



NUCLEAR FORENSIC REFERENCE MATERIAL PROGRAM:



ISOTOPIC REFERENCE MATERIALS



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Nuclear Forensic Reference Material Program

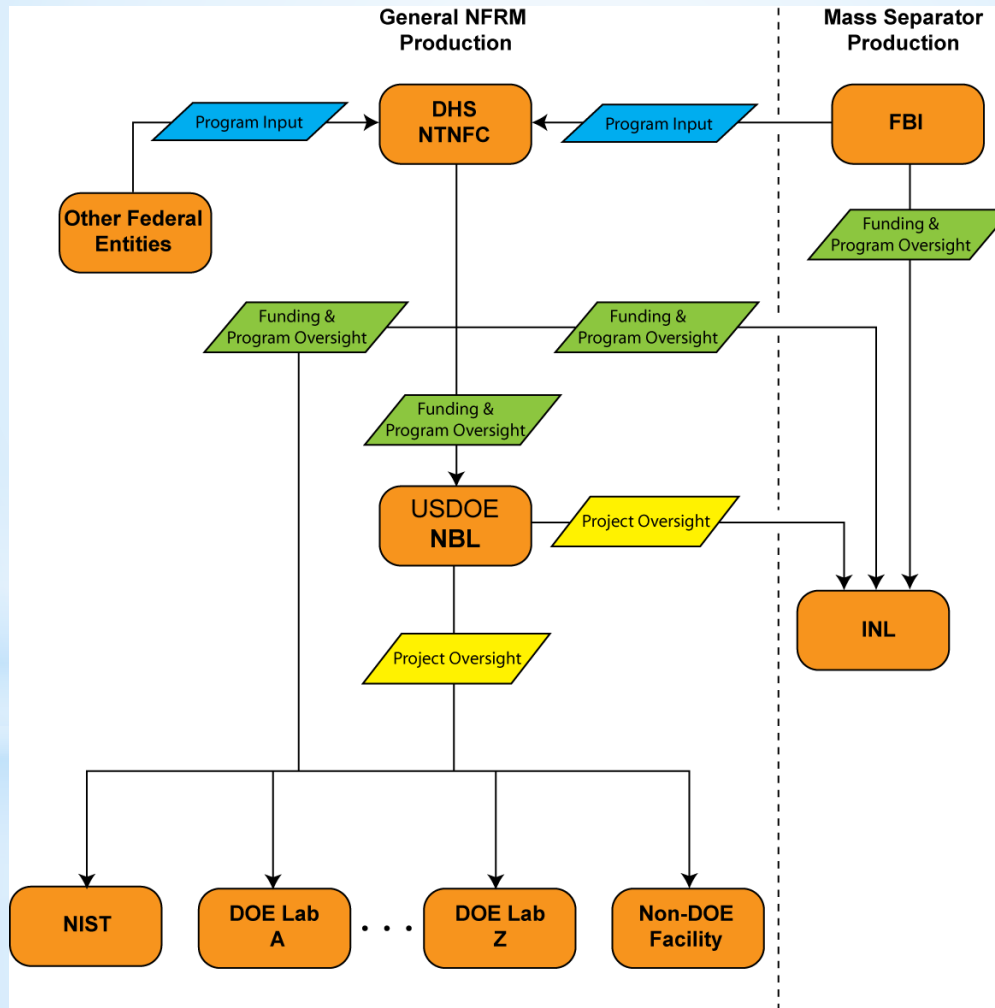


- Production of analytical reference materials to meet the specialized needs of the nuclear forensics analytical community.
- An interagency effort, endorsed by FBI, DHS, DoD, and DOE.
- Focuses resources and coordinates production effort towards critical needs.
- Provides management and oversight through a Full-Time NFRM Manager.





Nuclear Forensic Reference Material Program

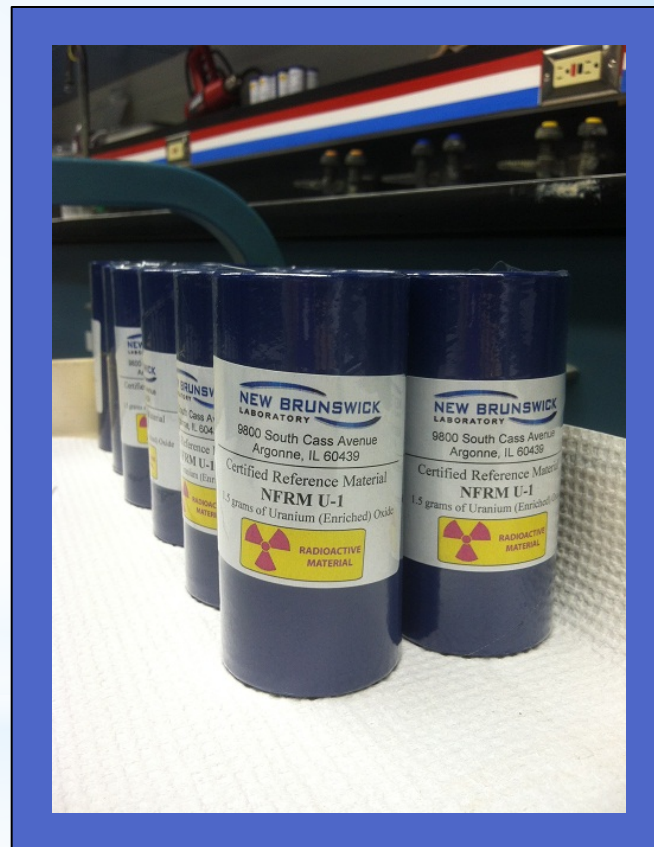




Nuclear Forensic Reference Material Projects



- Cs-Ba Radiochronometer RM
- U-Th Radiochronometer RM
- Th-229 Tracer
- Trace Actinides in Pu & U
- Trace Elements in Pu & U
- Ba-134 Tracer
- Trace U Isotope RMs
- Am-243 Tracer
- Pa-231 Calibration Material
- Np-236 Tracer





^{229}Th IDMS Tracer CRM



Project Description

- Characterization of existing NIST Th-229 stock material for Th-229 assay and isotopic composition ($T_{1/2}$ poorly known and somewhat controversial).
- Creation of ~160 IDMS tracer aliquots (80 units).
- Higher accuracy determination of Th-229 $T_{1/2}$.

Current Efforts

- Production completed.
- Analysis completed.
- Preliminary evaluation.
- Verification analysis project in process.



Future Efforts

- Transfer of units to NBL.
- Perform verification IDMS.
- Completion of certification report.

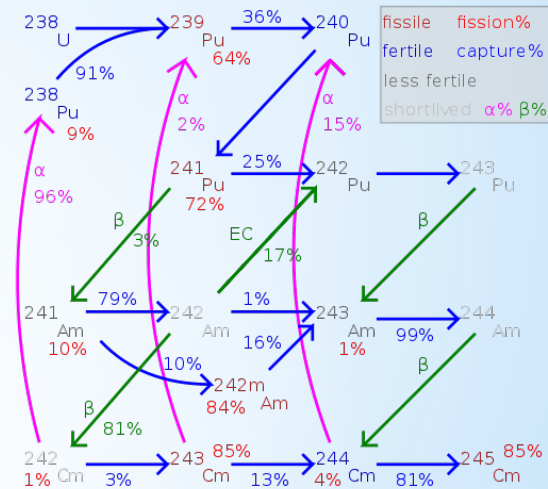


^{243}Am IDMS Tracer CRM



Project Description

- Highly enriched Am-243 tracer reference materials.
- Cooperative effort with NPL in the UK for production and characterization.
- ~25 certified tracer units and 3 units of stock material (~25 tracer units per stock unit).



Current Efforts

- Sample distribution for mass spectrometry characterization.
- IEWO in place at LLNL for mass spectrometry.

Future Efforts

- Receive material at NBL.
- Analysis by LLNL by IDMS.
- Draft of “US” certification report.
- Issue “US” certificate.



^{134}Ba IDMS Tracer CRM



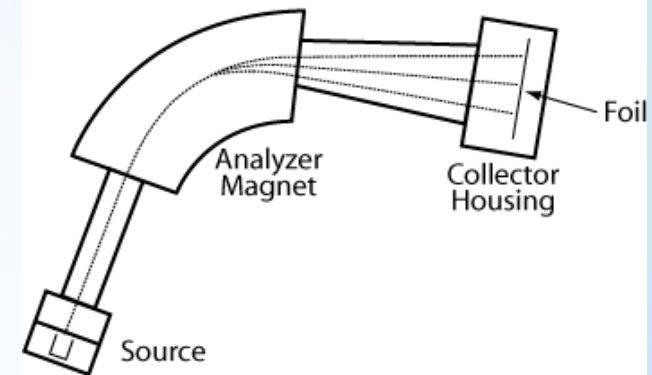
Project Description

- Production of a highly enriched Ba-134 isotopic tracer.
- Determination of tracer assay and isotopic composition.
- Production of units of tracer and starting material for synthetic mass spectrometer calibration material.

Current Efforts

- Completing processing of Ba-134 material.

Mass Separator Schematic



Future Efforts

- Production of tracer material sample units.
- Characterization of Ba-tracer units.
- Evaluation and certification of reference material.

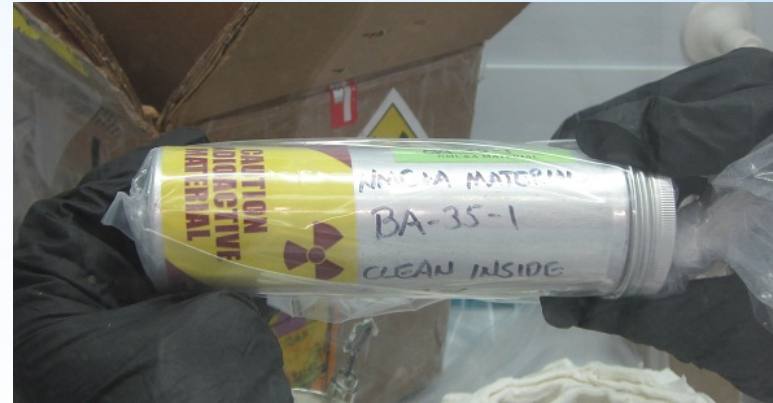


^{233}U IDMS Tracer CRM



Project Description

- Production of a highly enriched U-233 isotopic tracer.
- Determination of tracer assay and isotopic composition.
- Production and packaging of tracer units.



Current Efforts

- Material received at NBL.
- Drafting of project plan.

Future Efforts

- Dissolution and solution preparation.
- Production of tracer material sample units.
- Characterization of Ba-tracer units.
- Evaluation and certification of reference material.



Future Projects



Material	Project Status	Justification
^{230}Th Isotopic Tracer	“hot” separator project	needed for traceability / validation of measurements / no current CRMs / fills gap in available CRMs
^{96}Zr Isotopic Tracer	---	enhances current capabilities / needed for radiochronometry / no current CRMs of this type (isotope ratio & assay)
^{84}Sr Isotopic Tracer	follow-on to ^{134}Ba	enhances current capabilities / needed for radiochronometry / no current CRMs of this type (isotope ratio & assay)
^{231}Pa Calibration Material	initial scoping	enhances current capabilities / needed for radiochronometry / no current CRMs of this type (isotope ratio & assay)
^{236}Np Reference Material	feasibility and scoping	enhances current capabilities / needed for Pu & Am radiochronometry / no current CRMs of this type (isotope ratio & assay)



INL Mass Separators



- Idaho National Laboratory – Materials and Fuels Complex.
- Two Mass Separators:
 - Stable (active)
 - Radioactive (in progress)
- 90° Sector 1.5 Meter Radius
- Beam Currents: up to 30 μA
- 5 $\mu\text{g}/\text{hour}$ (operational)
- Micro to milligram quantities (99+% Enrichment)

