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2009.3 Revision of the Evaluated Nuclear Data Library (ENDL2009.3)

I. J. Thompson, B. Beck, M. A. Descalle, C. M. Mattoon, E. Jurgenson

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I. J. Thompson, B. Beck, M.-A. Descalle, C. M. Mattoon, and E. Jurgenson
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(Dated: November 7, 2017)

LLNL's Computational Nuclear Data and Theory Group have created a 2009.3 revised release of the Evaluated Nuclear Data Library (ENDL2009.3). This library is designed to support LLNL's current and future nuclear data needs and will be employed in nuclear reactor, nuclear security and stockpile stewardship simulations with ASC codes. The ENDL2009 database was the most complete nuclear database for Monte Carlo and deterministic transport of neutrons and charged particles. It was assembled with strong support from the ASC PEM and Attribution programs, leveraged with support from Campaign 4 and the DOE/Office of Science's US Nuclear Data Program.

This document lists the revisions and fixes made in a new release called ENDL2009.3, by comparing with the existing data in the previous release ENDL2009.2. These changes are made in conjunction with the revisions for ENDL2011.3, so that both the .3 releases are as free as possible of known defects.

Contents

I. INTRODUCTION

LLNL's Computational Nuclear Physics Group and Nuclear Theory and Modeling Group have collaborated to produce a next iteration of LLNL's evaluated nuclear database ENDL2009. ENDL2009 was the second in a series of major ENDL library releases designed to support LLNL's current and future nuclear data needs. This library contains many evaluations for radiochemical diagnostics (part of a Campaign 4 L2 milestone), structural materials (part of an ASC Attribution L2 milestone), and thermonuclear reactions (to support NIF diagnostics). In addition, ENDL2009 was at the leading edge of nuclear data library development by reviewing and incorporating new evaluations as they are made available to the nuclear data community. In addition, ENDL2009 supported new features such as energy dependent Q values from fission and unresolved resonances. Furthermore, this was the first ENDL library to be released in the TDF format. Finally, this release was our most highly tested release as we strengthened our already rigorous testing regime by adding tests against LANL Activation Ratio Measurements and many more new critical assemblies. That testing has now been incorporated into our development process and is serving to guide library improvements.

This document lists the revisions and fixes made in a new release called ENDL2009.3, by comparing with the existing data in the previous release ENDL2009.2.

The new library can be found on LLNL's Open & Secure Computing facilities. In addition, the data will soon be made available in the Nuclear and Atomic Data System (NADS) data viewer at `http://nuclear.llnl.gov/NADS`.

II. MODIFICATIONS FOR ENDL2009.3

The ENDL2009.3 revisions are in the repository branch /usr/gapps/CNP_data/all/live_repos/svnRepos/endl/branches/endl2009.3 and the latest release candidate is rc5 as tagged at /usr/gapps/CNP_-

data/all/live_repos/svnRepos/endl/tags/endl2009.3-rc5.

The various modifications are listed according to the ND keys used on the JIRA database at `https://lc.llnl.gov/jira/browse/ND/fixforversion/10807`.

1. ND-5: ^{12}C has incorrect gamma decay data

There were noticed ^{12}C(n,gamma) differences between ENDL2008.2 and ENDL2009.1

The gamma decay cross sections from the 2^+ state are now corrected to agree with the (n, n') cross sections in the C=11 channel. These should be the same since that state at 4.43 MeV was, according to our evaluations, the only inelastic state produced. Some previous ENDEP run had changed this, because of erroneous suspicion of bad energy balance, and this altered evaluations since ENDL2009.1. There is no energy balance issue according to our current ENDEP methods.

Repository revision 1066, and revision 12 in repository endl2009.3work

2. ND-47: the ^{7}Be evaluation ends at 8.1 MeV

Our evaluation is from ENDF/B-VII (December 2006). Issue of a low energy limit is being addressed at CSEWG by LANL. See `https://ndclx4.bnl.gov/gf/project/endf/tracker/?action=TrackerItemEdit&tracker_item_id=196&start=0`.

The cross sections for total, elastic, (n,p) and (n,a) extended to 20 MeV by rescaling the results of a defaults TALYS 1.6 calculation (without pre-equilibrium) to match the previous curves at 8.1 MeV.

This new evaluation has been accepted by CSEWG for the ENDF/B-VIII.0 evaluation.

Repository revision 1067.

3. ND-54: `endep` should not generate files for decays of isomer states

The isomer states in 27 nuclides list in JIRA/ND-54 should *not* have extra files generated by `endep` for their decay. More recent `Endep` versions now stop producing stubs of yo07 files for these decays.

4. ND-64: `endep` incorrectly processes discrete gamma decays from n+^{11}B

For many of the discrete states produced in n+^{11}B reactions, there are no yo07 files for gamma distributions, but instead the gamma lines are included in a c=55 s=3 file. More recent `Endep` versions now stop producing stubs of yo07 files for these decays.

5. ND-66 Erroneous cross section for ^{7}Li(t,n)^{9}Be(gs) reaction

For the reaction ^{7}Li(t,n)^{9}Be, the data on ENDL says it comes from the paper Brune et al PRC 43 (1991)875. The cross section should be taken from Fig. 7 in the paper, however, it appears that the cross section in ENDL is from Fig. 9 or similar source, and is too large. Most of the extra cross was moved to the ^{7}Li(t,n)[^{9}Be$^{*} \rightarrow$ n, 2α] channel. This error dates back at least to ENDL94.

Repository revision 1064.

6. ND-68: Updating the ^{6}Li evaluation to ENDF/B-VII.0

Replaced the ENDL99 evaluation for ^{6}Li+n with that from ENDF/B-VII that is already used in ENDL2011. The elastic and ^{6}Li(n,nd) cross sections are balanced differently, but still sum to the same combined total.

Repository revision 1079, 1080.

7. ND-76: With ^{237}U in ENDL2009.2, the endf and ENDL files are not consistent

The endl2009.2/endf/neutron and endl2011.2-rc2/endf/neutron both contain identical files 'n-092_U_237.LLNL-2009.endf'. However, the ENDL-formatted versions are quite different. That of 2011.2-rc2 appears to be consistent with the ENDF file, but that of 2009.2 is not. To fix this, we replaced 2009.2 ENDL ascii data with data from 2011.2-rc2 when making the endl2009.3 data set.

Repository revision 1065.

8. ND-79: ^{12}C has inaccurate total cross sections below 100 keV

The total cross section for n+^{12}C below 100 keV has been re-evaluated by Sofi Quaglioni. She found that ENDL evaluations follow closely the data from Uttley (1964), but this is not confirmed by any later measurements (nor does Uttley seem to agree with earlier measurements). In particular, Uttley has some seemingly resonant structures that are odd. The new ENDF/B.VIII evaluation clearly ignores the data from Uttley, and has no resonances below 1 MeV.

A new evaluation is therefore adopted below 1 MeV, using the new (n,tot) fitted cross section obtained with the R-matrix HYRMA. See figures in JIRA (`https://lc.llnl.gov/jira/browse/ND-79`) A new (n,el) cross section is found by subtracting the existing (n,γ) evaluation from the new total cross section, while all other cross sections/distributions remain unchanged. Above 1 MeV, we keep the existing endl2009 evaluation.

Repository endl2009.3work revision 10, 11.

III. CHANGES IN PREPARING ENDL2009.3 DATA

1. Revised ndfgen code for deterministic processing

The versions of ndfgen that were used in ENDL2009.2 and earlier had a severe bug that affected the code's conversion of I=1 and I=3 data to make an I=4 set for processing. Two subroutines used different leading dimensions for the array of Legendre polynomial values. The odd Legendre multiples resulted in being completely wrong, and even even multipoles are doubtful.

An 'experimental' version ENDL2009.2-ex3 was therefore made to improve the ndf files from the ENDL2009.2 ascii base, and all the ENDL2009.3 processing used the new ndfgen. The ENDL2009.2-ex3 version was therefore used has the base for displaying the effects of other changes for ENDL2009.3 that are listed in this document.

2. Treatment of thresholds in c55 files

Extraneous zero cross-section points removed from c55 files. This allows endep to be rerun without producing energy depositions for neutron energies below threshold (where the cross sections are zero).

Repository revisions 1068, 1072, 1090

3. Improvements in μ interpolation

Adding recalculated yo=1 I=1,3 files for outgoing neutrons, with added μ values at $\mu = 0.95$. This avoids the bump in neutron eigen-energy spectra from neutron-residual sticking configurations being transformed to lab coordinate frames. This affects mainly the distributions from pre-equilibrium processes described in the Kalbach-Mann formalism, where fete has translated them from c.m. to lab distributions.

Repository revision 5 in repository endl2009.3work.

4. Interpolation of gamma exit distributions

Gamma output angular distributions are now interpolated on incident neutron energy using unit-base methods in fetePy.py. This affects the conversion from input ENDF files to the ENDL ascii files.

Repository revision 6 in repository endl2009.3work.

IV. OUTLOOK

This new library will be found on LLNL's Open and Secure Computing facilities in file directory /collab/usr/gapps/data/nuclear/endl_official/endl2009.3. In addition, the data may soon be viewed in the Nuclear and Atomic Data System data viewer at http://nuclear.llnl.gov/NADS.

Acknowledgements

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

Appendix A: Known Issues

None as on release date.

More work is needed still to verify the spectra of gammas produced after neutron capture.

Appendix B: Detailed Test Results

Criticality tests by deterministic (AMTRAN) and Monte Carlo (MERCURY) codes were performed. The new revision ENDL2009.3 was compared with both the previous ENDL2009.2 evaluation, and with measurements from critical assemblies. The results are shown in the powerpoint file ENDL2009.3-rc5.pptx included in directory doc/ of the release.

The deviations between the predictions from the two different ENDL2009 releases are seen to be acceptably small compared to their common differences to the measured values.

1. Further Testing

This revision was accepted by both the deterministic and Monte Carlo transport teams at LLNL.

TABLE I: Summary of k_{eff} ratios of Monte Carlo tests with `Mercury`.

Assembly Name	Reflector	Experiment	Calculated	C/E	σ	C ratio to 9.0.1
U MET FAST 001	bare	1.0000 ± 0.0010	1.0003 ± 0.0001	1.0003	0.3	0.9998
HEU MET FAST 002	tuballoy(topsy8)	1.0000 ± 0.0030	1.0029 ± 0.0001	1.0029	1.0	1.0001
HEU MET FAST 003	Ni	1.0000 ± 0.0030	1.0085 ± 0.0001	1.0085	2.8	1.0003
HEU MET FAST 009	Be	0.9992 ± 0.0015	0.9221 ± 0.0003	0.9229	50.5	1
HEU MET FAST 010 1	B and Be	0.9992 ± 0.0010	0.9885 ± 0.0001	0.9893	10.7	1
HEU MET FAST 010 2	B and Be	0.9992 ± 0.0010	1.0000 ± 0.0001	1.0008	0.7	1
HEU MET FAST 012	Al	0.9992 ± 0.0018	0.9852 ± 0.0001	0.9860	7.7	1
HEU MET FAST 017	Be	0.9993 ± 0.0014	0.9953 ± 0.0001	0.9960	2.9	1.0001
HEU MET FAST 019	graphite	1.0000 ± 0.0030	1.0123 ± 0.0001	1.0123	4.1	0.9998
HEU MET FAST 020	polyethylene	1.0000 ± 0.0030	1.0019 ± 0.0001	1.0019	0.6	0.9998
HEU MET FAST 028	U(99%U238)	1.0000 ± 0.0030	1.0041 ± 0.0001	1.0041	1.4	1
HEU MET FAST 038	U(99%U238)/Be Refl.	0.9999 ± 0.0007	1.0019 ± 0.0001	1.0020	2.8	1
HEU MET FAST 055	DU(ZPR3-23)	0.9955 ± 0.0028	0.9977 ± 0.0001	1.0022	0.8	1
HEU MET FAST 060	Al	0.9955 ± 0.0024	1.0016 ± 0.0001	1.0061	2.6	1
HEU MET FAST 064	Pb	0.9996 ± 0.0008	1.0167 ± 0.0001	1.0171	21.2	1
HEU MET FAST 073	Cu	1.0082 ± 0.0003	1.0120 ± 0.0001	1.0038	11.7	1
HEU MET FAST 079 1	Ti	0.9996 ± 0.0015	0.9995 ± 0.0001	0.9999	0.1	1
HEU MET FAST 079 2	Ti	0.9996 ± 0.0014	1.0004 ± 0.0001	1.0008	0.6	1
HEU MET FAST 079 3	Ti	0.9996 ± 0.0015	0.9988 ± 0.0001	0.9992	0.5	1
HEU MET FAST 079 4	Ti	0.9996 ± 0.0014	1.0027 ± 0.0001	1.0031	2.2	1
HEU MET FAST 079 5	Ti	0.9996 ± 0.0015	1.0019 ± 0.0001	1.0023	1.6	1
HEU MET FAST 084 1	Al	0.9994 ± 0.0019	0.9993 ± 0.0001	0.9999	0.0	1
HEU MET FAST 084 10	Ni	0.9993 ± 0.0022	1.0012 ± 0.0001	1.0019	0.8	1
HEU MET FAST 084 11	polythene(isotopic,not-m)	0.9995 ± 0.0019	1.0038 ± 0.0001	1.0043	2.3	0.9995
HEU MET FAST 084 12	Ti	0.9994 ± 0.0020	0.9998 ± 0.0001	1.0004	0.2	1
HEU MET FAST 084 13	Unat	0.9994 ± 0.0022	1.0002 ± 0.0001	1.0008	0.4	1.0001
HEU MET FAST 084 14	W	0.9994 ± 0.0019	1.1071 ± 0.0001	1.1078	56.6	1
HEU MET FAST 084 15	Al2O3	0.9995 ± 0.0021	0.9985 ± 0.0001	0.9990	0.5	1
HEU MET FAST 084 16	Be	0.9994 ± 0.0020	0.9975 ± 0.0001	0.9981	1.0	1
HEU MET FAST 084 17	Co	0.9995 ± 0.0019	1.0278 ± 0.0001	1.0283	14.9	1.0002
HEU MET FAST 084 18	Cu	0.9995 ± 0.0022	0.9978 ± 0.0001	0.9983	0.8	0.9998
HEU MET FAST 084 19	steel	0.9996 ± 0.0019	0.9979 ± 0.0001	0.9983	0.9	0.9998
HEU MET FAST 084 2	Al2O3	0.9994 ± 0.0021	0.9999 ± 0.0001	1.0005	0.2	1
HEU MET FAST 084 20	Mo	0.9995 ± 0.0025	1.0036 ± 0.0001	1.0041	1.6	1
HEU MET FAST 084 21	MoC2	0.9995 ± 0.0045	1.0017 ± 0.0001	1.0022	0.5	1
HEU MET FAST 084 22	Ni	0.9994 ± 0.0020	0.9983 ± 0.0001	0.9989	0.6	1
HEU MET FAST 084 23	polythene(isotopic,not-m)	0.9993 ± 0.0024	0.9958 ± 0.0001	0.9965	1.4	1.0011
HEU MET FAST 084 24	U	0.9996 ± 0.0018	0.9994 ± 0.0001	0.9998	0.1	0.9999
HEU MET FAST 084 25	W	0.9995 ± 0.0020	1.0680 ± 0.0001	1.0685	34.2	1
HEU MET FAST 084 26	Be inner reflector,Fe out	0.9993 ± 0.0022	0.9987 ± 0.0001	0.9994	0.3	1
HEU MET FAST 084 27	Be inner reflector,Fe out	0.9994 ± 0.0020	0.9825 ± 0.0001	0.9831	8.5	1
HEU MET FAST 084 3	Be	0.9993 ± 0.0021	0.9972 ± 0.0001	0.9979	1.0	1
HEU MET FAST 084 4	graphite	0.9994 ± 0.0020	1.0033 ± 0.0001	1.0039	2.0	1
HEU MET FAST 084 5	Co	0.9993 ± 0.0021	1.0517 ± 0.0001	1.0525	24.9	1
HEU MET FAST 084 6	Cu	0.9994 ± 0.0024	0.9988 ± 0.0001	0.9994	0.3	0.9997
HEU MET FAST 084 7	steel	0.9995 ± 0.0020	0.9980 ± 0.0001	0.9985	0.7	0.9998
HEU MET FAST 084 8	Mo	0.9994 ± 0.0034	1.0092 ± 0.0001	1.0098	2.9	1
HEU MET FAST 084 9	MoC2	0.9993 ± 0.0054	1.0052 ± 0.0001	1.0059	1.1	1
HEU MET FAST 085 1	Cu(outer)	0.9998 ± 0.0029	1.0004 ± 0.0001	1.0006	0.2	1.0001
HEU MET FAST 085 2	Cu(outer)	0.9997 ± 0.0031	1.0045 ± 0.0001	1.0048	1.6	0.9999
HEU MET FAST 085 3	Fe(outer)	0.9995 ± 0.0046	0.9982 ± 0.0001	0.9987	0.3	1
HEU MET FAST 085 4	Cu-Ni-Zn-alloy	0.9996 ± 0.0029	1.0122 ± 0.0001	1.0126	4.3	1
HEU MET FAST 085 5	Th	0.9995 ± 0.0024	1.0012 ± 0.0001	1.0017	0.7	0.9999
HEU MET FAST 085 6	W	0.9997 ± 0.0029	1.0068 ± 0.0001	1.0071	2.4	1
IEU MET FAST 005	steel	1.0000 ± 0.0021	1.0043 ± 0.0001	1.0043	2.1	1.0001
IEU MET FAST 007	Unat	0.9948 ± 0.0013	0.9927 ± 0.0003	0.9979	1.6	1.0003
MIX MET FAST 001	bare(Pu core+HEU shell)	1.0000 ± 0.0016	1.0006 ± 0.0001	1.0006	0.4	0.9997
MIX MET FAST 002 1	flattop mixed metal	1.0000 ± 0.0042	1.0078 ± 0.0003	1.0078	1.9	1.0007
MIX MET FAST 002 2	flattop mixed metal	1.0000 ± 0.0044	1.0070 ± 0.0003	1.0070	1.6	0.9999
MIX MET FAST 002 3	flattop mixed metal	1.0000 ± 0.0048	1.0080 ± 0.0003	1.0080	1.7	1.0004
MIX MET FAST 005	Al	0.9990 ± 0.0017	0.9846 ± 0.0001	0.9856	8.5	1
MIX MET FAST 009	bare(Pu core+HEU shell)	1.0000 ± 0.0010	1.0011 ± 0.0001	1.0011	1.1	1
MIX MET FAST 010	bare(Pu core+HEU shell)	1.0000 ± 0.0009	1.0011 ± 0.0001	1.0011	1.2	1
PU MET FAST 001	bare	1.0000 ± 0.0020	1.0010 ± 0.0001	1.0010	0.5	1.0002
PU MET FAST 002	bare	1.0000 ± 0.0020	1.0013 ± 0.0001	1.0013	0.6	1
PU MET FAST 005	W	1.0000 ± 0.0013	1.0037 ± 0.0001	1.0037	2.8	1.0002
PU MET FAST 006	U	1.0000 ± 0.0030	1.0036 ± 0.0001	1.0036	1.2	1.0001
PU MET FAST 008a	Th	1.0000 ± 0.0006	1.0000 ± 0.0001	1.0000	0.0	1
PU MET FAST 009	Al	1.0000 ± 0.0027	1.0061 ± 0.0001	1.0061	2.2	0.9997
PU MET FAST 010	U	1.0000 ± 0.0018	1.0018 ± 0.0001	1.0018	1.0	1.0001
PU MET FAST 011	water	1.0000 ± 0.0010	1.0146 ± 0.0001	1.0146	14.6	0.9998
PU MET FAST 018	Be	1.0000 ± 0.0030	0.9970 ± 0.0001	0.9970	1.0	0.9999
PU MET FAST 019	Be	0.9992 ± 0.0015	0.9988 ± 0.0001	0.9996	0.3	1
PU MET FAST 020	DU	0.9993 ± 0.0017	1.0006 ± 0.0001	1.0013	0.8	1
PU MET FAST 022	bare	1.0000 ± 0.0021	0.9995 ± 0.0001	0.9995	0.2	1

TABLE I: Summary of k_{eff} ratios of Monte Carlo tests with `Mercury`.

Assembly Name	Reflector	Experiment	Calculated	C/E	σ	C ratio to 9.0.1
PU MET FAST 023	graphite	1.0000 ± 0.0020	1.0070 ± 0.0001	1.0070	3.5	1.0001
PU MET FAST 024	Polyethylene	1.0000 ± 0.0020	1.0045 ± 0.0001	1.0045	2.2	0.9999
PU MET FAST 025	steel	1.0000 ± 0.0020	0.9995 ± 0.0001	0.9995	0.3	1.0001
PU MET FAST 026	Steel	1.0000 ± 0.0024	0.9997 ± 0.0001	0.9997	0.1	1
PU MET FAST 028	Steel	1.0000 ± 0.0022	1.0007 ± 0.0001	1.0007	0.3	1
PU MET FAST 029	bare	1.0000 ± 0.0020	0.9966 ± 0.0001	0.9966	1.7	1
PU MET FAST 030	graphite	1.0000 ± 0.0021	1.0115 ± 0.0001	1.0115	5.5	1
PU MET FAST 032	Steel	1.0000 ± 0.0020	0.9992 ± 0.0001	0.9992	0.4	1
PU MET FAST 035	Pb	1.0000 ± 0.0016	1.0080 ± 0.0001	1.0080	5.0	1
PU MET FAST 039	Duraluminium	1.0000 ± 0.0022	0.9927 ± 0.0001	0.9927	3.3	1
PU MET FAST 040	Cu	1.0000 ± 0.0038	0.9973 ± 0.0001	0.9973	0.7	1
PU MET FAST 041	D38	1.0000 ± 0.0016	1.0087 ± 0.0001	1.0087	5.5	1
PU SOL THERM 011	solution assembly	1.0000 ± 0.0052	0.9687 ± 0.0001	0.9687	6.0	0.9998
U233 MET FAST 001	bare	1.0000 ± 0.0010	0.9996 ± 0.0001	0.9996	0.4	1.0001
U233 MET FAST 002	HEU(93%U235)	1.0000 ± 0.0010	0.9991 ± 0.0001	0.9991	0.9	1
U233 MET FAST 003	Unat	1.0000 ± 0.0010	0.9998 ± 0.0003	0.9998	0.2	0.9992
U233 MET FAST 004	W	1.0000 ± 0.0007	0.9999 ± 0.0001	0.9999	0.1	1.0002
U233 MET FAST 006	Unat	1.0000 ± 0.0014	1.0004 ± 0.0003	1.0004	0.2	0.9996

Appendix C: The README file

Here we reproduce the `README` file that accompanies the release.

```
ENDL nuclear data release ENDL2009.3
====================================

This release includes the following improved data evaluations and corrections:

1. Data for n+7Be scattering is extended from 8.1 MeV to 20 MeV neutron
energy.  The cross sections for total, elastic, (n,p) and (n,a) extended to
20 MeV by rescaling the results of a defaults TALYS 1.6 calculation (without
pre-equilibrium) to match the previous curves at 14 MeV.

2. Data for t+7Li scattering in the C = 11: t + 7Li -> n + 9Be(gs) channel
was reduced to agree with experiments of Brune et al. See documentation.txt
for more details

3. Data for n+237U scattering is replaced by that derived from the given
ENDF file n-092_U_237.LLNL-2009.endf.

4. Data for n+12C scattering has fixed gamma production from the C =
11 reaction to the 2+ state at 4.43 MeV. This was 25% too small in the
ENDL2009.1 and ENDL2009.2 releases.

5. Extraneous zero cross-section points removed from c55 files.  This allows
ENDEP to be rerun without producing energy depositions for neutron energies
below threshold (where the cross sections are zero).

6. Replaced the ENDL99 evaluation for 6Li+n with that from ENDF/B-VII that
is already used in ENDL2011. The elastic and 6Li(n,nd) cross sections are
balanced differently.

7. Gamma output angular distributions are now interpolated on incident neutron
energy using unit-base methods in fetePy.py

8. Adding recalculated yo01 I=1,3 files for outgoing neutrons, with added mu values at
mu=0.95. This avoids the bump in neutron eigen-energy spectra from neutron-residual
sticking configurations being transformed to lab coordinate frames.

9. Re-evaluated 12C(n,tot) cross section below 1 MeV, from Sofia Quaglioni.

10. Corrected za006012/yo00c55i000s003 file from endl2009.0. So the 12C(n,ng)
cross section is the same for gammas as neutrons

11. All data released is released also in GND format with GIDI processing for both
Monte Carlo (MC) and multigroup (MG) with 3 temperatures.


All Sn data is processed with the ndfgen version with corrected conversion of
I=1 and 3 data to make I=4 arrays for processing.


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```

Appendix D: Release Checklist

Here we reproduce the release checklist that accompanies this release:

ENDL2009.3 Data Release Checklist

Basic Tests

Check/Test	Success	Failure	Comments
python checker on ascii data	✓		
Check the processing errors/ warning messages	✓		
ndf checker	✓		
mcapm checker	✓		

Amtran Tests (ndf)

Check/Test	Success	Failure	Comments
za-loop	✓		
k_{eff}	✓		
Activation foils	✓		

Mercury Tests (mcf)

Check/Test	Success	Failure	Comments
za-loop	✓		
k_{eff}	✓		
LLNL pulsed spheres	✓		
Oktavian spheres	✓		

Other Release Tasks

	Complete	Comments
Add correct bdfls file	OCF: ✓ SCF: ✓	
Add/Edit README.txt	✓	
Check directory layout	OCF: ✓ SCF: ✓	
Check file permissions	OCF: ✓ SCF: ✓	
Post on NADS	Not yet	
Tag release in svn repo	✓	endl/branches/ENDL2009.3
Release documentation	✓	ENDL2009.3_release.pdf

Release Features

	Present?	Comments
Momentum deposition	✓	
Energy deposition	✓	
Energy-dependent Q-values for (n,f)	✓	
Multi-temperature data	✓	In mcf files
Large-Angle Coulomb Scattering (LACS) data	✓	Not present in ndf files
Thermal scattering ($S_{\alpha\beta}$) data	✓	For p,d,^{4}He, ^{12}C, and ^{16}O
Unresolved Resonance (URR) data (probability tables)	x	Removed since codes can't currently use it, but will be possible in the future
Uncertainty/Covariance data	about half	
Isomers	2, 1 processed	ASCII files have 2 isomer targets: ^{242m,244m}Am. However, only ^{242m}Am is processed: it replaces the ground state

Available Formats

	Present?	Comments
mcf	✓	mcf1.pdb.175 mcf1.pdb.230 mcf2.pdb mcf3.pdb mcf4.pdb mcf5.pdb mcf6.pdb mcf7.pdb
ndf	✓	ndf1.175 ndf1.230 ndf2.063 ndf3.063 ndf4.063 ndf5.063 ndf6.063 ndf7.040
tdf	✓	17 reactions
ENDF/B	some	ENDF for evaluation starting points for neutrons
gnd	x	
other	x	