.0	no	no	no	no	yes
56136.72c	134.737	endf70f	B-VII.0	2006	900.0	163781	17067	20.0	no	no	no	no	yes

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Ba-136													
56136.73c	134.737	endf70f	B-VII.0	2006	1200.0	161500	16741	20.0	no	no	no	no	yes
56136.74c	134.737	endf70f	B-VII.0	2006	2500.0	154941	15804	20.0	no	no	no	no	yes
Ba-137													
56137.70c	135.73	endf70f	B-VII.0	2006	293.6	141198	14180	20.0	no	no	no	no	yes
56137.71c	135.73	endf70f	B-VII.0	2006	600.0	138447	13787	20.0	no	no	no	no	yes
56137.72c	135.73	endf70f	B-VII.0	2006	900.0	135194	13322	20.0	no	no	no	no	yes
56137.73c	135.73	endf70f	B-VII.0	2006	1200.0	133960	13146	20.0	no	no	no	no	yes
56137.74c	135.73	endf70f	B-VII.0	2006	2500.0	129216	12468	20.0	no	no	no	no	yes
Ba-138													
56138.70c	136.72	endf70f	B-VII.0	2006	293.6	72716	6422	20.0	no	no	no	no	no
56138.71c	136.72	endf70f	B-VII.0	2006	600.0	71890	6304	20.0	no	no	no	no	no
56138.72c	136.72	endf70f	B-VII.0	2006	900.0	71279	6217	20.0	no	no	no	no	no
56138.73c	136.72	endf70f	B-VII.0	2006	1200.0	70790	6147	20.0	no	no	no	no	no
56138.74c	136.72	endf70f	B-VII.0	2006	2500.0	69390	5947	20.0	no	no	no	no	no
Ba-140													
56140.70c	138.708	endf70f	B-VII.0	1989	293.6	35023	3257	20.0	no	no	no	no	yes
56140.71c	138.708	endf70f	B-VII.0	1989	600.0	34311	3177	20.0	no	no	no	no	yes
56140.72c	138.708	endf70f	B-VII.0	1989	900.0	34207	3123	20.0	no	no	no	no	yes
56140.73c	138.708	endf70f	B-VII.0	1989	1200.0	34009	3101	20.0	no	no	no	no	yes
56140.74c	138.708	endf70f	B-VII.0	1989	2500.0	33236	3015	20.0	no	no	no	no	yes
Z = 57 ******** lanthanum ************													
La-138													
57138.70c	136.722	endf70f	B-VII.0	2006	293.6	108075	5644	20.0	no	no	no	no	yes
57138.71c	136.722	endf70f	B-VII.0	2006	600.0	107186	5517	20.0	no	no	no	no	yes
57138.72c	136.722	endf70f	B-VII.0	2006	900.0	106803	5462	20.0	no	no	no	no	yes
57138.73c	136.722	endf70f	B-VII.0	2006	1200.0	106200	5376	20.0	no	no	no	no	yes
57138.74c	136.722	endf70f	B-VII.0	2006	2500.0	105611	5292	20.0	no	no	no	no	yes
La-139													
57139.70c	137.71	endf70f	B-VII.0	2006	293.6	210419	21791	20.0	no	no	no	no	yes
57139.71c	137.71	endf70f	B-VII.0	2006	600.0	202314	20633	20.0	no	no	no	no	yes
57139.72c	137.71	endf70f	B-VII.0	2006	900.0	196484	19800	20.0	no	no	no	no	yes
57139.73c	137.71	endf70f	B-VII.0	2006	1200.0	192857	19282	20.0	no	no	no	no	yes
57139.74c	137.71	endf70f	B-VII.0	2006	2500.0	182398	17788	20.0	no	no	no	no	yes
La-140													
57140.70c	138.708	endf70f	B-VII.0	2006	293.6	385635	6705	20.0	yes	no	yes	no	yes
57140.71c	138.708	endf70f	B-VII.0	2006	600.0	385482	6686	20.0	yes	no	yes	no	yes
57140.72c	138.708	endf70f	B-VII.0	2006	900.0	385442	6681	20.0	yes	no	yes	no	yes

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** La-140 **													
57140.73c	138.708	endf70f	B-VII.0	2006	1200.0	385338	6668	20.0	yes	no	yes	no	yes
57140.74c	138.708	endf70f	B-VII.0	2006	2500.0	384938	6618	20.0	yes	no	yes	no	yes
Z = 58 ********* cerium *********													
** Ce-136 **													
58136.70c	134.74	endf70f	B-VII.0	2006	293.6	201621	3997	20.0	yes	no	yes	no	yes
58136.71c	134.74	endf70f	B-VII.0	2006	600.0	200973	3916	20.0	yes	no	yes	no	yes
58136.72c	134.74	endf70f	B-VII.0	2006	900.0	200517	3859	20.0	yes	no	yes	no	yes
58136.73c	134.74	endf70f	B-VII.0	2006	1200.0	199837	3774	20.0	yes	no	yes	no	yes
58136.74c	134.74	endf70f	B-VII.0	2006	2500.0	198486	3605	20.0	yes	no	yes	no	yes
** Ce-138 **													
58138.70c	136.721	endf70f	B-VII.0	2006	293.6	200903	3766	20.0	yes	no	yes	no	yes
58138.71c	136.721	endf70f	B-VII.0	2006	600.0	200023	3656	20.0	yes	no	yes	no	yes
58138.72c	136.721	endf70f	B-VII.0	2006	900.0	199302	3566	20.0	yes	no	yes	no	yes
58138.73c	136.721	endf70f	B-VII.0	2006	1200.0	198999	3528	20.0	yes	no	yes	no	yes
58138.74c	136.721	endf70f	B-VII.0	2006	2500.0	197806	3379	20.0	yes	no	yes	no	yes
** Ce-139 **													
58139.70c	137.713	endf70f	B-VII.0	2006	293.6	294795	4132	20.0	yes	no	yes	no	no
58139.71c	137.713	endf70f	B-VII.0	2006	600.0	294516	4097	20.0	yes	no	yes	no	no
58139.72c	137.713	endf70f	B-VII.0	2006	900.0	294347	4076	20.0	yes	no	yes	no	no
58139.73c	137.713	endf70f	B-VII.0	2006	1200.0	294051	4039	20.0	yes	no	yes	no	no
58139.74c	137.713	endf70f	B-VII.0	2006	2500.0	293827	4011	20.0	yes	no	yes	no	no
** Ce-140 **													
58140.70c	138.704	endf70f	B-VII.0	2006	293.6	255021	23640	20.0	no	no	no	no	no
58140.71c	138.704	endf70f	B-VII.0	2006	600.0	251406	23124	20.0	no	no	no	no	no
58140.72c	138.704	endf70f	B-VII.0	2006	900.0	248466	22704	20.0	no	no	no	no	no
58140.73c	138.704	endf70f	B-VII.0	2006	1200.0	246934	22485	20.0	no	no	no	no	no
58140.74c	138.704	endf70f	B-VII.0	2006	2500.0	242664	21875	20.0	no	no	no	no	no
** Ce-141 **													
58141.70c	139.7	endf70f	B-VII.0	2006	293.6	91442	2771	20.0	no	no	no	no	yes
58141.71c	139.7	endf70f	B-VII.0	2006	600.0	90792	2699	20.0	no	no	no	no	yes
58141.72c	139.7	endf70f	B-VII.0	2006	900.0	90396	2655	20.0	no	no	no	no	yes
58141.73c	139.7	endf70f	B-VII.0	2006	1200.0	89982	2609	20.0	no	no	no	no	yes
58141.74c	139.7	endf70f	B-VII.0	2006	2500.0	88939	2493	20.0	no	no	no	no	yes
** Ce-142 **													
58142.70c	140.69	endf70f	B-VII.0	2006	293.6	109490	8235	20.0	no	no	no	no	yes
58142.71c	140.69	endf70f	B-VII.0	2006	600.0	107804	7994	20.0	no	no	no	no	yes
58142.72c	140.69	endf70f	B-VII.0	2006	900.0	107026	7883	20.0	no	no	no	no	yes

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD														
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Ce-142 **														
58142.73c	140.69	endf70f	B-VII.0	2006	1200.0	106235	7770	20.0	no	no	no	no	yes
58142.74c	140.69	endf70f	B-VII.0	2006	2500.0	104933	7584	20.0	no	no	no	no	yes
** Ce-143 **														
58143.70c	141.685	endf70f	B-VII.0	2006	293.6	281621	5236	20.0	yes	no	yes	no	yes
58143.71c	141.685	endf70f	B-VII.0	2006	600.0	281357	5203	20.0	yes	no	yes	no	yes
58143.72c	141.685	endf70f	B-VII.0	2006	900.0	281197	5183	20.0	yes	no	yes	no	yes
58143.73c	141.685	endf70f	B-VII.0	2006	1200.0	281077	5168	20.0	yes	no	yes	no	yes
58143.74c	141.685	endf70f	B-VII.0	2006	2500.0	280829	5137	20.0	yes	no	yes	no	yes
** Ce-144 **														
58144.70c	142.678	endf70f	B-VII.0	2006	293.6	52842	2420	20.0	no	no	no	no	yes
58144.71c	142.678	endf70f	B-VII.0	2006	600.0	52828	2418	20.0	no	no	no	no	yes
58144.72c	142.678	endf70f	B-VII.0	2006	900.0	52814	2416	20.0	no	no	no	no	yes
58144.73c	142.678	endf70f	B-VII.0	2006	1200.0	52850	2421	20.0	no	no	no	no	yes
58144.74c	142.678	endf70f	B-VII.0	2006	2500.0	52878	2425	20.0	no	no	no	no	yes
Z = 59 ********** praseodymium **********														
** Pr-141 **														
59141.70c	139.697	endf70f	B-VII.0	2006	293.6	397172	26077	20.0	yes	no	yes	no	yes
59141.71c	139.697	endf70f	B-VII.0	2006	600.0	385051	24562	20.0	yes	no	yes	no	yes
59141.72c	139.697	endf70f	B-VII.0	2006	900.0	376548	23499	20.0	yes	no	yes	no	yes
59141.73c	139.697	endf70f	B-VII.0	2006	1200.0	370363	22726	20.0	yes	no	yes	no	yes
59141.74c	139.697	endf70f	B-VII.0	2006	2500.0	353675	20640	20.0	yes	no	yes	no	yes
** Pr-142 **														
59142.70c	140.691	endf70f	B-VII.0	2006	293.6	591178	7692	20.0	yes	no	yes	no	yes
59142.71c	140.691	endf70f	B-VII.0	2006	600.0	590970	7666	20.0	yes	no	yes	no	yes
59142.72c	140.691	endf70f	B-VII.0	2006	900.0	590890	7656	20.0	yes	no	yes	no	yes
59142.73c	140.691	endf70f	B-VII.0	2006	1200.0	590667	7628	20.0	yes	no	yes	no	yes
59142.74c	140.691	endf70f	B-VII.0	2006	2500.0	590194	7569	20.0	yes	no	yes	no	yes
** Pr-143 **														
59143.70c	141.683	endf70f	B-VII.0	2006	293.6	81771	3671	20.0	no	no	no	no	no
59143.71c	141.683	endf70f	B-VII.0	2006	600.0	81554	3640	20.0	no	no	no	no	no
59143.72c	141.683	endf70f	B-VII.0	2006	900.0	81450	3625	20.0	no	no	no	no	no
59143.73c	141.683	endf70f	B-VII.0	2006	1200.0	81350	3611	20.0	no	no	no	no	no
59143.74c	141.683	endf70f	B-VII.0	2006	2500.0	81098	3575	20.0	no	no	no	no	no
Z = 60 ********** neodymium **********														
** Nd-142 **														
60142.70c	140.689	endf70g	B-VII.0	2006	293.6	325897	12679	20.0	yes	no	yes	no	yes
60142.71c	140.689	endf70g	B-VII.0	2006	600.0	322609	12268	20.0	yes	no	yes	no	yes

May 29, 2008

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Nd-142 **													
60142.72c	140.689	endf70g	B-VII.0	2006	900.0	320713	12031	20.0	yes	no	yes	no	yes
60142.73c	140.689	endf70g	B-VII.0	2006	1200.0	319681	11902	20.0	yes	no	yes	no	yes
60142.74c	140.689	endf70g	B-VII.0	2006	2500.0	315905	11430	20.0	yes	no	yes	no	yes
** Nd-143 **													
60143.70c	141.682	endf70g	B-VII.0	2006	293.6	468788	25770	20.0	yes	no	yes	no	yes
60143.71c	141.682	endf70g	B-VII.0	2006	600.0	453967	24288	20.0	yes	no	yes	no	yes
60143.72c	141.682	endf70g	B-VII.0	2006	900.0	444047	23296	20.0	yes	no	yes	no	yes
60143.73c	141.682	endf70g	B-VII.0	2006	1200.0	435947	22486	20.0	yes	no	yes	no	yes
60143.74c	141.682	endf70g	B-VII.0	2006	2500.0	414778	20369	20.0	yes	no	yes	no	yes
** Nd-144 **													
60144.70c	142.674	endf70g	B-VII.0	2006	293.6	322390	9953	20.0	yes	no	yes	no	no
60144.71c	142.674	endf70g	B-VII.0	2006	600.0	319942	9647	20.0	yes	no	yes	no	no
60144.72c	142.674	endf70g	B-VII.0	2006	900.0	317886	9390	20.0	yes	no	yes	no	no
60144.73c	142.674	endf70g	B-VII.0	2006	1200.0	316910	9268	20.0	yes	no	yes	no	no
60144.74c	142.674	endf70g	B-VII.0	2006	2500.0	313575	8851	20.0	yes	no	yes	no	no
** Nd-145 **													
60145.70c	143.668	endf70g	B-VII.0	2006	293.6	570184	35882	20.0	yes	no	yes	no	yes
60145.71c	143.668	endf70g	B-VII.0	2006	600.0	540714	32935	20.0	yes	no	yes	no	yes
60145.72c	143.668	endf70g	B-VII.0	2006	900.0	522944	31158	20.0	yes	no	yes	no	yes
60145.73c	143.668	endf70g	B-VII.0	2006	1200.0	507854	29649	20.0	yes	no	yes	no	yes
60145.74c	143.668	endf70g	B-VII.0	2006	2500.0	470415	25905	20.0	yes	no	yes	no	yes
** Nd-146 **													
60146.70c	144.66	endf70g	B-VII.0	2006	293.6	305007	10274	20.0	yes	no	yes	no	yes
60146.71c	144.66	endf70g	B-VII.0	2006	600.0	303023	10026	20.0	yes	no	yes	no	yes
60146.72c	144.66	endf70g	B-VII.0	2006	900.0	301063	9781	20.0	yes	no	yes	no	yes
60146.73c	144.66	endf70g	B-VII.0	2006	1200.0	299551	9592	20.0	yes	no	yes	no	yes
60146.74c	144.66	endf70g	B-VII.0	2006	2500.0	296735	9240	20.0	yes	no	yes	no	yes
** Nd-147 **													
60147.70c	145.654	endf70g	B-VII.0	2006	293.6	275998	3951	20.0	yes	no	yes	no	yes
60147.71c	145.654	endf70g	B-VII.0	2006	600.0	274502	3764	20.0	yes	no	yes	no	yes
60147.72c	145.654	endf70g	B-VII.0	2006	900.0	273735	3668	20.0	yes	no	yes	no	yes
60147.73c	145.654	endf70g	B-VII.0	2006	1200.0	273358	3621	20.0	yes	no	yes	no	yes
60147.74c	145.654	endf70g	B-VII.0	2006	2500.0	271711	3415	20.0	yes	no	yes	no	yes
** Nd-148 **													
60148.70c	146.646	endf70g	B-VII.0	2006	293.6	367463	19283	20.0	yes	no	yes	no	yes
60148.71c	146.646	endf70g	B-VII.0	2006	600.0	360646	18431	20.0	yes	no	yes	no	yes
60148.72c	146.646	endf70g	B-VII.0	2006	900.0	356678	17935	20.0	yes	no	yes	no	yes

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Nd-148 **													
60148.73c	146.646	endf70g	B-VII.0	2006	1200.0	353542	17543	20.0	yes	no	yes	no	yes
60148.74c	146.646	endf70g	B-VII.0	2006	2500.0	344439	16405	20.0	yes	no	yes	no	yes
** Nd-150 **													
60150.70c	148.633	endf70g	B-VII.0	2006	293.6	333376	18383	20.0	yes	no	yes	no	yes
60150.71c	148.633	endf70g	B-VII.0	2006	600.0	327176	17608	20.0	yes	no	yes	no	yes
60150.72c	148.633	endf70g	B-VII.0	2006	900.0	322912	17075	20.0	yes	no	yes	no	yes
60150.73c	148.633	endf70g	B-VII.0	2006	1200.0	319944	16704	20.0	yes	no	yes	no	yes
60150.74c	148.633	endf70g	B-VII.0	2006	2500.0	312992	15835	20.0	yes	no	yes	no	yes
Z = 61 ********** promethium **********													
** Pm-147 **													
61147.70c	145.653	endf70g	B-VII.0	2006	293.6	100146	7325	20.0	no	no	no	no	yes
61147.71c	145.653	endf70g	B-VII.0	2006	600.0	97030	6880	20.0	no	no	no	no	yes
61147.72c	145.653	endf70g	B-VII.0	2006	900.0	95693	6689	20.0	no	no	no	no	yes
61147.73c	145.653	endf70g	B-VII.0	2006	1200.0	94670	6543	20.0	no	no	no	no	yes
61147.74c	145.653	endf70g	B-VII.0	2006	2500.0	90724	5979	20.0	no	no	no	no	yes
** Pm-148 **													
61148.70c	146.646	endf70g	B-VII.0	2006	293.6	57202	2603	20.0	no	no	no	no	no
61148.71c	146.646	endf70g	B-VII.0	2006	600.0	57188	2601	20.0	no	no	no	no	no
61148.72c	146.646	endf70g	B-VII.0	2006	900.0	57209	2604	20.0	no	no	no	no	no
61148.73c	146.646	endf70g	B-VII.0	2006	1200.0	57182	2600	20.0	no	no	no	no	no
61148.74c	146.646	endf70g	B-VII.0	2006	2500.0	57162	2597	20.0	no	no	no	no	no
** Pm-149 **													
61149.70c	147.639	endf70g	B-VII.0	2006	293.6	81483	2534	20.0	no	no	no	no	yes
61149.71c	147.639	endf70g	B-VII.0	2006	600.0	81435	2527	20.0	no	no	no	no	yes
61149.72c	147.639	endf70g	B-VII.0	2006	900.0	81468	2532	20.0	no	no	no	no	yes
61149.73c	147.639	endf70g	B-VII.0	2006	1200.0	81483	2534	20.0	no	no	no	no	yes
61149.74c	147.639	endf70g	B-VII.0	2006	2500.0	81427	2526	20.0	no	no	no	no	yes
** Pm-151 **													
61151.70c	149.625	endf70g	B-VII.0	2006	293.6	231373	8914	20.0	yes	no	yes	no	no
61151.71c	149.625	endf70g	B-VII.0	2006	600.0	226717	8332	20.0	yes	no	yes	no	no
61151.72c	149.625	endf70g	B-VII.0	2006	900.0	223861	7975	20.0	yes	no	yes	no	no
61151.73c	149.625	endf70g	B-VII.0	2006	1200.0	221638	7697	20.0	yes	no	yes	no	no
61151.74c	149.625	endf70g	B-VII.0	2006	2500.0	214302	6780	20.0	yes	no	yes	no	no
** Pm-148m **													
61548.70c	146.65	endf70g	B-VII.0	2006	293.6	46205	927	20.0	no	no	no	no	no
61548.71c	146.65	endf70g	B-VII.0	2006	600.0	46066	916	20.0	no	no	no	no	no
61548.72c	146.65	endf70g	B-VII.0	2006	900.0	45976	909	20.0	no	no	no	no	no

May 29, 2008

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Pm-148m **													
61548.73c	146.65	endf70g	B-VII.0	2006	1200.0	45873	901	20.0	no	no	no	no	no
61548.74c	146.65	endf70g	B-VII.0	2006	2500.0	45796	893	20.0	no	no	no	no	no
Z = 62 ********* samarium **********													
** Sm-144 **													
62144.70c	142.676	endf70g	B-VII.0	2006	293.6	301940	10955	20.0	yes	no	yes	no	yes
62144.71c	142.676	endf70g	B-VII.0	2006	600.0	298908	10576	20.0	yes	no	yes	no	yes
62144.72c	142.676	endf70g	B-VII.0	2006	900.0	297117	10352	20.0	yes	no	yes	no	yes
62144.73c	142.676	endf70g	B-VII.0	2006	1200.0	295717	10177	20.0	yes	no	yes	no	yes
62144.74c	142.676	endf70g	B-VII.0	2006	2500.0	291716	9677	20.0	yes	no	yes	no	yes
** Sm-147 **													
62147.70c	145.653	endf70g	B-VII.0	2006	293.6	609934	39554	20.0	yes	no	yes	no	yes
62147.71c	145.653	endf70g	B-VII.0	2006	600.0	564714	35032	20.0	yes	no	yes	no	yes
62147.72c	145.653	endf70g	B-VII.0	2006	900.0	535235	32084	20.0	yes	no	yes	no	yes
62147.73c	145.653	endf70g	B-VII.0	2006	1200.0	514244	29985	20.0	yes	no	yes	no	yes
62147.74c	145.653	endf70g	B-VII.0	2006	2500.0	458494	24410	20.0	yes	no	yes	no	yes
** Sm-148 **													
62148.70c	146.644	endf70g	B-VII.0	2006	293.6	201223	4702	20.0	yes	no	yes	no	yes
62148.71c	146.644	endf70g	B-VII.0	2006	600.0	200006	4550	20.0	yes	no	yes	no	yes
62148.72c	146.644	endf70g	B-VII.0	2006	900.0	199150	4443	20.0	yes	no	yes	no	yes
62148.73c	146.644	endf70g	B-VII.0	2006	1200.0	198774	4396	20.0	yes	no	yes	no	yes
62148.74c	146.644	endf70g	B-VII.0	2006	2500.0	196855	4156	20.0	yes	no	yes	no	yes
** Sm-149 **													
62149.70c	147.638	endf70g	B-VII.0	2006	293.6	479655	26500	20.0	yes	no	yes	no	yes
62149.71c	147.638	endf70g	B-VII.0	2006	600.0	438905	22425	20.0	yes	no	yes	no	yes
62149.72c	147.638	endf70g	B-VII.0	2006	900.0	415525	20087	20.0	yes	no	yes	no	yes
62149.73c	147.638	endf70g	B-VII.0	2006	1200.0	399066	18441	20.0	yes	no	yes	no	yes
62149.74c	147.638	endf70g	B-VII.0	2006	2500.0	358105	14345	20.0	yes	no	yes	no	yes
** Sm-150 **													
62150.70c	148.629	endf70g	B-VII.0	2006	293.6	300548	8796	20.0	yes	no	yes	no	yes
62150.71c	148.629	endf70g	B-VII.0	2006	600.0	298276	8512	20.0	yes	no	yes	no	yes
62150.72c	148.629	endf70g	B-VII.0	2006	900.0	296772	8324	20.0	yes	no	yes	no	yes
62150.73c	148.629	endf70g	B-VII.0	2006	1200.0	295325	8143	20.0	yes	no	yes	no	yes
62150.74c	148.629	endf70g	B-VII.0	2006	2500.0	291644	7683	20.0	yes	no	yes	no	yes
** Sm-151 **													
62151.70c	149.623	endf70g	B-VII.0	2006	293.6	377075	17861	20.0	yes	no	yes	no	yes
62151.71c	149.623	endf70g	B-VII.0	2006	600.0	356875	15336	20.0	yes	no	yes	no	yes
62151.72c	149.623	endf70g	B-VII.0	2006	900.0	344844	13832	20.0	yes	no	yes	no	yes

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Sm-151 **													
62151.73c	149.623	endf70g	B-VII.0	2006	1200.0	335163	12622	20.0	yes	no	yes	no	yes
62151.74c	149.623	endf70g	B-VII.0	2006	2500.0	312820	9829	20.0	yes	no	yes	no	yes
** Sm-152 **													
62152.70c	150.615	endf70g	B-VII.0	2006	293.6	396422	22080	20.0	yes	no	yes	no	yes
62152.71c	150.615	endf70g	B-VII.0	2006	600.0	385094	20664	20.0	yes	no	yes	no	yes
62152.72c	150.615	endf70g	B-VII.0	2006	900.0	378638	19857	20.0	yes	no	yes	no	yes
62152.73c	150.615	endf70g	B-VII.0	2006	1200.0	374135	19294	20.0	yes	no	yes	no	yes
62152.74c	150.615	endf70g	B-VII.0	2006	2500.0	361575	17724	20.0	yes	no	yes	no	yes
** Sm-153 **													
62153.70c	151.608	endf70g	B-VII.0	2006	293.6	217483	3179	20.0	yes	no	yes	no	no
62153.71c	151.608	endf70g	B-VII.0	2006	600.0	216171	3015	20.0	yes	no	yes	no	no
62153.72c	151.608	endf70g	B-VII.0	2006	900.0	215499	2931	20.0	yes	no	yes	no	no
62153.73c	151.608	endf70g	B-VII.0	2006	1200.0	214931	2860	20.0	yes	no	yes	no	no
62153.74c	151.608	endf70g	B-VII.0	2006	2500.0	213123	2634	20.0	yes	no	yes	no	no
** Sm-154 **													
62154.70c	152.6	endf70g	B-VII.0	2006	293.6	270530	10872	20.0	yes	no	yes	no	yes
62154.71c	152.6	endf70g	B-VII.0	2006	600.0	265970	10302	20.0	yes	no	yes	no	yes
62154.72c	152.6	endf70g	B-VII.0	2006	900.0	264050	10062	20.0	yes	no	yes	no	yes
62154.73c	152.6	endf70g	B-VII.0	2006	1200.0	262489	9867	20.0	yes	no	yes	no	yes
62154.74c	152.6	endf70g	B-VII.0	2006	2500.0	257809	9282	20.0	yes	no	yes	no	yes
Z = 63 ********* europium **********													
** Eu-151 **													
63151.70c	149.62	endf70g	B-VII.0	2006	293.6	132580	11039	20.0	no	no	no	no	yes
63151.71c	149.62	endf70g	B-VII.0	2006	600.0	115625	9155	20.0	no	no	no	no	yes
63151.72c	149.62	endf70g	B-VII.0	2006	900.0	106345	8124	20.0	no	no	no	no	yes
63151.73c	149.62	endf70g	B-VII.0	2006	1200.0	99676	7383	20.0	no	no	no	no	yes
63151.74c	149.62	endf70g	B-VII.0	2006	2500.0	84773	5727	20.0	no	no	no	no	yes
** Eu-152 **													
63152.70c	150.617	endf70g	B-VII.0	2006	293.6	117262	8321	20.0	no	no	no	no	no
63152.71c	150.617	endf70g	B-VII.0	2006	600.0	110156	7306	20.0	no	no	no	no	no
63152.72c	150.617	endf70g	B-VII.0	2006	900.0	105970	6708	20.0	no	no	no	no	no
63152.73c	150.617	endf70g	B-VII.0	2006	1200.0	102617	6229	20.0	no	no	no	no	no
63152.74c	150.617	endf70g	B-VII.0	2006	2500.0	96130	5302	20.0	no	no	no	no	no
** Eu-153 **													
63153.70c	151.608	endf70g	B-VII.0	2006	293.6	254464	9944	20.0	yes	no	yes	no	no
63153.71c	151.608	endf70g	B-VII.0	2006	600.0	241203	8618	20.0	yes	no	yes	no	no
63153.72c	151.608	endf70g	B-VII.0	2006	900.0	233574	7855	20.0	yes	no	yes	no	no

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** Eu-153 **													
63153.73c	151.608	endf70g	B-VII.0	2006	1200.0	227404	7238	20.0	yes	no	yes	no	no
63153.74c	151.608	endf70g	B-VII.0	2006	2500.0	213474	5845	20.0	yes	no	yes	no	no
** Eu-154 **													
63154.70c	152.6	endf70g	B-VII.0	2006	293.6	58425	3261	20.0	no	no	no	no	no
63154.71c	152.6	endf70g	B-VII.0	2006	600.0	56614	3070	20.0	no	no	no	no	no
63154.72c	152.6	endf70g	B-VII.0	2006	900.0	55279	2948	20.0	no	no	no	no	no
63154.73c	152.6	endf70g	B-VII.0	2006	1200.0	53919	2824	20.0	no	no	no	no	no
63154.74c	152.6	endf70g	B-VII.0	2006	2500.0	51136	2570	20.0	no	no	no	no	no
** Eu-155 **													
63155.70c	153.59	endf70g	B-VII.0	1999	293.6	44793	2158	20.0	no	no	no	no	no
63155.71c	153.59	endf70g	B-VII.0	1999	600.0	44315	2105	20.0	no	no	no	no	no
63155.72c	153.59	endf70g	B-VII.0	1999	900.0	43784	2046	20.0	no	no	no	no	no
63155.73c	153.59	endf70g	B-VII.0	1999	1200.0	43577	2023	20.0	no	no	no	no	no
63155.74c	153.59	endf70g	B-VII.0	1999	2500.0	42811	1938	20.0	no	no	no	no	no
** Eu-156 **													
63156.70c	154.586	endf70g	B-VII.0	2006	293.6	69019	2638	20.0	no	no	no	no	yes
63156.71c	154.586	endf70g	B-VII.0	2006	600.0	68985	2633	20.0	no	no	no	no	yes
63156.72c	154.586	endf70g	B-VII.0	2006	900.0	69019	2638	20.0	no	no	no	no	yes
63156.73c	154.586	endf70g	B-VII.0	2006	1200.0	69012	2637	20.0	no	no	no	no	yes
63156.74c	154.586	endf70g	B-VII.0	2006	2500.0	68957	2629	20.0	no	no	no	no	yes
** Eu-157 **													
63157.70c	155.577	endf70g	B-VII.0	2006	293.6	301053	5375	20.0	yes	no	yes	no	yes
63157.71c	155.577	endf70g	B-VII.0	2006	600.0	298325	5034	20.0	yes	no	yes	no	yes
63157.72c	155.577	endf70g	B-VII.0	2006	900.0	297133	4885	20.0	yes	no	yes	no	yes
63157.73c	155.577	endf70g	B-VII.0	2006	1200.0	296253	4775	20.0	yes	no	yes	no	yes
63157.74c	155.577	endf70g	B-VII.0	2006	2500.0	292677	4328	20.0	yes	no	yes	no	yes
Z = 64 ********** gadolinium **********													
** Gd-152 **													
64152.70c	150.615	endf70h	B-VII.0	2006	293.6	522408	30329	20.0	yes	no	yes	no	yes
64152.71c	150.615	endf70h	B-VII.0	2006	600.0	497008	27789	20.0	yes	no	yes	no	yes
64152.72c	150.615	endf70h	B-VII.0	2006	900.0	482738	26362	20.0	yes	no	yes	no	yes
64152.73c	150.615	endf70h	B-VII.0	2006	1200.0	472167	25305	20.0	yes	no	yes	no	yes
64152.74c	150.615	endf70h	B-VII.0	2006	2500.0	443668	22455	20.0	yes	no	yes	no	yes
** Gd-153 **													
64153.70c	151.608	endf70h	B-VII.0	2006	293.6	336408	3572	20.0	yes	no	yes	no	yes
64153.71c	151.608	endf70h	B-VII.0	2006	600.0	335458	3477	20.0	yes	no	yes	no	yes
64153.72c	151.608	endf70h	B-VII.0	2006	900.0	334128	3344	20.0	yes	no	yes	no	yes

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** Gd-153 **													
64153.73c	151.608	endf70h	B-VII.0	2006	1200.0	333578	3289	20.0	yes	no	yes	no	yes
64153.74c	151.608	endf70h	B-VII.0	2006	2500.0	332028	3134	20.0	yes	no	yes	no	yes
** Gd-154 **													
64154.70c	152.599	endf70h	B-VII.0	2006	293.6	607214	33802	20.0	yes	no	yes	no	yes
64154.71c	152.599	endf70h	B-VII.0	2006	600.0	583870	30884	20.0	yes	no	yes	no	yes
64154.72c	152.599	endf70h	B-VII.0	2006	900.0	571198	29300	20.0	yes	no	yes	no	yes
64154.73c	152.599	endf70h	B-VII.0	2006	1200.0	561318	28065	20.0	yes	no	yes	no	yes
64154.74c	152.599	endf70h	B-VII.0	2006	2500.0	533334	24567	20.0	yes	no	yes	no	yes
** Gd-155 **													
64155.70c	153.592	endf70h	B-VII.0	2006	293.6	343456	12875	20.0	yes	no	yes	no	yes
64155.71c	153.592	endf70h	B-VII.0	2006	600.0	323816	10911	20.0	yes	no	yes	no	yes
64155.72c	153.592	endf70h	B-VII.0	2006	900.0	312665	9796	20.0	yes	no	yes	no	yes
64155.73c	153.592	endf70h	B-VII.0	2006	1200.0	304326	8962	20.0	yes	no	yes	no	yes
64155.74c	153.592	endf70h	B-VII.0	2006	2500.0	286586	7188	20.0	yes	no	yes	no	yes
** Gd-156 **													
64156.70c	154.583	endf70h	B-VII.0	2006	293.6	441988	18799	20.0	yes	no	yes	no	yes
64156.71c	154.583	endf70h	B-VII.0	2006	600.0	431699	17513	20.0	yes	no	yes	no	yes
64156.72c	154.583	endf70h	B-VII.0	2006	900.0	425067	16684	20.0	yes	no	yes	no	yes
64156.73c	154.583	endf70h	B-VII.0	2006	1200.0	421243	16206	20.0	yes	no	yes	no	yes
64156.74c	154.583	endf70h	B-VII.0	2006	2500.0	409595	14750	20.0	yes	no	yes	no	yes
** Gd-157 **													
64157.70c	155.576	endf70h	B-VII.0	2006	293.6	394437	12206	20.0	yes	no	yes	no	yes
64157.71c	155.576	endf70h	B-VII.0	2006	600.0	383457	11108	20.0	yes	no	yes	no	yes
64157.72c	155.576	endf70h	B-VII.0	2006	900.0	377367	10499	20.0	yes	no	yes	no	yes
64157.73c	155.576	endf70h	B-VII.0	2006	1200.0	373578	10120	20.0	yes	no	yes	no	yes
64157.74c	155.576	endf70h	B-VII.0	2006	2500.0	358558	8618	20.0	yes	no	yes	no	yes
** Gd-158 **													
64158.70c	156.567	endf70h	B-VII.0	2006	293.6	440904	21865	20.0	yes	no	yes	no	yes
64158.71c	156.567	endf70h	B-VII.0	2006	600.0	431808	20728	20.0	yes	no	yes	no	yes
64158.72c	156.567	endf70h	B-VII.0	2006	900.0	426888	20113	20.0	yes	no	yes	no	yes
64158.73c	156.567	endf70h	B-VII.0	2006	1200.0	422688	19588	20.0	yes	no	yes	no	yes
64158.74c	156.567	endf70h	B-VII.0	2006	2500.0	411712	18216	20.0	yes	no	yes	no	yes
** Gd-160 **													
64160.70c	158.553	endf70h	B-VII.0	2006	293.6	371854	13744	20.0	yes	no	yes	no	yes
64160.71c	158.553	endf70h	B-VII.0	2006	600.0	366725	13103	20.0	yes	no	yes	no	yes
64160.72c	158.553	endf70h	B-VII.0	2006	900.0	364214	12789	20.0	yes	no	yes	no	yes
64160.73c	158.553	endf70h	B-VII.0	2006	1200.0	362205	12538	20.0	yes	no	yes	no	yes

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

								Emax					
ZAID	**AWR**	**Library Name**	**Source**	**Eval Date**	**Temp (K)**	**Length Words**	**NE**	**(MeV)**	**GPD**	**Nu**	**CP**	**DN**	**UR**

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Gd-160 **													
64160.74c	158.553	endf70h	B-VII.0	2006	2500.0	356518	11827	20.0	yes	no	yes	no	yes
Z = 65 ********** terbium **********													
** Tb-159 **													
65159.70c	157.56	endf70h	B-VII.0	2006	293.6	346338	38035	20.0	no	no	no	no	yes
65159.71c	157.56	endf70h	B-VII.0	2006	600.0	313376	33326	20.0	no	no	no	no	yes
65159.72c	157.56	endf70h	B-VII.0	2006	900.0	292746	30379	20.0	no	no	no	no	yes
65159.73c	157.56	endf70h	B-VII.0	2006	1200.0	277130	28148	20.0	no	no	no	no	yes
65159.74c	157.56	endf70h	B-VII.0	2006	2500.0	236915	22403	20.0	no	no	no	no	yes
** Tb-160 **													
65160.70c	158.553	endf70h	B-VII.0	2006	293.6	195138	1330	20.0	yes	no	yes	no	yes
65160.71c	158.553	endf70h	B-VII.0	2006	600.0	194849	1294	20.0	yes	no	yes	no	yes
65160.72c	158.553	endf70h	B-VII.0	2006	900.0	194705	1276	20.0	yes	no	yes	no	yes
65160.73c	158.553	endf70h	B-VII.0	2006	1200.0	194593	1262	20.0	yes	no	yes	no	yes
65160.74c	158.553	endf70h	B-VII.0	2006	2500.0	194273	1222	20.0	yes	no	yes	no	yes
Z = 66 ********** dysprosium **********													
** Dy-156 **													
66156.70c	154.585	endf70h	B-VII.0	2006	293.6	259917	5148	20.0	yes	no	yes	no	no
66156.71c	154.585	endf70h	B-VII.0	2006	600.0	256861	4766	20.0	yes	no	yes	no	no
66156.72c	154.585	endf70h	B-VII.0	2006	900.0	254588	4482	20.0	yes	no	yes	no	no
66156.73c	154.585	endf70h	B-VII.0	2006	1200.0	253356	4328	20.0	yes	no	yes	no	no
66156.74c	154.585	endf70h	B-VII.0	2006	2500.0	249716	3873	20.0	yes	no	yes	no	no
** Dy-158 **													
66158.70c	156.568	endf70h	B-VII.0	2006	293.6	236389	1856	20.0	yes	no	yes	no	no
66158.71c	156.568	endf70h	B-VII.0	2006	600.0	235990	1806	20.0	yes	no	yes	no	no
66158.72c	156.568	endf70h	B-VII.0	2006	900.0	235693	1769	20.0	yes	no	yes	no	no
66158.73c	156.568	endf70h	B-VII.0	2006	1200.0	235685	1768	20.0	yes	no	yes	no	no
66158.74c	156.568	endf70h	B-VII.0	2006	2500.0	234981	1680	20.0	yes	no	yes	no	no
** Dy-160 **													
66160.70c	158.551	endf70h	B-VII.0	2006	293.6	345725	18003	20.0	yes	no	yes	no	yes
66160.71c	158.551	endf70h	B-VII.0	2006	600.0	337677	16997	20.0	yes	no	yes	no	yes
66160.72c	158.551	endf70h	B-VII.0	2006	900.0	331381	16210	20.0	yes	no	yes	no	yes
66160.73c	158.551	endf70h	B-VII.0	2006	1200.0	327869	15771	20.0	yes	no	yes	no	yes
66160.74c	158.551	endf70h	B-VII.0	2006	2500.0	317277	14447	20.0	yes	no	yes	no	yes
** Dy-161 **													
66161.70c	159.544	endf70h	B-VII.0	2006	293.6	522499	37210	20.0	yes	no	yes	no	yes
66161.71c	159.544	endf70h	B-VII.0	2006	600.0	472371	30944	20.0	yes	no	yes	no	yes
66161.72c	159.544	endf70h	B-VII.0	2006	900.0	442995	27272	20.0	yes	no	yes	no	yes

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Dy-161 **													
66161.73c	159.544	endf70h	B-VII.0	2006	1200.0	422611	24724	20.0	yes	no	yes	no	yes
66161.74c	159.544	endf70h	B-VII.0	2006	2500.0	375003	18773	20.0	yes	no	yes	no	yes
** Dy-162 **													
66162.70c	160.536	endf70h	B-VII.0	2006	293.6	369239	19363	20.0	yes	no	yes	no	yes
66162.71c	160.536	endf70h	B-VII.0	2006	600.0	361624	18411	20.0	yes	no	yes	no	yes
66162.72c	160.536	endf70h	B-VII.0	2006	900.0	357511	17897	20.0	yes	no	yes	no	yes
66162.73c	160.536	endf70h	B-VII.0	2006	1200.0	353583	17406	20.0	yes	no	yes	no	yes
66162.74c	160.536	endf70h	B-VII.0	2006	2500.0	344623	16286	20.0	yes	no	yes	no	yes
** Dy-163 **													
66163.70c	161.529	endf70h	B-VII.0	2006	293.6	400160	23331	20.0	yes	no	yes	no	yes
66163.71c	161.529	endf70h	B-VII.0	2006	600.0	383768	21282	20.0	yes	no	yes	no	yes
66163.72c	161.529	endf70h	B-VII.0	2006	900.0	372832	19915	20.0	yes	no	yes	no	yes
66163.73c	161.529	endf70h	B-VII.0	2006	1200.0	364176	18833	20.0	yes	no	yes	no	yes
66163.74c	161.529	endf70h	B-VII.0	2006	2500.0	343368	16232	20.0	yes	no	yes	no	yes
** Dy-164 **													
66164.70c	162.521	endf70h	B-VII.0	2006	293.6	325796	15717	20.0	yes	no	yes	no	yes
66164.71c	162.521	endf70h	B-VII.0	2006	600.0	321541	15185	20.0	yes	no	yes	no	yes
66164.72c	162.521	endf70h	B-VII.0	2006	900.0	317036	14622	20.0	yes	no	yes	no	yes
66164.73c	162.521	endf70h	B-VII.0	2006	1200.0	314612	14319	20.0	yes	no	yes	no	yes
66164.74c	162.521	endf70h	B-VII.0	2006	2500.0	308173	13514	20.0	yes	no	yes	no	yes
Z = 67 ********** holmium **********													
** Ho-165 **													
67165.70c	163.513	endf70h	B-VII.0	2006	293.6	337892	36244	30.	yes	no	no	no	no
67165.71c	163.513	endf70h	B-VII.0	2006	600.0	299900	31495	30.	yes	no	no	no	no
67165.72c	163.513	endf70h	B-VII.0	2006	900.0	276836	28612	30.	yes	no	no	no	no
67165.73c	163.513	endf70h	B-VII.0	2006	1200.0	261252	26664	30.	yes	no	no	no	no
67165.74c	163.513	endf70h	B-VII.0	2006	2500.0	219628	21461	30.	yes	no	no	no	no
** Ho-166m **													
67566.70c	164.507	endf70h	B-VII.0	2006	293.6	216991	1855	20.0	yes	no	yes	no	yes
67566.71c	164.507	endf70h	B-VII.0	2006	600.0	216974	1853	20.0	yes	no	yes	no	yes
67566.72c	164.507	endf70h	B-VII.0	2006	900.0	216702	1819	20.0	yes	no	yes	no	yes
67566.73c	164.507	endf70h	B-VII.0	2006	1200.0	216574	1803	20.0	yes	no	yes	no	yes
67566.74c	164.507	endf70h	B-VII.0	2006	2500.0	215990	1730	20.0	yes	no	yes	no	yes
Z = 68 ********** erbium **********													
** Er-162 **													
68162.70c	160.538	endf70h	B-VII.0	2006	293.6	106762	6153	20.0	yes	no	no	no	no
68162.71c	160.538	endf70h	B-VII.0	2006	600.0	104586	5881	20.0	yes	no	no	no	no

May 29, 2008

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
**** Er-162 ****													
68162.72c	160.538	endf70h	B-VII.0	2006	900.0	102376	5605	20.0	yes	no	no	no	no
68162.73c	160.538	endf70h	B-VII.0	2006	1200.0	101169	5454	20.0	yes	no	no	no	no
68162.74c	160.538	endf70h	B-VII.0	2006	2500.0	98546	5126	20.0	yes	no	no	no	no
**** Er-164 ****													
68164.70c	162.521	endf70h	B-VII.0	2006	293.6	112169	7066	20.0	yes	no	no	no	no
68164.71c	162.521	endf70h	B-VII.0	2006	600.0	109450	6726	20.0	yes	no	no	no	no
68164.72c	162.521	endf70h	B-VII.0	2006	900.0	107962	6540	20.0	yes	no	no	no	no
68164.73c	162.521	endf70h	B-VII.0	2006	1200.0	106642	6375	20.0	yes	no	no	no	no
68164.74c	162.521	endf70h	B-VII.0	2006	2500.0	103467	5978	20.0	yes	no	no	no	no
**** Er-166 ****													
68166.70c	164.505	endf70h	B-VII.0	2006	293.6	282146	26520	20.0	yes	no	no	no	no
68166.71c	164.505	endf70h	B-VII.0	2006	600.0	268977	24874	20.0	yes	no	no	no	no
68166.72c	164.505	endf70h	B-VII.0	2006	900.0	261187	23900	20.0	yes	no	no	no	no
68166.73c	164.505	endf70h	B-VII.0	2006	1200.0	255281	23162	20.0	yes	no	no	no	no
68166.74c	164.505	endf70h	B-VII.0	2006	2500.0	239299	21164	20.0	yes	no	no	no	no
**** Er-167 ****													
68167.70c	165.498	endf70h	B-VII.0	2006	293.6	425917	43659	20.0	yes	no	no	no	yes
68167.71c	165.498	endf70h	B-VII.0	2006	600.0	381622	38122	20.0	yes	no	no	no	yes
68167.72c	165.498	endf70h	B-VII.0	2006	900.0	352381	34467	20.0	yes	no	no	no	yes
68167.73c	165.498	endf70h	B-VII.0	2006	1200.0	331887	31905	20.0	yes	no	no	no	yes
68167.74c	165.498	endf70h	B-VII.0	2006	2500.0	280733	25511	20.0	yes	no	no	no	yes
**** Er-168 ****													
68168.70c	166.487	endf70h	B-VII.0	2006	293.6	290136	26661	20.0	yes	no	no	no	no
68168.71c	166.487	endf70h	B-VII.0	2006	600.0	278169	25165	20.0	yes	no	no	no	no
68168.72c	166.487	endf70h	B-VII.0	2006	900.0	271257	24301	20.0	yes	no	no	no	no
68168.73c	166.487	endf70h	B-VII.0	2006	1200.0	266386	23692	20.0	yes	no	no	no	no
68168.74c	166.487	endf70h	B-VII.0	2006	2500.0	251921	21884	20.0	yes	no	no	no	no
**** Er-170 ****													
68170.70c	168.476	endf70h	B-VII.0	2006	293.6	161266	13145	20.0	yes	no	no	no	yes
68170.71c	168.476	endf70h	B-VII.0	2006	600.0	156953	12606	20.0	yes	no	no	no	yes
68170.72c	168.476	endf70h	B-VII.0	2006	900.0	154818	12339	20.0	yes	no	no	no	yes
68170.73c	168.476	endf70h	B-VII.0	2006	1200.0	152867	12095	20.0	yes	no	no	no	yes
68170.74c	168.476	endf70h	B-VII.0	2006	2500.0	148282	11522	20.0	yes	no	no	no	yes
Z = 71 ********** lutetium **********													
**** Lu-175 ****													
71175.70c	173.438	endf70i	B-VII.0	1998	293.6	141040	18755	20.0	no	no	no	no	yes
71175.71c	173.438	endf70i	B-VII.0	1998	600.0	127138	16769	20.0	no	no	no	no	yes

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

May 29, 2008

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD														
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Lu-175 **													
71175.72c	173.438	endf70i	B-VII.0	1998	900.0	119179	15632	20.0	no	no	no	no	yes
71175.73c	173.438	endf70i	B-VII.0	1998	1200.0	112571	14688	20.0	no	no	no	no	yes
71175.74c	173.438	endf70i	B-VII.0	1998	2500.0	95070	12188	20.0	no	no	no	no	yes
** Lu-176 **													
71176.70c	174.43	endf70i	B-VII.0	1998	293.6	75049	9148	20.0	no	no	no	no	yes
71176.71c	174.43	endf70i	B-VII.0	1998	600.0	67559	8078	20.0	no	no	no	no	yes
71176.72c	174.43	endf70i	B-VII.0	1998	900.0	64129	7588	20.0	no	no	no	no	yes
71176.73c	174.43	endf70i	B-VII.0	1998	1200.0	61329	7188	20.0	no	no	no	no	yes
71176.74c	174.43	endf70i	B-VII.0	1998	2500.0	54610	6228	20.0	no	no	no	no	yes
Z = 72 ********* hafnium *********													
** Hf-174 **													
72174.70c	172.446	endf70i	B-VII.0	1992	293.6	40126	4556	20.0	no	no	no	no	yes
72174.71c	172.446	endf70i	B-VII.0	1992	600.0	38817	4369	20.0	no	no	no	no	yes
72174.72c	172.446	endf70i	B-VII.0	1992	900.0	38096	4266	20.0	no	no	no	no	yes
72174.73c	172.446	endf70i	B-VII.0	1992	1200.0	37522	4184	20.0	no	no	no	no	yes
72174.74c	172.446	endf70i	B-VII.0	1992	2500.0	36234	4000	20.0	no	no	no	no	yes
** Hf-176 **													
72176.70c	174.43	endf70i	B-VII.0	1992	293.6	69513	8827	20.0	no	no	no	no	yes
72176.71c	174.43	endf70i	B-VII.0	1992	600.0	66510	8398	20.0	no	no	no	no	yes
72176.72c	174.43	endf70i	B-VII.0	1992	900.0	64557	8119	20.0	no	no	no	no	yes
72176.73c	174.43	endf70i	B-VII.0	1992	1200.0	63045	7903	20.0	no	no	no	no	yes
72176.74c	174.43	endf70i	B-VII.0	1992	2500.0	59482	7394	20.0	no	no	no	no	yes
** Hf-177 **													
72177.70c	175.423	endf70i	B-VII.0	1991	293.6	224374	30779	20.0	no	no	no	no	yes
72177.71c	175.423	endf70i	B-VII.0	1991	600.0	197914	26999	20.0	no	no	no	no	yes
72177.72c	175.423	endf70i	B-VII.0	1991	900.0	178818	24271	20.0	no	no	no	no	yes
72177.73c	175.423	endf70i	B-VII.0	1991	1200.0	165791	22410	20.0	no	no	no	no	yes
72177.74c	175.423	endf70i	B-VII.0	1991	2500.0	132821	17700	20.0	no	Nu	CP	no	yes
** Hf-178 **													
72178.70c	176.415	endf70i	B-VII.0	1991	293.6	71724	9187	20.0	no	no	no	no	yes
72178.71c	176.415	endf70i	B-VII.0	1991	600.0	68875	8780	20.0	no	no	no	no	yes
72178.72c	176.415	endf70i	B-VII.0	1991	900.0	67377	8566	20.0	no	no	no	no	yes
72178.73c	176.415	endf70i	B-VII.0	1991	1200.0	66138	8389	20.0	no	no	no	no	yes
72178.74c	176.415	endf70i	B-VII.0	1991	2500.0	63149	7962	20.0	no	no	no	no	yes
** Hf-179 **													
72179.70c	177.409	endf70i	B-VII.0	1991	293.6	107662	14227	20.0	no	no	no	no	yes
72179.71c	177.409	endf70i	B-VII.0	1991	600.0	101670	13371	20.0	no	no	no	no	yes

									Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words		NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Hf-179 **													
72179.72c	177.409	endf70i	B-VII.0	1991	900.0	97631	12794	20.0	no	no	no	no	yes
72179.73c	177.409	endf70i	B-VII.0	1991	1200.0	94201	12304	20.0	no	no	no	no	yes
72179.74c	177.409	endf70i	B-VII.0	1991	2500.0	84303	10890	20.0	no	no	no	no	yes
** Hf-180 **													
72180.70c	178.401	endf70i	B-VII.0	1991	293.6	169564	23242	20.0	no	no	no	no	yes
72180.71c	178.401	endf70i	B-VII.0	1991	600.0	161430	22080	20.0	no	no	no	no	yes
72180.72c	178.401	endf70i	B-VII.0	1991	900.0	155277	21201	20.0	no	no	no	no	yes
72180.73c	178.401	endf70i	B-VII.0	1991	1200.0	151091	20603	20.0	no	no	no	no	yes
72180.74c	178.401	endf70i	B-VII.0	1991	2500.0	140101	19033	20.0	no	no	no	no	yes
Z = 73 ********* tantalum *********													
** Ta-181 **													
73181.70c	179.4	endf70i	B-VII.0	1972	293.6	141529	15025	20.0	yes	no	no	no	no
73181.71c	179.4	endf70i	B-VII.0	1972	600.0	128819	13436	20.0	yes	no	no	no	no
73181.72c	179.4	endf70i	B-VII.0	1972	900.0	121811	12560	20.0	yes	no	no	no	no
73181.73c	179.4	endf70i	B-VII.0	1972	1200.0	117339	12001	20.0	yes	no	no	no	no
73181.74c	179.4	endf70i	B-VII.0	1972	2500.0	101801	10059	20.0	yes	no	no	no	no
** Ta-182 **													
73182.70c	180.387	endf70i	B-VII.0	1971	293.6	28409	2816	20.0	no	no	no	no	yes
73182.71c	180.387	endf70i	B-VII.0	1971	600.0	27443	2678	20.0	no	no	no	no	yes
73182.72c	180.387	endf70i	B-VII.0	1971	900.0	26624	2561	20.0	no	no	no	no	yes
73182.73c	180.387	endf70i	B-VII.0	1971	1200.0	26281	2512	20.0	no	no	no	no	yes
73182.74c	180.387	endf70i	B-VII.0	1971	2500.0	25574	2411	20.0	no	no	no	no	yes
Z = 74 ********* tungsten *********													
** W-182 **													
74182.70c	180.39	endf70i	B-VII.0	2004	293.6	270982	18395	150.0	yes	no	yes	no	yes
74182.71c	180.39	endf70i	B-VII.0	2004	600.0	262814	17374	150.0	yes	no	yes	no	yes
74182.72c	180.39	endf70i	B-VII.0	2004	900.0	257715	16729	150.0	yes	no	yes	no	yes
74182.73c	180.39	endf70i	B-VII.0	2004	1200.0	254913	16379	150.0	yes	no	yes	no	yes
74182.74c	180.39	endf70i	B-VII.0	2004	2500.0	245215	15174	150.0	yes	no	yes	no	yes
** W-183 **													
74183.70c	181.38	endf70i	B-VII.0	2004	293.6	227280	13389	150.0	yes	no	yes	no	yes
74183.71c	181.38	endf70i	B-VII.0	2004	600.0	221191	12628	150.0	yes	no	yes	no	yes
74183.72c	181.38	endf70i	B-VII.0	2004	900.0	216007	11980	150.0	yes	no	yes	no	yes
74183.73c	181.38	endf70i	B-VII.0	2004	1200.0	212559	11549	150.0	yes	no	yes	no	yes
74183.74c	181.38	endf70i	B-VII.0	2004	2500.0	203767	10450	150.0	yes	no	yes	no	yes
** W-184 **													
74184.70c	182.37	endf70i	B-VII.0	2004	293.6	202861	11149	150.0	yes	no	yes	no	yes

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** W-184 **													
74184.71c	182.37	endf70i	B-VII.0	2004	600.0	198349	10585	150.0	yes	no	yes	no	yes
74184.72c	182.37	endf70i	B-VII.0	2004	900.0	195683	10252	150.0	yes	no	yes	no	yes
74184.73c	182.37	endf70i	B-VII.0	2004	1200.0	193989	10040	150.0	yes	no	yes	no	yes
74184.74c	182.37	endf70i	B-VII.0	2004	2500.0	189011	9418	150.0	yes	no	yes	no	yes
** W-186 **													
74186.70c	184.36	endf70i	B-VII.0	2004	293.6	208629	11750	150.0	yes	no	yes	no	yes
74186.71c	184.36	endf70i	B-VII.0	2004	600.0	205234	11265	150.0	yes	no	yes	no	yes
74186.72c	184.36	endf70i	B-VII.0	2004	900.0	203120	10963	150.0	yes	no	yes	no	yes
74186.73c	184.36	endf70i	B-VII.0	2004	1200.0	201237	10694	150.0	yes	no	yes	no	yes
74186.74c	184.36	endf70i	B-VII.0	2004	2500.0	197150	10110	150.0	yes	no	yes	no	yes
Z = 75 ********** rhenium **********													
** Re-185 **													
75185.70c	183.364	endf70i	B-VII.0	1990	293.6	428476	60063	20.0	no	no	no	no	yes
75185.71c	183.364	endf70i	B-VII.0	1990	600.0	360611	50368	20.0	no	no	no	no	yes
75185.72c	183.364	endf70i	B-VII.0	1990	900.0	321229	44742	20.0	no	no	no	no	yes
75185.73c	183.364	endf70i	B-VII.0	1990	1200.0	293159	40732	20.0	no	no	no	no	yes
75185.74c	183.364	endf70i	B-VII.0	1990	2500.0	225721	31098	20.0	no	no	no	no	yes
** Re-187 **													
75187.70c	185.35	endf70i	B-VII.0	1990	293.6	383887	53544	20.0	no	no	no	no	yes
75187.71c	185.35	endf70i	B-VII.0	1990	600.0	332017	46134	20.0	no	no	no	no	yes
75187.72c	185.35	endf70i	B-VII.0	1990	900.0	298130	41293	20.0	no	no	no	no	yes
75187.73c	185.35	endf70i	B-VII.0	1990	1200.0	275177	38014	20.0	no	no	no	no	yes
75187.74c	185.35	endf70i	B-VII.0	1990	2500.0	221116	30291	20.0	no	no	no	no	yes
Z = 77 ********** iridium **********													
** Ir-191 **													
77191.70c	189.32	endf70i	B-VII.0	2006	293.6	431865	9337	20.0	yes	no	yes	no	no
77191.71c	189.32	endf70i	B-VII.0	2006	600.0	424153	8373	20.0	yes	no	yes	no	no
77191.72c	189.32	endf70i	B-VII.0	2006	900.0	420114	7868	20.0	yes	no	yes	no	no
77191.73c	189.32	endf70i	B-VII.0	2006	1200.0	416369	7400	20.0	yes	no	yes	no	no
77191.74c	189.32	endf70i	B-VII.0	2006	2500.0	408633	6433	20.0	yes	no	yes	no	no
** Ir-193 **													
77193.70c	191.305	endf70i	B-VII.0	2006	293.6	385638	9733	20.0	yes	no	yes	no	yes
77193.71c	191.305	endf70i	B-VII.0	2006	600.0	380566	9099	20.0	yes	no	yes	no	yes
77193.72c	191.305	endf70i	B-VII.0	2006	900.0	376446	8584	20.0	yes	no	yes	no	yes
77193.73c	191.305	endf70i	B-VII.0	2006	1200.0	374846	8384	20.0	yes	no	yes	no	yes
77193.74c	191.305	endf70i	B-VII.0	2006	2500.0	368575	7600	20.0	yes	no	yes	no	yes
Z = 79 ********** gold **********													

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Au-197 **													
79197.70c	195.274	endf70i	B-VII.0	2006	293.6	410653	43287	30.	yes	no	no	no	no
79197.71c	195.274	endf70i	B-VII.0	2006	600.0	380853	39562	30.	yes	no	no	no	no
79197.72c	195.274	endf70i	B-VII.0	2006	900.0	362389	37254	30.	yes	no	no	no	no
79197.73c	195.274	endf70i	B-VII.0	2006	1200.0	350733	35797	30.	yes	no	no	no	no
79197.74c	195.274	endf70i	B-VII.0	2006	2500.0	315437	31385	30.	yes	no	no	no	no
Z = 80 ********* mercury *********													
** Hg-196 **													
80196.70c	194.282	endf70i	B-VII.0	2004	293.6	153203	1690	150.0	yes	no	yes	no	no
80196.71c	194.282	endf70i	B-VII.0	2004	600.0	153084	1678	150.0	yes	no	yes	no	no
80196.72c	194.282	endf70i	B-VII.0	2004	900.0	153144	1684	150.0	yes	no	yes	no	no
80196.73c	194.282	endf70i	B-VII.0	2004	1200.0	153133	1683	150.0	yes	no	yes	no	no
80196.74c	194.282	endf70i	B-VII.0	2004	2500.0	152765	1646	150.0	yes	no	yes	no	no
** Hg-198 **													
80198.70c	196.266	endf70i	B-VII.0	2004	293.6	172593	3227	150.0	yes	no	yes	no	no
80198.71c	196.266	endf70i	B-VII.0	2004	600.0	171712	3139	150.0	yes	no	yes	no	no
80198.72c	196.266	endf70i	B-VII.0	2004	900.0	170873	3055	150.0	yes	no	yes	no	no
80198.73c	196.266	endf70i	B-VII.0	2004	1200.0	170653	3033	150.0	yes	no	yes	no	no
80198.74c	196.266	endf70i	B-VII.0	2004	2500.0	169673	2935	150.0	yes	no	yes	no	no
** Hg-199 **													
80199.70c	197.259	endf70i	B-VII.0	2004	293.6	173234	4135	150.0	yes	no	yes	no	no
80199.71c	197.259	endf70i	B-VII.0	2004	600.0	172904	4102	150.0	yes	no	yes	no	no
80199.72c	197.259	endf70i	B-VII.0	2004	900.0	172354	4047	150.0	yes	no	yes	no	no
80199.73c	197.259	endf70i	B-VII.0	2004	1200.0	171983	4010	150.0	yes	no	yes	no	no
80199.74c	197.259	endf70i	B-VII.0	2004	2500.0	171045	3916	150.0	yes	no	yes	no	no
** Hg-200 **													
80200.70c	198.25	endf70i	B-VII.0	2004	293.6	193447	2718	150.0	yes	no	yes	no	no
80200.71c	198.25	endf70i	B-VII.0	2004	600.0	193286	2698	150.0	yes	no	yes	no	no
80200.72c	198.25	endf70i	B-VII.0	2004	900.0	193222	2690	150.0	yes	Nu	CP	no	UR
80200.73c	198.25	endf70i	B-VII.0	2004	1200.0	193175	2684	150.0	yes	no	yes	no	no
80200.74c	198.25	endf70i	B-VII.0	2004	2500.0	192920	2652	150.0	yes	no	yes	no	no
** Hg-201 **													
80201.70c	199.244	endf70i	B-VII.0	2004	293.6	166136	3506	150.0	yes	no	yes	no	no
80201.71c	199.244	endf70i	B-VII.0	2004	600.0	165765	3469	150.0	yes	no	yes	no	no
80201.72c	199.244	endf70i	B-VII.0	2004	900.0	165356	3428	150.0	yes	no	yes	no	no
80201.73c	199.244	endf70i	B-VII.0	2004	1200.0	165175	3410	150.0	yes	no	yes	no	no
80201.74c	199.244	endf70i	B-VII.0	2004	2500.0	164967	3389	150.0	yes	no	yes	no	no
** Hg-202 **													

May 29, 2008

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
** Hg-202 **													
80202.70c	200.236	endf70i	B-VII.0	2004	293.6	155333	1980	150.0	yes	no	yes	no	no
80202.71c	200.236	endf70i	B-VII.0	2004	600.0	155277	1973	150.0	yes	no	yes	no	no
80202.72c	200.236	endf70i	B-VII.0	2004	900.0	155199	1963	150.0	yes	no	yes	no	no
80202.73c	200.236	endf70i	B-VII.0	2004	1200.0	155157	1958	150.0	yes	no	yes	no	no
80202.74c	200.236	endf70i	B-VII.0	2004	2500.0	155022	1941	150.0	yes	no	yes	no	no
** Hg-204 **													
80204.70c	202.221	endf70i	B-VII.0	2004	293.6	140620	834	150.0	yes	no	yes	no	no
80204.71c	202.221	endf70i	B-VII.0	2004	600.0	140739	849	150.0	yes	no	yes	no	no
80204.72c	202.221	endf70i	B-VII.0	2004	900.0	140810	858	150.0	yes	no	yes	no	no
80204.73c	202.221	endf70i	B-VII.0	2004	1200.0	140851	863	150.0	yes	no	yes	no	no
80204.74c	202.221	endf70i	B-VII.0	2004	2500.0	140994	881	150.0	yes	no	yes	no	no
Z = 82 ********** lead **********													
** Pb-204 **													
82204.70c	202.221	endf70i	B-VII.0	2004	293.6	613990	12401	200.	yes	no	yes	no	no
82204.71c	202.221	endf70i	B-VII.0	2004	600.0	604197	11993	200.	yes	no	yes	no	no
82204.72c	202.221	endf70i	B-VII.0	2004	900.0	598654	11762	200.	yes	no	yes	no	no
82204.73c	202.221	endf70i	B-VII.0	2004	1200.0	594527	11590	200.	yes	no	yes	no	no
82204.74c	202.221	endf70i	B-VII.0	2004	2500.0	584901	11189	200.	yes	no	yes	no	no
** Pb-206 **													
82206.70c	204.205	endf70i	B-VII.0	2004	293.6	1205531	36453	200.	yes	no	yes	no	no
82206.71c	204.205	endf70i	B-VII.0	2004	600.0	1188179	35730	200.	yes	no	yes	no	no
82206.72c	204.205	endf70i	B-VII.0	2004	900.0	1177716	35294	200.	yes	no	yes	no	no
82206.73c	204.205	endf70i	B-VII.0	2004	1200.0	1171498	35035	200.	yes	no	yes	no	no
82206.74c	204.205	endf70i	B-VII.0	2004	2500.0	1143682	33876	200.	yes	no	yes	no	no
** Pb-207 **													
82207.70c	205.198	endf70i	B-VII.0	2004	293.6	551210	12098	200.	yes	no	yes	no	no
82207.71c	205.198	endf70i	B-VII.0	2004	600.0	546459	11900	200.	yes	no	yes	no	no
82207.72c	205.198	endf70i	B-VII.0	2004	900.0	543531	11778	200.	yes	Nu	yes	no	no
82207.73c	205.198	endf70i	B-VII.0	2004	1200.0	541322	11686	200.	yes	no	yes	no	no
82207.74c	205.198	endf70i	B-VII.0	2004	2500.0	532876	11334	200.	yes	no	yes	no	no
** Pb-208 **													
82208.70c	206.19	endf70i	B-VII.0	2006	293.6	483193	7444	150.0	yes	no	yes	no	no
82208.71c	206.19	endf70i	B-VII.0	2006	600.0	481815	7382	150.0	yes	no	yes	no	no
82208.72c	206.19	endf70i	B-VII.0	2006	900.0	481121	7351	150.0	yes	no	yes	no	no
82208.73c	206.19	endf70i	B-VII.0	2006	1200.0	480469	7322	150.0	yes	no	yes	no	no
82208.74c	206.19	endf70i	B-VII.0	2006	2500.0	477863	7205	150.0	yes	no	yes	no	no

Z = 83 ********** bismuth **********

				Eval	Temp	Length		Emax					
ZAID	AWR	Library Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** Bi-209 **													
83209.70c	207.185	endf70i	B-VII.0	1999	293.6	267132	12408	150.0	yes	no	yes	no	no
83209.71c	207.185	endf70i	B-VII.0	1999	600.0	263542	12114	150.0	yes	no	yes	no	no
83209.72c	207.185	endf70i	B-VII.0	1999	900.0	260897	11907	150.0	yes	no	yes	no	no
83209.73c	207.185	endf70i	B-VII.0	1999	1200.0	258003	11688	150.0	yes	no	yes	no	no
83209.74c	207.185	endf70i	B-VII.0	1999	2500.0	253125	11309	150.0	yes	no	yes	no	no
Z = 88 ********** radium **********													
** Ra-223 **													
88223.70c	221.103	endf70k	B-VII.0	1988	293.6	22870	1010	20.0	no	tot	no	no	no
88223.71c	221.103	endf70k	B-VII.0	1988	600.0	22950	1020	20.0	no	tot	no	no	no
88223.72c	221.103	endf70k	B-VII.0	1988	900.0	22966	1022	20.0	no	tot	no	no	no
88223.73c	221.103	endf70k	B-VII.0	1988	1200.0	22862	1009	20.0	no	tot	no	no	no
88223.74c	221.103	endf70k	B-VII.0	1988	2500.0	22950	1020	20.0	no	tot	no	no	no
** Ra-224 **													
88224.70c	222.096	endf70k	B-VII.0	1988	293.6	19490	969	20.0	no	no	no	no	no
88224.71c	222.096	endf70k	B-VII.0	1988	600.0	19441	962	20.0	no	no	no	no	no
88224.72c	222.096	endf70k	B-VII.0	1988	900.0	19504	971	20.0	no	no	no	no	no
88224.73c	222.096	endf70k	B-VII.0	1988	1200.0	19504	971	20.0	no	no	no	no	no
88224.74c	222.096	endf70k	B-VII.0	1988	2500.0	19448	963	20.0	no	no	no	no	no
** Ra-225 **													
88225.70c	223.091	endf70k	B-VII.0	1988	293.6	16663	965	20.0	no	no	no	no	no
88225.71c	223.091	endf70k	B-VII.0	1988	600.0	16593	955	20.0	no	no	no	no	no
88225.72c	223.091	endf70k	B-VII.0	1988	900.0	16628	960	20.0	no	no	no	no	no
88225.73c	223.091	endf70k	B-VII.0	1988	1200.0	16663	965	20.0	no	no	no	no	no
88225.74c	223.091	endf70k	B-VII.0	1988	2500.0	16572	952	20.0	no	no	no	no	no
** Ra-226 **													
88226.70c	224.084	endf70k	B-VII.0	1993	293.6	102219	10724	20.0	no	tot	no	no	no
88226.71c	224.084	endf70k	B-VII.0	1993	600.0	98219	10224	20.0	no	tot	no	no	no
88226.72c	224.084	endf70k	B-VII.0	1993	900.0	95795	9921	20.0	no	tot	no	no	no
88226.73c	224.084	endf70k	B-VII.0	1993	1200.0	93379	9619	20.0	no	tot	no	no	no
88226.74c	224.084	endf70k	B-VII.0	1993	2500.0	89323	9112	20.0	no	tot	no	no	no
Z = 89 ********** actinium **********													
** Ac-225 **													
89225.70c	223.09	endf70k	B-VII.0	1988	293.6	13036	857	20.0	no	no	no	no	no
89225.71c	223.09	endf70k	B-VII.0	1988	600.0	13015	854	20.0	no	no	no	no	no
89225.72c	223.09	endf70k	B-VII.0	1988	900.0	13022	855	20.0	no	no	no	no	no
89225.73c	223.09	endf70k	B-VII.0	1988	1200.0	13022	855	20.0	no	no	no	no	no
89225.74c	223.09	endf70k	B-VII.0	1988	2500.0	12980	849	20.0	no	no	no	no	no

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

								Emax					
		Library		Eval	Temp	Length							
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** Ac-226 **													
89226.70c	224.084	endf70k	B-VII.0	1988	293.6	14753	1046	20.0	no	no	no	no	no
89226.71c	224.084	endf70k	B-VII.0	1988	600.0	14788	1051	20.0	no	no	no	no	no
89226.72c	224.084	endf70k	B-VII.0	1988	900.0	14669	1034	20.0	no	no	no	no	no
89226.73c	224.084	endf70k	B-VII.0	1988	1200.0	14711	1040	20.0	no	no	no	no	no
89226.74c	224.084	endf70k	B-VII.0	1988	2500.0	14718	1041	20.0	no	no	no	no	no
** Ac-227 **													
89227.70c	225.077	endf70k	B-VII.0	1988	293.6	21377	1085	20.0	no	tot	no	no	no
89227.71c	225.077	endf70k	B-VII.0	1988	600.0	21449	1094	20.0	no	tot	no	no	no
89227.72c	225.077	endf70k	B-VII.0	1988	900.0	21465	1096	20.0	no	tot	no	no	no
89227.73c	225.077	endf70k	B-VII.0	1988	1200.0	21345	1081	20.0	no	tot	no	no	no
89227.74c	225.077	endf70k	B-VII.0	1988	2500.0	21465	1096	20.0	no	tot	no	no	no
Z = 90 ********** thorium **********													
** Th-227 **													
90227.70c	225.077	endf70k	B-VII.0	1994	293.6	15012	939	20.0	no	both	no	no	no
90227.71c	225.077	endf70k	B-VII.0	1994	600.0	14956	932	20.0	no	both	no	no	no
90227.72c	225.077	endf70k	B-VII.0	1994	900.0	14948	931	20.0	no	both	no	no	no
90227.73c	225.077	endf70k	B-VII.0	1994	1200.0	14956	932	20.0	no	both	no	no	no
90227.74c	225.077	endf70k	B-VII.0	1994	2500.0	14860	920	20.0	no	both	no	no	no
** Th-228 **													
90228.70c	226.07	endf70k	B-VII.0	2005	293.6	33964	1713	20.0	no	both	no	no	no
90228.71c	226.07	endf70k	B-VII.0	2005	600.0	33580	1665	20.0	no	both	no	no	no
90228.72c	226.07	endf70k	B-VII.0	2005	900.0	33364	1638	20.0	no	both	no	no	no
90228.73c	226.07	endf70k	B-VII.0	2005	1200.0	33212	1619	20.0	no	both	no	no	no
90228.74c	226.07	endf70k	B-VII.0	2005	2500.0	32852	1574	20.0	no	both	no	no	no
** Th-229 **													
90229.70c	227.064	endf70k	B-VII.0	2006	293.6	29314	2534	20.0	no	both	no	no	no
90229.71c	227.064	endf70k	B-VII.0	2006	600.0	28706	2458	20.0	no	both	no	no	no
90229.72c	227.064	endf70k	B-VII.0	2006	900.0	28226	2398	20.0	no	both	no	no	no
90229.73c	227.064	endf70k	B-VII.0	2006	1200.0	27530	2311	20.0	no	both	no	no	no
90229.74c	227.064	endf70k	B-VII.0	2006	2500.0	26178	2142	20.0	no	both	no	no	no
** Th-230 **													
90230.70c	228.06	endf70k	B-VII.0	1977	293.6	63484	8278	20.0	no	tot	no	no	no
90230.71c	228.06	endf70k	B-VII.0	1977	600.0	61122	7941	20.0	no	tot	no	no	no
90230.72c	228.06	endf70k	B-VII.0	1977	900.0	59139	7657	20.0	no	tot	no	no	no
90230.73c	228.06	endf70k	B-VII.0	1977	1200.0	57412	7412	20.0	no	tot	no	no	no
90230.74c	228.06	endf70k	B-VII.0	1977	2500.0	54517	6998	20.0	no	tot	no	no	no
** Th-232 **													

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** Th-232 **													
90232.70c	230.045	endf70k	B-VII.0	2006	293.6	2440600	58038	60.	yes	both	yes	yes	yes
90232.71c	230.045	endf70k	B-VII.0	2006	600.0	2385142	51106	60.	yes	both	yes	yes	yes
90232.72c	230.045	endf70k	B-VII.0	2006	900.0	2356785	47561	60.	yes	both	yes	yes	yes
90232.73c	230.045	endf70k	B-VII.0	2006	1200.0	2335625	44916	60.	yes	both	yes	yes	yes
90232.74c	230.045	endf70k	B-VII.0	2006	2500.0	2288165	38981	60.	yes	both	yes	yes	yes
** Th-233 **													
90233.70c	231.04	endf70k	B-VII.0	1994	293.6	32764	1100	20.0	no	both	no	no	no
90233.71c	231.04	endf70k	B-VII.0	1994	600.0	32764	1100	20.0	no	both	no	no	no
90233.72c	231.04	endf70k	B-VII.0	1994	900.0	32764	1100	20.0	no	both	no	no	no
90233.73c	231.04	endf70k	B-VII.0	1994	1200.0	32764	1100	20.0	no	both	no	no	no
90233.74c	231.04	endf70k	B-VII.0	1994	2500.0	32764	1100	20.0	no	both	no	no	no
** Th-234 **													
90234.70c	232.033	endf70k	B-VII.0	1994	293.6	31324	1192	20.0	no	both	no	no	no
90234.71c	232.033	endf70k	B-VII.0	1994	600.0	31324	1192	20.0	no	both	no	no	no
90234.72c	232.033	endf70k	B-VII.0	1994	900.0	31380	1200	20.0	no	both	no	no	no
90234.73c	232.033	endf70k	B-VII.0	1994	1200.0	31366	1198	20.0	no	both	no	no	no
90234.74c	232.033	endf70k	B-VII.0	1994	2500.0	31366	1198	20.0	no	both	no	no	no
Z = 91 ********** protactinium **********													
** Pa-231 **													
91231.70c	229.051	endf70k	B-VII.0	2006	293.6	1397542	17370	60.	yes	both	yes	yes	yes
91231.71c	229.051	endf70k	B-VII.0	2006	600.0	1368940	14192	60.	yes	both	yes	yes	yes
91231.72c	229.051	endf70k	B-VII.0	2006	900.0	1351804	12288	60.	yes	both	yes	yes	yes
91231.73c	229.051	endf70k	B-VII.0	2006	1200.0	1340725	11057	60.	yes	both	yes	yes	yes
91231.74c	229.051	endf70k	B-VII.0	2006	2500.0	1316155	8327	60.	yes	both	yes	yes	yes
** Pa-232 **													
91232.70c	230.045	endf70k	B-VII.0	2005	293.6	20423	1524	20.0	no	both	no	no	no
91232.71c	230.045	endf70k	B-VII.0	2005	600.0	20359	1516	20.0	no	both	no	no	no
91232.72c	230.045	endf70k	B-VII.0	2005	900.0	20351	1515	20.0	no	both	no	no	no
91232.73c	230.045	endf70k	B-VII.0	2005	1200.0	20223	1499	20.0	no	both	no	no	no
91232.74c	230.045	endf70k	B-VII.0	2005	2500.0	19791	1445	20.0	no	both	no	no	no
** Pa-233 **													
91233.70c	231.038	endf70k	B-VII.0	2006	293.6	1533057	14062	60.	yes	both	yes	yes	yes
91233.71c	231.038	endf70k	B-VII.0	2006	600.0	1516967	12052	60.	yes	both	yes	yes	yes
91233.72c	231.038	endf70k	B-VII.0	2006	900.0	1506288	10717	60.	yes	both	yes	yes	yes
91233.73c	231.038	endf70k	B-VII.0	2006	1200.0	1498348	9724	60.	yes	both	yes	yes	yes
91233.74c	231.038	endf70k	B-VII.0	2006	2500.0	1478086	7191	60.	yes	both	yes	yes	yes

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

Z = 92 ********** uranium **********

Appendix G - MCNP Data Libraries
Neutron Cross-Section Libraries

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** U-232 **													
92232.70c	230.044	endf70j	B-VII.0	2005	293.6	198527	7422	30.	yes	no	no	no	yes
92232.71c	230.044	endf70j	B-VII.0	2005	600.0	194972	7027	30.	yes	no	no	no	yes
92232.72c	230.044	endf70j	B-VII.0	2005	900.0	192383	6739	30.	yes	no	no	no	yes
92232.73c	230.044	endf70j	B-VII.0	2005	1200.0	190860	6570	30.	yes	no	no	no	yes
92232.74c	230.044	endf70j	B-VII.0	2005	2500.0	185811	6009	30.	yes	no	no	no	yes
** U-233 **													
92233.70c	231.038	endf70j	B-VII.0	2006	293.6	452732	25024	30.	yes	no	no	yes	yes
92233.71c	231.038	endf70j	B-VII.0	2006	600.0	414977	20829	30.	yes	no	no	yes	yes
92233.72c	231.038	endf70j	B-VII.0	2006	900.0	393710	18466	30.	yes	no	no	yes	yes
92233.73c	231.038	endf70j	B-VII.0	2006	1200.0	379283	16863	30.	yes	no	no	yes	yes
92233.74c	231.038	endf70j	B-VII.0	2006	2500.0	349190	13515	30.	yes	no	no	yes	yes
** U-234 **													
92234.70c	232.03	endf70j	B-VII.0	2006	293.6	423459	25480	30.	yes	no	no	yes	yes
92234.71c	232.03	endf70j	B-VII.0	2006	600.0	409131	23888	30.	yes	no	no	yes	yes
92234.72c	232.03	endf70j	B-VII.0	2006	900.0	400423	22920	30.	yes	no	no	yes	yes
92234.73c	232.03	endf70j	B-VII.0	2006	1200.0	393165	22114	30.	yes	no	no	yes	yes
92234.74c	232.03	endf70j	B-VII.0	2006	2500.0	375444	20145	30.	yes	no	no	yes	yes
** U-235 **													
92235.70c	233.025	endf70j	B-VII.0	2006	293.6	832644	76525	20.0	yes	no	no	yes	yes
92235.71c	233.025	endf70j	B-VII.0	2006	600.0	689688	60641	20.0	yes	no	no	yes	yes
92235.72c	233.025	endf70j	B-VII.0	2006	900.0	629412	53941	20.0	yes	no	no	yes	yes
92235.73c	233.025	endf70j	B-VII.0	2006	1200.0	594954	50115	20.0	yes	no	no	yes	yes
92235.74c	233.025	endf70j	B-VII.0	2006	2500.0	534660	43413	20.0	yes	no	no	yes	yes
** U-236 **													
92236.70c	234.018	endf70j	B-VII.0	2005	293.6	358107	24118	30.	yes	no	no	yes	yes
92236.71c	234.018	endf70j	B-VII.0	2005	600.0	343652	22512	30.	yes	no	no	yes	yes
92236.72c	234.018	endf70j	B-VII.0	2005	900.0	335579	21615	30.	yes	no	no	yes	yes
92236.73c	234.018	endf70j	B-VII.0	2005	1200.0	327767	20747	30.	yes	no	no	yes	yes
92236.74c	234.018	endf70j	B-VII.0	2005	2500.0	311748	18967	30.	yes	no	no	yes	yes
** U-237 **													
92237.70c	235.012	endf70j	B-VII.0	2006	293.6	168048	8498	30.	yes	no	no	yes	yes
92237.71c	235.012	endf70j	B-VII.0	2006	600.0	164539	8108	30.	yes	no	no	yes	yes
92237.72c	235.012	endf70j	B-VII.0	2006	900.0	162118	7839	30.	yes	no	no	yes	yes
92237.73c	235.012	endf70j	B-VII.0	2006	1200.0	160569	7667	30.	yes	no	no	yes	yes
92237.74c	235.012	endf70j	B-VII.0	2006	2500.0	154945	7042	30.	yes	no	no	yes	yes
** U-238 **													
92238.70c	236.006	endf70j	B-VII.0	2006	293.6	1637757	157754	30.	yes	no	no	yes	yes

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** U-238 **													
92238.71c	236.006	endf70j	B-VII.0	2006	600.0	1423644	133964	30.	yes	no	no	yes	yes
92238.72c	236.006	endf70j	B-VII.0	2006	900.0	1321197	122581	30.	yes	no	no	yes	yes
92238.73c	236.006	endf70j	B-VII.0	2006	1200.0	1256218	115361	30.	yes	no	no	yes	yes
92238.74c	236.006	endf70j	B-VII.0	2006	2500.0	1114647	99631	30.	yes	no	no	yes	yes
** U-239 **													
92239.70c	237.001	endf70j	B-VII.0	2006	293.6	238312	8498	30.	yes	no	no	yes	yes
92239.71c	237.001	endf70j	B-VII.0	2006	600.0	235226	8155	30.	yes	no	no	yes	yes
92239.72c	237.001	endf70j	B-VII.0	2006	900.0	232948	7902	30.	yes	no	no	yes	yes
92239.73c	237.001	endf70j	B-VII.0	2006	1200.0	231499	7741	30.	yes	no	no	yes	yes
92239.74c	237.001	endf70j	B-VII.0	2006	2500.0	226136	7145	30.	yes	no	no	yes	yes
** U-240 **													
92240.70c	237.994	endf70j	B-VII.0	2005	293.6	296586	16896	30.	yes	no	no	yes	yes
92240.71c	237.994	endf70j	B-VII.0	2005	600.0	286064	15727	30.	yes	no	no	yes	yes
92240.72c	237.994	endf70j	B-VII.0	2005	900.0	281555	15226	30.	yes	no	no	yes	yes
92240.73c	237.994	endf70j	B-VII.0	2005	1200.0	278351	14870	30.	yes	no	no	yes	yes
92240.74c	237.994	endf70j	B-VII.0	2005	2500.0	266859	13593	30.	yes	no	no	yes	yes
** U-241 **													
92241.70c	238.99	endf70j	B-VII.0	2005	293.6	226675	8002	30.	yes	no	no	yes	yes
92241.71c	238.99	endf70j	B-VII.0	2005	600.0	224315	7766	30.	yes	no	no	yes	yes
92241.72c	238.99	endf70j	B-VII.0	2005	900.0	220265	7361	30.	yes	no	no	yes	yes
92241.73c	238.99	endf70j	B-VII.0	2005	1200.0	218565	7191	30.	yes	no	no	yes	yes
92241.74c	238.99	endf70j	B-VII.0	2005	2500.0	214575	6792	30.	yes	no	no	yes	yes
Z = 93 ********** neptunium **********													
** Np-235 **													
93235.70c	233.025	endf70j	B-VII.0	1995	293.6	28702	1075	20.0	no	no	no	no	no
93235.71c	233.025	endf70j	B-VII.0	1995	600.0	28558	1057	20.0	no	no	no	no	no
93235.72c	233.025	endf70j	B-VII.0	1995	900.0	28646	1068	20.0	no	no	no	no	no
93235.73c	233.025	endf70j	B-VII.0	1995	1200.0	28646	1068	20.0	no	no	no	no	no
93235.74c	233.025	endf70j	B-VII.0	1995	2500.0	28486	1048	20.0	no	no	no	no	no
** Np-236 **													
93236.70c	234.019	endf70j	B-VII.0	1999	293.6	22967	1778	20.0	no	no	no	no	no
93236.71c	234.019	endf70j	B-VII.0	1999	600.0	22695	1744	20.0	no	no	no	no	no
93236.72c	234.019	endf70j	B-VII.0	1999	900.0	22511	1721	20.0	no	no	no	no	no
93236.73c	234.019	endf70j	B-VII.0	1999	1200.0	22327	1698	20.0	no	no	no	no	no
93236.74c	234.019	endf70j	B-VII.0	1999	2500.0	21759	1627	20.0	no	no	no	no	no
** Np-237 **													
93237.70c	235.012	endf70j	B-VII.0	2004	293.6	460438	41035	20.0	yes	no	no	yes	yes

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Np-237 **													
93237.71c	235.012	endf70j	B-VII.0	2004	600.0	373547	31377	20.0	yes	no	no	yes	yes
93237.72c	235.012	endf70j	B-VII.0	2004	900.0	336134	27220	20.0	yes	no	no	yes	yes
93237.73c	235.012	endf70j	B-VII.0	2004	1200.0	313540	24713	20.0	yes	no	no	yes	yes
93237.74c	235.012	endf70j	B-VII.0	2004	2500.0	271987	20096	20.0	yes	no	no	yes	yes
** Np-238 **													
93238.70c	236.006	endf70j	B-VII.0	1993	293.6	30728	982	20.0	no	no	no	no	no
93238.71c	236.006	endf70j	B-VII.0	1993	600.0	30728	982	20.0	no	no	no	no	no
93238.72c	236.006	endf70j	B-VII.0	1993	900.0	30728	982	20.0	no	no	no	no	no
93238.73c	236.006	endf70j	B-VII.0	1993	1200.0	30728	982	20.0	no	no	no	no	no
93238.74c	236.006	endf70j	B-VII.0	1993	2500.0	30728	982	20.0	no	no	no	no	no
** Np-239 **													
93239.70c	236.999	endf70j	B-VII.0	1987	293.6	16798	1010	20.0	no	no	no	no	no
93239.71c	236.999	endf70j	B-VII.0	1987	600.0	16805	1011	20.0	no	no	no	no	no
93239.72c	236.999	endf70j	B-VII.0	1987	900.0	16812	1012	20.0	no	no	no	no	no
93239.73c	236.999	endf70j	B-VII.0	1987	1200.0	16792	1009	20.0	no	no	no	no	no
93239.74c	236.999	endf70j	B-VII.0	1987	2500.0	16799	1010	20.0	no	no	no	no	no
Z = 94 ********** plutonium **********													
** Pu-236 **													
94236.70c	234.018	endf70j	B-VII.0	2001	293.6	50069	1302	20.0	no	no	no	no	yes
94236.71c	234.018	endf70j	B-VII.0	2001	600.0	49989	1292	20.0	no	no	no	no	yes
94236.72c	234.018	endf70j	B-VII.0	2001	900.0	49973	1290	20.0	no	no	no	no	yes
94236.73c	234.018	endf70j	B-VII.0	2001	1200.0	49973	1290	20.0	no	no	no	no	yes
94236.74c	234.018	endf70j	B-VII.0	2001	2500.0	49853	1275	20.0	no	no	no	no	yes
** Pu-237 **													
94237.70c	235.012	endf70j	B-VII.0	1978	293.6	10998	720	20.0	no	no	no	no	no
94237.71c	235.012	endf70j	B-VII.0	1978	600.0	10982	718	20.0	no	no	no	no	no
94237.72c	235.012	endf70j	B-VII.0	1978	900.0	10990	719	20.0	no	no	no	no	no
94237.73c	235.012	endf70j	B-VII.0	1978	1200.0	10982	718	20.0	yes	Nu	no	no	UR
94237.74c	235.012	endf70j	B-VII.0	1978	2500.0	11030	724	20.0	no	no	no	no	no
** Pu-238 **													
94238.70c	236.004	endf70j	B-VII.0	1978	293.6	64195	5676	20.0	no	no	no	yes	yes
94238.71c	236.004	endf70j	B-VII.0	1978	600.0	61419	5329	20.0	no	no	no	yes	yes
94238.72c	236.004	endf70j	B-VII.0	1978	900.0	60851	5258	20.0	no	no	no	yes	yes
94238.73c	236.004	endf70j	B-VII.0	1978	1200.0	59651	5108	20.0	no	no	no	yes	yes
94238.74c	236.004	endf70j	B-VII.0	1978	2500.0	57211	4803	20.0	no	no	no	yes	yes
** Pu-239 **													
94239.70c	236.999	endf70j	B-VII.0	2006	293.6	808738	72098	20.0	yes	no	no	yes	yes

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** Pu-239 **													
94239.71c	236.999	endf70j	B-VII.0	2006	600.0	698776	59880	20.0	yes	no	no	yes	yes
94239.72c	236.999	endf70j	B-VII.0	2006	900.0	639835	53331	20.0	yes	no	no	yes	yes
94239.73c	236.999	endf70j	B-VII.0	2006	1200.0	601675	49091	20.0	yes	no	no	yes	yes
94239.74c	236.999	endf70j	B-VII.0	2006	2500.0	511369	39057	20.0	yes	no	no	yes	yes
** Pu-240 **													
94240.70c	237.992	endf70j	B-VII.0	1986	293.6	446466	47004	20.0	yes	no	no	yes	yes
94240.71c	237.992	endf70j	B-VII.0	1986	600.0	417306	43764	20.0	yes	no	no	yes	yes
94240.72c	237.992	endf70j	B-VII.0	1986	900.0	401115	41965	20.0	yes	no	no	yes	yes
94240.73c	237.992	endf70j	B-VII.0	1986	1200.0	386661	40359	20.0	yes	no	no	yes	yes
94240.74c	237.992	endf70j	B-VII.0	1986	2500.0	353271	36649	20.0	yes	no	no	yes	yes
** Pu-241 **													
94241.70c	238.978	endf70j	B-VII.0	2003	293.6	193359	18544	20.0	yes	no	no	yes	yes
94241.71c	238.978	endf70j	B-VII.0	2003	600.0	168114	15739	20.0	yes	no	no	yes	yes
94241.72c	238.978	endf70j	B-VII.0	2003	900.0	153471	14112	20.0	yes	no	no	yes	yes
94241.73c	238.978	endf70j	B-VII.0	2003	1200.0	143787	13036	20.0	yes	no	no	yes	yes
94241.74c	238.978	endf70j	B-VII.0	2003	2500.0	117759	10144	20.0	yes	no	no	yes	yes
** Pu-242 **													
94242.70c	239.979	endf70j	B-VII.0	1978	293.6	176132	16750	20.0	yes	no	no	yes	yes
94242.71c	239.979	endf70j	B-VII.0	1978	600.0	166178	15644	20.0	yes	no	no	yes	yes
94242.72c	239.979	endf70j	B-VII.0	1978	900.0	161210	15092	20.0	yes	no	no	yes	yes
94242.73c	239.979	endf70j	B-VII.0	1978	1200.0	158051	14741	20.0	yes	no	no	yes	yes
94242.74c	239.979	endf70j	B-VII.0	1978	2500.0	146576	13466	20.0	yes	no	no	yes	yes
** Pu-243 **													
94243.70c	240.974	endf70j	B-VII.0	1976	293.6	97802	9430	20.0	yes	no	no	no	yes
94243.71c	240.974	endf70j	B-VII.0	1976	600.0	92582	8850	20.0	yes	no	no	no	yes
94243.72c	240.974	endf70j	B-VII.0	1976	900.0	88478	8394	20.0	yes	no	no	no	yes
94243.73c	240.974	endf70j	B-VII.0	1976	1200.0	85094	8018	20.0	yes	no	no	no	yes
94243.74c	240.974	endf70j	B-VII.0	1976	2500.0	76301	7041	20.0	yes	no	no	no	yes
** Pu-244 **													
94244.70c	241.968	endf70j	B-VII.0	1978	293.6	63231	8164	20.0	no	no	no	no	yes
94244.71c	241.968	endf70j	B-VII.0	1978	600.0	60322	7748	20.0	no	no	no	no	yes
94244.72c	241.968	endf70j	B-VII.0	1978	900.0	59019	7562	20.0	no	no	no	no	yes
94244.73c	241.968	endf70j	B-VII.0	1978	1200.0	57615	7361	20.0	no	no	no	no	yes
94244.74c	241.968	endf70j	B-VII.0	1978	2500.0	55165	7010	20.0	no	no	no	no	yes
** Pu-246 **													
94246.70c	243.956	endf70j	B-VII.0	2000	293.6	19137	865	20.0	no	no	no	no	no
94246.71c	243.956	endf70j	B-VII.0	2000	600.0	19116	862	20.0	no	no	no	no	no

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

May 29, 2008

		Library		Eval	Temp	Length		Emax					
Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD													
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR
**** Pu-246 ****													
94246.72c	243.956	endf70j	B-VII.0	2000	900.0	19116	862	20.0	no	no	no	no	no
94246.73c	243.956	endf70j	B-VII.0	2000	1200.0	19116	862	20.0	no	no	no	no	no
94246.74c	243.956	endf70j	B-VII.0	2000	2500.0	19088	858	20.0	no	no	no	no	no
Z = 95 ********* americium *********													
**** Am-241 ****													
95241.70c	238.986	endf70k	B-VII.0	2006	293.6	271035	19721	30.	yes	both	no	yes	yes
95241.71c	238.986	endf70k	B-VII.0	2006	600.0	236037	15838	30.	yes	both	no	yes	yes
95241.72c	238.986	endf70k	B-VII.0	2006	900.0	218274	13854	30.	yes	both	no	yes	yes
95241.73c	238.986	endf70k	B-VII.0	2006	1200.0	206130	12515	30.	yes	both	no	yes	yes
95241.74c	238.986	endf70k	B-VII.0	2006	2500.0	179697	9578	30.	yes	both	no	yes	yes
**** Am-242m ****													
95242.70c	239.98	endf70k	B-VII.0:x	2005	293.6	143268	3068	20.0	no	both	no	no	yes
95242.71c	239.98	endf70k	B-VII.0:x	2005	600.0	140756	2754	20.0	no	both	no	no	yes
95242.72c	239.98	endf70k	B-VII.0:x	2005	900.0	139468	2593	20.0	no	both	no	no	yes
95242.73c	239.98	endf70k	B-VII.0:x	2005	1200.0	138596	2484	20.0	no	both	no	no	yes
95242.74c	239.98	endf70k	B-VII.0:x	2005	2500.0	136516	2224	20.0	no	both	no	no	yes
**** Am-243 ****													
95243.70c	240.973	endf70k	B-VII.0	2006	293.6	337057	27240	30.	yes	both	no	yes	yes
95243.71c	240.973	endf70k	B-VII.0	2006	600.0	287665	21752	30.	yes	both	no	yes	yes
95243.72c	240.973	endf70k	B-VII.0	2006	900.0	260188	18699	30.	yes	both	no	yes	yes
95243.73c	240.973	endf70k	B-VII.0	2006	1200.0	243495	16843	30.	yes	both	no	yes	yes
95243.74c	240.973	endf70k	B-VII.0	2006	2500.0	205054	12573	30.	yes	both	no	yes	yes
**** Am-244 ****													
95244.70c	241.968	endf70k	B-VII.0	1988	293.6	32164	1043	20.0	no	both	no	no	no
95244.71c	241.968	endf70k	B-VII.0	1988	600.0	32156	1042	20.0	no	both	no	no	no
95244.72c	241.968	endf70k	B-VII.0	1988	900.0	32124	1038	20.0	no	both	no	no	no
95244.73c	241.968	endf70k	B-VII.0	1988	1200.0	32100	1035	20.0	no	both	no	no	no
95244.74c	241.968	endf70k	B-VII.0	1988	2500.0	32076	1032	20.0	no	both	no	no	no
**** Am-242 ****													
95642.70c	239.98	endf70k	B-VII.0:x	2004	293.6	164044	6232	20.0	no	both	no	no	yes
95642.71c	239.98	endf70k	B-VII.0:x	2004	600.0	159972	5723	20.0	no	both	no	no	yes
95642.72c	239.98	endf70k	B-VII.0:x	2004	900.0	156828	5330	20.0	no	both	no	no	yes
95642.73c	239.98	endf70k	B-VII.0:x	2004	1200.0	154884	5087	20.0	no	both	no	no	yes
95642.74c	239.98	endf70k	B-VII.0:x	2004	2500.0	149420	4404	20.0	no	both	no	no	yes
**** Am-244m ****													
95644.70c	241.968	endf70k	B-VII.0	1988	293.6	34559	1110	20.0	no	both	no	no	no
95644.71c	241.968	endf70k	B-VII.0	1988	600.0	34567	1111	20.0	no	both	no	no	no

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** Am-244m **													
95644.72c	241.968	endf70k	B-VII.0	1988	900.0	34487	1101	20.0	no	both	no	no	no
95644.73c	241.968	endf70k	B-VII.0	1988	1200.0	34479	1100	20.0	no	both	no	no	no
95644.74c	241.968	endf70k	B-VII.0	1988	2500.0	34455	1097	20.0	no	both	no	no	no
Z = 96 ********* curium **********													
** Cm-241 **													
96241.70c	238.987	endf70k	B-VII.0	1978	293.6	9515	598	20.0	no	tot	no	no	no
96241.71c	238.987	endf70k	B-VII.0	1978	600.0	9515	598	20.0	no	tot	no	no	no
96241.72c	238.987	endf70k	B-VII.0	1978	900.0	9515	598	20.0	no	tot	no	no	no
96241.73c	238.987	endf70k	B-VII.0	1978	1200.0	9515	598	20.0	no	tot	no	no	no
96241.74c	238.987	endf70k	B-VII.0	1978	2500.0	9515	598	20.0	no	tot	no	no	no
** Cm-242 **													
96242.70c	239.979	endf70k	B-VII.0	1979	293.6	67939	5374	20.0	yes	both	no	yes	yes
96242.71c	239.979	endf70k	B-VII.0	1979	600.0	65707	5126	20.0	yes	both	no	yes	yes
96242.72c	239.979	endf70k	B-VII.0	1979	900.0	64843	5030	20.0	yes	both	no	yes	yes
96242.73c	239.979	endf70k	B-VII.0	1979	1200.0	63367	4866	20.0	yes	both	no	yes	yes
96242.74c	239.979	endf70k	B-VII.0	1979	2500.0	61801	4692	20.0	yes	both	no	yes	yes
** Cm-243 **													
96243.70c	240.973	endf70k	B-VII.0	1995	293.6	70848	6575	20.0	no	both	no	no	yes
96243.71c	240.973	endf70k	B-VII.0	1995	600.0	66680	6054	20.0	no	both	no	no	yes
96243.72c	240.973	endf70k	B-VII.0	1995	900.0	63792	5693	20.0	no	both	no	no	yes
96243.73c	240.973	endf70k	B-VII.0	1995	1200.0	61104	5357	20.0	no	both	no	no	yes
96243.74c	240.973	endf70k	B-VII.0	1995	2500.0	54688	4555	20.0	no	both	no	no	yes
** Cm-244 **													
96244.70c	241.966	endf70k	B-VII.0	2000	293.6	171323	19049	20.0	no	both	no	no	yes
96244.71c	241.966	endf70k	B-VII.0	2000	600.0	159995	17633	20.0	no	both	no	no	yes
96244.72c	241.966	endf70k	B-VII.0	2000	900.0	154883	16994	20.0	no	both	no	no	yes
96244.73c	241.966	endf70k	B-VII.0	2000	1200.0	151275	16543	20.0	no	both	no	no	yes
96244.74c	241.966	endf70k	B-VII.0	2000	2500.0	139731	15100	20.0	no	both	no	no	yes
** Cm-245 **													
96245.70c	242.96	endf70k	B-VII.0	2000	293.6	76955	5022	20.0	no	both	no	yes	yes
96245.71c	242.96	endf70k	B-VII.0	2000	600.0	73963	4648	20.0	no	both	no	yes	yes
96245.72c	242.96	endf70k	B-VII.0	2000	900.0	72323	4443	20.0	no	both	no	yes	yes
96245.73c	242.96	endf70k	B-VII.0	2000	1200.0	71403	4328	20.0	no	both	no	yes	yes
96245.74c	242.96	endf70k	B-VII.0	2000	2500.0	67699	3865	20.0	no	both	no	yes	yes
** Cm-246 **													
96246.70c	243.953	endf70k	B-VII.0	1995	293.6	84008	6936	20.0	no	both	no	no	yes
96246.71c	243.953	endf70k	B-VII.0	1995	600.0	81920	6675	20.0	no	both	no	no	yes

		Library		Eval	Temp	Length		Emax					
ZAID	AWR	Name	Source	Date	(K)	Words	NE	(MeV)	GPD	Nu	CP	DN	UR

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD

ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	Emax (MeV)	GPD	Nu	CP	DN	UR
** Cm-246 **													
96246.72c	243.953	endf70k	B-VII.0	1995	900.0	79936	6427	20.0	no	both	no	no	yes
96246.73c	243.953	endf70k	B-VII.0	1995	1200.0	78776	6282	20.0	no	both	no	no	yes
96246.74c	243.953	endf70k	B-VII.0	1995	2500.0	75880	5920	20.0	no	both	no	no	yes
** Cm-247 **													
96247.70c	244.948	endf70k	B-VII.0	2005	293.6	62874	5885	20.0	no	both	no	no	yes
96247.71c	244.948	endf70k	B-VII.0	2005	600.0	58098	5288	20.0	no	both	no	no	yes
96247.72c	244.948	endf70k	B-VII.0	2005	900.0	55946	5019	20.0	no	both	no	no	yes
96247.73c	244.948	endf70k	B-VII.0	2005	1200.0	54154	4795	20.0	no	both	no	no	yes
96247.74c	244.948	endf70k	B-VII.0	2005	2500.0	49122	4166	20.0	no	both	no	no	yes
** Cm-248 **													
96248.70c	245.941	endf70k	B-VII.0	1978	293.6	141494	14767	20.0	yes	tot	no	no	yes
96248.71c	245.941	endf70k	B-VII.0	1978	600.0	133619	13892	20.0	yes	tot	no	no	yes
96248.72c	245.941	endf70k	B-VII.0	1978	900.0	128129	13282	20.0	yes	tot	no	no	yes
96248.73c	245.941	endf70k	B-VII.0	1978	1200.0	124655	12896	20.0	yes	tot	no	no	yes
96248.74c	245.941	endf70k	B-VII.0	1978	2500.0	116852	12029	20.0	yes	tot	no	no	yes
** Cm-249 **													
96249.70c	246.936	endf70k	B-VII.0	2006	293.6	56238	3572	20.0	no	both	no	no	yes
96249.71c	246.936	endf70k	B-VII.0	2006	600.0	55302	3455	20.0	no	both	no	no	yes
96249.72c	246.936	endf70k	B-VII.0	2006	900.0	54822	3395	20.0	no	both	no	no	yes
96249.73c	246.936	endf70k	B-VII.0	2006	1200.0	54254	3324	20.0	no	both	no	no	yes
96249.74c	246.936	endf70k	B-VII.0	2006	2500.0	53262	3200	20.0	no	both	no	no	yes
** Cm-250 **													
96250.70c	247.93	endf70k	B-VII.0	2000	293.6	27291	1441	20.0	no	both	no	no	yes
96250.71c	247.93	endf70k	B-VII.0	2000	600.0	27251	1436	20.0	no	both	no	no	yes
96250.72c	247.93	endf70k	B-VII.0	2000	900.0	27187	1428	20.0	no	both	no	no	yes
96250.73c	247.93	endf70k	B-VII.0	2000	1200.0	27091	1416	20.0	no	both	no	no	yes
96250.74c	247.93	endf70k	B-VII.0	2000	2500.0	26971	1401	20.0	no	both	no	no	yes
Z = 97 ********** berkelium **********													
** Bk-249 **													
97249.70c	246.94	endf70k	B-VII.0	1986	293.6	85504	7875	20.0	no	both	no	no	yes
97249.71c	246.94	endf70k	B-VII.0	1986	600.0	80712	7276	20.0	no	both	no	no	yes
97249.72c	246.94	endf70k	B-VII.0	1986	900.0	77817	6914	20.0	no	both	no	no	yes
97249.73c	246.94	endf70k	B-VII.0	1986	1200.0	75296	6599	20.0	no	both	no	no	yes
97249.74c	246.94	endf70k	B-VII.0	1986	2500.0	68056	5694	20.0	no	both	no	no	yes
** Bk-250 **													
97250.70c	247.93	endf70k	B-VII.0	1987	293.6	91400	9660	20.0	no	both	no	no	yes
97250.71c	247.93	endf70k	B-VII.0	1987	600.0	85772	8856	20.0	no	both	no	no	yes

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
** Bk-250 **													
97250.72c	247.93	endf70k	B-VII.0	1987	900.0	82076	8328	20.0	no	both	no	no	yes
97250.73c	247.93	endf70k	B-VII.0	1987	1200.0	79773	7999	20.0	no	both	no	no	yes
97250.74c	247.93	endf70k	B-VII.0	1987	2500.0	71849	6867	20.0	no	both	no	no	yes
Z = 98 ********** californium **********													
** Cf-249 **													
98249.70c	246.94	endf70k	B-VII.0	1989	293.6	83333	6394	20.0	no	both	no	yes	yes
98249.71c	246.94	endf70k	B-VII.0	1989	600.0	78813	5829	20.0	no	both	no	yes	yes
98249.72c	246.94	endf70k	B-VII.0	1989	900.0	76182	5500	20.0	no	both	no	yes	yes
98249.73c	246.94	endf70k	B-VII.0	1989	1200.0	74269	5261	20.0	no	both	no	yes	yes
98249.74c	246.94	endf70k	B-VII.0	1989	2500.0	68774	4574	20.0	no	both	no	yes	yes
** Cf-250 **													
98250.70c	247.928	endf70k	B-VII.0	1976	293.6	78149	8229	20.0	yes	tot	no	no	yes
98250.71c	247.928	endf70k	B-VII.0	1976	600.0	75266	7869	20.0	yes	tot	no	no	yes
98250.72c	247.928	endf70k	B-VII.0	1976	900.0	74168	7731	20.0	yes	tot	no	no	yes
98250.73c	247.928	endf70k	B-VII.0	1976	1200.0	72316	7499	20.0	yes	tot	no	no	yes
98250.74c	247.928	endf70k	B-VII.0	1976	2500.0	68979	7082	20.0	yes	tot	no	no	yes
** Cf-251 **													
98251.70c	248.923	endf70k	B-VII.0	1976	293.6	78002	6222	20.0	yes	both	no	yes	yes
98251.71c	248.923	endf70k	B-VII.0	1976	600.0	75104	5900	20.0	yes	both	no	yes	yes
98251.72c	248.923	endf70k	B-VII.0	1976	900.0	74231	5803	20.0	yes	both	no	yes	yes
98251.73c	248.923	endf70k	B-VII.0	1976	1200.0	73520	5724	20.0	yes	both	no	yes	yes
98251.74c	248.923	endf70k	B-VII.0	1976	2500.0	70010	5334	20.0	yes	both	no	yes	yes
** Cf-252 **													
98252.70c	249.916	endf70k	B-VII.0	1976	293.6	80286	7766	20.0	yes	tot	no	no	yes
98252.71c	249.916	endf70k	B-VII.0	1976	600.0	77028	7404	20.0	yes	tot	no	no	yes
98252.72c	249.916	endf70k	B-VII.0	1976	900.0	76479	7343	20.0	yes	tot	no	no	yes
98252.73c	249.916	endf70k	B-VII.0	1976	1200.0	74382	7110	20.0	yes	tot	no	no	yes
98252.74c	249.916	endf70k	B-VII.0	1976	2500.0	71259	6763	20.0	yes	tot	no	no	yes
** Cf-254 **													
98254.70c	251.905	endf70k	B-VII.0	1994	293.6	17820	952	20.0	no	both	no	no	no
98254.71c	251.905	endf70k	B-VII.0	1994	600.0	17892	961	20.0	no	both	no	no	no
98254.72c	251.905	endf70k	B-VII.0	1994	900.0	17876	959	20.0	no	both	no	no	no
98254.73c	251.905	endf70k	B-VII.0	1994	1200.0	17876	959	20.0	no	both	no	no	no
98254.74c	251.905	endf70k	B-VII.0	1994	2500.0	17964	970	20.0	no	both	no	no	no
Z = 99 ********** einsteinium **********													
** Es-254 **													
99254.70c	251.905	endf70k	B-VII.0	1994	293.6	18087	1031	20.0	no	both	no	no	no

								Emax					
ZAID	AWR	Library Name	Source	Eval Date	Temp (K)	Length Words	NE	(MeV)	GPD	Nu	CP	DN	UR
Es-254													
99254.71c	251.905	endf70k	B-VII.0	1994	600.0	18087	1031	20.0	no	both	no	no	no
99254.72c	251.905	endf70k	B-VII.0	1994	900.0	18031	1024	20.0	no	both	no	no	no
99254.73c	251.905	endf70k	B-VII.0	1994	1200.0	18079	1030	20.0	no	both	no	no	no
99254.74c	251.905	endf70k	B-VII.0	1994	2500.0	18063	1028	20.0	no	both	no	no	no
Es-255													
99255.70c	252.899	endf70k	B-VII.0	1994	293.6	19107	998	20.0	no	both	no	no	no
99255.71c	252.899	endf70k	B-VII.0	1994	600.0	19011	986	20.0	no	both	no	no	no
99255.72c	252.899	endf70k	B-VII.0	1994	900.0	19059	992	20.0	no	both	no	no	no
99255.73c	252.899	endf70k	B-VII.0	1994	1200.0	19099	997	20.0	no	both	no	no	no
99255.74c	252.899	endf70k	B-VII.0	1994	2500.0	19003	985	20.0	no	both	no	no	no
Z = 100 ********** fermium **********													
Fm-255													
100255.70c	252.899	endf70k	B-VII.0	1994	293.6	17459	964	20.0	no	both	no	no	no
100255.71c	252.899	endf70k	B-VII.0	1994	600.0	17523	972	20.0	no	both	no	no	no
100255.72c	252.899	endf70k	B-VII.0	1994	900.0	17539	974	20.0	no	both	no	no	no
100255.73c	252.899	endf70k	B-VII.0	1994	1200.0	17451	963	20.0	no	both	no	no	no
100255.74c	252.899	endf70k	B-VII.0	1994	2500.0	17523	972	20.0	no	both	no	no	no

Table G.2 - Continuous-Energy and Discrete Neutron Data Libraries Maintained by X-1 NAD