

## INTRODUCING THE BRAZILIAN PROGRAMME OF TECHNICAL SUPPORT TO THE INTERNATIONAL ATOMIC ENERGY AGENCY - DEPARTMENT OF SAFEGUARDS

**Laércio A. Vinhas<sup>1</sup>, Lilia C. Palhares<sup>1</sup>, Fábio C. Dias<sup>1</sup> and Nikolai Khlebnikov<sup>2</sup>**

<sup>1</sup> Comissão Nacional de Energia Nuclear – CNEN  
Rua General Severiano, 90  
22294-900 Rio de Janeiro, RJ  
[lavinhas@cnen.gov.br](mailto:lavinhas@cnen.gov.br)  
[lpalhares@cnen.gov.br](mailto:lpalhares@cnen.gov.br)  
[fabio@ird.gov.br](mailto:fabio@ird.gov.br)

<sup>2</sup> International Atomic Energy Agency – IAEA  
Wagramer Strasse 5 - P.O. Box 100  
A1400 Vienna, Austria  
[N.Khlebnikov@iaea.org](mailto:N.Khlebnikov@iaea.org)

### ABSTRACT

As an active Member State of the International Atomic Energy Agency (IAEA), Brazil has applied substantial resources in order to maintain the best possible cooperation with the Agency, aiming at a continuous improvement of the effectiveness and efficiency of the safeguards system. Over the last decades a number of projects, involving the participation of high-level Brazilian professionals in the nuclear area, have already been jointly completed. To continue providing this voluntary support to the IAEA Department of Safeguards for research, development and implementation, in 2006 Brazil decided to accept the IAEA's invitation to participate in the IAEA Member States Support Programmes initiative, which currently includes 21 Member States. The Research and Development (R&D) Programme for Nuclear Verification is the IAEA reference in this regard, establishing the high priority needs and describing each recognized departmental project. The Programme is issued every two years. The "Brazilian Support Programme (BRZ SP)" was established on the basis of a set of administrative procedures titled "Cooperation Arrangements and Guidelines", agreed between the Brazilian National Nuclear Energy Commission (CNEN) and the IAEA – Department of Safeguards. The scope of the BRZ SP includes: the participation in field tests and the evaluation of state-of-the-art technologies as requested by the IAEA for its safeguards applications; the training of safeguards personnel involved with safeguards implementation at both facility and State levels; laboratorial support in the area of destructive and non-destructive analysis of nuclear materials; the analysis of safeguards issues; information acquisition, analysis and evaluation; and the provision of human resources, such as experts and consultants to work directly with the IAEA Secretariat. The activities agreed under the BRZ SP are not restricted to CNEN staff members. Professionals from other Brazilian organizations may also be involved with a number of projects, depending on their skills and the IAEA's request for support in the related area. The IAEA's Support Programme Coordination Unit and a group of selected CNEN staff members are responsible for coordinating the activities under the BRZ SP, including the selection of cooperation areas, professionals to conduct selected activities, monitoring the progress of tasks, and reporting on their status. Both the IAEA and CNEN look forward to the valuable cooperation of individuals and organizations to achieve the objectives established under the BRZ SP.

### 1. INTRODUCTION

The Brazilian Support Programme (BRZ SP) was established in 2006 as a voluntary initiative for contributing with the Department of Safeguards of the IAEA in the implementation of international safeguards more efficiently by supplementing human and material resources as appropriate. Since then, a number of activities has been conducted in areas such as novel

techniques and instruments; laboratorial capabilities for environmental analysis; training; analysis of safeguards approaches and testing of satellite transmission for safeguards purposes. This paper has the main intent of providing the Brazilian and international community with updated information about the conduction of the BRZ SP. By reading this paper and the reference documentation, it is also expected that additional Brazilian professionals and organizations can identify areas of potential collaboration for future activities under BRZ SP.

## **2. ORGANIZATIONS FOR PROGRAMME IMPLEMENTATION**

In the Brazilian side, the management, oversight and direction of the BRZ SP is conducted by the Safeguards and Physical Protection Coordination (COSAP), subordinated to the Directory of Radioprotection and Nuclear Security (DRS) of CNEN. Activities conducted by COSAP in the scope of BRZ SP include:

- Evaluation of all task requests received from the IAEA;
- Identifications of the main activities to be performed, the major milestones, the deliverables and the funding required to perform the task;
- Selection of tasks to be accepted under the BRZ SP and their notification to the IAEA;
- Approval of the task outlines;
- Monitoring the progress on and results of each task;
- Interfacing with IAEA staff, laboratory representatives and other collaborators concerning active and future tasks;
- Coordinating the preparations of the BRZ SP Annual Review Meetings when held in Brazil.

The Coordinator of COSAP is the official point-of-contact for general issues. The Coordinator works with IAEA representatives to establish work plans, document system requirements and discuss the conduction activities. This person is also responsible for performance of the task and for management of its own activities; for periodically reporting progress of all milestones to the IAEA; and for monitoring follow-up issues, which would require changes to the task outline or schedule.

At the IAEA, the administrative responsibility for all Support Programmes has been assigned to the Director of the Division of Technical Support (DIR-SGTS). He is assisted by the Support Programmes Officer, who manages the Support Programmes Administration (SPA). This central body is responsible for:

- Maintaining and providing information on the BRZ SP, the resources and capabilities available, the status of the programmes and activities, and the knowledge and experience of individual programmes;
- Consulting internally with IAEA areas to review the desirability and availability of BRZ SP assistance, the quality of task proposals (SP-1s), agreed task outlines and application reports of completed tasks;

- Maintaining and signing all substantive communication with BRZ SP, including, inter alia: task proposals and agreed task outlines and changes thereto; task completion or termination; acceptance of task products and results; application reports; financial matters; establishing and updating of administrative arrangements and procedures; and annual programme review matters;
- Providing administrative support needed to IAEA Department's end users during the active life of a task;
- Coordinating the preparations of the BRZ SP Annual Review Meetings when held in Vienna;
- Coordinating the evaluation of completed tasks and archiving of documents;
- Tracks budget, travel and other costs by task.

The same activities are conducted between the SPA and the other 19 Member States that have a Support Programme in force. There is also a Support Program between the IAEA and the European Commission (EC).

For each project, a project manager is selected by the Director of the IAEA Division responsible for the project. Project managers are responsible for developing and implementing a plan that satisfies the requirements of the Department's Research and Development Programme and implementation support requirements. All tasks are coordinated using these project overview plans.

The day-to-day management of a task is carried out by task officers of both the IAEA and CNEN. They are responsible for preparing the agreed task outline and assuring that it is accurate and adequately detailed and that necessary attachments are included. They also work on review, update of information in the database, preparation of system requirements, preparation of task reports, task execution and necessary actions associated with the implementation of the tasks.

Task specialists may also be assigned. Usually, they are responsible for maintaining current expertise and related documentation, ensuring that adequate approaches are utilized. They may also be consulted as necessary on task related specific matters, provide expert advice, reviews and concurrence with positions and task results.

### **3. THE IAEA R&D PROGRAMME FOR 2008-2009**

The purpose of the Research and Development (R&D) Programme [1] is to assist the IAEA meet its challenges and improve the practice of implementing its verification activities in a manner that is relevant, credible, efficient, and encourages innovation and excellence. The Programme is reviewed in a biennial basis so that near term needs can be addressed with adequate prioritization. Consistent with its original intent, the R&D Programme remains a working document that the IAEA uses to solicit the transfer of technology, funds and expertise that are provided through the Member State Support Programmes (MSSPs).

The resources required to implement the R&D Programme come from the IAEA itself, MSSPs and from other extra budgetary contributions. A major objective of the document is to allow MSSPs to identify areas for voluntary contribution to the IAEA.

The execution of the Programme is performed through a number of activities planned in project plans compiled in the R&D document. Currently, there are 23 projects covering all areas requiring research and development activities, as follows:

- Safeguards Approaches
- Quality Management
- Training
- NDA Techniques
- Improved Techniques and Instruments for Sealing and Containment Verification
- Next Generation Surveillance Systems
- Destructive Analysis of Nuclear Materials for Safeguards
- Improved Techniques and Instruments for Spent Fuel Verification and Monitoring
- Novel Techniques and Instruments for Detection of Undeclared Nuclear Facilities, Material and Activities
- Unattended and Remote Monitoring Systems
- Techniques and Equipment for Safeguards at Gas Centrifuge Enrichment Plants
- Universal NDA Data Acquisition Platform (UNAP)
- Integrated Safeguards Environment
- Commercial Satellite Imagery
- Information from Open Sources
- Enhanced Information Analysis Architecture
- Environmental Sampling for Safeguards
- R&D for Statistical Analysis
- Understanding Nuclear Trade Mechanisms
- Safeguards System for Rokkasho Reprocessing Plant (RRP)
- Safeguards System for JNFL MOX Fuel Fabrication Plant (J-MOX)
- R & D for Safeguarding Pebble Bed Reactors and Supporting Facilities
- Chernobyl

Detailed information on each project can be found in the latest version of the R&D Programme [1].

#### **4. CURRENT BRZ SP TASKS**

Currently there are eight tasks being conducted under BRZ SP:

Task: Support for Novel Technologies

Project: Novel Techniques and Instruments for Detection of Undeclared Nuclear Facilities, Material and Activities

It is a broad task that allows for the investigation of innovative technologies to strengthen the effectiveness and to improve the efficiency of safeguards, especially with regard to enhanced capability to detect undeclared nuclear material and activities.

Brazilian experts are actively contributing in the discussions, meetings and workshops about use of antineutrino detection and monitoring for safeguards applications. Representatives from the IAEA have also attended workshops conducted in Brazil. Future activities include

the testing and evaluation of detection instrumentation in a Brazilian location, possibly the site where the two nuclear power plants are located (city of Angra dos Reis).

Task: Qualification of Environmental Network Laboratories

Project: Destructive Analysis of Nuclear Materials for Safeguards

The IAEA has established a network of Analytical Laboratories (NWAL) for the analysis of nuclear material and environmental samples to assist its Safeguards Analytical Laboratory in the analysis of inspection samples. In the area of environmental analysis, additional laboratories with additional capabilities should be considered taking into account the increasing importance of environmental sampling as a tool for detecting undeclared nuclear activities as well as the Agency's policy of broadening geographical distribution of the analytical services.

Two Brazilian laboratories are currently participating in the qualification [2] process: one from the Institute of Radioprotection and Dosimetry (IRD) and another one from the Institute of Energetic and Nuclear Research (IPEN). Activities already conducted include: visits to the candidate laboratories; provision of information on quality management for each laboratory; analysis of test samples and evaluation of the results. Future activities include the analysis of additional samples and visits of IAEA auditors at the laboratories.

Task: UF6 Sampling Method using Alumina

Project: Destructive Analysis of Nuclear Materials for Safeguards

The Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) has developed a UF6 sampling method named the "ABACC Cristallini Method" [3]. The method uses a fluorothene tube containing alumina pellets to absorb and hydrolyze UF6. Expected benefits of this method include: no need to cool down the sampling tube with liquid nitrogen, less material required for sampling, less expensive sampling devices and the ability to conform to standard transportation regulations. The IAEA is interested in testing and implementing this new method.

Task officers for Brazil and IAEA have discussed testing procedures and are planning sampling and analysis activities to be conducted in Brazilian facilities in 2009 and 2010.

Task: Experimental Investigation of Behavior of Trace Elements in Uranium during the Concentration and Conversion Processes

Project: Environmental Sampling for Safeguards

Since recently the IAEA has begun analyzing various uranium samples for impurities content. These samples include uranium ores and ore concentrates, as well as samples from the conversion process, such as uranium oxides, fluorides, solutions and waste. The purpose of this analysis and the consequent data evaluation is to identify the origin of uranium materials as well as a process resulting in a given uranium material in order to compare it with the declared information. For this purpose, detailed information about trace elements in uranium compounds during the concentration and conversion processes are needed. Analysis should be performed by ICP MS technique or by other technique with comparable characteristics.

BRZ SP is being requested to support the IAEA on activities related to sampling of selected uranium compounds found in Brazil and performing the analysis of impurity content.

Task: Regional Training Course on SSAC, Brazil

Project: Training

The 2009 edition of the Regional Training Course on State Systems of Accounting and Control of Nuclear Material (SSAC) for Latin American and Caribbean countries will be held in Rio de Janeiro, Brazil, from 16 to 27 November 2009. The course is being jointly organized by CNEN, IAEA and ABACC and has the intent to assist Member States to organize their national safeguards systems and make them adaptable and responsive to future developments.

In the past, similar training course have been organized in the same way. In 2009, the activities are being conducted under the BRZ SP. Nomination of participants from the selected countries, including Brazil, will be processed during the three or four months before the course.

Task: Guidance for Designers and Operators on Design Features and Measures to Facilitate the Implementation of Safeguards at Future Nuclear Fuel Cycle Facilities

Project: Safeguards Approaches

One of the requirements of Innovative Nuclear Energy Systems (INSEs), to be assessed by an evaluator, is that "the diversion of nuclear material should be reasonably difficult and detectable". It is understood that taking into account design features that are aimed at facilitating the implementation of international safeguards at very early design stages will improve the proliferation resistance of an INSE. Incorporating safeguards into the design phase for new facilities will allow the IAEA to more effectively and efficiently monitor and verify nuclear material.

It is necessary to establish guidance for designers and operators on facility design features and measures that are suitable for facilitating the implementation of international safeguards at future nuclear fuel cycle facilities. The guidance may be given in the form of Technical Reports describing basic principles of IAEA safeguards and fundamental facility design features and measures that are suitable for facilitating the implementation of international safeguards and facility type specific guidelines for design features and measures that will allow the IAEA to implement safeguards more effectively and efficiently.

Based on a request from the IAEA, three Brazilian experts represented the BRZ SP in a workshop held in Vienna and aiming at the provision of inputs to the technical report. The draft of this report is currently under preparation by the group of experts.

Task: Assistance in Open Source Information Collection

Project: Information from Open Sources

Open source information plays an important role in the IAEA's strengthened safeguards system, particularly in the state evaluation process. It complements the Agency's inspection activities by providing a broader perspective on nuclear activities within a State and between States. The IAEA seeks to extend its open source information collection through cooperation

with Member States. The information provided to the Agency may be on the activities of the Member State or on the region as a whole. Of particular importance is the provision of information in languages other than English or information that is not available via the World Wide Web. Specific information requirements include: information on nuclear activities from media sources such as local or regional newspapers or journals; scientific or technical information published in scientific or technical trade journals, preprints, and technical reports; information on nuclear infrastructure and nuclear-related industries, such as annual reports of companies engaged in the production of nuclear equipment.

BRZ SP officers are currently evaluating methods to collect and analyze open source information. In order to minimize the time consuming effort associated with this activity, software tools will be required for the filtering of the large quantity of information available via open sources.

Task: Testing of Secure Satellite Communication for Remote Monitoring and Inspection Support

Project: Unattended and Remote Monitoring Systems

As part of the ongoing effort to reduce operating cost, improve system performances and provide secure data and voice transmission for remote monitoring and inspection support, a technology demonstrator, based on IP Security over satellite, capable to realistically demonstrate the network end-to-end functionalities of satellite communications, should be implemented in different countries. The demonstrator should be based on the utilization of available satellite capacity by commercial operators. The deployment of the necessary network infrastructure both at IAEA as well as in remote locations corresponding to specifically selected nuclear plant sites should be considered.

BRZ SP has received and installed a satellite antenna in the Safeguards Laboratory located at the Institute of Radioprotection and Dosimetry (IRD), Rio de Janeiro. Brazilian officers are currently proceeding with the satellite license. The pilot start date is planned for July 2009.

## **5. CONCLUSIONS**

In addition to benefits that the voluntary contribution received through the Member States Support Programme usually provides to the IAEA, the BRZ SP has been an excellent opportunity for Brazilian professionals and organizations to be in short contact with the latest advances, state-of-the-art technology and high level professionals involved with the conduction of the identified tasks. Both the BRZ SP and the IAEA understand that this cooperation mechanism is central to cope with current and future challenges to be faced by the international safeguards community.

For any information on the BRZ SP, the authors encourage the reader to make contact by e-mail.

## **REFERENCES**

1. International Atomic Energy Agency; “Research and Development Programme for Nuclear Verification”, 2008-2009 Edition.
2. International Atomic Energy Agency; “Procedure for the Qualification of a Candidate Laboratory for the Agency’s NWAL for Analysis of Safeguards Samples”, SGTCS-P22/Rev. 2-2005 (2005).
3. E. Galdoz, A. Esteban, O. Cristallini, J.A. Perrotta; “UF<sub>6</sub> Sampling Using Alumina”, *INMM Proceedings*, Nashville, TN, July 13-17, 2008.