



# ***1<sup>st</sup> CRP meeting on “Updated Decay Data Library for Actinides”***

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***2005 USNDP Meeting***  
***Brookhaven National Laboratory, November 9-11, 2005***

***Argonne National Laboratory***



A U.S. Department of Energy  
Office of Science Laboratory  
Operated by The University of Chicago



# Historical Background

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- ❑ IAEA Advisory Group Meeting on Transactinium Isotope Nuclear Data
  - ✓ Karlsruhe, Germany 1975
    - CRP on Measurement & Evaluation on TND – started in 1978
  - ✓ Cadarache, France, 1979
  - ✓ Uppsala, Sweden, 1984
- ❑ IAEA Technical Reports Series No. 261 (1986)/IAEA-CRP completed 1985
  - ✓ Detailed decay data evaluations for **23 nuclides** from **Th-229** to **Cf-252**
  - ✓ recommended half-lives and branching ratios for more than **120 nuclides** from **Hg-206** to **Es-253**
  - ✓ recommended gamma-ray energies and emission probabilities for ~ **50 nuclides** from **Tl-208** to **Cf-252**
  - ✓ recommended alpha energies and emission probabilities for ~ **30 nuclides** from **Th-228** to **Cf-252**
- ❑ Actinide Decay Data Review – **status 1986**, **comments 2000**  
A.L. Nichols, Appl. Radiat. Isot. v.55 (2001) 23-70

# IAEA-CRP on “Updated Decay Data Library for Actinides”

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## The Main Objective

to produce **improved** decay data files of direct application in nuclear facilities, waste management, safety assessments and safeguards/proliferation issues along with non-energy applications

## Who is involved?

Program Officer – Mark Kellett, IAEA

M.-M. Be (France)

V. Chechev (Russian Federation)

X. Huang (PR China)

F.G. Kondev (USA)

A. Luca (Romania)

G. Mukherjee (India)

A.L. Nichols (IAEA)

A. Pearce (UK)

The first meeting took place on October 17-19, 2005 at IAEA in Vienna, Austria

# Main topics discussed

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- What nuclides should be considered?
- What evaluation methodology will be used?
- What measurements are required?
- Which of these can be performed?
- On what timescales and by whom?
- Who will do which nuclide?

# What has been decided

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## Methodology

- ✓ DDEP evaluation procedure including in-depth DDEP review
- ✓ ICC data from BRICC program – “frozen orbital” approximation
- ✓ Software will be supplied by M-M. Be (end 2005)
- ✓ CEA Saclay Workshop 4-10 March 2006

## Nuclides selection

- ✓ Similar to what was included in IAEA Technical Reports Series No. 261 (1986), but the list was extended to include some heavier actinide nuclides that are of interest to some NE applications, e.g. advanced reactor systems & ADS

- Next meeting: ND2007 (22-27 April 2007, Nice, France) so will attempt to hold next CRP meeting the week before or the week after ND2007 in Vienna**

# What nuclides will be evaluated & by whom

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Th-228 ALN, -229 GM, -231 XH, -232 AP, -233 VC, -234 AL

Pa-231 AP, -233 VC

U-232 AP, -233 GM, -234 MM, -235 XH, -236 AL, -237 VC, -238 MM, -239 VC

Np-236, -236m, -237, -238, -239 (All VC)

Pu-238, -239, -240, -241, -242 (All VC)

Am-241 VC, -242m ALN, -243 MM, -244 ALN

Cm-242 VC, -243 FK, -244 VC, -245 FK, -246 FK

Cf-252 MM

(36 nuclides)

ALN = A. L. Nichols (IAEA), GM = G. Mukherjee (India), XH = X. Huang (PR China), AP = A. Pearce (UK), VC = V. Chechev (Russian Federation), MM = M-M. Be (France), AL = A. Luca (Romania), FK = F. Kondev (USA)

# What nuclides will be evaluated & by whom

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Hg-206 FK

Tl-206 FK, -207, -208 ALN, -209, -210

Pb-209, -210 MM, -211, -212 ALN, -214 MM

Bi-209, -210 MM, -211, -212 ALN, -213 XH, -214 MM, -215

Po-210 MM, -211, -212 ALN, -213, -214 MM, -215, -216, -218 MM

At-215, -217, -218, -219

Rn-217, -218, -219, -220 ALN, -222 MM

Fr-221, -223

Ra-223, -224 ALN, -225 XH, -226 MM, -228 ALN

Ac-225 XH, -227, -228 AP

(22 nuclides)

ALN = A. L. Nichols (IAEA), GM = G. Mukherjee (India), XH = X. Huang (PR China), AP = A. Pearce (UK), VC = V. Chechev (Russian Federation), MM = M-M. Be (France), AL = A. Luca (Romania), FK = F. Kondev (USA)

# What measurements will be undertaken

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**ANL:** Pa-233, Th-233 (Pg)  
Cm-243, -245, -246, -247 (P $\alpha$ , P $\gamma$ , T $_{1/2}$ )  
K and L X-rays from Pu-238/9/0 nuclides  
Ac-225, Bi-213 (medical applications) – future possible

**NPL:** Th-228, possibility (see also below)

**U-233:** IRMM, LNHB, PTB – T $_{1/2}$ , P $\alpha$ , P $\gamma$

**Pu-240:** IRMM, LNHB, NPL, PTB, CIEMAT - P $\alpha$ , P $\gamma$

## Future Decay Data Measurements

- ✓ IAEA will review needs from UKHEDD file
- ✓ Additional nuclei will be considered following evaluators' recommendations after initial assessments of data are made



# Extended list of nuclides

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Th-227, -228, -229, -230, -231, -232, -233, -234

Pa-231, -233, -234, -234m

U-232, -233, -234, -235, -236, -237, -238, -239

Np-236, -236m, -237, -238, -239

Pu-236, -238, -239, -240, -241, -242

Am-241, -242, -242m, -243, -244, -245

Cm-242, -243, -244, -245, -246, -247, -248

Bk-249

Cf-249, -250, -251, -252

(49 nuclides)

# Extended list of nuclides - cont

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Hg-206

Tl-206, -207, -208, -209, -210

Pb-209, -210, -211, -212, -214

Bi-209, -210, -211, -212, -213, -214, -215

Po-210, -211, -212, -213, -214, -215, -216, -218

At-215, -217, -218, -219

Rn-217, -218, -219, -220, -222

Fr-221, -223

Ra-223, -224, -225, -226, -228

Ac-225, -227, -228

(45 nuclides)

# Implications for ENSDF

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## □ Files distributions

- ✓ In addition to DDEP data format, the evaluated data will be made available in ENSDF & ENDF formats – comprehensive consistency checks will be made
- ✓ Publication in *Nuclear Data Sheets* through a special DDEP issue & then adopt in ENSDF?
- ✓ Direct inclusion in ENSDF?

**Need to establish an effective procedure to include specialized evaluations in ENSDF?**

**comments and suggestions are welcome!**