**Nuclear Data Section**

**International Atomic Energy Agency**

**P.O.Box 100, A-1400 Vienna, Austria**

**Memo CP-D/1005**

**Date:** 7 December 2020

**To:** Distribution

**From:** N. Otsuka

**Subject: DECAY-DATA: Coding of 511 keV annihilation decay data**

1. Radiation type and intensity of annihilation decay data coded under DECAY-DATA

Here are two examples of the DECAY-DATA code string for 11C annihilation γ-ray detection:

EXFOR 20348.002 (B.Anders+, J,ZP/A,301,353,1981

511 keV γ-ray-511 keV γ-ray coincidence counting is reported with its β+ intensity Iβ+=99.76%

DECAY-DATA (6-C-11,20.25MIN,AR,511.,.9976)



The 11C production cross section in this experiment was determined by

σ= [N(511 keV γ-511 keV γ coincidence) / Iβ+ ] …

EXFOR 22702.002 (Y.Uno, J,NSE,122,247,1996)

Detection of 511 keV γ counting reported with its γ intensity Iγ=199.518%

DECAY-DATA (6-C-11,20.39MIN,DG,511.0,1.99518)


The 11C production cross section in this experiment was determined by

σ= [N(511 keV γ) / Iγ ] …

Note that Iγ=2Iβ+.

We observe two ambiguities in coding of the 511 keV annihilation gamma decay data:

1. Choice of the radiation type – DG (decay gamma) or AR (annihilation radiation)?
2. Choice of the abundance (intensity) – number of gammas or coincidences?

The appendix of this memo lists the abundances of all DECAY-DATA code strings having (1) “DG” or “AR” in the radiation type subfield and (2) “511” in the energy subfield, and compared them with the annihilation gamma intensities extracted by Marco Verpelli (NDS) from the ENSDF library. It shows no consistency for both radiation type and abundance.

We may have the following two solutions for coding of decay data for annihilation γ detection:

Solution 1

Use DG when the γ-ray intensity is coded. Use AR when the γ-γ coincidence intensity (=β+-ray intensity) is coded.

Solution 2

Always use AR. Code the intensity written by the author by two when the author gives the β+-ray intensity instead of the γ-ray intensity.

2. DECAY-DATA subfield name: “Abundance” or “Intensity”

Rename of the subfield “Abundance” to “Intensity” is additionally proposed by Viktor Zerkin (NDS) since he considers that many users believe “abundance” usually means “isotopic abundance” in EXFOR. Indeed we routinely see “intensity” in decay data compilations, and ENSDF and ENDF manuals adopt it. On the other hand, this renaming would add confusion for those who are familiar with the current EXFOR convention.

3. Reference to decay data under REL-REF

LEXFOR “DECAY-DATA” mentions that “If the data given are taken from a known source, the reference for it may be coded under the keyword REL-REF”. I think it is rather important to code the decay data reference when the author cites a decay data reference (e.g., Table of Isotopes) but without providing the decay data themselves in the EXFOR source article.

Proposed change in LEXFOR “Decay Data”

(Many thanks to Otto Schwerer for formulating these sentences)

**Decay Data**

(See also **Half Lives**)

**…**

Free text explanation is often desirable, for example, a statement on whether the decay data were obtained from the experiment or quoted from another source.

* If the data given are taken from a known source, the reference for it may be coded under the keyword REL-REF (see Reference).
* If the authors quote only the source of the decay data but not their numerical values, the source should always be coded under REL-REF.

**Distribution:**

a.koning@iaea.org

abhihere@gmail.com

aloks279@gmail.com

bknayak@barc.gov.in

daniela.foligno@oecd-nea.org

dbrown@bnl.gov

draj@barc.gov.in

fukahori.tokio@jaea.go.jp

ganesan555@gmail.com

gezg@ciae.ac.cn

iwamoto.osamu@jaea.go.jp

j.c.sublet@iaea.org

jmwang@ciae.ac.cn

kaltchenko@kinr.kiev.ua

kenya.suyama@oecd-nea.org

kimdh@kaeri.re.kr

kimura.atsushi04@jaea.go.jp

l.vrapcenjak@iaea.org

manuel.bossant@oecd-nea.org

masaaki@nucl.sci.hokudai.ac.jp

michael.fleming@oecd-nea.org

mmarina@ippe.ru

nicolas.soppera@oecd-nea.org

n.otsuka@iaea.org

nrdc@jcprg.org

odsurenn@gmail.com

ogritzay@ukr.net

ogrudzevich@ippe.ru

otto.schwerer@aon.at

pikulina@expd.vniief.ru

pritychenko@bnl.gov

s.okumura@iaea.org

samaev@obninsk.ru

sbabykina@yandex.ru

scyang@kaeri.re.kr

selyankina@expd.vniief.ru

sonzogni@bnl.gov

stakacs@atomki.mta.hu

stanislav.hlavac@savba.sk

sv.dunaeva@gmail.com

tada@nucl.sci.hokudai.ac.jp

taova@expd.vniief.ru

tarkanyi@atomki.hu

vvvarlamov@gmail.com

v.zerkin@iaea.org

vidyathakur@yahoo.co.in

vsemkova@inrne.bas.bg

yolee@kaeri.re.kr

zholdybayev@inp.kz

**cc:**

m.verpelli@iaea.org

**Appendix: 511 keV γ-rays (DG or AR) under DECAY-DATA in EXFOR Master (Ver.2020-09-25)**

* “Type” (radiation type) shaded by green shows DG (AR) coded with the number of coincidences (γ-rays) per decay, i.e., against the proposed new rule.
* “Intensity (ENSDF)” is displayed as its upper boundary on the LiveChart of Nuclides.
* “Ratio” gives the intensity (EXFOR)/ intensity (ENSDF).
* “Remark” is given when the ratio is not within 1.0±0.1 or 2.0±0.1.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Nuclide** | **Type** | **Eγ** | **Intensity(EXFOR)** | **Intensity(ENSDF)** | **Ratio** | **EXFOR #** | **Remark** |
| 6-C-11 | DG | 511.0 | 0.995 | 1.995 | 2.0 |   |   |
| 6-C-11 | AR | 511. | 1.000 | 1.995 | 2.0 |   |   |
| 6-C-11 | DG | 511.0 | 1.995 | 1.995 | 1.0 |   |   |
| 6-C-11 | AR | 511. | 1.995 | 1.995 | 1.0 |   |   |
| 6-C-11 | AR | 511. | 1.920 | 1.995 | 1.0 |   |   |
| 6-C-11 | AR | 511.0 | 2.000 | 1.995 | 1.0 |   |   |
| 6-C-11 | AR | 511. | 2.000 | 1.995 | 1.0 |   |   |
| 6-C-11 | AR | 511. | 0.998 | 1.995 | 2.0 |   |   |
| 7-N-13 | AR | 511. | 1.996 | 1.996 | 1.0 |   |   |
| 7-N-13 | AR | 511.0 | 1.996 | 1.996 | 1.0 |   |   |
| 7-N-13 | AR | 511.0 | 2.000 | 1.996 | 1.0 |   |   |
| 7-N-13 | AR | 511. | 2.000 | 1.996 | 1.0 |   |   |
| 7-N-13 | DG | 511. | 2.000 | 1.996 | 1.0 |   |   |
| 7-N-13 | AR | 511. | 1.000 | 1.996 | 2.0 |   |   |
| 8-O-14 | AR | 511. | 0.994 | 1.998 | 2.0 |   |   |
| 8-O-15 | AR | 511. | 1.998 | 1.998 | 1.0 |   |   |
| 8-O-15 | AR | 511. | 1.000 | 1.998 | 2.0 |   |   |
| 9-F-17 | AR | 511. | 1.000 | 1.998 | 2.0 |   |   |
| 9-F-18 | AR | 511. | 1.000 | 1.935 | 1.9 |   |   |
| 9-F-18 | AR | 511. | 0.970 | 1.935 | 2.0 |   |   |
| 9-F-18 | DG | 511. | 0.967 | 1.935 | 2.0 |   |   |
| 9-F-18 | AR | 511.0 | 1.940 | 1.935 | 1.0 |   |   |
| 9-F-18 | AR | 511.0 | 1.934 | 1.935 | 1.0 |   |   |
| 9-F-18 | AR | 511. | 1.940 | 1.935 | 1.0 |   |   |
| 9-F-18 | AR | 511. | 1.930 | 1.935 | 1.0 |   |   |
| 9-F-18 | AR | 511.0 | 1.938 | 1.935 | 1.0 |   |   |
| 9-F-18 | DG | 511. | 1.935 | 1.935 | 1.0 |   |   |
| 9-F-18 | AR | 511. | 2.000 | 1.935 | 1.0 |   |   |
| 9-F-18 | AR | 511. | 1.934 | 1.935 | 1.0 |   |   |
| 10-NE-19 | AR | 511. | 1.000 | 1.998 | 2.0 |   |   |
| 11-NA-22 | AR | 511. | 0.898 | 1.808 | 2.0 |   |   |
| 11-NA-22 | AR | 511. | 0.900 | 1.808 | 2.0 |   |   |
| 11-NA-22 | AR | 511. | 1.810 | 1.808 | 1.0 |   |   |
| 11-NA-22 | AR | 511. | 0.905 | 1.808 | 2.0 |   |   |
| 11-NA-22 | DG | 511. | 1.000 | 1.808 | 1.8 | A0523.004 | (Ok) |
| 11-NA-22 | AR | 511. | 1.800 | 1.808 | 1.0 |   |   |
| 11-NA-22 | DG | 511. | 1.811 | 1.808 | 1.0 |   |   |
| 11-NA-22 | AR | 511. | 1.797 | 1.808 | 1.0 |   |   |
| 13-AL-26-M | AR | 511. | 2.000 | 1.998 | 1.0 |   |   |
| 15-P-30 | AR | 511.0 | 2.000 | 1.997 | 1.0 |   |   |
| 15-P-30 | AR | 511. | 2.000 | 1.997 | 1.0 |   |   |
| 17-CL-34-M | DG | 511.0 | 0.600 | 1.085 | 1.8 | C2008.017 | (Ok) |
| 19-K-38 | AR | 511. | 2.000 | 1.992 | 1.0 |   |   |
| 21-SC-43 | AR | 511. | 1.760 | 1.762 | 1.0 |   |   |
| 21-SC-43 | AR | 511.0 | 0.880 | 1.762 | 2.0 |   |   |
| 21-SC-44-G | AR | 511.0 | 0.915 | 1.885 | 2.1 |   |   |
| 21-SC-44-G | AR | 511. | 0.915 | 1.885 | 2.1 |   |   |
| 21-SC-44-G | AR | 511. | 1.880 | 1.885 | 1.0 |   |   |
| 22-TI-45 | AR | 511. | 1.720 | 1.696 | 1.0 |   |   |
| 22-TI-45 | AR | 511. | 1.000 | 1.696 | 1.7 | C0256.003 | (Ok) |
| 22-TI-45 | AR | 511. | 1.680 | 1.696 | 1.0 |   |   |
| 22-TI-45 | AR | 511. | 0.170 | 1.696 | 10.0 | 30962.002 | Typo? Question sent to Bhoraskar (2020-11-24). |
| 22-TI-45 | AR | 511. | 1.700 | 1.696 | 1.0 |   |   |
| 22-TI-45 | AR | 511. | 0.850 | 1.696 | 2.0 |   |   |
| 22-TI-45 | AR | 511. | 0.172 | 1.696 | 9.9 | 30640.004 | AR -> DG and 0.172 -> 1.72 in DECAY-DATA |
| 22-TI-45 | AR | 511.0 | 0.850 | 1.696 | 2.0 |   |   |
| 22-TI-45 | AR | 511. | 0.700 | 1.696 | 2.4 | 33001.007 | .70 -> 1.70 |
| 22-TI-45 | AR | 511.0 | 1.700 | 1.696 | 1.0 |   |   |
| 22-TI-45 | AR | 511.0 | 1.720 | 1.696 | 1.0 |   |   |
| 23-V-47 | AR | 511.0 | 1.930 | 1.931 | 1.0 |   |   |
| 23-V-47 | AR | 511.0 | 0.970 | 1.931 | 2.0 |   |   |
| 23-V-47 | AR | 511. | 0.970 | 1.931 | 2.0 |   |   |
| 23-V-47 | AR | 511. | 1.920 | 1.931 | 1.0 |   |   |
| 23-V-47 | DG | 511. | 1.000 | 1.931 | 1.9 |   |   |
| 23-V-47 | AR | 511.0 | 1.920 | 1.931 | 1.0 |   |   |
| 23-V-48 | AR | 511. | 0.560 | 0.998 | 1.8 | C0274.010 | (Ok. Both B+ and AR counting performed.) |
| 24-CR-49 | AR | 511. | 0.860 | 1.856 | 2.2 | 33001.006 | .86 -> 1.86 |
| 24-CR-49 | AR | 511. | 1.860 | 1.856 | 1.0 |   |   |
| 24-CR-49 | AR | 511. | 0.920 | 1.856 | 2.0 |   |   |
| 24-CR-49 | AR | 511. | 1.880 | 1.856 | 1.0 |   |   |
| 24-CR-49 | DG | 511.0 | 0.930 | 1.856 | 2.0 |   |   |
| 24-CR-49 | AR | 511. | 0.922 | 1.856 | 2.0 |   |   |
| 24-CR-49 | AR | 511. | 0.180 | 1.856 | 10.3 | 30962.003 | Typo? Question sent to Bhoraskar (2020-11-24). |
| 25-MN-51 | AR | 511. | 0.960 | 1.942 | 2.0 |   |   |
| 25-MN-52-G | AR | 511. | 0.290 | 0.588 | 2.0 |   |   |
| 25-MN-52-M | AR | 511. | 0.980 | 1.932 | 2.0 |   |   |
| 26-FE-53-G | AR | 511. | 1.960 | 1.937 | 1.0 |   |   |
| 26-FE-53-G | AR | 511. | 1.760 | 1.937 | 1.1 |   |   |
| 26-FE-53-G | DG | 511. | 1.960 | 1.937 | 1.0 |   |   |
| 26-FE-53 | AR | 511. | 0.960 | 1.937 | 2.0 |   |   |
| 27-CO-55 | AR | 511. | 0.790 | 1.518 | 1.9 |   |   |
| 27-CO-56 | AR | 511. | 0.181 | 0.394 | 2.2 | C0274.005 | (Ok. Both B+ and AR counting performed.) |
| 27-CO-58-G | AR | 511. | 0.300 | 0.298 | 1.0 |   |   |
| 27-CO-58 | DG | 511. | 0.300 | 0.298 | 1.0 |   |   |
| 28-NI-57 | AR | 511. | 0.470 | 0.872 | 1.9 |   |   |
| 28-NI-57 | AR | 511. | 0.800 | 0.872 | 1.1 |   |   |
| 28-NI-57 | AR | 511. | 0.990 | 0.872 | 0.9 |   |   |
| 28-NI-57 | AR | 511. | 0.920 | 0.872 | 0.9 |   |   |
| 28-NI-57 | DG | 511. | 0.938 | 0.872 | 0.9 |   |   |
| 28-NI-57 | AR | 511.0 | 1.000 | 0.872 | 0.9 |   |   |
| 29-CU-60 | AR | 511.0 | 1.840 | 1.852 | 1.0 |   |   |
| 29-CU-60 | AR | 511. | 0.936 | 1.852 | 2.0 |   |   |
| 29-CU-60 | AR | 511. | 0.935 | 1.852 | 2.0 |   |   |
| 29-CU-61 | AR | 511.0 | 1.220 | 1.229 | 1.0 |   |   |
| 29-CU-61 | AR | 511. | 0.620 | 1.229 | 2.0 |   |   |
| 29-CU-61 | AR | 511. | 0.621 | 1.229 | 2.0 |   |   |
| 29-CU-62 | AR | 511.0 | 1.960 | 1.957 | 1.0 |   |   |
| 29-CU-62 | AR | 511.0 | 1.940 | 1.957 | 1.0 |   |   |
| 29-CU-62 | DG | 511. | 2.000 | 1.957 | 1.0 |   |   |
| 29-CU-62 | AR | 511. | 1.956 | 1.957 | 1.0 |   |   |
| 29-CU-62 | AR | 511. | 1.940 | 1.957 | 1.0 |   |   |
| 29-CU-62 | AR | 511. | 0.980 | 1.957 | 2.0 |   |   |
| 29-CU-62 | AR | 511. | 2.000 | 1.957 | 1.0 |   |   |
| 29-CU-62 | AR | 511. | 0.987 | 1.957 | 2.0 |   |   |
| 29-CU-62 | AR | 511. | 1.960 | 1.957 | 1.0 |   |   |
| 29-CU-62 | AR | 511. | 0.950 | 1.957 | 2.1 |   |   |
| 29-CU-64 | DG | 511. | 0.343 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511. | 0.340 | 0.352 | 1.0 |   |   |
| 29-CU-64 | AR | 511. | 0.190 | 0.352 | 1.9 |   |   |
| 29-CU-64 | DG | 511. | 0.190 | 0.352 | 1.9 |   |   |
| 29-CU-64 | DG | 511. | 0.386 | 0.352 | 0.9 |   |   |
| 29-CU-64 | AR | 511. | 0.356 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511.0 | 0.350 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511. | 0.358 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511. | 0.772 | 0.352 | 0.5 | D0162.007, D0162.013 | (Ok) |
| 29-CU-64 | AR | 511.0 | 0.190 | 0.352 | 1.9 |   |   |
| 29-CU-64 | DG | 511. | 0.352 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511.006 | 0.386 | 0.352 | 0.9 |   |   |
| 29-CU-64 | DG | 511. | 0.357 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511. | 0.370 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511.0 | 0.358 | 0.352 | 1.0 |   |   |
| 29-CU-64 | AR | 511. | 0.187 | 0.352 | 1.9 |   |   |
| 29-CU-64 | DG | 511.0 | 0.386 | 0.352 | 0.9 |   |   |
| 29-CU-64 | DG | 511.00 | 0.386 | 0.352 | 0.9 |   |   |
| 29-CU-64 | AR | 511.0 | 0.357 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511. | 0.380 | 0.352 | 0.9 |   |   |
| 29-CU-64 | AR | 511. | 0.357 | 0.352 | 1.0 |   |   |
| 29-CU-64 | AR | 511. | 0.370 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511. | 0.360 | 0.352 | 1.0 |   |   |
| 29-CU-64 | DG | 511.0 | 0.357 | 0.352 | 1.0 |   |   |
| 29-CU-64 | AR | 511. | 0.380 | 0.352 | 0.9 |   |   |
| 29-CU-64 | AR | 511. | 0.386 | 0.352 | 0.9 |   |   |
| 30-ZN-62 | AR | 511. | 0.180 | 0.164 | 0.9 |   |   |
| 30-ZN-63 | AR | 511.0 | 0.904 | 1.855 | 2.1 |   |   |
| 30-ZN-63 | AR | 511. | 0.930 | 1.855 | 2.0 |   |   |
| 30-ZN-63 | DG | 511. | 1.860 | 1.855 | 1.0 |   |   |
| 30-ZN-63 | AR | 511. | 1.860 | 1.855 | 1.0 |   |   |
| 30-ZN-65 | DG | 511.0 | 0.028 | 0.028 | 1.0 |   |   |
| 30-ZN-71-G | DG | 511.6 | 0.320 | No β+ decay |   | 14468.006, 14468.007 | (Ok. 511.6 keV gamma line irrelevant to annihilation.) |
| 30-ZN-71-G | DG | 511.6 | 0.130 | No β+ decay |   | 21892.003, 21892.006 | (Ok. 511.6 keV gamma line irrelevant to annihilation. ENSDF gives 32.00%.) |
| 31-GA-65 | AR | 511. | 0.810 | 1.803 | 2.2 | C0269.021, C0296.002, C0296.003 | (Ok. Two gammas detected in coincidence.) |
| 31-GA-66 | AR | 511. | 0.513 | 1.136 | 2.2 | C0269,020, C0269.023 | (Ok. Two gammas detected in coincidence.) |
| 31-GA-66 | AR | 511. | 0.505 | 1.136 | 2.2 | C0296.002, C0296.003 | (Ok. Two gammas detected in coincidence.) |
| 31-GA-66 | AR | 511. | 0.879 | 1.136 | 1.3 | C0831.005, C0831.008, C0831.011 | 0.879 -> 0.5654 |
| 31-GA-68 | AR | 511. | 0.875 | 1.778 | 2.0 |   |   |
| 31-GA-70 | AR | 511. | 1.000 | 0.000 | 0.0 | C0269.011 | AR -> B- and delete 511. |
| 31-GA-72 | AR | 511.00 | 0.386 | No β+ decay |   | C0492.002 | 64Cu decay data are wrongly coded. |
| 32-GE-66 | AR | 511. | 0.760 | 0.472 | 0.6 | C0296.002 | (Ok. Two gammas detected in coincidence.) |
| 32-GE-67 | AR | 511. | 0.930 | 1.806 | 1.9 |   |   |
| 32-GE-68 | AR | 511. | 0.875 | 0.000 | 0.0 | C0296.002 | The radiation field must be under 31-GA-68. |
| 32-GE-68 | AR | 511. | 0.879 | 0.000 | 0.0 | C0831.002, C0831.016 | The radiation field must be under 31-GA-68. |
| 32-GE-69 | AR | 511. | 0.350 | 0.471 | 1.3 | 11825.002 | (Ok) |
| 32-GE-69 | AR | 511. | 0.680 | 0.471 | 0.7 | 20770.002 | (Ok) |
| 32-GE-69 | AR | 511. | 0.330 | 0.471 | 1.4 | C0296.002 | (Ok. Two gammas detected in coincidence.) |
| 32-GE-69 | AR | 511. | 0.705 | 0.471 | 0.7 | 20536.013 | (Ok) |
| 32-GE-69 | AR | 511. | 0.240 | 0.471 | 2.0 |   |   |
| 33-AS-74 | DG | 511. | 0.590 | 0.582 | 1.0 |   |   |
| 33-AS-74 | AR | 511. | 0.590 | 0.582 | 1.0 |   |   |
| 34-SE-73-G | AR | 511. | 0.690 | 1.292 | 1.9 |   |   |
| 35-BR-75 | DG | 511. | 0.154 | 1.492 | 9.7 | D0082.002 | 0.1536 -> 1.536 |
| 35-BR-76-G | AR | 511. | 1.330 | 1.112 | 0.8 | O0327.014 | (Ok) |
| 35-BR-76-G | AR | 511. | 0.650 | 1.112 | 1.7 | C0300.002, C0300.003 | (Ok) |
| 35-BR-78 | AR | 511. | 0.930 | 1.850 | 2.0 |   |   |
| 35-BR-78 | AR | 511. | 0.840 | 1.850 | 2.2 | 33001.005 | 0.840 -> 1.84 |
| 35-BR-78 | AR | 511. | 1.000 | 1.850 | 1.9 |   |   |
| 36-KR-77 | AR | 511. | 1.600 | 1.683 | 1.1 |   |   |
| 36-KR-79 | AR | 511. | 0.150 | 0.140 | 0.9 |   |   |
| 37-RB-84-G | AR | 511. | 0.206 | 0.514 | 2.5 | 20891.003 | (Ok) |
| 37-RB-84-G | DG | 511. | 0.380 | 0.514 | 1.4 | A0011.003 | (Ok) |
| 38-SR-82 | AR | 511. | 1.920 | 0.000 | 0.0 | C0339.002, C0339.004 | The radiation field must be under 37-RB-82-G. |
| 39-Y-88 | AR | 511. | 0.004 | 0.004 | 1.0 |   |   |
| 39-Y-91-M | DG | 511. | 0.950 | No β+ decay |   | O0594.012, O0594.016 | (Ok. 555.57 keV gamma line irrelevant to annihilation.) |
| 39-Y-91-M | AR | 511. | 0.950 | No β+ decay |   | O0594.004 | AR -> DG |
| 40-ZR-89-G | AR | 511. | 0.440 | 0.455 | 1.0 |   |   |
| 42-MO-91-G | AR | 511. | 1.882 | 1.875 | 1.0 |   |   |
| 42-MO-91-G | AR | 511. | 1.880 | 1.875 | 1.0 |   |   |
| 42-MO-91-G | DG | 511. | 1.870 | 1.875 | 1.0 |   |   |
| 42-MO-91-G | AR | 511. | 1.870 | 1.875 | 1.0 |   |   |
| 42-MO-91-G | AR | 511. | 1.874 | 1.875 | 1.0 |   |   |
| 42-MO-91-G | AR | 511. | 0.940 | 1.875 | 2.0 |   |   |
| 42-MO-91-M | AR | 511. | 1.000 | 0.8816 | 0.9 |   |   |
| 42-MO-91-M1 | AR | 511. | 0.756 | 0.882 | 1.2 | 30601.002 | M1 -> M |
| 44-RU-95 | AR | 511. | 0.195 | 0.279 | 1.4 | R0048.002 | (Ok) |
| 44-RU-106 | DG | 511.9 | 0.210 | No β+ decay |   | 13286.002 | The radiation field must be under 45-RH-106-G. (511.86 keV gamma line irrelevant to annihilation). |
| 44-RU-106 | DG | 511.8 | 0.206 | No β+ decay |   | 32636.001 | The radiation field must be under 45-RH-106-G. (511.86 keV gamma line irrelevant to annihilation). |
| 44-RU-106 | DG | 511.9 | 0.204 | No β+ decay |   | 22425.001 | The radiation field must be under 45-RH-106-G. (511.86 keV gamma line irrelevant to annihilation). |
| 44-RU-106 | DG | 511.9 | 0.864 | No β+ decay |   | 30787.001 | The radiation field must be under 45-RH-106-M. (511.7 keV gamma line irrelevant to annihilation). |
| 45-RH-102-G | AR | 511. | 0.280 | 0.294 | 1.1 |   |   |
| 45-RH-102-G | DG | 511. | 0.141 | 0.294 | 2.1 |   |   |
| 45-RH-102-G | AR | 511. | 0.141 | 0.294 | 2.1 |   |   |
| 45-RH-106-G | DG | 511.80 | 0.205 | No β+ decay |   | 30691.002 | (Ok. 511.86 keV gamma line irrelevant to annihilation.) |
| 45-RH-106-M | DG | 511.7 | 0.860 | No β+ decay |   | O0768.138 | (Ok. 511.7 keV gamma line irrelevant to annihilation.) |
| 47-AG-106-G | AR | 511. | 1.000 | 1.182 | 1.2 | 21400.005 | Delete both half-life and intensity (not in the article). |
| 47-AG-106-M | DG | 511.9 | 0.880 | 0.000 | 0.0 | O0768.053 | (Ok. 511.85 keV gamma line irrelevant to annihilation.) |
| 47-AG-106-M | DG | 511.8 | 0.883 | 0.000 | 0.0 | 21709.006 | (Ok. 511.85 keV gamma line irrelevant to annihilation.) |
| 47-AG-106-M | DG | 511.842 | 0.880 | 0.000 | 0.0 | F1269.003 | (Ok. 511.85 keV gamma line irrelevant to annihilation.) |
| 49-IN-112-G | DG | 511.0 | 0.470 | 0.480 | 1.0 |   |   |
| 49-IN-112-G | AR | 511.0 | 0.436 | 0.480 | 1.1 |   |   |
| 49-IN-112-G | DG | 511. | 0.240 | 0.480 | 2.0 |   |   |
| 49-IN-112-G | AR | 511. | 0.218 | 0.480 | 2.2 | 21106.003 | (Ok) |
| 49-IN-112-G | AR | 511.0 | 0.430 | 0.480 | 1.1 |   |   |
| 49-IN-112-G | DG | 511. | 0.440 | 0.480 | 1.1 |   |   |
| 49-IN-112-G | DG | 511. | 0.436 | 0.480 | 1.1 |   |   |
| 49-IN-112-G | AR | 511. | 0.440 | 0.480 | 1.1 |   |   |
| 50-SN-111 | DG | 511. | 0.706 | 0.604 | 0.9 |   |   |
| 51-SB-118-G | DG | 511. | 1.550 | 1.470 | 0.9 |   |   |
| 51-SB-118-G | AR | 511. | 1.000 | 1.470 | 1.5 | A0121.003 | 1.00 -> 1.55 |
| 51-SB-118 | AR | 511. | 1.550 | 1.470 | 0.9 |   |   |
| 51-SB-120-G | AR | 511. | 0.437 | 0.820 | 1.9 |   |   |
| 51-SB-120-G | AR | 511. | 1.000 | 0.820 | 0.8 | 21400.006 | Delete both half-life and intensity (not in the article). |
| 52-TE-118 | AR | 511.0 | 1.500 | 0.000 | 0.0 | C0094.002, C0094.003 | The radiation field must be under 51-SB-118. |
| 53-I-119 | AR | 511. | 1.020 | 1.150 | 1.1 |   |   |
| 53-I-120-G | AR | 511. | 1.800 | 1.366 | 0.8 | C0347.012.1, C0347.013.1 | (Ok) |
| 53-I-120-G | AR | 511. | 0.920 | 1.366 | 1.5 | O0327.015 | (Ok) |
| 53-I-121 | AR | 511. | 0.180 | 0.212 | 1.2 | O0327.015 | (Ok) |
| 53-I-122 | AR | 511. | 1.300 | 1.563 | 1.2 | O0327.015 | (Ok) |
| 53-I-124 | AR | 511. | 0.600 | 0.454 | 0.8 | C0347.006.2, C0347.007.2 | (Ok) |
| 55-CS-125 | AR | 511. | 0.490 | 0.795 | 1.6 | C0375.008, C0375.014, C0375.016, C0375.018 | (Ok. Two gammas detected in coincidence.) |
| 55-CS-127 | AR | 511. | 0.035 | 0.061 | 1.7 | C0375.002, C0375.004, C0375.008, C0375.014, C0375.015, C0375.016, C0375.018, C0375.019 | (Ok. Two gammas detected in coincidence.) |
| 55-CS-130-G | AR | 511. | 0.920 | 0.872 | 0.9 |   |   |
| 59-PR-139 | AR | 511. | 0.158 | 0.166 | 1.1 |   |   |
| 59-PR-140 | AR | 511. | 1.000 | 1.020 | 1.0 |   |   |
| 59-PR-140 | DG | 511. | 1.000 | 1.020 | 1.0 |   |   |
| 60-ND-140 | AR | 511. | 1.000 | 0.000 | 0.0 | C0321.002 | The radiation field must be under 59-PR-140. |
| 60-ND-140 | DG | 511.0 | 1.000 | 0.000 | 0.0 | C0378.002 | The radiation field must be under 59-PR-140. |
| 60-ND-140 | AR | 511. | 1.016 | 0.000 | 0.0 | O1352.007 | The radiation field must be under 59-PR-140. |
| 60-ND-141-G | AR | 511. | 0.025 | 0.052 | 2.1 |   |   |
| 60-ND-141-G | AR | 511. | 0.060 | 0.052 | 0.9 |   |   |
| 60-ND-141-G | DG | 511. | 0.050 | 0.052 | 1.0 |   |   |
| 60-ND-141-G | DG | 511. | 0.055 | 0.052 | 0.9 |   |   |
| 62-SM-143-G | AR | 511. | 0.740 | 0.898 | 1.2 | 10477.015 | (Ok) |
| 62-SM-143-G | DG | 511. | 1.000 | 0.898 | 0.9 |   |   |
| 62-SM-143-G | DG | 511. | 0.740 | 0.898 | 1.2 | 20541.019, 30682.007 | (Ok) |
| 62-SM-143-G | DG | 511. | 0.800 | 0.898 | 1.1 |   |   |
| 73-TA-174 | AR | 511. | 0.760 | 0.472 | 0.6 | C0402.002 | (Ok) |
| 73-TA-178-G | AR | 511. | 0.022 | 0.0248 | 1.1 |   |   |
| 84-PO-206 | DG | 511. | 0.244 | 0.000 | 0.0 | A0026.089 | (Ok. 511.36 keV gamma line irrelevant to annihilation.) |