

30 years of ABACC: The Role of State Authorities in Supporting its Activities

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Abstract

The confidence-building process between Argentina and Brazil during the 1980s led to the signature of a unique safeguards' agreement in July 1991: The Agreement between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy. This "Bilateral Agreement" incorporated all the nuclear commitments already made by both countries and established the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), a binational organization aimed at the management and implementation of the Common System of Accounting and Control of Nuclear Materials (SCCC). Particularly, the "Bilateral Agreement" establishes that Argentina and Brazil "shall make their technical capabilities available to the ABACC in support of its activities". In this regard, the role of the State Authorities responsible for safeguards implementation in Argentina and Brazil is crucial. In the year of ABACC's 30th anniversary, the paper summarizes the experience of the Nuclear Regulatory Authority (ARN) of Argentina and the National Nuclear Energy Commission (CNEN) of Brazil in supporting ABACC activities during the past decade (2011-2021).

1. Introduction

This paper does not intend to address the historical process that led to the creation of the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), a subject thoroughly analyzed by academics and key actors [1], nor details about its link with the Agreement between the Republic of Argentina, the Federative Republic of Brazil, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials and the International Atomic Energy Agency for the Application of Safeguards [2] ("Quadripartite Agreement"). Rather, it focuses on the framework of the Agreement between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy [3] ("Bilateral Agreement") and in particular on the role that national safeguards authorities play within it.

It is important to emphasize the high-level political will behind the negotiations on the establishment of the ABACC, considering that the initial intention was the establishment of a cross control system. Argentina and Brazil developed the Common System of Accounting and Control of Nuclear Materials (SCCC), exchanged declarations of their respective States' initial inventories and even did one inspection in the other State's facilities. Nevertheless, with the aim of achieving transparency in the nuclear activities developed by both countries there was the decision to create an external body to implement this control. Therefore, following the construction of their bilateral relations, and after a series of relevant nuclear commitments during the 1980s Argentina and Brazil signed a unique safeguards' agreement in July 1991. Ratified only 5 months later, this "Bilateral Agreement" established the ABACC, with the mission of managing and implementing the SCCC.

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2. The SCCC and the ABACC

In order to guarantee Argentina, Brazil and the international community that all existing nuclear material and facilities under their jurisdiction or control are used exclusively for peaceful purposes, this being the basic commitment that the countries assume, the "Bilateral Agreement" establishes the SCCC.

The SCCC is "a set of procedures established by the Parties to detect, with a reasonable degree of certainty, that the nuclear materials present in all their nuclear activities are not diverted to nuclear weapons or other nuclear explosive devices, in accordance with the terms"¹ of the present Agreement. For its administration and application, the Agreement creates the ABACC and institutes for it two bodies: the Commission and the Secretariat.

The Commission, the governing body, consists of four members, two of them appointed by each Government. Currently the Commission is composed of the presidents of the national safeguards' authorities (the Nuclear Regulatory Authority of Argentina and the National Nuclear Energy Commission of Brazil) and representatives of the foreign ministries (Director of the Department of Defense and Security Affairs for Brazil and the Director of the Directorate of International Security, Nuclear and Space Affairs for Argentina).

The Commission is responsible for supervising the functioning of the Secretariat, appointing its professional staff, preparing the list of inspectors from among those proposed by the Parties to carry out the inspection tasks entrusted to them by the Secretariat, and requiring the constitution of ad-hoc advisory groups, as needed. In addition, before the governments of Argentina and Brazil, it must report annually on the application of the SCCC and inform the Parties of the non-compliance by one of the Parties of the commitments made under the Agreement.

For its part, the Secretariat is the executive body that develops the activities necessary for the application of the SCCC and represents the ABACC before the national authorities of both countries and before third parties. The Secretariat is made up of professionals appointed by the Commission and auxiliary staff. The senior officers are the secretaries, one of each nationality, who rotate annually in the performance of their duties as Secretary and Deputy Secretary.

In structural terms, besides the administrative auxiliary personnel, it is organized into six sectors: Planning and Evaluation, Operations, Nuclear Materials Accounting, Technical Support (all made up of two officers, one of each nationality), and Institutional Relations and the Administrative-Financial sectors that are occupied by a single officer.

It is important to note that, in the fulfillment of their duties, the professional officers of the ABACC do not represent or are part of the governmental structures of either of the two countries and cannot request or accept instructions from any government or from any authority outside the ABACC. In other words, their responsibilities are exclusively international.

¹ Art 1., Annex of Agreement Between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy, INFCIRC No. 395, IAEA, Vienna (1991).

In the same way, in the fulfillment of their missions, the inspectors are also international officers, and they undertake to regulate their conduct taking into account only the interests of the ABACC.

3. Support from national authorities to ABACC activities

The Nuclear Regulatory Authority (“Autoridad Regulatoria Nuclear”) –ARN- and the National Nuclear Energy Commission (CNEN) are the State Authorities responsible for safeguards implementation (SRA) in Argentina and Brazil respectively.

In 1997 the National Nuclear Activity Act [4], established ARN as an autonomous and independent body within the jurisdiction of the Argentine Presidency, empowered to regulate and control all nuclear activities in the country, with competence on four branches: radiological and nuclear safety, physical protection, safeguards and nuclear non-proliferation.

The Nuclear Regulatory Authority, as SRA, has the goal of ensuring that nuclear activities are carried out exclusively for peaceful purposes. Particularly, it established the guidelines of the State System of Accounting for and Control of Nuclear Material (SSAC) in Argentina [5] and the relevant safeguards requirements and procedures, in line with the international agreements on safeguards and non-proliferation. To verify the compliance of licensees, the ARN performs regulatory controls through its own body of inspectors and analysts and to enforce their compliance it has the power of applying sanctions.

Within this legal framework, the ARN has the appropriate authority to exercise safeguards oversight and control over all nuclear material and activities in Argentina.

Particularly, safeguards-related activities are coordinated and performed by two areas within the ARN: the Non-Proliferation Policies Division and the Control of Safeguards and Physical Protection Division.

The Brazilian Nuclear Energy Commission (“Comissão Nacional de Energia Nuclear”) -CNEN- is an independent federal organization created in 1962 by Law 4.118 [6], complemented with law 6.189 [7], with the main objectives and obligations of participating in the definition of the national nuclear energy policies, carry out the research, development, promotion and services in the area of nuclear technology and its application for peaceful purposes and regulating, licensing, authorizing and controlling nuclear and radioactive materials and installations in Brazil. According to Article 21, XXIII(a) of the Brazilian Federative Republic Constitution, enacted on 5 October 1988, all nuclear activity in national territory will only be admitted for peaceful purposes and upon approval of the National Congress.

In the context of the above CNEN as a regulatory body is the responsible for controlling all nuclear material and nuclear installations and represents Brazil in the implementation of international safeguards agreements signed by Brazilian Government. Since May 2021, the process of separation between regulatory and research and promotion functions in the nuclear area is underway. The regulatory agency was created by a decree of the Brazilian Presidency [8] and is now under approval by the Brazilian Congress.

The regulatory basis for nuclear material control and safeguards was established in 1982 by the Regulation CNEN-NN-2.02 of April 1982, revised in September 1999 [9] and complemented by the on line e-Gamma System [10], approved and published in Brazilian Federal Register in 2013, for use by the facility operators in real time, to request CNEN the authorization for

nuclear material transfers and for other inventory changes, for records keeping and CNEN approval and authorization, as well as for auditing by ABACC and IAEA.

As pursuant to Article XVI of the Bilateral Agreement, ARN and CNEN make their technical capabilities available to the ABACC in support of its activities. They also play an important role with respect to the joint implementation of safeguards by the IAEA and ABACC.

3.1. Human capital

Throughout the 30 years of its existence, the national authorities have contributed to the ABACC with their human capital, not only because of the commitment assumed by the governments and thus manifested in the Bilateral Agreement, but also because of their conviction.

Both organizations, based on the profiles and areas of knowledge of their personnel, contribute with experts to participate in specialized ad hoc groups of the ABACC; places at ABACC's disposal agents with training in safeguards and with experience in nuclear verification at the national level to integrate the body of inspectors that, during the exercise of their functions, depends exclusively on the ABACC. Historically, the ARN and the CNEN have been the areas in which an immense majority of the officers of the Secretariat have developed their careers, as is the case of the current secretaries of the ABACC.

Differently from the professional officers and administrative staff, the inspectors are not permanent ABACC personnel, but rather a group of professionals, designated as inspectors by the Parties, and selected by the Secretariat to work for the ABACC on a temporary basis to carry out verification activities.

It should be noted that one of the strengths of the inspection system lies in its highly specialized body of inspectors with a deep knowledge of the idiosyncrasies and socio-economic and political conditions of the region [11]. This body contemplates a wide variety of profiles, both in terms of academic training and specialization in the nuclear field, as well as in the tasks that they carry out on a daily basis in their institutions of origin.

On the one hand, the list is made up of technicians and professionals from the area of research, development and promotion of nuclear energy from both countries, including state agencies, universities and companies that operate laboratories, nuclear fuel cycle facilities and nuclear power plants. From this role, beyond being specialists in the different types of nuclear facilities, they are usually familiar with and/or receiving inspections from the ABACC and the IAEA, which represents "the opportunity to better understand both sides of the system, to be constantly informed of advances in both areas and, especially, understand the importance of implementing adequate control of nuclear materials and apply these concepts more efficiently in their routine work [12]".

On the other hand, the ABACC has inspectors, whose institution of origin are the national safeguards authorities of Argentina and Brazil, with experience in accounting and control of nuclear materials and specific training and practice in the field in the development of national inspections in their countries. For these national inspectors, the possibility of acting as regional inspectors represents an important step in their professional career paths and for the national authorities a more experienced staff with a broader level of understanding of the nuclear facilities in the region.

This list is completed by retired personnel, without a current formal link with national institutions or organizations. In addition to the fact that ABACC can take advantage of all their years of experience in the field, they have the benefit of having immediate availability to carry out inspections. Also, some of them are consulted as advisers for certain issues.

It should be noted that ABACC officials can also carry out inspections, but for this they must be part of the list of inspectors of the ABACC.

The other strengthening element of the system, thus recognized internationally, is the scheme of cross inspections known as “neighbors watching neighbors” [13], through which inspectors of Brazilian nationality inspect facilities under the jurisdiction of Argentina and vice versa.

Currently, the Secretariat has a list of 97 inspectors, 46 of Argentine nationality, 51 of Brazilian nationality, of which 26% are women and 31% come from the CNEN and the ARN, which shows the importance that the national safeguards authorities assign to this work and to the maintenance of the inspectorate of the bilateral system.

3.2. Coordination

During the past ten years, the plans in the nuclear field in ABACC area have expanded and materialized through the execution of different projects of considerable magnitude. In the area of reactors it is worth mentioning the construction of the CAREM 25 Modular Reactor, near Buenos Aires, the first SMR under construction in Latin America and of the LABGENE Reactor, in São Paulo area, the prototype of the future Brazilian naval propulsion nuclear reactor, and the development of the projects in Buenos Aires, of the RA10 Research Reactor and, in São Paulo, of the Multipurpose Reactor, both setting a standard for scientific development in the region, in addition to its capabilities for the production of radioisotopes for industrial and medicinal purposes. In addition, a dry storage of irradiated fuel assemblies entered into operation in the site of the Angra Nuclear Power Plants and the 8th Cascade of Module 3 in the Resende Enrichment plant of Brazil. Also, a new uranium dioxide conversion plant is under construction in the province of Formosa and projects for a dry storage of irradiated fuel elements and a new nuclear power plant are in advanced feasibility study in Argentina.

As Argentina and Brazil deepen and increase their nuclear development, new facilities are included under ABACC's safeguards. This implies new challenges in terms of how to interpret the principles for the application of safeguards and the coordination of their efforts for their effective control, such as the carrying out of inspections.

Currently in ABACC area there are 75 facilities and LOFs under safeguards in Argentina and Brazil and 220 annual inspections are carried out, on average, between national and international inspections. All of them are coordinated well in advance according to the operational schedule provided by the operators.

The regulatory authorities of Argentina and Brazil coordinates, respectively, the international inspections with ABACC and IAEA and the facility operators, participate in the pre-inspection meetings and in all the inspection activities in the field.

3.3. Cooperation

This section refers to the cooperation of the national authorities, directly and indirectly, with the ABACC.

Argentina and Brazil regulatory authorities have, respectively, a Cooperation Protocol in force since the 1990s [14], revised in case of CNEN in 2013 [15], with the objective of promoting collaboration, for example, in safeguards techniques, laboratories, equipment and other services of mutual interest.

One of the most traditional cooperative activity under this framework consists of the joint provision of training on non-destructive assay (NDA) for safeguards applications to ABACC inspectors. The training, carried out in ARN's [16] and CNEN's safeguards laboratories, covers subjects such as NDA techniques and equipment, operational procedures for equipment, software and measurements, ABACC/IAEA joint use procedures for common use of equipment, good practices and measurement acceptance criteria, and a regular training for ABACC and IAEA inspectors in procedures for unannounced inspections, in which part of the training is held at the Brazilian enrichment facility.

It is worth mentioning that this cooperation has always benefited both sides. Regarding education and training, for example, since most ARN and CNEN inspectors also serve as regional inspectors, they benefit from the ongoing training carried out for ABACC inspectors and the knowledge and skills that they experience as ABACC temporary staff during these trainings also improve their capacities as national inspectors. This ultimately strengthens the national safeguards systems of both countries, and these solid national systems have a positive impact on the tasks carried out by ABACC in compliance with its mission.

In addition, both ARN and CNEN maintain a strong connection with relevant foreign institutions to foster collaboration on safeguards matters. These have represented an opportunity of cooperation with the ABACC and the promotion of the regional safeguards implementation of the ABACC. In this sense, and as part of the activities developed under the Agreement between, respectively, ARN and CNEN and the Department of Energy of the United States, the regulatory authorities encourage the participation and involvement of the ABACC which, in turn, also has a cooperation agreement with the DOE.

For example, it is worth highlighting ABACC's role in the five-day training course on statistical methodologies for safeguards applications that was held in Buenos Aires in August 2018, covering measurement models, variance propagation techniques, statistical concepts in enrichment measurements, destructive analysis, sampling variability, neutron measurements, holdup and waste measurements, material balance evaluation, measurement errors, MUF, shipper/receiver difference and nuclear material measurements at the ABACC [17].

Also, ABACC contributed with its experience and delivered a presentation on "ABACC Safeguards Regional System: Experience and Cooperation" at a workshop on domestic safeguards inspections for countries in the Americas, attended by participants from eight countries and IAEA officers.

3.4. Technical activities

Argentina and Brazil have developed, with the support of ABACC, technical solutions to challenges in the implementation of safeguards that, in some cases, have had an impact beyond the regional scope.

A concrete example of these developments, which represents a relevant contribution to the international community for the more efficient application of safeguards, is the uranium hexafluoride (UF₆) sampling method for the determination of enrichment, called "ABACC-Cristallini" [18].

This method for safeguards purposes promoted by ABACC presents benefits compared to the traditional method, including the reduction of the amount of nuclear material collected, thus minimizing costs, and facilitating the transport of samples [19].

From the beginning and during the validation process, ABACC had the constant support of the States, in terms of their technical and human capacities, and the commitment of the national authorities through their national support programs to IAEA safeguards.

It should be noted that the ABACC-Cristallini method achieved in 2019 the certification of the American Society for Testing and Materials (ASTM) for its use in nuclear facilities around the world and, within the framework of the Member State Support Programme (MSSP), the IAEA is testing the method in enrichment facilities of other countries that have expressed their interest in applying it. An important development was implemented by CNEN this year 2021, by providing ABACC and IAEA with the opportunity to collect samples from the process lines of the Enrichment Plant of Industrias Nucleares do Brasil (INB), using the ABACC-Cristallini Method, for further chemical and isotopic analysis and confirmation of the method reliability.

It is also worth mentioning the adoption of devices such as the Laser Curtain for Containment (LCCT), in the Dry Storage of Irradiated Fuel Elements of the Atucha I Nuclear Power Plant in Argentina, developed with the support of ABACC, based on the need to have a dual containment system for this new Building. For this, Argentina put its technical capacity and facilities at the service of ABACC for the technical validation of the LCCT [20] [21].

4. Conclusions

In the year of ABACC's thirtieth anniversary, there is no doubt about the degree of maturity that it has reached, together with international recognition as an agency with technical solvency and equipped with duly qualified and experienced staff. It should also be recognized that the State Authorities responsible for safeguards implementation in Argentina and Brazil have played an important role in supporting ABACC activities along the way.

The regional safeguards system between Argentina, Brazil and ABACC has reached considerable technical maturity both in the use and development of new methodologies as well as in the training of its human resources.

However, due to the development of the nuclear plans of Argentina and Brazil, new challenges are envisaged that will demand creativity and innovation in the definition of the control criteria to be applied.

During the next few years, challenges in the application of regional safeguards must be addressed, such as the multipurpose reactors in both countries, CAREM 25 Reactor and the LABGENE Reactor.

Other aspects that should be considered are the decommissioning of facilities, the incorporation of new safeguards technologies, generational change and knowledge transfer.

In this sense, the constant support of the national authorities, as part of the sustained commitment of both States over time, will continue to be a central element of the success of ABACC in its function of guaranteeing the peaceful use of nuclear materials in the region.

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