

Twenty years of ABACC. Accomplishments, lessons learnt and future perspectives

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Abstract:

From the inception of the implementation of the Quadripartite Agreement (INFCIRC/435), in 1991, ABACC has had an important role at the non-proliferation agenda and has also been an active player in the international safeguards. It was necessary for ABACC to develop a technical capacity to face the challenges to be a safeguards agency and to gain credibility in the nuclear safeguards world. This capacity means to develop and implement safeguards systems in the technical area, in the inspection framework, in the conceptual analysis of processes and approaches and in the political scenario. These tasks conducted the strategic plan of ABACC on the last 20 years.

Among the accomplishments, ABACC has been involved in the application of safeguards to sensitive and complex installations, in developing safeguards instrumentation, in establishing a technical and trained inspectorate, in constructing a cooperative and coordinate environment with IAEA for safeguards application. Other challenges as R&D of equipment and quality assurance systems were also managed during all these years.

ESARDA is one forum that ABACC is involved and always shares experience and ideas. On July 18th, 2011 ABACC will formally complete 20 years. This paper summarizes the accomplishments, lessons learnt and future actions for strengthen the ABACC safeguards role. It also addresses the collaboration of ABACC with other organizations in the non-proliferation and international safeguards arena.

Keywords: ABACC, Regional Systems, Safeguards Agency, Quadripartite Agreement.

1. Introduction

Considering the nuclear development of the two countries, not having a comprehensive safeguards agreement in force while willing to demonstrate to the world the peaceful use of their nuclear programs, Argentina and Brazil decided to establish a Common System of Accounting and Control of Nuclear Materials (SCCC) in 1990. This means that the norms for nuclear material control should be similar in the two countries and all nuclear materials and facilities should be subject to the same safeguards requirements. The SCCC was formalized through the Bilateral Agreement (INFCIRC/395), which was signed in July 1991 and ratified by the Congresses of the two countries six months later. To apply the SCCC, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials - ABACC- was created on July 18th, 1991.

The rules and boundary conditions for the application of the SCCC by the Secretariat of ABACC are designed in the Bilateral Agreement and in one specific document named *General Procedures of the SCCC*, which is approved by representatives from each country, who act as Members of the Commission of ABACC.

The safeguards measures foreseen in the SCCC refer to all declared nuclear material after a defined starting point, although the existence of undeclared nuclear material and facilities is not excluded (i.e.

facility misuse is considered). In the SCCC there are no provisions to apply safeguards either to non-nuclear materials or to research and development activities not involving the processing or storage of nuclear materials. The safeguards measures established by the SCCC complied with the comprehensive type of agreements like the INFCIRC 153.

Also in December 1991 Argentina, Brazil, ABACC and IAEA signed the Quadripartite Agreement which entered into force in March 1994. Through this comprehensive safeguards agreement the countries submit all nuclear materials in all nuclear activities to the IAEA safeguards. Under this agreement, the IAEA, in carrying out its verification activities, shall make full use of the SCCC. Furthermore, the IAEA and ABACC shall draw independent conclusions, but must avoid unnecessary duplication of ABACC's accounting and control activities. For this purpose, several provisions were introduced into the Quadripartite Agreement, its Protocol, and General Part of the Subsidiary Arrangements. These provisions produced several levels of coordination between the ABACC and the IAEA and between the two organizations and the two countries. Coordination arrangements were progressively implemented during the last twenty years.

2. Legal and Political framework of ABACC

The Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) consists of a four-member Commission appointed equally by the two countries and a Secretariat with headquarters in Rio de Janeiro, Brazil. The Secretariat consists of technical and administrative professionals appointed by the Commission, clerical staff, and inspectors. The present technical staff consists of ten people, five Brazilians and five Argentinians: one Secretary, one Deputy Secretary, two planning and evaluation officers, two operations officers, two technical support officers and two accounting officers. The higher-ranking technical officer of each country alternates annually as ABACC's Secretary. One administrative and finance manager and one institutional relation complete the team of ABACC professional staff.

The inspections are performed on a cross-national basis, with Argentine inspectors verifying facilities in Brazil and vice-versa. The inspectors do not work permanently for ABACC. They are experts who usually work for the nuclear area of countries, National Authorities, or other official organizations in each country, and are convoked by ABACC's Secretariat whenever necessary. It should be noted that the team of inspectors consists not only of people working in safeguards at a national level, but also of experts from several areas of safeguards interest (NDA, DA, design and operation of nuclear installations, etc.). Presently, the inspectorate of ABACC has around 90 inspectors being half and half for each country.

Established the legal framework ABACC would have not succeeded without the political support from the Argentinean and Brazilian government and the international safeguards organizations, such as ESARDA, INMM, DoE, European Commission to name a few, that have supported, helped and encouraged this regional organization.

The economic resources required for the implementation of the SCCC and the functioning of ABACC was established, in a general way, by the Bilateral Agreement; both countries share the costs on an equal basis. The regular operational budget of ABACC is of some US\$ 4 million per year (this figure does not include the salaries of the inspectors and consultants, which are borne directly by both countries). ABACC relies also on the nuclear structure of both countries to support its technical activities. Technical cooperation with other safeguards organizations also help to withhold the expenses on research and development of safeguards tools.

As a regional safeguards system, ABACC has also to fulfil its obligations and relationship with IAEA established at the Quadripartite Agreement.

The basic undertakings of the Quadripartite Agreement are:

- The acceptance by the Parties of safeguards on all nuclear materials in all nuclear activities, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other explosive devices

- The IAEA shall have the right and obligation to ensure that safeguards will be applied in accordance with the terms of the Agreement.
- ABACC undertakes to cooperate with the IAEA, in accordance with the terms of the Agreement.
- The IAEA shall apply its safeguards in such a manner as to enable it to ascertain that there has been no diversion of nuclear material to any nuclear weapon or other nuclear explosive device.
- The IAEA verification shall include, inter alia, independent measurements and observations.
- The IAEA verification shall take due account of the technical effectiveness of the SCCC.
- The signatory States, ABACC and the IAEA shall avoid unnecessary duplication of safeguards activities.

This Agreement is clear with regard to the relationship between ABACC and IAEA, mentioned in the Basic Undertakings and in various other articles. Furthermore, the four Parties have signed a Protocol specifying cooperation arrangements for the application of safeguards whose principles are:

- (a) the need for ABACC and the IAEA each to reach its own independent conclusions;
- (b) the need to coordinate as far as possible the activities of ABACC and the IAEA for the optimum implementation of the Agreement, and in particular to avoid unnecessary duplication of ABACC safeguards;
- (c) when performing their activities, ABACC and the IAEA shall work jointly, wherever feasible, in accordance with compatible safeguards criteria of the two organizations; and
- (d) The need to enable the IAEA to fulfill its obligations under the Agreement, taking into account the requirement for the IAEA to preserve technological secrets.

Additionally, the Protocol establishes a high level Four-Party Liaison Committee, responsible for coordinating the application of the Agreement and of the Protocol and which may appoint a sub-committee for the implementation of safeguards that should foster adequate coordination between the IAEA, ABACC and both countries.

During the past 20 years the four parties have agreed in a number of Guidelines, Joint Procedures, Cooperation procedures which casted the coordination of safeguards activities in the framework of the Quadripartite Agreement.

3. Technical capacity of ABACC (implementation)

To apply safeguards as an inspectorate, ABACC had to build a system which must have competence to fully develop, implement and evaluate safeguards measures. That means, this system must have human resources capacity, a set of well developed and useful safeguard equipment, a trained and knowledgeable inspectorate body and a good headquarters support system to integrate all data obtained from safeguards activities and to generate its evaluation.

The system must operate efficiently from the planning of safeguards measures, which will rely on the right safeguards approach, the preparation for the inspection, the instruments and equipment to be used to and the way that ABACC will treat and evaluate the data obtained.

The application of safeguards in the jurisdiction where ABACC operates has offered different challenges in a range of different technical aspects. The technical activities are mainly oriented to the verification of operator declarations of material inventories or facilities usage, as stated in the SCCC and in the Quadripartite Agreement signed by the parties involved.

The technical activities derived from the safeguards verification procedures in which ABACC have mainly worked can be categorized in six different areas:

- Safeguards Approaches;
- Inspector training;
- Non Destructive Assay (NDA);
- Destructive Assay (DA);
- Containment and Surveillance (C&S);
- Data management.

ABACC has been involved in the development of unique safeguards approaches which required it staff to support research efforts on the technologies available, testing of new equipment as well as to some development work.

Since ABACC was designed to get the competence and support from the States to carry out its activities, it was necessary to increase the efforts of the countries to support ABACC's activities (for instance, they need to expand their laboratories and human resources capabilities to be able to provide ABACC with the necessary support to carry out crossed inspections in the countries). This double role of the National Authorities is not new in the safeguard's field, and contributes for the effectiveness of the safeguard system. The technical support available from the two parties embraces inspectors, consultants, equipment maintenance and calibration, preparation of standards, laboratory services and any other safeguards related study or service.

That means that ABACC has to look for and manage the necessary support from the states in order to build its own system. This support shall not compromise the confidentiality of the safeguards system neither the credibility of the whole system.

ABACC has the responsibility to manage and support the necessary safeguards projects in the countries or any other institution. Even counting on the ABACC's staff composed by highly qualified and experienced technicians, ABACC does not have its own laboratories or enough technical personnel to conduct new R&D techniques for a particular application or to adapt and get acquainted with new methods and technologies to be used at the inspections.

It is also ABACC's responsibility to foster the development of the countries laboratories and expertise necessary for applying the safeguards. For instance, in order to check the status of the laboratories that analyze the samples collected by the inspectors, the ABACC technical support area keeps a permanent inter comparison program running. These comparison programs are carried out with the cooperation of other international laboratories - NBL and IAEA (Seibersdorf).

Groups of experts of Brazil and Argentina are also called by ABACC as consultants in order to discuss a particular technology whenever it is necessary. Cooperation with other institutions as DOE/USA, CEA, EURATOM, EC-JRC, IAEA, KINAC and some countries are very successful and profitable to overcome this point.

The need to have a system that could manage all data collected during the inspections and could integrate the different technical areas of ABACC led to the development of database systems that will allow the management of accountancy, technical and administrative data and the production of detailed reports related to safeguards implementation.

It is important to mention that two database systems that were developed by ABACC have special importance. One is the SJAR, an accountancy system that allows the data collected during the inspections feeds the ABACC database and checks are executed and automatic reports are generated to provide feedback on the legal flow of information. It was implemented and a Joint Use System for this software was established with the IAEA. Special files and reports are generated for feeding the IAEA database. The other system is the Operation Database System that fully integrates all planning, execution, data collected and reports from all inspection information. It is a powerful tool that is used for safeguards and technical evaluation of ABACC's safeguards system.

The technical projects are conducted together with other organizations. Indeed, it is ABACC's policy to develop new technological systems in cooperation with IAEA, which is an end user as ABACC, and with other organizations which have human resources or laboratories. Some of the projects are listed below:

Projects	Application	Hardware development	Collaboration Organizations
Safeguards Studies	Enrichment - centrifuge and gas diffusion	No	IAEA/DoE
	On load safeguards approach	No	IAEA
NDA	Gamma and neutron detection for visual restricted access points at enrichment cascades	Yes	IAEA/CNEN/DoE

	Gamma evaluation on hold up at diffusion plants	YES	IAEA/CNEA/DoE
	Neutron collar for unique type of fuel element with slight enrichment	Yes	IAEA
	System to verify a difficult to access spent fuel assemblies stored in a Spent Fuel Pond	Yes	IAEA/DoE
	U and Pu using bulk analysis	No	CNEN/ARN/DoE
	TMIS and SMIS analysis	Yes	CNEN/ARN
	Gamma Evaluation Codes for Plutonium and Uranium Isotope Abundance Measurements by High-Resolution Gamma Spectrometry	No	EURATOM/IAEA/DoE
	Software for Enrichment Measures	No	DoE
	Differential Peak Absorption (DPA) technique	No	DoE
DA	UF₆ sampling methodology with alumina pellets	Yes	CNEN/ARN/DoE/IAEA
Information System	Load cell authentication	Yes	CNEN/IAEA
Surveillance systems	Secure Video Surveillance System	Yes	DoE
	Moveable Surveillance System	Yes	CNEN/IAEA
Support Systems	Operation database	No	
	Accountancy database	No	IAEA

4. Coordination and collaboration with IAEA

In the safeguards system that succeeds the Quadripartite Agreement, four levels exist all together: the facility level, the State authority, the regional safeguards organization (the ABACC), and the international safeguards organization (the IAEA). In practical terms, all IAEA safeguards activities in the two countries are coordinated with the ABACC or through the ABACC.

The use of Regional/State Systems for international safeguards is not new. In INFCIRC/153 type comprehensive agreements says (Art. 7) that the State shall establish and maintain a system of accounting and control of all nuclear materials, and the applied safeguards shall allow the IAEA to verify the findings of the RSAC. For this purpose, the IAEA shall perform independent measurements, and its verification shall take due account of the technical effectiveness of the State's system. Furthermore, the document foresees (Art. 31) that the IAEA, in its verification activities, shall make full use of the RSAC and shall avoid the unnecessary duplication of the RSAC/SSAC activities. These provisions should be reflected in the technical criteria adopted by the IAEA: INFCIRC/153 states that the criteria to determine the actual number, intensity, duration, timing and mode of routine inspections of any facility shall include the effectiveness of the RSAC/SSAC. In short, the clear purpose of all these provisions is to assign to the SSAC or RSAC the control of the facilities and to the IAEA the control of the SSAC or RSAC. This does not mean that the IAEA can not draw independent conclusions, but rather that, in order to draw independent conclusions, the IAEA does not need to repeat all the actions of the Regional System. Although the results from coordination of activities are in general satisfactory, a full implementation of the provisions of the Quadripartite Agreement is yet to be reached.

The Quadripartite Agreement establishes that ABACC and the IAEA shall apply nuclear safeguards in a coordinated and cooperative way. In order to obtain the maximum of efficiency and effectiveness, using the minimum effort and assuring independent conclusions from each organization, coordination and cooperation between ABACC and the IAEA while applying safeguards plays a major role.

In the last 20 years a significant effort was made by both Agencies to improve Coordination and Cooperation. Many accomplishments were reached in some areas, among which we can list:

- a- Documentation framework area:
 - Guidelines for inspection coordination between ABACC and IAEA; (coordination)
 - Procedures for Common Use of Equipment; (cooperation)
 - Procedures for special inspections; (coordination); (coordination)
 - Procedures for secure communication between ABACC and IAEA; (coordination)
 - Procedures for Nuclear Material Reporting from the States to the Agencies; (coordination)
 - Procedures for specific inspections (sensitive installations). (coordination)

- b- Concept and evaluation area:
 - Participation in special groups concerned with particular installations. Development of safeguards approach and procedures for especial installations; (cooperation)
 - Reclassification of installations by type; (coordination)
 - Implementation of new policies; (coordination)
 - Domestic transfer verification approach; (coordination)
 - Implementation of Short Notice random Inspections; (coordination)
 - Facility Attachment negotiations; (coordination)
- c- Inspection implementation area:
 - Planning of Inspections; (coordination)
 - Inspections programming avoiding operational conflicts; (coordination)
 - Optimization of PDI without losing effectiveness; (coordination)
 - The application of Joint Use of Equipment in inspections; (cooperation)
 - Procedures for specific inspections (sensitive installations). (coordination)
- d- Technical and operational support area:
 - Planning of equipment acquisition between the Agencies; (cooperation)
 - Comparison of DA analysis results; (cooperation)
 - Data analysis from NDA results applied to error calculation for equipment used at facilities; (cooperation)
 - Joint training on specific inspection approaches (sensitive installations); (cooperation)
 - Joint training of inspector on equipment and procedures applied in inspections; (cooperation)
 - To use the DA results from ABACC; (cooperation)
- e- Administrative Area:
 - Administrative procurement, transfer and management of samples and equipment;
 - Support to inspectors in ABACC area;
 - Payment and reimbursement of services provided at ABACC zone.

Most of the items listed above have been implemented and some of them will remain in “on going” status as long as the Agencies apply safeguards based on the Quadripartite Agreement. Any new subject with the potential for improving the safeguards system will become an active item in the coordination agenda.

5. Cooperation with European Commission and ESARDA

It is important to remark at this time when ABACC is celebrating two decades of existence the support and collaboration from the European Commission, particularly represented by Euratom - European Atomic Energy Community and the ESARDA - European Safeguards Research and Development Association.

At the very beginning ABACC looked for other organizations in which it should resemble and learn from its experience. Being the first regional system, Euratom emerged as the unique choice at the beginning. However, even though we had just one organization to function as a standard to implement the ABACC system, it was a surprise for ABACC’s staff to verify the efficiency and competence of this regional system. It was also with a great pleasure that we could find support and partnership from our older brother.

During an extensive period ABACC took advantage of the way that Euratom system was developed and the help from Luxembourg staff in how to implement ABACC’s safeguards system. Today, this spirit of collaboration remains and from time to time the two organizations get together to share their experiences. We can say that even the long distance and the slight difference on the framework has not impeded an open and fruitful collaboration between the two directorates.

ESARDA also played an important role on the tasks realized by ABACC on the last 20 years. ABACC is an observer member at ESARDA and it is allowed to participate at the ESARDA working groups since the beginning. The collaboration on the Techniques and Standards for Destructive Analysis,

Techniques and Standards for Non Destructive Analysis, Containment and Surveillance, Implementation of Safeguards and Training and Knowledge Management working groups were the more profitable examples of such collaboration. ABACC always participate at the main ESARDA events, like the annual meeting and the annual working groups' workshops.

ABACC is proud to recognise the support obtained and friendship developed with these high level international safeguards institutions.

5. Lessons learnt

It is not easy to summarize the experience and lessons learnt by a regional system in its first 20 years of existence. Some of the features are subjective and the experience is laying on the culture of the institution. However, we may state a few points:

- The exact role of ABACC in the non-proliferation profile of the two countries. Even though the non-proliferation status is a characteristic that the state has to gain or show, ABACC function as tool for that purpose and it has to act always as an organization that contribute for such objective;
- The relationship among the States and ABACC and the IAEA and ABACC is unique. ABACC plays in the middle of these players and ABACC has to balance the exact hole as a regional system, understanding the peculiarities of the countries and the requirements of an international system that tends to be uniform and mechanistic;
- The IAEA needs the support of other safeguards systems to accomplish its tasks;
- The new trends on international safeguards and the new technologies should be absorbed by ABACC and after the right understanding they should be transmitted to the states;
- To guarantee the credibility of the system, ABACC has to be independent of the states political line and at the same time to have it own technical criteria (which sometimes may be different from those of the IAEA);
- The most important characteristic of ABACC is its own technical competence and the acknowledgement of this competence by the international safeguards community;

6. Future trends

ABACC considers of fundamental importance and fully supports IAEA initiatives to define the conditions and activities pursuant to the State-level concept and to define State-specific safeguards objectives to be applied to a State and to use the current Safeguards Criteria as a menu of safeguards tools, not as a prescriptive requirement for safeguards application. In particular, ABACC considers that some basic documents should be prepared for the appropriate consideration of the regional safeguards international system, in particular:

- a) A complete description of the methodology for determining the State-specific Safeguards Technical Objectives that are intended to be used for a State safeguards evaluation. Such a description would allow to consider alternative safeguards activities for covering these objectives and facilitate the proper introduction of new safeguards tools, either because of new techniques (e.g. remote monitoring, environmental sampling) or because use is made of RSAC or SSAC resources.
- b) A scheme of the rules and criteria to be used for evaluating the objective elements of an RSAC or SSAC. This will allow both the IAEA to consider the eventual "delegation" of some verification activities and the RSAC or SSAC to consider improvements of its system for a better inclusion into the integrated scheme.
- c) A summary description of the basic rules that would be used to consider the less quantitative elements that shall be considered for evaluating the credibility and effectiveness of RSAC and SSAC. This will allow the States and the RSAC or SSAC to understand logical differences in the application of the state level concept as well as to promote changes aimed at increasing credibility and effectiveness of the local system.
- d) A summary description of the basic scheme of the quality assurance program to be used by the IAEA to confirm, on a continuous basis, that the RSAC or SSAC maintains its initial credibility and

effectiveness. This will allow the States and the RSAC/SSAC to be prepared for an extensive integration. It should be noted that increase integration would imply, inter alia, the presence of IAEA inspectors at the RSAC or SSAC headquarters for long periods of time or the sudden incorporation of an IAEA Inspector to an ongoing RSAC/SSAC inspection at a given facility.

7. Final remarks

The successful projects developed by ABACC and its partners in this field of safeguards have contributed for the application of safeguards in a more effective and efficient way contributing for non-proliferation. The ABACC Secretariat is proud to complete the 20th anniversary with an organization that is recognized for excellence in international safeguards. New challenges are coming for the years ahead, and the initial spirit and strength of ABACC organization remains for facing these challenges.

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