

International Conference on

# NUCLEAR SECURITY

Sustaining and Strengthening Efforts

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**SUMMARY OF AN INTERNATIONAL CONFERENCE**

Vienna, Austria, 10–14 February 2020



**IAEA**

International Atomic Energy Agency

INTERNATIONAL CONFERENCE  
ON NUCLEAR SECURITY:  
SUSTAINING AND  
STRENGTHENING EFFORTS

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PROCEEDINGS SERIES

INTERNATIONAL CONFERENCE  
ON NUCLEAR SECURITY:  
SUSTAINING AND  
STRENGTHENING EFFORTS

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INTERNATIONAL ATOMIC ENERGY AGENCY  
AND HELD IN VIENNA, 10–14 FEBRUARY 2020

INTERNATIONAL ATOMIC ENERGY AGENCY  
VIENNA, 2023

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## FOREWORD

The International Conference on Nuclear Security: Sustaining and Strengthening Efforts (ICONS 2020) was held at the IAEA's Headquarters in Vienna from 10 to 14 February 2020. This was the third conference of this type convened by the IAEA, following those held in July 2013 and December 2016. It was attended by government ministers; senior officials and policymakers responsible for nuclear security; experts and representatives from a wide range of specialized organizations that contribute to nuclear security; representatives of international, intergovernmental and non-governmental organizations with relevant competencies; regulatory bodies and other national competent authorities, including national security and crisis management agencies; law enforcement and border control agencies; and industry and other entities engaged in activities relevant to nuclear security.

As the largest scientific conference hosted by the IAEA, ICONS 2020 reflects the continuing high level of importance attached to nuclear security worldwide and the value that States and organizations place on the inclusive forum provided by the conference. It also confirms the widespread recognition that, while activities relating to nuclear security are the responsibility of individual States, regional and global nuclear security can be greatly enhanced through collective commitments supported by national actions and international cooperation.

The conference was convened to discuss the experiences and achievements to date of individual States and of the international community as a whole in strengthening nuclear security; to enhance understanding of current approaches to nuclear security worldwide; to identify emerging trends; and to provide an inclusive forum at which ministers, policymakers, senior officials and nuclear security experts could look forward by formulating and exchanging views on future objectives for nuclear security globally.

This publication contains the Co-Presidents' report of the conference, the full text of the ministerial declaration adopted by consensus at the conference, and statements from the opening and closing sessions. The IAEA invited students and young professionals to submit an essay on a topic related to the conference for review by a panel of international judges. The three winning essays are reproduced in this publication. The supplementary files for this publication contain the full conference programme, the list of conference participants and national statements.

The IAEA gratefully acknowledges the cooperation and support of the numerous organizations and individuals involved in the planning and implementation of this conference. The IAEA officers responsible for this publication were D. Chen, K. Tajer, S. Mroz, and B. Denehy of the Division of Nuclear Security.

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# 1. EXECUTIVE SUMMARY

## 1.1. INTRODUCTION

The International Conference on Nuclear Security: Sustaining and Strengthening Efforts (ICONS 2020) was held at the IAEA's Headquarters in Vienna from 10 to 14 February 2020. This was the third conference of this type convened by the IAEA, following those held in July 2013 and December 2016.

The IAEA has been providing assistance to its Member States, upon request, in support of their national efforts to establish and strengthen nuclear security since the early 1970s. In March 2002, the IAEA's Board of Governors approved the first comprehensive action plan to protect against nuclear terrorism. Further Nuclear Security Plans were approved in 2005, 2009, 2013 and 2017. Member States have consistently recognized the central role of the IAEA in strengthening the nuclear security framework globally and in coordinating international cooperation in nuclear security. The objective of the IAEA Nuclear Security Programme, as set out in the current Nuclear Security Plan 2018–2021 (GOV/2017/34), is:

- To contribute to global efforts to achieve effective nuclear security, by establishing comprehensive nuclear security guidance and, upon request, promoting its use through peer reviews and advisory services and capacity building, including education and training;
- To assist in adherence to, and implementation of, relevant international legal instruments, and in strengthening the international cooperation and coordination of assistance;
- To play the central role and enhance international cooperation in nuclear security, in response to the priorities of Member States expressed through the decisions and resolutions of the Agency's Policy-Making Organs.

In this context, the conference provided a global forum to discuss ways to sustain and strengthen nuclear security worldwide, and to identify future developments. It was intended that the outputs from the conference would be used in the preparation of the next IAEA Nuclear Security Plan, which will cover the period 2022–2025.

The conference sought specifically to:

- Raise awareness to maintain and further strengthen national nuclear security regimes as well as international cooperation in strengthening nuclear security globally;
- Review the current status of nuclear security efforts, existing approaches and trends, and highlight areas that may need more focused attention including technological dimensions;
- Promote IAEA nuclear security guidance and other international guidelines, and their use by States;
- Promote the sharing of information and good practices in nuclear security while protecting sensitive information;

- Reaffirm and support the central role of the IAEA in strengthening the nuclear security framework globally and in leading the coordination of international activities in the field of nuclear security, while avoiding duplication and overlap;
- Highlight and promote the IAEA's efforts and programmes on the nuclear security relevant instruments of the IAEA and the United Nations;
- Discuss further enhancements of IAEA nuclear security activities and their sustainability.

ICONS 2020 was attended by a record number of 54 ministers and over 1900 participants from 141 Member States, 4 non-Member States and 25 international organizations.

The Co-Presidents' Report, included in these proceedings, highlights the key issues and main conclusions from the conference.

## 1.2. OVERVIEW OF THE CONFERENCE

The conference was composed of a ministerial session that aimed at providing an opportunity for ministers to deliver messages on achievements and adopt a Ministerial Declaration; and a scientific and technical programme comprising high-level policy discussions on the overall themes central to nuclear security and parallel technical sessions on specialized scientific and technical, legal and regulatory issues concerning nuclear security.<sup>1</sup>

### 1.2.1. Ministerial Session

The Minister of Foreign Affairs of Romania, HE Mr Bogdan Lucian Aurescu, and Vice-Minister of Foreign Affairs of Panama, HE Mr Federico Alfaro Boyd, assumed the role of Co-Presidents of the conference. The Resident Representatives of Romania and Panama, HE Mr Cristian Istrate and HE Ms Anabella Guardia de Rubinoff<sup>2</sup>, acted as coordinators of the preparatory process for the conference and co-chaired the informal open-ended consultations among Member States on the draft Ministerial Declaration.

The conference opened with addresses by the Director General, Mr Rafael Grossi, and by the Co-Presidents of the conference. The Resident Representative of the Republic of Korea to the IAEA, HE Mr Shin Chae-Hyun, also delivered a statement on behalf of HE Ms Kang Kyung-wha, Minister of Foreign Affairs, and the President of ICONS 2016 to reflect on developments since the last ICONS in 2016.

An important achievement of the conference was the adoption by consensus of the Ministerial Declaration. The Declaration demonstrates Member States' strong commitment to strengthening nuclear security to counter the threat of nuclear terrorism and other malicious acts. Strengthened nuclear security helps to ensure that all countries can enjoy the huge benefits of nuclear science and technology in improving the prosperity and well-being of their people.

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<sup>1</sup> The full programme of the conference is available on the IAEA's website at: <https://www.iaea.org/events/nuclear-security-conference-2020>.

<sup>2</sup> Following Ms Guardia de Rubinoff's departure during the summer of 2019, Panama was represented in this task by its Chargé d'Affaires, Mr Luis Eduardo Pabón Chevalier, who was in turn replaced in November 2019 by Ms Anayansi Rodríguez Vega as the new Chargé d'Affaires.

In the Ministerial Session, 109 ministers and other heads of delegation delivered national statements. All acknowledged the importance of national commitment to strengthen nuclear security globally, and the need for international cooperation and assistance to complement and support national actions. Many expressed appreciation for the IAEA's central role in coordinating such international efforts and providing such assistance when requested.

### **1.2.2. High Level and Technical Sessions**

The Ministerial Segment was followed by a scientific and technical programme comprising five high level discussions on broad themes central to nuclear security and 54 parallel technical sessions on specialized scientific, technical, legal and regulatory issues concerning nuclear security. The scientific and technical programme was complemented by a series of 32 side events hosted by Member States, NGOs and the IAEA.

A short introductory session for the scientific and technical programme included remarks by the Director General, and precautionary medical guidance on COVID-19 by Dr Matthias Lademann, Medical Director of the VIC Medical Services.

The introductory session was followed by five high level sessions focusing on key broad areas of nuclear security. Each of these sessions comprised a series of presentations, followed by a panel discussion and questions and comments from the floor. The high-level panel sessions focused on:

- The role of the IAEA in nuclear security;
- Emerging technologies and the digital age;
- International legally and non-legally binding instruments for nuclear security;
- National nuclear security regimes;
- International cooperation in information exchange, sharing of good practices and broader experience to enhance nuclear security.

In parallel, 54 technical sessions covered specific topics, including computer and information security, nuclear forensics, preventing illicit trafficking of nuclear and radioactive material, national nuclear security regulations, innovative technologies to reduce nuclear security risks and improve cost effectiveness where feasible, implementation of national legislative and regulatory frameworks and international instruments, transport security, nuclear security culture, and the interface between nuclear safety and security.

## 2. OPENING ADDRESSES

### 2.1. INTERNATIONAL ATOMIC ENERGY AGENCY

*(As prepared for delivery)*

#### **RAFAEL MARIANO GROSSI**

**Director General, International Atomic Energy Agency**

Good morning, Excellencies, Ladies and Gentlemen.

I am very pleased to welcome you all to this IAEA International Conference on Nuclear Security.

I thank Minister Aurescu of Romania and Vice-Minister Alfaro of Panama for agreeing to serve as Co-Presidents.

I also pay tribute to the tireless efforts of the Co-chairs in ensuring that the Ministerial Declaration which you will adopt today enjoys the consensus of all participating States.

This is the third IAEA ministerial conference on nuclear security. I am pleased to see record participation by ministers, which reflects the great importance which your governments attach to this issue.

We live in a world in which nuclear activities are growing in a very sustained way. The number of nuclear power plants, laboratories and locations dealing with nuclear material is increasing. This is a magnet for groups with malicious intent, which see in this material a possibility to create panic and bring distress and pain to our societies.

The sub-title of the conference, “Sustaining and Strengthening Efforts,” is an acknowledgment that considerable progress has been made throughout the world in recent years in protecting nuclear and other radioactive material against malicious use.

But we need to do more.

Nuclear security is the responsibility of individual countries. However, the need for international cooperation to guard against nuclear terrorism is universally recognized, as is the role of the IAEA as the inclusive global platform for that cooperation.

The IAEA’s role is indispensable.

Nuclear security is about more than just preventing nuclear terrorism. It is essential for ensuring that countries can enjoy the great benefits of the peaceful use of nuclear science and technology sustainably, and for maintaining public confidence.

Maintaining the highest levels of nuclear security should not be seen as an obstacle to using nuclear technology, but rather as an enabler.

Contrary to perceptions in some quarters, the use of nuclear power continues to grow. More and more use is also being made of non-power applications of nuclear technology in industry, health care, agriculture, food production and many other areas.

This means that the amount of nuclear and other radioactive material in the world continues to increase, as does the number of facilities in which such material is stored. This material and these facilities must be protected against malicious use.

The IAEA offers countries practical assistance, expert advice, equipment and training to ensure that nuclear and other radioactive material, and associated facilities, are secure.

Demands for our assistance in nuclear security are constantly increasing.

Let me give you a few numbers to illustrate the contribution of the IAEA since our last ministerial conference in 2016.

We provided face-to-face training to nearly 7000 people (including police and border guards) in nuclear security. More than 6000 other officials completed e-learning courses, which we make available in all six official IAEA languages.

We donated radiation detection equipment to 33 countries, including personal detectors and radiation portal monitors for scanning vehicles and containers at seaports and border posts.

We provided practical nuclear security support at 17 major public events, including World Youth Day in Panama, which was attended by Pope Francis and the presidents of seven Latin American countries.

We lent countries more than 1200 personal radiation detectors and related equipment for other public events.

We sent 15 expert missions to advise countries on improving security at nuclear facilities, hospitals and other places where nuclear materials are held.

We helped six countries to develop *Integrated Nuclear Security Support Plans*, which enable them to establish a comprehensive system to protect nuclear and other radioactive material.

We released 12 new publications in our Nuclear Security Series, providing very practical guidance.

We continued to expand our *Incident and Trafficking Database (ITDB)*, in which 140 countries now participate. In the last three years, more than 600 new incidents of nuclear or other radioactive material going out of regulatory control were reported by 71 countries.

With active encouragement from the Agency, five countries have adhered to the *Convention on the Physical Protection of Nuclear Material* and its Amendment, while 10 CPPNM States have adhered to the Amendment. The Convention is the only legally binding treaty on the protection of nuclear material and it is a very important instrument. The Amendment widened its scope.

In December 2018, we hosted an *International Conference on the Security of Radioactive Material*, focusing on prevention and detection, with participation from more than 100 countries.

As you can see, we have been busy - and this is just a selection of our activities.

Ladies and Gentlemen,

Strengthening the Agency's assistance to countries in the field of nuclear security will be a priority for me as Director General.

I believe more could be done to make us a real focal point in practice, not just in name, and to improve coordination among countries.

We are in a position to integrate and bring together the many valuable – but often scattered – efforts being made throughout the world to guard against nuclear terrorism and other threats, not just by governments, but also by think tanks, NGOs and others. Let us bring all such efforts home to the Agency.

I encourage all countries to make full use of IAEA expert peer review and advisory missions. These are among the most important services which we offer.

I hope that, in time, IAEA nuclear security guidance will enjoy the same status as our Safety Standards. As you know, the Safety Standards are not legally binding, but, in practice, they are adhered to by all our Member States and embedded in national practice.

I believe that funding for the IAEA's nuclear security activities needs to be put on a more sustainable footing. Nuclear security is much too important to be dependent on extra-budgetary contributions, as is the case today.

Ladies and Gentlemen,

Nuclear and radioactive material will always attract malevolent interest from terrorists and other criminals. We can never relax our guard. Even countries with little or no nuclear or other radioactive material on their territory must remain vigilant.

Let me conclude by thanking you once again for your presence here today, which demonstrates high-level political support for the work of the IAEA in nuclear security.

The goals you set will help to make the world safer and more secure for us all. The IAEA will continue to play its part in ensuring that those goals are translated into practical action.

I wish you a very successful Conference.

Thank you.

## 2.2. CONFERENCE CO-PRESIDENT, ROMANIA

*(As prepared for delivery)*

### **BOGDAN LUCIAN AURESCU**

#### **Minister of Foreign Affairs of Romania**

Mr. Director General,

Mr. Co-President,

Distinguished participants,

It is my pleasant duty to greet you all to the International Conference on Nuclear Security, so appropriately entitled “Sustaining and Strengthening Efforts”. I welcome your interest in the valuable debates taking place this week and I count on your active involvement and constructive contribution to a successful event.

I would also like to thank you, Vice-Minister Alfaro Boyd, and your colleagues, for the combined efforts, professionalism and team spirit shown during the ICONS 2020 organization process, as distinguished Co-President of our Conference. My appreciation also goes to the co-chairs of the Programme Committee, Ambassador Svetoslav Spassov of Bulgaria and Ambassador Omar Amer Yousseff of Egypt, for skillfully guiding the preparations for the Scientific and Technical Programme of ICONS 2020. Last but not least, I extend my personal recognition to the staff of the IAEA Secretariat for their dedication and intensive work in translating the vision of the Member States for the ICONS 2020 proceedings into practice.

The Ministerial Declaration we are adopting today is the result of a thorough and scrupulous process that started with the meeting of the IAEA Board of Governors in March 2019, when Romania and Panama were nominated Co-Presidents of this Ministerial Conference. For almost one year, IAEA Member States have shared their views on the future of nuclear security. The Co-Presidents have served as facilitators and honest brokers, with careful consideration for the valuable inputs and priorities put forward by Member States.

We have before us a concise and forward-looking document, which reflects our full-bodied political will and adds value to the process of strengthening nuclear security worldwide. It also builds on the previous Ministerial Declarations and takes into account the latest nuclear security resolution of the General Conference. Thus, I am confident that the ICONS 2020 Ministerial Declaration will guide and channel efforts of Member States, as well as the work of the IAEA, for ensuring nuclear security in the coming years.

Romania welcomed the opportunity of co-chairing ICONS 2020 and the preparatory process, including the negotiation of the Ministerial Declaration, due to our expertise of over 60 years in the nuclear sector. In our view, such a tradition obliges us to support global efforts to promote the peaceful use of nuclear energy, ensuring the safety of our citizens and the protection of the environment.

Before saying a few words in national capacity, allow me to underline that Romania is fully aligned with the EU intervention.



Mr. Director General,

Mr. Co-President,

Distinguished participants,

The IAEA has proven its worth and relevance, over and over again, in highly sensitive field. I would also like to extend Romania's wishes of success to Ambassador Grossi, as the Agency's Director General. My country stands ready to provide full support towards the fulfillment of your important duties.

The contribution of the IAEA to global peace, security and development is pivotal. For over 60 years, the Agency has been instrumental in tackling nuclear security challenges by supporting Member States strengthen nuclear safety and security, as well as access the real benefits of nuclear science and technology. As a founding member of the Agency, Romania is profoundly attached to the core mission of the IAEA.

There are more than 60 years since the start of the Romanian national nuclear programme dedicated exclusively to peaceful purposes, yielding significant economic benefits and strengthening our energy security. Based on this positive experience, Romania has also engaged with countries developing national nuclear programmes for peaceful purposes, sharing expertise and promoting adherence to the IAEA's founding principles.

Romania is party to all international instruments adopted under the auspices of the IAEA in the area of nuclear safety and security. Romania's expertise has not gone unnoticed. Quite recently, ambassador Cornel Feruță has ended his mandate as the Agency's Acting Director General, a position he earned thanks to his personal merits, but also to his country's relevance within the organization.

At the same time, the selection of Romania, along with Panama, to co-chair this conference is both a recognition of our efforts and as an incentive to live up to the high standards expected from us.

On this note, it is my pleasure to inform you of another recognition of Romania's contribution to the overall success of the organization: the recent designation of the Nuclear Research Institute in Pitești (RATEN ICN) as an International Centre based on Research Reactor (ICERR) in two areas of activity: "Education and Training" and "Joint Research and Development Projects". This is a reason for celebration for Romania, but also an asset for the Agency – therefore, a benefit for us all.

Another Romanian research institute, the "Horia Hulubei" National Institute for Research and Development in Physics and Nuclear Engineering (IFIN-HH), provides courses in nuclear safety and security for government representatives with responsibilities in the nuclear field. The Institute is a regional leader in the decommissioning of research reactors, providing both expertise and technical equipment for such projects, and is developing the first national nuclear forensics laboratory, in close collaboration with the IAEA.

Distinguished participants,

Romania is fully committed to maintaining high standards of nuclear security, in line with the international conventions, treaties and agreements, and is closely following current developments in this area.

Romania, through the National Commission for Nuclear Activities Control (CNCAN), is a valuable partner for the specialized services of the IAEA. CNCAN contributes with technical expertise in the framework of various events, ensuring the participation of lecturers in specific peer-review missions and hosting relevant meetings in cooperation with the IAEA. One such meeting was the Regional Workshop to Coordinate the Implementation of Integrated Nuclear Security Plans (INSSP) in Europe, organized in July 2019.

In this context, I would also like to mention Romania's support for the Agency's Technical Cooperation (TC) Programme, including voluntary financial contributions. Technical Cooperation is essential, for instance, for radioactive waste management efforts. In particular, such cooperation is key for the Romanian Nuclear Agency and Radioactive Waste (ANDR), which is building the National Near Surface Repository.

Our commitment to the principles and scope of the IAEA was visible during our first Presidency or the Council of the European Union (EU PRES). Within this framework, in 2019, we organized here, in Vienna, the workshop "*Nuclear Security: From Political Commitment to Practical Implementation*", in an effort to highlight the importance of political backing in achieving joint nuclear security goals.

To Romania, the consolidation of EU-level and regional cooperation, to improve prevention, detection and response capabilities, are underlying engagement priorities in the context of emerging nuclear threats.

Let me conclude by extending my delegation's sincere appreciation to the Director General and to the IAEA Secretariat for their hard work, professionalism and impartiality, and to assure them of our continuous support.

Thank you for your attention. I now pass the floor to my Co-President.

### 2.3. CONFERENCE CO-PRESIDENT, PANAMA

*(As prepared for delivery)*

#### **FEDERICO ALFARO BOYD**

##### **Vice-Minister of Foreign Affairs of Panama**

Dear all,

Like other countries, we also believe that in order to better understand the work of the IAEA it is very important to promote multilingualism, so I will address you in Spanish, a language which represents the mother tongue of more than 400 million people in the world.

*[The remainder of these remarks have been translated from Spanish]*

Your Excellency, Mr Bogdan Aurescu, Minister of Foreign Affairs of Romania and Co-President,

Mr Rafael Mariano Grossi, Director General of the IAEA,

Mr Juan Carlos Lentijo, Deputy Director General and Head of the Department of Nuclear Safety and Security of the IAEA,

Heads of delegation,

Ambassadors,

All delegations,

Allow me to first convey the apologies of Her Excellency Ms Rosario Turner, Minister of Health of Panama, who has been unable to attend this conference, as she is leading the national response to the public health emergency of international concern declared by the WHO. For me, as Vice Minister of Foreign Affairs of Panama, and the team accompanying me, it is an honour to be here at the International Conference on Nuclear Security 2020, of which we and our Romanian friends are privileged to be the Co-Presidents. We thank the Agency for placing its confidence in us.

For roughly a year, we have been actively working, together with the Romanian delegation and the technical team of the IAEA Secretariat, on the negotiation of a ministerial declaration, which we are today on the verge of adopting.

Heads of delegation,

We are cognizant of the countless discussions and rounds of negotiation that were required for us to be able to produce a document that will reflect the thinking and vision of the participating countries with respect to nuclear security. We appreciate the spirit of consensus demonstrated by all of you throughout this difficult process and hope that all the work of our delegations will culminate successfully in the adoption of the Ministerial Declaration.

We are confident that everyone will make the most of this conference to continue strengthening international ties of cooperation to improve the exchange of information and experiences among

the technical teams of our delegations, which will undoubtedly help bolster global nuclear security.

Distinguished delegates,

Panama reaffirms the objectives shared by us all regarding non-proliferation and the peaceful use of nuclear energy and recognizes that nuclear security contributes to international peace and security. The quantity of nuclear material worldwide is expected to continue growing in the coming years, especially as emerging nuclear technologies and their role in climate change mitigation are explored. We cannot allow that material to fall into the wrong hands.

Panama is also aware of the Agency's important work at the global level to establish effective and sustainable nuclear security systems, upon request, through cooperation in exchanging specialized knowledge, best practices and lessons learned in the peaceful use of nuclear energy.

From the end of 2017, we worked with the Agency to implement nuclear security measures before and during World Youth Day 2019, a large-scale event designed to accommodate a great many visitors, including the Supreme Pontiff and heads of State.

For this activity, the Agency's technical teams worked in coordination with our focal points to share their knowledge and experience with a range of Panamanian officials responsible for the welfare of the participants. As part of its contribution, the Agency also provided Panama with radiation detection equipment, which was deployed at the main points of entry and at the main venue of the major public events. All these successful efforts by Panama and the Agency left our country more prepared for the future.

Distinguished delegates,

I would like to congratulate Director General Rafael Grossi on his recent election as head of the Agency. Panama supported his candidacy from the outset and wishes him the best in his future tasks. Director General, you can be sure of our support in the initiatives that you propose for a safer and more prosperous world. I would also like to commend the Secretariat for its support and professionalism throughout the negotiation of the draft Ministerial Declaration and in the preparation of this conference.

Ladies and gentlemen,

ICONS is a unique opportunity for the international community to strengthen nuclear security nationally and multilaterally. Let us capitalize on these days to take decisive steps for a safer world in which nuclear energy is used solely for the progress of our peoples.

Thank you very much.

## 2.4. OUTGOING CONFERENCE PRESIDENT

*(As prepared for delivery)*

### **SHIN CHAE-HYUN**

#### **Permanent Representative of the Republic of Korea**

Co-Presidents,

Director General,

Excellencies,

Distinguished delegates,

First of all, as we commence the International Conference on Nuclear Security (ICONS) 2020, I would like to congratulate Co-Presidents, the Director General and the Secretariat on successfully preparing and organizing this important meeting.

Following in the footsteps of the Nuclear Security Summit process, ICONS has taken the center stage as the forum for renewing our commitments and strengthening our collective efforts for nuclear security. Through this process, nuclear security is now firmly placed on the global agenda, and a more robust and comprehensive nuclear security architecture has been established across the world. It is indeed an achievement that we all should be proud of.

From the outset, the Republic of Korea has firmly supported and actively participated in all these developments and international cooperation. And, drawing upon its experience as the host of the 2012 Seoul Nuclear Security Summit, it assumed the Presidency of ICONS 2016. Reaffirming its unwavering commitment, the Republic of Korea will continue to play an active role in taking our collective endeavor to the next level.

Excellencies and distinguished delegates,

As we reflect on our achievements, this conference, more importantly, provides a timely opportunity to redouble our efforts to address unfinished tasks and deal with emerging threats and challenges, especially at a time when the international security environment is changing rapidly. In this respect, drawing from Korea's experience as the former President, we would like to share a few thoughts on areas we should pay attention to and further build upon.

First, I would like to underline the significance of the role of the IAEA. The Agency's central role in facilitating international cooperation and its work of assisting Member States in establishing and improving their national nuclear security regimes is a crucial component of the global nuclear security framework. In this regard, it is important that the IAEA should further continue its active coordinating role and be provided with adequate resources to fulfill its mission effectively.

Second, we should mobilize our efforts toward the universalization and effective implementation of the relevant legally binding instruments, including the Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment. While its entry into force in 2016 demonstrated our collective will, we encourage all Member States that have yet to join to sign and ratify the Amendment at the earliest opportunity.

Third, I would also like to stress the increasing need to identify and address emerging threats to nuclear security resulting from rapidly developing technologies. In particular, as highlighted in the ICONS 2020's Ministerial Declaration to be adopted today, possible cyber-attacks at nuclear related facilities and their associated activities pose one of the most pressing challenges that we face. Unmanned Aerial Vehicles and portable Electronic Magnetic Pulse are likewise among emerging technologies that require our particular attention. I look forward to comprehensive and constructive discussions at the Scientific and Technical sessions this week.

Excellencies and distinguished delegates,

As we celebrate another milestone conference today, let us recall that nuclear security requires continuous vigilance and with Ministerial Declaration that we will adopt shortly, let us renew our commitments and further strengthen our efforts towards an effective and sustainable nuclear security architecture.

In closing, I would like to congratulate the Director General and Co-Presidents on successfully convening this Conference and with their excellent leadership and guidance, I have every confidence that this conference will produce a successful and meaningful outcome.

Thank you.

### 3. CLOSING ADDRESSES

#### 3.1. CONFERENCE CO-PRESIDENT, PANAMA

*(As prepared for delivery)*

#### **ANAYANSI RODRÍGUEZ VEGA**

**Chargé d'Affaires of Panama**

Estimado Director General, Rafael Grossi,

Dear Co-President of Romania,

Distinguished delegates,

It has been an honor for my country, me and my team to have discharged the role of Co-President of the process of both adopting the ICONS 2020 Ministerial Declaration and co-presiding, next to our friends from Romania, this International Conference on Nuclear Security.

Looking back, we would like to honor the work done by our former Ambassadors Ms Paulina Franceschi and Ms Anabella Guardia de Rubinoff, without whom we would not be here now concluding our role as Co-President.

Throughout this whole process, we experienced many changes in our team. Nevertheless, we, as a country that fulfills its international commitments, assumed the task entrusted to us to the best of our possibilities and capabilities.

Distinguished delegates,

ICONS 2020 marked a record attendance of Ministers. We thank Member States for ensuring high level participation and involvement in the proceedings of the conference. This demonstrates the interest of taking the agenda of Nuclear Security forward.

109 Member States intervened throughout the two days of the Ministerial Segment. A wide range of topics were raised such as: the appreciation for the adoption of the Ministerial Declaration; the importance of nuclear security as a national responsibility; the central role of the IAEA to facilitate and coordinate international cooperation and to assist States, upon request, in enhancing their national nuclear security regimes; the relevance of the universalization of the CPPNM and its Amendment and other international legal instruments relevant to nuclear security; the need for adequate funding for the Agency's nuclear security activities; the recognition of the national efforts to strengthen nuclear security; the importance of respecting the inalienable right of countries to the use of nuclear technology for peaceful purposes as part of their national development; the need to address computer security and the emerging technologies; the relevance of international and regional cooperation in nuclear security; and the support for the upcoming NPT Review Conference.

As for the scientific and technical segment, we had five high-level panel sessions. The main conclusions were the following: IAEA's central role in nuclear security globally is crucial; the need for enhanced synergies between safety and security; emerging technologies can be

valuable for improving nuclear security, while at the same time potentially imposing additional security risks; the Agency plays an important role in supporting investigations of new technologies for nuclear security applications and in raising awareness among States of the need to protect against cyber-attacks on nuclear and other radioactive materials, facilities and activities; the need for the international security framework to be able to adapt to the constant change and emerge of nuclear security threats; although legally binding instruments are good foundations for nuclear security, there is a need for agile non-binding instruments that reflect the good practice of Member States, such as the IAEA Nuclear Security Series; emphasis in the importance of the IAEA's role in providing assistance to States, upon request, in establishing and strengthening their nuclear security regimes; the need for adequate resources in the area of nuclear security; the identification of nuclear security needs is a State's responsibility; the importance to focus on specific areas within nuclear security to achieve maximum impact; partnerships should go further than International Organizations and also include industries; INSSPs and NSSCs are driving the international cooperation in nuclear security.

Furthermore, the conference organized other activities in its margins which included interactive sessions, side-events, among others.

This quantity and quality of meetings reflects nothing but the success of ICONS 2020. We are proud to have been part of it!

Our gratitude goes to the late DG Yukiya Amano, to DG Rafael Grossi, to DDG Juan Carlos Lentijo, to Director Raja Adnan, to Mr Darren Chen, to Ms Maria Eugenia Bermudez and to many other colleagues from the Secretariat who were involved in this enterprise.

Let me specially thank our Romanian colleagues, His Excellency Ambassador Istrate and Ms Livia Rusu, for their guidance and dedication. It has been a pleasure for me and Erik, to work together with you.

Now, I would like to give the floor to my distinguished Co-President. Ambassador Istrate, you have the floor.



### 3.2. CONFERENCE CO-PRESIDENT, ROMANIA

*(As prepared for delivery)*

#### **CRISTIAN ISTRATE**

##### **Permanent Representative of Romania**

Distinguished Director General Grossi,

Distinguished Co-President of Panama,

Distinguished delegates,

We are approaching the end of ICONS 2020, a milestone in the global efforts to strengthen nuclear security worldwide, which will be no doubt remembered as a meaningful, productive and forward-looking conference.

I would like, from my side, to thank first of all the Member States. The success of ICONS is your success! The rich outcome of this week-long event is your joint ownership! The future oriented outlook of deliberations, interactive sessions, and side-events was inspired and nurtured by you, delegates from all over the world: politicians, diplomats, experts!

You deserve the full credit for adopting the Ministerial Declaration, for your flexibility and spirit of compromise: thank you! We did it together!

And we should be proud of it, because reaching consensus in today's particularly difficult international context was no minor achievement.

It was, indeed, an achievement made possible by our collective support for nuclear security, carrying a message of continuity and of progress, a message which included political commitments, striving to consolidate trends, while taking the necessary precautions to ensure that a fine balance is preserved.

A fine balance, which indicates, nevertheless, a solid direction for the future of nuclear security, whereby States will continue to bear the responsibility, while the IAEA is strengthening its crucial coordinating and assisting role.

It is now up to each and every one of us to capitalize on the outcome of the ICONS in order to enhance the political attention to nuclear security, along the lines of its Ministerial Declaration.

One important opportunity in this regard will be the upcoming 2020 NPT Review Conference. Many delegations in their statements this week highlighted the connections and possible synergies between ICONS and the NPT RevCon. And they were right to do so, because the message that consensus can be achieved on a topic as sensitive and complex as nuclear security should resonate well also in New York next May.

We are already working in that regard with DG Grossi, to whom I would like to thank most warmly for his unwavering and inspirational support.

Much gratitude goes also to DDG Lentijo and Director Raja Adnan and their colleagues, Darren and Maria and other experts from the Department of Nuclear Safety and Security, who have been assisting the Co-Presidents with most valuable advice and deeds.

Many thanks to the conference services, the interpreters and all the IAEA's staff who contributed their bit to a great success!

Many thanks to the Ambassadors of Bulgaria and Egypt for their leadership in preparing a fantastic program for this week!

And now let me turn to my Panamanian friends: it has been a privilege working with you as a seamless team, we supported and complemented each other in an effective, result-oriented way. Together with Erik and Livia, our indispensable colleagues, we were able to fulfill the noble task entrusted to us by the forever remembered DG Amano: to serve the Member States in fulfilling their shared aspirations.

Thank you all once again and safe return home! The meeting is closed!

### 3.3. INTERNATIONAL ATOMIC ENERGY AGENCY

*(As delivered, verbatim)*

#### **RAFAEL MARIANO GROSSI**

**Director General, International Atomic Energy Agency**

Thank you, Ambassador, thank you very much. And thank you my dear colleague from Panama for these remarks. I don't think after these I have much more to add, frankly. You've said it all and you've said it right, and we are very grateful to you.

I think when I walk the corridors and I meet colleagues and friends I see that there is a shared impression that this was a good week. This was a week where lots of discussions took place and most of all, we reaffirmed once again how important is the work that we have in this area and how much, as I've been reminding, how much there is yet to achieve. But this has been a very solid, I would say, step in this direction of making nuclear security a real shared consolidated priority for all of us and to make sure we do the right thing back home, and in our regions, and collectively and in our groups.

I'm very happy to see that the flow of cooperation and assistance coming from you is growing. This week alone, in combined pledges, we've went above 20 million more. 20 million euros more apart from what we had already.

What is this? Is this an indication of generosity? Of course, it is an indication of generosity, but it is much more than that. It is an indication of the seriousness and the gravity of the problem. Countries do not give away tax payers' money like this if this is not for a good cause.

So, I think we should all be grateful for this, and make sure as much as we are concerned in the Secretariat, with the teams of DDG Lentijo, Raja, and all the experts, we are going to put this, together with you, to good use.

But the task doesn't stop there. I think we all know that here, in house, we still have a lot to do: working together in making nuclear security guidance get stronger, firm up, in the way to become standards and to be at the level they should be one day when the consensus for that will be ripe.

I'm sure that day will come, and this manifestation of interest and engagement from all of you gives us hope, that we all want to have a security normative structure that will allow us to avoid the unthinkable.

So, thank you for that excellent week. We come out of this reenergized. I wish you safe travels back home for those leaving Vienna. And it's not see you at the next ICONS, it's see you Monday or wherever the next opportunity will come to work on nuclear security.

I will give the floor back to you, as it's correct and appropriate, because being this a conference of member states, it is for member states to close it, not for the DG.

Thank you very much. You can count on all our efforts to make nuclear security what it needs to be.

## **4. CO-PRESIDENTS' REPORT**

**ANAYANSI RODRÍGUEZ VEGA**

**Chargé d'Affaires of Panama**

**& CRISTIAN ISTRATE**

**Permanent Representative of Romania**

### **4.1. INTRODUCTION**

The 2020 International Conference on Nuclear Security: Sustaining and Strengthening Efforts (ICONS 2020) was convened by the IAEA at its Headquarters in Vienna from 10 to 14 February 2020.

The purpose of the conference was to provide a forum for ministers, policymakers, senior officials and nuclear security experts to formulate and exchange views on experiences and achievements, current approaches, future directions and priorities for nuclear security. The conference succeeded in:

- Adopting the ICONS 2020 Ministerial Declaration by consensus;
- Raising awareness to maintain and further strengthen national nuclear security regimes as well as international cooperation in strengthening nuclear security globally;
- Reviewing the current status of nuclear security efforts, existing approaches and trends, and highlighting areas that may need more focused attention including technological dimensions;
- Encouraging the universalization and full implementation of the Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment;
- Promoting IAEA nuclear security guidance and other international guidelines, and their use by States;
- Encouraging the sharing of information and good practices in nuclear security whilst protecting sensitive information;
- Reaffirming and supporting the central role of the IAEA in strengthening the nuclear security framework globally and in leading the coordination of international activities in the field of nuclear security, whilst avoiding duplication and overlap;
- Highlighting and promoting the IAEA's activities and programmes with respect to the international instruments in the area of nuclear security;
- Discussing further enhancements of IAEA nuclear security activities and their sustainability;

- Recognizing the Nuclear Security Fund as an important instrument for the IAEA's activities in the field of nuclear security; and
- Highlighting the interfaces between nuclear safety and nuclear security.

The conference did not discuss any sensitive nuclear security information.

The conference was attended by a record number of 53 ministers and over 1900 participants from 141 Member States, 4 Non-Member States and 25 international organizations.

#### 4.2. MINISTERIAL SESSION

In their opening remarks, the IAEA Director General Mr Rafael Grossi and the Conference Co-Presidents, Mr Bogdan Lucian Aurescu (Minister of Foreign Affairs, Romania) and Mr Federico Alfaro Boyd (Vice-Minister of Foreign Affairs, Panama), underlined the importance of adopting the Ministerial Declaration that will inform the work of the IAEA and its Member States in sustaining and strengthening nuclear security worldwide in the coming years. They also underscored the importance of the central role of the IAEA in nuclear security globally.

After recognizing and thanking both the Co-Presidents for working together to lead the Conference, and the co-chairs for their efforts in assuring consensus on the Ministerial Declaration, the Director General highlighted how the record participation of ministers at the conference reflects the great importance attached to nuclear security by the Member States. He highlighted the sustained growth of nuclear activities and noted how they are a magnet for groups harboring malicious intent. He observed, while emphasizing that nuclear security is a national responsibility, that there is universal recognition of the need for international cooperation to guard against nuclear terrorism and of the role of the IAEA as the inclusive global platform for that cooperation. He emphasized that maintaining the highest levels of nuclear security should not be seen as an obstacle to using nuclear technology, but rather as an enabler. Listing a variety of examples, he highlighted the constantly increasing demands for IAEA assistance in nuclear security. On the Convention on the Physical Protection of Nuclear Material and its Amendment, the Director General highlighted the importance of the Convention as the only legally binding treaty on the protection of nuclear material. He also noted that since ICONS 2016, five additional countries have adhered to the Convention, while 10 CPPNM States have adhered to the Amendment. He expressed the desire to see the IAEA nuclear security guidance share the same status as IAEA safety standards. Emphasizing the need for sustained efforts in nuclear security, the Director General stressed that even countries with little or no nuclear or radioactive material on their territory must remain vigilant. He concluded by thanking all for their presence and high-level political support.

Following the Director General's remarks, Minister Aurescu took the floor, noting the concise and forward-looking Ministerial Declaration and pointing out the thorough and scrupulous process of negotiating the Declaration that lasted for almost a year under the co-chairmanship of Romania and Panama. He underlined that the Co-Chairs have served as facilitators and honest brokers and have carefully considered the valuable inputs and priorities put forward by Member States. He considered the Ministerial Declaration to reflect the political will of Member States, adding value to the process of strengthening nuclear security worldwide by guiding and channeling the efforts of both Member States and the IAEA in the coming years. He then recognized the importance of the IAEA's work in nuclear security, underscoring Romania's support for the IAEA in this area. He highlighted several efforts that Romania is undertaking in the nuclear area in general, and in nuclear security, in particular.

As Romania's national contribution to the IAEA, Minister Aurescu mentioned, among other efforts: the expertise of Ambassador Cornel Feruță, including through serving as the IAEA's Acting Director General; serving as Co-President of ICONS 2020, together with Panama; the recent designation of the Nuclear Research Institute in Pitești (RATEN ICN) as an International Center based on Research Reactor (ICERR) in two areas of activity: "Education and Training" and "Joint Research and Development Projects"; the activities undertaken by Horia Hulubei National Institute for Research and Development in Physics and Nuclear Engineering (IFIN-HH) in training in nuclear safety and security; acting as a regional leader in the decommissioning of research reactors and developing the first national nuclear forensics laboratory, in close collaboration with the IAEA; the work of the National Commission for Nuclear Activities Control (CNCAN) and of the Romanian Nuclear Agency and Radioactive Waste (ANDR); and organizing in April 2019 under the aegis of the first Romanian Presidency of the Council of the European Union, the workshop "Nuclear Security: From Political Commitment to Practical Implementation." Finally, he underscored Romania's support for the IAEA's Technical Cooperation Programme.

Vice-Minister Alfaro then took the floor, addressing the audience in Spanish to promote multilingualism and its potential to allow Member States to better understand the work of the IAEA, especially in nuclear security. He highlighted the spirit of consensus and flexibility shown by Member States throughout the process of negotiating the Ministerial Declaration. He then expressed his confidence that all participants would benefit from the Conference in continuing to strengthen international cooperation and further supporting nuclear security efforts worldwide.

Vice-Minister Alfaro recognized that nuclear security contributes to international peace and security, particularly as global stocks of nuclear material are expected to grow in the coming years as a means to mitigate the consequences of climate change. He expressed support for the IAEA's work to help Member States to establish sustainable nuclear security regimes by helping to share good practices and lessons learned. Finally, he highlighted the assistance provided to Panama by the IAEA in implementing nuclear security measures before and during the 2019 World Youth Day, including through holding training events and supplying radiation detection equipment. He noted that this successful cooperation had enhanced Panama's overall nuclear security architecture.

Following these remarks, the Resident Representative of the Republic of Korea to the IAEA, Ambassador Shin Chae-Hyun, was invited to deliver a statement on behalf of Ms Kang Kyung-wha, Minister for Foreign Affairs, and as the Chair of ICONS 2016, to reflect on developments since the last ICONS. After congratulating the Co-Presidents and the Director General for the successful organization of the conference, Ambassador Shin highlighted the importance of ICONS for supporting the collective efforts of the international community to place and maintain nuclear security on the global agenda.

Then, Vice-Minister Alfaro, along with Minister Aurescu, officially opened the conference. Afterwards, Minister Aurescu submitted the ICONS 2020 Ministerial Declaration for adoption. The Ministerial Declaration, adopted by consensus during the opening of the Ministerial Segment, is available on the conference web site.

The Conference continued with the Ministerial Segment, in which a total of 109 statements were delivered by Ministers and other Heads of Delegation on behalf of their States and the EU.

The Ministerial Segment was followed by a scientific and technical programme comprising five high level discussions on broad themes central to nuclear security and 54 parallel technical sessions on specialized scientific, technical, legal and regulatory issues concerning nuclear security. The programme also included an interactive scenario-based policy discussion involving Ministers and other Heads of Delegations which highlighted the benefits of becoming party to the amended CPPNM; over 70 interactive content presentations and over 80 poster sessions, 35 exhibitions and 32 side events.

This Co-Presidents' Report draws on rapporteurs' reports and highlights the main conclusions and key issues of the conference as a whole. Concluding remarks of the Co-Presidents were presented on the last day of the Conference. While every effort has been made to ensure that this Report is an accurate and balanced reflection of the conference, ultimately it is the Co-Presidents' and not a consensus report.

#### 4.3. HIGH-LEVEL PANEL SESSIONS

The five high-level panel sessions of the conference focused on:

- The role of the IAEA in nuclear security;
- Emerging technologies and the digital age;
- International legally and non-legally binding instruments for nuclear security;
- National nuclear security regimes;
- International cooperation in information exchange, sharing of good practices and broader experience to enhance nuclear security.

The main conclusions of these sessions are summarized in the following five sections.

##### **4.3.1. The role of the IAEA in nuclear security**

This session addressed the role of the IAEA in implementation of international instruments related to nuclear security as well as the central role of the IAEA in coordinating efforts and technical support provided to Member States, upon request, for strengthening nuclear security. Panellists described their perspectives on future focus areas and activities for the IAEA, and in particular, for the Nuclear Security Plan 2022 – 2025, which will begin to be developed in 2021. Further, some presenters touched upon how the activities of the IAEA and its Member States in nuclear security relate to the UN Sustainable Development Goals. Panellists also addressed opportunities for synergy and coordination between the IAEA's Division of Nuclear Security and other Departments and Divisions of the IAEA.

In conclusion, the panellists agreed that the IAEA's central role in nuclear security globally is crucial. They expressed appreciation for the IAEA's work with Member States to enhance their nuclear security regimes, calling for a strengthened role for the IAEA in nuclear security. Further, several panellists noted the need for enhanced synergies between safety and security, including related to IAEA guidance. Finally, while some panellists highlighted that safety and security are intrinsic to peaceful uses, others stressed that security should not be a constraint for provision of assistance related to peaceful uses.

##### **4.3.2. Emerging technologies and the digital age**

In this session, panellists discussed the impact of emerging technologies, their applications in improving nuclear security and the additional security challenges that they present. Panellists

also discussed the need to ensure adequate cyber security while dealing with challenges such as resource constraints and the speed of technological advancement.

Panellists brought perspectives from both public and private sectors, but agreed that cooperation between the two is key to ensuring emerging technology is accounted for in nuclear security. Multiple panellists proposed strong public-private partnerships in order to keep up with the speed of technological advancement, as well as to ensure that emerging technology meets security requirements and falls within regulatory frameworks. Panellists also suggested strong partnerships with vendors in order to maintain the integrity of supply chains.

Panellists concluded that emerging technologies are essential to improving operations and can be valuable for improving nuclear security. At the same time, they highlighted the additional potential security risks that accompany such technologies, especially those associated with information and computer security. Emerging technologies in areas such as artificial intelligence and big data have applications in detection, delay, and response to nuclear security events. Panellists expressed that the adoption of new technology to help ensure the safe and secure operation of activities involving nuclear and other radioactive material is becoming an expectation. However, they noted that vigilance is needed to avoid potentially introducing new security vulnerabilities as the efficiency and effectiveness of such activities is improved by the adoption of such technology.

Finally, panellists noted that the IAEA plays an important role in supporting investigations of new technologies for nuclear security applications, as well as in continuing to raise States' awareness of the need to protect against cyber-attacks on nuclear and other radioactive material facilities and activities. They emphasized that a strong regulatory foundation is critical to a State's ability to address how to handle technological advancements.

#### **4.3.3. International legally and non-legally binding instruments for nuclear security**

In this session, panellists discussed the range of international legally and non-legally binding instruments for nuclear security including United Nations Resolution 1540, the Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment, the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), and the IAEA Code of Conduct on the Safety and Security of Radioactive Sources. Some panellists elaborated on national experiences related to these instruments as well as with activities intended to support States in implementing them, such as International Physical Protection Advisory Service (IPPAS) missions. Others provided perspectives from international organizations such as UNOCT, UNODC and IAEA that seek to assist States in adhering to and implementing such instruments.

Much of the discussion following the panel briefings focused on the challenges, as well as the motivations, for Member States to join or adhere to these instruments. One panellist noted that crises such as the terrorist events in the United States on 11 September 2001 can motivate States to adhere to legal instruments, emphasizing that such crises can make it clear that the security of one country depends on the security of others. At the same time, several panellists stressed that the nuclear security community should be proactive and not only react to crises.

Multiple panellists encouraged States to adhere to international instruments related to nuclear security, particularly the CPPNM and its Amendment. They also expressed support for continuing efforts by international organizations, including IAEA legislative and technical assistance, to encourage further adherence.



In conclusion, it was noted that as nuclear security threats continue to change and emerge, the international nuclear security framework, comprised of both legally and non-legally binding instruments, needs to be able to adapt. Further, it was noted that legally binding instruments are good foundations for nuclear security but there is also a need for agile non-binding instruments that reflect the good practices of Member States, such as the IAEA Nuclear Security Series.

#### **4.3.4. National nuclear security regimes**

In this session, panellists provided overviews of national nuclear security regimes in individual Member States. Under this broad topic, panellists addressed national legal and regulatory frameworks, physical protection measures, methods for managing the interface between safety and security, sustainability and integrated approaches to nuclear security. The importance of nuclear security culture and capacity building, including training and education, was stressed by the panel. Further, a particular focus of the discussions was States that are initiating new nuclear programmes and the steps they have taken to establish and strengthen their national nuclear security regimes.

Both prescriptive and risk-informed performance-based approaches to designing nuclear security systems were discussed by various panellists. National experiences were shared regarding the use of each of these approaches. In addition, the importance of the State assessing the appropriateness of a performance-based or prescriptive approach for a particular situation was underscored.

Panellists emphasized the importance of the IAEA's role in providing assistance to Member States, upon request, in establishing and strengthening their national nuclear security regimes, including assistance in training and education and by providing legislative and regulatory assistance.

While it was agreed that the IAEA is providing good support for States, they receive a large number of requests, not all of which can be quickly addressed. The panel concluded that given the importance of the IAEA's coordination efforts, further investment of energy and resources in this area would be valuable.

#### **4.3.5. International cooperation in information exchange, sharing of good practices and broader experience to enhance nuclear security**

In this session, panellists shared their national perspectives, experiences, and success stories in international cooperation related to nuclear and radiological security. Panellists underscored the importance of taking long-term capacity building and sustainability into consideration when engaging in international cooperation. In particular, they stressed that international cooperation needs to be driven by Member States' needs, and expressed appreciation for the role of organizations such as the IAEA, INTERPOL, and the European Union, as well as bilateral partners in offering assessments of States' nuclear security gaps and of opportunities to enhance States' national nuclear security regimes. Panellists further observed that the IAEA's Integrated Nuclear Security Support Plans and Nuclear Security Support Centres are serving effectively as focal points for international cooperation to develop national and regional capability.

Panellists also observed that to make international cooperation more productive and effective, the international community should focus on the specific areas where States require support (in appropriate fora) in order to avoid duplication of efforts. They also emphasized that the international community should ensure the perspectives of industry and operators are taken into account, as these perspectives are valuable to the international exchange of information on

nuclear security. Lastly, they noted that bilateral and multilateral information exchange as well as public communication can increase confidence in national nuclear security regimes, which in turn supports the peaceful uses of nuclear technologies.

#### 4.4. TECHNICAL SESSIONS

Building on the discussions in the High-Level Panels, 54 technical sessions addressed in more detail a wide range of specific scientific, technical, legal and regulatory issues relevant to nuclear security. The main conclusions of these sessions are summarized in the following sections.

##### **4.4.1. International instruments and national regulations**

###### *4.4.1.1. National nuclear security regulations*

During the first of these technical sessions, discussions addressed the integration of nuclear forensics into national legal systems, case studies of nuclear security regulations, and the role of law enforcement in a State's physical protection and nuclear security response regime. It was noted that the implementation of nuclear forensics at national level should be in accordance with a State's national penal legislation, and that there is a need for an information exchange channel between judicial authorities or other investigative bodies. In addition, panellists agreed that international cooperation on issues related to nuclear forensics is essential, but at the same time, confidentiality concerns need to be addressed as part of national legislation and bilateral agreements in this area. Panellists also noted that there is a need to integrate nuclear security requirements into regulations in a way that optimizes regulatory activities and associated resources. They also underscored that the regulatory body, with the help of industry, should maximize the use of resources for ensuring continued protection of public health and safety.

During the second technical session on national nuclear security regulations, the main focus was on national experiences in implementing nuclear security regulations, with an emphasis on physical protection and computer security regulations. One panellist highlighted steps taken to increase the nuclear security capacity at the nuclear regulator, while another panellist discussed physical protection and computer security aspects of licensing the operation of a recently constructed nuclear power plant. In computer security, topics included the evolution of international standards for instrumentation and control systems in nuclear power plants, the creation, implementation and ongoing evolution of national computer security regulations, and experiences of one State to incorporate computer security threat profiling and risk mitigation into its nuclear security programme.

Finally, during a third session addressing national nuclear security regulations, Member States provided national perspectives on the establishment of their national nuclear security regimes and how these regimes can be sustainable. Panellists addressed new national legislation for security of nuclear material and nuclear facilities in detail, as well as their approaches for the development of nuclear security regulations. The active role of the IAEA in assisting Member States, upon request, in the development of such regulations was underscored. With respect to sustainability, guidance contained in the recently published IAEA Implementing Guide Sustaining a Nuclear Security Regime (IAEA Nuclear Security Series No. 30-G) was highlighted.

#### *4.4.1.2. The Amended Convention on the Physical Protection of Nuclear Material review conference in 2021*

This technical session included discussion of both the upcoming 2021 Conference of the Parties to the Amendment to the CPPNM as well as national experiences in adherence to and implementation of the CPPNM and its Amendment. One panellist provided an update on the preparations for the 2021 Conference, while another provided an argument for holding such conferences at regular intervals following the 2021 Conference, with the aim of keeping the Convention relevant. Panellists also suggested that a regional approach to reviewing the CPPNM as amended could be successful, particularly with respect to articles referring to information sharing and coordination. The session concluded that the CPPNM as amended is an important instrument to ensure a robust physical protection regime and panellists underscored the importance of all States adhering to the CPPNM and its Amendment, regardless of whether they have substantial nuclear programmes or not. Finally, during the discussion, panellists emphasized that IAEA IPPAS missions, bilateral agreements, and regional peer reviews could accomplish the same goals that verification measures serve in other treaties, while avoiding the challenges that accompany verification measures.

#### *4.4.1.3. Implementation of national legislative and regulatory frameworks, and international instruments*

The briefings presented during the first technical session on the implementation of national legislative and regulatory frameworks related to nuclear security addressed issues such as nuclear and other radioactive material; associated facilities; intra- and international cooperation; and good practices to implement a comprehensive national legislative and regulatory framework for nuclear security. The panellists emphasized that international cooperation, including bilateral assistance to strengthen States' national nuclear security regimes, is important for the international legal framework and that well-drafted regulations based on relevant international legal instruments as well as IAEA guidance documents and internationally accepted practices can enable better international cooperation in this area. The panellists also highlighted that legislative and regulatory frameworks may differ from State to State. Finally, they noted that national regulators have the primary responsibility to develop and enforce regulations, whereas nuclear operators have the responsibility to implement them, underscoring the importance of cooperation between the regulator and operators.

During the second technical session on the implementation of national legislative and regulatory frameworks and international instruments, several challenges were discussed, along with national experiences in addressing them. One panellist highlighted the challenges associated with assuring security of radioactive sources with limited resources, while another addressed challenges of exchanging information between various nuclear security stakeholders in the context of investigations and prosecutions related to nuclear security events. A third panellist focused on national experiences in implementing outcome-focused nuclear security regulations. Two other panellists addressed a national system for the electronic licensing of applications for facilities and activities using radioactive sources, and how a national internal compliance system is used by industries to comply with national and international export control policy.

#### **4.4.2. National nuclear security regimes**

##### *4.4.2.1. Identification of national needs through the development of an Integrated Nuclear Security Support Plan*

This technical session addressed national experiences in the development and implementation of Integrated Nuclear Security Support Plans (INSSPs). The panellists focused particularly on the benefits of developing and implementing an INSSP, including enhancing national coordination, applying a systematic and comprehensive approach to strengthening their national nuclear security regimes, coordinating assistance using the INSSP process and the use of self-assessment tools to enhance national nuclear security. The session concluded that an INSSP is a valuable tool to coordinate nuclear security activities in a State—in particular to increase coordination among relevant competent authorities—and to provide a systematic approach to strengthen national nuclear security regimes. In addition, they underscored that an INSSP can be a valuable tool in accessing IAEA assistance and coordinating other programmes of assistance and in ensuring that the assistance received addresses national needs.

##### *4.4.2.2. Regional experiences in nuclear security*

The Chair opened the session by stressing the importance of regional security and the variation across the world in nuclear security approaches. Following the Chair's introduction, the panellists highlighted their experiences with nuclear security cooperation in their respective regions. Notably, in some instances, work by organizations such as the Arab Atomic Energy Agency (AAEA) and the Association of Southeast Asian Nations Network of Regulatory Bodies on Atomic Energy (ASEANTOM) help members to build capacity and develop networks of experts in the region. Panellists stressed the importance of a national commitment to nuclear security. Such a commitment can provide authorities with needed political support enabling, for example, regulators to develop and implement memoranda of understanding (MOU) between regulatory bodies and other national and regional stakeholders with nuclear security responsibilities. Panellists also emphasized the importance of taking a “bottom-up” approach to nuclear security and of involving multiple stakeholders in processes such as developing national action plans as part of the European Union's Chemical, Biological, Radiological and Nuclear Risk Mitigation Centres of Excellence programme, and developing an Integrated Nuclear Security Support Plan with the IAEA. Broadly, panellists agreed that regional cooperation and coordination starts at the national level with the training of personnel and the creation of a network of experts to support regional efforts in nuclear security.

#### **4.4.3. Security of nuclear and other radioactive material and facilities**

##### *4.4.3.1. Addressing security from the start: Security by design and newcomers*

This technical session addressed two interrelated topics: security by design and newcomer States. During the briefings, panellists noted that many countries are beginning to explore the possibility of using nuclear energy to meet their energy needs, while efforts continue to develop and deploy new types of nuclear reactors globally. Panellists emphasized that as systems and facilities are first designed, it is important to keep in mind that efficient and effective design is best achieved when measures to meet national requirements for safety, safeguards and security are balanced and incorporated into the facility design from the initial stages. Briefings addressed security by design approaches ranging from changing reactor designs to reduce consequences, to broadly influencing decisions on siting of a nuclear facility and its facility layout and construction. During the discussion following the briefings, panellists re-emphasized the

importance of incorporating security by design features early in the design process. Further, panellists suggested that the IAEA intensify its efforts to encourage Member States to incorporate materials, particularly as part of new nuclear programmes.

#### *4.4.3.2. Physical protection systems: Evaluation and assessment*

The first technical session on this topic addressed experiences and lessons learned in the evaluation and assessment of physical protection systems. In particular, the session addressed the design and evaluation process for a physical protection system, including modeling and simulation tools, and the benefits of using performance testing to validate evaluation inputs when characterizing physical protection system effectiveness and performance. Further, the session addressed detection, delay, response, balanced protection and defence in depth measures, as well as lessons learned for design and placement of security measures for facilities with high radiation areas. The session also discussed the importance of the human factor in nuclear security. IPPAS missions and the follow-up physical protection upgrades were also identified as helpful to Member States in identifying and resolving challenges related to physical protection systems.

The second technical session on this topic focused on evaluation and assessment of physical protection systems, with a focus on modelling and simulation and response training. During the session, a case study was presented of the design and evaluation process for a physical protection system at a hypothetical facility used as a demonstration for university students. In addition, another panellist described the application of a risk management performance-based approach in physical protection, information security, and nuclear material accounting and control. Another briefing provided an overview and history of the design and evaluation process for a physical protection system, with an emphasis on the challenges associated with ensuring the effectiveness of physical protection measures through modelling and simulation as well as performance testing. Finally, an overview of a training course for a coordinated on-site and off-site response to nuclear security events was provided.

#### *4.4.3.3. Research reactor security*

The technical session focused on nuclear security at research reactors, including licensing, risk assessment and project management to implement and assess upgrades in response to identified risks. A digital tool to enhance nuclear safety and security at research reactors was also discussed. When discussing approaches for risk assessment at research reactors, panellists and audience members noted that explicit consideration of cyber and insider risks could be useful.

#### *4.4.3.4. Nuclear security of nuclear fuel cycle facilities: Emerging technologies and associated challenges and complex threats*

Briefings during this session focused on the challenges and complex threats to security of nuclear fuel cycle facilities from emerging technologies. Panellists highlighted their efforts to identify and evaluate new areas of threats and opportunities associated with such technologies, as well as their national regulatory experiences in this area. One panellist described a systematic methodology for analysing a range of emerging technologies and prioritizing them with respect to their potential impact on nuclear and radiological security. Approaches to strengthen national and international management of plutonium were also discussed. The panel discussion following the briefings highlighted that there is a lack of IAEA Nuclear Security Series guidance on activities such as disposal, decommissioning of facilities, spent fuel and waste generated from nuclear fuel cycle facilities. In conclusion, the panellists noted that

technological advances and corresponding potential vulnerabilities may pose additional nuclear security challenges. Such challenges should be regularly and systematically analyzed in order to keep nuclear security frameworks adequate and relevant to address emerging threats.

#### *4.4.3.5. National nuclear security inspections*

In this session on national nuclear security inspections, panellists provided briefings on how their countries implement security inspection regimes. The main themes covered in the session included the need for international cooperation and sharing of best practices on nuclear inspections; sustainability of inspection regimes; and training of inspectors and the inspection process. During the discussions, the panellists shared experiences on how nuclear security inspection regimes are implemented and sustained in their respective countries, and highlighted some of the challenges faced in the process. One particular challenge that was highlighted was the difficulty in developing and sustaining human resources. To address this challenge, panellists discussed multiple potential solutions, including incorporating multiple individuals in an inspection, ensuring trainees are paired with experienced inspectors, and allowing outside organizations to provide peer feedback. Panellists and audience members further discussed the importance of developing not only technical competencies, but also soft skills, such as communication, negotiation and behavioural skills.

#### *4.4.3.6. International Physical Protection Advisory Service: Good practices and lessons learned*

The briefings provided in this technical session highlighted the benefits provided by IPPAS and other IAEA advisory or review missions. It was noted that through the IPPAS missions, the IAEA can provide support to newcomers and opportunities for Member States with more developed nuclear programmes to further improve their nuclear security regimes, and for both newcomers and Member States with developed programmes to take concrete action in this area. All panellists reinforced that IPPAS missions are neither inspections nor audits, but rather provide advice to Member States on how to enhance their national nuclear security regimes. Panellists also stressed that the host country has ownership over the outcomes of an IPPAS mission and ultimately decides on how the outcomes are acted upon and with what priority. They also provided suggestions for the further enhancement of IPPAS missions, notably the development of self-assessment guidelines and sub-modules. Finally, it was underscored that early preparation for an IPPAS mission, involving all stakeholders, is key to a successful mission.

#### *4.4.3.7. Risk-informed approach to the security of radioactive material in use and storage and application of the graded approach and defense in depth to nuclear security*

During this technical session, briefings from panellists summarized risk informed approaches to the security of radioactive material in use and storage, with a focus on defense in depth, strengthening of security measures and developing and implementing regulations. Panellists generally encouraged more engagement between the regulator and the operator to promote a risk-informed approach and graded approach to nuclear security. With regard to reducing the security risk associated with radioactive materials and associated activities and facilities, one noted approach was to eliminate the risk of misuse of radioactive material by replacing high activity sources used in medicine by X-ray machines. However, panellists agreed that when radioactive material is being used, risk informed approaches and defense in depth should be used to protect this material, and an associated regulatory framework should be established. The use of the newly revised IAEA Implementing Guide Security of Radioactive Material in

Use and Storage and of Associated Facilities (IAEA Nuclear Security Series No. 11-G (Rev.1)) was recommended by panellists as guidance for Member States in applying a graded approach in this area.

#### **4.4.4. Preventing, detecting and responding to material out of regulatory control**

##### *4.4.4.1. Preventing illicit trafficking of nuclear and radioactive material*

In the first of these technical sessions, panellists discussed techniques employed in their respective countries to develop technical capabilities and to coordinate organizations in order to prevent illicit trafficking of nuclear and radioactive materials. Much of the discussion focused on improving radiation detection capabilities at ports of entry and commercial ports. Panellists shared experiences based on exercises and case studies on the successes and challenges to responding to potential illicit trafficking events. Additionally, panellists discussed how the coordinating bodies in their countries improve collaboration between multiple agencies while responding to potential incidents. The importance of international collaboration on developing radiation detection technologies, strategies on coordinating radiological and nuclear response, and sharing information on radiological and nuclear trafficking through mechanisms such as the IAEA's Incident and Trafficking Database (ITDB) was highlighted.

In the second technical session on this topic, panellists addressed illicit trafficking and the technologies and methodologies being employed by States to improve detection and risk assessment and to reduce cargo screening time. Some panellists shared stories regarding how countries that were made aware of incidents of illicit trafficking were able to cooperate. Following the briefings and discussion, it was concluded that it is important that States have a regulatory framework in place to address the issues of illicit trafficking, and that information exchange and cooperation between States, including in the area of risk assessment and management, is essential. Further, it was concluded that new developments in technology can improve detection systems.

##### *4.4.4.2. Detection technology performance testing*

This technical session addressed new technologies and approaches to detection technology and performance testing. It was noted that the landscape of detection technologies is constantly changing, and that there is a need for performance testing to ensure sustainability of equipment used for detection. Panellists identified a number of challenges with detection equipment, including human and environmental factors, cost and aging of equipment. Panellists also highlighted activities developed by individual Member States or through support of existing IAEA Coordinated Research Projects to develop techniques to improve performance and usability of detection equipment. In addition, panellists addressed new techniques for nuclear detection, including the use of gamma imaging to improve accuracy for collecting samples and the use of artificial intelligence to identify complex radionuclides. Broadly, the panellists agreed on the need for performance testing and developing new detection techniques to ensure that detection equipment is accurately detecting illicit material under various conditions.

##### *4.4.4.3. Building and maintaining a Nuclear Security Architecture*

During this technical session, briefings addressed systems and measures for the detection of nuclear and radioactive materials, including training tools, a case study of technical reachback, and methods for detection of radioactive sources in scrap metal. With respect to training tools, one panellist discussed the use of desktop radiation portal monitors for addressing the challenges associated with hands-on training, such as limited time for training on equipment

and likelihood of damage to the equipment. On reachback, it was stressed by panellists that there is a need for a national team of scientific experts who provide both advisory assistance to front line officers, as well as simulation tools and automated software to support timely and effective reachback. Finally, panellists emphasized that timely communication needs to be established between regulatory authorities regarding information on material out of regulatory control.

#### *4.4.4.4. Coordinated response to a nuclear security event*

In this technical session, panellists addressed challenges and opportunities related to developing and implementing a coordinated response to a nuclear security event. It was noted that substantial specialized resources are needed to respond effectively to a nuclear security event, and that an effective response involves coordination and cooperation from all levels of the national government, as well as international cooperation. Panellists specifically addressed an impact assessment of nuclear security events involving chemical explosives; challenges associated with a coordinated response to a nuclear security event; a model for nuclear security programme assessment and planning; and an airborne gamma mapping system developed for the response to nuclear security events.

#### *4.4.4.5. Good practices in the development and execution of nuclear security exercises: National experiences*

During this technical session, panellists discussed how nuclear security exercises can help strengthen the nuclear security regime; test and develop cooperation and coordination among various stakeholders; and evaluate procedures, personnel training and equipment. In addition, it was noted that exercises offer excellent opportunities for raising awareness, including for the public. Computer security was a particular focus of discussion, and it was noted that simulated exercises are very well adapted to be used in computer security. Panellists considered that due to the increasing threat of cyber-attacks, States should increasingly consider undertaking national exercises focused on computer security. They also noted that nuclear security events, including those involving cyber-attacks, can trigger a radiological emergency; thus, interactions between nuclear security and emergency response need to be taken into account when developing exercise scenarios.

#### *4.4.4.6. Nuclear security for major public events*

During the technical session focused on nuclear security for major public events, each panellist provided a case study of a major public event in their country that underscored the importance of preparation; the adoption of a ‘many agencies, one team with a shared goal’ approach; and training for such events. The panellists emphasized that the need for security, preparedness and operational capabilities for pre-event monitoring, detection, and response at major public events has steadily increased in recent years. Panellists noted that the intent of nuclear security measures at a major public event should not only be to protect the public, but also to deter adversaries by displaying a strong readiness capability. A common theme among the case studies was the understanding that in order to properly support a major public event, Member States need to develop a solid nuclear security framework that includes coordination among national agencies and strong collaboration among law enforcement agencies and nuclear experts. It was noted that this collaboration should be reinforced with strong joint training activities. The panellists also concluded that, due to the potential level of effort to execute nuclear security measures at large major public events, coordinating with the IAEA or partner



States for additional planning, training, resources, technical support and exchange of information can be beneficial.

#### *4.4.4.7. Nuclear forensics: Create and sustain*

Briefings during this technical session were focused on initiating and sustaining a national nuclear forensics programme. Several major themes emerged from the panellists' briefings, including: the value of using existing resources and applying them to national nuclear forensics programs; the need to establish national response plans; the value of detailed analytical plans and procedures; and the need for effective cooperation between nuclear forensics scientists and law enforcement. Panellists also highlighted the value for regional and international collaborations to initiate and sustain national nuclear forensics programs and the importance of training and exercises for establishing and maintaining nuclear forensics capabilities. Further, they underscored the need for national nuclear forensics programs to effectively collaborate and communicate with a diverse set of stakeholders both domestically and internationally, particularly nuclear forensics scientists and law enforcement.

#### *4.4.4.8. Nuclear forensics: Collaborative efforts*

This technical session reviewed recent technical forums, trainings, self-assessment tools and bilateral and regional cooperation promoting nuclear forensics. Panellists noted the growth of nuclear forensics over the past decade as a tool for preventing and responding to nuclear and other radioactive materials out of regulatory control, and raised the importance of a common and consistent approach to the conduct of a nuclear forensics examination. They also emphasized that nuclear forensics can be strengthened through the use of existing national tools and subject matter expertise, augmented by bilateral and regional partnerships and professional development assignments within leading nuclear forensics laboratories. Finally, it was stressed that the development and sustainability of nuclear forensics is contingent upon international collaboration in nuclear forensics and that the IAEA should consider organizing more frequent meetings similar to the Nuclear Forensics Technical Meeting convened in 2019.

### **4.4.5. Computer security for nuclear security**

#### *4.4.5.1. Identification, classification, and protection of digital assets in a nuclear security regime*

This technical session discussed the identification, classification, and protection of digital assets in nuclear security regimes. It was noted that digital assets are an integral part of nuclear security regimes and the defense of these assets is important for protecting against theft and sabotage of nuclear and other radioactive materials. One panellist in particular noted information and computer security risk analysis and technical defense architectures need to be more broadly considered in the construction stage of nuclear power plants. Several panellists suggested specific possible methods for protecting these assets and highlighted the need for ongoing research efforts to continually assure protection. For example, it was noted that a function-based approach allows measures to be directed based on the impact of compromise rather than just the protection of the digital asset itself.

#### *4.4.5.2. Computer security risk management for nuclear security*

During this technical session, panellists provided a range of methods used by States to manage computer security risk. During the briefings, it was stressed that safety needs to consider security and the protection against malicious acts in all computer systems relevant for safety.

Computer security capability maturity models, a method for evaluating the maturity of computer security programmes, can be developed and may be helpful to identify areas for improvement. It was noted that simulations can help not only in training, but also for research related to computer security. There was also discussion of cyber security training and exercises, during which it was highlighted that the constantly changing nature of computer security and cyber threats makes effective personnel training challenging. The panellists underscored that computer security exercises need to be undertaken to effectively determine the performance of a computer security programme.

#### *4.4.5.3. Secure digital asset design techniques*

This session heard from five Member States describing different aspects of the development and assessment of secure digital assets. The common challenge is how to achieve clarity and confidence about the correct design and performance of sensitive digital assets when faced with the intrinsic complexity of today's advanced digital technology and potential cyber-attacks. The examples, which ranged from complex software-based systems to programmable hardware systems, illustrated the value but also the dangers attendant on the use of models, programming languages and simulations to provide simplified abstractions of the complexity.

#### *4.4.5.4. Assurance activities for computer security*

During this technical session, a range of briefings were provided addressing assurance activities for computer security. In this context, the potential advantages and challenges of using artificial intelligence for cyber security were discussed. In addition, a performance-based cyber security self-assessment methodology was presented, as well as a risk management framework involving the use of continuous monitoring for information security. The session also included a briefing proposing a new application of a trust model lexicon for information and computer security assurance. The chair, panel and audience all agreed that each of these concepts has the potential to have a key impact on the treatment of computer security within nuclear security.

#### *4.4.5.5. Threat assessment (including Design Basis Threat) for computer security*

During this technical session, briefings addressed the complexities associated with developing a threat assessment for computer security, as well as potential solutions. The briefings and the ensuing discussions illustrated how the dynamic nature of cyber-attacks can challenge the orthodox approach to creating and using a threat assessment or a Design Basis Threat (DBT). One panellist provided a briefing proposing a two-step process for developing a threat assessment for computer security. The first step included characterizing the tactics, techniques and procedures; the events; and the scenarios and the adversaries. The second included considering how the target of the attack will respond to that characterization. A second briefing addressed methods for modelling the activities of both cyber adversaries and defenders with the goal of identifying an optimum defense strategy against a range of attack methods. A third panellist provided an analysis of a particular type of cyber threat, involving hiding information within legitimate protocol communications. Finally, a fourth panellist described work to model cyber-attacks and to determine the most probable type of attack being made against a system.

#### *4.4.5.6. National strategies for information and computer security*

During this technical session, a number of computer security challenges and methods to address them were discussed. One panellist provided an overview of computer security for nuclear security, drawing from the proceedings of the IAEA's *Technical Meeting on Computer Security: Approaches and Applications in Nuclear Security*, held 23-27 September 2019 in

Berlin. Following this briefing, a national case study on effective and efficient development of computer security guidelines and inspections was provided, and a potential framework was described for regulatory bodies to rely on when developing computer security regulations for radioactive material and associated facilities. Another panelist proposed a cyber threat model developed through the IAEA Coordinated Research Project (CRP) “Enhancing Computer Security Incident Analysis at Nuclear Facilities (J02008) that describes the capability sets and information prerequisites for different types of cyber-attacks that could lead to compromise of instrumentation and control systems. Finally, a panelist described the need for initiatives that encourage the sharing of good practices.

#### *4.4.5.7. IAEA Coordinated Research Projects for information and computer security*

During this technical session, panellists discussed the findings from the ongoing IAEA CRP “Enhancing Computer Security Incident Analysis at Nuclear Facilities.” As part of this CRP, a simulated nuclear environment was developed in the Asherah Nuclear Power Plant Simulator, which enables research on incident analysis. Briefings addressed a variety of subjects, to include: the need for a simulator to understand the anatomy of an attack and to analyze network traffic on an instrumentation and control (I&C) system; the different digital assets within a nuclear power plant and how virtualization can be used for security testing of the assets; and how cyber-attacks can disrupt critical functions in a nuclear facility.

#### *4.4.5.8. Future trends and activities in computer security*

During this session, briefings addressed the current state of computer security for the nuclear industry, emphasizing the evolving nature of computer security threats and the need for enhanced computer security to address these threats both now and in the future. Panellists noted that the cyber capabilities of threat groups and aggressors continue to develop at a faster pace than the capabilities of defensive technologies. This underscores the need for resilient nuclear process simulators capable of simulating and analysing threat and exploitation scenarios in order to develop strategies to detect and defend against them. Further, it was highlighted that such simulators could contribute to effective, flexible, and efficient training in computer security. Finally, it was noted that new and emerging technologies used in defensive architectures, including software-defined networking, could provide an increased ability to deny attacks while providing the types of rapid configuration changes needed to ensure reliable communications resistant to cyber-attacks.

### **4.4.6. Human resource development, capacity building and sustainability**

#### *4.4.6.1. Capacity building: Education*

Briefings during this technical session considered various approaches and practical experiences in designing and developing educational and training programmes in support of human resource development and capacity building in States for nuclear security. Panellists described their individual and collaborative programmes and indicated a number of lessons learned and good practices. They reiterated the importance of education as one of the instruments for capacity building in nuclear security. They also underscored that capacity building in nuclear security must include a comprehensive human resource development programme, including education and training. Further, they noted that Member State support for IAEA activities in human resource development is critical as it assures availability of resources, expertise, teaching materials and facilities. The panellists also encouraged States to prioritize human resource

development and emphasized the importance of early stakeholder engagement for the success of human resource development programmes.

#### *4.4.6.2. Capacity building, human resource development and job-specific training in nuclear security*

During this session, capacity building, human resource development and job-specific training in nuclear security were discussed. This included topics such as the establishment of training organizations for nuclear security, gender equality and career advancement, providing nuclear security training to non-technical personnel, and training programme sustainability. Panellists discussed the fruitful and productive cooperation of Rosatom Technical Academy with the IAEA in nuclear security training; training programmes that can be implemented on the protection of radioactive materials located at soft civilian targets; and the need for practical measures to effectively involve women in nuclear security activities. They also noted that employing a systematic approach to training and adult learning principles is important for further increasing the effectiveness of training. It was recognized that training in threat assessment and, in particular, including extremists' groups among the various threats assessed, should receive attention. Retaining competent staff is important to decrease the risk of terrorist groups exploiting their knowledge. Participation in IAEA CRPs is particularly effective for capacity building in Member States. It was emphasized that one of the most critical prerequisites for establishing sustainable nuclear security regimes is the availability of competent and motivated staff, and the involvement of stakeholders (particularly management staff) in evaluating and increasing the quality and effectiveness of nuclear security training.

#### *4.4.6.3. Capacity building: Non-governmental organizations*

During this technical session, panellists described the role of non-governmental organizations (NGOs) in nuclear security, identifying the missions of various NGOs and the challenges they have observed in the nuclear security field. Panellists emphasized that NGOs can support research, keep governments accountable and help with implementation of nuclear security initiatives. They also noted that some organizations work to raise awareness of challenges in nuclear security and convene meetings or seminars for capacity building and information sharing. Others develop partnerships with national governments or industry to support projects related to nuclear security. Finally, panellists agreed that there is a need for greater inclusion and gender parity in the nuclear security workforce, noting that many NGOs are currently sponsoring activities to address this challenge.

#### *4.4.6.4. Role of Nuclear Security Support Centres*

During this technical session, the role of Nuclear Security Support Centres (NSSC) in sustaining a State's national nuclear security regime was discussed. Participants also highlighted the NSSC network and its mission to foster international cooperation on the systematic and sustainable approach to NSSC development. Several conclusions were reached by the panel. First, NSSCs can play an important role in sustaining a State's nuclear security regime, and should be developed and customized according to the needs of each State. Second, the NSSC network and regional frameworks for cooperation provide effective platforms for sharing information, resources, and capacity building in centres around the world. Third, emphasis should be placed on further implementing and supporting instructor training and train-the-trainer activities among NSSCs. Finally, there is interest in NSSCs and the IAEA should continue to organize sessions at future conferences to further explore this subject.

#### **4.4.7. Minimization of highly enriched uranium**

##### *4.4.7.1. Minimization, on a voluntary basis, of high enriched uranium within civilian stocks and where technically and economically feasible*

The panellists discussed the challenges associated with minimizing the use of civilian high enriched uranium (HEU), including technical, political and economic obstacles to conversion, minimization and consolidation of HEU. One panellist highlighted the evolving security risks associated with HEU stockpiles and how this influenced their country to minimize such materials. Another panellist focused on the significant technical achievements their country has made in converting HEU research reactors, noting that in many aging facilities, the re-establishment of lost technical processes is needed to enable conversion. Two other panellists recognized the need for broad international cooperation and transparency to address all the technical challenges to enable successful conversion of such complex facilities from using HEU to using low enriched uranium.

#### **4.4.8. Nuclear material accounting and control and insider threat**

##### *4.4.8.1. Nuclear material accounting and control and national accounting and control measures for radioactive material*

This technical session addressed the importance of nuclear material accounting and control (NMAC) for both nuclear material and other radioactive materials. In particular, new technical measures for accounting and control were discussed, such as blockchain technology and automated cross-checking of separate databases to improve transparency and limit errors. Panellists also discussed the difference between physical protection regulations and NMAC regulations, and how these should complement each other for the protection of nuclear material. Additionally, one panellist provided information on a new IAEA course on NMAC for practitioners. Panellists also discussed good practices for regulating the accounting and control of other radioactive materials. The session concluded that the IAEA should seek to help Member States understand the difference between NMAC for nuclear security and safeguards and that more time and attention should be devoted to assisting Member States with developing their capacity in accounting and control of other radioactive materials.

##### *4.4.8.2. Insider threat*

During the briefings presented to this technical session, a range of national methods were discussed for analysing and managing the risk of insider threats at facilities containing nuclear or other radioactive material. In particular, panellists addressed strategies to prevent and detect insider threats and respond to them in the case where an insider intentionally or unintentionally causes harm to critical assets. A number of States' insider mitigation programmes were also discussed, as well as the systems used to organize insider mitigation programmes. It was underscored that insider mitigation programmes need to be adjusted to the culture of the State in order to be effective. Such programmes should utilize a planned and structured approach to maximize efficiency and cost effectiveness. The session concluded that an increased focus by States on trustworthiness and assessing and evaluating the characteristics of an insider could be valuable.

##### *4.4.8.3. Insider threat: Computer and information security*

The briefings in this technical session addressed insider threats to computer and information security, with a particular focus on the characteristics of these insider threats, possible

countermeasures, potential vulnerabilities at facilities and national regulations in this area. Panellists also discussed topics including the relationship between insider threats and outsider threats, computer security culture, and national good practices against insider threats. The panellists particularly emphasized that, in their view, an insider with cyber capabilities is the most dangerous threat to facilities where nuclear or other radioactive material is in use or stored.

#### **4.4.9. Emerging technologies and research and development in nuclear security**

##### *4.4.9.1. Risks and benefits to nuclear security from innovations in other fields, including artificial intelligence and big data*

Briefings in this technical session addressed a range of topics, from reconceptualising nuclear security as a business enabler to the impact of emerging technologies on nuclear security. During the discussions, it was stressed that the development and implementation of nuclear security culture programmes need commitment from senior level management. In addition, it was noted that rapid development of technologies—particularly in detection—can strengthen nuclear security capabilities at the national level. With respect to computer security, it was noted that new approaches have been undertaken to address computer security for nuclear security, and that States, international organizations and other stakeholders will need to work together to address and mitigate cyber risk. The session concluded that innovation in other fields, including in artificial intelligence and big data, are essential to enhancing national nuclear security regimes, and that such innovation should be supported.

##### *4.4.9.2. Innovative technologies to reduce nuclear security risks and improve cost effectiveness, where feasible*

During the first of these technical sessions, the panellists discussed innovative technologies to reduce nuclear security risks. Alternative technologies to radioisotopic irradiators were discussed by several panellists, while another addressed the use of low enriched uranium targets to replace highly enriched uranium targets for molybdenum-99 production. Specifically, some States are working to reduce nuclear security risks by using linear accelerator or X-ray based irradiators in place of cobalt-60 or caesium-137. International cooperation in this area is ongoing, as some States are providing assistance to others in transitioning to alternative technologies. The integrity of security systems themselves was also discussed, particularly the safekeeping of biometric data and the secure use of blockchain technology. The panellists agreed that innovative technologies such as blockchain have some potential to strengthen nuclear security and could be used as a part of nuclear security for insider threat, transportation security and NMAC. The panel concluded that it would be helpful to Member States for the IAEA to provide guidance on threat reduction and strengthening nuclear security through the use of innovative technologies.

During the second of these technical sessions, panellists focused on further innovative technologies to reduce nuclear security risks. During the briefings, panellists noted that systems and measures for enhancing nuclear security need to be modified using advances in science and technology to effectively manage evolving threats. They also underscored that digital innovations must be part of nuclear security, citing the integration of secure smartphone networks with radiation detection systems to enhance detection and response capabilities as one example. Further, they noted that technical, economic and political factors can be considered when evaluating the replacement of radiation source irradiators with alternative technologies to address nuclear security risks. Finally, the panellists emphasized that new technologies and processes can help to manage final disposal of radiation sources in a secure manner, like using

borehole disposal and melt processing. The session concluded by encouraging the IAEA to continue to support and advocate the use of innovations in science and technology to provide effective, efficient and sustainable nuclear security solutions.

#### *4.4.9.3. Nuclear security of new nuclear technologies*

During this technical session, panellists presented their national experiences as well as lessons learned related to nuclear security of new nuclear technologies. The panellists noted that the underlying principles of nuclear security for many new nuclear technologies—such as small modular reactors (SMRs)—are broadly the same principles as for traditional nuclear technologies. Thus, the panellists agreed that Member States that choose to pursue such technologies should refer to existing guidance documents, such as those in the IAEA Nuclear Security Series, for general guidance on securing these types of facilities. However, panellists also observed that for some new types of reactors, such as floating reactors, the threat environment and the nature of the technology are markedly different from traditional nuclear technologies. They underscored that efforts should be made to address the challenges associated with these types of technologies and suggested that the IAEA consider developing additional information to assist Member States with security regulation of these technologies.

#### *4.4.9.4. Advances in nuclear security research and development: International cooperation on nuclear security research*

During this technical session, panellists discussed a range of topics, with a focus on international cooperation and research in nuclear security. Panellists noted that international cooperation can provide opportunities for sharing experiences and good practices. It was also highlighted that bilateral and multilateral projects to build capabilities of Member States at the national and regional level could help to improve the long-term sustainability and usability of detection equipment, and that participation in IAEA CRPs can provide useful benefits to Member States that participate. Moreover, panellists noted that a bilateral project between the US and Japan to proactively reduce material attractiveness has the potential to inform the global standard. Finally, one of the panellists suggested that reviewing the follow up actions that came out of the Nuclear Security Summit process could provide a roadmap for future high-level engagements in nuclear security. The technical session concluded that the IAEA and Member States should consider focusing research and development on projects that will have a practical application and will address a well-defined need or gap.

### **4.4.10. The interface between nuclear safety and nuclear security**

#### *4.4.10.1. Nuclear safety/security interface: National experiences*

During this technical session, panellists addressed the many facets of interfaces between nuclear safety and nuclear security, with a focus on their national experiences in managing these interfaces. The briefings highlighted how the interface between safety and security is important in areas such as transport of nuclear materials, physical protection plans for nuclear power plants, disposal of disused radioactive sources, implementation of safeguards, development of security plans, and development and implementation of regulations. The panellists concluded that there are numerous differences and commonalities between safety and security that should be considered when developing regulations, fostering organizational culture and training experts.

#### *4.4.10.2. Nuclear safety/security interface: Implementation*

During this technical session, panellists addressed various aspects of accounting for the interface between safety and security at facilities using or storing nuclear and other radioactive material, including nuclear safety and security culture, physical infrastructure, stakeholder engagement and computer security. Panellists recognized the common goal of nuclear safety and nuclear security as well as commonalities between the two areas, such as the use of a graded approach. It was concluded that both nuclear safety and nuclear security play a critical role in the use and application of nuclear and other radioactive materials. However, challenges were noted, particularly regarding working with emergency responders to ensure the both safety and security are considered. Finally, it was emphasized that new and emerging technologies bring new challenges, not only due to the need for increased and adaptable computer security, but also related to changing legal requirements and higher levels of inter-connectedness.

#### *4.4.10.3. Emergency preparedness and response and nuclear security interfaces*

This technical session focused on strategies to prepare for responding to nuclear security and radiological emergency events. Common themes addressed included the need for States to have established organizational frameworks for emergency response, incorporating robust mechanisms for internal coordination and public communication. Panellists noted the emergence of new sensing and computer modelling technologies that can be leveraged to increase the safety and security of responders and to support effective integrated response strategies by providing timely and accurate technical information. The panellists suggested that such technologies should be researched and provided to emergency response organizations for training and operational deployment. Lastly, they emphasized the need to establish guidance at the national level in order to work effectively with local jurisdictions and to ensure that there are no gaps in capabilities related to the response to nuclear security events, to include cyber-attacks. Finally, it was considered important for States to invest in continuous improvement for nuclear security and emergency preparedness interfaces.

### **4.4.11. Transportation of nuclear and other radioactive material**

#### *4.4.11.1. Transportation*

The first of the technical sessions focused on transportation of nuclear material, with a focus on sharing national good practices. A major theme discussed was recognizing not only the differences between safety and security, but also the importance of their shared objective. Panellists also agreed on several points. First, that the technology used for tracking and securing nuclear materials needs to be effective and adaptable. Second, that communication is key to maintaining positive relationships with stakeholders and relevant authorities. Finally, that a robust security framework that is coordinated with all relevant and competent authorities is essential to effectively secure transport routes. The session concluded that every country and authority should take safety and security into account when considering the transport of nuclear materials; that transport of class 7 maritime material needs to comply with the International Maritime Organization's (IMO) Voluntary Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes Onboard Ships (INF Code); that security needs a high level of interagency coordination, cooperation, planning, and training; and that emerging challenges need to be accounted for.

The second of the technical sessions on transportation also focused on good practices for the transportation of nuclear and other radioactive material. The development and deployment of



advanced transport containers—including how they meet revised security regulations—was addressed, as well as the complex challenges associated with developing regulatory frameworks for transport safety and security. Further, the role of national law enforcement in addressing transportation security for nuclear and other radioactive material was reviewed, and an overview was provided of the role of industry in developing and reviewing nuclear security transport regimes, especially in addressing new and evolving threats. In addition, an overview was provided of the 2019 International Symposium on radioactive and nuclear material, and States were encouraged to sign on to the Joint Statement on Transport Security of Nuclear Materials (INFCIRC/909). The use of statistical analysis for designing the fundamental and necessary aspects of a transport security regime was also discussed.

#### **4.4.12. Nuclear security culture**

##### *4.4.12.1. Nuclear security culture: Performance indicators*

The briefings provided in this first session highlighted the crucial role of the management system in successfully implementing and sustaining nuclear security culture. Panellists addressed the importance of increasing understanding among staff of the crucial role that security culture plays in nuclear security and ensuring that the organization prepares, supports and assists staff during organizational changes, including those associated with expert staff turnover in the nuclear area. Panellists also provided an overview of tools and methods for strengthening security culture, with the goal of keeping pace with evolving threats, noting that the current range of tools available to assess the performance of security culture is not yet adequate. The panellists also agreed on the essential role of the human factor, to include leadership and all levels of staff, in developing and maintaining a strong security culture.

During the second session on nuclear security culture, panellists emphasized the important role of the regulatory body and management system in successfully enhancing and sustaining nuclear security culture. During the discussions, panellists stressed the importance of the involvement of top management at all competent authorities in building a strong nuclear security culture. They also underscored the role of top management in ensuring the sustainability of a nuclear security culture enhancement programme.

#### **4.5. CLOSING OF THE CONFERENCE**

In their closing remarks, the Conference Co-Presidents provided a brief overview of the key insights, statistics and conclusions of the Conference. They thanked and congratulated the Member States on the success of ICONS 2020 and for adopting the Ministerial Declaration by consensus in a particularly difficult international context. They attributed this success to the collective support for nuclear security, which they see as going in the right direction, with the IAEA in a crucial coordinating and assisting role.

The Co-Presidents recognized the upcoming Tenth Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons as an important opportunity to enhance the political attention on nuclear security and to deliver the message that it is possible to achieve consensus on a topic as sensitive and complex as nuclear security.

They went on to thank the Director General for his unwavering and inspirational support. They also thanked DDG Lentijo, Director Raja Adnan, the ICONS team and others from the Secretariat, who assisted the Co-Presidents in myriad ways throughout the preparatory process and the Conference.

In his closing remarks, the Director General thanked the Co-Presidents, the Co-Chairs of the Programme Committee and the ICONS organizing team for the success of the Conference. He expressed his appreciation for the strong participation in the conference, the adoption of a substantive Ministerial Declaration and for the expression by Member States of their determination to counter the threat of nuclear terrorism and other malicious acts. He also appreciated the recognition of support for the role of the IAEA in nuclear security expressed throughout the Conference. Finally, he thanked the Conference Co-Presidents for bringing the Conference to a successful conclusion.

This document represents a summary record of the *International Conference on Nuclear Security: Sustaining and Strengthening Efforts* held in Vienna from 10 to 14 February 2020.

## 5. MINISTERIAL DECLARATION

1. We, the Ministers of the Member States of the International Atomic Energy Agency (IAEA), gathered at the International Conference on Nuclear Security: Sustaining and Strengthening Efforts, reiterate our commitment to sustain and strengthen effective and comprehensive nuclear security of all nuclear and other radioactive material and facilities.
2. We reassert that the responsibility for nuclear security within a State rests entirely with that State in accordance with its respective national and international obligations.
3. We remain concerned about existing and emerging nuclear security threats and committed to addressing such threats.
4. We acknowledge that nuclear security measures may enhance public confidence in the peaceful use of nuclear applications. We also acknowledge that those applications contribute to Member States' sustainable development and we should ensure that measures to strengthen nuclear security do not hamper international cooperation in the field of the peaceful uses of nuclear applications.
5. We reaffirm the common goals of nuclear non-proliferation, nuclear disarmament and peaceful uses of nuclear energy, recognize that nuclear security contributes to international peace and security, and stress that progress in nuclear disarmament is critically needed and will continue to be addressed in all relevant fora, consistent with the relevant obligations and commitments of Member States.
6. We support the work of the IAEA in assisting Member States, upon request, in establishing and improving effective and sustainable national nuclear security regimes, including through guidance development, advisory services, and capacity building, and accordingly its central role in facilitating and coordinating international cooperation to strengthen nuclear security, as well as its role in facilitating, as appropriate, regional activities.
7. We recognize physical protection as a key element in nuclear security, and support the further development of the IAEA's assistance in the relevant areas of importance to Member States to include prevention, detection and response.
8. We encourage Member States to implement threat mitigation and risk reduction measures that contribute to improving nuclear security including, but not limited to, ensuring the protection of nuclear and other radioactive materials and facilities, in accordance with national legislation.
9. We call upon all Member States possessing HEU and separated plutonium in any application, which require special precautions to ensure their nuclear security, to make sure they are appropriately secured and accounted for, by and in the relevant State, and we encourage Member States, on a voluntary basis, to further minimize HEU in civilian stocks, when technically and economically feasible.
10. We recognize the threats to computer security and from cyber-attacks at nuclear related facilities, as well as their associated activities including the use, storage and transport of nuclear and radioactive materials, and call on Member States to strengthen protection of sensitive information and computer-based systems, and encourage the IAEA to continue to foster international cooperation and to assist Member States, upon request, in this regard.
11. We reaffirm the importance of continuing to promote the universalization and implementation by its States Parties of the Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment, and look forward to the 2021 conference. We also reaffirm the importance of other relevant international legal

instruments, such as the International Convention on the Suppression of Acts of Nuclear Terrorism (ICSANT).

12. We commit to maintaining effective security of radioactive sources throughout their life cycle, consistent with the objectives of the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary guidance documents.
13. We encourage the IAEA to continue to facilitate, in close cooperation with Member States, a coordination process to address the interface between nuclear security and nuclear safety, as appropriate.
14. We reiterate our commitment to combatting illicit trafficking of nuclear and other radioactive material and to ensure that the material cannot be used by non-State actors for malicious purposes and encourage Member States to continue sharing relevant information, on a voluntary basis, including through relevant channels and databases. The States providing notifications to databases are responsible for accuracy, objectivity and purely technical character of this information.
15. We support the IAEA's and Member States' efforts to strengthen nuclear security culture and also insider threat mitigation, in particular through providing education and training opportunities, and note the contribution of other relevant institutional entities, such as regulators and industry, in this regard.
16. We encourage Member States to use and contribute to the IAEA's nuclear security advisory services and peer reviews, on a voluntary basis.
17. We call upon Member States to support and contribute, as appropriate, to the IAEA's nuclear security activities by providing experts and sharing national expertise, best practices, lessons learned, as well as highlighting recent successes, with due regard to the protection of sensitive and confidential information.
18. We recognize the Nuclear Security Fund as an important instrument for the Agency's activities in the field of nuclear security. We will continue to provide, on a voluntary basis, funds to the Nuclear Security Fund, as well as technical and human resources, as appropriate for the IAEA to implement its work in nuclear security and to provide, upon request, the support needed by Member States.
19. We commit to promote geographical diversity and gender equality, in the context of IAEA's nuclear security activities, and encourage Member States to establish an inclusive workforce within their national security regimes, including ensuring equal access to education and training.
20. We call upon the IAEA Secretariat and Member States to take this Ministerial Declaration into account in the consultation process between the Secretariat and the Member States during the development of the IAEA's 2022 – 2025 Nuclear Security Plan, while also considering the proceedings of this conference, as appropriate.
21. We call upon the IAEA to continue to improve communication with Member States about its nuclear security activities and to facilitate the exchange of technical and scientific information on nuclear and radioactive security technology options.
22. We call upon the IAEA to continue to organize international conferences on Nuclear Security every four years and encourage all Member States to participate at a Ministerial level.

## 6. ESSAY COMPETITION WINNING ESSAYS

The IAEA opened an essay competition for students and early career professionals, aged 35 years and under, to submit an innovative and original essay on the future of nuclear security as part of the IAEA's 2020 International Conference on Nuclear Security: *Sustaining and Strengthening Efforts*.

The essay competition attracted 320 submissions from 70 countries. Three winners were selected through a blind evaluation process, conducted in partnership with the International Nuclear Security Education Network (INSEN), and were invited to participate in the International Conference. IAEA Director General Rafael Mariano Grossi presented prizes to the winners at a side event, *the NuSec Talks: 2020 and Beyond*, where they were also invited to present their essays.

The essays contained recommendations for strengthening nuclear security through Blockchain technology, emerging technology and nuclear forensics. The competition was sponsored by the Permanent Mission of the United Kingdom of Great Britain and Northern Ireland to the IAEA.

The full essays are included in these proceedings. The opinions expressed in these essays are those of the authors and do not necessarily represent the views of the IAEA, its Member States or other cooperating organizations.

## 6.1. THE TRUST MACHINE: BLOCKCHAIN TECHNOLOGY IN NUCLEAR SECURITY AND PROSPECTS FOR APPLICATION IN THE MIDDLE EAST

*Ms. Jasmine Auda (Jordan)*

“A single source of truth.” In a region where endemic mistrust among its neighbours has been a contributor to the lack of sustainable cooperative security, the Middle East region would be a prime beneficiary of any such construct – but does it exist? According to the core tenets of the emerging Blockchain technology, this is exactly what it does, which is to create a system with inherently transparent, verifiable, and tamper-proof mechanisms. As a digital network of information that can streamline and secure data absent the presence of any central authority, Blockchain, referred to as “the trust machine,” is a manifestation of decentralized Distributed Ledger Technology (DLT) most notably associated with the cryptocurrency Bitcoin. The World Economic Forum estimates that 10% of GDP could be stored in Blockchains by 2027 [1], and the technology has been credited with the purported ability to revolutionize industries as wide-ranging as banking, government, and healthcare.

In recognition of the potential role that can be played by Blockchain and other emerging technologies, the IAEA has started to explore how it can be applied to the nuclear field, most notably by introducing sessions on Blockchain in its Symposium on International Safeguards [2]. The still limited research on Blockchain’s role in the non-proliferation and security sphere has mostly focused on possible applications in areas such as safeguards and export control, but its implications for the nuclear security domain remain largely underexplored. In the 2018-2021 Nuclear Security Plan, the IAEA highlighted emphasis by its Member States to stay abreast of evolving challenges and threats to nuclear security using scientific and technological innovation [3]; this is likely to continue being emphasized in future iterations of the Plan, thereby warranting greater consideration from the Agency and its Member States today. In the context of the Middle East, any contemplation as to its suitability and application needs to be prefaced by an assessment of the current state of regional nuclear security.

Nuclear security in the Middle East consists of a fragmented framework of legally binding instruments, cooperation agreements, and voluntary commitments, with significant variances in the degree of implementation between countries. While this is not too dissimilar from the global state of nuclear security, the situation in the Middle East is far more acute given the turmoil and instability being experienced across the region. The presence of non-state actors, and the “nuclear renaissance” which set off the interest of six countries in nuclear power programs, further compound the already multi-faceted challenges to nuclear security. The measures that will be required to ensure robust nuclear security for these programs and the corresponding fuel cycle activities will need to take into account physical protection, operational security elements such as the human factor, and nuclear material accounting and control. It is the last of these that could be a candidate for the deployment of Blockchain technology, particularly in the context of the security of materials in the nuclear fuel cycle.

IAEA safeguards, which only apply to the back-end of the nuclear fuel cycle, do not include activities such as the mining, milling, or conversion of natural uranium [4]. While Uranium Ore Concentrate (UOC) is generally not considered a highly attractive option for theft or diversion due to the large quantities required to cause any significant impact, there have nonetheless been

an estimated 91 incidents of illegal trafficking of natural uranium between 1993 and 2007 [5]. Even though most nuclear industries have developed control systems for material inventory, and the majority of states maintain databases of their nuclear material stock, these processes lack sufficient oversight, are largely fragmented, and continue to operate in silos [6]; more significant, however, is that industries can take up to 30 days to detect the loss or theft of a single UOC drum [7].

In this context, the implementation of a Blockchain-based monitoring system could help secure the material with digital identifiers that provide real-time monitoring and tracking data to relevant parties including supplier and importer states, private companies, and any auditing or regulatory authorities [8]. The most remarkable advantage of Blockchain in such a system, which cannot be supplanted by mere digitization, would be the creation of a secure network that is not susceptible to interference or the questioning of the veracity of its contents. This would be invaluable in furthering trust and building confidence regarding material security within a country's borders, between countries across the region, and between the region and the international community at large.

With a number of regional states currently hinging on prospects for commercially viable uranium reserves in their territories to either fuel their own plants or even contribute to a regional enrichment facility [9], the deployment of Blockchain could also help the region build confidence with a sometimes sceptical international community, and at the same contribute to regional security through its promotion of transparency and assurances of security. By positioning nuclear security as the lowest common denominator upon which neighbouring states can find cooperation to be mutually constructive, broader regional security can in turn be enhanced. In fact, nuclear security on the global level has been relatively successful in encouraging discourse and collaboration among technical experts, and there is hope that these successes can have spillover effects into the more politically-fraught areas of non-proliferation and disarmament [10].

Ultimately, technical innovations can be critical to sustaining and strengthening efforts on nuclear security, but the fundamentals of nuclear security should continue to be promoted across the region through different methods, including capacity-building. Regional civil society organizations in particular can play an important role toward this end, and as local “trust machines,” they can provide a neutral and apolitical platform for regional countries to address the transnational nature of, and challenges to, nuclear security. Given the novelty and yet to be proven concept of Blockchain in this domain, obstacles to implementation are likely to be as paramount as any possible benefits. Nonetheless, Blockchain has the potential to redefine trust and confidence-building in the era of the Fourth Industrial Revolution. The fact that it may be a long time before the adoption of any such technology should not deter further consideration – on the contrary, stakeholders advocating for or working in nuclear security should continuously seek new and innovative methods that complement and strengthen the current nuclear security regime.

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## 6.2. EMERGENCE OF TECHNOLOGICAL THREATS AND OPPORTUNITIES FOR NUCLEAR SECURITY IN THE DIGITAL AGE

*Mr. Yevhen Kalinichenko (Ukraine)*

The development of science, technology and means of production creates both new opportunities and new threats to nuclear security.

### **Drone Threat**

For example, the availability and using of unmanned aircrafts systems (UAS) or drones have increased significantly in recent years. Today, drones are available in sizes ranging from a matchbox to those that can lift an adult. Their capabilities are amazing. They can be incredibly manoeuvrable, slipping into small windows at full speed and navigating inside buildings [1]; act autonomously according to a predetermined plan [2]. Some drones can remain in the air even after a partial loss of rotors, and act in coordination with large groups of other drones [3, 4]. Their scope is huge: aerial shooting, inspections, agriculture, searches, rescues, firefights, cargo delivery and many more. Naturally, so capable and easily accessible technology is already widely used by smugglers [5], terrorists and in modern conflicts for aerial reconnaissance, artillery fire adjustment, sabotage operations and dropping munitions on ground forces [6-8].

This technology is a serious threat to nuclear security and safety [9-11]:

- 1) The possibility of stealth smuggling of prohibited substances and objects both to and from the protected areas of nuclear facilities and across borders (i.e., nuclear materials, radioactive materials, weapons, ammunition, explosives, RF transmitters that can affect or hack wireless communication etc.);
- 2) Stealth reconnaissance of the means of nuclear facilities physical protection and the work of security guards from the air or from imperceptible landed drones;
- 3) Sabotages with possible damage to critical infrastructure elements, blackouts, lots of fires, explosions.

So nuclear facilities not equipped with effective means of detecting and fighting drones are potentially vulnerable to the spread of dangerous materials and terrorist sabotage attacks [12]. But not all existing technologies for detecting and counteracting drones are universal and each of them has advantages and disadvantages [13, 14]. Drones can be very hard to spot and counteract especially if they fly autonomously at high altitudes or in poor visibility conditions.

For example, passive detection systems based on *radio frequency (RF) analysis* are able to detect controlled drones in advance and quickly determine the exact position of its operator. But these systems are weak in detecting autonomous drones or in overcrowded RF environment. *Optical* and *acoustic detection systems* have modest capabilities in range, viewing angle, weather conditions and other parameters. Active systems based on *radar technologies* are universal, but require licenses and measures to prevent harmful interference and potential collateral damage.

Potential collateral damage and restrictions of regulators can also be issues for such effective drone countermeasures as *high-power microwave devices (HPM)* and *high energy lasers*. *Jamming radio frequencies* and *spoofing GPS* are useless against drones with autonomous navigation systems and can cause harmful RF interference too. There is also interesting countermeasure where drone-protector catches intruder-drones with nets.

So, most universal and effective anti-drone solutions should combine different detection systems and countermeasures in a way to cover all possible risks. Although it is possible to protect nuclear facilities, the protection of long borders and critical infrastructure from nuclear and radioactive materials smuggling and terrorism by drones is much larger task and huge threat. On the other hand, drones can really help in nuclear security by catching or pursuing enemy drones and intruders, or by watching from the air.

## **Cybersecurity**

News about cyberattacks and critical zero-day vulnerabilities found in digital systems appear with alarming frequency [15-17]. As practice shows, established approaches in creating software and hardware cannot provide guaranteed invulnerable digital systems. Moreover, nuclear facilities can have thousands of different digital systems each of which may have zero-day vulnerabilities. The effects of targeted cyberattacks can be devastating [16-18].

Important approaches to ensure cybersecurity should be:

- 1) Designing important for security digital systems that fundamentally cannot receive data from external networks or standardized data storages such as USB sticks (by using data diodes and unidirectional gateways [19]);
- 2) Restrictions and access control to safety and security systems;
- 3) Access control to source codes and documentation of digital systems that are important or can influence on nuclear safety and security;
- 4) Staff training in cyber-secure ways of working with digital systems;
- 5) Reasonable limiting or usage control of employee's personal devices. (i.e., software control of prohibited uses or RF analysis of large wireless data uploads);
- 6) Continuous information monitoring about critical vulnerabilities of systems and quick fixing of them;
- 7) Restrictions on the use of wireless networks and wireless peripherals devices.

## **AI Surveillance**

As for the new opportunities that technologies provide, I want to mention artificial intelligence (AI) based on Machine Learning. AI really helps in advanced methods to detect drones [20, 21] Also AI tech in combination with video surveillance and bio-identification allows, to recognize people and to analyze their actions with high accuracy. For example, Amazon Go are stores where, surveillance system can monitor all visitors, with the help of cameras and sensors. The system automatically takes into account what visitors took from shelves, what they put back and takes payment for the goods taken from store.

So imagine a system that is capable to:

- recognize personnel by face and gait;
- analyze and recognize unusual, suspicious and forbidden behavior for every employer individually;
- detect unknown persons in the protected area or suspicious activities nearby.

Such a system can significantly reduce the risk of unauthorized access to controlled areas and insider threats. It will help to identify threats to nuclear security at an early stage and respond in time.

## Conclusions

To ensure nuclear security it is essential to provide analysis of new threats and new technical and organizational means to counter security threats. This is why such conferences are so important. We can share experiences, ideas and opinions on the threats and threat management techniques, to develop effective up-to-date plans, programs and practices for improving nuclear security. IAEA Member States should include them in the scope of their nuclear security regime to be able to withstand emerging threats of our fast-changing world [22].

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### 6.3. THE APPLICATION, DEVELOPMENT, AND POSSIBILITIES OF NUCLEAR FORENSICS IN INTERNATIONAL COOPERATION ON NUCLEAR SECURITY

*Mr. John Lubianetsky (USA)*

The communiqué of the Nuclear Security Summit held in Seoul in 2012 articulated that “Nuclear forensics can be an effective tool in determining the origin of detected nuclear and other radioactive materials and in providing evidence for the prosecution of acts of illicit trafficking and malicious uses” [1]. This statement reminds us of the potential nuclear forensics has in facilitating nuclear security concerns. Porous borders and globalization have created a world where mismanaged or lost nuclear materials pose grave security risks if left unchecked. In the 21st century especially, no state can effectively combat the illicit trafficking of nuclear, radiological, or other hazardous materials in isolation, even on a local scale, without international cooperation [2]. While barriers still impede the full potential of international nuclear forensics cooperation, the development of nuclear forensics provides new opportunities for states to better strengthen technical infrastructure, legal and regulatory framework, and human capital.

Technical infrastructure in nuclear forensics is highly dependent upon continuous and frequent visits of regional and international technical experts to other countries [3]. As such, countries should create joint projects where nuclear experts brief other experts on proper forensic procedures and techniques. These ventures enable a greater transfer of expertise which will allow for a more secure nuclear security environment. One example of these ventures is the European Commission's Joint Research Centre, Institute for Transuranium Elements (ITU) and the US National Nuclear Security Administration's (NNSA) collaborative cooperation with ASEAN states. In this venture, experts exchanged knowledge and experiences in response planning, the issue of illicit nuclear trafficking, and methods to expand nuclear forensic capabilities in the region [4]. Such cooperation could be used as a future model for international nuclear forensics training and cooperation.

Moreover, the knowledge that a state has a robust nuclear forensics program may provide a strong deterrent to groups seeking to illicitly traffic nuclear or radiological material. Nuclear forensics' future as a potential deterrent relies on its implementation and success in facilitating investigations and the legal proceedings that follow it [5].

How nuclear forensics is defined is also an area that can see improvement. The IAEA currently understands nuclear forensics as the “Examination of nuclear and other radioactive material, or of other evidence that is contaminated with radionuclides, in the context of legal proceedings” [6]. Since forensics is understood in specialized literature as “the application of science to law” [7], it can be interpreted that nuclear forensics could play an active role in the formation and drafting of policies. If this reading is taken even further, perhaps the field can be interpreted as including international law, regulations, and treaties [8]. This reinterpretation would enable nuclear forensics to materialize as a unique multi-disciplined field that is capable of addressing the needs of contemporary nuclear security and policy.

It is also important to stress the continued development of the nuclear forensics workforce with a focus on students. Besides being less politically sensitive than technical exchanges between government laboratories, bilateral training sessions, workshops, and advice from professionals

provide students with the necessary skills and expertise to develop a stronger sense of the international importance of nuclear forensics [9]. These joint sessions also provide a common area of understanding that stands to deepen bilateral commitments to nuclear security in areas of mutually beneficial cooperation. The need to cultivate a new generation of nuclear forensics will only grow in importance as the current workforce ages. These forms of cooperation present distinct opportunities to enhance bilateral relations, the development of future nuclear forensics, and the potential for a more uniform and standardized understanding of nuclear forensics among professionals.

Nuclear forensics has the potential to redefine how states maintain and ensure nuclear security, but there are still substantial bilateral and multilateral barriers that prevent proper cooperation in nuclear forensics between countries. One such problem is a general unwillingness for some states to divulge information crucial to forensic investigations. Potential solutions to this problem include finding methods of sharing information that does not divulge sensitive or classified information, and that sharing information would be in the states' best interest. Another problem area for forensic cooperation is the unfounded myth that legal factors in other countries will inevitably impede forensic cooperation. There are typically few legal barriers that impede upon forensic cooperation in other countries [10]. Work should be done to dispel this myth. It would also be in states' interests to participate or establish regional or bilateral agreements that have the proper legal framework for states to more effectively share information or facilities relevant to nuclear forensic-related occurrences. One well-known example of this approach is the Georgia, Ukraine, Azerbaijan, and Moldova (GUAM) Organization for Democracy and Economic Development's regional collaboration in nuclear forensics. A network of nuclear laboratories in the GUAM countries is designed to allow them to share their analysis capabilities, thereby avoiding the need to duplicate those facilities in each country [11]. These are general actions or goals that should be accomplished to break down barriers to bilateral and multilateral information sharing in nuclear forensics.

The second greatest barrier to the proper use of nuclear forensics at a national and international level is the lack of capacity within certain states to properly address the pressing needs of nuclear forensics and security. States with a more developed nuclear security apparatus should focus on cooperating with interested states on capacity building and improving information sharing. These barriers may be circumvented with the development of strong technical infrastructure.

Maria Wallenius, a research scientist at the European Commission's Joint Research Center, claims that "We have come a long way since the 1990's... With the IAEA's assistance, the international community has improved nuclear forensic science analytical techniques and enacted tougher and more precise laws for prosecuting the perpetrators" [12]. Nuclear forensics stands capable of becoming a potent tool in international nuclear security, but reforms and improvements should and must be made. This paper recommends that the Nuclear Security Plan 2022-2025 adopt provisions that encourage the development of the capacity building and multilateral and bilateral cooperation in nuclear forensics.

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## APPENDIX I. LIST OF PAPERS

Paper Number	Presenter	Member State/ Organization	Title of Paper
6	F. Petruceli	Brazil	International Transport of Nuclear Material in Brazil – a model of success
7	S. Tomažič	Slovenia	First national exercise in computer security in nuclear sector in Slovenia
11	H. Yoo	Republic of Korea	Efforts of the Republic of Korea to enhance nuclear security awareness
12	N. Alawadhi	Kuwait	National Nuclear Security Regime In The State Of Kuwait: Role Of The IAEA
13	W. P. D. Beta	Indonesia	Lesson Learned from Security Culture at National Border Management Agencies: A Case study in Indonesia
14	M. A. Mogahed	Sudan	INSSP contributes to strengthening the Sudan nuclear security regime
19	C. Hobbs	United Kingdom	Reconceptualising Nuclear Security as a Business Enabler: Opportunities and Challenges
23	A. Solodov	USA	Development of a Framework for Analyzing Impact of Emerging Technologies on Nuclear and Radiological Security
25	A. Solyman	Egypt	Increasing Log-Access Security System Based On Face Recognition
27	A. Sfetsos	Greece	Quantifying Potential Target Attractiveness In Research Reactors And Associated Facilities
29	A. Zafar	Pakistan	Nuclear security as part of the security of major public events
31	T. Walter	Germany	IEC Standard-Family on Cybersecurity for Nuclear Power Plants
32	F. L. De Lemos	Brazil	A systemic approach to information and cyber security
36	V. Lesage	France	2018 French IPPAS mission – Experience and lessons learned
37	D. Hossain	Bangladesh	Integrated Safety and Cyber Security Analysis for Building Sustainable Cyber Physical System at Nuclear Power Plants: A Systems Theory Approach



<b>Paper Number</b>	<b>Presenter</b>	<b>Member State/ Organization</b>	<b>Title of Paper</b>
42	I. Ahmad	Pakistan	Capacity building in nuclear security education and job specific trainings in Pakistan
43	J. Iqbal	Pakistan	Sustaining the security of radioactive sources through compliance with regulatory requirements
45	S. R. Ali	Pakistan	Safety and security interfaces during lifetime of a nuclear power plant – national experience
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54	T. Ahmad	Pakistan	Regulatory Approach for Development and Implementation of Safety Security Interface
56	A. Ullah	Pakistan	PNRA Technical Support Capabilities for Detection Technologies and Associated Challenges
58	M. T. Chaudhary	Pakistan	Risk informed approach to the security of radioactive sources in use and in storage in Pakistan
59	R. Evans	WINS	WINS Academy Programme: Sustaining Demonstrable Competency in Nuclear Security Management
70	T. Majeed	Pakistan	Study on the implementation of nuclear forensics in various legal systems
75	R. Howsley	WINS	Security in the Civil Nuclear and Aviation Sectors – What can they learn from each other?
76	F. Lanave	France	Cross-checking accounting and transportation data: a systematic action towards security
78	S. Chirayath	India	Evaluation of the Effectiveness of Physical Protection System for Nuclear and other Radioactive Materials Used in Research Institutes
81	M. Rowland	Canada	Application of a simplified five step process to identify and classify Sensitive Digital Assets
82	J. Sladek	Canada	Evaluation of the appropriateness of Trust Models to specify Defensive Computer Security Architectures for Physical Protection Systems

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88	A. Tolba	Egypt	IAEA's Technical support for Establishing Requirements for the Security Up-Grades at Egypt's Second Research Reactor Complex
91	M. StJohnGreen	United Kingdom	If it is not secure, it is not safe
93	H. Kroeger	Germany	Co-60 in scrap metal containers
95	S. Neakrase	NTI	Strengthening the CPPNM Regime through Regular Review Conferences
99	D. Bokov	Russian Federation	Nuclear security requirements for control of nuclear material: graded approach
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107	M. Botha	Australia	Reflections on regional training efforts in support of nuclear forensic capability development in South-East Asia
111	Y. Kimura	Japan	Development of Nuclear Security Technologies for Response on Material Out of Regulatory Control Event and Nuclear Forensics Activities in Japan
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113	C. Speicher	Germany	The intricate security culture issue: some considerations about the role of managers
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128	J. Galy	EU/EC-JRC	Protection of Major Public Events against the Radiological Terrorist Threat: The Users' Perspectives
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160	C. Tertrais	France	Supporting carriers efforts to develop their security culture
161	C. Tertrais	France	Enhancing and maintaining unpredictability on nuclear transports
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186	A. Livsic	Lithuania	A new horizon for the NSSC network: good practices in taking a systematic and sustainable approach to cooperation in nuclear security
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372	M. Pomper	NTI	Strengthening National and International Plutonium Management Approaches
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379	S. Helton	USA	Crediting Law Enforcement Response in the U.S. Nuclear Regulatory Commission’s Security Inspection Program
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<b>Paper Number</b>	<b>Presenter</b>	<b>Member State/ Organization</b>	<b>Title of Paper</b>
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