

Connector

Issue 7 | Autumn 2022



EDITORIAL

by Julie Oddou (ESARDA President)

Dear Reader,

All good things must come to an end!

It has been a real honour and pleasure to serve as ESARDA President during these two years.

Despite all obstacles, I am delighted that we have managed to maintain this link in Europe and overseas through ESARDA. My only regret is not having been able to welcome you in France and that we had so few occasions to

meet in person.

On the other hand, virtual meetings have increased the frequency of exchanges and the number of members and participants. It has been especially beneficial to colleagues and students from other continents. The number and geographical repartition of participants in the numerous virtual ESARDA meetings is indicative of this contribution of video-conferences.

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This issue features:

- A synthesis of the feedback of a survey on the way of implementation of Safety, Security and Safeguards carried out among 11 countries



Photo of attendees of the ESARDA Annual Meeting in the Luxembourg Congress Centre, in May 2022. In the forefront J.Oddou, ESARDA President, and next to her, W. Janssens, former ESARDA President.

Recently, we signed an MoU with ABACC - Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials. After many years of participation in ESARDA meetings, it was time to achieve a formal collaboration document between ESARDA and ABACC.

We also welcomed one new Party with Westinghouse Electric Belgium.

The future will be to achieve a balance between virtual exchanges and face-to-face meetings, which are finally essential to strengthen ties. The 44th ESARDA Annual Meeting in Luxembourg in May was a great occasion to see all colleagues and to exchange views on emerging and disruptive information technologies for Safeguards and on SMRs. It is my desire that the upcoming 2022 Safeguards Symposium and the 2023 Joint INMM/ESARDA Annual Meeting will also be successful events for the whole Safeguards community to meet in the nice "Atoms for Peace" city of Vienna.

In May 2022, the 20th edition of the ESARDA Course on Nuclear Safeguards and Non Proliferation brought together 116 participants, 47 from Africa and 5 from Asia. The ESARDA Course Syllabus, Edition 2022, is in the last stages of editing and should be available before this Connector issue.

We made some progress in our external communication, both with the Bulletin and the Connector.

Recently, Scopus has confirmed that it will upload all ESARDA Bulletin articles from 2017 onwards (2017-2020). Therefore, four years of articles will be available for citation in Scopus.

With the approval of the new status and role of the Editorial Committee, which is now an institutional committee that follows all topics relevant to communication within the association, I hope we will continue to improve in this area.

I wish all the best to Mari Lahti, the future ESARDA President!



Logos of ABACC and Westinghouse, the former signed a collaboration agreement and the latter a party agreement with ESARDA.

news & events

Keeping you up to date with all the latest news of the association and its partners, as well as all the upcoming events in the near future.



NEWS

INMM/ESARDA Joint Annual Meeting 2023 Call for Papers

INMM and ESARDA encourage you to submit an abstract for the Technical Program of the INMM & ESARDA 2023 Joint Annual Meeting, to be held in Vienna, Austria from May 22-26. The theme for this meeting is Atoms for Peace: Evolution of Technologies for the Future.

The Technical Program is seeking contributions that reflect the diverse scope and common goals of our organizations, on all aspects of nuclear materials management – from nuclear material control, safeguards, non-proliferation, materials disposition, and nuclear security to advancements in the nuclear fuel cycle, strategic trade control and the growing contributions of nuclear techniques used for to sustainable development around the world.

Abstracts must be submitted by **December 9**, to be considered for acceptance. An extension is expected.

[Read more.](#)

New ESARDA Course Syllabus Released

Since the first ESARDA Course was organised in 2005, the organisers and lecturers provid-

ed a first draft of the Course Syllabus. Since its first release many things in the safeguards world have evolved and changed. This new volume reflects these changes and includes an updated overview of nuclear safeguards and non-proliferation overall.

[Read more.](#)

Strengthening the Nuclear Material Control Systems in Africa

The African Commission on Nuclear Energy (AFCON), which has recently signed a collaboration agreement with ESARDA, is preparing to launch an ambitious five-year programme “Strengthening the Nuclear Material Control Systems in Africa” in 2023, that aims to collectively uplift nuclear safeguards in Africa. This programme will be implemented with the expert support of one of ESARDA’s historical partners, the Radiation and Nuclear Safety Authority of Finland (STUK) and will be financed by the European Union and the Republic of Finland.

Read the [press release](#).

INMM 2022 & INMM/ESARDA 2021 plenary session recordings

INMM have announced the publication of plenary sessions on their Youtube channel. The videos also include the INMM/ESARDA 2021 Joint Annual Meeting sessions:

- Keynote speaker: Director General Rafael M. Grossi, International Atomic Energy Association
- Plenary Speaker: Ms. Jill Hruby, Deputy Secretary of U.S. DOE and Head of NNSA
- Industry Perspective Plenary featuring

View the [plenary sessions](#).

IAEA Launches New Safeguards Glossary

The IAEA’s Safeguards Glossary, a reference book released this week explains the specific terminology related to safeguards in an accessible way. The Glossary ensures safeguards practitioners are ‘on the same page’, use the same definitions, and can therefore work together more efficiently.

As IAEA Deputy Director General and Head

of the Department of Safeguards, Max Aparo said, “Our new Safeguards Glossary is our authoritative reference for the terms that we use in implementing safeguards,”

[Read more.](#)

ESARDA Bulletin Scopus Citation Index Update

The ESARDA Editorial Committee was set up ten years ago as a working group with the scope to handle all matters related to the association’s publication portfolio (Bulletin, proceedings and Course Syllabus). Up until then, the ESARDA Secretariat handled all matters concerning the publications. However, since the decision to transition the ESARDA Bulletin into a fully peer-reviewed publication, and the subsequent workload increase, the Editorial Committee working group was created.

The Editorial Committee meets twice a year to validate the editorial process and take related decisions (topics, guest editors, choice of reviewers). Its members elect the Chair of this committee for a two-year renewable mandate. His or her job is to monitor the publications’ editorial process and website at regular intervals, and to pursue contacts with contributors and authors, as well as with the publishers and the distributor.

Heading the ESARDA Bulletin (The International Journal of Nuclear Safeguards and Non-Proliferation) are the Editor and Deputy Editor, assisted by the members of the Editorial Committee, comprised of experts in the journal’s field. The role of the Committee in-

cludes:

- Review and suggests potential reviewers for submitted manuscripts.
- Advise on journal policy and scope.
- Identify topics for special issues.
- Attract new authors and submissions.
- Promote the journal to their colleagues and peers.
- Assist the editor(s) in decision making over issues such as plagiarism claims and submissions where reviewers can’t agree on a decision.

Currently the Editorial Committee is also in charge of the newsletter, the Connector, launched in 2019. The Connector is coordinated by the Editorial team, and is released twice a year, in spring and autumn. The Connector is not simply a newsletter, as apart from informing the community regarding the latest activities of the Association it also includes technical articles, position papers, and student articles.

During the 2022 ESARDA Annual Meeting, the Executive Committee agreed that the Editorial Committee’s role did not reflect the true nature of a working group, where regular outputs were expected, but rather played an institutional role as a service provider on all matters related to the communication strategy of the Association. As such, the Executive Committee formalised the new institutional role of the Editorial Committee, outlining a new set of rules and responsibilities. These included also broader communication aspects that the Editorial Committee will also be involved with, such as the overall communication strategy of ESARDA, including the website, promotional material and the coordination of events.

EVENTS

<p>2023 April 24-28</p>	<p>24th - 28th April 2023 21st ESARDA Course Joint Research Centre of the European Commission, Ispra (VA), Italy The JRC announces the 21st ESARDA COURSE on Nuclear Safeguards and Non Proliferation to be held in spring 2023. Organised by the Training, Knowledge Management Working Group. [Read more]</p>	 <p>ESARDA Course</p>
<p>2023 May 22-26</p>	<p>22nd - 26th May 2023 INMM & ESARDA Joint Annual Meetings Vienna, Austria Join INMM and ESARDA for their second annual Joint Annual Meeting to be held at the Austria Center in the vibrant, dynamic city of Vienna! The program will include plenary sessions, technical talks, poster presentations, exhibits, and a return to face-to-face, in-person networking! [Read more]</p>	 <p>INMM & ESARDA JOINT ANNUAL MEETING <i>atoms for peace</i> EVOLUTION OF TECHNOLOGIES FOR THE FUTURE 22-26 MAY, 2023 AUSTRIA CENTER VIENNA, AUSTRIA</p>
<p>2023 June 12-16</p>	<p>12th - 16th June 2023 International Conference on Advancements in Nuclear Instrumentation Measurements Methods and their Applications (ANIMMA) Lucca, Italy The eighth of a series of conferences devoted to endorsing and promoting scientific and technical activities based on nuclear instrumentation and measurements. [Read more]</p>	 <p>ANIMMA LUCCA 2023 JUNE 12-16 REAL COLLEGIO - ITALY</p>
<p>2023 June 19-23</p>	<p>19th - 23rd June 2023 CTBT: Science and Technology conference series (SnT2023) Vienna, Austria The CTBTO relies on innovation to enhance the capabilities of the Treaty's verification regime as well as to help move the Treaty closer to universalization and entry into force. [Read more]</p>	 <p>SnT 2023 CTBT: SCIENCE AND TECHNOLOGY CONFERENCE 19 TO 23 JUNE HOFBURG PALACE, VIENNA & ONLINE</p>
<p>2023 September 24-28</p>	<p>24th - 28th September 2023 International Thorium Energy Conference (iThEC23) Geneva, Switzerland The international Thorium Energy Committee iThEC is organizing, in cooperation with the European Organization for Nuclear Research CERN and the International Atomic Energy Agency IAEA, iThEC23, an international conference on thorium as a sustainable energy resource. [Read more]</p>	 <p>iThEC23 INTERNATIONAL THORIUM ENERGY CONFERENCE 2023</p>

2023
October
9-11

9th - 11th October 2023

Fifth Technical Meeting on Statistical Methodologies for Safeguards

Virtual meeting

The International Atomic Energy Agency is organizing (IAEA) the 5th Technical Meeting on Statistical Methodologies for Safeguards.

[\[Read more\]](#)



INMM & ESARDA
JOINT ANNUAL MEETING
atoms for peace
EVOLUTION OF TECHNOLOGIES FOR THE FUTURE
22-26 MAY, 2023 | AUSTRIA CENTER
VIENNA, AUSTRIA

INMM
INSTITUTE OF
NUCLEAR MATERIALS
MANAGEMENT

ESARDA
European Safeguards Research & Development Association

The banner features a background image of a modern building with a curved facade and many windows. The text is overlaid on a dark blue and green circular graphic. The INMM logo is on the left, and the ESARDA logo is on the right.

new partners

New partners have the opportunity to present their organisation's activities and how they can contribute to ESARDA.

ABACC

BRAZILIAN-ARGENTINE

**AGENCY FOR ACCOUNTING
AND CONTROL OF NUCLEAR
MATERIALS**

More than 30 years of cooperation in the implementation of Regional and International Safeguards

by M.A. Marzo and
S. Fernández Moreno (ABACC)

ABACC, is a regional safeguards organization established by Argentina and Brazil in 1991. ABACC's mission to verify the exclusively peaceful use of nuclear energy undertaking assumed by two countries with relevant fuel cycle nuclear activities has been established in an agreement known as "The Bilateral Agreement" [1]. A comprehensive safeguards agreement between Argentina, Brazil, ABACC and the IAEA, known as the "Quadripartite Agreement", entered into force in March 1994 [2].

ABACC is an intergovernmental organization of technical nature with its own legal authority and independence to apply the verification system provided for in the Bilateral Agreement – The SCCC [3] to all nuclear materials in all nuclear facilities of the two countries. ABACC has under its purview seventy-five facilities and about 4500 significant quantities of nuclear material. The fuel cycle activities of the countries encompass uranium conversion, fuel fabrication, enrichment, research and power reactors, spent fuel dry storages and other activities. ABACC is structured in a Secretariat and a policy decision making organ, the Commission. The Secretariat is composed by senior experts and more than ninety ABACC inspectors designated by the two countries. The inspectors are called on demand to fulfill the annual safeguards verification plan established by the Secretariat every year.

To accomplish its technical objectives and to draw robust safeguards conclusions ABACC carries out an average of hundred inspections per year and dedicates an effort of more



Agência Brasileiro-Argentina de Contabilidade e Controle de Materiais Nucleares

Agencia Brasileño-Argentina de Contabilidad y Control de Materiales Nucleares

than one-thousand inspectors-day annually based on technical criteria, procedures and approaches which considers the design and operational information of the nuclear facilities under control. Over thirty years more than three-thousand inspections have been performed, including three-hundred unannounced and short-notice inspections. Despite all restrictions caused by the Covid-19 pandemic, ABACC was able to comply with its annual verification plan in 2020 and 2021.

Cooperation in Safeguards:

Since its creation, ABACC Secretariat was oriented to establish strong technical cooperation ties with diverse regional and international organizations. Cooperation towards effective and efficient safeguards has been essential and has been a permanent characteristic of ABACC activities. Since the entry into force of the Quadripartite Agreement and trough more than 25 years, ABACC and the IAEA have been successfully coordinating on the imple-



ABACC in numbers for 2021

mentation of their respective safeguards. In general, ABACC cooperation arrangements have been focused in the following three areas:

1. Development, acquisition and tests of NDA, C&S equipment and other technologies

ABACC had to equip itself from scratch with adequate organization and technical capacities to fulfill its mission. Therefore, since the beginning ABACC gave priority to acquiring portable NDA and other equipment to enable the verification activities in the field. The fast evolution of NDA technologies required a lot of efforts and investments to maintain along the time the latest international standard that is a pre-requirement to get efficient and effective safeguards and to draw robust and credible safeguards conclusions. This also applies to other technologies for safeguards use.

2. Training of inspectors

The unique characteristic of ABACC’s inspectorate model requires an intensive inspector’s training. ABACC inspectorate is formed by Argentinean and Brazilian safeguards and nuclear fuel cycle experts ABACC has developed an extensive training program to ensure the inspectors’ adequate skills and knowledge, including the training in NDA measurements and C&S

3. Qualification of Argentinean and Brazilian analytical laboratories that support ABACC’s activities

The analytical laboratories network that performs DA analysis for ABACC shall maintain qualified results on uranium and U-235 determination. This has to be periodically confirmed through the laboratories’ participation in regional and international programs of intercomparison exercises.

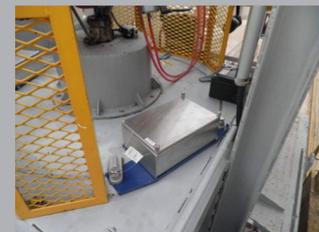
The cooperation in research and development of technology as well as the knowledge sharing and the networking of the safeguards

ABACC SG ACTIVITIES DURING THE GLOBAL CRISIS POSED BY THE PANDEMIC OF COVID19



- ABACC restricted its activities at HQ to the minimum essential – home-office modality.
- SCCC/SG activities during the pandemic of covid-19 were conducted successfully under a complex and stressful context.
- ABACC/IAEA/Argentina and Brazil have strongly cooperated to carry out critical verification activities.
- Critical role of national authorities.

Non-Destructive Assay (NDA) by Unattended Neutron Passive Measurements



Unattended Monitoring of Spent Fuel Transfers using the Mobile Unattended Neutron Detector (MUND) at a power reactor in Argentina

and nuclear non-proliferation community were instrumental for the consolidation of ABACC. Table 1 summarizes the main ABACC’s international cooperation agreements and arrangements oriented to cooperate on the above-mentioned areas.

Table 1: List of ABACC’s main international cooperation agreements

Agreement/Arrangements	Date
US-Department of Energy	1994
IAEA	1998
EURATOM	1999
KINAC – Republic of Korea	2006
ESARDA	2022



Picture of the signature of ABACC-US/DOE cooperation agreement in 1994



Picture of the signature of ABACC-IAEA Technical Cooperation Agreement in 1998

In 1999, ABACC and EURATOM signed the cooperation agreement that formalized the technical cooperation that already existed [4]. Many projects related to C&S and training have since then been developed and successfully concluded under this agreement, in particular those related to development and test of Laser 2D Curtain Containment and 3D Laser Scanning Systems and ultrasonic seals. It should be also noted that all environmental samples collected by ABACC's inspectors are analyzed by the Institute for Transuranium Elements (ITU) in Karlsruhe.

Over 30 years ABACC's officers have been participating in ESARDA Working Groups and

exchanging knowledge in the various areas of safeguards verification NDA techniques; on containment and surveillance systems and other technologies and concepts to ensure efficient and effective safeguards.

Few words about ABACC and ESARDA cooperation:

On the basis of the ESARDA initiative to deepening the bonds with ABACC and other organizations in areas of mutual interest, a Memorandum of Understanding (MoU) [5] on Cooperation in the Area of International and Regional Safeguards and Nuclear Materials Management was signed in 2022.

This MoU reflects the desire of both organizations to cooperate in advancing, promoting and improving the quality, effectiveness and efficiency of nuclear safeguards implementation in ABACC/ESARDA regions and worldwide.

The cooperation envisaged in this MoU is supportive of:

1. building and sustaining national, regional and international nuclear safeguards capabilities;
2. promoting regional cooperation in nuclear safeguards application and practices; and

3. facilitating the coordination and provision of nuclear safeguards technical cooperation.

Among the areas of cooperation it is worth noting the exchange of information on the enhancement of techniques, technologies and methodologies (e.g., nuclear material accounting and control, containment and surveillance, destructive and non-destructive methods and analysis); the participation of ABACC in the ESARDA Working Groups; the promotion and undertaking of collaborative R&D and information exchange on safeguards subjects of mutual interest (e.g., sharing of safeguards knowledge and best practices); the participation in each other's training courses as trainers and trainees and collaboration in other educational activities of mutual interest. Another relevant area for cooperation is the exchange of information on safeguards concepts and approaches with experts from operators, State and regional (EURATOM/ABACC) authorities, the industry and research institutions.

Within this framework the coordination and support of training, education and knowledge management on safeguards regionally and globally is of particular interest for both organizations. The increase of the nuclear activities for peaceful applications both in extent and complexity in the foreseeable future requires the existence of well-trained and educated new generations of people. The education of

national, regional and international safeguards inspectors as well as the support to create and sustain technically robust "State Systems of Accounting and Control of Nuclear Materials" (SSAC), together with the promotion of safeguards culture among all the interested actors, especially the Operators of nuclear facilities will continue to be crucial in the coming years. Equally important is the research and the development of verification techniques and technologies that complement the safeguards inspectors' activities in the field. The cooperation of regional and international safeguards needs to be enhanced to promote further the development of technology of joint use. Following this orientation would increase both, the efficiency and the effectiveness of safeguards.

Remarks:

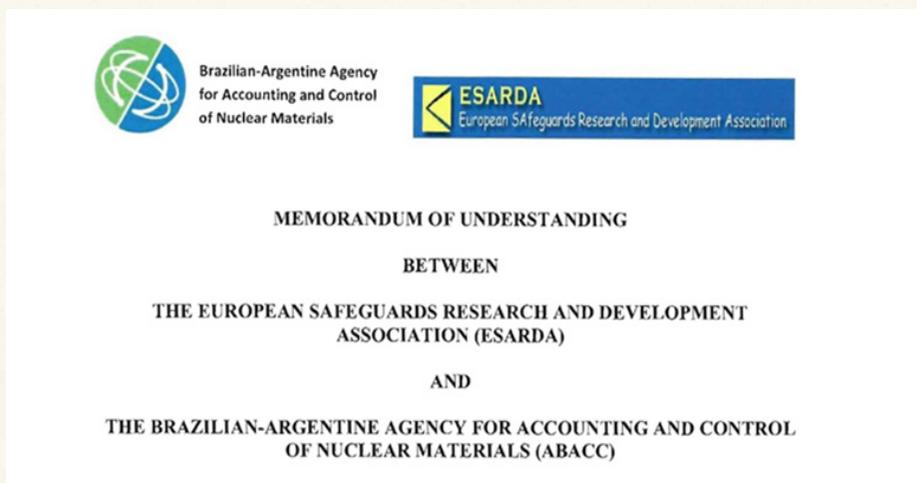
After the first stage of cooperation, ABACC has continued giving high importance to regional and international cooperation to ensure efficient and effective safeguards. The exchanges on technologies and concepts for safeguards, the knowledge sharing of the safeguards community, the training and the promotion of a safeguards culture and the research and development are fundamental to the robustness, transparency and credibility of the safeguards system.

The cooperation between regional safeguards organizations like ABACC and the EURATOM,

the IAEA, associations like ESARDA and the INMM as well as other partners, serves to further the shared objective of ensuring the safe and peaceful use of nuclear energy for the benefit of mankind. ABACC, as a unique model of regional safeguards verification and confidence building, applauds cooperative initiatives like the one taken by ESARDA and is committed to continue enhancing the cooperation with relevant organizations and associations devoted to safeguards and non-proliferation.

References:

- [1] Agreement Between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy (Bilateral Agreement) – www.abacc.org.br
- [2] Agreement of 13 December 1991 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 (INFCIRC/435) – www.abacc.org.br
- [3] Common System of Accounting and Control of Nuclear Materials (SCCC) - Bilateral Agreement
- [4] Cooperation Agreement N° 14445-1998-11 S0PC SIP BR between the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) and The European Atomic Energy Community.
- [5] Memorandum of Understanding on Cooperation in the Area of International and Regional Safeguards and Nuclear Materials Management.



Picture of the Memorandum of Understanding signed between ABACC and ESARDA

working group reports

This section of the Connector has the objective to inform the ESARDA Community about the latest undertaking of the Working Groups' activities during the last six months. Each Working Group Chair has been invited to provide a brief overview of findings in their fields of interest.

CONTAINMENT AND SURVEILLANCE WORKING GROUP (C/S)

by Katharina Aymanns (C/S Working Group Chair), and Heidi Smartt (C/S Working Group Vice-Chair)

The Containment & Surveillance (C/S) working group meeting took place during the 44th ESARDA Annual Meeting in May'22. The hybrid meeting was attended by 32 colleagues. The WG's mission is to provide the safeguards community with expert advice on C/S instruments and methods as well as acting as a forum for exchange of information of these. In this regard, the following topics were addressed and discussed during this meeting:

- "Overview of Swedish final disposal activities and safeguards challenges", Jan-Olov Stal (SKB)
- "Progress with the Encapsulation Plant - Safeguards", Olli Okko (STUK)
- "Integration of Safety, Security & Safeguards requirements as part of GDF design process & UK's GDF Strategy", Will Haynes (ONR)
- "Laser Curtain for Containment and Tracking (LCCT)", Vitor Sequeira (JRC Ispra)
- "Use of legged robots for nuclear safeguards, Vitor Sequeira (JRC)
- "Hey Inspecta", Heidi Smartt (SNL)
- "Fiber Optic Sensing for Surveillance of In-ground Long-term Storage – FOS-SILS", Jim Garner (ORNL)
- "PUCK and PUCK/SAW Loop Seals", Heidi Smartt (SNL)
- "The Field Verifiable Passive Seal", Alex Enders (IAEA)
- "Remote Monitoring and Automation of Signal processing: Updates and new developments", Andreas Smejkal (EURATOM DG ENER)
- "Master on Nuclear Safeguards", Katharina Aymanns (FZJ)

An important highlight of the meeting was the presentation of a new safeguards sealing system. After forty years of using the metal cap



"Field Verifiable Passive Seal" (FVPS), courtesy of IAEA

seal the IAEA has issued a new development in 2020 to improve the current passive sealing system. The agency aimed to enhance this tool by allowing for example in-situ verification and tamper indication in the field. As a result, the new "Field Verifiable Passive Seal" (FVPS) system has been developed and was currently approved for safeguards use. Alex Enders from the IAEA gave a presentation on the development process and the technical features of the new FVPS system. The start of the in-field deployment of this seal is planned to begin in June 2022.

STANDARDS AND TECHNIQUES FOR DESTRUCTIVE ANALYSIS WORKING GROUP (DA)

by Evelyn Zuleger (DA Working Group Chair), Philip Kegler (DA Working Group Vice-Chair), and Brian Ticknor (DA WG Chair, INMM)

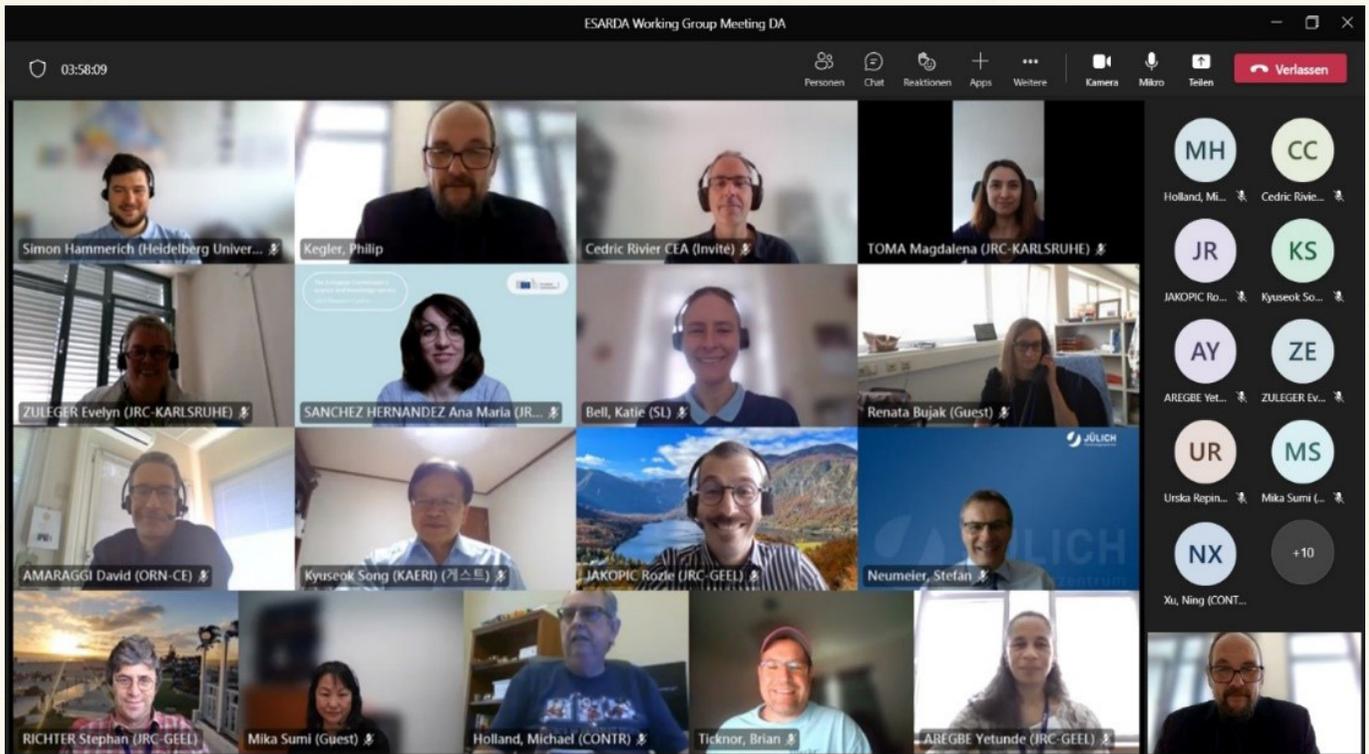
During the ESARDA Annual Meeting in Luxembourg a Working Group Meeting on Standards and Techniques for Destructive Analysis (WG DA) was organised as a hybrid meeting with around 24 participants mainly from Europe. However, the DA WG of the INMM has been again invited to participate to join

forces. The picture below shows a snapshot of the DA WG meeting.

Organisationally, Evelyn Zuleger (JRC Karlsruhe) and Philip Kegler (Forschungszentrum Jülich GmbH) are appointed Chair and Vice-Chair, respectively for the next 2 years. Both gratefully acknowledge the work of Stefan Neumaier in the last 2 years and the presenters contributing to the DA WG meeting. Stefan Neumaier presented the DA WG activities on the world Café actions, especially actions on the topics 1,4,5,6,9, and 10 were addressed. Members should provide individual world café actions to the DA WG chairs in order to collect them and to transfer them to the steering committee. Please find here the new link to the World Café Report: https://esarda.jrc.ec.europa.eu/world-cafe-report-2019_en for inspiration.

DA members are heavily involved in teaching and education, e.g. in the framework of safeguards courses and the recently launched Specialising Master Program in Nuclear Safeguards organised by the European Nuclear Education Network (ENEN). Rozlé Jakopič presented the Module 7 on Destructive Analysis for this course, which was developed in cooperation between JRC Geel, JRC Karlsruhe and the IAEA. The module was, even with the high technical content, highly appreciated by the students and students were evaluating the module with high scores.

In addition, together with the NDA and TKM WG a joint meeting was held to discuss the



Screengrab of the DA WG meeting on May, 3, 2022 in Luxembourg.

experience of the organizers and the teachers regarding the first master course for safeguards. ENEN informed that a second course will start in 2023, however the duration will be extended to 15 month rather than 12 month to give the students more time to attend and prepare the material required for passing the course.

A discussion on "Technical Sheets" for the various methods typically used in Safeguards took place and a decision was taken to re-establish them. It was decided, that the technical Sheets are of great values for students, inspectors and are good tools for conversation between the various working groups as well as for the public. A pre-requirement is that these documents are publically available on the ESARDA-webpage. Nine presentations provided a snapshot of the status and perspective of DA activities in the last year.

Pete Mason provided an update on the NBL activities. Since 2 years NBL is now part of the NSSA and the operation and proficiency testing program are separated. Y12 is now the primary storage and shipping place and allows about a 50 shipments per year with a turno-

ver time of < 30 days. All infrastructure has now improved and a collaboration with NIST is established to have an independent evaluator of all reference materials. In addition, the Standard Material Evaluation program (SME) is re-established underpinned with a quarterly newsletter and a new website: <https://www.energy.gov/nnsa/nbl-program-office>.

CETama and JRC Geel provided an update on production and recertification of reference materials and announced future inter laboratory tests.

Update were provided on the safeguards laboratory status of NML IAEA and the JRC Karlsruhe. Both laboratories are after Covid 19 restrictions in full operation again.

FZ Jülich and the University Heidelberg presented their progress of systematic studies on shelf life and start to produce a new particle reference material requested by the IAEA.

New insights of Thermoluminescence measurements for nuclear forensic were presented by Rob Hayes, NCSU.

Together with the NDA working group a joint meeting was held on the status of the review of International Target Values (ITV) 2022. For the majority of the DA related ITVs 2010 are kept. However, a lot of work was done to have more granularity in the DA tables as well as moving tables to NDA or creating as in the case of COMPUCEA new ones. Still the narratives are to be finalized. Soon IAEA will provide an online platform, which will be available for the safeguards community. In addition a continuous update of the ITV's is supported from the review board rather than a 10 years review cycle.

The INMM DA WG meeting adjacent to the 63. Annual INMM 2022 has invited also the ESARDA DA WG for participating.

As a next step the ESARDA WG DA is planning to prepare and discuss again together with the INMM counterpart the contributions on the next INMM-ESARDA Annual Meeting in 2023 in Vienna.

A lot of progress was achieved in the last year, despite of the still lasting pandemic situation, regarding the development and provision

of reference materials, the development of analytical techniques incl. the availability of state-of-the-art analytical tools as well as the organisation and conduction of international interlaboratory comparison exercises.

After the replacement of the IAEA responsible for the ITVs on DA members from INMM and ESARDA participated in several expert group meetings and contributed significantly to the revision of the International Target Values (ITV).

Last but not least, DA members are heavily involved in teaching and education, e.g. in the framework of safeguards courses and the recently launched Specialising Master Program in Nuclear Safeguards organised by the European Nuclear Education Network (ENEN). It turns out that comprehensive overlap and supplementation exist between the INMM and ESARDA activities and that both working groups as well as the IAEA will benefit from an intensive exchange between the experts. The DA WG will continue and strengthen the relationship between INMM and ESARDA by continuing the organisation of Joint INMM/ESARDA WG-DA meetings in the future.

The ESARDA WG DA will meet and discuss again together with the INMM counterpart at the ESARDA 44th Annual Meeting in May 02-06, 2022 hopefully in-person in Luxembourg.

FINAL DISPOSAL WORKING GROUP (FD)

by Klass Van der Meer (FD Working Group Chair), and Mentor Murtezi (FD Working Group Vice-Chair)

Final Disposal WG was formed in 2019; its creation was encouraged by results of the world café organized during 2019 ESARDA Symposium in Stresa, Italy. In fact, EPGR topics were discussed across many WGs and we decided it is time to gather them together under a topical WG.

The 1st meeting happened in February 2020 in

Mol (just at the onset of COVID-19 pandemic). At this meeting the WG's Terms of Reference were formulated.

Unfortunately, our planned annual meeting did not happen in 2021, however, in August 2021 during the INMM/ESARDA Joint Annual Meeting the final disposal topics were addressed during a panel dedicated to "C/S and NDA Safeguards Measures for Facilities at the Back End of the Fuel Cycle".

Throughout 2020 and 2021, mainly in cyberspace, safeguards concepts, tools and ongoing R&D projects were discussed between operators of nuclear facilities, safeguards inspectorates and scientific community.

In 2022, during the 44th ESARDA Annual Meeting, a short FD WG session was attached to the IS WG proceedings. The following topics were discussed:

- Safeguarding geological disposals - towards the implementation stage in Finland – a status update by safeguards inspectorates (Mentor Murtezi, EURATOM)

SG approach principles, CoK assurance, remote monitoring and inspecting/decision making process and platform, greenlighting concept

- Characterisation and Safeguards Verification of SNF at Clink (Jan-Olov Stal, SKB)

Status update of the Swedish geological disposal project: principles for joint NDA before encapsulation and transfer to GR, CoK, licencing procedure and expected Swedish GD project timeline

- Update on Cigéo: the French Deep Geological Repository Project (Pascal Leverd, ANDRA)

Status update: public hearings, licencing, system testing, and expected project timeline

- NDA for final disposal (Topi Tupasela & Tapani Honkamaa, STUK)

PNAR development: good results obtained during testing, in Finland PGET is intended for deployment, together with PGET, for NDA of SF to be encapsulated sent to GR

Future:

In the 2nd half of 2023 we are planning to organize a WG meeting in Finnish Olkiluoto. Exact dates will be communicated soon.

IMPLEMENTATION OF SAFEGUARDS WORKING GROUP (IS)

by Marko Hämäläinen (IS Working Group Chair), and Marianne Calvez (IS Working Group Vice-Chair)

The Implementation of Safeguards Working Group (IS WG) is a horizontal issues working group of ESARDA. Its objective is to provide the Safeguards Community with proposals and expert advice on the implementation of safeguards concepts, methodologies and approaches aiming at enhancing the effectiveness and efficiency of safeguards on all levels. This WG is also a forum for exchange of information and experiences on safeguards implementation.

In 2022, the working group has so far organized one meeting and that occurred in connection with ESARDA's annual meeting in May. The meeting was organized in a hybrid mode, with a total of about forty people, half of whom participated in person in Luxembourg and half of whom participated virtually. It was the first IS WG meeting organised also in person on site after the appearance of Covid.

The meeting was dedicated to traditional IS working group topics, such as round table discussions and current SG activities by the IAEA and EC since the previous working group meeting. The second day was partly organized together with the final disposal working group (FD WG) to discuss current topics such as safeguarding disposal facilities and the NDA for final disposal of spent nuclear fuel, both

of which are also interesting from the point of view of the IS WG. Cooperation between working groups is always advantageous and the IS WG plans to continue this in the future as well.

In the implementation of safeguards, it is essential to ensure the continuity of information and the preservation of safeguards data. Thus, the WG took the opportunity to have Cindy Vestergaard from the Stimson Center (USA) present the work done for STUK on distributed ledger technology (DLT) to track asset transactions; blockchain is a subset of DLT. Stimson has developed a DLT prototype called SLAFKA to manage nuclear safeguards data, and the benefits of nuclear safeguards to operators, state regulator, Euratom and the IAEA were discussed: using DLT would reduce the risk of errors and facilitate monitoring of transactions between the parties.

The IS working group usually holds a two-day meeting twice a year. So, at the moment, the plan is to organize a working group meeting during the fall somewhere where the group can get to know the safeguards implementation of the state in question. And this meeting is to be organized partially in a hybrid mode, so that even those members who cannot travel would have the opportunity to participate and contribute.

TRAINING AND KNOWLEDGE MANAGEMENT WORKING GROUP (TKM)

by Riccardo Rossa (TKM Working Group Chair), and Pierre Funk (TKM Working Group Vice-Chair)

The ESARDA TKM working group scheduled its annual meeting during the ESARDA annual meeting that was held in hybrid form from 2nd-6th of May 2022 in Luxembourg and on-line. The WG meeting included four presentations: (1) ESARDA Course 2022 and Status of the ESARDA Course Syllabus (K. Abbas, JRC-Ispra); (2) Online Training Course Develop-



2022, ESARDA Course screengrab

ment (M. Baldassari, IAEA); (3) Tools and Approaches for Knowledge Retention at IAEA (S. Hambaryan & M. Galindo-Arranz, IAEA); The Professional Development Program at INMM (M. Sharp, ORNL & T.-A. Wellington, NNSA).

During the ESARDA annual meeting the TKM working group also held a joint WG meeting on “Organizer’s and Teacher’s experiences gained in the first round of the Master on Nuclear Safeguards”. The First Level Specializing Master on Nuclear Safeguards is organized by the Politecnico di Milano and the European Nuclear Education Network (ENEN) in the frame of the SATE project (<https://www.nuclearsafeguards.polimi.it/>). This meeting allowed a discussion among representatives from each module already completed in the Master to identify strengths and weaknesses of the Master. As result of the discussion a call for volunteers was launched across ESARDA to: (1) review the training material developed for the first edition of the Master, (2) develop one extensive table-top exercise to be used throughout the second edition of the Master. People interested in these activities can contact the TKM WG chair at rossa@sckcen.be.

The 20th ESARDA Course on Nuclear Safeguards and Non-proliferation was held from 16th-20th of May 2022 and co-organised by the European Commission’s Joint Research Centre (Ispra) and the ESARDA TKM Working Group. Considering the success of the previous edition, the ESARDA Course has been held on-line also for the 2022 edition. The 20th ESARDA Course had 116 registrations

from 37 countries out of four continents (Europe, Africa, America and Asia). For the first time in the ESARDA Course the participation from African countries equalled the one from European ones.

VERIFICATION TECHNOLOGIES AND METHODOLOGIES WORKING GROUP (VTM)

by Zoe Gastelum (VTM Working Group Chair)

The Verification Technologies and Methodologies (VTM) working group is a horizontal working group which aims to evaluate the potential technical opportunities and challenges of new technologies and methodologies – and novel uses of existing technologies and methodologies - to the verification of nuclear safeguards, arms control, and other non-proliferation agreements.

Since our last Communicator update, VTM has held a joint technical exchange on synthetic data and a traditional working group meeting. Each activity is described below.

Joint Technical Exchange on Synthetic Data

On March 30 and 31, 2022, the VTM working

group held host a virtual joint technical exchange with the Institute of Nuclear Materials Management (INMM) Open Source and Geospatial Information (OSGI) working group on the use of synthetic and proxy data for nuclear safeguards and non-proliferation research and development activities. Our two-day exchange engaged more than 20 participants on diverse topics related to the use of synthetic data to support nuclear nonproliferation research and development. The technical exchange included presentations on synthetic State safeguards declarations to the International Atomic Energy Agency, simulations that modeled safeguards equipment responses to a variety of material diversion and processing scenarios, inserting synthetic text to emulate relevant events for natural language processing, and synthetic video, gamma spectra, and imagery to support machine learning and deep learning applications.

May Working Group Meeting

On May 4, 2022, VTM held a hybrid Working Group meeting as part of the ESARDA Annual Meeting. The VTM meeting was held in two parts: research updates, and strategic planning. Research updates from VTM members included:

- Verification in a complex and unpredictable world: Social, political and technical processes (VeSPoTec), presented by Irmie Niemeyer of the Jülich Research Center (FZJ).
- Detection of partial defects in spent fuel assemblies using Artificial Neural Networks, presented by Moad Al-dbissi of the Belgian Nuclear Research Center, (SCK-CEN).
- Extracting Verification-relevant Information from Geospatial Big Data, presented by Lisa Beumer of the Jülich Research Center (FZJ).
- Inferring Nuclear Histories using Nuclear Fuel Cycle Simulations, presented by Max Schalz, from Rhenish-Westphalian Technical University of Aachen (RWTH Aachen).

The second part of the working group meeting focused on strategic planning. We discussed the working group's progress on actions from the World Café, topics for focused collaboration and research as a working group, meeting formats, and the working group's future activities.

and the RDT" and to proceed as a first step to the organisation of a roundtable on this subject during the next INMM & ESARDA Joint Annual Meeting.

featured articles

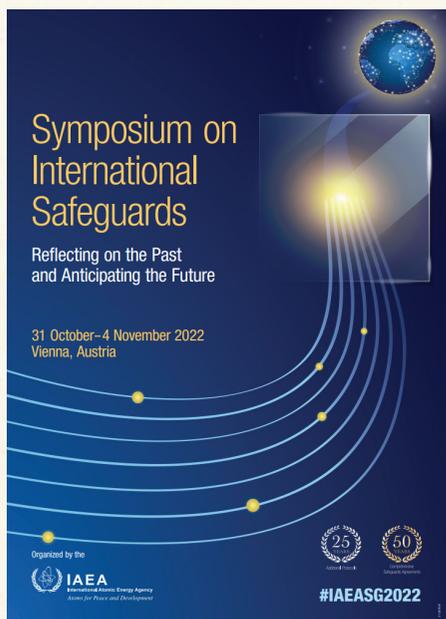
This section presents prominent articles on the latest news and topics of interest in the safeguards community

**BRIEF REPORT ON THE
IAEA SAFEGUARDS
SYMPOSIUM 2022**

by W. Janssens
(European Commission, JRC, Ispra)

The fourteenth Symposium on International Safeguards took place from 31 October to 4 November 2022, a year marking three key safeguards anniversaries: 60 years of IAEA inspections, 50 years of comprehensive safeguards agreements (CSAs), and 25 years of additional protocols (AP).

There were over 700 registered participants from 112 IAEA Member States and nearly 500 virtual observers. The Symposium contained some 50 sessions, over 120 e-Posters, 50 ES-SPACE presentations and 24 exhibitors. There was a strong emphasis on historical insights, feeding the future with dedicated analysis by the IAEA DG, by 3 generations of IAEA DDGs on Nuclear Safeguards and by a variety of key safeguards experts. A Millennial Nuclear Causus was held and the IAEA DDG participated to the podium discussions on Voices of the Future. A special emphasis was indeed given to the Futures work, described below.



Millennial Nuclear Causus podium discussions on Voices of the Future

The objectives of the 2022 Symposium were to:

Reflect — celebrate the historic anniversaries and achievements thus far, building common understanding of experience gained and key milestones that have shaped safeguards, and reflecting on experience gained and lessons learned over the course of decades of safeguards implementation;

Anticipate — anticipating nuclear energy’s role in addressing global challenges, envisage how the IAEA’s operating environment will likely evolve over the coming decades, and identify what this means for safeguards in the form of both new challenges and opportunities; and **Inspire** — based on lessons from the past and insights about the future, identify actions to take, stakeholders, and partnerships to support them, towards ensuring a safeguards system that is well prepared for continued success in the decades ahead.

In preparation for the IAEA Safeguards Symposium, a series of working meetings were held to prepare the so-called “Futures” scenarios (to map the challenges and opportunities for IAEA in 2057 - 100 years IAEA). This is

considered highly relevant by the IAEA DG and DDG. It is currently planned that a follow-up of this FUTURES work can be integrated in the May 2023 joint INMM-ESARDA Symposium focusing on the effective impact and input for the collective thinking on the challenges for implementing nuclear safeguards.

FUTURES work at IAEA

The intensive, multinational and multidisciplinary approach of the FUTURES work for IAEA, professionally moderated by Futures specialist, building also upon external input (as e.g. from the Singapore experience, practicing Futures analysis at government level since over 10 years), is indeed believed to bring additional value also to the INMM and ESARDA Strategic Planning and positioning. The “Futures” work for IAEA nuclear was managed by a group of external consultants (non safeguards nor nuclear specialists, but professional “Futures” discussion moderators), who called upon about 20 safeguards related organisations to make experts available to execute the work that was structured along a proven methodology (again using the Singapore experience).

The table below shows the steps and amount

Engaging parties to the FUTURES work	30+ participants from 17 organisations
Framing of the FUTURES work (3 day brainstorming)	261 issues across 7 domains
Scanning of the issues to “group” / categorise	58 trends identified and emerging issues
Futuring (structure for scenarios discussions)	17 Drivers, 8 uncertainties/disruptors, 3 scenarios

Steps and amount of inputs that were generated in the period between July 2022 and end of October

of inputs that were generated in the period between July 2022 and end of October, resulting in the presentation of the first outcome at the IAEA SG Symposium during the opening plenary on 01/11/22.

A key outcome of the brainstorming, discussions and reflections (as multiple groupings are possible, due to strong interlinks between the identified issues) are the 17 identified drivers, made available through a card-deck that allow the audience and analysts to “play with it” (electronic copies are available). The identified drivers were the following:

Geopolitics, security and Governance

1. War and Conflict 3.0
2. Geopolitical Flux
3. Refitting for Purpose

Society

4. Lie to me
5. Survival of the Richest
6. Ideological Tribalism
7. Demographic Destinies

Economy

8. Uncertain Economies
9. Reshuffling Supply Chains
10. Green Economy

Climate, Energy and Nuclear

11. Climate Changed
12. Securing Energy
13. Nuclear Next

Emerging Technology

14. Web 3.0
15. Information Overload
16. Beyond Human

Uncertainties and Disruptors

For the sake of the conference, and to structure the discussions in several break-out rooms, these were grouped in 3 major scenarios labelled

- Information Storm
- Greenolution
- The Great Game

It is clear that other groupings could have been made but that is a priori irrelevant, as the main objective of this exercise is to make



Attendees at the residence of the Finnish Ambassador in Vienna

organisations reflect (and then possibly adapt their culture) on what a combination of drivers could mean for their work. This is NOT about probabilities, but about possibilities. Trends are identified that might happen or not and emerging issues are suggested that could offer both opportunities and threats to the organisation’s work.

The objective of preparing this and then presenting it at the Safeguards Symposium was to collect input, reactions and reflections about what this could mean for nuclear energy deployment, nuclear safeguards, the way of working at IAEA and thus also for strategic reflections in related organisations like e.g. INMM and ESARDA. During the symposium, further discussion took place how to analyse these scenarios w.r.t. the safeguards significance / relevance and the outcome of this is being harvested. It is therefore deemed interesting to dedicate a specific session in the joint INMM/ESARDA meeting to the outcome, as this will also widen the INMM/ESARDA horizon and might inspire multiple technical divisions and working groups and potentially raise issues currently not being addressed by INMM/ESARDA.

AFCON

A short mention is made here also of a major new project to develop a regional safeguards capacity building for the African Union that will be executed by AFCON, the African Commission on Nuclear Energy and is mainly funded by EC DG INTPA and co-funded by the Republic of Finland. The project was presented at the residence of the Finnish Ambassador in Vienna based also on the expert support that will be delivered to this project by STUK, the Finnish Radiation and Nuclear Safety Authority. A special session on this engagement can be foreseen in the next INMM/ESARDA annual meeting. This will also be an opportunity to strengthen the collaboration between AFCON and EURATOM.

Input 2023 ESARDA/INMM Joint Annual Meeting

From a series of presentations at the IAEA Nuclear Safeguards Symposium a list of potential special sessions can be envisaged for the next INMM/ESARDA Symposium.

- Engaging the African Union in nuclear safeguards and non-proliferation
- Synergies and Complementarities be-

tween nuclear safety, security and safeguards (incl at IAEA) : JRC can also foresee specific / coordinated contributions to this

- Updating of the Nuclear Safeguards Additional Protocol annexes
- Opportunities and challenges for Wide Area Environmental Sampling
- Information Storm including Web 3.0, fake news
- Machine learning and its applications to nuclear safeguards
- Safeguards by Design for micro- and small modular reactors
- COMPASS
- Interaction between nuclear security and safeguards in education and training

In addition, it was discussed with IAEA Senior Management to organize during the annual meeting in May 2023, visits to a number of relevant IAEA Nuclear Safeguards and Security Facilities:

- Instrument laboratory in the basement of VIC
- Seibersdorf analytical laboratories
- New IAEA Nuclear Security Training Centre

EU Side Event on Nuclear Safeguards Training and Education

During the Symposium there was an EC side event organised on 3/11 to recognise the first ever development, implementation and successful completion of the nuclear safeguards master course (DG INTPA funded project with ENEN as contractor and POLIMI as responsible university and large input from JRC). Presentations were held by the Head of the UN section of the EU Delegation in Vienna (EEAS), the IAEA DDG and Head of Department of Safeguards and JRC followed by a panel with the President from ENEN and two colleagues from DG ENER. The presentation part of the event, that was very well attended, was concluded by the testimony, in person, of three of the students who received the diploma on 28/10/22 and a video with further comments of the graduates recorded the week before. During the following short

reception, many questions were asked about the follow-up and next session(s) as there is high interest from future potential participants. It is noted here that DG ENER stressed that they would like to see in the next session of the master also a high number of European students to be enrolled (in addition to the extra-European ones, seen that the budget for the development and implementation of the master came from the INSC under DG INTPA). It is now being analysed whether indeed a new edition will take place in 2023 and whether the course materials that were developed under this programme can be shared with a broader (university) community.



CHAIR'S SUMMARY OF THE 12TH APSN PLENARY MEETING (VIRTUAL MEETING) 24TH - 25TH FEBRUARY 2022 HANOI, VIET NAM

by APSN Chair

1. The 12th Asia-Pacific Safeguards Network (APSN) Annual Meeting was held on 24th - 25th February 2022, participated by 70 representatives from 20 countries and organizations, including the International Atomic Energy Agency (IAEA), European Safeguards Research and Development Association (ESARDA) and UAE Federal Authority for Nuclear Regulations (FANR) for the 1st time. Due to the restriction of face-to-face activities during Covid-19 pandemic, the meeting was conducted through a virtual platform.
2. The APSN meeting was hosted by the Government of Socialist Republic of

Viet Nam and organized by Viet Nam Agency for Radiation and Nuclear Safety (VARANS) with three main agenda items: (1) Steering Committee Meeting, which was a strategic meeting among four APSN Steering Committee Members and Viet Nam (temporary member of Steering Committee); (2) topical sessions, which were dedicated for knowledge and information sharing and updating on safeguards implementation; and (3) APSN next steps and future activities. The three main agenda items were addressed in nine sessions (see agenda attached).

3. The 12th APSN meeting was opened and chaired by Prof. Nguyen Tuan Khai, the Director General of VARANS, as the APSN Chairman. In the Opening session, Prof. Nguyen Tuan Khai gave opening remarks conveying the messages that Viet Nam reaffirms its full support for the APSN and the strong commitment to their IAEA safeguards agreement as always. He also emphasized that the APSN member countries are benefiting from the Network through exchanging information, sharing best practices, mutual support and focusing on regional training for capacity building.
4. During the opening session, Dr. Geoffrey Shaw, Director General, of Australian Safeguards Non-Proliferation Office (ASNO) also presented opening remarks and summarised the outcomes of the APSN Steering Committee (SC) Group meeting which included:
 - a) Australia to continue as Steering Committee Chair until end of 2022 after which Japan will assume this role;
 - b) Thailand nominated as Chair of APSN for 2023-24;
 - c) Potential APSN activities at the 2022 IAEA Safeguards Symposium; and
 - d) Undertaking to address gender balance in safeguards, in support of the IAEA Director General's priority on this matter.
5. The second meeting session was entitled "IAEA Program and Activities on Safeguards Implementation under COVID-19: Past experiences and future plans". The session invited IAEA experts: Mr. Peter Rance, Section Head, OAC, Department

of Safeguards, IAEA gave a presentation on "Safeguards implementation and initiatives" including 2022 Priorities (encouraging APSN members to contribute to the Symposium Abstracts submission); emphasized the key assurances of safeguards implementation on the State level and State-level safeguards approach (SLA), IAEA effort in SLA Improvement Project to ensure consistency of SLA in analyzing acquisition paths, improving technical objective standardization. Mr. Craig Everton, Section Head OA3, Department of Safeguards, IAEA presented an update on the IAEA's COMPASS project which brings assistance to Member States. Mr. Can Viet Tuan, VARANS/ Viet Nam gave a presentation on "Safeguards implementation:

Situational practice & challenges" in which he described the practices in Viet Nam over the past two years in fulfilling its safeguards obligation to the Agency adapting the application of restricted measures to control covid-19 diseases. The challenges of VARANS in human resources for nuclear safeguards were also mentioned.

The Session was facilitated by Mr. Stephan Bayer, Director, IAEA Safeguards Division, Australian Safeguards and Non-Proliferation Office (ASNO) (Australia).

6. In the third session, each APSN member state participating in the meeting delivered a short statement on their country's safeguards implementation in the past year. In general, APSN members provided updates on their recent safeguards implementation activities, especially under covid-19-related circumstances. Members emphasized the benefits of being a member of APSN, and expectations for the future APSN activities. The European Safeguards Research and Development Association (ESARDA) contributed to the Meeting with a pre-recorded video on its activities to support capacity building demand of the network members.

This session was facilitated by Ms. Bui Thi Thuy Anh, Director of International Cooperation, Viet Nam Agency for Radi-

ation and Nuclear Safety (VARANS), Viet Nam.

7. In Day 2, the fourth Meeting session was entitled "APSN Activities over 2020-2021". Ms. Margot Mininni presented on "Safeguards Engagement and Training since Covid-19 Pandemic". The Meeting also discussed the practices of organizing virtual trainings (challenges, opportunities and new directions...to produce higher effectiveness of Human Resource Development activities).

The Session was facilitated by Dr. Hoo-sik Yoo, Vice President, Korea Institute of Nuclear Nonproliferation and Control (KINAC), Republic of Korea.

8. The fifth Meeting session was entitled "Capacity Building: Member States experiences and needs". Mr. Hori Masato, Deputy Director, ISCN/JAEA shared experiences in organizing online trainings adapted under Covid-19 12th APSN Meeting Chair's Summary 3 conditions (integration of online lectures and e-learning modules, shortened training duration, enhanced interaction among participants, cooperation and support from IAEA/DOE, etc.). Mr. David Moroz, Director, International Safeguards Division, CNSC also shared experiences on regulatory activities and training programs in Canada.

The Session was facilitated by Mr. Murakami Kenji, Special Assistant to the Minister for Foreign Affairs, Japan. The Session provided useful information and exchange of views on capacity building and managing capabilities.

9. The sixth Meeting session was entitled "Safeguards by Design". Mr. Jeremy Whitlock, Section Head, Nuclear Safeguards Department, IAEA discussed the types, benefits and examples of SBD. His presentation also provided Safeguards considerations for SMRs, safeguards technical needs for SMRs, and challenges in implementing SBD. Dr. Anagha Iyengar, DOE/NNSA spoke on recommendations for SRA and the assistance NNSA could provide.

The Session was facilitated by Mr. Kus-

bandono, Deputy Director for Safeguards Inspection Division, Nuclear Energy Regulatory Agency (BAPETEN), Indonesia.

10. In the session on APSN next steps and future activities, Mr. Stephan Bayer, Director, IAEA Safeguards Division, Australian Safeguards and Non-Proliferation Office (ASNO) (Australia) facilitated a discussion on APSN future activities including: the 2nd APSN meeting in first half of December 2022, elaboration of ideas for APSN activities at the 2022 IAEA Safeguards Symposium, and enlargement of APSN members. The Meeting also gained APSN's endorsement for Thailand to take up the Chair of APSN for the next two years (2023 to 2024). Mr. Tularak Thitidej on behalf of Office of Atoms for Peace (OAP)/Thailand expressed the readiness and support of Thailand to strengthen the Network cooperation.
11. Under the session on "Any Other Business", the Meeting welcomed for the first time the participation of UAE Federal Authority for Nuclear Regulation (FANR) as an observer. Mr. Stephen Brion, FANR Safeguards Manager, introduced FANR participants and expressed FANR's sincere gratitude for the invitation to observe the Meeting. Mr. Luay Qassim, Nuclear Non-Proliferation Engineer, presented the UAE's nuclear sector and safeguards activities. He highlighted the UAE's commitment to the highest standards of nuclear non-proliferation, its efforts in international cooperation and engagement, and FANR's interest in working with APSN.
12. In the closing remarks, Ms. Bui Thi Thuy Anh on behalf of VARANS/Viet Nam once again expressed her sincere gratitude to all facilitators, presenters and participants for the exchange of their experiences and discussions during the meeting. Ms. Bui Thi Thuy Anh also expressed her highest appreciation to the Steering Committee Members, to Indonesia as the previous Chair of APSN, US-DOE, IAEA and ESARDA, as well as all participating countries for their extension of support for the Network.

technical articles

Technical articles covering the latest findings of our community of experts on fundamental issues

A SYNTHESIS OF THE FEEDBACK OF A SURVEY ON THE WAY OF IMPLEMENTATION OF SAFETY, SECURITY AND SAFEGUARDS CARRIED OUT AMONG 11 COUNTRIES

by Implementation of Safeguards Working Group

Abstract

This paper presents the methodology and results of a work conducted within the Implementation of Safeguards Working Group of ESARDA on the implementation of the 3S safety, security and safeguards and their interactions. This work was based on a questionnaire sent to some of the countries whose members are participating in the working group. Except for one country, the data were gathered from competent authorities or technical support organizations. Eleven countries were involved in the survey. As a consequence, the identified trends are limited in terms of scope. Nevertheless, the gathered results provide a first overview on the 3S trends (mainly in Europe) and could be used by whoever would conduct a more general and structured study on this topic. It appeared that there is no unique perspective or strong tendency toward a global « 3S » approach. Also, the security has frequently been mentioned as very sensitive and, as a consequence, a dichotomy is observed between states considering that the relevant level for the 3S implementation is the regional or international level and the countries considering that such a 3S approach should be managed at the level of the state mainly. In this regard, while safeguards is seen as a matter of international responsibility where states have to play an active role, the security remains often the exclusive competence of the state that has the prerogative to define its ad hoc organization involved in it.

Introduction

Safety, security and safeguards have often been presented as complementing each oth-

er and as being parts of a coherent whole through interfaces, while it is also recognized amongst experts from these fields that those interfaces may lead to challenges that need to be addressed considering the high importance and priority given to these. As different approaches towards implementing the so-called 3S approach exist amongst states and considering that a synthesis on how the 3S are implemented and managed in some countries taking into account their specificities, it may be of interest for whoever is involved in this topic to be aware of the existing trends relating to the 3S throughout the world. This led, as a first step, the "Implementation of Safeguards" working group of ESARDA to explore the diversity of the national approaches in Belgium, the Czech Republic, Finland, France, Hungary, Lithuania, Norway, Romania, Spain, Switzerland and the United States.

The aim of this article is to present the gathered data and the major observed trends on the different 3S approaches existing in the aforementioned countries. In this article, the followed methodology and the use of a standard questionnaire will be explained. Finally, the gathered results and the identified trends as a result of the survey will be explained and described.

Methodology

At the beginning of the working group discussions on that matter, its members were informed that a questionnaire had been issued by the Pacific Northwest National Laboratory (PNNL) for a survey with quite similar objectives. It was then decided to take this first questionnaire as a basis and to tailor it to the working group's needs. The resulting questionnaire that was used afterwards, is attached as an annex to the present article. It was also decided not to target industrial companies but to focus on national authorities or technical support organizations to get perspectives mainly on the approaches endorsed by the states. An exception can be noticed since the United States (US) answers have been issued by a national laboratory.

It is worth mentioning that amongst the concerned states, two are Nuclear Weapon States

(NWS) and nine are Non-Nuclear Weapon States (NNWS). Also, the majority of the countries are under the Euratom safeguards regime. Having different types of safeguards agreements and texts of concern in this study may induce a potential diversity in the answers, particularly regarding the state organizations. Qualitatively speaking, the sample of respondents is interesting because it covers a wide range of countries, from countries with a limited nuclear industry to countries with a highly developed fuel cycle.

Gathered questionnaires

Eleven questionnaires were collected from eleven countries: Belgium, the Czech Republic, Finland, France, Hungary, Lithuania, Norway, Romania, Spain, Switzerland and the United States. All of them were filled out by competent authorities or technical support organizations, except for the US questionnaire, filled out by a national laboratory (PNNL). Hence, the PNNL filled-in questionnaire expresses the position of the laboratory, but not of the US government as such. This questionnaire is therefore referred to as being the PNNL one throughout the rest of the document.

With only eleven filled-in questionnaires, our study does not permit a comprehensive and statistically significant analysis of a global trend worldwide. Nevertheless, the feedback is enough to draw some broad conclusions: the gathered results provide a first view on the 3S trends, mainly in Europe, and could be used by whoever would conduct a more general and structured study on this topic.

While taking into account the reservations expressed above, we can attempt to establish trends that will be discussed below; we can also note a great diversity within the answers that shows that a unique, or at least a nearly universally shared, perspective regarding the 3S concept does not exist.

Main identified trends

Definition

Regarding the definition of radiation protec-

tion, nuclear safety and nuclear security, the content of the provided answers are broadly coherent and meet the usual international definitions. Only PNNL gives an answer for nuclear security that is quite far from the other provided definitions, emphasizing mainly the concept of physical protection. Nevertheless, this difference is probably due to the fact that the PNNL response is the only one that does not come from a regulatory body or a technical support organization, which could lead to a bias.

The situation is quite different for safeguards since the answers bring to light an actual slight diversity in the conceptual approaches, especially on what is insisted upon in the definitions and descriptions provided in the questionnaires. In particular, France focuses on the difference in the aims of the controls of IAEA and Euratom: the first is seen as a finality control while the latter is seen more as a conformity control. The Czech Republic emphasizes the necessity for the state to implement the obligations resulting from its Safeguards Agreement and its Additional Protocol and also the support to the IAEA and EURATOM verifications activities. Spain underlines the measures taken in order to verify that there is no diversion of nuclear material; Hungary mentions the measures (national, regional, international) to ensure and verify that countries comply with their international and national obligations to use nuclear material only for peaceful purposes. Belgium highlights measures and strategies put in place following the Euratom Treaty and the Non-Proliferation Treaty while Norway stresses the need of fulfilment of international safeguards it is committed to. PNNL points out the implementation of a NMAC system and Finland specifies that the purpose of nuclear safeguards is to ensure that the use of nuclear energy is in compliance with what is declared and does not contribute to the proliferation of nuclear weapons. In this group, a clear dichotomy is identified between the states stressing on activities that should be conducted in order to comply with international obligations and states stressing on the non-proliferation goals. Our analysis did not point out any reason to base this dichotomy on different states' points of view on the safeguards. It could be simply explained by the human factor associated to the persons from the organisations who an-

swered the questionnaires and to the fact that some countries are also under the Euratom regime which could modulate the signification of what safeguards are.

Competent authorities involved in safety, security and safeguards

With regard to the organization of the state, various situations can be distinguished. Some countries have a unique authority covering all the fields (radiation protection, safety, security, safeguards): the Czech Republic, Lithuania, Hungary, Belgium, Norway, Romania and Finland. Other countries have a more complex structure with several authorities: Switzerland, Spain, the US and France. In this respect, France mentions the inter-ministerial coordination as the only means to ensure a global coherence.

Generally, the regulatory bodies are described as being independent from organizations and ministries that promote nuclear activities. The only exceptions are safeguards in Switzerland, security and safeguards in Spain, and the radiation protection in the US.

All the respondents agree on the fact that they did not observe conflicts of competences or redundancies between regulatory bodies, except for PNNL, that underlines different priorities among agencies, reflecting their different responsibilities, particularly for the security aspects: the definition of the threats to take into account, the definition of the material categories and the protection requirements were mentioned as being a source of divergences. Nevertheless, the work method used does not allow to know the origin of these potential divergences: it could be again the consequence of the fact the PNNL respondent was the only one not belonging to an authority or its direct technical support organization.

Regarding the other agencies supporting the regulatory bodies in the implementation of the regulation and/or in the surveillance, some countries (Spain and the US) do not have any technical support organization while others have it, but they do not always support for all of the 3S (Lithuania for security, Finland for Safety, Switzerland for radiation protection). Belgium has a common technical support or-

ganization for safety and radiation protection of class I facilities while for security matters, this technical support organization provides technical support at specific requests of the Federal Agency for Nuclear Control. Furthermore, Belgium does not have any technical support organization for safeguards, which are addressed by the authority itself. Hungary, the Czech Republic and France have technical support organization for all the fields, which is unique for the two latter. It is noted though that the absence of technical support organizations for the 3S does not seem to imply a lack of qualification as many respondents have declared that the equivalent of the expertise present in those organizations for other countries is present within the regulatory bodies in their countries (the US and Spain for example). By contrast, nuclear state policy in other countries like France for example, seems to be based on the principle of a separation between the authority and the technical support expertise, to ensure that expert assessments and political decisions are fully independent from each other. Further details on this specific topic were not gathered within this survey but it could be addressed in a future work.

It appears then that the frameworks in the different countries are tailored to the size of their nuclear industry and to their political and historical contexts. Following the authors, the nature of these frameworks could necessarily play on the practical implementation of the 3S and their respective interactions.

3S interfaces at the international level

Concerning the involvement of the international authorities in the management of the 3S interfaces and the roles they could play in this field, Belgium, France, Hungary and Switzerland declared that the right level at which the 3S topic should be managed is mainly the state level. France also stated that no "3S" concept is to be considered at the regional or international level since the governances of safety, security and safeguards are fundamentally different and shall remain different; France also highlighted that nuclear security is the exclusive competence of each state and that it is the sole prerogative of each state to decide how to organize itself regarding this matter: as a consequence, "3S" can only be

a “state level approach” if so considered relevant by the state. Similarly, Belgium stated that *“while safeguards is an international responsibility where states have to play a very active role, the nuclear security is solely a state responsibility [...] As a consequence, it is inconceivable in Belgium to think about the involvement of a regional or international body in the 3S implementation.”* All the others, except for Romania, answered that regional or international bodies could be involved in the 3S implementation, but Spain mitigates its position underlining that nuclear security is a competence of the states. The Spanish position could at a first view seem to be opposite to the French one, while the related comments provided in the questionnaires are very similar to each other. Finland mentioned that all levels have to be involved. Romania underlines that some fields have to remain at the state level while others are logically addressed at a regional or international level.

Management of the 3S interfaces

With regard to the existence of a systematic or compulsory approach at the level of the state to foster a management of the interfaces and the identification of synergies among safety, security and safeguards, the answers are balanced (five are positive and six are negative). Such an approach is mentioned by Belgium, the Czech Republic, Lithuania, Romania and Finland. The Czech Republic and Lithuania mention the existence of “3S friendly” procedures or guidelines, while Belgium refers to application files addressed in an integrated manner by the competent authority and a political level statement towards managing the 3S. Romania underlines that the physical protection measures and equipment installed at a nuclear facility are implemented after a common evaluation with safeguards, safety and security experts, while Finland points out the integrating role of the nuclear energy act that is efficiency. It is noted that this act requires from the operators elements to be given regarding safety, security and safeguards for any new nuclear facility at a very early stage. In this regard, for these projects in Finland, it is mentioned that preliminary information relating to the concept must be filed sixty days before the date of parliamentary ratification of the decision in principle for the new facilities.

Concerning a possible convergence of opinion at a political level on the benefits of an understanding and managing of the interfaces and/or of the synergies between the 3S, the answers are mainly negative. Only Belgium, the Czech Republic, France and Hungary have identified such a convergence. Hungary mentions a project to harmonize state level tasks in the area of emergency management concerning safety and security related events. The Czech Republic highlights the existence of a unique authority covering the whole nuclear field that is by virtue a non-political, technical organization at a ministerial level, integrating safety, security and safeguards. France acknowledges the existence of interfaces between pairs of disciplines within these three fields and mentions that its nuclear regulatory structure is organized to manage these interfaces in an appropriate way. It is mentioned that at the French national level, on a technical standpoint, each couple of fields (safety/security, security/safeguards) is managed by the competent authorities with a tailored approach depending on the nature of the interfaces, and that whenever more transverse coordination of the different actors is needed, it takes place under the responsibility and authority of the Prime Minister. France considers that the *“management of interactions between safety, security and safeguards is the sole responsibility of each state. Indeed, it is a national prerogative for each state to decide how to organize itself: there cannot be an international agreed model”*.

Regarding the question *“Do you know about a voluntary and systematic approach of non-state actors involved in the nuclear industry of your country to foster a management of the interface and the identification of synergies among safety - security - safeguards or to apply the concept of 3S into their operations and / or management?”*, the answer is almost unanimously negative, except for the US, Belgium and Finland. The US note that various individuals and organizations associated with nuclear and radiological materials have been advocates, but there is no institutional requirement. Belgium highlights that some nuclear operators have integrated the 3S concept in their management system and Finland, in the same way, notes that operators have managed the interfaces and have been trying to

identify synergies among safety, security and safeguards for a long time. In particular for Belgium, it is mentioned that the safeguards field at the operator level is always managed while considering impacts of any safeguards related decision on safety (for example concerning the compliance to the ALARA principle) and security (for example concerning the access rights given to the international inspectors).

It can be noted that the involvement of states at the political level towards managing the 3S remains marginal, which does not mean that the 3S interfaces are not managed at the technical level. However, it seems that there are rarely political or strategic clearly stated approaches. A systematic and voluntary approach also appears to be rare at the level of the industry. However, this probably conceals a significant variability within a given country, including within the countries for which respondents have given a negative response. In fact, the operating costs and the costs of subsequent modifications to a large nuclear installation are high enough to call for caution on the part of industrialists, leading them to take into account all the safety, security and safeguards aspects in an integrated manner. Such an analysis could be the subject of further work.

Communication throughout the 3S

Only Switzerland, Belgium, Finland and PNNL report a feedback of examples with problems resulting from lack of communication, coordination, cooperation or integration among safety, security and safeguards at the national or facility level. Switzerland mentions problems regarding the definition of security measures for sensitive shipments of nuclear material and the subsequent confidentiality, while for US the secrecy needed and subsequently the security concerns when collaboration and information exchanges among disciplines are called for is pointed out. Belgium highlights a good integration of the 3S at the authority’s level. However, it is mentioned that it is not always the case at the operator level: nuclear security is frequently managed by teams of specialized security experts and safety experts, and security services are often integrated in safety departments, which contributes to ensure a good management of the 2S interface. Never-

theless, by contrast, the safeguards field is in general managed in other departments, which could cause in some cases minor communication issues (for example concerning the classified documents management). Finland mentions examples with remote data transmission, the definition of which was not clear enough at the beginning for the security experts, and with non-destructive analyses, for which there can be safety and radioprotection concerns. In any case, it can be supposed that other states have probably faced similar difficulties even without taking note of them. A management structure at a level at which the 3S may be addressed (an inter-ministerial level for example), if the 3S are not already addressed at the regulatory level, could lead to identify and address similar difficulties.

In summary, no major difficulties were reported in terms of communication in the implementation of the 3S but improvement ways exist. While at the level of the state a management structure where the 3S interfaces are addressed is probably the key to resolving potential difficulties, at the level of the operator, the main difficulty seems to stem from confidentiality requirements and from a lack of integration of the three areas into a single team, or teams that communicate frequently. The confidentiality issues are normal and cannot be avoided; concerning the second issue, an integration of the three fields within a unique department or the definition of a specific management structure to frequently address the potential 3S issues, would allow to get a coherent and exhaustive overview on the 3S interfaces allowing the operators to better manage them.

Overlaps in responsibilities within the implementation of a 3S concept

Eight countries did not identify overlaps between the roles and responsibilities involved in the safety, security and safeguards fields. Only Belgium, the Czech Republic and PNNL pointed out this kind of problem, essentially regarding the management of accesses in case of an emergency, being not necessarily a negative issue as long as the teams involved exchange regularly and do find solutions considering the requirements from both the safety and security worlds. Belgium mentions also the role

of the authority as a facilitator between the operator and Euratom or IAEA that leads to a very different posture of the competent authority compared to the usual control posture the operators may be used to. From the analysis performed, the potential overlaps in responsibilities seem to be more easily identified when there is a routine approach towards managing the 3S. Indeed, the lack of answers or negative answers from many countries could be explained by the lack of implementation of a 3S concept as a whole, including by the lack of communication between the teams involved in the three fields. In the French case though, it is expressly mentioned that “safety, security and safeguards are implemented separately, and that the intersection fields are addressed at an inter-ministerial level when it is required”. Regarding areas of conflicts that may arise in practice within these overlaps in responsibilities between at least two of the three disciplines, only the Czech Republic did not identify any of them. The other ten questionnaires bring various answers but always identify such conflicts. The most given answers are “*Limited understanding of the other disciplines by those responsible for one of the disciplines*” (nine questionnaires) and “*Conflicts resulting from confidentiality or sensitivity of information*” (eight questionnaires).

In summary, overlaps in responsibilities may appear between the three domains. Again, a good communication and overall, the existence of a management structure to coherently address the potential 3S issues are key solutions in this perspective.

Conflicts identified within the 3S interfaces and shared common goals

Finland notes that training and cooperation allow any difficulty to be coped with. All the other countries identified possible conflicts and security is systematically mentioned: Belgium, France, Hungary, Romania, Norway and Switzerland expressly mention the conflicts arising from the couple “security – safeguards”. In this respect, France underlines that security requirements are likely to interfere with safety or safeguards objectives and that potential overlaps have to be managed by the concerned competent authorities and operators. PNNL notes that safety is necessarily paramount, but

that the requirements of the other disciplines can be accommodated, and that cooperation, coordination and communication can help in overcoming the conflicts. Belgium mentions that conflicts between the 3S can be handled, however, this needs time and a strong commitment of experts from each of these areas to have an in-depth cooperation. Lithuania states that the biggest problem identified when managing the safety and security interface is linked to the sensitivity of information when this information has to be shared and Romania underlines that conflicts resulting from confidentiality or sensitivity of information may be difficult to cope with.

Regarding the existence of shared common goals among nuclear safety, security and safeguards, the answers are varied. The Czech Republic, Lithuania, PNNL and Finland point out the shared fundamental goal of protection of human life or of human life and the environment, Belgium highlights the safe (in its general meaning) use of nuclear material, Romania mentions the need to avoid incidents or events while France and Spain underline the contribution to the peaceful uses of nuclear energy and the confidence in the nuclear sector.

Nuclear Material Accounting and Control and declarations

All the respondents declared that a national nuclear material accounting and control (NMAC) system exists with the exception of Spain and Belgium that fully rely on the accountability of operators and on the Euratom verification mechanisms. However, it is mentioned for Belgium that the concerned competent authority can intervene on a case-by-case basis towards managing the NMAC provisions. Except for Belgium, all respondents have a safeguards related system of control of nuclear material at the level of the state.

In terms of safeguards declaration, some states have organization(s) responsible for collecting, managing and sending information to EURATOM and/or IAEA. This organization is almost systematically the authority in charge of safeguards. However, for the majority of the European Union countries involved in the study, a large part of the safeguards information is sent directly from the operators to Euratom

om, particularly the accountancy reports, without validation from the states needed. In this regard, it is noted that France, on the contrary, has established a centralized system whereby all information relating to safeguards, including those owed by operators, is transmitted to the national authority in charge of safeguards, which forwards it to EURATOM. France reports that this results in increased efficiency, both for France and for EURATOM. It is noted that EURATOM countries are divided into two categories for the declarations relating to the Additional Protocol: *Side Letter States* and *Non-Side Letter States*, as Side Letter States have asked the European Commission to collect data concerning dual-use goods, research and development activities and development plans for the nuclear fuel cycle and to transmit these to the IAEA on their behalf in the framework of the Additional Protocol implementation. For example, in Belgium, which is a Side Letter State, the Energy Administration of the Ministry of Economy is responsible for collecting some of the Additional Protocol declarations which are then transmitted to Euratom by FANC.

It is noted then that the vast majority of the answering states have a centralization organization gathering and managing NMAC data, but different approaches are identified in terms of the roles played by the authorities towards managing and controlling these data before they are sent to IAEA and/or to Euratom.

Conclusion

The objective of this paper was to identify and to compare the perspectives of different countries regarding the interactions between the safety, security and safeguards fields, and the

associated synergies or conflicts. Without any surprise, this survey, which involved eleven countries, showed that there is an important diversity in the 3S approaches. The variety of those approaches is, according to the authors of this paper, the fruit of many factors, including mostly the diversity in the situations of the answering states, as well in terms of involvement in the nuclear industry as in terms of development levels of the nuclear fuel cycle and in terms of nuclear status (NWS or NNWS). Further analysis to better understand the link between some factors associated to the 3S visions and implementation practices on one hand, and the associated characteristic of a states, specifically relating to the nuclear field, on the other hand would require collecting data from a larger panel of states. As an illustration, two respondent countries are NWS, the other nine are NNWS, some countries have few or no fuel cycle facilities, while others have facilities covering almost the entire fuel cycle. This is the reason why this conclusion is focused mainly on the observed trends while noting that going ahead to better identify the rationales behind the identified differences could be further addressed in the future by the Implementation of Safeguards Working Group.

A systematic or compulsory approach at the level of the state to foster a management of the 3S interfaces and the systematic identification of synergies between safety, security and safeguards was mentioned by five out of the eleven respondents. In this perspective, only three states underlined a convergence of opinion at a political level on the benefits of an understanding and managing of the interfaces and/or of the synergies between the 3S, one of them underlining the role of inter-ministerial coordination. Only one respondent mentioned a 3S approach at the level of non-state actors,

but it is to be noticed that the duly completed questionnaire concerned was the only one that was not filled in by an authority. About the existence of a systematic or compulsory 3S approach, the authors identified the possibility to expand in the future the field of investigation to the area of material holders (industry, laboratories, ...).

No major difficulties were reported in terms of communication between the actors in the implementation of the safety, security and safeguards fields or in terms of overlaps in responsibilities, but the authors believe that improvement ways exist and could be addressed in the future: While at the level of the state a management structure where the 3S interfaces are addressed is probably the key to resolving potential difficulties, at the level of the operator, the main difficulty seems to stem from confidentiality requirements and from a lack of integration of the three areas into a single team or teams that communicate frequently. Overlaps in responsibilities may appear between the three domains.

Finally, the perspectives regarding the involvement of the international authorities in the management of the 3S interfaces and the roles they could play in this field are quite balanced. Four countries declare that the right level of management of the 3S topic is mainly the state level. In particular, security is commonly presented as the sole prerogative of the state. Two countries give an intermediate answer, and five consider that the international level could also play an active role.

The original questionnaire is available at: <https://spcollab.pnnl.gov/sites/3SSurvey>

Number 07
Autumn 2022

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ESARDA is an association formed to advance and harmonise research and development for safeguards.

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