ABACC AND EURATOM: A REFLECTION OF THE PAST AND FUTURE COOPERATION BETWEEN REGIONAL SAFEGUARDS ORGANIZATIONS

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Abstract

ABACC (the Brazilian-Argentine Agency for Accounting and Control) and EURATOM (the European Atomic Energy Community) are the two only regional safeguards organizations in the world, which together have over 90 years of cumulative safeguards experience. For decades, these two organizations have coordinated and cooperated with the IAEA in applying the verification agreements in their individual regions of the world. Recognizing common challenges and opportunities, ABACC and Euratom signed a cooperation agreement in 1999, providing a framework for the exchange in technical and operational safeguards matters. The paper reviews the experience under the ABACC/Euratom cooperation agreement and reflects on future challenges and opportunities, including on facilitating and promoting the efficiency and the effectiveness of IAEA safeguards implementation.

1. INTRODUCTION

ABACC (the Brazilian-Argentine Agency for Accounting and Control) and EURATOM (the European Atomic Energy Community) are the two only regional safeguards organizations in the world. They result from the confidence building process between their respective Member States and underpin their cooperation in the peaceful uses of nuclear energy. Both organizations are key to the implementation of international safeguards in collaboration with the IAEA (International Atomic Energy Agency) in their respective geographies and provide the foundation for continued non-proliferation assurances both to their respective Member States and the international community.

The two organizations have long recognized that they share common challenges and sought opportunities for collaboration. This led, in 1999, to the signature of a cooperation agreement [1] between ABACC and EURATOM, providing a solid framework for the exchange in technical and operational safeguards matters. The most recent initiative of collaboration took place at the Tenth Review Conference of the Treaty of Non-Proliferation of Nuclear Weapons (NPT) in August 2022, on the occasion of a European Union (EU) side event

(regarding safeguards at a regional level) in which ABACC collaborated. The event showcased how regional safeguards, such as those implemented by the EURATOM and ABACC, further transparency and mutual confidence between States, strengthen non-proliferation assurances and the implementation of international safeguards. It is also worth mentioning the special panel organized at the 2021 INMM/ESARDA Joint Annual Meeting on international-regional cooperation as a basis to ensure safeguards effectiveness and efficiency. Here, again, high-level experts shared their experience in the implementation of international and regional safeguards aiming at sharing lessons learned and making proposals to further enhance cooperation.

Though sharing many common traits, ABACC and EURATOM have unique individual legal frameworks. Consequently, safeguards implementation by these two regional safeguards organizations and, especially, cooperation with the IAEA in implementing international safeguards, is particular to each organization.

The paper highlights both differences and communalities and identifies safeguards challenges and opportunities for ABACC and EURATOM collaboration. It begins, in section 2, with a brief description of the history and legal framework of the individual organizations. Section 3 provides further details on the cooperation with the IAEA in implementing the respective safeguards agreements and the challenges posed by this collaboration to the individual regional organizations. Section 4 reviews the main achievements of the technical cooperation between ABACC and EURATOM. Finally, section 5 reflects on how best to leverage this cooperation to enhance efficient and effective application of safeguards together with the IAEA and meet future safeguards challenges.

2. ABACC AND EURATOM: HISTORY AND LEGAL BACKGROUND

2.1. ABACC history and legal background

On July 18, 1991, Argentina and Brazil signed an Agreement for the Exclusively Peaceful Use of Nuclear Energy[1] that entered into force in December of the same year, after approval and ratification of the Congresses of the signatories States (known as the Bilateral Agreement). This Agreement expresses the commitment of Brazil and Argentina to use nuclear energy only for peaceful purposes and establishes a common verification system applied to all nuclear materials and activities in both States, "the SCCC"[2], to verify the fulfilment of their non-proliferation undertakings. Furthermore, this Agreement establishes the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials – ABACC –as an independent intergovernmental organization empowered to administer and implement this regional safeguards. Worth noting that right after the entry into force of the Bilateral Agreement, Argentina, Brazil and ABACC approached the IAEA to negotiate a comprehensive safeguards agreement (CSA) based on the model of INFCIRC/153 (Corrected), signed also in 1991, which entered into force in March 1994. This Agreement is known as the "Quadripartite Agreement" [2]. This regional-international safeguards verification model was at the time of its establishment, and still is, an innovation within the international nuclear non-proliferation and safeguards regimes which constitutes a tangible contribution to peaceful uses of nuclear energy and regional and international peace and security.

Therefore, ABACC is a technical specialized organization, entrusted to administer the SCCC and to draw independent conclusions of these two countries with fully-fledged peaceful nuclear programs, through inspections and other technical activities and evaluation criteria and measures to verify that nuclear materials are not diverted towards the manufacture of nuclear weapons or any other nuclear explosive device.

ABACC performs its duties within a unique cross-inspection regime through a cadre of highly qualified inspectors and international officers. Currently ABACC has 95 inspectors to carry out verification activities at the 75 facilities under safeguards in Argentina and Brazil under the purview of its technical Secretariat composed by senior officers of both nationalities working hand in hand, guided by a shared deep commitment to fulfil its mandate. ABACC inspectors are nuclear fuel cycle and safeguards specialists that reside in their respective countries and are called by the Secretariat on demand. ABACC works under a strict policy and rules of

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[1] "Agreement between Argentina and Brazil for the Exclusively Peaceful Use of Nuclear Energy" – www.abacc.org.br

[2] "Common System of Accounting and Control of Nuclear Materials" – SCCC – www.abacc.org.br

confidentiality, the validity of which does not expire, even when the officials and the inspectors have ceased to belong to the agency.

Thus, ABACC's Secretariat is responsible for the execution of the verification system and the coordination with the IAEA safeguards activities in both States. The ABACC's Commission is ABACC's policy making organ and is composed by four Members, two from Argentina and two from Brazil. Its main duty is to provide guidance to the Secretariat on the fulfilment of its verification mandate. The Commission has both the responsibility and the duty to inform the Governments of both countries of any anomaly occurring in the course of the SCCC verification.

Over more than thirty years of existence, ABACC has performed more than 3500 inspections to nuclear facilities in both countries to verify more than 4500 SQ[3] of nuclear material based on States Declarations under the Bilateral Agreement. Accountancy and design information verification are key to the SCCC. These measures are complemented by technologies related to containment, surveillance and radiation detection systems, among other means.

2.2. EURATOM history and legal background

The Treaty establishing the European Atomic Energy Community (EURATOM) [3], henceforth the EURATOM Treaty, was signed in Rome in 1957, and is one of the founding treaties of what is today the European Union (EU). The treaty stemmed from the recognition by EURATOM's six original Member States (Belgium, Germany, France, Italy, Luxembourg and The Netherlands) that the peaceful use of nuclear energy constituted a powerful resource for development which could only be exploited to its full extent, in a safe and peaceful manner, by their joint effort.

Under the treaty provisions, the EURATOM Community (the words EURATOM or Community are used interchangeably in the text) is given a separate legal entity, and charged with contributing *"to the raising of the standard of living in the Member States and to the development of relations with the other countries by creating the conditions necessary for the speedy establishment and growth of nuclear industries."* [4]. Note that Member States are free to choose their energy mix and opt for nuclear power or not[5].

Among the different tasks the Community is charged with, it is specifically requested to *"make certain, by appropriate supervision, that nuclear materials are not diverted to purposes other than those for which they are intended"*[6]. To this end, the treaty confers, on the one hand, a number of powers and obligations on the European Commission (the supranational institution created under European Union law to apply the treaties, with particular coordinating, executive and management functions), and, on the other hand, duties and obligations on nuclear operators and Member States.

The powers and obligations of the European Commission include the power to send inspectors to the territories of the EURATOM Member States, who shall *"at all times have access to all places and data and to all persons who, by reason of their occupation, deal with materials, equipment or installations subject to the safeguards"*[7]; these inspectors, recruited by the European Commission, are responsible for obtaining and verifying the information supplied by nuclear operators under their reporting obligations and communicate any infringement to the Commission. The inspections may not be opposed or in any way delayed. The European Commission also has the power to impose sanctions directly on nuclear operators and issue directives to Member States.

Obligations for nuclear operators include the declaration of the basic technical characteristics of the installations - to the extent the knowledge is necessary for the attainment of safeguards objectives- and the keeping and transmission to the European Commission of records permitting the accounting for nuclear materials under safeguards. Member States have the duty to facilitate the work of the European Commission and take *"all*

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[3] Significant Quantity

[4] cf. article 1 of the EURATOM Treaty.

[5] cf. article 194 of the Treaty of the Functioning of the European Union [4].

[6] cf. article 2(e) of the EURATOM Treaty.

[7] cf. article 81 of the EURATOM Treaty.

appropriate measures /…/ to ensure fulfilment of the obligations out of this [EURATOM] Treaty or resulting from action taken by the institutions of the Community."[8]

Finally, the EURATOM Treaty also tasks the Community to *"promote research and ensure the dissemination of technical information"*[9] and gives the European Commission the task to establish a Joint Nuclear Research Centre. The Joint Research Centre (JRC) has evolved to become the Commission's science and knowledge service, with a wide portfolio of activities, including beyond nuclear. The JRC maintains several research and development activities in the field of safeguards, including in collaboration with international partners, such as ABACC (see section 4).

Further details on EURATOM's legal framework can be found in references [5] and [6].

The EURATOM Treaty entered into force in 1958. For 64 years, the European Commission has applied safeguards in all the EURATOM territory to all nuclear materials in peaceful use[10] and provided assurances of non-diversion and compliance with international obligations.

As the Non-Proliferation Treaty (NPT) [7] opened for signature in July 1968 and entered into force in 1970 and EURATOM's non-nuclear weapon (NNW) Member States became signatories to the NPT, it became necessary, under the terms of article III(1) of the NPT, to conclude and bring into force a safeguards agreement with the IAEA. In addition, to promote acceptance of the IAEA safeguards system, France and UK[11], at the time the two nuclear weapon States party to EURATOM, both concluded voluntary offer safeguards agreements (the UK has since withdrawn from EURATOM and the EU). Thus, the following safeguards agreements were concluded:

- INFCIRC/193 [8], a comprehensive safeguards agreement between the IAEA, EURATOM and the (at the time) seven NNWS, signed in 1973 and entered into force in 1978; currently, all 26 NNW EURATOM Member States (Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden) are party to this safeguards agreement.
- INFCIRC/290 [9], a voluntary offer agreement between the IAEA, EURATOM and France signed in 1978 and entered into force in 1981.

Given the powers assigned by the Members States to EURATOM and its institutions via the EURATOM Treaty (and the general legal framework established under European Union law), these safeguards agreements recognise the EURATOM safeguards system, its supranational character and exclusive competences in the territory of its Member States, and include particular principles for collaboration between the IAEA and EURATOM. Section 3.2 provides details on the cooperation between EURATOM and the IAEA, with a focus on implementation of INFCIRC/193.

3. IMPLEMENTATION OFABBAC'S AND EURATOM'S SAFEGUARDS AGREEMENTS WITH THE IAEA AND ITS CHALLANGES

3.1. ABACC

Cooperation is an indispensable component of the peaceful uses of nuclear energy and the successful, efficient and effective implementation of regional and international safeguards. In particular, cooperation is fundamental to develop and implement good practices and methodologies to fulfil each organization' mandates and, at the same time, minimize the duplication of activities.

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[8] cf. article 192 of the EURATOM Treaty.

[9] cf. article 2(a) of the EURATOM Treaty.

[10] cf. article 94 of the EURATOM Treaty regarding the limits of EURATOM safeguards.

[11] Agreement of 6 September 1976 between the United Kingdom of Great Britain and Northern Ireland, the European Atomic Energy Community and the Agency in Connection with the Treaty of the Non-Proliferation of Nuclear Weapons, INFCIRC No. 263, IAEA, Vienna (1978).

Since the entry into force of the Quadripartite Safeguards Agreement, the SCCC has been implemented in full coordination with the IAEA in accordance with that agreement. For more than twenty-five years, the IAEA and ABACC have been cooperating and making progress to jointly improve the coordination of their respective activities in order to avoid unnecessary duplication of safeguards efforts, while maintaining the principle that both organizations shall be able to reach independent conclusions.

The Quadripartite agreement, and in particular its Protocol, describes the provisions related to the coordination and cooperation between the IAEA and ABACC. Article 1 of the Protocol notes that:

"In implementing these arrangements, the Parties to the Agreement shall be guided by the following principles:

(a) the need for ABACC and the Agency each to reach its own independent conclusions;

(b) the need to co-ordinate to the extent possible the activities of ABACC and the Agency for the optimum implementation of this Agreement, and in particular to avoid unnecessary duplication of ABACC's safeguards;

(c) when performing their activities, ABACC and the Agency shall work jointly, wherever feasible, in accordance with compatible safeguards criteria of the two organizations; and

(d) the need to enable the Agency to fulfill its obligations under this Agreement taking into account the requirement for the Agency to preserve technological secrets."

The good results obtained in the coordination of activities between the IAEA and ABACC throughout more than 25 years reflect the high level of understanding and cooperation reached by both organizations. Based on the past experience and the lessons learnt to date, ABACC is of the view that there are opportunities to expand and optimize further this cooperation as foreseen in the agreement and as part of the evolution of safeguards.

Under the provisions of the Quadripartite and the Technical Cooperation agreements and guidelines between ABACC and the IAEA [10], both agencies have established several mechanisms and procedures to coordinate and to cooperate in carrying out their activities. The Liaison and Liaison Sub-Committees foreseen in the Protocol to the Quadripartite Agreement, together with the ABACC-IAEA Coordination meetings provide the framework to consider and review the performance of the co-ordination arrangements between the IAEA and ABACC.

To ensure a good implementation of their respective verification systems, ABACC and the IAEA develop and agree on SCCC/Safeguards approaches, joint inspection and equipment/technology procedures and other guidelines and working documents. Of special note is the performance of joint auditing activities during the inspections of the nuclear material inventories of both countries based on a specific software developed by ABACC and approved by the IAEA for joint use (NSJAR)[12] which permits each agency to perform this important inspection activity in an efficient and effective manner.

Moreover, the IAEA/ABACC agreement on procedures for joint use of equipment, technologies and methods is of the utmost importance to maintain the technical cooperation at the highest possible level and enable use of state-of-the-art technology, as well as ensure efficiency and effectiveness of each agency's safeguards while avoiding unnecessary duplication of verification efforts and minimizing the burden for nuclear facilities.

ABACC and the IAEA work in a well-coordinated way under their respective internal rules and guidance to acquire and approve the containment and surveillance equipment, non-destructive assay (NDA) equipment and other technologies for use in safeguarding nuclear material and facilities in Argentina and Brazil. However, in light of the increasing relevance of the use of reliable, secure and effective technology and the expansion of the nuclear activities in these two States, ABACC considers that having a mechanism in place to regularly exchange views and directions regarding technology and to continue working in defining procedures and guidelines that facilitate the "joint use" concept, would be beneficial in terms of enhancing the efficiency and effectiveness of regional and international safeguards.

With this in mind, and considering the theme of the 2022 IAEA Safeguards Symposium: "Reflecting on the past and anticipating the future", ABACC is of the view that one area of particular attention for the future, in terms of opportunities, is the consideration of the increasing role that technology plays in safeguards' approaches at nuclear installations and the related rules and practices that each agency has to follow to approve its use in a way that promotes further the concept of joint use.

[12] The New Software for Joint Auditing of Records ABACC – IAEA ABACC system.

In addition, as it may be expected that nuclear energy will play an increasing role in addressing current and future challenges in vital areas for humankind and the environment, IAEA safeguards should seek to prepare for the increase of the peaceful uses of nuclear energy in an efficient and effective way. The use of innovative technologies and the development of new concepts and approaches to respond to the changes in the nuclear technology area, including the fullest possible sharing of safeguards technology and methods among interested parties, are part of the measures that could serve this purpose.

In concrete terms, an important area that would merit further reflection refers to the IAEA approach towards the selection of the technology for safeguards. ABACC believes that the IAEA could promote and prioritize the development of technology that meets the condition of common use and develop procedures and acceptance and security criteria that can be fully shared for joint approval with regional safeguards agencies. Equally important is seeking for ways to promote and facilitate a broader use of regional agencies' capabilities. These examples of partnership approaches may well serve some of the future challenges.

In summary, sharing technology and verification methods and techniques for effective and efficient safeguards at regional and international levels will continue to be of paramount importance. Therefore, it would be important to work together with the IAEA in sharing perspectives and directions of future technology and defining procedures for validation, certification or authorization of technologies that ensure the early and full participation of ABACC, thus ensuring the timely approval of the use of these technologies for in-field use.

3.2. EURATOM

The Safeguards Agreement concluded pursuant to the NPT between the NNW States of the European Union, EURATOM and the IAEA (INFCIRC/193), entered into force in 1978. The Agreement, and specifically, its Protocol, provide for a very close collaboration between the IAEA and EURATOM, with due consideration given to the supranational character of EURATOM and its institutions.

The European Commission, acting for the EURATOM Community, and in its role of Regional System of Accounting and Control (which it had held, by 1978, for 20 years already), provides the IAEA with all relevant safeguards information as required under the terms of the INFCIRC/193, namely concerning nuclear material and information on nuclear facilities[13]. The European Commission also agrees directly with the IAEA on Subsidiary arrangements.

The main principle of cooperation between the IAEA and EURATOM, enshrined in the Protocol, is that the application of safeguards under the agreement shall avoid duplication of EURATOM's safeguards activities. To this end, inspections (either routine or for the purpose of verification of design information) are carried out jointly. The scheduling and planning of inspections is carried out by EURATOM, in cooperation with the IAEA.

Originally, joint inspection activities were conducted following the "observation principle". This principle was based on the concept that the IAEA would, whenever it could achieve its objectives by so doing, observe the inspection activities of EURATOM. Where greater inspection effort was required, the IAEA and EURATOM cooperated on the basis of a "joint team", avoiding, by the sharing of tasks, duplication of work, and consequently reducing the duration of inspections and intrusiveness to the operator.

These arrangements, though effective, did not provide for efficiency. As such, in 1992, after a common reflection by the IAEA and EURATOM, a new collaborative approach was agreed between the two organizations: the New Partnership Approach, endorsed by the IAEA Director General Hans Blix and the European Commission's Commissioner for Energy Cardoso e Cunha [11], [12].

The NPA is based on the following elements [11]:

"(a) optimizing the necessary practical arrangements and using commonly agreed safeguards approaches, inspection planning and procedures, inspection activities, and inspection instruments, methods and techniques;

(b) avoiding unnecessary duplication of effort by performing inspection activities based on the principle "one-job-one-person," supplemented by quality control measures to enable both organizations to satisfy their respective obligations to reach independent conclusions and required assurances;

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[13] This information, under the provisions of the EURATOM Treaty, is provided directly to the Commission by nuclear operators (see section 2).

(c) sharing analytical capabilities in order to reduce the number of samples to be taken, transported and analysed;

(d) co-operating in research and development and in the training of inspectors with the aim to reduce resources spent by both sides and to encourage commonly agreed products and procedures; and

(e) increasing common use of technologies to replace, to the extent possible, the physical presence of inspectors by appropriate equipment."

The objective of the NPA is to strengthen safeguards collaboration between IAEA and EURATOM, taking both effectiveness and efficiency of safeguards into account while allowing both organizations to reach their own independent conclusions and required assurances.

The Liaison Committee foreseen in the Protocol to INFCIRC/193 has played an important role in the practical implementation of the NPA and is the cornerstone of the coordination between EURATOM and IAEA in implementing safeguards under the Agreement. It meets in two configurations, the Higher Level Liaison Committee (HLLC) and the Lower Level Liaison Committee (LLLC). The HLLC is responsible, inter alia, for the main policy decisions and the review of the coordination arrangements. The LLLC, which reports to the HLLC, deals with the technical aspects of the IAEA and EURATOM collaboration under INFCIRC/193, including those related to effective and efficient safeguards implementation (safeguards approaches at individual facilities or facility types, inspection activities and procedures, inspection planning, joint training, use of common instruments, sharing of analytical capabilities, identification of common equipment needs of the IAEA and EURATOM and sharing the costs of equipment purchase, etc.).

A changing nuclear landscape, with new installation types coming into construction and operation, and an acceleration of safeguards technology, including new instruments and/or new uses (e.g., the unattended use of special safeguards equipment, possibly with the concomitant remote transmission of data) have brought new challenges to the EURATOM/IAEA collaboration. These include, for example, challenges related to the approval and use of common safeguards instruments with the IAEA, an essential tenet of the NPA to avoid duplication.

These challenges are not unlike those described in section 3.1 above, thus providing, through communality, an opportunity to enhance collaboration between ABACC and EURATOM, and, ultimately, to improve the collaboration with the IAEA in application of the safeguards´ agreements.

Finally, it is to be noted that this year EURATOM and the IAEA celebrate the 30 years of the NPA. With all its challenges, this collaborative approach has considerably improved the efficiency and effectiveness of safeguards implementation by avoiding the unnecessary duplication of effort and costs and allowing both organizations to meet their safeguards goals in a robust manner and draw independent conclusions.

4. MAIN ACHIEVEMENTS OF THE TECHNICAL COOPERATION BETWEEN ABACC AND EURATOM

The relationship between ABACC and EURATOM and the contribution of this cooperation to the effective application of regional and IAEA safeguards, dates back a long time. The Cooperation Agreement between ABACC and the European Atomic Energy Commission was signed in February 10, 1999 [1] based on the interest of both parties to stimulate cooperation in research and development in the field of nuclear safeguards. Prior to this agreement, both organizations were already cooperating, exchanging experience and information in safeguards areas of mutual interest.

During the first stage of cooperation, there were frequent exchanges of experience between EURATOM and ABACC, as well as the development of technical projects on containment and surveillance systems, characterization and supply of nuclear material standards, exchange of experience on safeguards operations, including the analysis of safeguards regional systems role, safeguards criteria and approaches, unattended systems for verification of nuclear material, and the exchange of experience on common use of equipment with the IAEA, nuclear material accountancy and inspectors training.

As an example of those years of collaboration, a technical meeting between EURATOM, the IAEA, ABACC and DoE (United States Department of Energy) was organized by ABACC to discuss" Containment and Surveillance Systems Technologies for Safeguards Applications" with the overall objective of providing a forum to exchange experiences and information about the status of the applications of containment and surveillance systems for safeguards purposes, developments and trends in this field. Technologies such as the Next Generation

Surveillance Systems (NGSS), at present in safeguards routine use worldwide, the Digital Multi-channel Optical Surveillance System (DMOS), the Electronic Optical Sealing System (EOSS) or the Ultrasonic Sealing Bolt for CANDU systems, were some of the systems addressed.

More recently in time, the "Collaborative Project between ABACC and the European Commission on Strengthening the Safeguards Capabilities" was implemented with JRC. The aim of the project was the transfer of technology and equipment and the training on methodologies related to the use of instruments. Two tasks were considered. The first was one on the area of 3D Laser Verification for detecting minute spatial changes in a nuclear site (indoor application) of potential use on verification of Plant Design and Layout. The second one was the development and testing of ultrasonic seals for containing spent fuel in a complex storage environment. Both technologies, 3D Laser Verification and Ultrasonic Seals, were developed by the JRC-Ispra.

The technical cooperation has been also relevant in the area of UF6 analytical verification for safeguards purposes. An exercise organized by ABACC in cooperation with DoE that involved laboratories of Argentina, Brazil, Europe, IAEA and United States to validate the Method ABACC-Cristallini for UF6 sampling in enrichment and conversion plants was an important milestone.[14]

This exercise concluded that the ABACC-Cristallini UF6 sampling method provides comparable results to a direct hydrolysis method for uranium isotopic determinations. The ABACC-Cristallini UF6 sampling method has been embedded in the ASTM International C1880-19: Standard Practice for Sampling Gaseous Uranium Hexafluoride Using Alumina Pellets in 2019. This has been an important step in contributing to more efficient and simpler safeguards method. At present, within ABACC-IAEA and the IAEA States Support Programs to Safeguards, work continues to test the method in commercial enrichment plants.

Another relevant aspect of the cooperation refers to one of the most powerful techniques in terms of verification of safeguards, such as the analysis of swipe samples, especially for enrichment facilities. JRC-Karlsruhe provides the particle analysis of ABACC verification samples.

More recently, ABACC and the IAEA have approved for use in safeguards a 2D Laser technology system developed by the JRC for the containment of a dry storage of irradiated fuel under construction at the Atucha I Nuclear Power Plant of Argentina.

These are examples that show the contribution of the cooperation between regional and international institutions to more effective and efficient safeguards.

4. OPPORTUNITIES FOR ENHANCED COOPERATION BETWEEN ABACC AND EURATOM

EURATOM and ABACC are committed to enhancing their cooperation further. Two very important components of the current and future cooperation are the exchange of best practices and lessons learnt in implementing ABACC's and EURATOM's respective obligations as well as the identification of state-of-the-art technologies that could improve the efficiency and the effectiveness of safeguards.

The safeguards challenges identified in section 3, including, but not limited to, the development and/or deployment of safeguards technology that meets the condition of common use with the IAEA, create an opportunity to enhance the collaboration. ABACC and EURATOM have identified the following possibilities for further collaboration:

- Participate jointly in initiatives related to the evolution of technology and concepts for safeguards;
- Support research and development (R&D) of technology and knowledge sharing and networking in the safeguards and non-proliferation community; this can be done through direct collaboration in the R&D field and through coordination and collaboration, e.g., under the IAEA Member States Support Programmes (which, for the European Commission, is coordinated by JRC) or through Cooperation Agreements (in the case of ABACC).
- Organize and offer training on specific safeguards topics to their respective inspectorates;

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[14] The worldwide joint validation program carried out in 2016 included laboratories of the European Commission, such as the JRC-Geel (Directorate G - Nuclear Safeguards and Forensics, European Commission, Belgium), LANIE-CEA/Saclay (Laboratoire de Development Analytique Nucleaire, Isotopique et Elementaire, France) and the JRC-Karlsruhe (Directorate G - Nuclear Safeguards and Forensics, Analytical Service, European Commission, Germany).

- Establish an informal trilateral venue, such as dialogue forum, where both organizations and the IAEA could discuss topics of mutual interest to ensure efficient and effective safeguards in their respective regions.

Looking beyond the cooperation agreement between EURATOM and ABACC, and in view of extending the networking and knowledge sharing base, it is relevant to mention the signature of a "Memorandum of Understanding" between ESARDA (the European Safeguards Research & Development Association) and ABACC in 2021 to expand the collaboration in areas of mutual interest. In addition, and in the same light, EURATOM and ABACC could envisage training of safeguards inspectorates at SSACs[15], regional and international safeguards levels, as well as sharing experience and networking with other relevant associations, such as the Asian Pacific Safeguards Network and the African Commission on Nuclear Energy and other stakeholders.

5. CONCLUSIONS

Cooperation to ensure effective and efficient regional/international safeguards is of the essence to an adequate response to challenges and opportunities, now and in the future. A high level of technical cooperation, between EURATOM, ABACC and the IAEA namely in developing and deploying safeguards technology and implementing their respective verification systems, is not only desirable, but necessary and, arguably, even mandatory.

Cooperation between all the parties involved in implementing safeguards is essential to guarantee effective and technically robust conclusions on the fulfilment of safeguards objectives at the lowest possible costs and minimizing the interference to the normal operation of nuclear facilities.

The commonalities between ABACC and EURATOM with respect to the coordination with, and the contribution to, IAEA safeguards have been a shared ground and guided their relationship over time. Maintaining and enhancing the coordination and the cooperation with the IAEA safeguards by both EURATOM and ABACC are permanent objectives of these organizations and will continue to guide their relationship with the IAEA.

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