



# Decay Data Evaluation Project (DDEP)

---

[kondev@anl.gov](mailto:kondev@anl.gov)

# What is DDEP?

The **Decay Data Evaluation Project** (DDEP) is an international collaboration of scientists from the US national laboratories, national metrology laboratories (world-wide), physics institutions, and universities. The main goal is to provide carefully evaluated decay data for radioactive nuclei that are of importance to various applications

This [introduction](#) presents a brief description of the radioactivity physical processes, the enumeration of the evaluation rules leading to the recommended data and their evaluation (in various languages):



Participants: USA, EU, Russia, China & Australia

[www.nucleide.org/DDEP.htm](http://www.nucleide.org/DDEP.htm)



# Historical Remarks

- **1991 – Richard Helmer initiated discussions with members of LNHB (Saclay) and PTB (Braunschweig) on the feasibility of collaborating in the evaluation of nuclear data.**
- **1992 – 1993 – LNHB and PTB reached an agreement to set up such a collaboration.**
- **1994 - US evaluators of nuclear data received approval from DOE to participate in this collaboration.**
- **1994 – 1995 – Russian and British evaluators of nuclear data joined the collaboration.**
- **1995 - First meeting of the new *Decay Data Evaluation Project* (DDEP) collaboration was held in Paris.**

## DDEP Coordinators

Richard Helmer (INEEL) – 1995-2001

Edgardo Browne (LBNL) – 2001-2010



# Nuclide Selection

- ❑ 259 radionuclides extracted from various sources
  - ✓ list supplied by the Laboratoire National Henri Bequerel (LNHB)
  - ✓ list supplied by the AEA Technology, European Collaboration in Measurement Standards (EUROMET), National Institute of Standards and Technology (NIST), and Idaho National Energy and Environmental Laboratory (INEEL)
  - ✓ Russian books presented at the IAEA-Specialists Meeting on the “Development of an International Nuclear Decay Data and Cross-Section Database”, Vienna, November 1994
  - ✓ proceedings of the conference on “Industrial Applications of Radioisotopes and Radiation Technology,” Grenoble, France, September 28 – October 2, 1981.
  - ✓ reports on “Radionuclides for Reactor Decommissioning,” INDC(NDS)-269 (1993); and PTB-Ra-16/4, Braunschweig, July 1993.
  
- ❑ people involved: R.G. Helmer, M-M. Bé, N. Coursol, A. Nichols, K. Debertain, and E. Browne



# DDEP Evaluations Status

updated: 27<sup>th</sup> September 2010

latest entry: Am-242m

latest updates: Am-241, Cm-244

(170 nuclides in table, sorted by alphabetical order / [atomic number](#) / [mass number](#) /

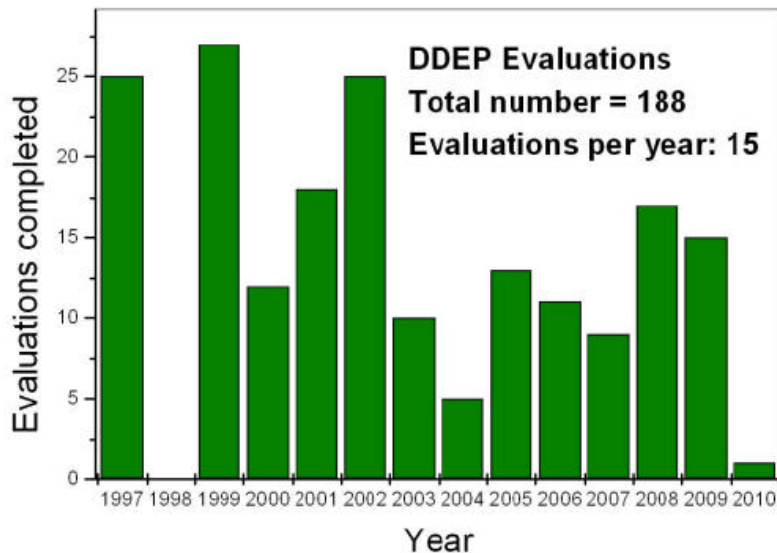
(Type of updates since last revision: 1 - update in comments only ; 2 - minor update in

Nuclide	Tables	Comments	ENSDF	UpDate	Type
Ac-225	<sup>225</sup> Ac	<a href="#">table</a>	<a href="#">comments</a>	<a href="#">ensdf</a>	26/08/2009 3
Ac-227	<sup>227</sup> Ac	<a href="#">table</a>	<a href="#">comments</a>	<a href="#">ensdf</a>	16/02/2009 2
Ac-228	<sup>228</sup> Ac	<a href="#">table</a>	<a href="#">comments</a>	<a href="#">ensdf</a>	22/01/2010 3
Ag-108	<sup>108</sup> Ag	<a href="#">table</a>	<a href="#">comments</a>	<a href="#">ensdf</a>	04/09/2006 2
Ag-108m	<sup>108</sup> Ag <sup>m</sup>	<a href="#">table</a>	<a href="#">comments</a>	<a href="#">ensdf</a>	24/01/2008 1
Ag-110	<sup>110</sup> Ag	<a href="#">table</a>	<a href="#">comments</a>	<a href="#">ensdf</a>	12/03/2004 1
Ag-110m	<sup>110</sup> Ag <sup>m</sup>	<a href="#">table</a>	<a href="#">comments</a>	<a href="#">ensdf</a>	24/03/2004 1
Al-26	<sup>26</sup> Al	<a href="#">table</a>	<a href="#">comments</a>	<a href="#">ensdf</a>	24/07/2003 1

[www.nucleide.org/DDEP\\_WG/DDEPdata.htm](http://www.nucleide.org/DDEP_WG/DDEPdata.htm)

## Status of Evaluations

- Number of radionuclides
  - ✓ original: 259
  - ✓ new: 63
  - ✓ total: **322**
- Completed: **170** (53%)
- Under review: **20**
- Need to be completed: **132** (41%)
- Evaluations on W<sup>3</sup>: **163** (51%)

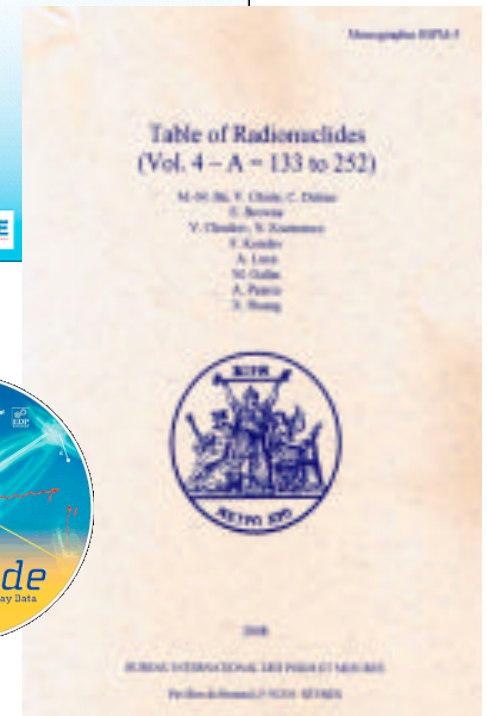


# DDEP Publications

[www.nucleide.org/Publications/monographies\\_bipm.htm](http://www.nucleide.org/Publications/monographies_bipm.htm)

- Evaluations published in BIPM Monographies & W<sup>3</sup>
- ✓ 127 nuclides published
- ✓ special issue of *Appl. Radiat. & Isotopes* (to be explored)
  
- IAEA CRP's
- ✓ X- and Gamma-ray calibration standards (**63** nuclides)
- ✓ Updated decay Data Library for Actinides (**85** nuclides)

At the General Meeting of **the International Committee for Radionuclide Metrology (ICRM)** (Oxford, September 2005) the delegates formally approved the recommendation made by the Nuclear Data Working Group of using the DDEP evaluated decay data in all future nuclear data studies



# Topical Evaluations

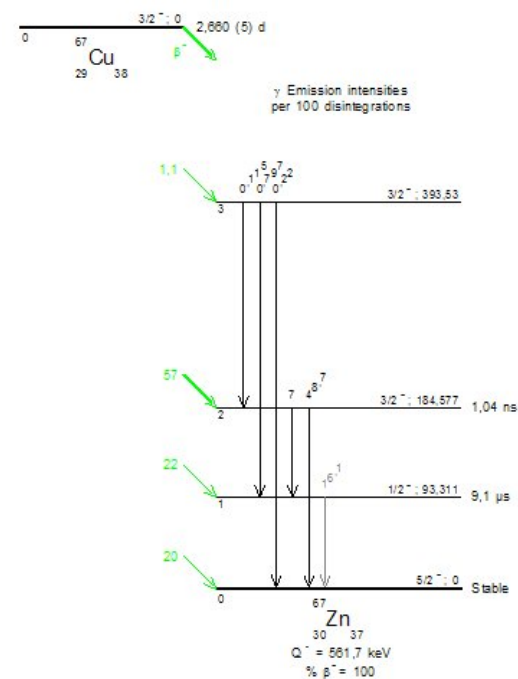
## Medical isotopes (also Impurities which are important!)

- ✓ incomplete decay schemes
- ✓ need for precise measurements

**$^{67}\text{Cu}$  (61.9 h)**  
cancer treatment

### Decay scheme based on:

- ✓  $I_{\beta}$  to the ground state  $\sim 20\%$  (1953Ea11)
- ✓  $I_{\gamma}$  relative values (1978Me10)
- ✓ calculated internal conversion coefficients



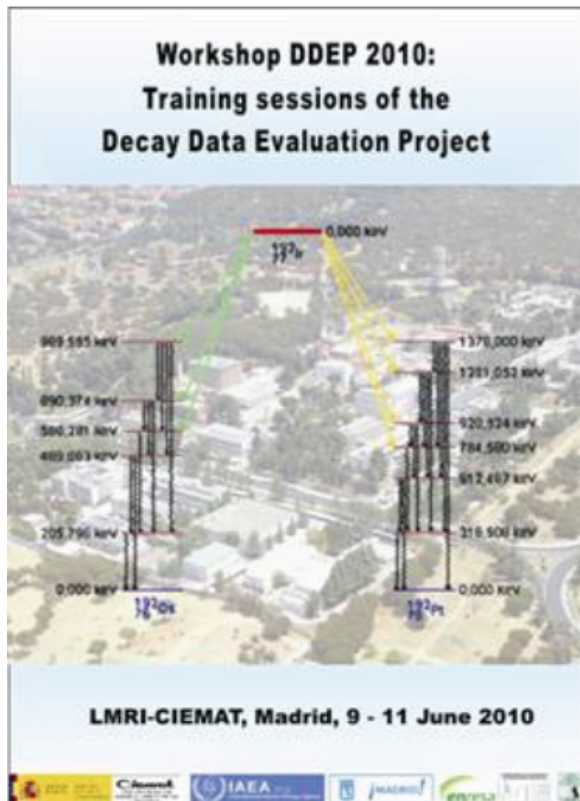
## Excellent project for an IAEA CRP:

### “Decay Data Library for Medical Isotopes”?

- ✓ combine data evaluation with a viable measurements program



# DDEP meetings & training workshops



2006 Saclay, France

2008 Bucharest, Romania

2010 Madrid, Spain

2012 Beijing, China or Belgium (to be decided)

**Madrid, June 9-11, 2010**

25 participants – BNL, LBNL & ANL from USNDP

[www.ciemat.es/portal.do?TR=C&IDR=1535](http://www.ciemat.es/portal.do?TR=C&IDR=1535)

## Discussed Topics

- ✓ inconsistent decay schemes
- ✓ evaluation procedures
- ✓ estimation of uncertainties
- ✓ evaluation software
- ✓ techniques for analyzing discrepant values
- ✓ assessment the needs for future decay data measurements





# Concluding Comments

- ❑ DDEP activities are complementary (and useful) to ENSDF
  - ✓ evaluations are available in ENSDF format
  - ✓ evaluation of atomic properties, e.g. X-rays for example
  - ✓ new decay data evaluation physics/tools development – calculation the shape of beta-spectra (J. Mougeot, LNHB ) – emphasis on forbidden non-unique transitions - opportunity improve *log ft*
  
- ❑ DDEP & ENSDF have similar issues to deal with
  - ✓ **sustaining evaluator's effort** – some evaluator groups disappeared (PTB, Korea, Brazil) – key retirements unlikely to be replaced ...
  - ✓ **training new evaluators** – it is a long-lasting process – a good evaluation is not just averaging numbers ...

