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2009.5 Revision of the Evaluated Nuclear Data Library, with ENDL2009.5-direct

I. Thompson, B. R. Beck, M. A. Descalle, C. M. Mattoon, G. Gert

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2009.5 Revision of the Evaluated Nuclear Data Library, with ENDL2009.5-direct

I. J. Thompson, B. R. Beck, M.-A. Descalle, C. M. Mattoon, and G. Gert
Lawrence Livermore National Laboratory, Livermore California 94551
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LLNL's Nuclear Data and Theory Group have created a 2009.5 revised release of the Evaluated Nuclear Data Library (ENDL2009.5). 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 ENDL2009.5, by comparing with the existing data in the previous releases ENDL2009.3 and ENDL2009.4.

In addition to the legacy library ENDL2009.5 from ENDL-format files generated by FETE, an ENDL2009.5-direct library is also released, in which ENDF6-formatted sources are used wherever possible to avoid possible translation errors from FETE.

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. 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. 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 ENDL2009.5, by comparing with the existing data in the previous releases ENDL2009.3 and ENDL2009.4. We will (later) compare this ENDL2009.5 with ENDL2009.5-direct.

The new library can be found on LLNL's Open & Secure Computing facilities.

II. MODIFICATIONS FOR ENDL2009.5 FROM ENDL2009.4

1. Improved low-energy cross sections for charged particles

Better extrapolation of charged-particle cross sections down to low energies. The details are given in Table I for each exothermic reaction between charged particles. For each reaction, the experimental data are examined to determine for what energy E_g the data are reliable or good above that value. The S-factor is determined by $S(E) = \frac{\sigma(E)}{E} e^{2\pi\eta(E)}$, where $\eta(E)$ is the Sommerfeld parameter. The S-factor value $S(E_g)$ is taken as constant for all lower energies $E < E_g$.

This is a great improvement over previous libraries where cross-sections at say 1 keV were chosen either purely from experiment, or somewhat arbitrarily and

without reference to what that implies for the low energy behavior of the S-factor.

III. MODIFICATIONS FOR ENDL2009.5 FROM ENDL2009.3

The ENDL2009.5 revisions are in the repository branch /usr/gapps/CNP_data/all/live_repos/svnRepos/endl/branches/endl2009.5, created at revision 1119. The latest release is the acceptance of release candidate is rc1 as tagged at /usr/gapps/CNP_data/all/live_repos/svnRepos/endl/tags/endl2009.5 as revision 1146.

1. Evaluation of n + ^{6}Li reactions

The n + ^{6}Li evaluation reverts to that of ENDL86 through ENDL2009.2, reversing the change made going from ENDL2009.2 to ENDL2009.3 *except that* the C=35 channel has been rebuilt.

This C=35 reaction is the ^{6}Li(n,d)^{5}He channel: a two-body reaction giving a ^{5}He($3/2^-$) resonance state, which then decays into a neutron and an alpha particle. The energy distributions were previously not correctly following this reaction pattern, but gave too much energy to the deuteron. Now, following the measurements of Frye [PR 93, 1086 (1954), Fig 11], we take the two-body reaction as $Q = -2.5$ MeV, broadened by a ^{5}He ground-state width of 0.5 MeV as a resonance. The deuteron, neutron and alpha energy distributions have all been recalculated on this model, assuming the isotropic angular distributions seen in experiment. In ENDL, the C=35 channel is now S=1, through a discrete state, and the n, d and α distributions in yo01c35i004s001, yo03c35i004s001 and yo16c35i004s001 are new.

This changes the files in directory ascii/yi01/za003006 at svn revision 1130 and 1131.

2. Evaluation of the d + ^{7}Li → n + 2α reaction

The previous ECPL data for this channel was unrealistically large at low energies (below 100 keV), in not following the shape to be expected for the Coulomb barrier in the entrance channel.

So we imported yo00c26i000s000 data translated from ENDF/B-VII.1, as made by Gerry Hale in 2003, into file ascii/yi03/za003007/yo00c26i000s000 at svn revision 1116.

3. Evaluation of the t + ^{7}Li → 2n + 2α reaction

The cross-section for this channel has been halved, as ENDL2009.2 and ENDL2009.3 previously had the neutron-*production* cross-section that included a multiplicity of 2. This changes the data in file ascii/yi04/za003007/yo00c33i000s000 in svn revision 1116.

Note that this cross-section, as having a 4-body final state, is not included in TDF.

4. Energy distributions of γ-rays from fission

For neutrons on ^{235}U, ^{238}U and ^{239}Pu, the energy range of the gammas from fission has been extended from 8 to 20 MeV. This was done by copying data from the ENDL99 library to replace ENDL2009.3 data above 4 MeV, and renormalizing the distributions (I=4). For ^{235}U and ^{239}Pu the fission gammas are combined into C=55 for incident neutrons above 1.09 MeV, while below 1.09 MeV the yo=7 C=15 I=4 S=0 files are modified. For ^{238}U, all the fission gammas are in the yo=7 C=15 I=4 S=0 file.

These are updated in svn revision 1121.

IV. CHANGES IN PREPARING ENDL2009.5 DATA FROM ENDL2009.3

1. Fluorescence data included again

The fluorescence data in yi=7 for (γ, γ') reactions were accidentally excluded in the processing for ENDL2009.3 (to help with GNDS processing). Now they have been restored.

2. Another reaction in the TDF library

Following the policy of including in the TDF library all exothermic reactions ($Q > 0$), we now include the `n1+He3=H1+H3` reaction in the TDF set.

3. ENDL2009.5-direct

An ENDL2009.5-direct library is also released at LC location `/usr/gapps/data/nuclear/development/GNDS_2.0/ENDL2009/ENDL2009.5-direct`, in which ENDF6-formatted sources are used as often as possible to avoid possible translation errors from FETE. This library is only available in GNDS format.

Channels and product distributions that were added to ENDL2009 after the initial translation into ENDL format have been also added to the direct translations from ENDF6 to GNDS formats. The channels and product distributions added are listed in Table II, along with the sources of the original ENDF6-formatted files. Not shown in that table, all fissioning nuclides also include the energy-dependent $Q(E)$ distributions from ENDL2009.5 ENDL format files.

The ENDF6 files are included in `/usr/gapps/data/ nuclear/development/GNDS_-2.0/ ENDL2009/ENDL2009.5/endf`, and the combined GNDS files before processing are at `/usr/gapps/data/ nuclear/development/GNDS_-2.0/ ENDL2009/ENDL2009.5-direct/originals`.

All the data in ENDL2009.5-direct has been processed with Fudge and Merced, and are available on LC in directory `/usr/gapps/data/nuclear/development/GNDS_2.0/ENDL2009/ENDL2009.5-direct-rc1`.
The library files translated into GNDS are in the `originals`sub-directory, and these are processed for room-temperature at `processLib.py originals -t 2.586e-8 -a "-mc -mg -up"` , and at all legacy temperatures with `processLib.py originals --temperaturesLegacy -a "-mc -mg -up"` .

An second multigroup folder with 87 groups for neutrons (with unchanged groups for charged-particles and gammas) is available on LC at `ENDL2009.5-direct-rc1/neutrons_87group`.

A third multigroup folder with only room-temperature data for neutrons is available on LC at `ENDL2009.5-direct-rc1/RoomTemp`.

V. OUTLOOK

This new library, after testing, will be moved to LLNL's Open and Secure Computing facilities in directory `/collab/usr/gapps/data/nuclear/endl_-official/endl2009.5-direct`. In addition, the data may soon be viewed in the Nuclear and Atomic Data System data viewer on LC at `/usr/gapps/fudge/NADS/nads`.

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Appendix A: Known Issues

None so far.

Appendix B: Detailed Test Results for ENDL2009.5

Criticality tests by deterministic (ARDRA) and Monte Carlo (MERCURY) codes were performed. The new revision ENDL2009.5 was compared with both the previous ENDL2009.3 evaluation, and with measurements from critical assemblies. The results are shown in the files

MC-Legacy_ENDL2009.3-ENDL2009.5.pdf
MC-GNDS_ENDL2009.3_ENDL2009.5.pdf
Ardra-legacy_endl2009.5-rc1_vs_endl2009.3.pdf

that are included in directory `doc/` of the release.

These show that deterministic ARDRA and MonteCarlo MERCURY results agreed with those of endl2009.3 to better to 1 part in 10^4, as do the Monte Carlo results with GNDS library files. No discernible differences are visible on the plots of cumulative χ^2 deviations, nor in the pulsed-sphere delay-time curves.

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

TABLE I: Improvements to charged-particle cross-sections at low incident energies.

Incident	**Exit**	**Q-value** (MeV)	**good above** (MeV)	**S-factor S**(E_g) (MeV.b)	**E**$_g$ (MeV)	$\sigma(E_g)$ (barns)
p + t	a + photon	19.81	0.02	4.547e-06	0.02	2.7e-07
p + Li6	h + a	4.02	0.0	3.5486	0.005	4.12e-16
p + Li7	a + a	17.3473	0.0	0.06671	0.000709	2.674882e-47
d + d	n + h	3.269	0.0	0.05256	0.00062	5.4436e-23
d + t	n + a	17.59	0.0	11.7615	0.000517016	5.7145e-23
d + h	p + a	18.354	0.0	5.9054	0.000517018	4.3223e-50
d + Li6	n + Be7	3.382	0.0073345	33.4435	0.0073345	2.6329e-18
d + Li7	n + 2a	15.124	0.02	31.83890	0.02	2.3659e-10
d + Be7	p + (Be8 → 2a)	16.768	0.75	21.790	0.75	0.057
t + p	a + photon	19.81	0.05985	4.5474e-06	0.05985	2.7e-07
t + d	n + a	17.59	0.0	11.7615	0.0007742	5.71453e-23
t + t	2n + a	11.33	0.0	0.18466	0.0005	3.1052e-31
t + h	n + (Li5 → p + a)	12.097	0.0	0.137471	0.4	0.003
t + Li6	n + (Be8 → 2a)	16.118	0.36	20.67815	0.36	0.016
t + Li7	n + Be9	10.439	0.0101	59.6884	0.0101	4.45093e-19
t + Be7	n + p + 2a	10.511	0.75	22.02743	0.75	0.015
h + d	p + a	18.354	0.0	5.905442	0.00077421	4.32232e-50
h + t	n + (Li5 → p + a)	12.097	0.0	0.06840	1.0	0.0044
h + Li6	H2 + Be7	0.11	0.25	1503.920	0.25	1e-05
h + Li7	n + p + 2a	9.631	5.0	5.27638	5.0	0.015
h + Be7	2p + 2a	11.275	1.0	69923.67	1.0	0.107
a + Be9	n + C12	5.702	0.0	1286.815	1.5	0.003

TABLE II: Reactions and product distributions previously added to ENDL-formatted ENDL2009 after the first translation from ENDF6 format, so now patched into the GNDS translations from ENDF6 sources. Additionally, all fissioning nuclides now include the energy-dependent $Q(E)$ distributions from ENDL2009.5 ENDL format files.

Target	**Origin**	**Patching?**	**Added reactions and products**
n	za000001	ENDL unchanged	
H1	ENDF.B-VII.0	ENDF unchanged	
H2	JENDL-4	ENDF + patched	dist: H3
H3	ENDF-B-VII.1	ENDF + patched	dist: H2
HinH2O	za001801	ENDL unchanged	
HinCH2	za001901	ENDL unchanged	
DinD2O	za001902	ENDL unchanged	
He3	ENDF.B-VII.0	ENDF + patched	dist: photon He4 H1 H3 H2 H2__a
He4	JENDL-3.3	ENDF unchanged	
Li6	za003006	ENDL unchanged	
Li7	za003007	ENDL unchanged	
Be7	LLNL-2016	ENDF unchanged	
Be-metal	za004809	ENDL unchanged	
BeinBeO	za004909	ENDL unchanged	
Be9	za004009	ENDL unchanged	
B10	za005010	ENDL unchanged	
B11	ENDF.B-VII.0	ENDF + patched	dist: H3
C12	za006012	ENDL unchanged	
C13	za006013	ENDL unchanged	
graphite	za006912	ENDL unchanged	
N14	za007014	ENDL unchanged	
N15	za007015	ENDL unchanged	
O16	ENDF.B-VII.0	ENDF + patched	2n+O15
OinBeO	za008916	ENDL unchanged	
F19	za009019	ENDL unchanged	
Ne20	za010020	ENDL unchanged	
Na22	ENDF.A-7.2009	ENDF + patched	dist: H1 photon He4 He4 H1 H2 He4
Na23	JENDL-3.3	ENDF unchanged	
Mg0	za012000	ENDL unchanged	
Mg24	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 He4

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Target	**Origin**	**Patching?**	**Added reactions and products**
Mg25	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 He4
Mg26	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 He4
Al25	LLNL-2009	ENDF unchanged	
Al26	LLNL-2009	ENDF unchanged	
Al27	ENDF.B-VII.0	ENDF unchanged	
Al28	LLNL-2009	ENDF unchanged	
Al29	LLNL-2009	ENDF unchanged	
Si0	za014000	ENDL unchanged	
Si28	ENDF.B-VII.0	ENDF + patched	dist: H2
Si29	ENDF.B-VII.0	ENDF + text corrections	
Si30	ENDF.B-VII.0	ENDF unchanged	
P31	ENDF.B-VII.0	ENDF + patched	dist: H1 H1 He4
S32	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 He4
S33	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 He4
S34	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 He4
S36	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 He4
Cl0	za017000	ENDL unchanged	
Cl35	ENDF.A-7.2009	ENDF unchanged	
Cl37	ENDF.A-7.2009	ENDF unchanged	
Ar0	za018000	ENDL unchanged	
Ar34	LLNL-2009	ENDF unchanged	
Ar35	LLNL-2009	ENDF unchanged	
Ar36	LLNL-2009	ENDF + text corrections	
Ar38	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 He4 H1 H2 He4
Ar40	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
K0	za019000	ENDL unchanged	
K39	ENDF.A-7.2009	ENDF + patched	dist: H1 He4 H1 He4
K40	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 He4
K41	ENDF.A-7.2009	ENDF + patched	dist: H1 He4 H1 He4
Ca0	za020000	ENDL unchanged	
Ca40	ENDF.B-VII.0	ENDF unchanged	
Ca41	za020041	ENDL unchanged	
Ca42	ENDF.B-VII.0	ENDF unchanged	
Ca43	ENDF.B-VII.0	ENDF unchanged	
Ca44	ENDF.B-VII.0	ENDF unchanged	
Ca45	za020045	ENDL unchanged	
Ca46	ENDF.B-VII.0	ENDF unchanged	
Ca47	za020047	ENDL unchanged	
Ca48	ENDF.B-VII.0	ENDF unchanged	
Sc41	za021041	ENDL unchanged	
Sc42	za021042	ENDL unchanged	
Sc43	za021043	ENDL unchanged	
Sc44	za021044	ENDL unchanged	
Sc45	JEFF-3.1	ENDF + patched	Sc46_m1
Sc46	za021046	ENDL unchanged	
Sc47	za021047	ENDL unchanged	
Sc48	za021048	ENDL unchanged	
Sc49	za021049	ENDL unchanged	
Sc50	za021050	ENDL unchanged	
Ti0	za022000	ENDL unchanged	
Ti44	za022044	ENDL unchanged	
Ti45	za022045	ENDL unchanged	
Ti46	ENDF.A-7.2009	ENDF + patched	dist: H1 photon He4 H1 H1 H2 H3 He3 He4
Ti47	ENDF.A-7.2009	ENDF + patched	dist: H1 photon He4 H1 H1 H2 H3 He3 He4
Ti48	ENDF.A-7.2009	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
Ti49	ENDF.A-7.2009	ENDF + patched	dist: H1 photon He4 H1 H1 H2 H3 He3 He4
Ti50	ENDF.A-7.2009	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
Ti51	za022051	ENDL unchanged	
Ti52	za022052	ENDL unchanged	
V0	za023000	ENDL unchanged	
V46	za023046	ENDL unchanged	
V47	za023047	ENDL unchanged	
V48	za023048	ENDL unchanged	
V49	za023049	ENDL unchanged	
V50	za023050	ENDL unchanged	
V51	za023051	ENDL unchanged	
V52	za023052	ENDL unchanged	
V53	za023053	ENDL unchanged	
Cr0	za024000	ENDL unchanged	
Cr47	za024047	ENDL unchanged	
Cr48	za024048	ENDL unchanged	
Cr49	za024049	ENDL unchanged	
Cr50	ENDF.B-VII.0	ENDF + patched	dist: H2
Cr51	za024051	ENDL unchanged	
Cr52	ENDF.B-VII.0	ENDF unchanged	

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Target	Origin	Patching?	Added reactions and products
Cr53	ENDF.B-VII.0	ENDF unchanged	
Cr54	ENDF.B-VII.0	ENDF unchanged	
Cr55	za024055	ENDL unchanged	
Cr56	za024056	ENDL unchanged	
Mn50	za025050	ENDL unchanged	
Mn51	za025051	ENDL unchanged	
Mn52	za025052	ENDL unchanged	
Mn53	za025053	ENDL unchanged	
Mn54	za025054	ENDL unchanged	
Mn55	ENDF.A-7.2009	ENDF + patched	dist: H2 H3 He3
Mn56	za025056	ENDL unchanged	
Mn57	za025057	ENDL unchanged	
Fe0	za026000	ENDL unchanged	
Fe52	za026052	ENDL unchanged	
Fe53	za026053	ENDL unchanged	
Fe54	ENDF.B-VII.0	ENDF + patched	dist: H2
Fe55	za026055	ENDL unchanged	
Fe56	ENDF.B-VII.0	ENDF + patched	dist: H2 H3 He3
Fe57	LLNL-2009	ENDF unchanged	
Fe58	ENDF.B-VII.0	ENDF unchanged	
Fe59	za026059	ENDL unchanged	
Co57	LLNL-2009	ENDF unchanged	
Co58	LLNL-2009	ENDF unchanged	
Co59	LLNL-2009	ENDF unchanged	
Co60	LLNL-2009	ENDF unchanged	
Co61	LLNL-2009	ENDF unchanged	
Ni0	za028000	ENDL unchanged	
Ni56	za028056	ENDL unchanged	
Ni57	za028057	ENDL unchanged	
Ni58	ENDF.B-VII.0	ENDF + patched	dist: H2
Ni59	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 He4 H1 H1 H2 H3 He4
Ni60	ENDF.B-VII.0	ENDF + patched	dist: H2
Ni61	ENDF.B-VII.0	ENDF + patched	dist: H1
Ni62	ENDF.B-VII.0	ENDF + patched	dist: H2
Ni63	za028063	ENDL unchanged	
Ni64	ENDF.B-VII.0	ENDF + patched	dist: H2
Ni65	za028065	ENDL unchanged	
Ni66	za028066	ENDL unchanged	
Ni67	za028067	ENDL unchanged	
Cu0	za029000	ENDL unchanged	
Cu62	za029062	ENDL unchanged	
Cu63	ENDF.B-VII.0	ENDF + patched	dist: H2 He3
Cu64	za029064	ENDL unchanged	
Cu65	ENDF.B-VII.0	ENDF + patched	dist: H2 H3 He3
Cu66	za029066	ENDL unchanged	
Cu67	za029067	ENDL unchanged	
Cu68	za029068	ENDL unchanged	
Zn0	za030000	ENDL unchanged	
Zn62	za030062	ENDL unchanged	
Zn63	za030063	ENDL unchanged	
Zn64	za030064	ENDL unchanged	
Zn65	za030065	ENDL unchanged	
Zn66	za030066	ENDL unchanged	
Zn67	za030067	ENDL unchanged	
Zn68	za030068	ENDL unchanged	
Zn69	za030069	ENDL unchanged	
Zn70	za030070	ENDL unchanged	
Zn71	za030071	ENDL unchanged	
Zn72	za030072	ENDL unchanged	
Zn73	za030073	ENDL unchanged	
Ga0	za031000	ENDL unchanged	
Ga68	za031068	ENDL unchanged	
Ga69	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H1 H2 H3 He3 He4
Ga70	za031070	ENDL unchanged	
Ga71	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H1 H2 H3 He3 He4
Ga72	za031072	ENDL unchanged	
Ge70	ENDF.B-VII.0	ENDF unchanged	
Ge72	ENDF.B-VII.0	ENDF unchanged	
Ge73	ENDF.B-VII.0	ENDF unchanged	
Ge74	ENDF.B-VII.0	ENDF unchanged	
Ge76	ENDF.B-VII.0	ENDF unchanged	
As73	LLNL-2009	ENDF unchanged	
As74	LLNL-2009	ENDF unchanged	
As75	LLNL-2009	ENDF unchanged	
Se74	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H1 H2 H3 He3 He4

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Target	Origin	Patching?	Added reactions and products
Se75	za034075	ENDL unchanged	
Se76	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H1 H2 H3 He3 He4
Se77	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H1 H2 H3 He3 He4
Se78	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Se79	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Se80	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Se81	za034081	ENDL unchanged	
Se82	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Br75	za035075	ENDL unchanged	
Br76	za035076	ENDL unchanged	
Br77	za035077	ENDL unchanged	
Br78	za035078	ENDL unchanged	
Br79	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H1 H2 H3 He3 He4
Br80	za035080	ENDL unchanged	
Br81	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Br82	za035082	ENDL unchanged	
Kr76	LLNL-2009	ENDF unchanged	
Kr77	LLNL-2009	ENDF unchanged	
Kr78	LLNL-2009	ENDF unchanged	
Kr79	za036079	ENDL unchanged	
Kr80	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H1 H2 H3 He3 He4
Kr81	za036081	ENDL unchanged	
Kr82	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Kr83	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H1 H2 H3 He3 He4
Kr84	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Kr85	ENDF.B-VII.0	ENDF unchanged	
Kr86	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Rb77	za037077	ENDL unchanged	
Rb78	za037078	ENDL unchanged	
Rb79	za037079	ENDL unchanged	
Rb80	za037080	ENDL unchanged	
Rb82	za037082	ENDL unchanged	
Rb83	za037083	ENDL unchanged	
Rb84	za037084	ENDL unchanged	
Rb85	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Rb86	ENDF.B-VII.0	ENDF unchanged	
Rb87	ENDF.A-7.2009	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He4
Sr84	ENDF.B-VII.0	ENDF unchanged	
Sr86	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H1 H2 H3 He4
Sr87	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Sr88	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
Sr89	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
Sr90	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He4
Y88	za039088	ENDL unchanged	
Y89	ENDF.A-7.2009	ENDF + text corrections	
Y90	ENDF.B-VII.0	ENDF unchanged	
Y91	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Zr0	za040000	ENDL unchanged	
Zr90	ENDF.A-7.2009	ENDF unchanged	
Zr91	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 He4 H1 H2 H3 He3 He4
Zr92	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 He4 H1 H2 H3 He4
Zr93	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Zr94	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 He4 H1 H2 H3 He4
Zr95	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He4
Zr96	ENDF.A-7.2009	ENDF + patched	dist: H1 He4 H1 H2 H3 He4
Nb93	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 He4 H1 H2 H3 He4
Nb94	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He3 He4
Nb95	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He3 He4
Mo0	za042000	ENDL unchanged	
Mo92	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 H1 H2 H3 He3 He4
Mo94	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 H1 H2 H3 He3 He4
Mo95	ENDF.B-VII.0	ENDF + patched	dist: He4
Mo96	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 H2 H3 He4
Mo97	ENDF.A-7.2009	ENDF + patched	dist: H1 He4 H1 H2 H3 He3 He4
Mo98	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 H2 H3 He4
Mo99	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Mo100	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Tc99	JEFF-3.1.1	ENDF + text corrections	
Ru96	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H1 H2 H3 He3 He4
Ru98	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H1 H2 H3 He3 He4
Ru99	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Ru100	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He4
Ru101	ENDF.B-VII.0	ENDF unchanged	
Ru102	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
Ru103	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4

TABLE II: Reactions and product distributions previously added to ENDL-formatted ENDL2009 after the first translation from ENDF6 format, so now patched into the GNDS translations from ENDF6 sources. Additionally, all fissioning nuclides now include the energy-dependent $Q(E)$ distributions from ENDL2009.5 ENDL format files.

Target	Origin	Patching?	Added reactions and products	
Ru104	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Ru105	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Ru106	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Rh103	JEFF-3.1	ENDF + patched		dist: photon
Rh105	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He3 He4
Pd102	JENDL-3.3	ENDF + patched		dist: H1 H2 photon He4 H1 H1 H2 H3 He3 He4
Pd104	ENDF.B-VII.0	ENDF unchanged		
Pd105	ENDF.B-VII.0	ENDF unchanged		
Pd106	ENDF.B-VII.0	ENDF unchanged		
Pd107	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He4
Pd108	ENDF.B-VII.0	ENDF unchanged		
Pd110	ENDF.B-VII.0	ENDF unchanged		
Ag107	ENDF.B-VII.0	ENDF + patched	H2, H3	and dist: H1 He4 H1 He4
Ag109	ENDF.B-VII.0	ENDF unchanged		
Ag111	ENDF.B-VII.0	ENDF unchanged		
Cd0	za048000	ENDL unchanged		
Cd106	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 He4 H1 H1 H2 H3 He3 He4
Cd108	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Cd110	JENDL-3.3	ENDF + patched		dist: H1 He4 H1 H2 H3 He4
Cd111	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 He4 H1 H2 H3 He4
Cd112	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Cd113	ENDF.A-7.2009	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Cd114	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Cd116	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He3 He4
In0	za049000	ENDL unchanged		
In113	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 H3 photon He4 H1 H2 H3 He3 He4
In115	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Sn0	za050000	ENDL unchanged		
Sn112	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H1 H2 H3 He3 He4
Sn113	ENDF.B-VII.0	ENDF unchanged		
Sn114	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He3 He4
Sn115	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Sn116	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Sn117	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He4
Sn118	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Sn119	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He4
Sn120	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Sn122	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Sn123	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Sn124	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Sn125	ENDF.B-VII.0	ENDF unchanged		
Sn126	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Sb0	za051000	ENDL unchanged		
Sb121	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Sb123	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Sb124	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Sb125	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Sb126	ENDF.B-VII.0	ENDF unchanged		
Te120	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Te122	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He3 He4
Te123	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Te124	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Te125	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 photon He4 H1 H2 H3 He4
Te126	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Te127	za052127	ENDL unchanged		
Te128	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Te130	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Te132	ENDF.B-VII.0	ENDF + text corrections		
I124	za053124	ENDL unchanged		
I125	za053125	ENDL unchanged		
I126	za053126	ENDL unchanged		
I127	ENDF.B-VII.0	ENDF + text corrections		
I128	za053128	ENDL unchanged		
I129	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 H3 photon He4 H1 H2 H3 He4
I130	ENDF.B-VII.0	ENDF unchanged		
I131	ENDF.B-VII.0	ENDF + patched		dist: H1 H2 H3 photon He4 H1 H2 H3 He4
I135	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4
Xe0	za054000	ENDL unchanged		
Xe122	LLNL-2009	ENDF unchanged		
Xe123	LLNL-2009	ENDF unchanged		
Xe124	LLNL-2009	ENDF unchanged		
Xe125	za054125	ENDL unchanged		
Xe126	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He3 He4
Xe127	za054127	ENDL unchanged		
Xe128	ENDF.B-VII.0	ENDF + patched		dist: H1 photon He4 H1 H2 H3 He4

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Target	Origin	Patching?	Added reactions and products
Xe129	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Xe130	JENDL-3.3	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Xe131	ENDF.B-VII.0	ENDF unchanged	
Xe132	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Xe133	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He4
Xe134	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Xe135	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He4
Xe136	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Cs133	ENDF.B-VII.0	ENDF + text corrections	
Cs134	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He3 He4
Cs135	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Cs136	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Cs137	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Ba130	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H1 H2 H3 He3 He4
Ba132	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
Ba133	ENDF.B-VII.0	ENDF unchanged	
Ba134	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Ba135	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He3 He4
Ba136	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Ba137	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He4
Ba138	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
Ba140	JENDL-3.3	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
La138	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He3 He4
La139	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
La140	ENDF.B-VII.0	ENDF unchanged	
Ce136	ENDF.B-VII.0	ENDF unchanged	
Ce138	ENDF.B-VII.0	ENDF unchanged	
Ce139	ENDF.B-VII.0	ENDF unchanged	
Ce140	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 photon He4 H1 H2 H3 He4
Ce141	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
Ce142	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Ce143	ENDF.B-VII.0	ENDF unchanged	
Ce144	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Pr141	ENDF.B-VII.0	ENDF unchanged	
Pr142	ENDF.B-VII.0	ENDF unchanged	
Pr143	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He3 He4
Nd142	ENDF.B-VII.0	ENDF unchanged	
Nd143	ENDF.B-VII.0	ENDF + patched	dist: He4
Nd144	ENDF.B-VII.0	ENDF unchanged	
Nd145	ENDF.B-VII.0	ENDF + patched	dist: He4
Nd146	ENDF.B-VII.0	ENDF unchanged	
Nd147	ENDF.B-VII.0	ENDF unchanged	
Nd148	ENDF.B-VII.0	ENDF unchanged	
Nd150	ENDF.B-VII.0	ENDF unchanged	
Pm147	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He3 He4
Pm148	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He3 He4
Pm149	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Pm151	ENDF.B-VII.0	ENDF unchanged	
Sm144	ENDF.B-VII.0	ENDF unchanged	
Sm147	ENDF.B-VII.0	ENDF + patched	dist: He4
Sm148	ENDF.B-VII.0	ENDF unchanged	
Sm149	ENDF.B-VII.0	ENDF + patched	dist: He4
Sm150	ENDF.B-VII.0	ENDF unchanged	
Sm151	ENDF.B-VII.0	ENDF unchanged	
Sm152	ENDF.B-VII.0	ENDF + text corrections	
Sm153	ENDF.B-VII.0	ENDF unchanged	
Sm154	ENDF.B-VII.0	ENDF unchanged	
Eu0	za063000	ENDL unchanged	
Eu151	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He3 He4
Eu152	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He3 He4
Eu153	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 He3 He4
Eu154	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Eu155	ENDF.B-VII.0	ENDF + patched	dist: H1 photon He4 H1 H2 H3 He4
Eu156	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4
Eu157	ENDF.B-VII.0	ENDF unchanged	
Gd0	za064000	ENDL unchanged	
Gd152	ENDF.B-VII.0	ENDF + patched	dist: He4
Gd153	ENDF.B-VII.0	ENDF + patched	dist: He4
Gd154	ENDF.B-VII.0	ENDF unchanged	
Gd155	ENDF.B-VII.0	ENDF + patched	dist: He4
Gd156	ENDF.B-VII.0	ENDF + text corrections	
Gd157	ENDF.B-VII.0	ENDF + patched	dist: He4
Gd158	ENDF.B-VII.0	ENDF unchanged	
Gd160	ENDF.B-VII.0	ENDF unchanged	
Tb159	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 H3 photon He4 H1 H2 H3 He4

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Target	Origin	Patching?	Added reactions and products
Tb160	ENDF.B-VII.0	ENDF unchanged	
Dy156	ENDF.B-VII.0	ENDF + text corrections	
Dy158	ENDF.B-VII.0	ENDF unchanged	
Dy160	ENDF.B-VII.0	ENDF unchanged	
Dy161	ENDF.B-VII.0	ENDF unchanged	
Dy162	ENDF.B-VII.0	ENDF unchanged	
Dy163	ENDF.B-VII.0	ENDF + text corrections	
Dy164	ENDF.B-VII.0	ENDF + text corrections	
Ho165	ENDF.B-VII.0	ENDF unchanged	
Er162	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 H2 H3 He4
Er164	ENDF.B-VII.0	ENDF + patched	dist: H1 He4 H1 H2 H3 He4
Er166	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 He4 H1 H2 H3 He4
Er167	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 He4 H1 H2 H3 He4
Er168	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 He4 H1 H2 H3 He4
Er170	ENDF.B-VII.0	ENDF + patched	dist: H1 H2 He4 H1 H2 H3 He4
Tm169	TENDL-2008	ENDF + text corrections	
Tm171	TENDL-2008	ENDF + text corrections	
Yb168	TENDL-2008	ENDF + text corrections	
Yb169	TENDL-2008	ENDF + text corrections	
Yb170	TENDL-2008	ENDF + text corrections	
Yb171	TENDL-2008	ENDF + text corrections	
Yb172	TENDL-2008	ENDF + text corrections	
Yb173	TENDL-2008	ENDF + text corrections	
Yb174	TENDL-2008	ENDF + patched	dist: He3
Yb176	TENDL-2008	ENDF + text corrections	
Lu175	ENDF.B-VII.0	ENDF + patched	dist: photon H1 He4
Lu176	ENDF.B-VII.0	ENDF + patched	dist: photon H1 He4
Hf0	za072000	ENDL unchanged	
Hf174	ENDF.A-9.2009	ENDF unchanged	
Hf176	ENDF.A-9.2009	ENDF unchanged	
Hf177	ENDF.A-9.2009	ENDF unchanged	
Hf178	ENDF.A-9.2009	ENDF unchanged	
Hf179	ENDF.A-9.2009	ENDF unchanged	
Hf180	ENDF.A-9.2009	ENDF unchanged	
Ta178	LLNL-2009	ENDF unchanged	
Ta179	LLNL-2009	ENDF unchanged	
Ta180	LLNL-2009	ENDF unchanged	
Ta181	LLNL-2009	ENDF unchanged	
Ta182	LLNL-2009	ENDF unchanged	
Ta183	LLNL-2009	ENDF unchanged	
W0	za074000	ENDL unchanged	
W178	LLNL-2009	ENDF unchanged	
W179	LLNL-2009	ENDF unchanged	
W180	IAEA-W-CRP-2009	ENDF + text corrections	
W181	LLNL-2009	ENDF unchanged	
W182	IAEA-W-CRP-20092	ENDF + text corrections	
W183	IAEA-W-CRP-20092	ENDF + text corrections	
W184	IAEA-W-CRP-20092	ENDF + text corrections	
W185	LLNL-2009	ENDF unchanged	
W186	IAEA-W-CRP-20093	ENDF + text corrections	
W187	LLNL-2009	ENDF unchanged	
W188	LLNL-2009	ENDF unchanged	
Re183	LLNL-2009	ENDF unchanged	
Re184	LLNL-2009	ENDF unchanged	
Re185	ENDF.B-VII.0	ENDF + patched	dist: photon
Re186	LLNL-2009	ENDF unchanged	
Re187	ENDF.B-VII.0	ENDF + patched	dist: photon
Re188	LLNL-2009	ENDF unchanged	
Re189	LLNL-2009	ENDF unchanged	
Os0	za076000	ENDL unchanged	
Os184	TENDL-2008	ENDF + text corrections	
Os186	TENDL-2008	ENDF + text corrections	
Os187	TENDL-2008	ENDF + text corrections	
Os188	TENDL-2008	ENDF + text corrections	
Os189	TENDL-2008	ENDF + text corrections	
Os190	TENDL-2008	ENDF + text corrections	
Os191	TENDL-2008	ENDF + text corrections	
Os192	TENDL-2008	ENDF + text corrections	
Os193	TENDL-2008	ENDF unchanged	
Ir191	ENDF.B-VII.0	ENDF + text corrections	
Ir193	ENDF.B-VII.0	ENDF + text corrections	
Pt0	JEFF-3.1	ENDF unchanged	
Pt190	TENDL-2008	ENDF + text corrections	
Pt192	TENDL-2008	ENDF + text corrections	
Pt194	TENDL-2008	ENDF + text corrections	
Pt195	TENDL-2008	ENDF + text corrections	
Pt196	TENDL-2008	ENDF + text corrections	
Pt198	TENDL-2008	ENDF + text corrections	

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Target	**Origin**	**Patching?**	**Added reactions and products**	
Au195	LLNL-2009	ENDF unchanged		
Au196	LLNL-2009	ENDF + text corrections		
Au197	ENDF.B-VII.0	ENDF + patched		dist: H1 He4
Hg0	za080000	ENDL unchanged		
Hg196	ENDF.B-VII.0	ENDF + patched		dist: H1 He4 H1 H2 He4
Hg198	ENDF.B-VII.0	ENDF + patched		dist: H1 He4 H1 H2 He4
Hg199	ENDF.B-VII.0	ENDF + patched		dist: H1 He4 H1 H2 He4
Hg200	ENDF.B-VII.0	ENDF + patched		dist: H1 He4 H1 H2 He4
Hg201	ENDF.B-VII.0	ENDF + patched		dist: H1 He4 H1 H2 He4
Hg202	ENDF.B-VII.0	ENDF + patched		dist: H1 He4 H1 H2 He4
Hg204	ENDF.B-VII.0	ENDF + patched		dist: H1 He4 H1 H2 He4
Tl0	za081000	ENDL unchanged		
Tl203	TENDL-2008	ENDF + text corrections		
Tl204	TENDL-2008	ENDF + text corrections		
Tl205	TENDL-2008	ENDF unchanged		
Pb0	za082000	ENDL unchanged		
Pb202	LLNL-2009	ENDF unchanged		
Pb203	LLNL-2009	ENDF unchanged		
Pb204	LLNL-2009	ENDF unchanged		
Pb205	LLNL-2009	ENDF unchanged		
Pb206	LLNL-2009	ENDF unchanged		
Pb207	LLNL-2009	ENDF unchanged		
Pb208	LLNL-2009	ENDF unchanged		
Pb209	LLNL-2009	ENDF unchanged		
Pb210	LLNL-2009	ENDF unchanged		
Bi209	JEFF-3.1	ENDF unchanged		
Po209	TENDL-2008	ENDF unchanged		
Ra223	ENDF.B-VII.0	ENDF + patched		dist: photon
Ra224	ENDF.B-VII.0	ENDF + patched		dist: photon
Ra225	ENDF.B-VII.0	ENDF + patched		dist: photon
Ra226	ENDF.B-VII.0	ENDF + patched		dist: photon
Ac225	JENDL-AC-2008	ENDF unchanged		
Ac226	JENDL-AC-2008	ENDF unchanged		
Ac227	JENDL-AC-2008	ENDF unchanged		
Th227	JENDL-AC-2008	ENDF unchanged		
Th228	JENDL-AC-2008	ENDF unchanged		
Th229	JENDL-AC-2008	ENDF unchanged		
Th230	JENDL-AC-2008	ENDF unchanged		
Th231	JENDL-AC-2008	ENDF unchanged		
Th232	ENDF.B-VII.0	ENDF unchanged		
Th233	ENDF.B-VII.0	ENDF + patched		dist: photon
Th234	JENDL-AC-2008	ENDF unchanged		
Pa229	JENDL-AC-2008	ENDF unchanged		
Pa230	JENDL-AC-2008	ENDF unchanged		
Pa231	JENDL-AC-2008	ENDF unchanged		
Pa232	JENDL-AC-2008	ENDF unchanged		
Pa233	ENDF.B-VII.0	ENDF unchanged		
U230	JENDL-AC-2008	ENDF unchanged		
U231	JENDL-AC-2008	ENDF unchanged		
U232	ENDF.B-VII.0	ENDF unchanged		
U233	ENDF.B-VII.0	ENDF unchanged		
U234	ENDF.B-VII.0	ENDF unchanged		
U235	ENDF.B-VII.0	ENDF patched	Varying $Q_{\text{fis}}(E)$.	dist: fission γ to 20 MeV
U236	ENDF.A-9.2009	ENDF + text corrections		
U237	LLNL-2009	ENDF unchanged		
U238	ENDF.B-VII.0	ENDF patched	Varying $Q_{\text{fis}}(E)$.	dist: fission γ to 20 MeV
U239	LLNL-2009	ENDF unchanged		
U240	ENDF.B-VII.0	ENDF unchanged		
U241	ENDF.B-VII.0	ENDF unchanged		
Np234	JENDL-AC-2008	ENDF unchanged		
Np235	JENDL-AC-2008	ENDF unchanged		
Np236	JENDL-AC-2008	ENDF unchanged		
Np237	JENDL-AC-2008	ENDF unchanged		
Np238	JENDL-AC-2008	ENDF unchanged		
Np239	JENDL-AC-2008	ENDF unchanged		
Pu236	JENDL-AC-2008	ENDF unchanged		
Pu237	JENDL-AC-2008	ENDF unchanged		
Pu238	JENDL-AC-2008	ENDF unchanged		
Pu239	ENDF.B-VII.0	ENDF patched	Varying $Q_{\text{fis}}(E)$.	dist: fission γ to 20 MeV
Pu240	ENDF.A-9.2009	ENDF + text corrections		
Pu241	JENDL-AC-2008	ENDF unchanged		
Pu242	JENDL-AC-2008	ENDF unchanged		
Pu243	za094243	ENDL unchanged		
Pu244	JENDL-AC-2008	ENDF unchanged		
Pu246	JENDL-AC-2008	ENDF unchanged		

TABLE II: Reactions and product distributions previously added to ENDL-formatted ENDL2009 after the first translation from ENDF6 format, so now patched into the GNDS translations from ENDF6 sources. Additionally, all fissioning nuclides now include the energy-dependent $Q(E)$ distributions from ENDL2009.5 ENDL format files.

Target	**Origin**	**Patching?**	**Added reactions and products**	
Am240	LLNL-2009	ENDF unchanged		
Am241	ENDF.A-9.2009	ENDF + patched	Am242_m1	
Am242	ENDF.B-VII.0	ENDF + patched		dist: photon
Am242_m1	za095242m	ENDL unchanged		
Am243	ENDF.B-VII.0	ENDF + text corrections		
Am244	ENDF.B-VII.0	ENDF + patched		dist: photon
Am244_m1	za095244m	ENDL unchanged		
Cm240	JENDL-AC-2008	ENDF unchanged		
Cm241	JENDL-AC-2008	ENDF unchanged		
Cm242	JENDL-AC-2008	ENDF unchanged		
Cm243	JENDL-AC-2008	ENDF + text corrections		
Cm244	JENDL-AC-2008	ENDF unchanged		
Cm245	JENDL-AC-2008	ENDF unchanged		
Cm246	JENDL-AC-2008	ENDF unchanged		
Cm247	JENDL-AC-2008	ENDF unchanged		
Cm248	JENDL-4	ENDF unchanged		
Cm249	JENDL-AC-2008	ENDF unchanged		
Cm250	JENDL-AC-2008	ENDF unchanged		
Bk245	JENDL-AC-2008	ENDF unchanged		
Bk246	JENDL-AC-2008	ENDF unchanged		
Bk247	JENDL-AC-2008	ENDF unchanged		
Bk248	JENDL-AC-2008	ENDF unchanged		
Bk249	JENDL-AC-2008	ENDF unchanged		
Bk250	JENDL-AC-2008	ENDF unchanged		
Cf246	JENDL-AC-2008	ENDF unchanged		
Cf248	JENDL-AC-2008	ENDF unchanged		
Cf249	JENDL-AC-2008	ENDF + text corrections		
Cf250	JENDL-AC-2008	ENDF unchanged		
Cf251	JENDL-AC-2008	ENDF unchanged		
Cf252	JENDL-AC-2008	ENDF unchanged		
Cf253	JENDL-AC-2008	ENDF unchanged		
Cf254	JENDL-AC-2008	ENDF unchanged		
FP99120	za099120	ENDL unchanged		
FP99125	za099125	ENDL unchanged		