



A SAFEGUARDS MEASUREMENT EVALUATION PROGRAM WITH INTERNATIONAL SIGNIFICANCE

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New Brunswick Laboratory (NBL), a United States Department of Energy (DOE) laboratory, has been operating its Safeguards Measurement Evaluation (SME) Program since 1984. Originally, this program was instituted to monitor the quality of safeguards measurements for United States domestic participants only. Currently, there are approximately 15 United States and one foreign participants in this program. NBL has historically administered several sample exchange programs, including the Safeguards Analytical Laboratory Evaluation (SALE) Program, which had as many as 50 participants, both foreign and domestic, between 1970 and 1984. In 1984, due to changes in DOE directives for NBL, the SALE Program was terminated.

The international dimension to the SME Program was added in 1996 with the inclusion of the Safeguards Analytical Laboratory located in Tokai, Japan. With the approval of the DOE's Office of Safeguards and Security, this laboratory was included on a cost-recovery basis. NBL now has approval to include additional interested non-United States participants on a similar cost-recovery basis. Details on the program are presented below.

One of the primary responsibilities of the United States Department of Energy, the United States Nuclear Regulatory Commission (NRC), and indeed the entire nuclear community is the safeguarding of nuclear materials. Measurements are essential in demonstrating that this responsibility has been fulfilled. To verify that a given facility's measurements are of adequate quality to assure successful safeguards, the facility must demonstrate that its measurements have adequate precision and accuracy, and are traceable to and compatible with the international measurement base. This is accomplished through quality assurance.

Within a laboratory, internal quality control is typically assured by analyzing well-known, traceable reference materials, either Certified Reference Materials (CRMs) or working standards, concurrently with sample analyses. This, however, does not completely assure the accuracy of the measurements. Quality problems may arise, for instance, in the preparation and handling of the reference material prior to destructive analysis. A sample exchange program provides another, external level of quality assurance through the distribution of samples with characterized, traceable values. Additionally, a sample exchange program allows a comparison between facilities in different locations, having different analysts, and possibly different methods of analysis. In this way, compatibility is more fully assured.

All of the test materials distributed through the SME Program have characterized, traceable reference values. Test materials are either devised from materials in-house, or are obtained from the participating facilities. They are prepared and packaged at NBL, and are characterized as packaged, following a random sampling plan and an analysis plan devised by the NBL's Numerical Analysis Group. The analytical methods utilized in the characterization include the NBL-modified Davies and Gray titration for uranium concentration, and thermal ionization mass spectrometry for uranium enrichment. For all characterizations, multiple quality control

aliquants prepared from NBL CRMs are analyzed each analysis day, to provide quality assurance and traceability. The characterization data are subjected to statistical analysis. A mean value is assigned and a 95% confidence interval calculated which includes all statistically significant sources of variation. As a continuing validation, the NBL also participates in the SME Program in the analysis of all the current test materials, through the NBL Measurement Services Program. This serves as a check not only of our own performance, but also of the integrity of the materials.

After characterization, materials are then sent to the participating facilities following all pertinent shipping regulations. An accompanying letter includes instructions on handling and analysis, and reporting dates. Whenever possible, participants are asked to analyze each of two samples in duplicate on each of two days, producing a total of eight results. This maximizes the information available for statistical analysis, while minimizing analytical effort.

The initial product of the program is an individualized report on the statistical analysis of the data submitted. Whenever possible, the report is processed and sent to the participating facility and its operations office within two weeks of receipt. The report includes an explanatory cover letter, the statistical evaluation, and a graph of the data plotted in terms of percent relative deviation from the reference value. Also, data are consolidated, and accumulated data for an entire year are compared between facilities in an overall annual report sent to the participants and their respective oversight organizations. The international target values are used as a benchmark to evaluate performance.

It should be noted that NBL is the U. S. Certifying Authority for uranium and plutonium reference materials for elemental and isotopic composition, primarily in support of destructive analyses. NBL serves as an IAEA network laboratory, and also performs referee analyses on DOE and NRC safeguards samples for inventory verification and for resolution of shipper-receiver differences. A move to expand international involvement in the SME Program operated by NBL is a positive step in internationalizing the methodology and accuracy of measurements in the evaluation and support of nuclear safeguards.

REFERENCE

M.I. Spaletto, M.M. Smith, M.D. Soriano, "The Safeguards Measurement Evaluation Program: A Safeguards Sample Exchange Program", Proceedings of the Institute of Nuclear Materials Management, July 1994, pp. 1238-1241.