NNSA's Confidence Building Measures Program (CBM)

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CBM Mission

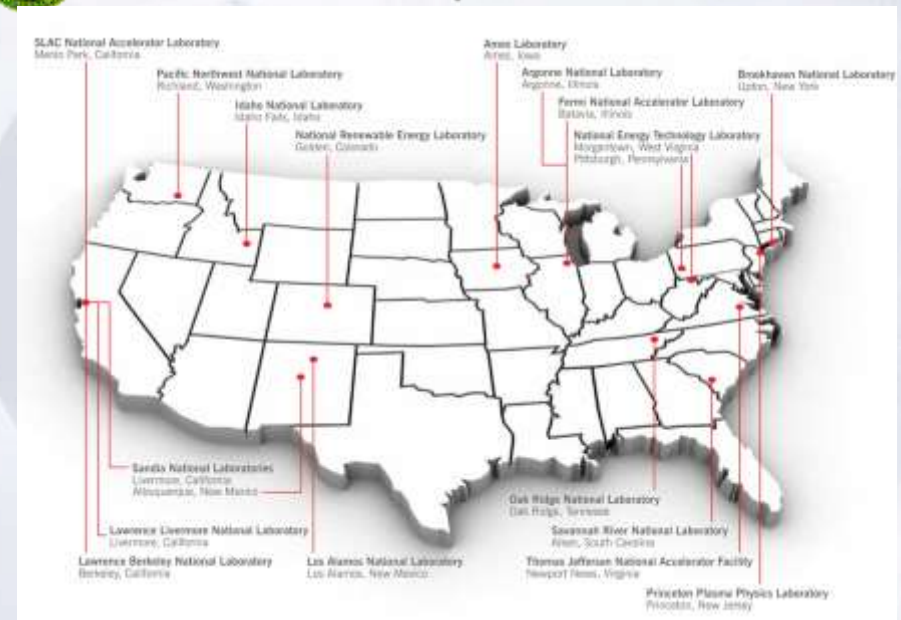
CBM Vision

Build international capacity in nonproliferation nuclear forensics to support global nuclear security efforts.

CBM Program Mission

Work bilaterally, multilaterally, and through international organizations to support states as they develop a pre-detonation nuclear forensics capacity as an integral part of their nuclear security framework.

DOE National Laboratory Complex



CBM: Key Objectives

Objective 1: Build global nuclear forensics awareness

Objective 2: Build confidence in foreign forensic analyses through direct capacity-building efforts

Objective 3: Facilitate peer laboratory interactions

Objective 1: Build global nuclear forensics awareness

Develop **international guidance for nuclear forensic best practices**

Develop **international recommendations and implementing guidance**

Raise **awareness of nuclear forensics in the global community**

Objective 1: Build global nuclear forensics awareness

Multilateral awareness raising efforts

- IAEA Nuclear Security Series
  - NSS #2 Revision
  - National Nuclear Forensics Libraries
- Support to the GICNT Nuclear Forensics Working Group
  - TTX Karlsruhe, Iron Koala, Tiger Reef
- ASEAN Regional Forum engagement

Objective 2: Build confidence in foreign forensic analyses through direct capacity-building efforts

Provide support to strategic partner States to improve nuclear forensic programs

South Africa

- Support development of analytical capabilities
- Support renovation of laboratory space
- Support development of a National Nuclear Forensics Library




Ukraine

- Support development of a National Nuclear Forensics Library

Objective 3: Facilitate peer laboratory interactions

Bilateral and multilateral projects of interest to the international nuclear forensics community

Radiochronometers provide insight into separation date and quality

Areas for improvement

- Certified Reference Materials
  - Development of ^{229}Th
- Measurement and interpretation of multiple parent-progeny pairs
  - $^{230}Th/^{234}U$
  - $^{231}Pa/^{235}U$

Current Focus: Uranium Chronometry

- Work with partners to increase precision and accuracy in uranium age dating
- Historically interlaboratory has been a bias with these measurements
- Focus on a single topic to maximize CBM's investment

Radiochronometry Examples

Measurement	Sample	Units	MS Value	MS Exp. Unc.	RC	RC Exp. Unc.	Years since casting
^{234}U-^{230}Th Age	A	years	6.861	0.041	7.02	0.67	6.82
	B		6.041	0.036	5.62	0.65	6.17
^{235}U-^{231}Pa Age	A	years	33.73	0.36			
	B		35.77	0.37			
^{241}Pu-^{241}Am Age	A	years	14.35	0.33	12.3	1.3	
	B		17.46	0.37	15.3	1.9	

Example from ITWG: Behavior of U, Pa, Pu, Am during U metal casting

Common Radiochronometers

$^{234}U \rightarrow {}^{230}Th$; $t_{1/2} = 2.5 \times 10^5$ yr

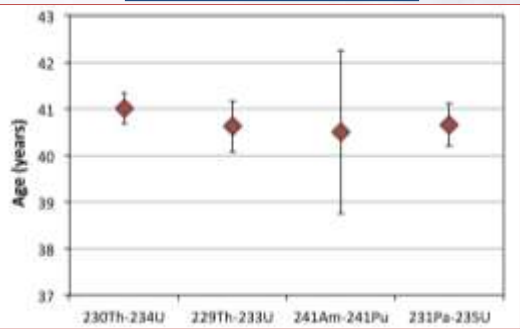
$^{235}U \rightarrow {}^{231}Pa$; $t_{1/2} = 7.0 \times 10^8$ yr

$^{233}U \rightarrow {}^{229}Th$; $t_{1/2} = 1.6 \times 10^5$ yr

$^{241}Pu \rightarrow {}^{241}Am$; $t_{1/2} = 14.4$ yr

$^{241}Am \rightarrow {}^{237}Np$; $t_{1/2} = 433$ yr

Age of an HEU Sample



Summary

- Continue to provide technical support to awareness raising activities through various multilateral initiatives (IAEA, GICNT, ARF, and others)
- Increase global technical capacity to conduct nuclear forensic analyses in accordance with established best practices and community norms
- Encourage partner States to sustain and grow nuclear forensic capabilities though scientific exchanges and development of best practices

Collaborators

- United States
  - Lawrence Livermore National Laboratory
  - Los Alamos National Laboratory
  - Pacific Northwest National Laboratory
  - Sandia National Laboratory
  - Department of State
  - Department of Homeland Security
  - Federal Bureau of Investigation
- Australia
  - Australia Nuclear Science and Technology Organization
- Canada
  - Canada Nuclear Safety Comission
- China
  - China Institute for Atomic Energy
- European Commission
  - Joint Research Center-Institute for Transuranium Elements
- France
  - Commissariat a l'Energie Atomique
- International Atomic Energy Agency
  - Division of Nuclear Security
- Japan
  - Japan Atomic Energy Agency
- Republic of Korea
  - Korea Atomic Energy Research Institute
  - Korea Institute of Nuclear Nonproliferation and Control
- South Africa
  - Nuclear Energy Corporation of South Africa
- Ukraine
  - Kyiv Institute for Nuclear Research