MEASUREMENT EVALUATION PROGRAM MEETING MINUTES

NEW BRUNSWICK LABORATORY

NASHVILLE CONVENTION CENTER AND RENAISSANCE HOTEL NASHVILLE, TENNESSEE

JULY 12, 2008

U.S. DEPARTMENT OF ENERGY • OFFICE OF SCIENCE • CHICAGO OFFICE • ARGONNE, ILLINOIS

NBL-ME 2008 – Annual Meeting
August 2008

U.S. DEPARTMENT OF ENERGY

MINUTES
MEASUREMENT EVALUATION PROGRAM
ANNUAL MEETING

Nashville Convention Center and Renaissance Hotel
Nashville, Tennessee

JULY 12, 2008

Meeting organized

By

B. Srinivasan

NEW BRUNSWICK LABORATORY
9800 South Cass Avenue
Argonne, Illinois 60439

NBL Home Page: www.nbl.doe.gov
NBL Internet Address: USDOE.NBL@CH.DOE.GOV
NBL Telephone Number: 630-252-2776
NBL Facsimile Number: 630-252-6256

TABLE OF CONTENTS

NBL: HISTORY AND MISSION

The New Brunswick Laboratory (NBL) is owned and operated by the United States Department of Energy through the Office of Science, Chicago Office. The laboratory was established in 1949 as an analytical chemistry laboratory in New Brunswick, New Jersey to provide support to the United States Atomic Energy Commission. At that time, it was staffed by scientists from the National Bureau of Standards who had contributed significantly to nuclear material measurement programs in the Manhattan Project. At the New Brunswick Laboratory, they provided the technical expertise and skills to solve problems related to quantitative analyses of uranium-bearing materials. Over the years, these scientists and others following them have expanded the capabilities of the laboratory to include chemical and mass spectrometric analyses of plutonium and other trans-uranium elements, research and development activities in chemical analyses techniques, preparation of certified reference materials, and operation of the nuclear safeguards measurement evaluation program. In 1977, the laboratory moved from New Jersey to its present location at the Argonne National Laboratory site in Illinois.

The major mission of the New Brunswick Laboratory is to provide technical assistance to the Department of Energy in the following areas: measurement evaluation program operation, certified (nuclear) reference materials preparation, measurement techniques development, and actual measurements of special nuclear materials. In addition to fulfilling these tasks, the laboratory helps the Department in three other areas: conducting technical audits, resolving shipper/receiver differences in material transfers, and assisting in nuclear nonproliferation programs within the United States and internationally.

INTRODUCTION

The New Brunswick Laboratory (NBL) Measurement Evaluation (ME) Program was initiated in 1985 to assess and evaluate the adequacy of measurement technology as practiced in Department of Energy (DOE) facilities for nuclear materials accounting. Now, the program is open to DOE laboratories, other government and commercial facilities in the U.S., and also international laboratories. It consists of two parts: the Safeguards Measurement Evaluation (SME) program for the evaluation of destructive analyses results of uranium and plutonium bearing materials, and the Calorimetric Exchange (CALEX) program for the evaluation of non-destructive analyses results of plutonium. The main objective of these two programs is to monitor the internal quality control practices – an important element in making accurate and precise nuclear material accountability measurements. The program now serves 27 laboratories.

In the SME program, the participants analyze uranium and plutonium test samples using destructive methods of analyses (e.g., Davies and Gray titration, thermal ionization mass spectrometry). The test samples are made from certified reference materials and other well characterized materials. NBL evaluates the measurement results for bias and precision and issues performance evaluation reports.

In the CALEX program, participants analyze plutonium oxide working reference material standards by non-destructive methods - heat output by calorimetry, and plutonium and ^{241}Am isotopes abundances by high resolution gamma spectrometry. NBL evaluates the measurement results and two other quantities (effective specific power and plutonium mass) calculated from the measurement results for bias and precision, and issues performance evaluation reports.

NBL organizes and conducts a meeting once a year to discuss progress made in these two programs and to address other topics of interest pertaining to nuclear safeguards (e.g., new advances in measurement techniques, environmental/forensic analyses, performance evaluation methods, uncertainty estimation, new test materials). The meeting is usually held a day prior to the start of the International Nuclear Material Management (INMM) Annual Meeting and at the same venue. The 2008 meeting was held on July 12th at Nashville.

LIST OF ATTENDEES

Name	Affiliation	Telephone	E-mail
Steve Balsley	IAEA Safeguards Analytical Laboratory	10043-12600-28565	s.d.balsley@iaea.org
Stefan Buerger	NBL	630-252-2466	Stefan.buerger@ch.doe.gov
Lisa Colletti	LANL	505-667-9621	lcolletti@lanl.gov
Dave Dearborn	LLNL	925-424-6974	Dearborn1@llnl.gov
Fabio Dias	CNEN-Brazil	55-21-21732930	Fabio@ird.gov.br
Adolfo Esteban	CNEA-Argentina	54-11 6772 7424	esteban@cnea.gov.ar
Erwin Galdoz	ABACC	+55 21 3171 1228	galdoz@abacc.org.br
Steve Goldberg	NBL	630-252-2464	Steven.goldberg@ch.doe.gov
Will Guthrie	Statistical Engineering Division; NIST	301-975-2854	Will.guthrie@nist.gov
Katharine Hales	URENCO UK, Capenhurst UK	44 151 4734175	Katharine.hale@urenco.co.uk
Matt Harker	AWE (A), Reading, RG74PR, U.K.	+44(0)118 982 7854	Matthew.Harker@awe.co.uk
Ron Hawkins	Y-12	423-257-7672	rnhawk@aol.com
Michael K. Holland	Savannah River Site	803-952-3424	Michael.holland@srs.gov
Darryl Jackson	Los Alamos, NM	Not given	DarrylJackson@earthlink.net
Lloyd Jollay	Y-12/NNSA	865-241-1872	jollayl@y12.doe.gov
Gary Kodman	DOE/HS-61	865-466-0050	kodmang@comcast.net
Robert “Bud” Marsh	NNSA LSO	925- 422-2188	bud@llnl.gov
Steve McGuire	Y-12, Oak Ridge, TN	865-576-8263	mcguiresa@Y12.doe.gov
Mark Mount	LLNL	925-422-9800	Mount1@llnl.gov
Jon Neuhoff	NBL	630-252-2446	Jon.neuhoff@ch.doe.gov
Olivio Pereira Oliveira, Jr.	IPEN – CTMSP; Brazil	+5511 38177180	oliviojr@ipen.br
Jeremy Poling	Y-12	865-574-4610	polingjw@y12.doe.gov
Lynne Preston	DOE/HS-82	301-903-2627	Lynne.preston@hq.doe.gov
Stephan Richter	IRMM, Belgium	Not given	Stephan.richter@eu.europa.eu
Tom Sampson	P.O. Box 3633; Carefree, AZ 85377	480-488-0605	tsampson@lanl.gov
Peter Santi	Los Alamos National Laboratory	505-665-0741	psanti@lanl.gov

Name	Affiliation	Telephone	E-mail
Mark Schanfein	DOE/LANL	505-667-4830	kram@lanl.gov
Chris Schmitzer	IAEA Safeguards Analytical Laboratory	0043-12600-28503	c.schmitzer@iaea.org
Taeko Shinonaga	IAEA-SAL Clean Lab	+43(0)12600 28672	t.shinonaga@iaea.org
Andrew Verbruggen	IRMM, Belgium	Not given	Andre.verbruggen@eu.europa.eu
Stephan Vogt	NBL	630-252-2415	Stephan.vogt@ch.doe.gov
Roger Wellum	EC-IRMM (retired)	+32 494 395964	r.wellum@gmail.com
Terri Welsh	Hanford	509-373-2475	Terri_L_WelshL@rl.gov
Harold Wheat, Jr.	B&W Y-12; Oak Ridge, TN	865-574-8420	ywx@Y12.doe.gov
Evelyn Zuleger	ITU, Karlsruhe	0049-7247-951-181	Evelyn.zuleger@ec.europa.eu

AGENDA

Measurement Evaluation Program Meeting

July 12, 2008

Nashville Convention Center and Renaissance Hotel, Nashville, Tennessee

9:00 AM	Opening remarks	Jon Neuhoff, NBL, USA
9:15 AM	2007-2008 SME Program	B. Srinivasan, NBL, USA
9:40 AM	Plutonium Oxide Control Material: Long Term Characterization for Destructive Assay	Lisa Colletti*, Khal Spencer, Lav Tandon and Laurie Walker, LANL, USA
10:05 AM	Uranium Feedstock Material Evaluation	Lloyd Jollay, Y-12, USA
	Break 10:30 AM to 10:45 AM	
10:45 AM	News about Nuclear Isotopic Reference Materials and Inter-Laboratory Comparisons at IRMM	S. Richter*, A. Alonso, Y. Aregbe, F. Kehoe, H. Kuhn, A. Verbruggen and R. Wellum, IRMM, Belgium
11:10 AM	ABACC Analytical Network and NBL Cooperation Program	Erwin Galdoz, ABACC, Brazil
11:35 AM	ABACC Network Laboratories Chemical and Physical Control Laboratory Activities	Adolfo Esteban, CNEA, Argentina
12:00 PM	Assessing the Reliability of Uranium Measurement Results Performed for Nuclear safeguards	Olivio Pereira de Oliveira, IPEN, Brazil
	Lunch 12:25 PM to 2:30 PM	
2:30 PM	The application of Large-Size Dried Spike in Japan: Current Status and Future Alternatives	Steve Balsley*, Chris Schmitzer, Erwin Kuhn, Tomonori Iwamoto, Toru Suzuki, Yusuke Kuno, and Yasuhiro Tsutaki, IAEA, Austria
2:55 PM	2007-2008 CALEX Program	B. Srinivasan, NBL, USA
3:20 PM	Calex I Working Reference Material: Re-evaluation of the Initial Am-241 and Pu-238 Content	Stefan Buerger*, Kattathu Mathew, Usha Narayanan, and B. Srinivasan, NBL, USA
	Break 3:45 PM to 4:00 PM	
3:45 PM	Long Term Performance of LANL Calorimeters on Heat Source and CALEX Standards	Thomas E. Sampson, LANL, USA
4:10 PM	A U.K. Laboratory's Early Experiences with a Commercially-supplied Dual cell, Water-bath Calorimeter	Matthew Harker, AWE, UK
4:35 PM	Blank Corrections Using a Linear Regression approach	William F. Guthrie, NIST, USA
5:00 PM	SRNL Upgrading Mass Spectrometers at the SRS Analytical Laboratories	Joseph Cordaro, George E. Reeves, John B. McIntosh, Robert F. Eakle, Jr., Craig B. Mauldin, Sherold R. Johnson and Michael K. Holland*, SRS, USA
5:25 PM	Concluding Remarks	

*** Speaker**

SUMMARY

Morning session

Jon Neuhoff of NBL welcomed the attendees and gave a brief overview of the Measurement Evaluation Program and accomplishments in CY 2007.

B. (Chino) Srinivasan of NBL presented a talk on the progress made in the SME program. The number of laboratories participating in the program increased, new uranium test samples were made, and the turn-around time between results submission and results evaluation was reduced. Srinivasan also reviewed the performance of those laboratories participating in CY 2007. Results pertaining to uranium samples analyses were reviewed; plutonium samples were not analyzed this year. The development work on a new database/software system for evaluating measurement results evaluation was completed; the new system was used for evaluating the CY 2007 results.

Lisa Colletti of LANL gave a presentation on the long-term use of a plutonium oxide standard for internal quality control. The characteristics of the standard change with time due to radioactive decay; periodic updates of characterized values are needed. The talk emphasized the need for well characterized internal quality control standards and periodic experimental verification of the decay corrected values using “state of the art” analytical techniques.

Lloyd Jollay of Y-12 presented a talk on the casting of enriched uranium metal and determining its homogeneity through a well defined sampling and analysis plan. Homogeneity is established through uranium concentration, uranium isotope abundance, and doped impurity elements concentration measurements. NBL intends to use one of the newly cast uranium metal for producing a certified reference material.

Stephan Richter described the activities at IRMM laboratories in preparing a number of isotopic reference materials. The uranium reference materials were made by mixing highly enriched and pure isotopic components. These reference materials and also a newly made ^{239}Pu reference material are needed in various applications; instrument calibration, environmental studies, elemental concentration determination using isotope dilution mass spectrometry etc.

The next three talks were from ABACC. In the first of the three talks, Erwin Galdoz of ABACC-HQ provided an account of the nuclear safeguards programs in Argentina and Brazil and the role of the network laboratories in providing technical expertise to these programs. Several ABACC network

laboratories regularly participate in the NBL SME Program. Galdoz provided an overview of their performance in the recent participation through analyses of uranium test samples for elemental concentration and isotopes abundance.

In the second ABACC talk, Adolfo Esteban of the Chemical and Physical Control Laboratory in Argentina described the analytical capabilities of his laboratory and its contributions to the nuclear programs of that nation. A significant recent contribution is a new method to sample UF_6 for uranium isotopic composition analysis. The sampling method based on uptake of UF_6 on alumina substrate appears to be simple, elegant and safe (for shipment).

In the final ABACC talk, Olivio Pereira de Olliviera Jr. of CTMSP in Brazil traced the history of the laboratory – starting with assistance in uranium enrichment followed by work on nuclear fuel characterization and nuclear safeguards. The laboratory finds that participation in external quality control programs (e.g., NBL SME, REIMEP) is extremely useful to its growth and contributing to improvements in analyses skills of laboratory chemists and technicians.

Afternoon Session

Steve Balsley of IAEA reported that fuel reprocessing facilities in Japan will need a continuous supply of large-size dried spikes for uranium and plutonium assay measurements. The anticipated need cannot be met by IRMM alone, the current supplier. A large fraction of the spikes need to be produced in Japan itself. NBL will be asked to provide assistance in this effort.

B. (Chino) Srinivasan of NBL described the characteristics of Calex I and Calex II, the two working reference material standards used for monitoring performance in calorimetry/gamma spectrometry measurements. The characterized values of the Calex I material are given in a certificate issued recently in January 2008. The certified values, except for ^{238}Pu abundance, are exactly the same as those used in the past evaluations of measurement results. Only the ^{238}Pu abundance is about 2% lower in the certificate; this difference is not significant and it will not change the conclusions of the performance evaluation reports already issued. Another important point discussed in this talk pertains to half-life values used in correcting the characterized values to measurement dates. Especially important is the half-life for the short-lived ^{241}Pu. The CALEX Program now uses 14.348 years for ^{241}Pu half-life. A more recent experiment completed at IRMM shows the value to be 14.326 ± 0.024 years replacing an older value of 14.290 ± 0.006 year determined by the same institution. (Roger Wellum and Andre Verbruggen gave an account of the recently completed IRMM experiments to re-establish the ^{241}Pu half-life). An official DOE report listing the values for

plutonium half-lives to be used in various DOE programs is much needed. Srinivasan provided a report on performance evaluations of CY 2007 calorimetry/gamma spectrometry measurement results from Hanford, LLNL and LANL.

Stefan Burger of NBL gave an account of a study undertaken to re-determine the (initial) ^{238}Pu and ^{241}Am abundances in the Calex I material. Two lines of evidence seem to point out that the certified values may be higher for these two isotopes: a) 1987 verification experiments by NBL and LLNL and b) non-destructive gamma spectrometry results (mainly from Hanford and LLNL). The important conclusions to emerge from this study are as follows: a) the (initial) ^{238}Pu abundance given in the certificate is correct, and b) the initial ^{241}Am abundance stated in the certificate appears to be about 15% higher relative to the value recommended by this study. Nonetheless, within the limits of uncertainties, the ^{241}Am concentration from this study overlaps with the certified value. In discussing the conclusions of this presentation, the calorimeter practitioners recommended no changes to be made in the certified values for ^{238}Pu and ^{241}Am abundances.

Thomas Sampson made a comparative study of LANL water bath calorimeter power measurements results, obtained over a number of years, using Calex I and ^{238}Pu heat sources. The main conclusions of this study are that calorimetric power measurements can be made with (relative) bias of less than 0.1%, and precision of about 0.2 to 0.3% (at 1 watt power level).

Matthew Harker of AWE in UK spoke on the recent acquisition of a water-bath calorimeter for plutonium material accounting. He described the power measurement results from the new calorimeter and issues related to accuracy and precision in the measurements. A DOE calorimetry expert provided assistance to AWE in evaluating the performance of the new calorimeter and suggested methods to improve performance. AWE would like to obtain a Calex I unit for measurement quality control and is interested in joining the CALEX Program.

William Guthrie of NIST spoke on a linear regression approach for estimating blank corrections in analytical results as well as providing a realistic estimate of blank correction uncertainty. He illustrated the method using examples. Blanks, blank corrections, and estimating uncertainties from these corrections – all are equally important in defining the final measurement results with uncertainties.

Michael Holland of SRS gave an account of a recently started SRS/SRNL collaborative program on re-design and upgrade of mass spectrometers. A Finnigan MAT 271 gas mass spectrometer and a VG 3038 mass spectrometer were upgraded with highly satisfactory results. A Finnigan

MAT 261, a thermal ionization mass spectrometer, will be upgraded next. The SRS/SRNL program is expected to provide much needed support to operational maintenance of older instruments in DOE facilities. The manufacturers are providing only minimal or no support towards maintenance of these instruments; the SRS/SRNL program fills an important void.

ACKNOWLEDGEMENTS

The organizer of the NBL Measurement Evaluation Program Annual Meeting thanks the speakers and the attendees for active participation. Special thanks are given to Ms. Leah McCrackin and Ms. Jodi Metzgar (both of INMM) for meeting room arrangements (room set-up, power point slides projection), Alma Stiffin (of NBL) for help in preparing the minutes for printing, and Michele Nelson, Linda Graf, Lorenza Salinas, and Gary Weidner (of Argonne) for printing.

ABSTRACTS AND SLIDES

The abstracts of the talks and the slides used in the presentation of the talks are included in the following pages in the same order as shown in the agenda.

Abstracts and Graphics are linked from the Agenda Bookmark