

NNSA's NBL Program Office Update

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The NBL Program Office (NBL PO) is the US certifying authority for special nuclear reference materials. The NBL PO mission transferred from the Department of Energy's Office of Science to the National Nuclear Security Administration beginning in FY2020. This talk will present the current status of the US nuclear reference material inventory, discuss shipping and storage capabilities and remaining challenges, review material needs collected from US and other customers, present the status of several CRM projects currently underway, and discuss the current plans for producing new uranium, plutonium and other CRM's. Additionally, the NBL PO's proficiency testing program (Safeguards Measurement Evaluation Program) will be reviewed with discussion on the status and plans to revitalize the program with new materials and operating approaches.

Sales and Shipping Update:

A new full time staff member, Ms Christina Santisi, has take on the role of program analyst at NBL PO in February 2023. Ms. Santisi is responsible for overseeing sales and coordinating shipping operations at Y12, ORNL and LANL. Additionally, Christina is performing inventory assessments, financial tracking and planning can coordinating routine repackaging of materials by ORNL. The ORNL and Portsmouth completed the transfer of 18 UF6 reference materials in new 2S cylinders, and a dedicated lab with three sampling manifolds is in place at ORNL to allow NBL PO to resume UF6 operations. Shipping operations at the NBL Center at Y12 have reached a steady-state with the completion of all material transfers from the former NBL and realignment of materials at the three Y12 storage locations. Y12 continue to meet NBL PO expected shipping turnaround times, and most importantly successfully completed a large order of reference materials composed of seven different consignments to the IAEA.

Due to the staffing shortage, the NBL PO has just completed our FY22 sales report and distributed to US government stakeholders, and we are currently performing our annual inventory assessment of all materials at our DOE sites to identify specific actions for those materials requiring additional effort or evaluation. This includes identifying those needing updated packaging/labeling, estimating remaining inventory lifetime based on previous 10 years sales volume, reviewing the status of long-term stability evaluations of several materials (e.g. dry nitrates) requiring further verification, evaluation of items for replacement or replenishment, and identifying those materials that may be candidates for discard.

The alternative back-up site for key CRM's at Oak Ridge National Laboratory is nearly complete, and several hundred plutonium CRM units vital to DOE/NNSA were transferred from Y12 to ORNL. The remaining items identified will be transferred in FY23 and into FY24. This back-up site will ensure a supply of NBL's most important materials in the event of a work stoppage or other issue at Y12.

The NBL PO, Y12 and JRC-Geel have identified excess US CRM and base materials to be returned to NBL PO possession. We hope to execute the first of several shipments within the calendar year, and planning is underway. These materials include a variety of U-series isotopic standards, some plutonium materials, and base material that was used to produce the CRM 969/EC171 gamma standards.

Programmatic Activities

The NBL PO has begun funding key DOE collaborator labs to establish and/or maintain ISO 17025 accreditation. The NBL PO will compare key methods listed in our modes of certification to those at our key DOE collaborators and will work to ensure that methods utilized for future NBL PO certification efforts meet the requirements of our Quality Management System and ISO 17034 and 17043. In a related area, the NBL PO funded several DOE laboratory's participation in an IAEA-conducted uranium and plutonium round-robin exercise, and also funded lab participation in the IAEA plutonium coulometry method interlaboratory comparison exercise.

As the effort to relocate uranium hexafluoride materials from Portsmouth to ORNL has been completed and the NBL PO funded refurbishment of a dedicated lab space for UF₆ sampling and handling is finished, the NBL PO announced resumption of UF₆ in the proficiency testing program. We expect more than 23 laboratories to participate in the NBL PO program this year.

The NBL PO has funded a top-to-bottom refurbishment and re-equipping of four laboratory spaces at ORNL. Another NNSA program is funding the purchase of a thermal ionization mass spectrometer and a multi-collector inductively coupled mass spectrometer which will be sited and installed in the NBL-refurbished laboratory to allow NBL access to isotopic measurement of a range of materials.

The SRNL has begun refurbishment of a laboratory dedicated to uranium high precision titrimetry, and a staff member travelled to ORNL for HPT refresher training. Having two sites capable of performing this key method will ensure continuity in primary uranium assay measurements.

The NBL PO and NIST completed an InterAgency Agreement (IAA) related to technical support and review and assessment of NBL PO operations and projects. This agreement includes support from NIST's Chemical Sciences Division (CSD) and Statistical Evaluation Division (SED), in addition to the Radiation Physics Division. NIST has completed independent reviews of two nuclear forensics reference materials and NBL PO will be issuing Certificates for both so that they may be used in an on-going uranium radiochronometry CRM project with LLNL.

CRM Projects

The measurements leading to certification of C137A (and C137) plutonium isotopic standard are complete and data evaluation is underway. The LLNL completed purification and production of C136A units, and has distributed analytical samples to each of the participating laboratories. LLNL is expected to commence unit production of C138A materials in the Fall. Upon

completion of data evaluation, the NBL PO will issue C137A, expected this Fall, and additionally re-issue the C137 Certificate with updated values and uncertainties.

The ORNL has produced and provided to NBL PO ten grams of purified neptunium oxide to serve as the base material for a Np reference material. The source material underwent consecutive anion and cation exchange, followed by peroxide precipitation and calcination. ORNL chemistry staff developed a unit production plan, and the NBL PO will be reaching out to SRNL and LANL to review the production plan and discuss measurement plans. The ORNL is currently performing a variety of tests (alpha/gamma, ICP-OES, ICP-MS) to evaluate the purity of the material.

The Y12 plant has identified high-purity depleted uranium metal suitable to serve as a replacement for CRM 115. The NBL and Y12 are discussing the metal working required to produce the unit sizes and geometries needed. Production of units of C115A is expected in FY23/early FY24, followed by characterization of uranium assay and isotopics.

The ORNL completed the production of a <20% enriched isotopic reference material for use by LLNL and NBL in a future uranium radiochronometry reference material. The isotopic standard, produced from metrologically-produced solutions of CRM 112A NU metal and CRM 116A HEU metal, has been shipped to LLNL.

Los Alamos National Laboratory and NBL PO have finalized production plans for a replacement for plutonium metal standard C126A, and LANL has begun purification of the bulk Pu metal prior to casting/packaging. LANL, SRNL and NBL PO are currently developing characterization plans for the material

Proficiency Testing Program

The NBL PO Safeguards Measurement Evaluation Program (SMEP) has been announced, with orders being placed currently and tentative ship dates in the late summer. The NBL PO had previously modified the SME program to comply with many of the requirements of ISO 17043. The NBL PO has continued conversations with NNSA and DOE lab site offices/metrology managers with a goal of establishing requirements for participation, updating key methods and materials, and establishing reporting protocols. The goal is to ensure the NNSA and DOE programs have adequate assurance of the quality of nuclear material measurements.