Special Nuclear Certified Reference Materials: Current Supplies and Anticipated Needs for Enriched Isotopes

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New Brunswick Laboratory

- New Brunswick Laboratory (NBL) is a Government Owned-Government Operated analytical Facility.
- NBL was established by the AEC in 1949 at a site in New Brunswick, New Jersey. The lab's purpose was to provide the USG with a capability for analysis of U Materials. Pu analysis capability was added in 1959.
- From 1975-1977, the lab was moved from New Jersey to the Argonne National Lab site outside of Chicago, Illinois.
- Responsibility as the United States Government's certifying authority for nuclear reference materials was transferred from the National Bureau of Standards (now NIST) in 1981 and the final transfer of NBS materials and responsibility for distribution occurred in 1987.

New Brunswick Laboratory: Facts and Figures

- 8,400 m^2 of potential laboratory space
- 38 resident staff members
  - 28 Federal employees
  - 7 contractors
  - 3 post-doctoral appointment
- Capabilities
  - Isotopic Analysis (5 Mass Spectrometers)
  - U and Pu Assay
  - Alpha Spectrometery

New Brunswick Laboratory: Primary Missions

- Special Nuclear Reference Materials
  - Certified Reference Materials
  - Working Reference Materials & Custom Test Materials
- Safeguards Measurement Evaluation Program
  - International Safeguards Support
- Nuclear Forensic Reference Materials (DHS Sponsored)

Certified Reference Material Mission

- Provide analytical materials to USDOE Labs, NRC facilities, international community, research community.
- U and Pu Isotopic analysis calibration materials (28)
- Highly enriched U and Pu isotopic CRMs (7)
- U, Pu, & Th assay and impurity reference materials (9)
- U and Th ore reference material (15)
- U gamma and neutron CRMs (3)


25 grams


000-028


NBL CERTIFIED
REFERENCE MATERIAL
112-A
Uranium Metal
25 grams

Certified Reference Materials

- CRM Definition: “a reference material characterized by a metrologically valid procedure…accompanied by a certificate that provides the value of the specified property, its associated uncertainty, and a statement of metrological traceability.” (ISO Guide 30 Amd. 1)
- Steps for CRM Production:
  - Determine Fitness for Purpose
  - Estimate Quantity of RM Needed
  - Evaluate Material Stability
  - Evaluate Homogeneity
  - Assure Traceability
  - Perform Characterization & Verification
  - Maintain Process Control
  - Document All of the Above

Isotopic Materials Available from NBL

Isotope	Physical Form	Purity and/or Specifications	Size of Reserve	Comments
U-233	Nitrate Soln Nitrate Soln	99.49 % U-233 99.92 % U-233	<2.0 g (390 units) <0.5 g (100 units)	CRM 111-A CRM 111 (limited)
U-235	Nitrate Soln	99.8 % U-235	<1.0 g	CRM 135
U-235	Oxide	99.8 % U-235	250 g	Stock Material
U-236	Oxide	99.97 % U-236	2 g	Stock Material
U-238	Metal Oxide	99.79 % U-238 99.98 % U-238	>4.5 kg (140 units) >60 g (140 units)	CRM 115 CRM U0002
Pu-242	Pu Nitrate	99.95 % Pu-242	>0.8 g (800 units)	CRM 130
Pu-244	Pu Nitrate	97.9 % Pu-244	<0.3 g (290 Units)	CRM 131
Am-241	Metal	?? Am-241	0.77 g	Stock Material
Am-243	Metal	?? Am-243	0.76 g	Stock Material
Misc. U & Pu	Oxide, Nitrate, Metal, UF6	High purity solids and solution of U and Pu. Various isotopic mixtures	<1 g to 10s of kg	Various Certified Reference Materials and Stock Materials

Identified Isotopic Material Needs

Isotope	Research or Applied	User (DOE Agency, Nat. Lab., Univ., or others)	Intended Use	Purity and/or specifications	Physical Form
U-233	Applied	DOE, International Safeguards, others	High purity IDMS tracer. Starting material for other	High-purity U U-233 enrichment >99.99%	U3O8
U-234	Applied	DOE, International Safeguards, others	Starting material for calibration material.	High-purity U U-234 enrichment ~99%	U3O8 or Nitrate Soln
Th-230	Applied	DOE, International Safeguards, others	Starting material for calibration material.	High-purity Th Th-230 enrichment ~99%	Solid or Nitrate Soln
Pu-244	Applied	DOE, International Safeguards, others	High purity IDMS tracer.	High-purity Pu Pu-244 enrichment ~99.9%	Nitrate Soln

Summary

- New Brunswick Laboratory's primary mission is to characterize and distribute SNM Certified Reference Materials for USG, international safeguards, the nuclear industry, and research institutions.

- Limited Supplies of key Special Nuclear Material CRMs.

- Specialized needs for specific isotopes to meet current and future requirements of the nuclear analytical community.