Accomplishments of the ABACC-DOE Cooperation Program

Gevaldo Lisboa de Almeida, Lilia Palhares, Olga Mafra, Luis Rovere, Ruben Nicolas; ABACC

Don Glidewell, Susan Hayes, Margaret Legel, Lisa Owens, Douglas Reilly, Caroline Smith, Michael Whitaker; DOE

ABSTRACT

In 1994, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) and the U.S. Department of Energy (DOE) signed an agreement of cooperation in the area of international safeguards. During 1997, several projects were undertaken to strengthen safeguards with improved measurement methods, safeguards approaches, and inspection procedures. Positive results were achieved through technical consulting, training, and acquisition of safeguards equipment. Areas of technical cooperation include destructive and non-destructive analysis, remote monitoring, environmental sampling, containment and surveillance, and information management. In the area of destructive analysis, the ABACC network of analytical laboratories began to participate in the *Safeguards Measurement Evaluation Program (SME)* of DOE's New Brunswick Laboratory, which also is participating in the second round of the ABACC Intercomparison Program. For non-destructive analysis, several instruments were acquired and specialized training courses and workshops were conducted in Argentina, Brazil, and the United States. Seminars and reciprocal visits were conducted in environmental sampling, information management, and remote monitoring. Courses on containment and surveillance were conducted for inspectors and equipment was acquired for evaluation and use. Technical cooperation has been enhanced through the designation of U.S. *Nonproliferation and Disarmament Funds* to support training and the acquisition of safeguards instrumentation. The technical cooperation between ABACC and DOE has been mutually beneficial in evaluating and implementing improved, cost-effective measures for verifying nuclear materials.

Introduction:

In 1985, Argentina and Brazil began to open their nuclear programs to each other, and the world, to demonstrate that they were pursuing only peaceful uses. In 1990, their two Presidents signed the "Declaration of Iguazu" which committed them to peaceful nuclear programs and to a joint system of accounting and control of nuclear materials. This led to the creation of the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) and the Quadripartite Safeguards Agreement of 1994. Technical interactions between the Argentine Atomic Energy Commission (CNEA), the Brazilian Nuclear Energy Commission (CNEN), and ABACC, and the US Department of Energy (DOE) led to Agreements of Cooperation in Implementation of International Safeguards between DOE and CNEA, and between DOE and ABACC, which were both signed on 14 April 1994 at San Carlos de Bariloche, Argentina. A similar agreement was signed in Vienna on 19 September 1995 between CNEN and DOE. ABACC is the regional organization which administers the Common System of Control and Accounting for Nuclear Materials. ABACC has headquarters in Rio de Janeiro and an inspectorate of approximately 60 nuclear experts from Argentina and Brazil. In 1997, ABACC celebrated its 5th anniversary and its success at bringing good accounting and control of nuclear materials to this region and gaining respect in the international safeguards community. DOE is proud of its growing cooperation with ABACC which

includes destructive and nondestructive assay (NDA), environmental monitoring (EM), remote monitoring (RM), information management, and training.

Safeguards Training:

Safeguards training was especially important at the start, and remains important today with emphasis slowly shifting to more advanced subjects and the issues of the IAEA's Strengthened Safeguards System (SSS, previously know as 93+2). The first major project was a 3-week safeguards course presented in Buenos Aires in June 1993, even before the cooperation agreement was signed. This course is presented annually with an evolving syllabus. In November 1997, it was again in Buenos Aires and covered NDA, environmental sampling, remote and unattended monitoring, information management, and other issues covered in the Model Protocol (INFCIRC/540). There were four DOE instructors and others from the Joint Research Center in Ispra, Italy; Japan; ARN, CNEN, CEA (France), and the IAEA. DOE instructors covered NDA, SSS, EM, and RM. The Permanent Coordinating Group (PCG) meeting for the ABACC-DOE agreement was held at the same time in the headquarters of the Argentine Nuclear Regulatory Authority (ARN) in Buenos Aires.

Figure 1. Participants at Second PIV Workshop in Resende, Brazil

In June 1997, the second Physical Inventory Verification (PIV) Workshop was organized by ABACC and presented at the Fuel Element Fabrication Plant (FEC/INB) in Resende, Brazil (see Fig. 1 & 2). Twelve ABACC inspectors participated in this workshop, which simulated a safeguards PIV inspection at a fuel fabrication plant. Two DOE instructors participated in the course. The first PIV workshop was presented in 1995 at the CONUAR plant in Ezeiza, Argentina, also with DOE participation.

ABACC, DOE, and the Argentine and Brazilian authorities participate in each other's safeguards courses; a cooperation that began in the early 1980's. An ABACC officer was an instructor in the State Systems of Accounting and Control of Nuclear Materials (SSAC) Training Course that was presented in Santa Fe, New Mexico, in May 1997. The Director of Safeguards and Nonproliferation of ARN also was an instructor in this course.

Figure 2. Inspectors measure fuel rods during PIV workshop at Resende, Brazil

Environmental Monitoring:

Environmental monitoring is one of the three "pillars" of the IAEA's Strengthened Safeguards System (INFCIRC/540). This technology, which looks to measure trace amounts of uranium and plutonium in swipe, air, soil, and water samples, is intended to address the issue of undeclared nuclear activities. Both Argentina and Brazil have participated in the initial IAEA studies of this technology. Instructors from DOE laboratories presented a seminar on environmental monitoring at CNEN headquarters in Rio de Janeiro in March 1997. Participants included 14 Brazilian and 4 Argentine inspectors. An important part of the seminar was careful instruction on the proper procedure for taking swipe samples in and around nuclear facilities (see Fig. 3). ABACC, ARN, and DOE met in Buenos Aires in November 1997 to organize a second workshop in Argentina on swipe sampling.

Figure 3. Demonstration of swipe sampling technique to ABACC representatives at Oak Ridge

Remote Monitoring:

Remote monitoring is another SSS pillar. As the name implies, the technology involves transmission of safeguards data from nuclear facilities to IAEA field offices and headquarters. The goal is to

reduce the cost of routine inspections and allow inspectors to become more efficient. The IAEA's principal initiative in this arena, involves remoting the many video surveillance systems that have been installed at reactors around the globe. A major cooperation has been underway since 1994 involving ABACC, IAEA, ARN, and DOE to develop a remote monitoring system at the Embalse Nuclear Power Station (see Fig. 4) in Argentina. In addition to providing access to the existing 15 video surveillance cameras, this system uses radiation sensors to monitor the transfer of long-cooled fuel from wet to external, dry storage.

Figure 4. Embalse Nuclear Power Station in Argentina

A seminar on remote monitoring was presented by ABACC and DOE instructors in Buenos Aires in December 1996. An ABACC Technical Support Officer took part in the International Remote Monitoring Project workshop presented at Sandia National Laboratories in February 1997 and presented a paper on ABACC's work in remote monitoring.

Information Management:

Cooperation in Information Management seeks to provide ABACC with an overview of the methodology, applicability, limitations, and information sources and describe tools developed by DOE to store, display, and analyze safeguards information. The program also provides consultation on authentication and encryption technology, client-server architectures, and database interfaces. A meeting was held in Rio de Janeiro in December 1996 with DOE experts from Pacific Northwest National Laboratory to begin this cooperation. During the visit, PNNL presented a seminar on data bases, encryption, and network security. Five ABACC officers traveled to Washington, DC, in October 1997 for a demonstration exercise on data processing and consistency analysis.

Nondestructive Assay Development:

A new task was defined in 1997 to analyze, develop, and evaluate nondestructive assay (NDA) instruments that are required to safeguard specific facilities and to study NDA techniques that may be used during ABACC inspections. The first activity was an NDA workshop in June 1997 at the Portsmouth Gaseous Diffusion Plant to study the measurement of UF_6 cylinders and in-cascade

holdup. Participants included two ABACC officers and six inspectors. The Portsmouth plant makes large use of NDA and has developed much of its own instrumentation and procedures.

Figure 5. Measurement of 32A/B UF_6 cylinders at the Portsmouth Gaseous Diffusion Plant

ABACC involvement in developing a safeguards approach for the Pilcaniyeu Gaseous Diffusion Plant is covered under this task (Fig. 5 and 6). Other planned activities include a workshop in Sao Paulo on applying neutron detectors at enrichment plants, a workshop on using the GRAND/Fork system for spent fuel assay, and a workshop on applying the neutron coincidence collar to measure fresh nuclear fuel.

Figure 6. Measurement of high-enriched UF_6 in 5A cylinders at Portsmouth

Destructive Assay Development:

Cooperation in destructive analysis is coordinated by ABACC's Technical Support Officers and DOE's New Brunswick Laboratory (NBL). ABACC is developing a network of analytical laboratories in Argentina and Brazil that can accept and accurately analyze nuclear material samples from inspections. The network includes 14 laboratories, all of which participate in an intercomparison program to improve analytical skills and procedures. Two exercises have been organized by ABACC with NBL participation. In the first, defined in 1993, NBL characterized the nuclear material that was used as a secondary standard. In the second, defined in 1997, NBL provided the reference value for the uranium content of the samples. In June 1997, a specialist from NBL participated in a meeting of the ABACC intercomparison group to discuss implementation of a

permanent system for evaluating quality control in the laboratories, the isotopic intercomparison program, and the basis for ABACC laboratory participation in the Safeguards Measurement Evaluation Program (SME). In the SME program, NBL prepares and distributes nuclear material samples to participating laboratories who then submit their assay results to NBL for analysis. A major purpose of such programs is to encourage consistency within a laboratory network and, hopefully, improve bias and precision. At present seven Argentine and six Brazilian laboratories are participating in the SME program and some have already sent results to NBL. Reciprocal visits have occurred between ABACC laboratories and NBL and will continue in the future.

Containment and Surveillance:

Containment and surveillance (C&S) is an important safeguards measure; this is as true for ABACC as for the IAEA. A technical meeting was held at Sandia National Laboratory in 1995 to discuss specific needs and acceptance criteria for C&S equipment and technology used in enrichment plants and spent fuel storage facilities. Digital optical surveillance equipment, fiber optic electronic seals, and equipment tagging units were demonstrated at the Aquila Technologies Group plant in Albuquerque.

In mid 1996 laboratory tests started with two Gemini optical surveillance systems and one review station purchased with NDF funds. In July 1997, one of the systems was installed for a field test in the feed and withdrawal station of a Brazilian enrichment facility. The system has operated for a test period of two months, ending with a joint review and a preliminary evaluation by ABACC and the IAEA. Utilizing the system on a routine basis is pending definition of the final safeguards approach for the facility; this is now being discussed between ABACC, IAEA, and CNEN.

A C&S workshop was presented by ABACC, CNEN, and Sandia on 13-18 July 1998.

Conclusions and Publications:

Since our initial cooperative activity in June 1993, the interaction between ABACC and DOE has flourished and grown. The recent addition of NDF funds from the US Department of State has supplemented ABACC funds for equipment and travel. Our cooperation involves many people from DOE national laboratories and from the many nuclear facilities in Argentina and Brazil. We should note that the separate agreements between DOE and ARN and CNEN work together to form a significant interaction between the United States, Argentina, and Brazil in nuclear material safeguards and nonproliferation. This interaction benefits all parties. At the 1997 Annual meeting, the following papers were presented describing some cooperative activities involving ABACC and DOE:

- ALGORITHM TO DETERMINE THE CALIBRATION PARAMETERS FOR AN NDA METHOD OF INVENTORY VERIFICATION IN A DIFFUSION ENRICHMENT CASCADE, Gevaldo Lisboa de Almeida, Carlos Feu Alvim, ABACC.
- MEASUREMENTS ON SHORT TIME COOLED PWR FUEL WITH A FORK DETECTOR, Howard Menlove, Mark Abhold, Douglas Reilly, Los Alamos National Laboratory; Olga Mafra, Gevaldo Almeida, Luis Rovere, ABACC; Emmanuel Gryntakis, IAEA; Osvaldo Larrieu, Centro Atomico de Bariloche.

DOE and its National Laboratories are proud to be a part of this cooperative program with

ABACC.