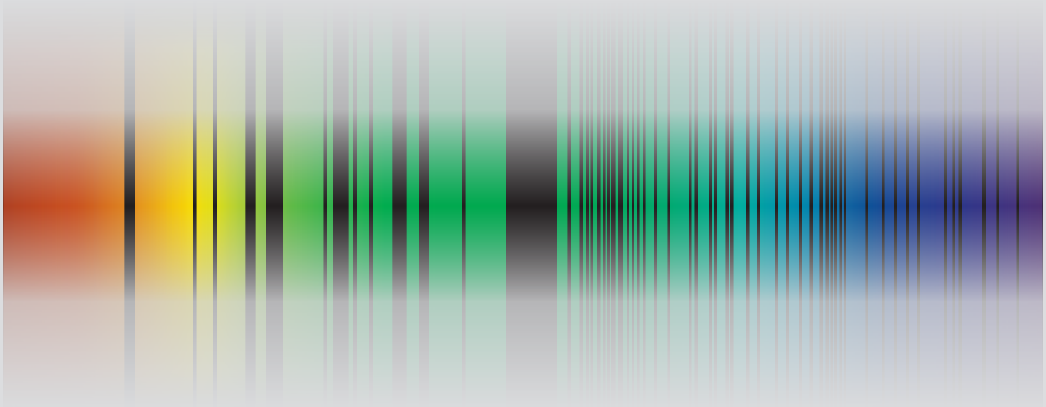
nuclear law institute

A Collective View on a Decade of Capacity Building and Development in Nuclear Law



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The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world''.

NUCLEAR LAW INSTITUTE

A COLLECTIVE VIEW ON A DECADE OF CAPACITY BUILDING AND DEVELOPMENT IN NUCLEAR LAW

INTERNATIONAL ATOMIC ENERGY AGENCY
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Marketing and Sales Unit, Publishing Section
International Atomic Energy Agency
Vienna International Centre
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FOREWORD

by Rafael Mariano Grossi
Director General

Nuclear science and technology saves lives and livelihoods, whether by fighting diseases or by helping communities adapt to climate change. In partnering with its Member States to make the benefits of nuclear technology and its many applications more widely accessible around the world, the IAEA has fulfilled its indispensable mandate for more than six decades.

A significant part of our work has focused on assisting our Member States in addressing their responsibilities in nuclear safety, security and non-proliferation. The IAEA is also the key international organization at the centre of facilitating the crucial international legal frameworks and guidelines in these areas. Risks must be carefully assessed, managed and controlled without unduly limiting the contribution nuclear technology makes to our well-being and economic development.

Just as our scientists assist experts in making sure the right level of radiation is administered to cancer patients, our security experts advise on how to proactively reduce the chance of theft and our safeguards inspectors check that nuclear material remains exclusively used for peaceful purposes. In the same way, our legal teams support Member States in establishing and strengthening the required national legal frameworks that underpin the entire safety, security and non-proliferation regime.

To address the increasing demand for legislative assistance, the IAEA established a training institute in 2011. Since the launch of the Nuclear Law Institute (NLI), annual training in nuclear law has become one of the main components of the IAEA's legislative assistance programme.

The NLI has a special focus on drafting legislation in all areas of nuclear law, namely safety, security, safeguards and civil liability for nuclear damage, providing practical, hands-on assistance. Over the past decade, more than 600 officials from across the world have participated in the programme, joining valuable networks of experts with whom they can share their experiences.

As Director General I will make sure that the IAEA works ever more steadfastly and innovatively in partnership with its Member States to render these essential legal frameworks as universal and as well implemented as possible, making Atoms for Peace and Development more accessible than ever before.

CONTENTS

INTRODUCTION

BACKGROUND

The Nuclear Law Institute (NLI) was established by the International Atomic Energy Agency in 2011 to address the needs of Member States for capacity-building in nuclear law and in drafting corresponding legislation. Ten years later, the NLI programme has not only played a major contribution in the establishment or enhancement of national nuclear legal frameworks around the world but has also become a global reference for training programmes on nuclear law. This provides a welcome opportunity to reflect on both the NLI and the nuclear law developments that have helped shape the programme during the past decade.

SCOPE

This publication is intended to provide information on the background, programme and methodology of the NLI, and its impact on Member States and to reflect on current topics, trends and developments in international and national nuclear law to which the NLI has contributed through the past decade. In order to achieve this, the publication brings together contributions from NLI organizers, facilitators, lecturers and alumni.

OBJECTIVE

It is intended that this publication will provide a useful reference for trainers, drafters and officials in Member States interested in training programmes in nuclear law, in gaining knowledge on current topics in international and national nuclear law and in drawing from lessons learned and experiences gained in other countries.

STRUCTURE

Chapters 1 to 4 focus on the origin, unique features and impact of the NLI on Member States, its role within the overall framework of the IAEA's capacity building activities under the technical cooperation programme, how the NLI and other training in nuclear law is expected to evolve to continue addressing Member States needs in the coming years, and the NLI curriculum as a comprehensive programme in nuclear law and legislative drafting.

Chapters 5 to 10 analyse current topics and trends in the various areas of nuclear law that have developed during the decade, starting with an examination of how the IAEA's legislative assistance programme contributes to such developments and to the overall evolution of nuclear law. This is followed by an analysis of how international safety instruments have evolved during the last two decades, with one contribution focusing on the two incentive safety conventions and their guidance documents, namely the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and another paper focusing on the two IAEA codes of conduct, namely the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary guidance and the Code of Conduct on the Safety of Research Reactors. In the area of nuclear security, one contribution addresses the relationship between legally binding and non-legally binding instruments, while another one addresses both the legal frameworks for security and for safeguards to highlight developments and synergies. The complexities and evolution in the definition of nuclear damage and the concept of non-nuclear damage are also examined in one dedicated chapter to determine damage that gives rise to compensation under the nuclear liability regime.

Chapters 11 to 15 address topics which have been the subject of special sessions during the NLI having emerged as areas of particular interest for Member States. These topics include the policy and legal aspects of the oversight of nuclear activities, nuclear trade in the context of non-proliferation, the growing importance of environmental protection and environmental law for nuclear activities, legal aspects of financial arrangements for nuclear decommissioning, as well as policy, legal and regulatory considerations for the deployment of SMRs to developing countries.

Finally, chapters 16 and 17 contain national experiences from two Member States, namely Kenya and Serbia. In these papers, NLI alumni from these countries explain the context, goals and challenges faced in their way towards enhancing the national legal frameworks for the safe, secure and peaceful use of nuclear technology in their respective countries and how IAEA legislative assistance and training through the NLI assisted them in these endeavours.

1. TAKING STOCK OF A NEW APPROACH TO TEACHING NUCLEAR LAW

P.L. JOHNSON[1], [2],[3]
International Atomic Energy Agency

1.1.INTRODUCTION

At the conclusion of its first decade, the Nuclear Law Institute (NLI) has matured into a key feature of legislative assistance provided by the IAEA to Member States. This milestone offers an opportunity to pause and reflect upon the origin, methodology and achievements of the programme. Recalling the considerations that led to its creation in 2011, the following provides an overview of the previously employed approach to teaching nuclear law and impetus for innovation, followed by a description of the unique features implemented to convey the knowledge and skills needed for drafting nuclear legislation and finally an illustration of achievements, drawing upon quantitative indicators and feedback received.

1.2.ORIGINS

1.2.1. Background

The activities of the Office of Legal Affairs (OLA) devoted to legislative assistance seek, inter alia, to transfer knowledge on nuclear law to Member States. Despite law not being the first subject that comes to mind as a "technical" discipline – these efforts are carried out in the context of Technical Cooperation (TC) projects, as IAEA provides assistance to Member States not only in capacity-building for the application of nuclear technology, but also for its regulation.

Demand for this type of assistance has been substantial since the IAEA's inception and, more particularly, since the IAEA first began, in 1997, to systematically support states seeking to establish or strengthen nuclear legal frameworks. Within the following ten years, OLA provided advice on the national legislation of more than 100 Member States on questions ranging from nuclear safety and security to safeguards and liability for nuclear damage.

Delivery of this aspect of the IAEA mandate was, and remains, based on the needs of Member States, and follows an approach that employs a variety of activities, ranging from regional to national, working to policy-level, general to country-specific and *ad hoc* to programmatic. These activities have included workshops and seminars at headquarters and in the field, bilateral drafting assistance and awareness-raising missions for senior government officials, preparing reference material to inform assessment and drafting of nuclear legislation, as well as training through in-house fellowships and support for participation in specialized programmes such as the OECD/NEA International School of Nuclear Law (ISNL) held annually in Montpellier.

With the increased adoption of international legal instruments and increased interest in nuclear power and other applications of nuclear technology, by 2008, the demand for legal guidance started to raise exponentially. For instance, in addition to the 30 States that already operated

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[1] Peri Lynne Johnson is the Legal Adviser and the first female Director of the Office of Legal Affairs of the IAEA. She joined in January 2011 and the first NLI was held in October 2011.
[2] This article was written with the support of Michael J. Moffatt, Associate Legal Officer, Office of Legal Affairs.
[3] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

nuclear power programmes at the time, as many as 50 additional States expressed a desire to pursue similar plans, while IAEA membership had increased to 145, with the new Member States seeking to benefit from nuclear applications in many fields and needing to develop their legal frameworks accordingly. In this context, the IAEA recognized a need to design a training programme focused on legislative drafting. Indeed, until then, training for drafting nuclear legislation was mainly provided through individual fellowships in OLA, an approach that proved to be insufficient in the timely accommodation of increased demand from Member States.

1.2.2. Identified Needs and Challenges

The requisite expansion would, for one, need to accommodate a significant increase in terms of volume, with more officials from a greater number of Member States seeking training. For another, the content delivered would have to be adapted to speak to audiences facing different concerns at various stages of nuclear development. For example, it would need to address individual interested States with no nuclear legislation in place at all, or with no cause to regulate more than a certain facet of nuclear applications, such as the use of radiation sources for medicine, industry and other uses, as well as those states considering on embarking on nuclear power programmes. Thus, with the progression of nuclear technology programmes, corresponding legal frameworks and national know-how of varying degrees, assistance would have to address the needs of all participating States whether embarking upon first nuclear undertakings or seeking to adjust an existing framework.

Similarly, an effective approach would necessitate developing a curriculum that was both comprehensive and specifically relevant to the exigencies of the audience in terms of subject matter. Defining a suitable substantive scope would thus involve achieving the right focus and balance with respect to the appropriate range of and depth on individual subjects. This required not only an assessment of the degree to which binding international legal instruments, safety standards and recommended best practices should be addressed in national legislation, but also whether specialized questions, such as may arise in the context of nuclear trade, maritime transport and EU norms, would be considered as well, albeit with a primary focus on the legal adviser supporting national implementation of international obligations.

In addition, an effective instruction programme would require a concept reflective of both a horizontally and vertically heterogenous pool of officials. In addition to the differences in national circumstances, trainees would have different backgrounds, with some coming from regulatory bodies and others from ministries responsible for matters such as interior and external affairs, defence, economics, industry, labour, health, environment, and mining. Moreover, with various levels of government involved, instruction would have to be capable of providing useful contributions to policy makers, drafters and implementing officials alike.

Finally, the year-long experience of the organization in implementing an approach carefully tailored to the particular needs of participating officials and States would be factored in to develop a programme on broader footing that would strike a balance between generic and customized content and methodology. A suitable approach would therefore encompass the right measure of abstract concepts, combined with practical exercises, including those seeking to verify that knowledge and skills conveyed had been sufficiently digested and could be applied as required. Moreover, deciding upon the appropriate language, or languages, of instruction, the frequency and duration of individual units and the programme itself, as well as the most auspicious location were of equal concern.

1.2.3. Objectives of the Novel Approach

Considering the above background and identified needs, the IAEA Office of Legal Affairs initiated an internal consultative process aimed at developing "*a new nuclear law curriculum*". The outcome of this process was a set of criteria that defined the objectives of the new approach in terms of intended audience, substantive scope, modes of knowledge transfer and format.

In terms of audience, the programme would be open mostly to officials from Member States participating in the relevant technical cooperation projects, with the possibility of participation of some officials from other Member States on a case-by-case basis. Criteria for participation would be a legal or regulatory background and involvement in the process of drafting of nuclear legislation. Priority would be given to participants from those Member States engaged at the time in this process.

In terms of subject-matter, the primary objective of the programme would be to equip officials with the ability to develop domestic nuclear legislation, including by drafting a nuclear law or statute. At the same time, the curriculum would furnish attendees with a solid understanding of the fundamental concepts of international nuclear law, i.e., the legal framework governing the four basic pillars of nuclear law as taught by the IAEA, safety, security, safeguards and liability. Further, the syllabus would be complemented by individual technical aspects, safety standards and basic questions relevant to national nuclear legislation, including related matters subject to other national laws such as transport, trade, environment as well as export and import controls. In addition to an appreciation of the role of the IAEA, participants would also be offered an intensive experience to hone practical skills, not least drafting techniques.

Establishing a commensurate methodology, the new curriculum aimed to ensure that the programme would be equally useful to participants of various backgrounds seeking different outcomes. This would be accomplished, inter alia, by identifying common features meriting joint instruction and grouping participants accordingly (e.g., by region, legal system, stage or size of nuclear programme). Training modules would encompass lectures, as well as interactive exercises in small groups of no more than 10 persons through facilitated sessions, focussing on implementation of broader principles at the practical level and entailing defence of positions developed within individual teams in front of the larger group. The circle of instructors would be composed of experienced IAEA and international experts familiar with the specificities of particular regions and subjects as well as facilitators and mentors.

With respect to the format of the programme, it was decided that instruction would be provided in a single location and in the English language over a two-week period. The main curriculum would be complemented engagement with the nuclear law community through special sessions, while social events would encourage interaction and networking. Further, procuring feedback from participants, as well as maintenance of a statistical program and database would support assessment and continuous improvement of the programme over the course its operation. Similarly, an alumni network would provide an avenue for an enduring exchange of information between current and past participants.

1.3.PROGRAMME AND METHODOLOGY

1.3.1. Impulse Lectures

The point of departure for the core subjects taught during the NLI are generally 45-minute "impulse lectures", i.e., presentations that convey fundamental concepts and key messages, designed to prompt further engagement and more in-depth consideration. A unique feature of

the NLI is that the sessions combine for each topic a lecture on the applicable legal framework and a lecture on the technical aspects, as it is important for trainees to understand these interrelations so that legal input may be consistent with the applicable technical content. Impulse lectures are generally held by IAEA experts from the Office of Legal Affairs and Agency departments of Nuclear Safety and Security, Nuclear Energy and Safeguards, as well as leading international experts in specialized fields like the transport and mining of radioactive material. In addition to providing an overview of and introduction to a particular area of nuclear law and its corresponding technical content, impulse lectures are also designed to prepare participants for specific learning objectives, which are facilitated in subsequent interactive sessions, or "TOP Sessions" (see section 3.3. below).

1.3.2. Special Sessions

While impulse lectures convey the essentials of the main pillars of nuclear law, i.e., safety, security and safeguards (also known as the "3S" principles), as well as civil liability for nuclear damage, special sessions are reserved for a variety of ancillary topics. It is in this context, that participants gain familiarity with the broader range of legal disciplines significant to regulating a host of matters relevant to various aspects of nuclear technology, links between nuclear and environmental law, financial questions that arise in the context of decommissioning, legal aspects of small and medium-sized reactors or the features of nuclear trade. These special sessions provide an intermediate level of engagement, furnishing participants with the opportunity to raise inquiries and request further clarification during Q&A sessions, but without engaging in practical exercises.

1.3.3. TOPs, FIGs and Fora

Once participants have been introduced to the fundamentals of a certain subject during impulse lectures, they have the opportunity to engage in additional exercises in concentrated groups.

One such activity involves sessions, referred to as "TOP Sessions", where participants are divided into so-called "TOP Groups" of approximately 10 persons from different regions and legal systems. While these working groups maintain their composition throughout the programme, their members designate different leaders and rapporteurs at each individual session on a rotating basis. Each TOP Group is supported by a facilitator from the NLI team, who, upon request, may answer questions asked and furnish information sought by participants. At the same time, the facilitator seeks to accompany TOP Groups in a non-invasive manner, ensuring that participants can approach the objectives set independently, drawing upon the professional experience and knowledge of the various members of a group. In this manner, participants can digest the substance of lectures, while identifying and sharing components that are particularly relevant to their professional context with other members of the group. These discussions seek to produce collective questions to be addressed during one-hour Q&A sessions. Experience has shown that this type of exercise is particularly appreciated by participants, as it offers an opportunity to link the substance of lectures to the professional background of the members of a group and reflect through a dialectic process before requesting further clarification from lecturers.

A second type of engagement takes place during Issue Forum Group sessions, referred to as "FIG Sessions". These are practical exercises, where participants choose to participate in one of six groups, with each drafting a domestic nuclear law while focussing on a specific aspect of nuclear legislation. FIGs constitute the final step in the progressive learning process, where participants apply what they have learned through lectures, special sessions and TOPs and practice the primary skill that they are meant to acquire during the NLI, i.e., drafting nuclear

legislation. In this context, FIGs also seek to provide a framework where participants are able to focus on acquiring implementation skills that are specifically relevant to their state and professional context. Depending on the needs of the participants in a given year, FIG sessions might focus on subjects such as mining and processing of radioactive ores, licensing of nuclear power plants, safety and security of radioactive sources, civil liability for nuclear damage, decommissioning or radioactive waste management. FIGs are also accompanied by a facilitator, which take a more active role compared to that assumed during TOP sessions. In the context of FIGs, the objective of the facilitator is to stimulate the work of the group, maintain a balance between the contributions of its members and also manage the available time. In this sense, it is the responsibility of the facilitator to guide the drafting process rather than its outcome.

At the conclusion of their work, FIGs present the product of their exercise in Issue Fora. During these presentations, groups demonstrate that they are able to capture, in general terms, the key elements of a comprehensive nuclear law while also illustrating how the specific subject of focus has been implemented in the more detailed provisions drafted. One of the most significant benefits of this type of exercise, is that the members of a group are able to identify and resolve actual challenges that arise when drafting a nuclear law and take these lessons learned back home to inform preparation of their domestic nuclear legislation.

1.4.ACHIEVEMENTS

1.4.1. Quantitative Indicators

In terms of geographic distribution, statistics of NLI participation during 2011–2019 indicate that the NLI has accomplished what it set out to achieve — equitable global participation, mainly from Member States participating in the IAEA Technical Cooperation Programme. Of the approximately 550 NLI alumni, with 34% of participants the African region is the most well represented among NLI graduates. It is followed by Asia, the Pacific and Australia, with 30%, Europe with 21% and Latin America and the Caribbean with 15%.

The final composition of the participant body in any given year depends on a variety of factors, not least the desire to balance geographical with gender distribution. Though the NLI has not achieved perfect gender parity over the course of its operation, with an average 44 % female graduates, there is an increasing trend of female participation, with 51% women having participated in the 2019 NLI session. When looking at the comparatively low percentage of women working in nuclear industry, the NLI team is proud to have many female graduates.

As indicated at the outset, legislative drafting may involve a wide range of stakeholders that require expertise in nuclear law to provide useful input to this process. As a result, while the majority of participants come from the nuclear field, mainly from regulatory bodies but also from promoting organizations, such as the Nuclear Energy Programme Implementing Organizations (NEPIO) and industry, there is also a good number of participants coming from coordinating or stakeholder institutions in the legislative process, such as officials from Ministries of Justice, Energy, Health and Natural Resources, that also require expertise on the subject. In addition, while the majority of students have a legal background, there is also a good number with a technical or a policy background, reflecting the importance of their participation in the legislative process.

Overall, the statistical data collected demonstrates that the NLI has succeeded in its efforts to ensure that all areas of the world benefit from the programme. In a similar vein, women have found a relatively high level of representation within the student body. As regards the distribution of participants, the cited statistics indicate that NLI alumni reflect the reality of

legislative assistance in nuclear law as an interdisciplinary exercise that requires the involvement of officials at the policy, legal and technical levels.

1.4.2. Feedback from NLI Alumni

Collecting feedback for the purpose of ensuring continuous improvement of both the curriculum as a whole and its individual components has been an inherent feature of the programme from the outset. Over the years, participants have shared their views in this context, allowing an assessment of the usefulness of the NLI for those who have attended it.

In this respect, various elements of the programme have been highlighted as particularly useful. With States striving to not only fully comply with their international obligations, but also meet the highest attainable standards through continuous improvement, both instruction during the NLI and the materials for further reference provided have been cited as highly useful in practice. Some participants have emphasized that the NLI has made a highly specialized and sometimes complicated discipline more approachable for them, for example, by gaining familiarity with the nuances of terminology. Others have noted that the international character of the programme and the versatility of its participants have made it exceptionally rewarding. Though the regulatory framework and exigencies of each state vary, officials of very different backgrounds have reported facing quite similar challenges and thus greatly benefitting from the opportunity to share experiences and exchange solutions with one another. This interactive element — facilitating two-way communication between lecturers and participants, but also among the participants themselves — has proven to constitute a notable source of added value. This has also held true for experts already having attained a high degree of proficiency in nuclear law prior to participation, expressing their appreciation for the opportunity to share best practices and also reflect upon the implications of recent developments.

From the collected feedback, it shows that participants have been highly satisfied with the programme and consider it successful in attaining its primary objectives of gaining knowledge of the international legal instruments that govern questions of nuclear law and their implementation at the domestic level. Moreover, the acquisition of practical skills — most importantly drafting nuclear legislation, but also honing incidental abilities, such as working on a project in a team, presenting its outcome and holding up conclusions under scrutiny has been equally valued.

1.5.CONCLUSION

The Nuclear Law Institute was born out of an increased demand by Member States for guidance during the process of developing or enhancing legal frameworks enabling the use of nuclear technology, including nuclear power programmes, and of transposing the international nuclear legal framework into national law. Providing this type of assistance to a significantly greater number of Member States and their officials was no easy task. It required the IAEA to augment its legislative assistance activities with a programme that could accommodate a high volume of trainees with very different backgrounds. This presented the challenge of conveying both theoretical knowledge and drafting skills, as well as general concepts and highly specific technical rules, to a diverse body of professionals at various levels of government, coming from states with differing needs at various stages of nuclear development.

Against this backdrop, the Office of Legal Affairs recognized that the necessary in-depth instruction called for an adaptive approach embedded in a curriculum that was thorough and practical. The subsequently devised methodology struck a balance between frontal lectures and personal engagement. Impulse lectures on fundamental ideas were complemented by special

sessions on ancillary topics. TOP sessions encouraged follow-up and drawing upon collective experience, while FIG sessions allowed newly acquired knowledge to be tested in practice and scrutinized during fora. This approach, supplemented by a social framework as well as continuous improvement and ongoing support, has provided a working formula for success.

In quantitative terms, statistics show that as many as 550 professionals from all regions of the world have graduated from the NLI, nearly half of them women. In qualitative terms, meaningful indicators of the NLI's success may be found in the positive feedback received not only from NLI alumni, which have praised the programme as an avenue for gaining knowledge on nuclear law at the highest standard, making difficult concepts more approachable and sharing experiences, but also from Member States, as reflected in statements during meetings of the IAEA's Policy-Making Organs.

Ten years after its inception, the NLI may thus be considered as an effective instrument to meet the needs of Member States and deliver upon the IAEA mandate. The number of nuclear laws adopted in Member States during the decade, approximately 35, is also an important indicator of the success of the programme, its ultimate goal being to help countries develop nuclear legislation through capacity-building in nuclear law and legislative drafting.

2. THE NLI CURRICULUM: A COMPREHENSIVE PROGRAMME ON NUCLEAR LAW

A. CHERF [1,2]
Former Senior Legal Officer,
Office of Legal Affairs, IAEA

2.1. INTRODUCTION

The Nuclear Law Institute (NLI) was established in 2011. The training objective of the NLI is to provide participants with a solid understanding of all aspects of nuclear law and with the skills needed to draft, amend or review national nuclear legislation.

In order to achieve this objective, the programme addresses all areas of nuclear law: nuclear safety, security, safeguards and non-proliferation and nuclear liability and insurance. Drawing on teaching methods based on interaction and practice, the NLI provides a combination of impulse lectures covering the fundamentals of nuclear law, facilitated small group sessions (or TOPs) focusing on the implementation of the information from the lectures and a number of legislative drafting exercises in the context of forum issue groups (or FIGs). In addition, special sessions allow participants to gain in-depth knowledge of topics of specific interest.

This paper provides an overview of the impulse lectures of the NLI, highlighting their learning objective and how their approach has evolved throughout the years to enhance knowledge transfer in the respective areas.

2.2.NUCLEAR LAW – GENERAL OVERVIEW

The NLI programme starts with a preliminary session which provides a general overview on nuclear law through four lectures.

The two first lectures cover the institutional aspects in connection with nuclear law i.e., the organizations playing a major role in the area of nuclear law: the International Atomic Energy Agency and the Nuclear Energy Agency of the Organisation for Economic Cooperation and Development (OECD-NEA). The third lecture offers an introduction to nuclear law including its basic principles and the last lecture of this part is dedicated to the technical terms used in nuclear law, highlighting the importance of the terminology and the difficulties and challenges that legislative drafters experience often in their work.

2.2.1. Introduction to the International Atomic Energy Agency (IAEA)

The lecture provides an overview of the history, programme and activities of the IAEA. It introduces the organizational structure, objectives, functions and legal instruments governing

[1] Mr Abdelmadjid Cherf is a former senior legal officer at the Nuclear and Treaty Law Section, IAEA Office of Legal Affairs. *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

the work of the IAEA and highlights its role in the development of nuclear law. In order to do so, the lecture covers the following topics:

- IAEA's Statute adopted in 1957 and its mandate of accelerating and enlarging the contribution of atomic energy to peace, health and prosperity worldwide;
- IAEA's policy-making organs: The General Conference, which conducts debates on relevant current global issues and the IAEA's policies and programmes, and the Board of Governors, which is the executive organ of the IAEA;
- The IAEA Secretariat, its Departments and Offices;
- The three pillars of the Agency's work: Nuclear Science and Technology, Nuclear Safety and Security, and Safeguards and Verification;
- IAEA's role in the development of nuclear law through the agreements it concludes as an international organization with legal personality, through the adoption of standards and recommendations and through the treaty-making activities undertaken by Member States under its auspices.

While many students are familiar with the work of the IAEA, there is also a significant number of students for whom the NLI is the first interaction with the IAEA and even with the nuclear field and for whom this lecture is particularly relevant.

2.2.2. Introduction to the Organization for Economic Co-operation and Development (OECD) and the Nuclear Energy Agency (NEA)

The lecture explains the history, functions, areas of work and legal instruments of the OECD and its specialized Nuclear Energy Agency (NEA), as well as NEA activities related to nuclear law. In order to do so, the lecture covers the following topics:

- Origin, mandate, structure and functions of the OECD and the NEA;
- Activities of the NEA promoting the uses of nuclear energy for peaceful purposes, in a safe, environmentally sound and economic manner;
- Cooperation of NEA with other OECD organizations, such as the International Energy Agency (IEA), and internationally such as the IAEA, the European Commission and the nuclear industry;
- NEA's work to collect, analyze and disseminate information on nuclear law generally and on topical nuclear law issues;
- NEA's nuclear law committee and its work on the nuclear liability regime;
- NEA's nuclear law publications, notably the biennial Nuclear Law Bulletin, special publications addressing specific topics and the Online Nuclear Legislation database.

2.2.3. Introduction to Nuclear Law

The lecture provides an introduction to nuclear law, explaining its concept, objectives and principles as a specific branch of law, its international and national components, as well as the "3S" concept in nuclear law. To do so, the lecture covers the following topics:

- The definition and objective of nuclear law in providing the legal framework for conducting activities related to nuclear energy and ionizing radiation in a manner which adequately protects individuals, property and the environment from the dangerous effects of ionizing radiation;

- The “3S” concept in nuclear law encompassing nuclear safety, security, safeguards, as well as civil liability for nuclear damage;
- The international component of nuclear law, including the background, objective and scope of application of the relevant binding and non-binding international legal instruments;
- The national component of nuclear law, including the main elements of national nuclear legislation, possible modalities for a comprehensive nuclear law or for separate laws on specific elements and relation with subsidiary regulations.

2.2.4. Terminology in Nuclear Law

This lecture was introduced in the sixth session of the NLI, as experience when providing legislative assistance has demonstrated that the use of terminology in nuclear law is one of the most challenging issues in the legislative drafting process. The lecture addresses the following topics:

- Special nature of nuclear technology that makes necessary special legal arrangements and the use of specific technical terms in national legislation;
- Importance of defining the terms used in the legislation in a clear, concise and consistent manner;
- Resources that may be consulted in this regard, such as the IAEA Glossaries, the IAEA Safety Standards, the IAEA security guidance documents, as well as international legal instruments;
- Overview and explanation of key terms in the various areas of nuclear law that require special attention when drafting national legislation.

2.3. NATIONAL LEGAL FRAMEWORK

This part aims to provide the most up to date information on national legal infrastructure to support a nuclear power programme or a nuclear applications programme involving the use of radiation sources for medical, industrial, agriculture and research purposes. It is widely recognized that regardless of the magnitude of the programme, there is a need for a legal and regulatory infrastructure to be in place as a fundamental element of the overall national infrastructure. The basic concepts and principles are explained through three lectures: summarized as follows:

2.3.1. Sources of Ionizing Radiation: Concepts and Terminology

The lecture provides an overview of the basic concepts and technical terms pertaining to ionizing radiation sources. Most of the participants of the NLI are lawyers and may need to acquire the basic technical knowledge in this area as ionizing radiation sources are widely used. To achieve this objective the lecture:

- Describes the various types of radiation and provides examples on the uses of ionizing radiation sources in the fields of medicine, industry and research and development;
- Defines and contextualizes the technical terminology;
- Explains the characteristics and differences between ionizing and non-ionizing radiation;
- Focuses on sources of ionizing radiation emitted from living beings, planets and the naturally occurring radioactive material (NORM), or man-made;
- Describes the various sectors of the use ionizing radiation sources;

- Provides clarifications on the use of specific terms to mention different types of radioactive sources, including sealed and unsealed sources, dangerous sources, spent sources, disused and orphan sources and vulnerable sources.

2.3.2. The IAEA Milestones Approach for nuclear power infrastructure development and IAEA support to embarking countries

The lecture explains the Milestones approach of the IAEA in considering and implementing a nuclear power programme within a Member State. In this context, the lecture refers to the IAEA publication "the Milestones in the development of a National Infrastructure for Nuclear Power" No. NG-G-3.1 and provides details on how the milestones approach:

- Serves as a roadmap for embarking Member States as well as for the nuclear industry in general;
- Provides a comprehensive framework for the development of nuclear infrastructure and a programme management guide for these States;
- Determines three phases for the implementation of the programme; namely consideration, preparation, and construction; each to be concluded upon reaching the corresponding milestone; as well as the 19 defined infrastructure issues;
- Addresses the roles of the three key organizations: the Government Nuclear Energy Programme Implementing Organization (NEPIO), the Regulatory Body; and the owner (or operator).

Finally, the lecture emphases on the importance of the Integrated Nuclear Infrastructure Review Missions (INIR) which are international expert peer review missions based on the Milestones Approach to identify areas for further actions and improvements.

2.3.3. Comprehensive National Nuclear Legislation

The lecture provides an overview of the content of a comprehensive national nuclear law and the corresponding legislative process including an analysis of each element of a nuclear law. the lecture's approach is based on the "3S" concept. To achieve this objective, the lecture, explains the importance of a clear and concise drafting of the provisions of a nuclear law covering:

- Objectives, scope, and definitions;
- Independent regulatory body and adequate human and financial resources;
- Functions of the regulatory body including authorization, inspection and enforcement;
- Radiation protection and safety and security of radioactive sources;
- Nuclear facilities;
- Emergency preparedness and response;
- Mining and processing of radioactive ores activities;
- Transport of radioactive material;
- Radioactive waste and spent fuel management;
- Decommissioning of facilities;
- Nuclear security and physical protection;
- Safeguards and, and import and export controls;
- Civil liability for nuclear damage.

2.4.NUCLEAR SAFETY

This part will cover nuclear safety which encompasses the idea of protecting people and the environment from the harmful effects of ionizing radiation. It is a fundamental aspect for the use of nuclear technology. This part includes seven lectures which are summarized below:

2.4.1. The International Legal Framework of Nuclear Safety

This lecture lays out and explains the main objectives and features of the relevant international binding legal instruments in the area of safety as follows:

- Convention on Nuclear Safety,
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
- Convention on Earlier Notification of a Nuclear Accident;
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

Alongside the conventions, the lecture covers also the following non-legally binding instruments:

- Code of Conduct on the Safety and Security of Radioactive Sources;
- Code of Conduct on the Safety of Research Reactors;
- IAEA Regulations for the Safe Transport of Radioactive Material.

2.4.2. The Basic Principles of Radiation Protection

The lecture provides an overview on different aspects of Radiation protection; to do so, it addresses the following issues and areas:

- The basic principles of Radiation Protection, namely Justification, Optimization and Dose Limits;
- Practical issues associated with the implementation of these principles;
- Examples of inconsistency among various reference documents, as well as ongoing and future challenges in the area of radiation protection ;
- A reference to nuclear law including relevant international conventions, safety standards codes of conduct;
- The responsibility for radiation safety which follows a top- down approach (Government, regulatory body, authorization holder and other parties);
- Practical challenges in the application of the principles;
- Future challenges in relation to the complexity and comprehensiveness of radiation protection considering its scientific background and complex terminology.

2.4.3. The Transport of Radioactive Material

The lecture aims to elaborate on the understanding of the legal provisions and practices of the transport of dangerous goods with a particular focus on the transport of radioactive material (class 7). To achieve this objective, it covers:

- The development process of the international regulations for the transport of radioactive material;
- The role of the IAEA in this context including the role of TRANSSC in the review of the interpretation, implementation, evaluation and revision of the IAEA Transport Regulations;
- The role of the national competent authority which enforce transport regulations;
- The Specific Safety Requirement No. 6 (SSR-6) Regulations for the Safe Transport of Radioactive Material, and its relationship with other international regulations.

In focusing on the IAEA regulations, the lecture describes the content of the SSR-6 publication and focuses mainly on package design approval, the competent authority's duty on transport. application of the graded approach to limits on the radioactive content for packages, and integrity of package.

2.4.4. Regulating Uranium Mining and Production

The lecture provides an overview of all legal aspects of mining and processing of radioactive ores and also shares the experience of Canada on the relation of mining activities with indigenous rights in this country. To do so, the lecture covers:

- Uranium mining regulations;
- Interrelationships in nuclear law between uranium mining and other aspects such as radiation protection, non-proliferation, nuclear fuel cycle and environmental protection;
- Evolution of environmental standards, social responsibility and financial guarantees;
- Regulatory framework for uranium mining including its three facets: the protection of workers, the public and the environment;
- The licensing process of each of the five stages of the uranium lifecycle, including indigenous involvement and corresponding financial guarantee required;
- The reference to the various guidance documents published by the IAEA, the NEA and the World Nuclear Association (WNA), as well as the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in relation to its scope regarding naturally occurring radioactive material such as in the case of mining.

2.4.5. Safety of Nuclear Installations: Regulatory Oversight Process

The lecture clarifies the role of nuclear safety as an essential element for a successful and sustainable nuclear power programme. To achieve this objective, the lecture covers the following:

- Responsibilities of the government, the regulatory body in nuclear power activities, and the operating organization;
- The appropriate regulatory control over nuclear facilities and activities, transparency, adherence to up-to-date safety standards and an effective safety culture;
- The Convention on Nuclear safety and the Safety Standards, including General Safety Requirements Part 1 Governmental, Legal and Regulatory Framework for Safety, General Safety Requirements (GSR Part1), which represent the consensus of Member States in the application of safety principles;
- Fundamental Safety Principles including, prime responsibility for safety, responsibility of the government to establish an effective legal and governmental framework for safety

with an independent regulatory body, and others more technical such as optimization of protection;
- Regulatory Activities including authorization, inspection and enforcement processes;
- The licensing stages of a nuclear power plant (NPP) including siting, construction, commissioning, operation and decommissioning.

2.4.6. Emergency Preparedness and Response

The lecture provides an overview of the International Emergency Preparedness Response (EPR) Framework which consists of legal instruments, safety standards and tools, protocols, and operational arrangements. In this context, the lecture covers the following:

- The Conventions on Early Notification for a Nuclear Accident and on Assistance in case of Radiological Emergency;
- The main safety standards on EPR: Safety Fundamentals No. 1 (SF-1), the General Safety Requirements Part 7 and General Safety Guides No. 2, 2.1 and 11;
- The role of the IAEA in facilitating notification and information exchange through officially designated Contact Points;
- Public information;
- Coordination and international assistance;
- Integrated National Emergency planning and response arrangements;
- Transboundary impacts;

2.4.7. Radioactive Waste Management and Decommissioning

The lecture describes the principles and objectives, policies and strategies and explains the technologies related to spent fuel and radioactive waste management (RWM), as well as decommissioning. To do so, the lecture covers the following aspects:

- National policy including allocation of responsibilities generally under the polluter pays principle;
- Strategies for RWM including setting the timing for collection, characterization, treatment, storage and disposal of different types of waste;
- Compliance with IAEA Safety Standards and technical guidance documents;
- Issues related to disposed of radioactive waste in deep geological reserve;
- Concepts of open and closed fuel cycle and the corresponding consequences in terms of spent fuel and radioactive waste management;
- Decommissioning of facilities and main strategies;
- Adequate financial resources and funding schemes.

2.5.NUCLEAR SECURITY

Nuclear security is the prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities. It is an area of nuclear law that is expanding with the growing concern about nuclear security in the world. This part includes two lectures which are summarized as follows:

2.5.1. The International Legal Framework for Nuclear Security

The lecture explains what nuclear security is, lists and explains the relevant international binding and non-binding legal instruments with a focus on those adopted under the IAEA auspices as follows:

UN legally binding instruments:

- International Convention for the Suppression of Acts of Nuclear Terrorism;
- International Convention for the suppression of the financing of Nuclear Terrorism;
- Instruments of the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO);
  the UN Security Council Resolutions (Resolution 1373) (Resolution 1540);

IAEA legally binding and non-binding instruments:

- Convention on the Physical Protection of Nuclear Material and its Amendment;
- Code of Conduct on the Safety and Security of Radioactive Sources;
- Nuclear Security Recommendations on the Physical Protection of Nuclear Material and Nuclear Facilities (also known as the INFCIRC/225/Rev.5).

2.6.NUCLEAR SECURITY – FROM PHYSICAL PROTECTION TO COMBATTING ILLICIT TRAFFICKING OF NUCLEAR & OTHER RADIOACTIVE MATERIALS

The lecture focuses on the common goals of nuclear safety and nuclear security, the objectives and elements of a State's nuclear security and physical protection regimes, the various concepts on physical protection and nuclear security and concludes with the IAEA's vision and activities related to nuclear security. In doing so, the lecture addresses:

- Concept of nuclear Security Regime;
- Terminology;
- Nuclear security culture ;
- Implementation of measures to locate and recover any missing or stolen nuclear material;
- Protection against sabotage;
- Responsibilities for nuclear security;
- Design-Basis Threat of a nuclear facility and Threat Assessment;
- Physical protection systems;
- Arrangements and response plans at local, national, and international levels to security events.

2.7.NUCLEAR LIABILITY AND INSURANCE

The issue of how to compensate victims of a nuclear accident came early in the development of the nuclear industry. The international arrangements currently in place are quite complex. They are covered in this part by two lectures which are summarized below:

2.7.1. The International Legal Framework for Civil Liability for Nuclear Damage

The lecture presents the Vienna and Paris international legal instruments on civil liability for nuclear damage and introduces the common principles of the nuclear liability. In doing so, the lecture covers the following conventions:

- The 1960 Paris Convention, the 1963 Brussels Convention and the 2004 Protocol;
- The 1963 Vienna Convention and 1997 1997 Protocol;
- The 1988 NEA/IAEA Joint Protocol;
- The 1997 Convention on Supplementary Compensation for Nuclear Damage.

And discusses the following nuclear liability principles:

- The liability is exclusively channeled to the operator of the installation or receiving or sending operator in transport;
- The liability is absolute and strict;
- The installation State cannot limit liability below a threshold set by the convention it is Party to;
- The operator must maintain a financial security;
- No action can be brought against the operator after a certain period of time;
- All victims shall be treated equally, irrespective of their nationality, domicile or residence;
- The courts of the Contracting Party where the accident occurred shall have exclusive jurisdiction on liability, and its judgments shall be recognized in all Contracting parties.

2.8.FINANCIAL SECURITY FOR NUCLEAR RISKS

The lecture describes and discusses the various practical aspects of nuclear insurance including the relationship between nuclear liability provisions and insurance arrangements. In doing so, the lecture addresses the following:

- Nuclear insurance from the insurer’s perspective and the nuclear operator’s view;
- Concepts of insurance and reinsurance;
- Historical development of nuclear insurance;
- Specific features of nuclear insurance and pre- requisites;
- Technicalities pertaining to the coverage of nuclear insurances;
- Insurance for transport of nuclear material and for a nuclear facility;
- Relations between third-party liability insurance and the elements of international conventions on civil liability for nuclear damage.

2.9.SAFEGUARDS AND NON-PROLIFERATION

Safeguards are a technical means for verifying States legally binding undertakings not to use nuclear material or facilities to develop nuclear weapons or other nuclear explosive devices. It is a specific area in nuclear law which is covered by two lectures summarized as follows.

2.9.1. The Legal Framework for IAEA Safeguards

The lecture defines IAEA safeguards and explains the legal aspects related to this area of Agency work. To achieve this objective, the lecture covers the following:

- The IAEA Statute
- Bilateral Safeguards Agreements between the Agency and the States
- The Additional Protocol to the Safeguard Agreements
- Nuclear cooperation agreements,
- Nuclear-weapons-free zone treaties
- The Treaty on the Non-Proliferation of Nuclear Weapons,
- The historical development of the safeguards system
- The rights and obligations of the IAEA and the States in the application of safeguards

2.9.2. Safeguards – Concepts and Practices

The presentation describes the role of the IAEA in the implementation of safeguards; identifies the different types of safeguards as well as relevant information that is collected, evaluated and used by the IAEA; and lays out the process that leads to the drawing of conclusions related to safeguards. To do so, the lectures cover:

- Objectives of Safeguards
- States' commitments and rights and obligations of the IAEA
- Conducting verification
- Typical Inspection activities
- Information facility design
- Complementary access to restricted areas
- Drawing safeguards conclusions
- State evaluation concept.

3. INCREASING NATIONAL CAPACITIES IN LEGAL AND REGULATORY INFRASTRUCTURE FOR NUCLEAR AND RADIATION SAFETY WITH SUPPORT OF THE TECHNICAL COOPERATION PROGRAMME

DAZHU YANG[1], [2]
Former Deputy Director General,
Department of Technical Cooperation, IAEA

3.1.INTRODUCTION

Nuclear science and technology offer a significant contribution to help IAEA Member States achieve several of the 17 United Nations Sustainable Development Goals, which countries have committed to meet by 2030.

Many of these contributions are unique and vital for IAEA Member States' national priorities. Nuclear science and technology can be applied across a broad and diverse range of categories, for instance: to improve the diagnosis and treatment of diseases such as cancer, ensure the availability of safe food, and develop varieties of staple crops and animal feed to contribute to food security while also helping reduce malnutrition and hunger. There are other equally important applications that can address water shortages, increase access to reliable energy and monitor environmental degradation and pollution.

Before Member States can fully realize the benefits of these peaceful nuclear applications, however, national governments are responsible for putting in place an adequate legal framework for establishing a regulatory authority to oversee and govern the safe, secure and sustainable use of radiation techniques, and protect staff, patients, the public and the environment.

Although complicated and time-consuming, drafting, approving and ratifying a national nuclear law is just the beginning of the journey. To help countries in their efforts to develop nuclear regulation and legislation, the IAEA provides highly qualified personnel and specialist expertise through its primary support mechanism, the technical cooperation (TC) programme. This assistance supports the development and establishment of robust legal systems to control and govern the use and management of radiation sources and to use nuclear applications effectively. Due to the individual nature of each country's priorities, careful planning and coordination is required between the respective government and specialists across the IAEA to help build capacities and develop a bespoke roadmap going forward.

3.2.INITIATING THE LEGISLATIVE PROCESS

To provide Member States with the necessary guidance in the early stages of their journey to establish a regulatory infrastructure, the IAEA founded a training programme known as the Nuclear Law Institute in 2011, delivered through the TC programme, to fill the gap where independent, world-class nuclear legislative knowledge is otherwise scarce. This annual

[1] Former staff member at the IAEA. *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*
[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

intensive training programme provides participants with in-depth knowledge on all aspects of nuclear law governing the safe, secure and peaceful use of radiation sources, nuclear material and any other radioactive material, as well as specialized training in drafting nuclear legislation. Participants use the opportunity to delve more deeply into the study and implementation of safety, security, safeguards and liability treaties in their national legal system (see Figure 1).

The Institute has proved itself an effective mechanism to deliver targeted training and is considered a key channel through which the fundamentals of drafting legislation are conveyed to national officials. Following the training, the students are in a better position to advise their authorities on how best to develop or revise the national legal framework. Many continue to be actively engaged in their national legislative processes.

Some 130 Member States from different regions have benefited from the Nuclear Law Institute's training in the essential components of the legal process. Since its establishment ten years ago, close to 550 participants have graduated from the Institute, of whom around 50 per cent were women. Two-thirds of students came, almost equally, from Africa and Asia and the Pacific, with Europe and Latin America and the Caribbean making up 21 and 15 per cent of participants respectively. It is also encouraging to note that over 35 Member States have now adopted their first nuclear laws, supported both by this training and by other ongoing IAEA initiatives in this area.

FIGURE 1. The IAEA established NLI in 2011 as the first global training programme on nuclear law focused on supporting countries in drafting their legislation regulating the peaceful use of nuclear technology. (Photo: D Calma/IAEA)

3.3.LEGISLATIVE ASSISTANCE FROM 2011 TO 2020

Experience over the past decade has shown that legislative assistance to Member States can be addressed through activities under a national project with individual work plans as well as through a regional or sub-regional project, as this facilitates a better exchange of national experiences.

The IAEA provides support to Member States on an ongoing basis to assess, revise and draft corresponding national legislation, enhance overall understanding and national capabilities in nuclear law through training, and to inform and raise the awareness of decision makers of the requirements for a national legal framework for the safe, secure and peaceful use of nuclear energy and ionizing radiation.

For example, in 2018/2019, the IAEA's technical cooperation programme supported 36 activities to help assess and draft legislation. Assistance was provided through document reviews, bilateral meetings and expert missions and assignments. Awareness missions and national workshops on nuclear law were also conducted.

3.3.1. Support to Member States in Africa

Nearly all 46 Member States in Africa have benefitted from IAEA legislative assistance. As a region, Africa has made the greatest progress in developing and promulgating adequate legal frameworks, with a good number of specialists trained in nuclear law.

IAEA legislative assistance in the region has enabled 22 countries to put comprehensive nuclear laws in place. Of the 17 countries which have nuclear laws, 11 are in the process of drafting or enacting enhanced and comprehensive nuclear legislation. Five countries do not have nuclear legislation in place, however four of these are in the process of drafting or enacting their first nuclear law. Where a country does not have a nuclear law, a series of decrees and ordinances can be issued to regulate nuclear activities, and to help govern pertinent areas such as healthcare.

Bilateral assistance was planned for 2021 in various forms in the region, some of which is being provided virtually due to Covid-19 related travel restrictions. Such activities include awareness and expert missions, and scientific visits, each helping to assist the development of nuclear legislation.

Building on a series of regional workshops for anglo- and francophone African countries in 2017, a second round is planned for 2021. These workshops will provide an opportunity to reassess the nuclear law status in those group of countries, evaluate impact and progress, identify needs and plan for individual IAEA assistance for each country.

3.3.2. Support to Member States in Asia and the Pacific

The IAEA is providing bilateral legislative assistance support to 11 Member States in Asia and the Pacific to draft, review and adopt their new national nuclear laws.

Nearly all Member States in the region are benefitting from IAEA legislative assistance. Activities include raising awareness of the relevant international legal instruments, conducting regional and national workshops, training in nuclear law and participation in the annual Nuclear Law Institute.

3.3.3. Support to Member States in Europe and Central Asia

More than half of the IAEA Member States in Europe and Central Asia have adopted or amended their national nuclear legislation with the assistance of the IAEA. This is now enabling them to benefit from the peaceful uses of nuclear technology in a safer and more secure manner, consistent with national plans for the development or expansion of nuclear applications.

A broad range of support is available through the legislative assistance programme, including activities focused on raising awareness among senior officials and decision-makers of the importance of international and national nuclear law, together with national workshops. A continuing important area of assistance to Member States in the region is the training of lawyers to support national capacity building in assessing, revising and maintaining an up-to-date

national legal framework. The principal vehicle for this continues to be the annual Nuclear Law Institute.

In January 2020, participants from 16 Member States in Europe and Central Asia took part in a regional workshop on harmonizing national nuclear law with international and European law. The event provided an opportunity to discuss issues arising from the transposition of relevant EU Directives. Bilateral discussions held during the workshop also provided an opportunity to address the Member States' needs over the next two years for strengthening their legal frameworks regarding the safe, secure and peaceful uses of nuclear energy and ionizing radiation.

3.3.4. Support to Member States in Latin America and the Caribbean

Nuclear legislation still needs to be developed in several Member States in Latin America and the Caribbean, particularly in those who have recently joined the IAEA. Very few Member States currently have a comprehensive nuclear law that adequately addresses all the elements necessary for nuclear safety, security, safeguards and civil liability. Much national nuclear legislation needs to be enhanced or updated to bring it in line with the relevant international instruments or to address existing gaps.

While 13 countries have nuclear laws, six lack regulatory controls for areas such as health, and ten Member States do not yet have a nuclear law at all. Of these countries, 16 have now embarked on the development of comprehensive nuclear laws with IAEA assistance or have concrete plans to do so.

3.4.SPECIALIZED SCHOOLS AND POSTGRADUATE COURSES ON RADIATION PROTECTION AND EMERGENCIES

In addition to the Nuclear Law Institute, the IAEA supports a range of additional training opportunities, including specialized schools dedicated to radiation protection, emergency preparedness and emergency management. For instance, the IAEA has supported student participation at the International School of Nuclear Law, established by the University of Montpellier in cooperation with the OECD Nuclear Energy Agency (NEA) in 2001.

The Postgraduate Educational Course (PGEC) in Radiation Protection and the Safety of Radiation Sources is a comprehensive training programme that targets young professionals, primarily from national regulatory bodies. The course aims to help students acquire a sound basis in radiation protection and the safety of radiation sources. An evaluation of the course, conducted in 2015, confirmed that it plays an important role in building a core of professionals competent in radiation protection, as well as in strengthening the radiation safety infrastructure at institutional and national levels. The first PGEC was held in Argentina, in 1981. Today the course is offered in Arabic, English, French, Portuguese, Russian and Spanish.

Postgraduate Educational Courses in 2019

Africa: 35 young professionals were trained as radiation protection officers at PGECs hosted in Algeria and Ghana. Since 2002, 449 students were trained in PGECs hosted in Ghana in English and in French in Algeria and Morocco.

Asia and the Pacific: 31 trainees participated in PGECs in 2019. 388 trainees in total have graduated in the region since 2001.

Europe: 19 participants from 16 countries attended a PGEC in Greece, which has hosted 6 PGECs in Europe in English since 2003 and trained over 100 students. Training is also offered in Belarus in Russian.

Latin America and the Caribbean: 20 participants from 12 countries attended the PGEC in Spanish (Argentina). 43 PGEC courses have been organized in the region to date, with over 600 participants.

Since its establishment, over 1800 young professionals from 120 countries have taken part, benefitting their professional careers and contributing significantly to strengthened national radiation safety infrastructure.

In addition, for example, a three-week School of Radiation Emergency Management took place in China in 2019. Twenty-four participants from 14 different countries from Asia and the Pacific were trained to develop and manage sustainable emergency preparedness and response programmes, based mainly on IAEA safety standards, technical guidelines, tools and training material. The event provided the participants with a comprehensive understanding of the nuclear and radiological emergency preparedness and response framework.

Over the last ten years, the IAEA, through the annual two-week Nuclear Law Institute as well as other activities, delivered through its TC programme, has provided a key support that has enabled over 35 IAEA Member States to successfully adopt their first nuclear laws. For many countries, participation in the Nuclear Law Institute is an essential step in the process of building comprehensive national capacity, ensuring that they can benefit, in full, from the safe, sustainable and peaceful application of nuclear science and technology for development. Table 1 below shows the summary of all the TC projects that have provided legislative assistance to IAEA Member State over the past decade.

TABLE 1: A summary of TC projects that have provided legislative assistance to IAEA Member States over the past decades.

Project no:	Project title
INT0096	Establishing and Enhancing National Legal Frameworks for the Safe, Secure and Peaceful Use of Nuclear Energy and Ionizing Radiation (2018)
RAF0044	Providing Legislative Assistance for the Preparation of Nuclear Related Law (2014)
RAF0048	Establishing National Legal Frameworks in African Member States (2016)
RAF0057	Establishing and Enhancing National Legal Frameworks (AFRA) (2020)
RAS0071	Providing Legislative Assistance on Establishing and Upgrading the Legal Framework for Safe, Secure and Peaceful Use of Nuclear Energy (2014)
RAS0085	Establishing and Enhancing National Nuclear Legal Frameworks in Member States (2020)
RAS9063	Providing Legislative Assistance (2012)
RER0038	Establishing National Legal Frameworks (2014)
RER0042	Establishing and Enhancing National Legal Frameworks (2016)
RER0046	Enhancing National legal Frameworks in European Member States (2020)
RER9105	Establishing National Legal Frameworks (2012)
RLA0051	Establishing National Legal Frameworks (2014)
RLA0055	Establishing National Legal Frameworks in Member States (2016)
RLA0067	Establishing and Enhancing National Legal Frameworks (2020)

4. THE NEXT TEN YEARS: ADDRESSING THE EVOLVING NEEDS OF MEMBER STATES FOR TRAINING IN NUCLEAR LAW

W. TONHAUSER[1]
International Atomic Energy Agency

4.1.INTRODUCTION

Training is one of the main components of the IAEA's legislative assistance programme, which seeks, *inter alia*, to transfer knowledge to Member States on the national and international legal framework for the safe, secure and peaceful use of nuclear energy and ionizing radiation.

Since the first reported "international course organized to study the legal aspects of the peaceful uses of atomic energy" was conducted at IAEA headquarters in Vienna on 16–26 April 1968 [1], the IAEA has continued to offer capacity-building opportunities in nuclear law to address the increasing demand from Member States, a demand that led 10 years ago to the establishment of the Nuclear Law Institute (NLI).

Having arrived at the tenth anniversary of the NLI, this paper, after summarizing and assessing training activities conducted during the last decade, looks ahead and considers how the NLI and other IAEA training may further develop in the next years, based on lessons learned from a decade of implementation and current needs in Member States identified in the context of IAEA's legislative assistance programme.

4.2.OVERVIEW OF IAEA TRAINING IN NUCLEAR LAW

Technical cooperation projects for the provision of legislative assistance include a training component. Extrabudgetary resources help to increase the outreach and scope of training activities and have been particularly important to enable the implementation of specific training projects and reference material in nuclear law.

The objective of the training is to provide the knowledge needed to understand the international legal instruments adopted in the areas of safety, security, safeguards and civil liability for nuclear damage, the implications and obligations arising from these instruments and how to reflect them in national legislation. In addition, IAEA training activities seek to supply officials with the skills needed for assessing, reviewing and drafting corresponding national legislation and for providing legal support to the national implementation of international legal instruments and related laws. The ultimate goal is to transfer relevant knowledge to Member States in support of human resource development and capacity building at the national level.

In this context, the main IAEA training programme on nuclear law under the legislative assistance programme is the Nuclear Law Institute (NLI), which is conducted annually since 2011. The NLI is supplemented by national and regional courses and workshops as well as fellowships and scientific visits tailored to specific needs of requesting Member States. These

[1] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

activities are supported by the development of reference and training material, notably the handbooks on nuclear law published in 2006 and 2010 [2, 3].

4.2.1. The Nuclear Law Institute (NLI)

The training objective of the NLI is to provide participants with a solid understanding of all aspects of nuclear law and with the skills needed to draft, amend or review national nuclear legislation.

In order to achieve this objective, the programme addresses all areas of nuclear law: nuclear safety, security, safeguards and non-proliferation and nuclear liability and insurance. Drawing on teaching methods based on interaction and practice, the NLI provides a combination of impulse lectures covering the fundamentals of nuclear law, facilitated small group sessions (or TOPs) focusing on the implementation of the information from the lectures and a number of legislative drafting exercises in the context of forum issue groups (or FIGs). In addition, special sessions allow participants to gain in-depth knowledge of topics of specific interest.

Since its inception, the NLI has trained more than 600 lawyers and other officials from Member States, many of which have played a leading role in the establishment or update of national nuclear legislation in their countries. An IAEA-managed LinkedIn page supports networking among NLI alumni.

4.2.2. National and regional training activities

Due the limitation in the number of participants that may be accepted each year to the NLI programme, normally not more than one participant per country, the NLI is not sufficient to address the training needs of Member States. National and regional activities play therefore and important role in meeting these training needs, reaching a wider audience at the national level and allowing focused attention on the regional or national circumstances.

Regional workshops with a training component on nuclear law are conducted every 3–4 years and have proved very useful to facilitate an exchange of experiences and lessons learned and to create networking opportunities on nuclear law at the regional level. National training courses and workshops are conducted at the country's request and tailored to their specific needs. In many cases, there is an interest in providing through these training activities nuclear law training to officials from non-nuclear institutions, as a way to improve understanding of the specificities of the field and facilitating the interaction of the nuclear regulatory authorities within the overall national institutional framework.

Since 2011, more than 70 of these national and regional training courses and workshops have been conducted.

4.2.3. Fellowships and scientific visits

Fellows and scientific visitors may be hosted at the Office of Legal Affairs to support Member States in implementing a specific project or assessing priority topics on nuclear law representing a need that requires individual consultations or tailored training that cannot be addressed through general training programmes. Fellowships and scientific visits have been particularly relevant for projects linked to legislative proposals related to national legislation or treaty adherence or to the revision of the national legal framework.

4.2.4. Assessing results (2011–2020)

Between 2011 and 2020 IAEA regional and interregional training activities in nuclear law have benefited more than 1000 officials from Member States, while close to 60 fellows and scientific visitors have been hosted by the Office of Legal Affairs. With more than 60 national training courses and workshops conducted since 2011, the number of officials having benefitted from these activities is estimated at 800–1000.

4.3. CURRENT TRAINING NEEDS IN MEMBER STATES

An assessment of needs in Member States at the regional and national level, as reflected in the legislative assistance workplans agreed with Member States between 2014 and 2020 under the relevant technical cooperation projects, shows that training in nuclear law and the related international legal instruments is one of the key areas where IAEA assistance continues to be required, not only for the training of drafters, but also for the training of specific groups or training on particular topics of regional or subregional interest.

4.3.1. Training for drafters

IAEA training has traditionally focused in helping officials in Member States develop the skills needed for drafting nuclear legislation, in line with their international obligations, and in helping them gain the knowledge needed to assess and advice on the implications of adhering to the relevant international legal instruments.

With a significant number of countries involved in drafting or revising nuclear legislation, or planning to do so, the demand in training for drafters remains high and will continue to be addressed through the NLI and its interactive programme and complemented where needed and requested through tailored national activities.

4.3.2. Training for policymakers and stakeholders

Experience shows that there may be delays in the legislative process when senior officials, decision-makers and non-nuclear stakeholders are not aware of the specificities of nuclear law. This has led to an increasing demand from Member States for the conduct of awareness missions, workshops and other activities to help them gain a better understanding in this respect in support of the legislative process.

Training for policymakers is challenging as it needs to be kept at a high-level while providing a clear picture on the nuclear law topics requiring policy decisions at the national level and on the specificities of nuclear law of which they need to be aware of when considering joining international legal instruments or deciding on national legislation in the nuclear field. These interactions are supported by targeted reference material such as the legal briefs for policymakers developed in the recent years [4 – 7]. For institutional stakeholders, the goal of the training is to provide a good understanding on the interrelations between the nuclear legislation and their respective legal framework so that they may be in a position to provide useful input to the legislative process.

4.3.3. Training for legal advisers and regulators

In response to requests from Member States, a meeting for legal advisers of regulatory bodies was held in Vienna in 2019, during which participants exchanged on their role in the development and maintenance of the national legal and regulatory framework and in the

exercise of regulatory functions for the control of facilities and activities involving nuclear technology. They also considered that increased training and networking opportunities would be very useful to support them in their role.

Training for legal advisers, including on the areas where legal support is normally required and the competences needed, was considered particularly relevant for Member States having only recently enacted nuclear legislation and/or established a legal and regulatory framework for the control of facilities and activities involving nuclear technology.

4.3.4. Training for trainers

As Member States seek to enhance self-reliance, rather than relying only in the Agency training to satisfy all the internal demand, there is an increased focus on train-the-trainer programmes. With such programmes in place, officials trained by the Agency may further a multiplying effect, enhancing impact and sustainability at the national level.

The requests for the development of training curricula and train-the-trainer programmes in nuclear law have therefore grown in the last years, particularly from Member States introducing nuclear power programmes that face appointments of new legal staff at nuclear regulatory bodies and operating organizations on a regular basis and that would like to complement Agency national and regional training opportunities with their own programmes to face the need for ongoing training. These programmes seek to provide future trainers with the tools needed for teaching nuclear law in their respective countries, including the development of soft skills through practical exercises.

4.4.OUTLOOK FOR THE FUTURE

4.4.1. The NLI: An Evolving Programme

The NLI has made a major contribution to the establishment and maintenance of adequate national nuclear legal frameworks in Member States. A key to the success of the programme is that it has evolved throughout the years based on the feedback received from facilitators, lecturers and participants. New lectures and special sessions on topics like terminology in nuclear law, the legal framework for small modular reactors and for a nuclear power programme, have been introduced in response to this feedback. New self-assessment and practical exercises have also been introduced and adapted to lessons learned from previous sessions.

The NLI team will continue to monitor trends and developments in the international and national contexts so that they may be factored into the programme. Based on feedback from NLI alumni, special sessions, which address topics of interest for Member States, such as the legal framework for a nuclear power programme and for small modular reactors and the legal aspects of decommissioning of nuclear facilities, among others, are expected to be expanded to address also areas like decommissioning of radiation facilities, liability for radiological damage other than nuclear damage and the return of radioactive sources to the country of origin at the end of their useful life.

4.4.2. Regional and topical approaches

Feedback from participants consistently rates the NLI as a unique networking and interaction opportunity among lawyers from different regions and legal systems, but questions are also often raised as to whether the NLI could be replicated in other languages so that a higher number

of participants may benefit from the programme, including those that may not have the necessary language skills to apply for the NLI, which is conducted only in English. To address these issues, regional training approaches on nuclear law are expected to increase in the coming years to complement the NLI, in line with regional needs, interests and priorities. These approaches could be facilitated through collaborative arrangements with regional or national training or education centres, as some Member States have expressed interest in hosting centres for training in nuclear law at the regional level.

4.4.3. Virtual and online training

The Agency has always been actively involved in the development of online and e-learning modules as part of its capacity building activities. The COVID-19 outbreak in 2020 that led to the postponement of face-to-face training activities, including the 2020 session of the NLI that was scheduled for the month of October, highlighted however the importance of further focusing on these training modalities. In this context, a series of interactive webinars on nuclear law was launched for the first time in October 2020 with the aim of enhancing awareness of the role and importance of nuclear law and providing an opportunity for officials to engage in a virtual information exchange on related topics. Structured in three parts and comprising nine webinars, the series ran from October to December 2020. The high number of participants in the series, for an average of 500 registered participants per webinar, shows the continued interest and availability of Member States to engage in learning activities through alternative means and the importance of finding innovative approaches for training.

An e-learning module was developed in 2018 to provide an overview on the development of a legal framework for the safe, secure and peaceful use of nuclear technology, including for a nuclear power programme [8]. It has become however necessary to expand the offer for online training in nuclear law and to develop a full-fledged training course that would be available online for Member States. To enhance impact, the online course should preferably be available in several languages, not only in English. Along the same lines, virtual workshops and meetings with Member States on different aspects of nuclear law are expected to increase, with approximately 10 of such activities in planning as of August 2020.

4.4.4. Partnerships and networking

The Agency is not alone in providing training in nuclear law. Other international organizations, as well as educational centres and universities in Member States, also offer training in this area.

In the framework of the technical cooperation programme, the Agency grants fellowships for participation in the International School of Nuclear Law (ISNL) conducted annually by the OECD's Nuclear Energy Agency in collaboration with the Montpellier University. It also grants fellowships for participation in nuclear law conferences like the Inter Jura Congress of the International Nuclear Law Association (INLA). Additionally, several Member States with experienced regulatory bodies have agreed to host, as scientific visitors, legal advisers of newly established regulators to support them in gaining a better understanding of their role in providing legal support to the exercise of regulatory functions. In some cases, rather than providing training, the role of the Agency is to provide a forum for officials from Member States, such as legal advisers of regulatory bodies, to exchange on current topics of interest.

In this context, the Agency will continue its focus on strengthening partnerships to increase and maximize the impact of training and networking opportunities in nuclear law. The first international conference on nuclear law to be held in 2022 will provide an opportunity to

identify and explore possible modalities to expand regional, international, South-South and triangular cooperation in this field.

4.5.CONCLUSION

The increase in demand for legislative assistance in drafting nuclear legislation led in 2011 to a dedicated formal training programme, the NLI, to address this need in Member States. The design of the NLI programme drew on decades of Agency experience in providing drafting assistance to its Member States. With the further evolution of the legislative assistance programme to also address the needs of Member States in terms of nuclear law training and awareness-raising of national officials in other contexts, together with the demand for further regional, topical and online training and networking opportunities, it appears timely to formally recognize and consolidate these needs and experience through specific programmes.

It is therefore expected that in the coming years, while the NLI remains the main general training programme on nuclear law and legislative drafting, there will also be a focus on specific training modules, curricula or networking opportunities for the groups that have been identified in Member States as particularly important, such as legal advisers of regulatory bodies, policymakers and trainers, as well as an increase in the offer of virtual and online training programmes on nuclear law, with an emphasis on multilingualism.

The identification of innovative training approaches and strategic partnerships with other training providers at the national, regional and international levels will necessarily be a key driver in the development and implementation of these initiatives.

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5. THE IMPACT OF IAEA'S LEGISLATIVE ASSISTANCE PROGRAMME IN THE DEVELOPMENT AND EVOLUTION OF NUCLEAR LAW

F. TONOS PANIAGUA[1], [2]
United Nations Project Consultant and former Legal Officer,
Office of Legal Affairs, IAEA

5.1.INTRODUCTION

The International Atomic Energy Agency (IAEA) has provided legislative assistance to its Member States since its inception. Under its technical cooperation programme, the IAEA assists governments, not only in benefiting from the peaceful use of nuclear technology applications but also in setting up the infrastructure for regulating and controlling such applications, including in the establishment of the necessary legislation through its legislative assistance programme.

This paper examines the impact that the IAEA's legislative assistance programme has in the development of nuclear law, as the vehicle supporting Member States to establish adequate legal frameworks for the safe, secure and peaceful use of nuclear technology, promoting the related international legal instruments, fostering the application of recognized nuclear law concepts and principles and enabling interactions on these topics among its Member States.

In order to do so, this paper illustrates, with reference mainly to developments during the last decade, how the programme, through bilateral drafting assistance, awareness-raising efforts and training activities, contributes to improve the status of national nuclear legal frameworks, to identify and address common issues and challenges and to develop trends and approaches that may eventually have an impact in the further evolution of nuclear law.

5.2.OVERVIEW AND EVOLUTION OF THE PROGRAMME

5.2.1. Background and Objective

The development of nuclear law as a distinct branch of law started with the recognition that the peaceful use of nuclear technology goes hand in hand with its regulation and control, making it necessary to put special legal arrangements in place enabling the conduct of related activities in a manner that adequately protects people and the environment from their inherent risks.

Today, 75 years after the adoption in 1945 of the first nuclear law, that is, specific legislation providing for the control of nuclear technology [1], nuclear law has developed and consolidated to embody a set of internationally recognized concepts and principles that cover four distinct

[1] Ms Fanny Tonos Paniagua is a former legal officer in the Nuclear and Treaty Law Section, IAEA Office of Legal Affairs. *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

areas: safety, security, safeguards and civil liability for nuclear damage[3], and that has, like other branches of law, not only a national but also an international component [2, 3].

Indeed, today the hopes expressed in 1968 during the first IAEA training course on nuclear law for the harmonization of rules related to the peaceful use of nuclear energy and the creation of a "world nuclear law" [4] appear to be realized to a large extent, as a wide range of international legal instruments have already been adopted under the auspices of the IAEA that establish principles and requirements for the safe, secure and peaceful use of nuclear technology [5 – 22], several of which provide the basis for international cooperation in related matters.

The IAEA General Conference regularly encourages Member States to adhere to these international legal instruments and to establish and maintain, inter alia, adequate legal infrastructures for the use of nuclear technology [23]. At their request, the IAEA Secretariat supports Member States in these endeavours.

This support is provided through IAEA's legislative assistance programme, which aims to create awareness in Member States on the international legal instruments adopted under its auspices and to assist them in complying with their international obligations and in establishing and maintaining adequate national nuclear legal frameworks. The programme, primarily funded and implemented through technical cooperation projects, also seeks to transfer related knowledge to Member States through regional and interregional training events like the Nuclear Law Institute (NLI). Reference materials, such as the IAEA handbooks on nuclear law [2, 3], are also developed under the programme and made available for use by officials in Member States.

5.2.2. Scope of the Programme

The IAEA has been providing legislative assistance to Member States since its inception in 1957, by "sending experts to the countries to advise national authorities in drafting nuclear laws, or by supplying written opinions on draft laws and regulations or discussing them with national representatives" [1]. The programme has nevertheless evolved throughout the years to adapt to the changing needs of Member States. As the interest in nuclear technology increased progressively throughout the years and the international legal instruments grew in number and complexity, the demand for legislative assistance by Member States started to raise exponentially. This led to the progressive consolidation of the programme and the approval in 1996 of the first technical cooperation project dedicated to legislative assistance[4], under which the IAEA Secretariat started to provide support in a more comprehensive and systematic manner.

The scope of legislative assistance has also evolved to address all areas of nuclear law, namely safety, security, safeguards and civil liability for nuclear damage. Indeed, while in the early years national legislation focused largely on safety considerations, as described below, modern

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[3] Safety refers to the protection of people and the environment against radiation risks and to the safety of facilities and activities that give rise to these risks; Security refers to the prevention and detection of, and response to, malicious acts involving nuclear and other radioactive material or associated facilities; Safeguards refers to measures to ensure that States' undertakings to use nuclear material only for peaceful purposes are upheld; Nuclear liability refers to the establishment of mechanisms for compensation of nuclear damage caused by a nuclear accident.

[4] Regional technical cooperation project for Europe *RER/0/015 Legislative Assistance for the Utilization of Nuclear Energy* was approved by the IAEA Board of Governors in 1996 for the 1997-1998 cycle [32].

nuclear laws are much broader in scope, many of which cover all these areas in a comprehensive manner.

The nature of the legislative process, which involves a wide range of national stakeholders and many steps at the technical, governmental and parliamentary levels, has also played an important role in the evolution of the programme. Many years may pass from the provision of bilateral assistance by the IAEA until the enactment and entry into force of the legislation and Member States started more and more to also seek IAEA assistance at later stages of the process. The programme has therefore expanded to offer support to Member States in all stages of the legislative process, from the identification of elements that need to be addressed and the related policy decisions that need to be made at the initial drafting stage, through text review of legislative proposals, organization of meetings with drafting teams and conduct of briefings for stakeholder institutions and parliamentarians.

Legislative assistance is available to all Member States, regardless of the respective scope of their nuclear technology programmes, and to achieve results it needs to adjust accordingly to specific national circumstances and needs. Some Member States are involved for the first time in the development of nuclear legislation to enable the implementation of priority projects such as cancer control programmes. Others have many years of regulatory experience and seek to correct identified gaps, take stock of lessons learned or peer reviews or bring their legislation in line with a treaty or convention to which they have adhered. Others yet may be engaged in considering a nuclear power programme and need to revise their legislation accordingly or may be interested in other new projects involving nuclear technology for which the existing legislation is not adequate.

5.2.3. Overview of Activities, Tools and Outputs

In view of the increase in demand from Member States, to facilitate long-term and targeted support, it became necessary to develop specific tools allowing for a systematic planning and assessment of individual needs. A country work plan mechanism was therefore developed that has been used since 2014 for the planning, monitoring and follow-up of legislative assistance activities and nuclear law developments in Member States. These informal work plans, which are in place for close to 110 Member States, are periodically reviewed and updated, normally in the context of regional events.

Country work plans seek to address Member States needs and priorities through tailored activities. In most cases, to achieve results when supporting Member States in developing nuclear legislation, bilateral assistance in assessing, revising and drafting national laws needs to be complemented with other components of the programme like training of drafters and awareness-raising of decision-makers. Training and awareness-raising through national seminars or workshops are also key in helping officials gain a better understanding of the relevant international legal instruments, in support of the national adherence process.

Although developed on a bilateral basis, work plans also allow to take into account common needs that could be addressed through sub-regional or interregional initiatives or through regular training programmes like the Nuclear Law Institute (NLI). They are also factored into broader IAEA frameworks for providing and coordinating assistance to Member States, such

as Country Programme Frameworks[5], Integrated Nuclear Security Support Plans[6] and Integrated Work Plans[7]. For easy access and reference, data from these legislative assistance work plans is reflected and consolidated in an internal dedicated database.

Regional technical cooperation projects have provided the vehicle to identify and address common needs in Member States while enabling also to assess and target individual needs through the country work plan mechanism. As an illustration, since 2014, 12 regional projects and one interregional project have been or are being implemented[8], and the following activities were conducted between 2014 and 2019:

— 106 reviews of draft laws;
— 50 awareness or legislative assistance meetings and missions, including 22 national workshops or seminars;
— 15 regional or topical workshops on nuclear law.

As illustrated in the below sections, through the above activities the IAEA's legislative assistance programme has played a key role in enhancing legal frameworks in Member States, in terms of both national legislation and treaty participation. In addition, in the context of these activities, lessons learned are transferred to and discussed among Member States and common or recurring legal issues thus start to arise as topics, trends or developments in respect of which an identification, consolidation and exchange of experiences through the programme is particularly valuable for Member States.

5.3.IMPACT OF THE PROGRAMME IN MEMBER STATES

5.3.1. Status of Nuclear Legislation

Many Member States have already nuclear laws in place, that is, specific legislation providing for the regulatory control of activities and facilities involving the use of nuclear technology. According to some records, in 1968 at least 56 countries had enacted some kind of nuclear legislation [1]. Today, out of 143 Member States with national technical cooperation programmes [32], 117 already have specific nuclear laws in place[9], while most of the others are in the process of developing such legislation.

As set out in Figure 1, during the last decade (2011–2020), bilateral legislative assistance has been provided to 86 Member States from Africa, Asia and the Pacific, Europe and Latin America and the Caribbean. 26 of these States were or are developing nuclear legislation for

[5] Country Programme Frameworks (CPFs) are prepared by Member States in collaboration with the Secretariat and define priority development needs and interests to be supported through technical cooperation activities, based on national development plans and priorities. There were 100 valid CPFs at the end of 2018 [31].
[6] Integrated Nuclear Security Support Plans (INSSPs) are intended to assist Member States, upon request, in systematically and comprehensively enhancing their nuclear security regimes. There were 81 approved INSSPs at the end of 2018 [31].
[7] Integrated Work Plans (IWPs) are used to provide integrated support for nuclear infrastructure development in Member States considering or embarking on a new nuclear power programme [31].
[8] For the 2020–2021 cycle the following projects are being implemented for, respectively, Africa, Asia and the Pacific, Europe and Latin America and the Caribbean: *RAF0057 Establishing and Enhancing National Legal Frameworks (AFRA), RAS0085 Establishing and Enhancing National Legal Frameworks in Member States, RER0046 Enhancing National Legal Frameworks in European Member States* and *RLA0067 Establishing and Enhancing National Legal Frameworks* [32].
[9] Some Member States without specific nuclear laws in place provide the legal basis for regulatory control in general laws such as health or environmental legislation.

the first time in order to put in place the legal framework needed for the safe, secure and peaceful use of nuclear technology.

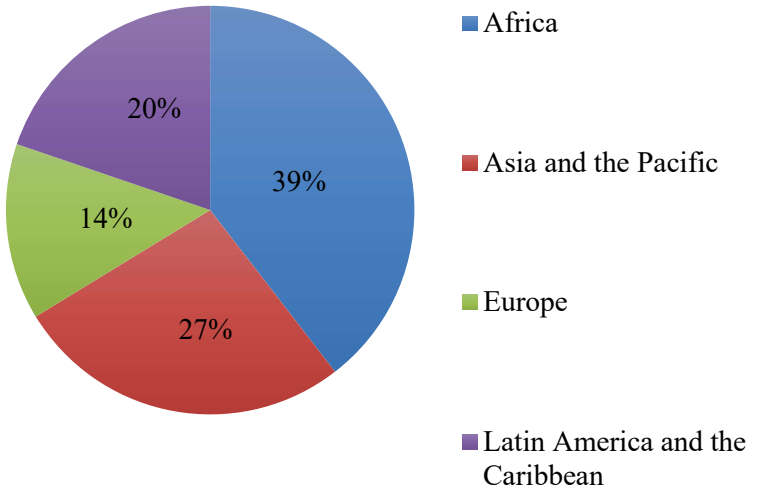

FIGURE. 1. Chart showing the distribution of Member States, per region, which received IAEA bilateral legislative assistance during 2011–2020.

As of August 2020, first or new nuclear laws had already been enacted in 35 of those States. In 15 Member States legislation drafted with Agency assistance is currently undergoing the national approval process, while in 29 States the legislation is still in development, that is, in the process of technical consideration or finalization. In the remaining 7 States the matter may still be under consideration or on hold due to changes in national circumstances (more details are provided in Figure. 2)

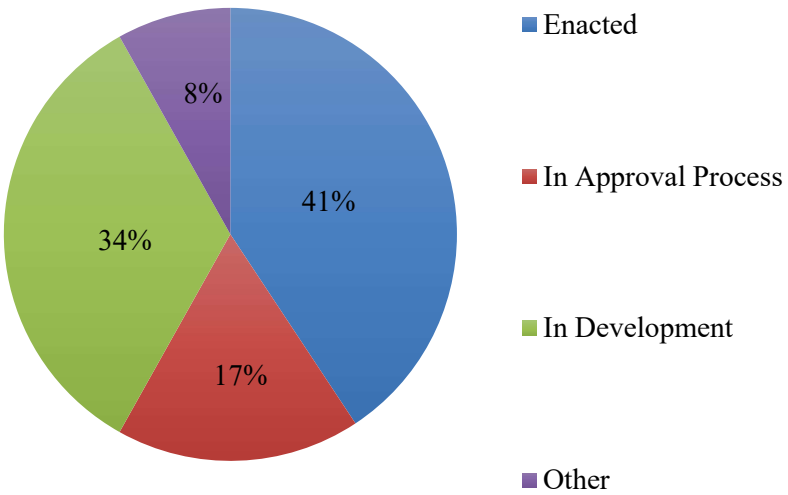

FIGURE. 2. Chart showing the current status of the draft nuclear laws reviewed by the IAEA in the context of bilateral legislative assistance activities conducted during 2011–2020.

5.3.2. Status of Treaty Participation

During the last decade Member States have also increased their participation in the international legal instruments adopted under IAEA auspices. For instance, in the case of safety conventions, adherence to the Convention on Nuclear Safety (CNS) has increased by approximately 19% when compared to 2011, while for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (JC), there has been a 32% increase, and a 11% increase for the Convention on Early Notification of a Nuclear Accident (NOT) and the Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency (ASSIST). The increase has been more significant in the area of nuclear security: 12% for the Convention on the Physical Protection of Nuclear Material (CPPNM) and 138% for its Amendment (CPPNM/A). As reflected in the respective country work plans, the process for adherence to several instruments is ongoing or under consideration in many Member States. A chart comparing the number of parties to the safety and security conventions adopted under IAEA auspices in 2011 and in 2020 is set out in Figure. 3.

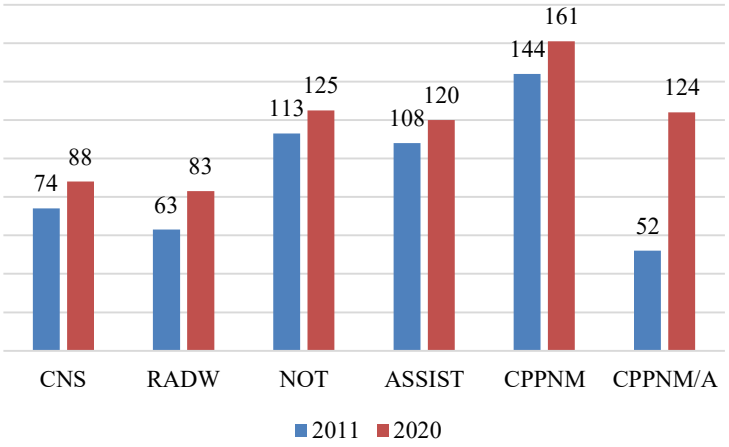

FIGURE. 3. Chart comparing the number of parties to the safety and security conventions adopted under IAEA auspices in 2011 and in 2020.

5.4.TRENDS AND DEVELOPMENTS IN NATIONAL NUCLEAR LEGISLATION

As mentioned above, during the last decade countries have increasingly focused on all aspects of nuclear law, namely safety, security and safeguards, and often also civil liability for nuclear damage, mostly by developing a single comprehensive nuclear law, and in addressing in this manner the '3S' interface in the national legal framework. Below follows a discussion of these approaches and of some of the topics to which drafters have paid special attention during the last decade[10], such as those related to developments in the international legal framework, the positioning of the nuclear law and regulator within the related national legal and institutional

[10] As previously mentioned, this paper refers to trends and developments identified in the context of the legislative assistance programme, as implemented in the framework of relevant technical cooperation projects in Member States participating in these projects and should thus not be considered to necessarily reflect experiences or approaches in Member States that do not participate in such projects.

framework, as well as how some specific regulatory concepts like the graded approach may be best reflected in national legislation.

5.4.1. Comprehensive Nuclear Laws in Member States

A look at national nuclear laws adopted or drafted in the last decade shows that many countries involved in developing or revising nuclear legislation have chosen to develop a single piece of legislation, or comprehensive nuclear law, covering relevant aspects of safety, security and safeguards and covering most of the related elements described in the IAEA handbooks on nuclear law [2, 3] (see Figure.4). In summary, such elements normally include the following:

- The establishment or designation of a regulatory body with the requisite independence, human and financial resources and a clear set of functions and powers;
- The legal authority to implement a regulatory system of control including:
  - Developing or issuing regulations and guides;
  - Granting, suspending and revoking authorizations, including establishing and amending conditions of authorization;
  - Conducting inspections to monitor compliance with applicable requirements; and
  - Taking enforcement actions and imposing sanctions in the event of non-compliance with the applicable requirements.
- Legal provisions on fundamental safety aspects like radiation protection principles and requirements and plans for preparing and responding to nuclear and radiological emergencies;
- Legal provisions on fundamental security aspects like physical protection requirements, international cooperation and assistance and criminalization of offences;
- Legal provisions implementing the country's obligations under the respective safeguards agreements concluded with the IAEA;
- Legal provisions for specific activities, depending on the extent of the national programme for nuclear applications, such as those involving radioactive sources, transport of radioactive material, radioactive waste management, decommissioning, nuclear installations and mining and milling of radioactive ores.

In terms of scope of the legislation, as illustrated in Figure 4, out of the 35 laws enacted in the last decade in Member States having received IAEA legislative assistance, a significant number cover elements of safety, security and safeguards. The comparison illustrated in Figure 4 also shows that there is an increasing recognition of the above as the key elements of a comprehensive nuclear law, although the level of detail of the legislation in respect of each element invariably differs from country to country depending on the national legal system and legislative practice.

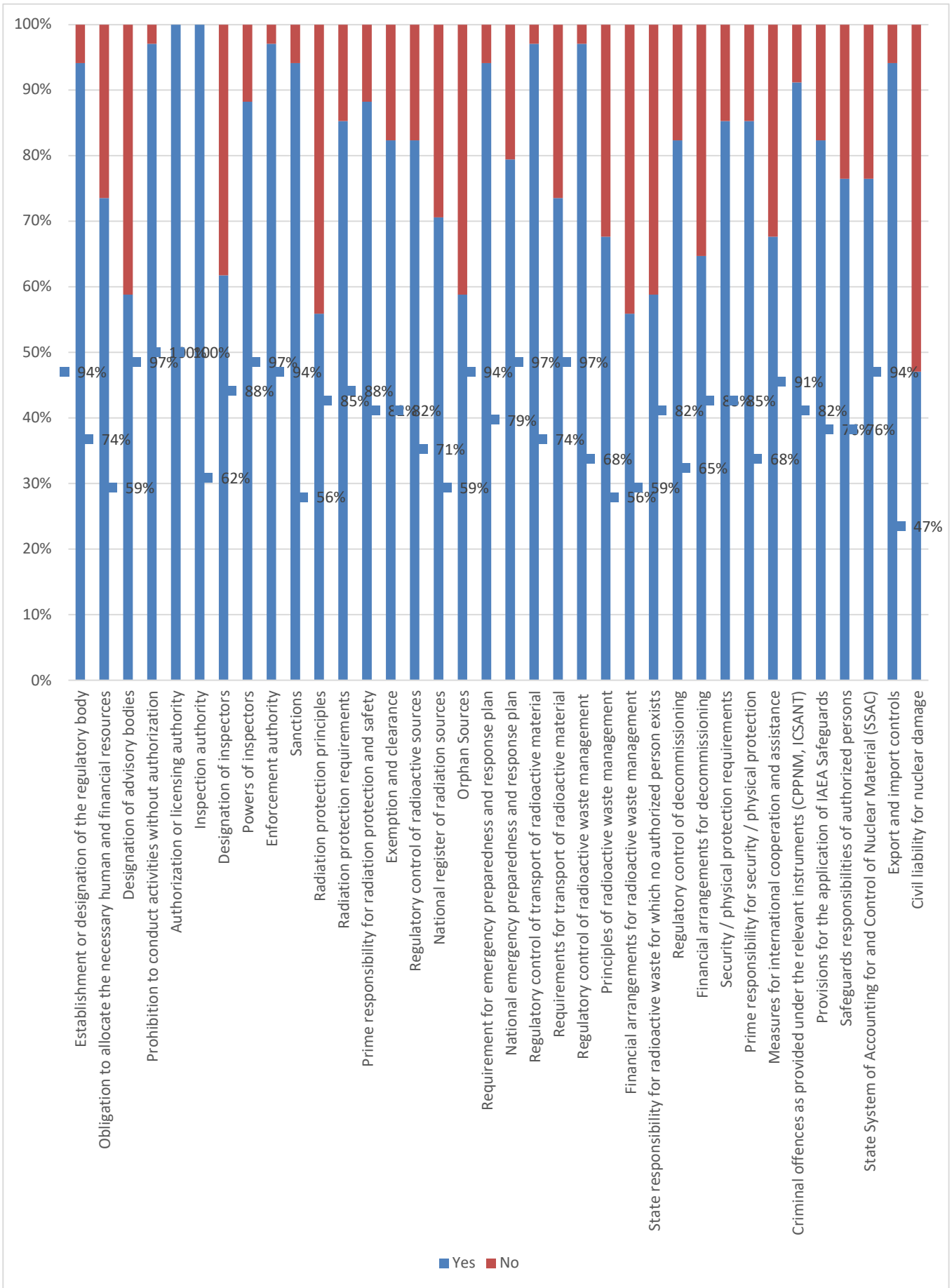

FIGURE. 4. Chart showing the elements of nuclear laws enacted between 2011 and 2020

5.4.2. The Interface between Safety, Security and Safeguards in the National Legal Framework

Given that the main areas of regulatory concern, namely safety, security and safeguards, have different objectives, regulatory coordination becomes necessary to prevent gaps and duplications and to ensure that measures taken in one area do not affect or compromise the other areas [33].

A consistent and comprehensive national legal framework will necessarily have a positive impact in enabling the regulatory body or bodies to successfully address this interface and in promoting a coordinated approach. Coherent legislative texts in terms of delineation of responsibilities among relevant institutions, choice and use of terminology and scope of regulatory control are among the key factors identified in national laws to achieve this.

5.4.2.1. Delineation of Responsibilities

An identification of institutions involved in or cooperating with the exercise of regulatory control, and their respective roles, as well as the granting of the legal authority or the establishment of a legal obligation to make arrangements for inter-institutional cooperation and coordination is one of the ways in which the nuclear law may provide the means for the regulatory body or bodies to address the interface between safety, security and safeguards.

While this delineation of responsibilities will necessarily be less complex for countries deciding to adopt a 3S nuclear law and regulator, and where the 3S interface will thus be reflected at the legislative and institutional levels, this is still an important factor that needs to be addressed to prevent regulatory duplications and ensure inter-institutional coordination with bodies that are called to cooperate with the regulator in areas like nuclear security. This approach is further elaborated below in a broader context.

5.4.2.2. 3S Terminology in Nuclear Law

The choice and definition of terms is a key element in any legislative act. When drafting a nuclear law, this being a highly technical field, it is important for the drafters to choose and define terminology in a manner that is consistent with the relevant international legal instruments, safety standards and security guidance. This exercise may however prove challenging in some cases as drafters are faced with multiple sources that may use identical or similar terms with different meanings, in line with their respective objective and scope of application.

For instance, as reflected in the below definitions, a nuclear installation for the purposes of the nuclear liability regime [19 – 22] is not necessarily a nuclear installation for the purposes of the Convention on Nuclear Safety [7], just as a facility or location that needs to be subject to regulatory control from the safety and security perspective is not necessarily a facility or location subject to provisions of the safeguards agreement [15, 18].

- Article 2(i) of the Convention on Nuclear Safety [7]: "nuclear installation" means *"[…] any land-based civil nuclear power plant under its jurisdiction including such storage, handling and treatment facilities for radioactive materials as are on the same site and are directly related to the operation of the nuclear power plant […]"*.
- Article 1(d) of the Convention on the Physical Protection of Nuclear Material [14], as amended: "nuclear facility" means *"a facility (including associated buildings and equipment) in which nuclear material is produced, processed, used, handled, stored or disposed of, if damage to or*

interference with such facility could lead to the release of significant amounts of radiation or radioactive material".

- Article I, paragraph 1(j) of the Vienna Convention on Civil Liability for Nuclear Damage [19]: "Nuclear installation" means *"(i) any nuclear reactor other than one with which a means of sea or air transport is equipped for use as a source of power, whether for propulsion thereof or for any other purpose; (ii) any factory using nuclear fuel for the production of nuclear material, or any factory for the processing of nuclear material, including any factory for the re-processing of irradiated nuclear fuel; and (iii) any facility where nuclear material is stored, other than storage incidental to the carriage of such material […]".*
- Article 98.I of the Standard Text of Safeguards Agreements [17]: "Facility" means: *"(a) A reactor, a critical facility, a conversion plant, a fabrication plant, a reprocessing plant, an isotope separation plant or a separate storage installation; or (b) Any location where nuclear material in amounts greater than one effective kilogram is customarily used."*

Against this background, when drafting a comprehensive nuclear law, drafters distinguish between, on the one hand, the terms that are going to be used in a generic manner throughout the nuclear law, that is, from a 3S perspective, in provisions of general application and, on the other hand, to the terms that are going to be used for the sole purpose of specific sections or provisions reflecting international obligations in one of these areas.

In the first category we find terms like 'regulatory control' or 'operator' that, if used in the law, will normally be defined in a generic manner or with reference to elements of safety, security and of safeguards implementation, if and as applicable, depending on the law structure. Failing to do so may lead to ambiguities and gaps as to the scope of application of relevant legal provisions or the extent of the respective legal requirement or obligation. For instance, in the IAEA Safety Glossary [24], the term "operator" is defined solely from the safety perspective as *"Any person or organization applying for authorization or authorized and/or responsible for safety when undertaking activities or in relation to any nuclear facilities or sources of ionizing radiation."*. In a comprehensive nuclear law, the definition is normally generalized or adapted accordingly.

On the other hand, while terms like "facility" and "nuclear installation" may be defined in a generic manner in the law for use in provisions of general application[11], for instance, for stating that the law shall apply to all facilities in the country, they will also have to be defined and used in a different and narrower manner, for the sole purpose of specific sections of the law providing for the implementation of the relevant international legal instruments. Indeed, notably in the areas of safeguards and civil liability for nuclear damage, the relevant terms should be used as defined in the respective legal instruments to prevent inconsistencies in the implementation of these treaties at the national level. Some countries may choose, instead of incorporating such definitions in the law, to provide for the use of such specific terms by reference, for instance by providing that terms in the relevant sections shall have the meaning given in the respective instrument. Experience in some countries shows however that this option should be carefully assessed and drafted to prevent the risk of conflicting interpretations.

5.4.2.3. Scope of Regulatory Control

[11] "Facilities" are defined in the IAEA Safety Glossary [24] as including *"nuclear facilities; irradiation installations; some mining and raw material processing facilities such as uranium mines; radioactive waste management facilities; and any other places where radioactive material is produced, processed, used, handled, stored or disposed of — or where radiation generators are installed — on such a scale that consideration of protection and safety is required."*

A comprehensive nuclear law provides the legal basis for the regulatory control of activities and facilities involving the use of nuclear technology from the safety, security and safeguards perspective. The scope of activities and facilities subject to regulatory control is however different in each case:

— From the safety perspective, regulatory control is exercised over all activities and facilities associated to the use of sources of ionizing radiation, including sources within or outside the nuclear fuel cycle[12];
— From the security perspective, regulatory control is exercised over all activities and facilities associated to the use of nuclear and other radioactive material, thus excluding radiation generators, a type of source that does not contain radioactive material[13];
— From the safeguards perspective, regulatory control is exercised over all activities and facilities as defined in the respective safeguards agreement, which are in general those associated with the nuclear fuel cycle, but which also cover matters that may not necessarily be subject to regulatory control from the safety and security perspective as not involving the use of sources of ionizing radiation, such as information on research and development related to the nuclear fuel cycle[14].

In this respect, drafters pay special attention to making sure that the text describing the scope of the law or specific requirements does not contradict the above. This may normally be achieved through a consistent choice and use of defined terms. For instance, before stating that security requirements shall apply to "sources of ionizing radiation", and not only to "radioactive material" or "radioactive sources", drafters should be aware that this goes beyond the scope of IAEA security guidance and may risk posing an unnecessary regulatory burden. If the term "facilities" is not also defined in a manner consistent with the safeguards agreement, this may lead to an inconsistency between the scope of regulatory control to be applied under the law and the scope of the safeguards agreement.

5.4.2.4. Regulatory Functions and Requirements

A comprehensive 3S nuclear law will consolidate common elements to safety, security and safeguards in general provisions, while including specific provisions in separate chapters. Obviously, the core regulatory functions of standard-setting, authorization, inspection and enforcement are relevant from the safety, security and safeguards perspective and are specifically referred to in several of the treaties concerning these topics. Related provisions should therefore be consolidated to avoid duplications. For instance, in a 3S nuclear law with a 3S regulator a separate license application for, respectively, safety, security and safeguards would not be required, but a single license application, to be evaluated by the regulator from

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[12] The IAEA Safety Glossary [24] defines a "source" of ionizing radiation as *"anything that may cause radiation exposure – such as by emitting ionizing radiation or by releasing radioactive substances or radioactive material – and can be treated as a single entity for purposes of protection and safety.* The term "radiation sources" is often used in a narrow sense to refer to sources outside the nuclear fuel cycle.

[13] IAEA safety standards [24] and security guidance [29] define "radioactive material" as *"material designated in national law or by a regulatory body as being subject to regulatory control because of its radioactivity".* A "radiation generator" is defined in the IAEA Safety Glossary [24] as *"a device capable of generating ionizing radiation, such as X rays, neutrons, electrons or other charged particles, that may be used for scientific, industrial or medical purposes."*

[14] Article 1.a.(i) of the model additional protocol to the safeguards agreement [16] refers to an obligation to provide the IAEA with a declaration containing *"A general description of and information specifying the location of nuclear fuel cycle-related research and development activities not involving nuclear material carried out anywhere that are funded, specifically authorized or controlled by, or carried out on behalf of, ..."*.

the perspective of applicable safety, security and safeguards requirements. While these areas are normally the subject of different sets of regulations, guides developed by the regulatory body are often used to inform applicants of all such relevant requirements in a consolidated manner.

5.4.3. International Legal Instruments and National Legislation

Consistent with the above-mentioned increase in treaty participation, in the last decade many countries have been involved in revising their nuclear legislation to bring it in line with the international legal instruments to which they have become a party or which they intend to join, or to take into account elements of the most recent versions of IAEA safety standards and security guidance. Below follows a discussion of some of the areas that may be highlighted in this respect.

5.4.3.1. Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM)

The Amendment to the CPPNM was adopted on 8 July 2005 and entered into force on 8 May 2016, after 2/3 of the parties to the CPPNM had deposited their instruments of adherence with the IAEA Director General. With the entry into force of the Amendment, countries that had adhered to this instrument or that planned to do so started to engage more and more in implementing resulting obligations in the national law, in particular the new core obligation "to establish, implement and maintain an appropriate physical protection regime applicable to nuclear material and nuclear facilities" and, in doing so, "to establish and maintain a legislative and regulatory framework to govern physical protection", as provided in new Article 2A of the CPPNM as amended.

Therefore, in addition to legal provisions on the three main elements of the CPPNM and its Amendment, namely physical protection requirements, international cooperation and assistance and criminalization, countries have also sought to refer directly in the nuclear law to the national physical protection regime, such as by providing for the creation of inter-institutional mechanisms to oversee the implementation and periodic review of the regime, and referring in a more specific manner to some of the fundamental principles that, according to the above article, are to be applied "insofar as reasonable and practicable" when implementing a physical protection regime[15]. For instance, in addition to the above elements, specific provisions on the conduct and update of the threat assessment at the national level[16], on the promotion of security culture[17] and on the protection of sensitive information[18], have been of interest for drafters in recent years when developing nuclear legislation.

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[15] Article 2A of the CPPNM as amended lists 12 fundamental principles of physical protection of nuclear material and nuclear facilities: Responsibility of the State, Responsibilities During International Transport, Legislative and Regulatory Framework, Competent Authority, Responsibility of the License Holders, Security Culture, Threat, Graded Approach, Defence in Depth, Quality Assurance, Contingency Plans and Confidentiality [14].

[16] FUNDAMENTAL PRINCIPLE G: Threat - The State's physical protection should be based on the State's current evaluation of the threat [14]

[17] FUNDAMENTAL PRINCIPLE F: Security Culture - All organizations involved in implementing physical protection should give due priority to the security culture, to its development and maintenance necessary to ensure its effective implementation in the entire organization [14].

[18] FUNDAMENTAL PRINCIPLE L: Confidentiality - The State should establish requirements for protecting the confidentiality of information, the unauthorized disclosure of which could compromise the physical protection of nuclear material and nuclear facilities [14].

Finally, it is worth mentioning that, in most comprehensive nuclear laws the above elements are addressed jointly in legal provisions applicable to the security of nuclear and other radioactive material [29], in some cases with further specific provisions for, on the one hand, the security of radioactive sources [9] and, on the other hand, the physical protection of nuclear material and facilities [14][28].

5.4.3.2. Civil Liability for Radiological Damage other than Nuclear Damage

The number of national laws addressing civil liability for nuclear damage that seek to implement, or prepare for the country's participation in, the relevant international nuclear liability instruments [19]-[22] has increased in the last decade. This has brought an increased interest in providing also in national laws compensation mechanisms in the event of radiological damage other than nuclear damage, that is, damage caused by accidents involving radioactive sources, as opposed to nuclear damage caused by a nuclear incident occurring in a nuclear installation or during transport of nuclear material to or from such an installation.

When addressing this matter, it is important to recall that the international nuclear liability regime has a specific scope of application that should not be extended to radiological damage other than nuclear damage. Indeed, for these cases no special international legal regime exists, and drafters will rely on the country's general laws should they wish to establish special rules or insurance mechanisms for compensation. The nuclear liability regime, having been designed for the extraordinary risks associated with nuclear installations, would not be adequate to deal with compensation for radiological damage other than nuclear damage. In this context, it may be mentioned that the International Expert Group on Nuclear Liability (INLEX) recommends that insurance coverage or other financial security be required for at least categories 1 and 2 radioactive sources, as identified in the Code of Conduct of the Safety and Security of Radioactive Sources [9]. Some drafters have chosen to refer to this matter in a generic manner, for instance by granting the authority to the regulator to establish such insurance requirements.

5.4.3.3. IAEA Basic Safety Standards

As mentioned above, IAEA safety standards are not legally binding *per se*, but by representing an international consensus of what constitutes a high level of safety, provide a basis for harmonization of approaches and international cooperation and are widely used as reference by policymakers, drafters and regulators when developing national laws and regulations. Among the most relevant resources in this context, we find the Basic Safety Standards, which establish requirements to be fulfilled in all activities and facilities that give rise to radiation risks.

New Basic Safety Standards (BSS) were published in 2014 [26]. These superseded the 1996 BSS and introduced significant changes that have played an important role in the development and update of radiation protection legal and regulatory infrastructures in Member States, in the understanding however that only general principles and requirements are normally reflected in the nuclear law, with detailed technical requirements to be reflected in regulations.

Among the new approaches that are being reflected at the legislative level, we find that, while the 1996 BSS used the terms "practices" and "interventions"[19] to refer to general categories of

[19] In the 1996 BSS "practice" was defined as *"any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure or the number of people involved"*, and "intervention" was defined as *"any action intended to reduce or avert exposure or the likelihood*

situations requiring regulation and control, the new BSS uses instead the terms "activities" and "facilities" as generic terms in this context and also defines three exposure situations requiring regulation and control, namely planned, emergency and existing exposure situations. Regulatory control is therefore to be exercised over all activities and facilities involving the use of sources of radiation, including all situations giving rise to radiation exposure and all categories of exposure, namely occupational, medical and public exposure. These new approaches have been reflected in the terminology used in recent nuclear legislation.

Another aspect that may be mentioned here relates to the practices that under the BSS are deemed to be not justified[20], such as practices involving the deliberate addition of radioactive substances in food or cosmetics and the frivolous use of radiation in commodities or consumer products like toys and personal jewellery[21], which some drafters have taken into account when determining activities to be prohibited in the national law.

5.4.3.4. Guidance on Disused Radioactive Sources

This supplementary Guidance to the Code of Conduct on the Safety and Security of Radioactive Sources was endorsed by the IAEA General Conference on 21 September 2017 by way of resolution GC(61)/RES/8 after having been approved by the Board of Governors on 11 September 2017 [11]. Its objective is to provide further guidance on the management of disused radioactive sources, that is, sources that are no longer used and in respect of which there is no intention of using them again in the practices they were authorized for.

While specific technical requirements are normally not included in the law, the new Guidance has inspired some drafters to include general provisions on this topic, focusing on aspects like national policy and strategy for management, financial arrangements to cover management costs, the obligation on the part of users to notify when a source becomes disused, provisions requiring that arrangements be put in place for the return of disused sources to the supplier at the end of their useful life as a requirement for authorizing the import for some categories of sources and identification of the entity responsible for management when an authorized user cannot be identified. Some of these aspects are often covered in the context of, or consolidated with, the legal provisions on radioactive waste management.

5.4.4. Implementing the Graded Approach in the Nuclear Law

The concept of the graded approach is a key regulatory concept that is reflected in IAEA safety standards [25][26] and security guidance [28][29] and in some international legal instruments like the Amendment to the CPPNM [14]. In general, the exercise of regulatory control should

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of exposure to sources which are not part of a controlled practice or which are out of control as a consequence of an accident" [35].

[20] The radiation protection principle of "justification" provides that an activity or practice shall not be authorized unless it produces sufficient benefit to exposed persons or to society in a manner that offsets the radiation harm that it may cause, taking into account social, economic and other relevant factors [26].

[21] According to Requirement 10, paragraph 3.17 the following practices are deemed to be not justified: *"(a) Practices, except for justified practices involving medical exposure, that result in an increase in activity, by the deliberate addition of radioactive substances or by activation, in food, feed, beverages, cosmetics or any other commodity or product intended for ingestion, inhalation or percutaneous intake by, or application to, a person; (b) Practices involving the frivolous use of radiation or radioactive substances in commodities or in consumer products such as toys and personal jewellery or adornments, which result in an increase in activity, by the deliberate addition of radioactive substances or by activation23; (c) Human imaging using radiation that is performed as a form of art or for publicity purposes"* [26].

follow a graded approach, meaning that the extent of control should be commensurate to the potential risks associated with the activity concerned[22].

In order to enable the application of the graded approach, the legislation should avoid provisions that establish pre-determined processes or requirements that are not adequate for all categories of activities and facilities. For instance, fixed timelines for deciding on applications may not be consistent with the graded approach, as these will vary considerably depending on the type of application and should therefore be rather fixed through regulations and not in the law. Amendments to administrative laws may be needed when these laws, by establishing such pre-determined processes or requirements, are in contradiction with this concept. Also, providing for the categorization of sources and material in the law and types of authorization with different levels of requirements will enable the regulator to follow a graded approach when exercising regulatory control.

In recent years, for further clarity and guidance to the regulator, some countries have in addition chosen to refer specifically in the law to the graded approach by defining this concept and including provisions on the obligation to follow a graded approach when exercising regulatory functions, such as establishing requirements and licensing modalities, developing the inspection programme and determining enforcement actions and sanctions for non-compliance. The recurring question of how to assess whether the regulator is complying with this obligation may to some extent be addressed by referring to internationally recognized guidance, preferably in an explicit manner in the text of the law itself, if permitted under the national legal system.

5.5.CONCLUSION

The IAEA has played a leading role in the development of nuclear law: it concludes agreements in its capacity of international organization with legal personality under public international law, it establishes IAEA safety standards and security guidance documents and it provides the forum for the negotiation and adoption of nuclear related treaties by Member States.

The IAEA's legislative assistance programme also plays an important role in this context. When supporting Member States the programme helps drafters and officials translate recognized nuclear law principles and requirements into the national context. With the time, lessons learned, best practices and legal solutions to similar issues are necessarily identified, which become the object, not only of exchanges of national experiences during bilateral and regional activities conducted in the context of the programme or in other fora, but also of structured consolidation through reference material and publications such as, most notably, the handbooks on nuclear law published in 2006 [3] and 2010 [4]. In this way the programme has, not only a quantitative impact in the development of nuclear law by helping enhance the status of national legislation and increase treaty participation in Member States, but also a qualitative impact in

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[22] In the IAEA safety glossary [24], graded approach is defined as *"a process or method in which the stringency of the control measures and conditions to be applied is commensurate, to the extent practicable, with the likelihood and possible consequences of, and the level of risk associated with, a loss of control"* or as *"an application of safety requirements that is commensurate with the characteristics of the facilities and activities or the source and with the magnitude and likelihood of the exposures"*. From the security perspective, Article 2A of the CPPNM as amended, refers to the principle of graded approach as follows: *"Physical protection requirements should be based on a graded approach, taking into account the current evaluation of the threat, the relative attractiveness, the nature of the material and potential consequences associated with the unauthorized removal of nuclear material and with the sabotage against nuclear material or nuclear facilities"* [14].

the identification and development of common trends, approaches and challenges in national legal frameworks, some of which, particularly those identified during the last decade, have been discussed in this paper.

The first IAEA international conference on nuclear law planned to be held in 2022 will provide a global forum to take stock of these and other developments and assess how they may influence, or pave the way for, the further evolution of nuclear law in the next decades.

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6. THE EVOLUTION OF SAFETY CONVENTIONS AND THEIR GUIDANCE DOCUMENTS: CONTINUOUS ENHANCEMENT OF NUCLEAR SAFETY WORLDWIDE

J. SILYE[1]
International Atomic Energy Agency

6.1.INTRODUCTION

The Convention on Nuclear Safety (the "CNS") and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the "Joint Convention") are two of the most significant legally binding instruments in the field of nuclear safety. These conventions and their supporting guidance documents ("Guidance documents" or "Guidelines") have constantly evolved over the past two decades, as the 'peer review process' established therein provides a periodic review for Contracting Parties to assess, share, and incorporate lessons learned, experiences and impact of technological developments. This paper aims to lay out the life-cycle of these conventions by focusing on their Guidelines. In order to do so, it will examine each 'review cycle' of these conventions and analyse the impact on their respective Guidelines. The paper will also identify similarities and differences in the life-cycle of the two conventions with the aim to assess how developments of one influenced the other.

6.2.LEGAL BACKGROUND TO AMEND THE CONVENTIONS AND THE GUIDELINES

With respect to procedural matters, both conventions follow by-and-large the same rules, but more importantly, due to their incentive[2] nature, both work on the basis of consensus. A detailed procedure is laid down in each of them, according to which any Contracting Party may propose an amendment to either of the conventions that has to be considered at a review meeting or an extraordinary meeting. Strict requirements are set concerning deadlines and quorum.[3] Pursuant to these requirements, the consensual approval of such an amendment to the conventions would

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[1] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

[2] There is no enforcement mechanism included in either of the conventions

[3] Article 32 of the CNS: "1. Any Contracting Party may propose an amendment to this Convention. Proposed amendments shall be considered at a review meeting or an extraordinary meeting.
2. The text of any proposed amendment and the reasons for it shall be provided to the Depositary who shall communicate the proposal to the Contracting Parties promptly and at least ninety days before the meeting for which it is submitted for consideration. Any comments received on such a proposal shall be circulated by the Depositary to the Contracting Parties.
3. The Contracting Parties shall decide after consideration of the proposed amendment whether to adopt it by consensus, or, in the absence of consensus, to submit it to a Diplomatic Conference. A decision to submit a proposed amendment to a Diplomatic Conference shall require a two-thirds majority vote of the Contracting Parties present and voting at the meeting, provided that at least one half of the Contracting Parties are present at the time of voting. Abstentions shall be considered as voting.
4. The Diplomatic Conference to consider and adopt amendments to this Convention shall be convened by the Depositary and held no later than one year after the appropriate decision taken in accordance with paragraph 3 of this Article. The Diplomatic Conference shall make every effort to ensure amendments are adopted by consensus. Should this not be possible, amendments shall be adopted with a two-thirds majority of all Contracting Parties."
As for the Join Convention, the same requirement applies to amend the convention (Article 41 of the Joint Convention).

probably entail lengthy negotiations to be adopted and take a relative long period to enter into force[4].

To date[5], several amendments have been proposed to the CNS yet no amendment to the Joint Convention has ever been tabled.

With regard to the supporting Guidelines to these conventions, Rules of Procedure and Financial Rules were adopted by consensus, pursuant to procedural arrangements, at the preparatory meeting and in accordance with these rules two other Guidelines regarding the form and structure of the national reports, a date for the submission of such reports and the process for reviewing such reports were established.[6]

At a review or an extraordinary meeting, the aforementioned arrangements (Rules of Procedure and Financial Rules and the other two Guidelines) may be reviewed and revised by consensus.[7] These Guidelines including the Rules of Procedures have been amended several times so far. (Amendments of the Guidelines of each convention are summarized in Table 1. and Table 2.)

6.3.CONVENTION ON NUCLEAR SAFETY

In the aftermath of the Chernobyl accident the international legal framework for nuclear safety was established. This accident, often referenced as "a wake-up call" of the international nuclear community, triggered the development of four very important legal instruments[8] (the so-called "post Chernobyl conventions") in the field of nuclear safety, and established a framework therefor.

The CNS[9] was the cornerstone of this framework, which is the first legally binding international treaty to address the safety of nuclear installations and seeks to ensure that such installations are operated in a safe, well-regulated and environmentally sound manner. The CNS applies to the safety of nuclear installations, meaning land-based civil nuclear power plants under a Contracting Party's jurisdiction. These include such storage, handling and treatment facilities for radioactive materials on the same site and directly related to the operation of the nuclear power plant. The CNS is based on the Contracting Parties' common interest to achieve higher levels of nuclear safety that will be developed and promoted through "review meetings" held every three years. It obliges Contracting Parties to submit reports on the implementation of their

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[4] For an amendment to the CNS to be effective, it is subject to ratification, acceptance, approval, or confirmation by the Contracting Parties and shall enter into force for those Contracting Parties which have ratified, accepted, approved or confirmed them on the ninetieth day after the receipt by the Depositary of the relevant instruments by at least three fourths of the Contracting Parties. For a Contracting Party which subsequently ratifies, accepts, approves or confirms the said amendments, the amendments will enter into force on the ninetieth day after that Contracting Party has deposited its relevant instrument. (Paragraph 5, Art 32. of the CNS)
The Joint Convention adopted the same requirement for an amendment to the Joint Convention to be effective (Paragraph 5, Article 41. of the Joint Convention).

[5] i.e. 31 December 2020

[6] Paragraph 1, Article 22. of the CNS and Paragraph 2. (ii) - (iii), Article 29. of the Joint Convention.

[7] Paragraph 2, Article 22. of the CNS and Paragraph 2. (ii), Article 30. of the Joint Convention.

[8] The Convention on Early Notification of a Nuclear Accident (https://www.iaea.org/sites/default/files/infcirc335.pdf), the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (https://www.iaea.org/sites/default/files/infcirc336.pdf), the CNS and the Joint Convention.

[9] It was opened for signature in 1994 and entered into force on 90th day after the date of deposit with the Depository of the 22nd instruments of ratification, acceptance or approval, including 17 States, each having at least one nuclear installation.

obligations for "peer review" at review meetings. This mechanism is the main incentive element of the CNS.

Following the accident at TEPCO's Fukushima Daiichi Nuclear Power Station ("Fukushima accident")[10], the international community aimed at, *inter alia,* strengthening the effectiveness of international legal framework. In March 2011, the IAEA Director General called for a Ministerial Conference on Nuclear Safety[11] at which the Ministers requested the Director General to prepare — for submission to the IAEA Board of Governors at its meeting in September 2011 — a draft Action Plan building on the Ministerial Declaration.[12] The IAEA Action Plan on Nuclear Safety[13] ("Action Plan") defined a programme of work to strengthen the global nuclear safety framework[14], was unanimously endorsed by the IAEA General Conference[15].

At the Fifth Review Meeting of the Contracting Parties to the CNS, which was held after the accident from 4 to 14 April 2011 and provided the first international forum to discuss actions as responses to the Fukushima accident, the Contracting Parties adopted a statement in which they, *inter alia*, reaffirmed their commitment to the objectives of the CNS. The Contracting Parties agreed to hold an extraordinary meeting[16] to review and discuss initial analyses of the accident and the effectiveness of the CNS.[17] The main objectives of the Second Extraordinary Meeting were the following:

— To enhance safety through reviewing and sharing lessons learned and actions taken by the CPs in response to the Fukushima accident, and

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[10] The accident occurred in Japan, on 11 March in 2011 and caused by the Great East Japan Earthquake and the subsequent tsunami. (See Fukushima Daiichi Accident, GC(59)/14, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1710-ReportByTheDG-Web.pdf)

[11] The overall objective of the Conference, which was held in Vienna from 20 to 24 June 2011, was to draw on the lessons from the accident in order to strengthen nuclear safety throughout the world. The Conference provided an opportunity to undertake, at the ministerial and senior technical levels, a preliminary assessment of the accident, actions for safety improvements, issues regarding emergency preparedness and response, and implications for the global nuclear safety framework. (IAEA Ministerial Conference on Nuclear Safety 20-24 June 2011, Report by the Director General, GOV/INF/2011/13-GC(55)/INF/10, https://www.iaea.org/sites/default/files/gc/gc55inf-10_en.pdf)

[12] Declaration by the IAEA Ministerial Conference on Nuclear Safety in Vienna on 20 June 2011, INFCIRC/821, https://www.iaea.org/sites/default/files/infcirc821.pdf

[13] https://www.iaea.org/sites/default/files/actionplanns.pdf

[14] This plan outlined actions to strengthen safety in 12 areas: safety assessment of nuclear power plants; IAEA peer reviews; emergency preparedness and response; national regulatory bodies; operating organizations; IAEA safety standards; the international legal framework; Member States planning to embark on a nuclear power programme; capacity building; protection of people and the environment from ionizing radiation; communication and information dissemination; and research and development.

[15] The Action Plan was approved by the IAEA Board of Governors on 13 September 2011, as endorsed by the IAEA General Conference during its 55th regular session on 22 September 2011.

[16] The Second Extraordinary Meeting was convened at IAEA Headquarters in Vienna from 27 to 31 August 2012.

[17] At the meeting Contracting Parties discussed: external events; design issues; severe accident management and recovery (on-site); national organizations; emergency preparedness and response; post-accident management (off-site); and international cooperation. They also agreed by consensus on a number of concrete actions to enhance the effectiveness of the peer review process. The three underlying guidance documents of the Convention were amended in order to enhance the transparency of the review process, encourage Contracting Parties to refer to the IAEA safety standards in their National Reports, and reinforce efforts for continuous improvement by performing periodic reassessments of safety through periodic safety reviews or alternative methods.

— To review the effectiveness of the CNS and consider the proposals to amend the Guidelines and the Rules of Procedure as well as those to amend the convention.

Indeed, proposed amendments to the CNS were submitted by the Russian Federation and Switzerland. The Swiss proposal aimed to enhance transparency (including the deletion of the confidentiality of the discussions in country groups), advance the IAEA safety standards and their effective implementation nationwide and thereby worldwide, as well as – in accordance with the Action Plan – periodical review the effective implementation of the IAEA safety standards by international expert peer review missions with special focus on nuclear power plant design and operation. The proposal of the Russian Federation was also focused on the application of the IAEA safety standards that are to be taken into account in the course of assessment and verification of safety, as well as the coordination of actions (including joint actions) among State bodies and organizations operating nuclear installations with respect to the management of an accident and mitigation of its consequences. In addition, regarding new nuclear installations, it was also proposed to take all necessary steps with regard to long-term planning and establishment of the requisite infrastructure in conformity with IAEA recommendations prior to the commencement of construction of the installation. [18]

At the Second Extraordinary Meeting of the CNS, these proposals were presented and discussed. At the meeting, Contracting Parties also considered a set of action-oriented objectives for strengthening nuclear safety, concerning the use of IAEA safety standards, the enhancement of transparency, the regulatory effectiveness as well as the use of international peer review missions, whose primary importance has been highlighted by the first lessons learnt from the Fukushima accident. They recognized the necessity to further improve the overall review process. In this context, the Working Group on Effectiveness and Transparency[19] was established – which was open to all Contracting Parties – with the task of reporting to the next (Sixth) Review Meeting on a list of actions to strengthen the CNS and on proposals, including the aforementioned proposals by Switzerland and the Russian Federation, to amend, where necessary the CNS.

Following the Second Extraordinary Meeting of the CNS, in December 2013, Switzerland submitted a formal proposal (Swiss Proposal) to amend Article 18 of the CNS, which relates to Design and Construction of Nuclear Installations, essentially that nuclear power plants must be designed and constructed to prevent accidents and, should an accident occur, mitigate the effects and avoid releases of radionuclides causing long term off-site contamination. This objective must be applied at existing plants as well. At the Sixth Review Meeting, pursuant to Paragraph 3, Article 32. of the CNS, due to the absence of consensus, the Contracting Parties present and voting decided by a two-thirds majority to submit the Swiss proposal to a Diplomatic Conference[20] within one year to consider the Swiss Proposal. The Contracting Parties attending the Sixth Review Meeting also requested the depositary to organize, at least

[18] Final Summary Report of the 2nd Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety, 27-31 August 2012, Vienna, Austria, CNS/ExM/2012/04/Rev.2, Final Summary Report - Second Extraordinary Meeting of Contracting Parties to Convention on Nuclear Safety (iaea.org)

[19] The Working Group on Effectiveness and Transparency (WGET) met 4 times in 2013 and produced a final report that has been presented last week at the Sixth Review Meeting. Based on this report some Contracting Parties submitted proposals to amend the CNS Guidance documents and made proposals for recommendations to another body.

[20] With regard to procedural requirements see also footnote 2.

90 days prior to the first day of the Diplomatic Conference, a consultation meeting open to all Contracting Parties to exchange views and prepare for the adoption of the rules of procedure. [21]

An Informal Working Group (IWG) was established to facilitate preparations for the Diplomatic Conference. The IWG met several times during these meetings, Contracting Parties discussed draft rules of procedure, related organizational issues, and the substance of the Swiss Proposal, as well as a draft document, namely the Vienna Declaration, that would include a political commitment by the Contracting Parties to certain principles for implementation of the CNS's objectives to prevent occurrence of accidents and mitigate their radiological consequences should they occur. This document was offered by the IWG as an outcome around which the Contracting Parties could achieve consensus.[22]

At the Diplomatic Conference, although Contracting Parties thoroughly considered the Swiss proposal, they concluded that it was not possible to reach consensus thereon. Instead, in order to reach the same objective as the proposed amendment, Contracting Parties unanimously recommended for adoption the "Vienna Declaration on Nuclear Safety" [23], which contains a series of principles to guide States on the implementation of the objective of the CNS in order to prevent accidents and mitigate radiological consequences.

6.3.1. The first review cycle of the CNS

Following the entry into force of the CNS, in the course of the preparation for the first review meeting an informal working group was established in order to draft the Rules of Procedure and Financial Rules, the Guidelines Regarding the Review Process as well as the Guidelines regarding the Form and Structure of National Reports, which, pursuant to Article 22 of the CNS, were adopted by consensus at the Preparatory Meeting held from 21 to 24 April 1997. At the Preparatory Meeting, besides the adoption of the Guidance documents, Contracting Parties decided on the starting date of the first Review Meeting which was to continue for maximum three weeks with a note that its exact duration was to be decided at the First Organizational Meeting[24].

6.3.1.1. The First Review Meeting of the CNS (12–23 April 1999)

Although the first review process conducted at the First Review Meeting was very successful, it was concluded that based on the observations made certain improvements and amendments to the supplementing procedural arrangements were needed. Tasks of an organizational meeting, as listed in Rule 11 of INFCIRC/573, were increased and thereby this meeting elected the President and the Vice-Presidents as well as the country group Coordinators and selected the country group[25] Chairs, Vice Chairs and Rapporteurs. In this context, it should be noted that country group Rapporteurs were elected by the country groups for the First Review Meeting at the First Organizational Meeting and each country group elected a Chairperson and a Vice-

[21] Annex I of the Summary Report, 6th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety 24 March – 4 April 2014, Vienna, Austria, CNS/6RM/2014/11_Final, https://www-ns.iaea.org/downloads/ni/safety_convention/2014-cns-summary-report-w-annexes-signed.pdf

[22] Summary Report, 6th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety 24 March – 4 April 2014, Vienna, Austria, CNS/6RM/2014/11_Final, https://www-ns.iaea.org/downloads/ni/safety_convention/2014-cns-summary-report-w-annexes-signed.pdf

[23] Summary Report, Diplomatic Conference to consider a Proposal by Switzerland to amend the Convention on Nuclear Safety 9 February 2015, Vienna, Austria, CNS/DC/2015/3/Rev.2, https://www.iaea.org/sites/default/files/cns_summary090215.pdf

[24] The First Organizational Meeting was held from 29 September to 2 October 1998.

[25] Contracting Parties are divided into country groups for conducting the review process.

Chairperson at the First Review Meeting. Another amendment to the Guidelines regarding the Review Process (INFCIRC/571) was approved that, subject to a consensus decision of Contracting Parties, provided late ratifiers with a possibility to attend plenary sessions of the review meeting and to participate in discussions relating to the conduct of the subsequent review meeting. In addition, the Coordinator among his or her other tasks was to analyze the questions and comments and identify any trends to streamline the discussion. This analysis was discussed in country groups. Furthermore, based on 'lessons learned' so far, an Annex to provide some suggested approaches which may assist a more efficient and useful review of national reports in country group sessions was attached to these Guidelines as well. With respect to the Guidelines regarding the National Report (INFCIRC/572), the format of submission was clarified in more details as well as further guidance was provided on the scope and content of the 'first' and the 'subsequent' reports, which should contain updated information on matters covered in the 'first' report and note significant changes.

In response to concerns regarding the overlap between the Rules of Procedure and the Guidelines regarding the Review Process, the Secretariat was requested to conduct a review of these documents (without amending their substance) prior to the second review meeting and present them thereat.

6.3.2. The second review cycle of the CNS

6.3.2.1. The Second Review Meeting of the CNS (15–26 April 2002)

The Second Review Meeting was held just after the tragic events of 11 September 2001 and consequently the security of nuclear installations received broader attention. Although the CNS does not consider security and physical protection matters, the interface between safety and security at nuclear installations had been given much attention by all States. Contracting Parties submitted several proposals for enhancing the procedural arrangements for the Second Review Meeting. These proposals were related to the below listed procedural matters and discussed at the Open-Ended Working Group[26] sessions of the review meeting.

- Options to increase publicly available information from the review process;
- Submission and distribution of national reports by electronic means;
- The general organization of the review process.

Concerning electronic means, the Secretariat was requested to set up a password-protected web site to be operational as soon as possible, but not later than April 2003. At the final plenary session, some amendments to the Guidance documents were adopted by the Contracting Parties. Deadlines for submitting questions and comments by Contracting Parties were set, the compilation of these questions and comments were added to the tasks of the Coordinator and distribution of written responses to these questions and comments were also incorporated into the text the Guidelines regarding the Review Process (INFCIRC/571/Rev.1). With respect to increasing transparency, Contracting Parties agreed to add an Annex on Voluntary Practices Regarding Publicly Available Information to the Guidelines regarding the National Reports

[26] Contracting Parties in plenary session can decide to create one or more open-ended groups to meet during a Review Meeting. As the name suggests, any Contracting Party can attend any meeting of an open-ended group. The purpose of such groups is to allow discussion and resolution of procedural and other issues relevant to the functioning of the Convention prior to their consideration by a plenary session. (Paragraph 20, INFCIRC/603/Rev.7)

(INFCIRC/572/Rev.1). Contracting Parties also approved to amend the Rules of Procedure and Financial Rules (INFCIRC/573/Rev.1) in order to allow the participation of other Contracting Parties (that are not full participants of the particular country group) in the discussion of questions and answers they have submitted prior to the review meeting.

6.3.3. The third review cycle of the CNS

6.3.3.1. The Third Organizational Meeting of the CNS (28–30 September 2004)

The Third Organizational Meeting discussed an information document on the roles and responsibilities of officers and decided to submit this document for consideration of Contracting Parties to the CNS at the Third Review Meeting. The CNS secure website was demonstrated at the meeting and the Contracting Parties agreed to upload the questions and answeres. In addition, its evaluation was aimed to be completed at the Third Review Meeting. As in the Second Review Meeting, the Third Organizational Meeting also discussed how to enhance further the review process. In this context, a Lessons Learned document was presented, which included several suggetstions, such as the establishment of an Open-ended Working Group together with a proposal for elaboration of the terms of reference thereof and other details.

6.3.3.2. The Third Review Meeting of the CNS (11–22 April 2005)

At the outset, it should be noted that since the Second Review Meeting of the CNS, the Joint Convention held its first review meeting in 2003 and the Code of Conduct on the Safety and Security of Radioactive Sources and on the Safety of Research Reactors were approved by the IAEA General Conference in 2003 and 2004. In order to strengthen the review process and thereby amending the underlying Guidance documents at the Third Review Meeting of the CNS, Contracting Parties convened an Open-ended Working Group to discuss written proposals of Contracting Parties and to submit its recommendations to the Final Plenary session of the Third Review Meeting during which Contracting Parties made a number of decisions[27] to improve the review process and the result of these decisions aimed to be applied in future review meetings.

Rules of Procedures and Financial Rules (INFCIRC/573/REV.2) and Guidelines regarding the Review Process (INFCIRC/571/REV.2) were revised respectively in the following aspects:

- All Officers are “elected” and no longer “selected”. Their “Roles and Responsibilities” are prescribed and added as a new Annex to the Guidelines. The election process was simplified and brought in line with the IAEA General Conference’s rules.
- Admission to Country Group session was elaborated on and clarified. Contracting Parties that are initially assigned to a particular Country Group and those that have submitted questions and comments can “participate” and representatives of any other Contracting Party have the right to “observe” in the Country Group sessions.
- In terms of transparency, working documents and the visual part of the Country Group Summary Reports are made available to all Contracting Parties.
- The Rapporteur’s report is required to be approved by the Country Group taking into account all input received earlier and on the basis of this report, the Country Group Summary report is presented at the final plenary session by the Rapporteur.

[27] Summary Report, Third Review Meeting of the Contracting Parties to the CNS, CNS-RM-2005/08 FINAL, https://www.iaea.org/sites/default/files/conv-2005.pdf

— The use of the CNS secure web was also enhanced in many respects for instance the Coordinator's analysis, questions and comments together with the responses thereto are posted. Consequently, this website aimed to be used to facilitate communication between Contracting Parties.
— With regard to the arrangements of an extraordinary meeting, a new rule, i.e. Rule 45. was added on detailing the process of convening extraordinary meetings.

6.3.4. The fourth review cycle of the CNS

6.3.4.1. The Fourth Organizational Meeting of the CNS (24–25 September 2007)

Although a number of proposals were briefly discussed to further enhance the review process, Contracting Parties agreed to refer all of these proposal to the Open-ended Working Group for its consideration and further elaboration.

6.3.4.2. The Fourth Review Meeting of the CNS (14–25 April 2008)

The Review Meeting established an Open-ended Working Group to discuss 11 proposals (1) to improve the overall operational effectiveness of the review process, (2) to promote the CNS and improve the understanding of the review process and (3) to improve the effectiveness of the existing review process. After careful consideration, the Contracting Parties – *inter alia* – decided[28] that:

— The alteration of dates for the preparation of the subsequent review meetings[29];
— The Officers appointed at one Organizational Meeting remain as Officers until they are replaced at the next Organizational Meeting, essentially a three-year term of office; to hold a Officers' meeting of incoming and outgoing Officers at the end of the Organizational Meeting to describe the process in detail, including key documents, and to share experience and lessons learned;
— To structure the National Presentation in a more focused manner;
— The Officers should produce a report on major topics of the Fourth Review Meeting; and
— In order to improve transparency, journalists would be invited to attend the opening plenary session of the review meeting and a Press Conference would be organized at the end of each review meeting with the participation of the President and Vice-Presidents of the Review Meeting.

In addition, Contracting Parties established the 'Working Party on National Reports' (WPNR), which was requested, in accordance with its approved work plan and with the assistance of the IAEA Secretariat, to develop a draft revised version of the Guidelines regarding National Reports (INFCIRC/572/Rev.2).

The Contracting Parties also requested that the Secretariat review the Guidance documents (INFCIRC/571/Rev.3, INFCIRC/573/Rev.3 and INFCIRC/572/Rev.2) for internal consistency. In this context, it was agreed that this consistency check would take place after the adoption of

[28] Summary Report of the 4th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 14–25 April 2008, Vienna, Austria, CNS/RM/2008/6 FINAL, https://www.iaea.org/sites/default/files/summary-report-april2008-final.pdf
[29] The timing of the organizational meeting was six months in advance of the review meeting, which was brought forward to allow more time for preparation by Contracting Parties and fuller briefing of incoming Officers.

INFCIRC/572/Rev.3, by the First Extraordinary Meeting. It was also agreed that the Contracting Parties would provide their approval within two months after the circulation of the revised Guidance documents.

6.3.4.3. The First Extraordinary Meeting of the CNS (28 September 2009)

The Fourth Review Meeting of the CNS decided to have this First Extraordinary Meeting in conjunction with the Fifth Organizational Meeting to discuss and agree on the changes to Guidelines Regarding National Reports under the Convention on Nuclear Safety (INFCIRC/572/Rev.2).

Further to the request of the Contracting Parties made at the Fourth Review Meeting, a new version of the Guidelines Regarding National Reports was developed and submitted for comments to all Contracting Parties and subsequently the Extraordinary Meeting reviewed the draft in which all comments were incorporated and Contracting Parties finally adopted them. Consequently, these Guidelines were restructured and well detailed in order to support the preparation of the National Report.

6.3.5. The fifth review cycle of the CNS

6.3.5.1. The Fifth Organizational Meeting of the CNS (29 September 2009)

At the Meeting, Contracting Parties to further enhance the review process briefly discussed a number of proposals related to various topics such as the enhancement of country group composition; consideration of creating a process for topical issue discussion between Review Meetings; the engagement of national contact points in the review process; developing guidance for the Contracting Parties' review of other national reports. They also recognized that Contracting Parties with emerging nuclear programmes may need extended presentations for presenting their issues on nuclear safety infrastructure. Finally, the Meeting agreed to refer all of proposals to the Open-ended Working Group for further elaboration.

6.3.5.2. The Fifth Review Meeting of the CNS (4–14 April 2011)

As it was mentioned earlier[30], the ***Fifth Review Meeting*** of the Contracting Parties to the CNS was held after the Fukushima accident and therefore the focus of the Open-ended Working Group was to prepare a draft consensus statement of the Contracting Parties on the Fukushima accident. Due to the substantial time devoted to the preparation of the said statement most of the proposals (referred to the OEWG at the Fifth Organizational Meeting) had not been discussed, these had to be resubmitted prior to the next Review Meeting.

As the then current method for assignment of Contracting Parties to country groups did not provide for a substantial change in Country Group composition from review meeting to review meeting, the Contracting Parties, despite the time constraints, agreed upon a new method of determining the makeup of Country Groups. Additionally, in order to enhance the continuity of knowledge of the CNS processes, they were also in agreement to include the roles and

[30] Paragraph 5, Section 3.

responsibilities of the National Contact, and subsequently to amend the Guidelines regarding the Review Process (INFCIRC/571/Rev.4.) in this regard[31].

6.3.5.3. The Second Extraordinary Meeting of the CNS (27–31 August 2012)

In the course of the preparation for the Second Extraordinary Meeting[32], the Presidency[33] requested the Secretariat to prepare the revised versions of the Guidance documents, which reflected the various proposals to amend them. In order to facilitate this request, the Secretariat convened two consultancy meetings with the participation of those Contracting Parties that had submitted proposals. This working group reached an agreement on the revised drafts which were circulated prior to the Second Extraordinary Meeting; whereat, following thorough discussion of these drafts, changes were agreed to all Guidance documents (INFCIRC/571/Rev.5, INFCIRC/572/Rev/3, INFCIRC/573/Rev.4). The Secretariat was also requested to perform an editorial review before the issuance of the new versions of these documents.

The possibility to request the Secretariat to prepare a Generic Safety Observation Report[34] presenting observations on significant issues related to the safety of nuclear installations based on all information available to the IAEA was added to Guidelines Regarding the Review Process (INFCIRC/571/Rev.5). It was also assured that no Officer is assigned to the Country Group of which his or her country is a member[35]. Follow-up of earlier Challenges and Suggestions and related implementation of remedial actions taken since the previous review meeting should also be clearly documented in the Rapporteur's report[36] and subsequently Annex I thereto. Furthermore, the Summary Report should identify which Contracting Parties submitted National Reports (in accordance with Article 5 of the CNS) and those that presented their National Report during the Review Meeting[37].

Regarding the general suggestions on the content of the National Report (INFCIRC/572/Rev.3), Contracting Parties were in agreement to reflect suggestions (besides challenges) identified at the previous review meeting and to regard the IAEA Generic Safety Observations Report in their National Report. Reference to the IAEA Safety Fundamentals and Requirements, could also be made when reporting on the obligations of the Convention. Furthermore, Contracting Parties planning construction of their first nuclear installation were provided guidance as well. The part of the guidance on "Reporting article by article" was amended in order to enhance reporting on transparency and communication with the public, the independence of the regulatory body, assessments of safety, emergency response and preparedness, siting and re-evaluation of site related factors, as well as design and construction. The summary part of the National Report was elaborated in order to properly address the changes made to these Guidelines as well. With respect the Rules of Procedure and Financial Rules

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[31] Summary Report of the Fifth Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 4-14 April 2011, Vienna, Austria, CNS/RM/2011/6/FINAL, https://www.iaea.org/sites/default/files/cns-rm5-summary-report_englsih_final_signed.pdf

[32] Final Summary Report, Second Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety, 27-31 August 2012, Vienna, Austria, https://www.iaea.org/sites/default/files/2012-cns-summary-report-english.pdf

[33] The Presidency elected at the Fifth Organizational Meeting consisted of Mr Li Ganjie of China as President of the 5th Review Meeting, Mr Bill Borchardt of USA and Mr Patrick Majerus of Luxembourg as Vice-Presidents.

[34] Paragraph 6 of INFCIRC/571/Rev.6

[35] Paragraph 7 of INFCIRC/571/Rev.6

[36] Paragraph 20 of INFCIRC/571/Rev.6

[37] Paragraph 39 of INFCIRC/571/Rev.6

(INFCIRC/573/Rev.4) only a few editorial changes were made to the attendance of and the tasks of the Organizational meeting (Rule 11).

6.3.6. The sixth review cycle of the CNS

6.3.6.1. The Sixth Review Meeting of the CNS (24 March–4 April 2014)

It has already been mentioned at the beginning of this article[38], that a Working Group on Effectiveness and Transparency (WGET) was established at the Second Extraordinary Meeting to improve the effectiveness and the transparency of the CNS. As a result of the work of the WGET and based on the list of actions contained in its Final Report, proposals (including a joint proposal submitted by several Contracting Parties) were submitted to and extensively discussed at the Open-ended Working Group to greater transparency towards the public, improve the review process, achieve greater consistency and to provided clearer guidance to meet the objectives of the CNS. Proposals that had been agreed by the Open-ended Working Group by consensus and its recommendations to amend all Guidance documents (INFCIRC/571/Rev.6, INFCIRC/572/Rev/4, INFCIRC/573/Rev.5) was discussed and approved by the Contracting Parties at the Final Plenary session of the Sixth Review Meeting[39].

Contracting Parties were in agreement to add the followings to Guidelines Regarding the Review Process (INFCIRC/571/Rev.6):

- Other organizations that are involved in activities directly related to nuclear installations should be engaged in the preparation of the National Report.
- Writing the National Reports should be a process of self-assessment and focus on the challenges to be addressed and the follow-up action taken since the last Review Meeting.
- At Officers' Turnover Meetings the transfer of knowledge on the CNS, its processes and the role of officers should be assured.
- Organizational Meetings may suggest any topics that could warrant special attention by the Contracting Parties in preparing their upcoming National Reports.
- Country Review Reports (CRR) were introduced and elaborated on. (They are to be prepared by the Rapporteur and finalized by the Country Group).
- Officers were also tasked to agree on a template for the Country Review Reports and on the approach for the presentation of National Reports.
- In terms of transparency, each National Report will be made publicly available by the Secretariat, as uploaded to the secure and restricted database, within 90 days after the Review Meeting unless the Contracting Party concerned notifies the Secretariat otherwise.
- A new Annex IV was agreed on the proposed template for guidance to support Contracting Parties' review of other National Reports.

Guidelines regarding National Reports (INFCIRC/572/Rev.4) were agreed that the National Report should also provide information on

- Identified challenges faced by a Contracting Party to improve safety at its nuclear installations; and efforts made to enhance international cooperation and assistance to

[38] Paragraph 6 of Section 6

[39] Summary Report, 6th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety 24 March–4 April 2014,Vienna, Austria, CNS/6RM/2014/11_Final, https://www.iaea.org/sites/default/files/2014-cns-summary-report-w-annexes-signed.pdf

improve nuclear safety worldwide including international peer review missions and follow-up missions and measures taken by the Contracting Party to voluntarily make public the reports on their international peer review missions; (Contracting Parties without nuclear installations and planning to embark on a nuclear power programme were also encouraged to report on related peer review missions including progress made in implementing the findings and plans for follow-up.)

- Means by which effective separation is ensured between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy,
- The mechanisms by which the Contracting Parties ensures that the license holder of the nuclear installation has appropriate resources (technical, human, financial) and powers for the effective on-site management of an accident and mitigation of its consequences,
- Contracting Parties' arrangements for ensuring the necessary financial resources are available in the event of a radiological emergency;
- Re-evaluations of hazard assumptions and an overview on periodic safety assessments of nuclear installations during operation, including references to appropriate standards and practices and illustrations on how new evidence is taken into account (safety assessment);
- The implementation of design measures and those particular measures that are applied to maintain, where appropriate, the integrity of the physical containment and to avoid long term off-site contamination, in particular actions taken or planned to cope with natural hazards more severe than those considered in the design basis (design);
- Managing accident situations at multi-unit nuclear installations and/or multi-facility sites.

It was also agreed that should a Contracting Party decide – on voluntary basis – to report on the safety of other types of civilian nuclear reactors, it could follow the format of these Guidelines, addressing the relevant articles of the CNS as they deem appropriate and the Annex to INFCIRC/572/Rev.4 was amended accordingly.

With regard to the Rules of Procedure and Financial Rules (INFCIRC/573/Rev.5), only a few changes were approved mainly in the context of the CRR, i.e. its distinction from the Rapporteur's report[40].

6.3.7. The seventh review cycle of the CNS

6.3.7.1. The Seventh Review Meeting of the CNS (27 March–7 April 2017)

The Open-ended Working Group (OEWG) was established at the opening plenary session of the Seventh Review Meeting. A few proposals were submitted by the Contracting Parties and discussed during the OEWG meetings. Amongst other recommendations of the OEWG, Contracting Parties at the 7th Review Meeting of the CNS decided to reference the Vienna Declaration on Nuclear Safety on principles for the implementation of the objective of the CNS and added a new paragraph 3 to the Introduction to the Guidelines regarding the National Reports (INFCIRC 572/Rev.5) on that topic.

[40] Definitions, Rule 2 of INFCIRC/573/Rev.6: "Country Review Report" means a document prepared by the Rapporteur summarizing the discussion in conclusions of the Country Group on a particular National Report" and "Rapporteur's Report" means a report summarizing on the basis of the CRR the entire discussion on all National Reports in the Country Group"

TABLE 1. AMENDMENTS OF THE CNS GUIDANCE DOCUMENTS[41]

Convention on Nuclear Safety (INFCIRC/449)	Rules of Procedure and Financial Rules (INFCIRC/573)	Guidelines regarding the Review Process (INFCIRC/571)	Guidelines regarding the Form and Structure of National Reports (INFCIRC/572)
Adoption	at the Preparatory Meeting held from 21 to 24 April 1997		
1st amendment	at the 1st Review Meeting held from 12 to 23 April 1999	at the 1st Review Meeting held from 12 to 23 April 1999	at the 1st Review Meeting held from 12 to 23 April 1999
2nd amendment	at the 2nd Review Meeting held from 15 to 26 April 2002	at the 2nd Review Meeting held from 15 to 26 April 2002	at the 2nd Review Meeting held from 15 to 26 April 2002
3rd amendment	at the 3rd Review Meeting held from 11 to 22 April 2005	at the 3rd Review Meeting held from 11 to 22 April 2005	At the 1st Extraordinary Meeting held 28 September 2009
4th amendment	At the 1st Extraordinary Meeting held 28 September 2009	At the 1st Extraordinary Meeting held 28 September 2009	At the 2nd Extraordinary Meeting held from 27 to 31 August 2012
5th amendment	At the 2nd Extraordinary Meeting held from 27 to 31 August 2012	at the 5th Review Meeting held from 4 to14 April 2011	at the 6th Review Meeting held from 24 March to 4 April 2014
6th amendment	at the 6th Review Meeting held from 24 March to 4 April 2014	At the 2nd Extraordinary Meeting held from 27 to 31 August 2012	at the 7th Review Meeting held from 27 March to 7 April 2017
7th amendment		at the 6th Review Meeting held from 24 March to 4 April 2014	

[41] Table reflects when the decision was made by the Contracting Parties.

6.4.JOINT CONVENTION

The Joint Convention is the first legally binding international treaty on the safety of spent fuel management and radioactive waste management. It represents a commitment by participating Member States to achieve and maintain a high level of safety in these areas as part of a global regime for ensuring the protection of people and the environment. The Joint Convention applies to (i) safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors, (ii) safety of radioactive waste management when the radioactive waste results from civilian application and (iii) to certain radiological discharges. The CNS formed the basis for the structure of the Joint Convention. The Joint Convention also applies the same "peer review" mechanism as the CNS.

The Joint Convention has been in force for almost 20 years[42], during which, it hasn't been amended. However, following the Fukushima accident, improvements for future review meetings as well as other arrangements to ensure continuity between meetings were identified by the Contracting Parties during deliberations at the Open-Ended Working Group. At the meetings of the Open-Ended Working Group, the Contracting Parties discussed eleven topics inter alia enhancing the effectiveness of the review process as well as enhancing the continuity and on-going dialogue between review meetings. In this regard, they decided to hold inter-sessional meetings to continue consideration of proposals to improve implementation of the Joint Convention and to develop recommendations for consideration by the Contracting Parties and topical meetings to address specific topics for ensuring effective approaches to the back end of the fuel cycle identified at the Fourth Review Meeting and subsequent review meetings. [43]

Contracting Parties worked on several proposals to enhance the review process but there was no proposal submitted to amend the Joint Convention itself.

6.4.1. The First review cycle of the Joint Convention

In December 2001, similarly to the CNS, the Preparatory Meeting for the Joint Convention adopted, by consensus, three Guidance documents:

— Rules of Procedure and Financial Rules;
— Guidelines Regarding the Review Process; and
— Guidelines regarding the Form and Structure of National reports.

At the First Organizational Meeting, there was a call from some delegations for further reflection by Contracting Parties before the review meeting as to whether any changes to the Rules of Procedure and Financial Rules (INFCIRC/602) or the Guidelines regarding the Review Process (INFCIRC/603) were needed to accommodate considerations that emerged during the discussions on the selection process of Officers.

6.4.1.1. The First Review Meeting of the Joint Convention (3-14 November 2003)

[42] The Joint Convention was adopted on 5 September 1997, opened for signature on 29 September 1997 and entered into force on 18 June 2001. (See INFCIRC/546)
[43] Final Summary Report on the Fourth Review Meeting of the Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, JC/RM4/04/Rev.2, https://www.iaea.org/sites/default/files/summary-report-english.pdf

In this context, the First Review Meeting[44] agreed to establish an Open-ended Working Group to discuss a list of topics including those that had been raised at the First Organizational Meeting that implied several changes to the Guidance documents (INFCIRC/602/Rev.1 and INFCIRC/603/Rev.1). The main topics addressed by the Open-ended Working Group were related to procedure for the establishment of the Open-ended Working Group, the selection of officers, organizing topical sessions at review meetings, attendance and participation of late ratifiers, and guidelines regarding the format and content of national reports as well questions and answers thereto.

On the subject of clarifying Guidelines to better reflect the duties of the officers, prior to and during a review meeting, as well as their necessary qualifications, the Secretariat was requested to prepare draft documents. It was decided by the Contracting Parties that the General Committee[45] was to function between the First and Second Review Meeting as a body to which such drafts could be referred for comments. The First Review Meeting recognized the need to ensure that experience gained during this meeting was not lost and asked to take this also into account at the Second Review Meeting.

As agreed, the General Committee met and discussed inter alia draft documents on the duties, qualifications, training of the Joint Convention Officers ("Guidance to Officers on How to Conduct a Country Group session") and the proposed second revisions to INFCIRC/602 and INFCIRC/603. At this meeting the Committee also discussed the issue of confidentiality of documents related to in particular the Rapporteur's Report. In terms of attendance of country groups, the Committee saw clear distinction between the members of that particular country group and other participants (like other Contracting Parties that are assigned to another country group) in the country group. The review of a national report is primarily the responsibility of members in the relevant country group and therefore those individuals should approve the Rapporteur's report on a particular national presentation.

Due to time constraints, the revised versions of the aforementioned documents could not be completely prepared and distributed; therefore, regarding the way forward, various options were discussed including the organization of an extraordinary meeting.

6.4.1.2. The First Extraordinary Meeting of the Joint Convention (7 November 2005)

The First Extraordinary Meeting was convened by the Secretariat pursuant to Article 31, paragraph (ii)[46] of the Joint Convention. A written request of a Contracting Party was circulated together with three proposals to be considered prior to the Second Review Meeting so that they might enter into effect for the second review cycle of the Joint Convention. These were namely proposals for amending the Rules of Procedure and Financial Rules, the Guidelines regarding

[44] Summary Report of Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management First Review Meeting of the Contracting Parties 3 to 14 November 2003 Vienna, Austria, JC/RM.1/06/Final version, Microsoft Word - merged 03-7813-8487E.doc (iaea.org)

[45] The General Committee of the Review Meeting is composed of the President of the meeting, who presides, the two Vice-Presidents, and the Chairpersons of the Country Groups. It assists the President in the general conduct of the business of the Review Meeting. (Rule 16, INFCIRC/602/Rev. 5.)

[46] Paragraph (ii), Art 31. of the JC: "at the written request of a Contracting Party, within six months of this request having been communicated to the Contracting Parties and notification having been received by the secretariat referred to in Article 37 that the request has been supported by a majority of the Contracting Parties."

the Review Process as well as new guidelines regarding the Topic Session[47] in the Review Process. The majority of the Contracting Parties supported this request hence an extraordinary meeting was held in 2005.

With respect to the Rules of Procedures and Financial Rules, changes were proposed to the election of Country Group Rapporteurs and Chairpersons, basically the term "selection" was amended to "election". The establishment of the General Committee was simplified as well, thereby eliminating the election of its members at the review meeting. Rule 37 was adjusted to be in line with to the Rules of Procedure of the IAEA General Conference and of the IAEA Board of Governors. In addition, there were discussions regarding the deadline for submission of National Reports and treatment of late ratifiers, but these were decided to be sufficient as set initially. Written answers, as responses, to questions and comments on national reports had been requested within a certain deadline and the participation in country groups was also clarified in more details. Following intense discussion on the proposed new guidelines on the Topic Session, the President suggested it be withdrawn.

6.4.2. The Second review cycle of the Joint Convention

6.4.2.1. The Second Organizational meeting of the Joint Convention (7–8 November 2005)

At the meeting, modifications were proposed to the peer review process to allow for improved efficiency. The proposal was to have the Country Group sessions during the first week and the Final Plenary sessions begin the second week. The Rapporteurs, Country Group Chairs and President and Vice- Presidents would draft the Report over the weekend in between. The Contracting Parties agreed to consider the proposal at the Second Review Meeting. At the meeting, to help to facilitate elections, the President of the Organizational Meeting proposed informal guidelines[48] for candidate selection.

6.4.2.2. The Second Review Meeting of the Joint Convention (15–24 May 2006)

Following the proposals made at the Second Organizational meeting, the Contracting Parties agreed that it would be appropriate to apply the following changes to the review process (INFCIRC/603/Rev.3, INFCIRC/604/Rev.1):

— The Contracting Parties should provide a copy of the presentation to the Country Group Chair by noon the day before the presentation is scheduled, so that it may be distributed to the Country Group officers and Country Group members before the close of business;
— The Contracting Party which provides its presentation should arrive in the Country Group meeting room 15 minutes before the presentation to review logistics with the Country Group Chair;
— The following division of time in Country Group sessions should be adopted: a maximum of one-third of the total duration for the oral presentation, one-third for discussions and one-third for drafting and agreeing to the Rapporteur's daily report; and

[47] The draft guidelines regarding topic sessions in the review process aimed at providing suggestions as to how topic sessions could be conducted if desired in future review meetings especially on the establishment and composition of the 'Topic Groups', the participation in these groups, the conduct of discussions and the timing of these sessions.
[48] The Guidelines included: gender, rotation of leadership positions amongst Contracting Parties, mixture of regulators and operators, representation from large and small countries, geographic variability, and strong language skills.

— Each National Report shall include an overview matrix to be used by the Rapporteur during the Country Group review. Its format and definitions should be agreed by the Contracting Parties.

6.4.3. Third review cycle of the Joint Convention

6.4.3.1. The Third Organizational Meeting of the Joint Convention (13–14 October 2008)

Extensive discussions were held on two proposals, submitted by two Contracting Parties, with regard to a voluntary data presentation tool for the national reports and the knowledge transfer between out-going and in-coming officers, eventually, it was agreed that these topics would be considered at Open-ended Working Group sessions of the Third Review Meeting. In addition, a list of topics to be discussed in the Open-ended Working Group were also proposed, which covered, inter alia, the continuity– knowledge transfer between meetings, usage of the Matrix for Contracting Parties National Presentation at Country Group sessions, and assurance of a robust peer review process that may imply further changes to the Guidance documents.

6.4.3.2. The Third Review Meeting of the Joint Convention (11–20 May 2009)

Based on the recommendations on the Open-ended Working Group, which was established in the beginning of the review meeting, and the discussions at the plenary sessions the Guidance documents were again amended. The Third Review Meeting [49] agreed that, other than the qualifications of officers highlighted in the Annex of INFCIRC/603/Rev.3, there were no formal or informal restrictions on who may serve as an officer of a review meeting. In addition, the Meeting expressed the view that experience in a prior meeting may be useful but not essential and that diversity among officers may result in a broader range of experience and perspectives for achieving the objectives of the Joint Convention. Consequently, new versions of the Rules (INFCIRC/602/Rev.3) and the Guidelines regarding the Review Process (INFCIRC/603/Rev.4) were adopted.

In particular, a strict timeline was introduced regarding the nomination of officers and additional considerations were to be taken into account while electing the officers, as well as a requirement to hold an officers' meeting following the organizational meeting were added to the Guidelines. Concerning the Rules, it was clarified that most officers will relinquish their functions at the end of the following organizational meeting.

6.4.4. Fourth review cycle of the Joint Convention

6.4.4.1. The Fourth Review Meeting of the Joint Convention (14–23 May 2012)

At the Fourth Review Meeting[50], Contracting Parties, based on the Open-ended Working Group's recommendation delivered at the Final Plenary Sessions, adopted the following proposals to improve the peer review process.

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[49] Summary Report of Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management Third Review Meeting of the Contracting Parties 11 to 20 May 2009, Vienna, Austria, JC/RM3/02/Rev2, https://www.iaea.org/sites/default/files/final-report-english.pdf

[50] Final Summary Report of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management Fourth Review Meeting of the Contracting Parties 14 to 23 May 2012, Vienna, Austria, JC/RM4/04/Rev.2, 4RM summary report draft clean 12-05-23 afternoon plenary agreed_FINAL (iaea.org)

A proposal on enhancing the continuity of knowledge of the peer review process implied further changes to INFCIRC /603/Rev.4. More specifically, National Contacts in reality perform much more complex function than simply acting as the custodian of information and data flow, as well as they often remaining in position for several years and therefore contribute to the improvement of the review process. The third revision of INFCIRC/603 did not include national contacts in the identified process of ensuring and enhancing the continuity of expertise and knowledge in the Joint Convention peer review process. Hence, the status and functions of the National Contacts were proposed to be clarified.

Additionally, another proposal on the changed role of the coordinator was also presented. Since the introduction of the Joint Convention secure website, the role of the coordinator has evolved. The emphasis has changed from ensuring formal compliance as regards to timely submittal of questions and answers to developing to developing more factual, qualitative, analysis of contents. Consequently, the Guidelines (INFCIRC /603/Rev.4) were accordingly adjusted.

6.4.4.2. The Second Extraordinary Meeting of the Joint Convention (12–13 May 2014)

At the Fourth Review Meeting, several improvements to the Rules and Guidance documents had been proposed. Hence it was decided that the Secretariat would organize additional meetings to continue consideration of proposals to improve the implementation of the Joint Convention. In this context, the first Inter-sessional Meeting was held in April 2013. Several proposals had been discussed and eventually eight proposals to amend the Guidelines (INFCIRC/602/Rev.4, INFCIRC/603/Rev.5, INFCIRC/604/Rev.2.) were submitted by Contracting Parties for consideration at the Second Extraordinary Meeting.

At the meeting, the following changes to the Guidelines were approved:

In the Rapporteur's report good practices, challenges and further suggestions are provided as valuable feedback to a Contracting Party. These terms were defined and added as an Annex to INFCIRC/603. In this context, Contracting Parties decided that one of the objectives of the Country Group sessions is to identify "overarching common issues" that should be highlighted to improve nuclear safety.

The Joint Convention offers confidentiality to Contracting Parties in order to foster a direct and focused peer review of Contracting Parties' national safety programmes for radioactive waste and spent fuel management. Without a degree of confidentiality, there remains an atmosphere of reluctance to candidly deal with challenges and problems associated with the management of these materials and activities. Changes were proposed to INFCIRC/602/Rev.4 and INFCIRC/603/Rev.5 to make all reports and analyses (rapporteur report, and coordinator analyses) available to the entire group of officers, both as exemplary templates for new officers and for background information for currently serving officers[51].

In addition, the significant time pressure placed upon the rapporteurs to prepare their reports during the country reviews was highlighted following the Fourth Organizational Meeting and

[51] At the April 2013 intersessional meeting, the delegates supported the proposal with the caveat that the document shared by Contracting Parties would only be open to the participants of the Review Meeting and not available for the public.

reaffirmed at Fourth Review Meeting[52]. Therefore, changes were proposed in this regard to INFCIRC/603/Rev.5 and INFCIRC/604/Rev.2.

Changes to INFCIRC/603/Rev.5 were also proposed and accepted regarding the electronic batch submittal of questions, comments and responses relating to the National Reports as an option alongside continuing use of the actual system. At the Meeting[53], it was extended to the submission format of the national reports as well.

The promotion of utilization of IAEA Safety Standards, as one of the most important factors in the field of nuclear safety especially after the Fukushima accident was also accepted to be referenced in INFCIRC/604/Rev.3. Furthermore, to ensure the effective independence of the regulatory body its meaning was also clarified, as well as to address the date of the most recent international peer review mission(s) and its(their) result(s) were added to INFCIRC/604/Rev.2.

Finally, transparency had been enhanced by adding voluntary practices regarding publicly available information as a new Annex to INFCIRC/604/Rev.2.

6.4.5. Fifth review cycle of the Joint Convention

6.4.5.1. The Fifth Review Meeting of the Joint Convention (11–22 May 2015)

Since a range of proposals were accepted at the Second Extraordinary Meeting in 2014, the Open-ended Working Group, established at the Fifth Review Meeting[54], was therefore encouraged to focus on policy and organizational matters rather than proposals for additional changes to the Guidance documents.

In the light of the above, a recommendation was made by the Open-ended Working Group only as regards to identifying ways of improving the definition of the roles and responsibilities of the rapporteurs and the coordinators, as well as their interactions.

In this context, following the request of the Contracting Parties, a Consultancy Meeting was held in 2016 open to all Contracting Parties. The mandate of this meeting also encompassed the analyses of other proposals to improve the review process, in particular for Contracting Parties without nuclear power plants.

It was also decided by Contracting Parties at the Fifth Review meeting to hold an extraordinary meeting prior to the Sixth Organizational Meeting and its agenda would include the conclusion of the aforementioned consultancy meeting[55].

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[52] At the intersessional meeting Contracting Parties favoured the idea of limiting the time allocated to the presentation to encourage more robust subsequent discussion.
[53] Summary Report of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) Second Extraordinary Meeting of the Contracting Parties 12–13 May 2014, Vienna, Austria, https://www.iaea.org/sites/default/files/summary-report-2nd-meet-2nd-rev-meeting-may13.pdf
[54] Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management Fifth Review Meeting of the Contracting Parties 11 to 22 May 2015, Vienna, Austria, JC/RM5/04/Rev.2, https://www.iaea.org/sites/default/files/summary-report-fifthreviewmeeting-e.pdf
[55] At the Fifth Review Meeting of the Joint Convention, the Contracting Parties requested to consider the process regarding openness and transparency adopted by the CNS Contracting Parties.

6.4.5.2. The Third Extraordinary Meeting of the Joint Convention (16–17 May 2017)

Based on the report on the Consultancy Meeting, at the Third Extraordinary Meeting[56], the Contracting Parties agreed to further discuss the issue of the reporting needs of the Contracting Parties without a nuclear power programme during the OEWG at the Sixth Review Meeting. In this context, several Contracting Parties expressed an interest in working together to develop proposals for consideration in the OEWG.

Regarding the enhancement of transparency, Contracting Parties agreed that the Secretariat would make publicly available each National Report, 90 days after the Review Meeting, unless the Contracting Party notifies the Secretariat otherwise (INFCIRC/603/Rev.6).

In addition, without amending any of the Guidance documents, they also agreed that the President can permit web-streaming of the Opening Plenary Session and the part of the Closing Plenary Session whereat the Summary Report is adopted, as well as the President can request the Secretariat to invite journalists to the same sessions of the review meeting.

Additional proposals were discussed at the meeting yet no amendments to the Guidelines were agreed.

It was suggested to re-assign the discussions identifying the overarching issues to be discussed during plenary from Country Group sessions to General Committee Meetings held during the Review Meeting. There was general agreement that the discussion should continue to take place in the Country Group sessions but should be done in a more efficient manner. It was also noted that the Country Group Chairs and the President would play an important role in consolidating and presenting the list of overarching issues to the Closing Plenary Session.

To ensure that a strict and consistent interpretation of the term "Good Practice" was applied across all Country Groups. It was agreed that a similar approach to the CNS should be followed at the Sixth Review Meeting of the Contracting Parties to the Joint Convention, as well as other achievements such as "Areas of Good Performance" should be also recognized.

As a result of the increasing number of Contracting Parties, the number of Country Groups were also increased from seven to eight, without changes in time allocation for the discussion of the National Presentations.

6.4.6. Sixth review cycle of the Joint Convention

6.4.6.1. The Sixth Review Meeting of the Joint Convention (21 May–01 June 2018)

The meeting[57] established an Open-ended Working Group during which extensive discussions were held on several proposals aimed at amending the Guidance documents. Nevertheless, there was general consensus on the intent of most of the proposals, at the Final Plenary sessions only some had been approved but without changing the Guidance documents.

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[56] Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) Third Extraordinary Meeting of the Contracting Parties 16–17 May 2017, Vienna, Austria, JC/EM3/07/Final, https://www.iaea.org/sites/default/files/summary-report-third-em.pdf

[57] Final Summary Report of Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management Sixth Review Meeting of the Contracting Parties 21 May to 01 June 2018, Vienna, Austria, JC/RM6/04/Rev.2, https://www.iaea.org/sites/default/files/summary-report-sixth-review-meeting-e.pdf

A proposal to address the country group officers election process during the Organizational Meeting, on which consensus had not been achieved during the meeting of the OEWG was introduced to the plenary. The need for clarity, certainty and fairness in this process had been recognized, but there was not agreement on the exact mechanism of the process.

The Contracting Parties recommended that

- Each national report should highlight the significant changes from the previous national report.
- Those Contracting Parties interested in submitting proposals are encouraged to do so no later than thirty days before the start of the Review Meeting, to allow other Contracting Parties sufficient time to review proposals. This recommendation does not preclude the submission of proposals within thirty days before the start of the Review Meeting; or the submission of proposals during the Review Meeting; or changes to submitted proposals.
- The submission of National Reports in electronic form only to the secure website is an acceptable practice.
- That the Sixth Review Meeting of the Joint Convention request the IAEA Secretariat to ask the CNS for approval to share the report to be presented to the CNS on its findings regarding video conferencing.

Based on the need expressed by Contracting Parties, it was also decided by consensus to hold an Extraordinary Meeting prior to the Organizational Meeting of the Seventh Review Meeting "with the view to discuss possible ways to improve procedural mechanisms of the Joint Convention, taking into account the growing number of Contracting Parties to the Joint Convention, and with the view to identify and eliminate technical discrepancies between existing procedural documents of the Joint Convention. Excluded from the proposal are any changes to the articles of the Joint Convention itself."[58]

TABLE 2. AMENDMENTS OF THE JOINT CONVENTION GUIDANCE DOCUMENTS

Joint Convention on the Safety of Spent Fuel and on the Safety of Radioactive Waste Management	Rules of Procedure and Financial Rules (INFCIRC/602)	Guidelines regarding the Review Process (INFCIRC/603)	Guidelines regarding the Form and Structure of National Reports (INFCIRC/604)
Adoption	at the Preparatory Meeting held from 10 to 12 December 2001		
1st amendment	at the 1st Review Meeting held from 3 to 14 November 2003	at the 1st Review Meeting held from 3 to 14 November 2003	at the 2nd Review Meeting held from 15 to 24 2006

[58] Paragraph 83 of the Final Summary Report of Sixth Review Meeting of the Joint Convention

2nd amendment	at the 1st Extraordinary Meeting held on 7 November 2005	at the 1st Extraordinary Meeting held on 7 November 2005	at the 4th Review Meeting held a from 14 to 23 May 2012
3rd amendment	at the 3rd Review Meeting held from 11 to 20 May 2009	at the 2nd Review Meeting held from 15 to 24 May 2006	at the 2nd Extraordinary Meeting held from 12 to 13 May 2014
4th amendment	at the 4th Review Meeting held a from 14 to 23 May 2012	at the 3rd Review Meeting held from 11 to 20 May 2009	
5th amendment	at the 2nd Extraordinary Meeting held from 12 to 13 May 2014	at the 4th Review Meeting held a from 14 to 23 May 2012	
6th amendment		at the 2nd Extraordinary Meeting held from 12 to 13 May 2014	
7th amendment		at the 3rd Extraordinary Meeting held from 16 to 17 May 2017	

6.5.CONCLUSIONS

The CNS was developed, adopted and entered into force earlier than the Joint Convention. History shows that the Joint Convection follows the structure of the CNS and its procedural arrangements as well, and therefore it is often referenced as the “sister” convention of the CNS. Thus, in the past two decades when Contracting Parties to the CNS agreed on substantial changes to the Guidance documents, the Contracting Parties to the Joint Convention most of the time followed and adopted that approach as they were faced with the same or similar issues.

7. IAEA CODES OF CONDUCT: TRENDS AND DEVELOPMENTS

W. TONHAUSER, H. MANSOUX, A.WETHERALL[1], [2]
International Atomic Energy Agency

7.1.INTRODUCTION

Over the course of the past two decades, the international legal framework for the safe and secure uses of nuclear technology and its applications has continued to evolve, with international nuclear law-making developing new norms, rules, mechanisms and procedures. Today, the global nuclear safety and security framework comprises of several inter-governmental legally binding and non-binding instruments adopted by and under the auspices of the International Atomic Energy Agency (IAEA).

The 'traditional' form of international norm-making is through binding agreements concluded between States. Most often, these are referred to as "treaties", "agreements", "conventions", "charters" etc. These instruments are codified in the 1969 Vienna Convention on the Law of Treaties [1]. Among them, are bilateral and multilateral agreements as well as legally binding conventions. The relative simplicity of traditional international law has, in the nuclear field, given way to intricate forms, processes, instruments, and norms. In addition to the treaty making process, the international community has taken a second, and new, approach to the normative control of nuclear risks through the adoption of legally non-binding norms governing the safe and peaceful uses of nuclear energy. The international legal framework not only includes such conventions, but also legally non-binding Codes of Conduct adopted by the IAEA. Unlike legally binding international instruments, a Code of Conduct by its very nature is not legally binding *per se* and is considered as an instrument of "soft law".

Two IAEA Codes of Conduct have been established by IAEA MSs acting through the IAEA policy-making organs the Board of Governors (Board) and General Conference (GC), respectively. They address the safety and security of radioactive sources (RSs) and the safety of civil research reactors (RRs), respectively. First, there is the Code of Conduct on the Safety and Security of Radioactive Sources of 2003 (2003 RSs CoC).[2] Second, there is the Code of Conduct on the Safety of Research Reactors of 2004 (2004 RRs CoC).[3] These instruments were first drafted in consultants' meetings and/or technical and legal meetings of MSs representatives. They were then adopted by the Board and subsequently endorsed by the GC. Once approved and endorsed, these Codes of Conduct are considered to become legal instruments of a non-binding nature, prepared at the international level, to offer guidance and recommendations to States for the development and harmonization of national policies, laws, and regulations and sets forth desirable attributes.

The 2003 RSs CoC is now recognised as the principal international instrument for both the safety and the security of RSs. It forms the basis of many national and international regulations on the use of RSs. The 2003 RSs CoC has been supplemented by two Guidance documents.

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[1] The authors thank Mr. Adeeb Jonathan Haddad from the IAEA Office of Legal Affairs for his valuable assistance in finalising this paper.
[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

The first, the Guidance on the Import and Export of Radioactive Sources, aims to provide for an adequate transfer of responsibility when a source is being transferred from one State to another.[4] The second, the Guidance on the Management of Disused Radioactive Sources provides further guidance, for example, regarding the establishment of a national policy and strategy for the management of disused sources, and on the implementation of management options such as recycling and reuse, short and long-term storage pending disposal and return to a supplier.[5] States continue to be encouraged to implement the Code of Conduct and its Guidance, as appropriate, in order to maintain effective safety and security of RSs throughout their life cycle. In addition, the 2004 *RRs* CoC is today considered as the primary international instrument aiming at maintaining a high-level of safety at RRs. It provides international best practice guidance to a State, its regulatory body and a *RR* operating organization for the management of research reactor safety. States also continue to be encouraged to apply the guidance of the 2004 *RRs* CoC as the basis upon which to regulate and conduct activities at all stages in the life of RRs (including planning) and to freely exchange their *RR* regulatory and operating experience and information.

Support for the IAEA Codes of Conduct and fulfilment of their objectives are expressly and implicitly reflected in the Agency's work, IAEA safety standards and nuclear security guidance and integrated into appropriate IAEA safety and security review services, technical cooperation projects and extra-budgetary programmes. Moreover, they are reflected in the IAEA's biennial regular programme of activities[3] and the IAEA Technical Cooperation (TC) Programme[4] as financed from the TC Fund and extrabudgetary contributions.

Further, in 1990 an IAEA Code of Practice was adopted, namely, the Code of Practice on the International Transboundary Movement of Radioactive Waste (1990 TM CoP).[6] The terms Code of Conduct or Code of Practice are used with no substantial difference in meaning[5]. In addition, it is also recalled that past efforts, albeit without completion, were also made to establish IAEA Codes of Conduct in other areas, namely, the management of international emergencies and the control of transboundary movement of radioactive material inadvertently incorporated into scrap metal and semi-finished products of the metal recycling industries[6]. In addition, there are informal talks to potentially develop a potentially new Code of Conduct addressing the facilitation of the safe and secure transport of radioactive material.

This paper focuses on legal and regulatory aspects of IAEA Codes of Conduct, as well as trends and developments particularly, as concerns support thereof and levels of national implementation. Part 2 provides an overview of Codes of Conduct with a focus on the the 2003 RSs CoC (and its supplementary Guidance) and the 2004 *RRs* CoC. Thereafter Part 3 discusses the development of the 1990 TM CoP.[6] This Part also identifies past efforts to establish other IAEA codes: namely the proposed draft Code of Conduct for the International Emergency Management System of 2006 (2006 International Emergency CoC) and the proposed Codes of Conduct on the Control of Transboundary Movement of Radioactive Material Inadvertently

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[3] IAEA, The Agency's Programme and Budget 2020–2021, GC(63)/2 (2019). In respect of the 2003 RSs CoC and its supplementary Guidance see Major Programme 3, Programme 3.1 on EPR, Programme 3.3 Radiation and Transport Safety; Programme 3.3 Radiation and Transport Safety; and Programme 3.5 Nuclear Security. In regard to the 2004 RRs CoC see Major Programme 3, Programme 3.2 Safety of Nuclear Installations.
[4] IAEA, Technical Cooperation: The Agency's Programme for 2020-2021.
[5] OECD/NEA, Three International Atomic Energy Agency Codes, International Nuclear Law: History, Evolution and Outlook, 10th Anniversary of the International School of Nuclear Law, NEA No. 6934, OECD 2010.
[6] Three International Atomic Energy Agency Codes, International Nuclear Law: History, Evolution and Outlook, 10th Anniversary of the International School of Nuclear Law, NEA No. 6934, OECD 2010.

Incorporated into Scrap Metal and Semi finished Products of the Metal Recycling Industries of 2013 (2013 Metal Recycling CoC). However, both these proposed drafts were not adopted and endorsed. Part 3 also highlights ongoing informal talks to potentially develop a new Code of Conduct addressing the facilitation of the safe and secure transport of radioactive material (Facilitation CoC). Part 4 then considers the effectiveness of the two IAEA Codes of Conduct by focusing on the levels of support for their development and implementation, as well as the mechanisms established to support implementation. Finally, Part 5 then touches upon the IAEA legislative and technical assistance to facilitate commitments to and national implementation. Readers should note that this paper focuses on matters of safety and security and does not address the two other branches of nuclear law, namely safeguards and non-proliferation, as well as civil liability for nuclear damage.

7.2.THE TWO CURRENT IAEA CODES OF CONDUCT

7.2.1. Overview

Both the 2003 RSs CoC and *2004 RRs* CoC share common objectives in achieving and maintaining a high level of safety (and security in the case of the 2003 RSs CoC); protecting individuals, society or the environment; and mitigating or minimizing radiological consequences of emergencies associated with the use of radioactive sources (irrespective of its initiating cause, either safety or security related). Both CoCs also share common elements such as the establishment and maintenance of an effective national legislative and regulatory system of control, including legislation and a regulatory body as an effectively independent authority for regulatory control, with sufficient financial and human resources and legal authority, including, for preparing and issuing regulations and guides, licensing, inspection and enforcement. Similar to the Convention on Nuclear Safety (CNS) of 1994 [10] and the Joint Convention (JC) of 1997 [13], both instruments are based on existing international IAEA safety standards (and in the case of the 2003 RSs CoC, also IAEA nuclear security guidance). These standards and guidance, which continue to be updated to reflect developments, also support the implementation of the Code of Conduct. However, different to the CNS [10] and JC [13] which are confined to establishing fundamental principles, the Codes of Conduct establish detailed technical provisions.

National implementation of both Codes of Conduct is being accomplished mainly through development of national safety, security and emergency preparedness and response (EPR) regulations. States are being encouraged to make full use of the Agency's safety standards and security guidance relevant to RRs and RSs and the governmental, legislative and regulatory infrastructure for nuclear, safety, security, radiation, radioactive waste, transport safety and EPR framework, including, GSR Part 1 (Rev 1).[14] For the IAEA, providing for the implementation of the IAEA Codes of Conduct is achieved through a multi-faceted approach, including, IAEA legislative and technical assistance, peer review and advisory services, capacity building activities through education and training, outreach and periodic exchange of information and experience, as well as the development of training materials.

In the same way that efforts are focused on enhancing the transparency, efficiency and effectiveness of the discussions of the review processes of the CNS [10] and JC [13], much has been achieved regarding discussions at the international level concerning the implementation of the Codes of Conduct (and supplementary Guidance to the RSs CoC). The Codes of Conduct are not just static instruments but are also supported by IAEA organised meetings of States which provide a unique opportunity to share experiences on implementation and for collective learning by experience. These meetings provide a forum to identify challenges and provides

ideas on how to address them based on the experiences of other States. The accompanying measures for Codes of Conduct ultimately reflect an effort to strengthen the instruments.

7.2.2. Safety and Security of Radioactive Sources

Sealed and unsealed RSs are used extensively throughout the world for a wide range of beneficial purposes, particularly in medicine, industry, agricultural research and educational applications. RSs are commonly used in a variety of medical applications for both diagnosis and therapy. As defined, sealed RSs are radioactive material that is permanently sealed in a capsule or closely bonded, in a solid form[7]. When used as designed, RSs have far-reaching benefits. However, theft, malevolent us or inadequate handling of sources and other causes leading to emergencies continue to occur. When RSs are not used properly, lost, stolen, or make their way into untrained or malicious hands, the consequences can be equally far-reaching, and even deadly in some cases. RSs are sometimes lost on construction sites or when old equipment is thrown away or simply abandoned. RSs which are no longer used, and are not intended to be used, for the practice for which an authorization has been granted are considered as disused sources. Lost or discarded devices containing RSs can also end up in scrap metal yards. Radioactive sources that are not under regulatory control, either because they have never been under regulatory control, or because they have been abandoned, lost, misplaced, stolen or transferred without proper authorization are considered as orphan sources. Acquisition and malevolent use of RSs may cause radiation exposure or dispersal of radioactive material into the environment. Such incidents could also cause significant social, psychological and economic impacts. The safety and security of RSs is a topic that continues to be on the world's collective radar.

7.2.2.1. Background to the Development of the 2001/2003 RSs Code of Conduct

The need to ensure the safety and security of RSs had been recognized for many years, and many MSs established regulatory infrastructures for that purpose. Even so, the occurrence of a number of serious incidents in the 1980s and 1990s led the international community to question the effectiveness of these controls. The adoption of the RSs Code of Conduct, first in 2001 and then as revised in 2003, marks the culmination of developments and efforts spanning the past several years.

Over the decades, the IAEA organized a number of specific international conferences to examine the issues and make recommendations[8]. The origins of the RSs CoC can be traced back to the findings of the 1998 Dijon International Conference [19] in the light of which the Board requested the Secretariat to prepare an action plan which the Board subsequently approved in September 1999 and which, called for the development of a Code of Conduct on the safety and security of RSs[9]. In approving the RSs CoC in September 2000, the Board also

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[7] The capsule of a sealed RS is designed to prevent the radioactive material from escaping or being released during normal usage and under probable accident conditions. Two broad types of devices exist that entail radiation hazards: those that generate radiation electrically and those that contain radioactive material. Devices capable of generating radiation electrically include particle accelerators and X-ray machines.

[8] In particular, there is the 1998 Dijon International Conference [19]; the 2000 Buenos Aires International Conference [17]; the 2003 Hofburg Conference [18]; the 2005 Bordeaux International Conference [20]; the 2009 International Tarragona Conference [21]; and 2013 Abu Dhabi International Conference [16].

[9] The 1998 Dijon Conference also led to an IAEA Action Plan on the Safety of Radiation Sources and Security of Radioactive Materials, which was approved by the IAEA GC in 1999 (GOV/1999/46-GC(43)/10). This Action Plan requested the Secretariat to initiate a meeting of technical and legal experts for exploratory discussions

envisaged that the Code of Conduct might be subject to revision by requesting the DG to organize consultations on the application and implementation of the RSs CoC and make recommendations to the Board. Further to the Board's approval, the GC endorsed the RSs CoC in resolution GC(44)/RES/11 which invited IAEA MSs to take note of it and to consider, as appropriate, means of ensuring its wide application[7]. International support for the 2003 RSs CoC was soon expressed at the 2000 Buenos Aires International Conference which called upon States to provide for it's application and implementation [17]. The major findings of the Conference also lead to the Secretariat's revision of the earlier action plan[10] which called for the IAEA Secretariat to consult MSs on their experience in implementing the 2003 RSs CoC[11]. The Dijon and Buenos Aires International Conferences took place primarily in response to the growing realization that inadequate controls over RSs had led to some significant radiological incidents, some of which had caused serious injuries, even death, and/or severe economic disruption[12]. These incidents had their origins in a breakdown or absence of proper regulatory control and were not a result of malicious intent. However, the most relevant radiological incident (the one taking place in Goiania) was related to a source out of regulatory control, even though there was not any malevolent intent involved. In light of the tragic events of 11 September 2001, concerns regarding the possible use of RSs for malicious purposes led the international community to broaden the focus of discussions to also consider the need to strengthen controls over the security of RSs. The 2003 RSs CoC was consequently revised to reflect the change in the international community's perception of threats[13]. The findings of the President of the 2003 Hofburg International Conference included a recommendation that States make a concerted effort to follow the principles contained in the RSs CoC, which was currently being revised [18].

The text of the revised RSs CoC was finalized in July 2003 and approved on 8 September 2003 by the Board. In resolution GC(47)/RES/7.B, the GC welcomed the Board's approval and endorsed the objectives and principles set out in the revised RSs CoC, while recognizing

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relating to an international undertaking in the area of the safety of radiation sources and the security of radioactive materials. This undertaking would address the establishment of regulatory infrastructures, national arrangements for prompt reporting of missing sources, national systems for ensuring appropriate training of personnel, national arrangements for management and disposal of disused sources, and arrangements for a response to the detection of orphan sources. The 1998 GC held immediately after the Dijon Conference, requested the Secretariat to prepare a report for the Board of Governors on an international undertaking for ensuring the safety of radiation sources and the security of radioactive materials. However, it soon became clear that States did not wish to enter into such a binding commitment at the present time. The output of meetings of technical and legal experts held in March and July 2000 resulted in the RSs CoC. As a result of decisions taken at those meetings, the RSs CoC focused on sealed RSs, was addressed to States and national regulators, and was non-legally binding.

[10] This revised IAEA Action Plan was approved by the Board of Governors on 10 September 2001 and endorsed by the GC in GC(45)/RES/10.

[11] The effectiveness of the 2003 RSs CoC was reviewed at a meeting of technical and legal experts in August 2002. At that meeting, the Code's provisions relating to the security of sources were strengthened. At a second and third meeting of technical and legal experts, held in March 2003 and July 2003 further changes were made. The revised Code included strengthened provisions specifically relating to the security of RSs including the need for: an assessment of domestic threats; measures to reduce the likelihood of malicious acts including sabotage; the mitigation or minimisation of radiological acts; an assessment of the trustworthiness of individuals; and protecting the confidentially of security information. It also provided for the establishment of national registries of such sources.

[12] While the 2003 RSs CoC's provisions addressed security, the focus at that time was very much on incidents such as RSs in scrap metal. No consideration being given to the possible use of sources for malicious purposes such as Radiological Dispersal Devices (RDDs). At that time, agreement was not reached on a number of issues, notably those relating to the creation of comprehensive national registries for RSs, obligations of States exporting RSs, and the possibility of unilateral declarations of support.

[13] Wheatley J., Revised IAEA Code of Conduct on the Safety and Security of RSs, IAEA, 2001.

that it was not a legally binding instrument. The final version of the revised RSs CoC was published January 2004 and a copy was sent to all States[14] [2].

7.2.2.2. Scope, Objectives and Salient Provisions of the 2001/2003 RSs CoC

This revised 2003 RSs CoC, aimed primarily at Government, contains legally non-binding guidance on legislation, regulations and the regulatory body, and import/export controls for life-cycle control of RSs. The RSs CoC applies to all RSs that may pose a significant risk to individuals, society and the environment, referred in Annex I of the document. States should also devote appropriate attention to the regulation of other potentially harmful RSs. With regard to unsealed radioactive sources, a preambular paragraph in the RSs CoC notes that, although the contents of the RSs CoC should not be applied precisely to unsealed RSs, States are encouraged to regulate them under similar principles in some circumstances. The 2003 RSs CoC does not apply to nuclear material as defined in the CPPNM [8] except for sources incorporating plutonium-239. Nor does the 2003 RSs CoC apply to RSs within military or defence programmes.

The 2003 RSs CoC aims at helping national authorities to ensure that RSs are used within an appropriate framework of radiation safety and security. The general objective of the 2003 RSs CoC is to achieve a high level of safety and security of RSs that may pose a significant risk to health. These are referred to as Category 1, 2 and 3 sources and are defined in Annex I of the document. Although the 2003 RSs CoC generally applies to sources in Categories 1, 2 and 3, those recommendations that relate to national registers and export/import controls are limited to sources in Categories 1 and 2.

The specific objectives of the 2003 RSs CoC are, through the development, harmonization and implementation of national policies, laws and regulations, and through the fostering of international co-operation, to: (i) achieve and maintain a high level of safety and security of RSs; (ii) prevent unauthorized access or damage to, and loss, theft or unauthorized transfer of, RSs, so as to reduce the likelihood of accidental harmful exposure to such sources or the malicious use of such sources to cause harm to individuals, society or the environment; and (iii) mitigate or minimize the radiological consequences of any incident involving a RS. These objectives are to be achieved through the establishment of an adequate system of regulatory control of RSs, applicable from the stage of initial production to their final disposal, and a system for the restoration of such control if it has been lost. This is to be done through the development, harmonization and implementation of national policies, laws and regulations, and through the fostering of international co-operation.

The 2003 RSs CoC relies on existing international standards relating to nuclear, radiation, radioactive waste, EPR and transport safety and to the control of RSs. It is intended to complement existing international standards in these areas. Further, the 2003 RSs CoC contains a framework of principles and measures that a State should take to implement legislation and regulations, a regulatory body and control over import and export of RSs. Further, it includes guidance on general basic principles, legislation and the regulatory body, with some specific

[14] For a discussion of the background to the Code see Boustany K., A Code of Conduct on the Safety of Radioactive Sources and the Security of Radioactive Materials: A New Approach to the Normative Control of a Nuclear Risk?, Nuclear Law Bulletin No. 65 (2000/1), OECD/NEA, p. 7.

guidance on the import and export of RSs. The basic principles provide general recommendations that States should follow to protect individuals, society and the environment.

7.2.2.3. Supplementary Guidance to the 2003 RSs CoC

a) Import and Export of RSs

In 2004, guidance was developed to supplement the 2003 RSs CoC to further assist States in implementing Paragraphs 23–29 of the CoC on the import and export of RSs. The Guidance on the Import and Export of RSs was approved in September 2004 (RSs Import/ Export Guidance) as supplementary to the 2003 RSs CoC. The text was developed following a similar process to that for the 2003 RSs CoC, as well as its adoption and endorsement by the policy-making organs. The RSs Import/Export Guidance represents the first international export control framework for RSs.

In response to a request from the Chairman of the Board during the Board meeting to approve the 2003 RSs CoC, the matter of the import and export of RSs was further explored. During 2003–2004 the Secretariat convened working groups composed of legal and technical experts to discuss ways to strengthen the transfer of responsibility between States when sources are to be transported form the exporting States to the importing State. Safety and security of the transfers of RSs across borders were of concern because they were not always being tracked and countries were often unaware that large sources had entered their territories. Further, there was minimal evaluation of whether the recipient was licensed to possess and use the sources and whether the receiving State had adequate controls to ensure the source would be managed in a safe and secure manner. While the 2003 RSs CoC contained general export provisions, specific guidelines were considered necessary so that these transactions were carried out in a safe, secure and internationally harmonized fashion.

In September 2004, the Board approved the supplementary RSs Import/ Export Guidance. In Resolution GC(48)/RES/10.D, the GC welcomed the Board's approval; endorsed the supplementary Guidance while recognizing that it is legally non-binding. The 2004 RSs Import/ Export Guidance was published in March 2005[9]. The supplementary Guidance is focused on those RSs in Categories 1 and 2 of Annex I of the 2003 RSs CoC but it may also be applied to other RSs, as deemed necessary by a State. The objective of the Guidance is to improve safety and security of imports and exports of RSs in accordance with the provisions of the 2003 RSs CoC.

In 2011, the IAEA convened a consultants meeting to consider what revisions may be necessary to the RSs Import/ Export Guidance after 6 years of implementation. Later, it was followed by a technical meeting to consider the consultants' recommendations. There was general consensus that the main provisions of the RSs Import/ Export Guidance should not be altered. However, participants supported revisions to update and clarify the text in order to improve harmonized implementation, based on experience. The biggest change was to Annex 1 of the RSs Import/ Export Guidance which provides a questionnaire for helping assess a State's ability to safely and securely manage sources. A revised text was approved by the Board in September 2011, endorsed by the GC in resolution GC(55)/RES/9 (2011) revised and published in May 2012 [4].

b) Management of Disused RSs

The President of the 2013 Abu Dhabi Conference recommended that "additional guidance at the international level for the long-term management of disused RSs should be developed" [16].

In 2014, the GC in Resolution GC(58)/RES/10 paragraph 17, encouraged the Agency to "improve the long-term management of disused sealed RSs", and in Resolution GC(58)/RES/11 paragraph 22 "call[ed] upon all [MSs] to ensure that there is adequate provision for safe and secure storage and disposition pathways for disused radioactive sealed sources". During 2014-2016, three Open-ended Meetings of Legal and Technical Experts were convened to develop guidance. The draft Guidance on the Management of Disused RSs was considered by the Board in March 2017. However, informal additional consultations on the proposed text were needed resulting in a revised text being submitted to the Board in September 2017. The revised text was approved by the Board on 11 September 2017, which in resolution GC(61)/RES/8 (paragraph 26) on 21 September 2017 was welcomed by the GC which also endorsed the Guidance while recognizing it is legally non-binding and published in May 2018 [5].

The supplementary Disused RSs Guidance is focused on the safe and secure management of disused sources within the scope of the 2003 RSs CoC[15]. The supplementary Disused RSs Guidance provides further guidance regarding the establishment of a national policy and strategy for the management of disused sources, and on the implementation of management options such as recycling and reuse, long term storage pending disposal and return to a supplier. The Guidance is intended to consolidate and provide further details on the management of disused sources consistent with the Code. The Guidance takes account of the JC [13], as well as the relevant IAEA Safety Standards and Nuclear Security Series publications and the Nuclear Energy Series.

7.3.SAFETY OF RRS

RRs provide important benefits throughout the world, including research, education, radioisotope production, fuel and materials testing and medical and industrial applications. For more than 60 years, these reactors have been centres of innovation and productivity for nuclear science and technology programmes around the world. These nuclear reactors primarily generate neutrons — rather than power — for research, education and training purposes, as well as for applications in areas such as industry, medicine and agriculture. They also contribute to building expertise to support national nuclear power programmes [26]. According to the IAEA Research Reactor Database (RRDB), the number of RRs that have been constructed worldwide for civilian applications is 818. Of the reactors constructed, 236 are currently in operation, 58 are permanently shut down for decommissioning, 13 are in an extended shutdown state, and 511 have been decommissioned (as at January 2021)[16]. More than two-thirds of all operating RRs worldwide are over thirty years old.

7.3.1. Background to the Development of the 2004 RRs CoC

The adoption by the Board and endorsement by the GC of the RRs CoC in 2004 marked an important step towards an international nuclear safety regime for RRs that may be considered as being comparable to that for nuclear power plants (NPPs) under the CNS [10]. It represented the culmination of several years of work to develop a Code of Conduct and obtain a consensus on its provisions.

[15] Disused sources are defined as sources that are no longer used and there is no intention of using them again in the practices they were authorized. Spent sources, which can no longer be used for their intended purposes as a result of radioactive decay, are a sub-set of disused sources.

[16] See the IAEA Research Reactor Database (RRDB) can be accessed here < https://www.iaea.org/resources/databases/research-reactor-database-rrdb >.

At the outset, it is recalled that the scope of the CNS [10] adopted in 1994 and which entered into force in 1996 was purposefully limited to apply to those reactors that posed the greatest safety risk due to the magnitude of the inventory of radioactive isotopes and the stored energy, being nuclear power reactors. The CNS therefore excluded the category of *RRs*, which existed in considerable numbers and variety, including in many countries with no nuclear programme[17]. In the absence of any formal international agreement, the question of developing a normative instrument to handle this family of nuclear installations was raised. The process leading to the 2004 RRs CoC began in 1998, when the IAEA International Nuclear Safety Advisory Group (INSAG) first informed the DG of concerns about the safety of RRs. INSAG has identified three major safety issues: the increasing age of RRs; the number of RRs that are not operating anymore but have not been decommissioned yet; and the number of RRs in countries that do not have appropriate regulatory authorities. Later in April 2000, INSAG suggested the development of a Protocol to the CNS [10] or some similar legal instrument as a way of establishing a better international safety framework for RRs. Pursuant to GC GC(44)/RES/14 a Working Group was convened by the IAEA Secretariat. The Working Group's recommendations were submitted to the Board, which requested the Secretariat (GOV/2001/28-GC(45)/11-paragraph 18) to develop and implement, in conjunction with MSs, an international *RR* safety enhancement plan. The Board's decision was endorsed by the GC GC(45)/RES/10. An element of the plan included the preparation of a Code of Conduct on the safety of RRs with a view to establishing the desirable attributes for management of *RR* safety.

The Code of Conduct was drafted at two meetings of an Open-ended Working Group of Legal and Technical Experts in 2002. This draft Code of Conduct was circulated to all MSs for comment. On the basis of the responses received, a revised draft of the RRs CoC was prepared by the Secretariat with the advice of an expert Working Group. The revised draft RRs CoC was again circulated to all MSs for comment, along with the report of the Chairman of the Expert Working Group. In March 2004, the Board in adopting the final draft of the RRs CoC, requested the DG to circulate the approved Code of Conduct to all MSs and relevant international organizations and transmit it to the GC with a recommendation for its endorsement and a call for its wide application. In September 2004, in resolution GC(48)/RES/10.A.8 the GC welcomed the Board's adoption of the RRs CoC, and endorsed the guidance in the RRs CoC. Further, the GC encouraged MSs to apply the RRs CoC guidance to the management of RRs. Finally, it requested the Secretariat to continue to assist MSs in the implementation of the RRs CoC and associated safety guidance within available resources. In accordance with resolution GC(48)/RES/10, MSs are encouraged to use the CoC as the basis upon which to regulate and conduct RR activities. The 2004 RRs CoC was published in 2006 [3].

7.3.1.1. Scope, Objectives and Salient Provisions of the 2004 RRs CoC

In accordance with resolution GC(48)/RES/10, MSs are encouraged to use the 2004 RRs CoC as the basis upon which to regulate and conduct *RR* activities. The Code of Conduct applies to the safety of RRs at all stages of their lives from siting to decommissioning but does not apply to the physical protection of RRs or to RRs within military or defence programmes[18]. Its objective is to achieve and maintain a high level of safety in civilian RRs worldwide through

[17] For statements on the scope of the CNS made during the Diplomatic Conference held from 14 to 17 June 1994 see IAEA, Convention on Nuclear Safety, Legal Series No. 16, IAEA, Vienna (1994).

[18] For the purpose of the Code, 'research reactor' means a nuclear reactor used mainly for the generation and utilization of neutron flux and ionizing radiation for research and other purposes, including experimental facilities associated with the reactor and storage, handling and treatment facilities for radioactive material on the same site that are directly related to safe operation of the research reactor. Facilities commonly known as critical assemblies are included.

the enhancement of national measures and international cooperation including, where appropriate, safety related technical cooperation. This objective is to be achieved by proper operating conditions, the prevention of accidents and, should accidents occur, the mitigation of the radiological and non-radiological consequences of emergencies affecting RR, in order to protect workers, members of the public and the environment against radiation hazards. While non-binding, the 2004 RRs CoC is intended to serve as guidance on the development and harmonization of laws, regulations and policies on the safety of RRs. It offers best practice guidance based on international consensus and forms a framework for international cooperation and information sharing on *RR* safety. Unlike the 2003 RSs CoC, the 2004 RRs CoC addresses not only States and regulatory bodies but also RR operating organization.

The 2004 RRs CoC provides 'best practice' guidance to these stakeholders for the management of *RR* safety. In implementing the Code through national safety regulations, States are encouraged to make appropriate use of Agency safety standards relevant to RRs and those relating to the legal and governmental infrastructure for nuclear, radiation, radioactive waste, and transport safety such as GSR Part (Rev.1) (2015) [14].

7.4.OTHER IAEA CODES AND PROPOSALS FOR THE DEVELOPMENT THEREOF

7.4.1. Overview

This Part now discusses the development of the IAEA CoP Transboundary Movement of 1990 and the past efforts to establish the proposed 2006 International Emergency CoC and the proposed 2013 Metal Recycling CoC. This Part also highlights ongoing activities to consider the development of Facilitation CoC.

7.4.2. Transboundary Movement of Radioactive Waste (1999)

During the late 1980s the unauthorized international transboundary movement of radioactive waste, particularly to the territory of developing countries, and the danger of improper management and disposal of such waste became a subject of increasing concern to many countries[19]. No convention, code or guide on international transboundary movement of radioactive waste existed at that time. In June 1988, the Secretary General of the Organization of African Unity (OAU) wrote to the IAEA DG highlighting concern at the practice of disposing of nuclear and industrial wastes in African countries[20]. Pursuant to resolution GC(XXXII)/RES/490 adopted by the GC in September 1988, the IAEA DG set up an international Technical Working Group of Experts[21]. The Group was entrusted with elaborating, with a sense of urgency, a [CoP]"based on, inter alia, a review of current national and international laws and regulations on waste disposal". In September 1989, the GC, expressed the hope that the Technical Working Group would "complete its task in time for

[19] For an overview of the development of the 1990 TM CoP see Jankowitsch, O., A code of practice on the international transboundary movement of radioactive waste: Countries adopt a global response to the alleged "dumping" of radioactive waste, IAEA BULLETIN, 4/1990, IAEA (1990).

[20] With his letter, the Secretary General of the OAU also transmitted to the Agency the resolution adopted by the African Heads of State and Government at their summit in 1988. It inter alia requested the OAU in "close collaboration with the [IAEA DG]" "to assist African countries to establish appropriate mechanisms for monitoring and control of the movement and disposal of nuclear and industrial wastes in Africa". It should be highlighted that that no illegal disposal of radioactive waste had been found but the possibility of unauthorized movement and "dumping" of such waste, notably in the territories of developing countries, had to be addressed.

[21] The Technical Working Group of Experts was composed of experts from 20 Member States and observers from five Member States and four international organizations. It met twice from 22 to 25 May 1989 and from 5 to 9 February 1990.

submission of a draft CoP on Radioactive Waste Transactions to the GC at its thirty-fourth (1990) regular session" (Resolution GC(XXXIII)/RES/509). Further to the action of the Board[22], the GC adopted the TM CoP on 21 September 1990 and requested the DG to, inter alia, to take all necessary steps to ensure wide dissemination of the TM CoP at both the national and the international level (Resolution GC(XXXIV)/RES/530) [6].

The 1990 TM CoP addresses a specific aspect of radioactive waste management, namely the conditions under which radioactive waste should be moved from one country to another[23]. The 1990 TM CoP establishes a set of principles designed to serve as guidelines in ensuring the safety of international transboundary movements of radioactive waste. It provides that such movements should take place only when they are authorized by all States involved in the movement (that is, "with the prior notification arid consent of the sending, receiving and transit States"), when all stages of the movement can be conducted in a manner consistent with international safety standards and when all States involved in the movement have the administrative and technical capacity and regulatory structure to fulfil their respective responsibilities for the movement in a manner consistent with international safety standards.

The 1990 TM CoP relies on international standards for the safe transport of radioactive material and the physical protection of nuclear material, as well as the standards for basic nuclear safety and radiation protection and radioactive waste management; it does not establish separate guidance in these areas. Further, the 1990 TM CoP is intended to serve as guidelines to States for, inter alia, the development and harmonization of policies and laws on the international transboundary movement of radioactive waste. Pursuant to the 1990 TM CoP every State should take the appropriate steps necessary to ensure that radioactive waste within its territory, or under its jurisdiction or control is safely managed and disposed of, to ensure the protection of human health and the environment. Further, every State should take the appropriate steps necessary to minimize the amount of radioactive waste, taking into account social, environmental, technological and economic considerations. Finally, the 1990 TM CoP, which is advisory, does not affect in any way existing and future arrangements among States which relate to matters covered by it and are compatible with its objectives.

Article 27 of the JC of 1997 [13] is largely based on the 1990 TM CoP. Following the spirit and the purpose of the 1990 TM CoP, preambular paragraph (xii) of the JC text recognises the sovereign right of every State to prohibit the import of radioactive waste into its territory. Furthermore, Article 27 of the JC ensures that transboundary movements of radioactive waste take place in accordance with internationally accepted safety standards and respective national laws and regulations. Finally, as did the 1990 TM CoP in the form of a recommendation only, Article 27 of the JC, in effect, definitely disapplies the Basel Convention (see section 7.4.7). Different from the 1990 TM CoP, Article 27 of the JC prohibits the shipment of spent fuel or radioactive waste to Antarctica and, also different from the 1990 TM CoP, the JC seems to

[22] The September 1990 session of the Board requested the DG to transmit the Code to the GC with a recommendation that the Conference adopt the Code, ensure its wide dissemination and monitor its implementation.

[23] Such waste, is defined as any material that contains or is contaminated with radioriudidgs.at concentrations or radioactivity levels greater than the 'exempt quantities' established by the competent authorities and for which no use is foreseen "

accord less protection to states of transit, meaning States through whose territory a transboundary movement of spent fuel or radioactive waste takes place[24].

7.4.3. Emergency Preparedness and Response (2005-2006)

An example of an unsuccessful attempt to establish a new IAEA Code of Conduct can be found regarding the proposed draft Code of Conduct on the international emergency management system. This Code did not materialize due to a lack of political will at that time, combined with a lack of full and correct interpretation of the international emergency response and preparedness (EPR) framework (Emergency Conventions, EPR Safety Standards, operational arrangements), During 2005 and 2006, some States were of the view that then existing EPR system should be consolidated, expanded and strengthened. Their aim at the time was to close purported gaps that existed for incidents and emergencies via the negotiation of a Code of Conduct addressing, amongst other things, elements of response to malicious acts and other nuclear security-related issues.
It is recalled that the legal foundations of the international EPR system derive from the Agency's statutory objectives and are based on the Early Notification and Assistance Conventions[25] [11,12]. In addition to these Conventions, there were at the time (and still are) relevant IAEA Safety Requirements[26]. Furthermore, a number of operational arrangements were established by the Secretariat, the Policy-making Organs, and the Meetings of the Competent Authorities (being a bi-annual meeting of the representatives of the competent authorities in accordance with the Early Notification Convention and the Assistance Convention) [27.] These included Board and GC documents and resolutions and the reports of the DG elaborating the Agency's incident and emergency system and Incident and Emergency Centre (IEC)[28]. The various operational arrangements served both to facilitate the implementation of existing obligations under the Conventions, as well as to reflect developments beyond their scope of application but within scope of the IAEA Safety requirements and of the existing/in-development operational arrangements.

The proliferation of parallel operational arrangements, however, was creating confusion and magnified the call for a consolidated, harmonized and comprehensive EPR system. Moreover,

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[24] IAEA and OECD/NEA, Tonhauser W. and Jankowitsch-Prevor O., The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, International Nuclear Law in the Post-Chernobyl Period, A Joint Report by the OECD Nuclear Energy Agency ISBN 92-64-02293-7 and the International Atomic Energy Agency, 2006.
[25] In addition, the CNS [10] and JC [13] address some aspects of EPR in relation to nuclear facilities and to management of spent fuel and radioactive waste, respectively. The CPPNM and its Amendment include provisions for States Parties to voluntarily exchange information, as and where appropriate, with the IAEA and other relevant international organizations in the case of nuclear security incidents within the scope of the CPPNM and amended Convention.
[26] At the time there was the IAEA Safety Standards Series No. GS-R-2, Preparedness and Response for a Nuclear or Radiological Emergency. This has been since superseded by IAEA Safety Standards Series No. GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency (2015).
[27] At the time there was the 2004 International Action Plan for Strengthening the International Preparedness and Response System for Nuclear and Radiological Emergencies, the Emergency Notification and Assistance Technical Operations manual (ENATOM), the IAEA Response Assistance Network (RANET) and the Joint Radiation Emergency Management Plan of the International Organizations (J-Plan).
[28] Prior to 1 February 2005, the centre was known as the Emergency Response Centre (ERC). Its functions were extended to include: incident reporting, coordinating prompt assistance to requesting States in the case of a nuclear security incident, and to providing coordinated technical support to the IAEA's Division of Public Information in the case of an incident of safety or security concern to the media.

the third meeting of the Meeting of the Competent Authorities[29], recommended to the IAEA Secretariat that it initiate the development of a Code of Conduct for an International Emergency Management System (the International Emergency CoC) as the basis to support the operational aspects of the Conventions and the Emergency Notification and Assistance Technical Operations Manual (ENATOM) — the then existing concept of operations manual[30]. In 2005, the Secretariat received a request to seek to close gaps in the legal framework of the Conventions by negotiating the International Emergency CoC[31]. In its resolution GC(50)RES/10, the GC in September 2006 welcomed the initiative to develop such a "[CoC] with the objective of ensuring appropriate development, implementation and maintenance of harmonized [EPR] programmes". Pursuant to the above request and in light of GC(50)RES/10, the Secretariat convened a Technical Meeting from 11 to 15 December 2006. The Technical Meeting did not aim to finalize a draft Code but rather to elaborate a draft text which was circulated for consideration by MSs.

In light of the discussions at the Technical Meeting, representatives at the 2007 Competent Authorities' meeting, while reaffirming the need to strengthen the international framework for emergency preparedness and response and agreeing with the intent of the proposed recommendations, noted that the proposed draft 2006 International Emergency CoC was not universally accepted[32]. As a result, representatives recommended the importance of the Secretariat continuing its efforts towards a strengthened international framework by identifying suitable alternatives to the proposed 2006 International Emergency CoC.

7.4.4. Control of Transboundary Movement of Radioactive Material Inadvertently Incorporated into Scrap Metal and Semi-Finished Products of the Metal Recycling Industries (2010-2013)

Another example of an unsuccessful attempt to establish a Code of Conduct can be found in the area of the control of transboundary movement of radioactive material inadvertently incorporated into scrap metal and semifinished products of the metal recycling industries. For several decades now, metal recycling is an important industrial activity with a large international dimension due to the substantial transboundary movement of scrap metal and the semi-finished products of the metal recycling industries. In spite of the efforts made to improve the safety and security of sealed RSs that may pose a significant risk to individuals, society and the environment, such sources may still inadvertently be incorporated into scrap metal. RSs in lower categories than those considered by the RSs CoC may also present a risk to health or be the source of contamination in metal recycling facilities. Furthermore, radioactive material in unsealed form may be present in scrap metal, either as radionuclides of natural origin or for reasons of inadequate control of radioactive material used in nuclear or industrial facilities. The

[29] IAEA, Report of the Third Meeting, Third Meeting of the Representatives of Competent Authorities Identified Under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, NCAM/REP/2005, 2005-08-08.
[30] The Emergency Notification and Assistance Technical Operations Manual (EPR-ENATOM 2004) was first published on 18 January 1989 and was republished in December 2000 and December 2004. The 2004 edition reflected, inter alia, that emergency situations could arise from both accidents and deliberate acts (malicious acts). Superseding the previous edition, IEComm (2012), the current manual is EPR-IEComm (2019) - the Operations Manual for Incident and Emergency Communication, IAEA, Vienna (2020). EPR-IEComm (2019) addresses the international emergency communication arrangements for a nuclear or radiological emergency regardless of its origin, including those triggered by nuclear security incidents.
[31] IAEA, Nuclear Safety Review 2007, Section D.3, Page 7, IAEA, Vienna (2007).
[32] IAEA, Report of the Fourth Meeting, Fourth Meeting of the Representatives of Competent Authorities Identified Under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, CAM/REP/2007, 2007-09-19.

presence of radioactive material in scrap metal or the semi-finished products of the metal recycling industries may cause health, economic and public acceptance problems. However, there are no globally agreed procedures established for the safe handling of radioactive material in scrap metal when first discovered at border monitoring locations. When shipments of scrap metal containing radioactive material are rejected and transported without the proper application of radiation safety provisions, it becomes challenging to bring this material back under regulatory control.

The 2009 International Tarragona Conference was organized as a response to increasing global concerns. The participants of the conference unanimously recognized "the potential benefit that would result from establishing some form of binding international agreement between governments to unify the approach to trans-border issues concerning scrap metal containing radioactive material"[21]. In September 2009, in resolution GC(53)/RES/10, the IAEA GC noted "the outcomes from the [2009 Conference], and [requested] the Secretariat to take into account [its] recommendations […]". In response, the Secretariat held a Consultancy Meeting on the Establishment of an International Agreement on the Transboundary Movement of Scrap Metal Containing Radioactive Material in Vienna in July 2010 "to develop an initial draft proposal for an international agreement concerning the transboundary movement of scrap metal containing radioactive material". In September 2010, the GC requested the Secretariat to begin preparatory work on the development of a non-binding instrument, including the convening of an open-ended group of technical and legal experts to undertake exploratory discussions in line with the findings of the 2010 Consultancy Meeting. Further, to the request the Secretariat initiated the development of a Code of Conduct on the transboundary movement of radioactive material inadvertently incorporated into scrap metal and semi-finished products of the metal recycling industries. From 2011 to 2013, three open-ended technical meetings were held to develop a text resulting in proposed draft 2013 Metal Recycling CoC. In September 2013, in Resolution GC(57)/RES/9, the IAEA GC recorded that it "[a]ppreciate[d] the intensive efforts undertaken by the Secretariat to develop [the proposed draft 2013 Metal Recycling CoC], and encourage[d] the Secretariat to make the results of the discussion conducted on this issue available to MSs by issuing a relevant TECDOC…" In accordance with that resolution, the draft text of the proposed draft 2013 Metal Recycling CoC was published in February 2014, but the Metal Recycling CoC was not further elaborated[33].

The objective of the proposed draft 2013 Metal Recycling CoC was to protect people, property and the environment from ionizing radiation arising from the transboundary movement of radioactive material that may be inadvertently incorporated into scrap metal and semi finished products of the metal recycling industries by bringing that radioactive material under regulatory control. The proposed Code of Conduct set out provisions for the discovery of, and response to, radioactive material inadvertently incorporated into scrap metal and the semi-finished products of the metal recycling industries destined for or delivered to an importing State from an exporting State. Implementation of the proposed draft 2013 Metal Recycling CoC was without prejudice to the authorized movement of radioactive material. Implementation of the Code of Conduct was to be accomplished through the development, harmonization and implementation of national policies, laws, regulations, guidance, and strategies, as applicable, and through the fostering of international cooperation. In implementing the Code of Conduct, States were encouraged to make appropriate use of the IAEA's safety standards.

[33] IAEA, Control of Transboundary Movement of Radioactive Material Inadvertently Incorporated into Scrap Metal and Semi-finished Products of the Metal Recycling Industries, IAEA, Vienna (2014).

Similar to the 2004 RR CoC, the proposed draft 2013 Metal Recycling CoC did not only address the roles of the State, the regulatory body and the IAEA but also that of the industry. The proposed draft Code of Conduct was intended to harmonize the approaches of MSs in relation to the discovery of radioactive material that may inadvertently be present in scrap metals and semi-finished products subject to transboundary movement, and their safe handling and management to facilitate regulatory control. While the proposed draft 2013 Metal Recycling CoC was non-binding, the Secretariat expected that its implementation would help national authorities to ensure that radioactive material that has inadvertently been incorporated into scrap metal or the semi-finished products of the metal recycling industries would be discovered and appropriately managed within an appropriate radiation safety framework.

The proposed draft 2013 Metal Recycling CoC was intended to complement existing international legal instruments, standards and guidance relating to radiation, transport and radioactive waste safety. For example, it took account of other related developments spanning the past decade or so that relate to the safety and security of RSs, in particular the RSs CoC and its supplementary Guidance. Further, the proposed draft 2013 Metal Recycling CoC also took account of the provisions of the JC [13], the Early Notification and Assistance Conventions [11, 12] and the arrangements given in the then existing concept of operations manual for communicating to the IAEA in emergencies (IEComm 2012)[34].

Notwithstanding the lack of consensus on the proposed draft 2013 Metal Recycling CoC, the Secretariat continues to work on the radiation safety aspects of the management of movement of scrap metal or materials produced from scrap metal that may inadvertently contain radioactive material continues. In September 2021, the GC in Resolution GC(65)/RES/8 repeated its request for the Secretariat to further facilitate, as appropriate, information exchange between interested Member States in this area. Finally, in the context of meetings on 2003 RSs CoC with regard to the inadvertent presence of radioactive materialin the metal scrap and metal recycling industry products, the IAEA was encouraged to continue to promote its existing publications on this topic and, considering the various available options to increase awareness on this issue and to encourage harmonized approaches to prevent and manage such presence,

[34] Additionally, the proposed draft CoC was developed in light of the then General Safety Requirements which contain recommendations for protection against exposure to ionizing radiation and for the safety of RSs (Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (IAEA General Safety Requirements Part 3, Vienna, 2011), and the then General Safety Requirements containing recommendations regarding the necessary infrastructure for safety (IAEA Governmental, Legal and Regulatory Framework for Safety Part 1, Vienna, 2010), as well as the then IAEA Safety Requirements for the transport of radioactive material (Regulations for the Safe Transport of Radioactive Material (IAEA Safety Standards Series No. SSR-6, Vienna 2012) and General Safety Requirements Part 7, (2015) that include requirements applicable to nuclear or radiological emergencies taking place during transport of radioactive material. In addition, the proposed draft CoC took account of the guidance given in the IAEA Safety Guide, Application of the Concepts of Exclusion, Exemption and Clearance (IAEA Safety Standards Series No. RS-G-1.7, Vienna, 2004) and in the IAEA Safety Guide, Control of Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries (IAEA Safety Standards Series No. SSG-17, Vienna, 2012). Finally, the proposed draft CoC was envisaged as being complementary to the Safety Guide on Control of Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries (IAEA Safety Standards Series No. SSG-17), which provides recommendations, principally within a national context, on the protection of workers, members of the public and the environment in relation to the control of radioactive material inadvertently incorporated in scrap metal.

from a safety and a security perspective, evaluate the benefits and drawbacks of these options to decide on the best way forward[35].

7.4.5. Facilitation of the Safe and Secure Transport of Radioactive Materials (2019)

Radioactive materials are transported for use in medicine, industry, research and for production of power. Transport of such materials is governed by national and international regulations. A robust international regulatory framework has been established for several decades for the transport of radioactive material (Class 7 dangerous goods) that applies to all modes of transport. The principal requirements for the safe transport of radioactive material are established in the IAEA Regulations for the Safe Transport of Radioactive Material, 2018 Edition (SSR-6, Rev. 1) [27]. The safety requirements of SSR-6, Rev. 1 are in turn incorporated into the UN Recommendations on the Transport of Dangerous Goods – Model Regulations [28], from which they are subsequently incorporated in the modal regulations that apply to international transport by air (Technical Instructions for the Safe Transport of Dangerous Goods by Air) [29] and sea (International Maritime Dangerous Goods (IMDG) Code) [30]. The requirements are also incorporated into regional agreements that apply to the transport of radioactive material (e.g., ADR Guide) and in most countries, into national regulations for the transport of radioactive material.

The great majority of shipments of radioactive material occur routinely and without issue every day by all modes of transport [36]. Despite the establishment of a robust international regulatory framework and compliance with national and international regulatory requirements and good transportation practices, denials and delays of some shipments occasionally take place, which results in a lack of reliability and efficiency concerning the international transport of radioactive material. This results in unwarranted actions, rerouted journeys, and increases in financial and human resources creating frustration for the parties concerned. Efforts to reduce denials have both safety and security benefits In general, there is a lack of agreement around the world about the extent of denial. This is partly because industry is, in fact, finding sub-optimal, costly and time-consuming solutions to getting their product from one destination to another which has economic and social consequences. While there is evidence of instances of denial and delay, there was no accurate measure of the nature and extent of the issues.

The 2003 International Transport Conference addressed problems with denials of shipments and noted that the nuclear industry and other industries using radioactive material were facing a reduced availability of transport routes, modes and carriers as a result of decisions by commercial carriers, ports and handling facilities not to accept radioactive material [22]. In Resolution GC(49)/RES/9 of September 2005, the GC encouraged the Agency to constitute an International Steering Committee to oversee the resolution of the issue of denials of shipments of radioactive material. In 2006 the IAEA established the International Steering Committee on Denials of Shipments (ISC-DOS) as an inter-agency committee with a mandate over a limited period of time, to address the issue of denial. The work of the ISC led to the creation of a comprehensive Action Plan, a network of national focal points (and Regional Coordinators), a

[35] IAEA, Report of the Chairman, Open-ended Meeting of Technical and Legal Experts to Share Information on States' Implementation of the [CoC] on the Safety and Security of RSs and its Supplementary Guidance, Vienna, Austria, 27–31 May 2019, GOV/2020/35-GC(64)/7, Annex 1, Attachment 2.

[36] Wright T. de, Gray P., Sobriera A. C. F., Schwela U., Xavier C. C., Delay and Denial of Shipment, Proceedings of the International Conference on the Safe and Secure Transport of Radioactive Material: The Next Fifty Years, Held in Vienna, Austria, 16-21 October 2011, IAEA-TECDOC-CD-1792, IAEA, Vienna (2016).

database recording reports of denials, a set of training packages and a communication strategy[37]. Notwithstanding these efforts, the International Conference on the Safe and Secure Transport of Radioactive Materials, held in October 2011, found that denial of shipments continued to be a problem which must be addressed[38]. In 2013, the ISC-DOS was dissolved and in 2014 the Transport Facilitation Working Group (TFWG), a standing group of experts made up of former Chairs of ISC-DOS, and representatives of interested MSs and industry bodies, was set up[39].

In September 2018, the GC in Resolution GC(62)/RES/6 recognized ongoing difficulties relating to the delay and denial of shipments. In September 2019, the GC in Resolution GC(63)/RES/7 requested the Secretariat to hold a technical meeting to share experience and with a view to establishing a Working Group, with full participation of interested MSs and relevant experts, to consider the options for addressing denials of and delays in shipment, including a Code of Conduct on facilitation, and provide an initial report on these options to the MSs by June 202040. Due to the COVID 19 pandemic, the meeting took place, virtually, 23–26 March 2021. The Agency's efforts to establish the Working Group were welcomed by the GC that September in Resolution GC(65)/RES/8

7.4.6. Determining the Effectiveness of the IAEA Codes of Conduct

7.4.6.1. Trends and Developments

The 2003 RSs CoC was developed to strengthen the safety and security of sealed RSs and the 2004 RRs to strengthen the safety of RRs. Today, the importance of both Codes of Conduct as an element of the international legal framework for the safe and secure uses of nuclear technology and its applications, is recognized by IAEA policy-making organs and IAEA ministerial and other conferences[41], as well as in different fora, including, in the case of the 2003 CoC, the past Nuclear Security Summits and the EU and the Organization for Security and Co-operation in Europe.

Both IAEA Codes of Conduct serve to codify good practices to improve national law-making leaving flexibility to states. Despite their legally non-binding form, CoC do frequently alter the behaviour of their targets — usually by containing standard minimum rules and so forth. In fact,

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[37] The objectives of the ISC-DOS were to serve as a mechanism to facilitate the coordination of a comprehensive international work plan of activities conducted by the organizations of the Committee membership related to delays and denials of shipments of radioactive material. Membership of the ISC-DOS was drawn from UN and other international, governmental and nongovernmental organizations, transport trade organizations and manufacturers of sources of radioactive material.

[38] IAEA, Proceedings of the International Conference on the Safe and Secure Transport of Radioactive Material: The Next Fifty Years, Held in Vienna, Austria, 16-21 October 2011, IAEA-TECDOC-CD-1792, IAEA, Vienna (2016).

[39] TFWG is a non-IAEA body. Its role is to propose strategies and activities necessary to facilitate the safe and secure global transport of radioactive materials, and to contribute to their implementation. It submits regular reports to the Inter-Agency Group (IAG), composed of representatives of the IAEA, ICAO, and IMO Secretariats as well as UNECE.

[40] IAEA, GC Resolution GC(64)/RES/9 (2020).

[41] For example paragraph 12 of the Ministerial Declaration of the IAEA International Conference on Nuclear Security: Sustaining and Strengthening Efforts, Vienna, Austria, 10–14 February 2020, states "We [the Ministers of IAEA MSs] commit to maintaining effective security of [RSs] throughout their life cycle, consistent with the objectives of the [2003 RSs CoC] and its supplementary guidance documents.

both Codes are detailed, far more so than one could imagine being established in a legally non-binding instrument.

The effectiveness of these Codes of Conduct may be considered from the view as to whether they induced observable desirable changes by States' behaviour consistent with their respective objectives such as concerns the national legislative and regulatory framework. Their effectiveness being the measure of that change. Both Codes of Conduct require implementation at the national level by States such as through the passage of legislation, promulgation of regulations, designation of institutions and enforcement of rules. States must have "due regard" to Codes of Conduct where they reflect a consensus of relevant states, even if they are not obliged to follow them in every single detail.

With regard to the 2003 RS CoC, an increasing number of countries now recognise that it provides the international (non-binding) legal foundation for RSs safety and security. National regulatory infrastructures and regulations have been strengthened and, in many cases where they previously did not exist, they have now been developed. As a result, the number of incidents leading to serious radiation exposure has notably declined. By intensifying the implementation of the 2003 CoC and its supplementary Guidance, countries are strengthening radiation safety and nuclear security not only domestically, but also internationally. Bilateral, regional and multilateral cooperation, programmes have been established to assist in the establishment of regulatory infrastructures, to share experiences, to assist in the improvement of both the physical protection and security management of RSs throughout their life cycle and to build capacity for EPR to radiological emergencies. Also, some States have established bilateral administrative arrangements to ensure that the import and export of RSs are done in a harmonized manner consistent with the supplementary 2011 Import/Export Guidance.

Implementation of Codes of Conduct can be encouraged through the incorporation of "peer review" mechanisms such as in the CNS [10] and JC [13]. While at the outset, States did not wish the inclusion of such a mechanism during the preparatory work on the 2003 RS CoC, the international community reconsidered the effectiveness of its application. The process established since their initial adoption which enable States to report their progress in implementing the principles in both Codes of Conduct, on a voluntary basis, is considered a useful mechanism for States to assess their continuing progress, to identify further needs and to benefit from the experiences of others.

With regard to the 2004 RRs CoC, feedback from Agency activities, international conference and meetings show that an increasing number of Member States are applying its provisions, including on regulatory supervision, ageing management, periodic safety reviews and preparation for decommissioning. The IAEA has also organized major international conferences on topics of interest to the RR community every four years, with the last, held in 2019 in Argentina[42]. During such activities the improved implementation by MSs of the provisions of the 2004 RRs CoC has been recognised, as has the progress in improving utilization of many research reactors for a variety of purposes, including research, education and training, and production of radioisotopes for medical and industrial applications.

[42] IAEA, Conclusions and Recommendations, International Conference on Research Reactors: Addressing Challenges and Opportunities to Ensure Effectiveness and Sustainability, 25–29 November 2019, Buenos Aires, Argentina, STI/PUB/1927 (2020). In 2015, an International Conference on Research Reactors: Safe Management and Effective Utilization was held in Vienna.

By enhancing the implementation of the 2004 RRs CoC, countries are strengthening safety of their RRs. Many countries established regulatory supervision programmes for RRs, implemented (or planning) ageing management programmes including projects for refurbishment and modernization of facilities in accordance with up-to-date safety standards as well as processes for periodic safety review consistent with the provisions of the code. Additionally, the number of research reactors in extended shutdown state has been significantly reduced, resulting in reduction of the global safety and security risk.

The main challenges the research reactor community is facing include the need to ensure regulatory effectiveness, manage the ageing of the facilities, ensure knowledge transfer, and improve utilization programmes and strategic planning. Several challenges have been noted regarding fuel management and decommissioning, including the continued supply of fresh fuel for some types of RRs and back-end options for spent fuel for countries that do not operate NPPs[43]. The lack of preliminary decommissioning plans for many operating RRs has also been noted and development of such plans should start as soon as possible.

7.4.7. Recourse to a Code of Conduct

The reasons to opt for the adoption of a Code of Conduct could be the will to avoid formal and visible pledges, to avoid lengthy ratification procedures, to be able to easily renegotiate or modify as circumstances change and to achieve a result. A practical advantage of Codes of Conduct over formal treaties is that they could take effect without the need for lengthy ratification procedures. Negotiations leading to the adoption of a new Convention or the amendment of one, are typically lengthy processes. Further, the expression by States Parties to be bound by a new Convention or an amendment is typically equally lengthy and in the case of an amendment implies that until all States Parties have expressed their consent different regimes will apply to different States.

At first glance, some readers may consider that a legally non-binding instrument, like a Code of Conduct, appears to be a step backwards. Like the safety standards they are not obligatory, leaving States free to choose whether to apply at will the norms contained therein.

However, whatever the legal form of an instrument — whether it is binding such as a treaty, or not — is to a certain extent not of primary importance. In fact, a binding instrument may itself contain non-obligatory language and it may do very little to alter the behaviour of its addressees — even more so if it is not in force or is deficient from a lack of adherence. In practice, non-obligatory and merely recommendatory texts may have as much effect as formal rules and obligations, in so far as channelling state conduct. In addition, the focus in the field of international cooperation need not be on the formal character of the commitment but rather on the degree of compliance with that commitment. As with any international legal instrument, but even more so with a Codes of Conduct, proper implementation or application is key to its success.

At the same time, a non-binding instrument such as a Code of Conduct can be supported by many more States committing themselves to apply the guidance contained therein, than might become party to a legally binding convention. Wide acceptance of the 2003 RSs CoC as the primary instrument for the safety and security of RSs is reflected in the high number of political

[43] Supra note 40.

commitments to it. As former DG Hans Blix observed[44], it may seem paradoxical but, while we find that legal commitments are not always fulfilled, it is not infrequent that non-binding commitments are faithfully complied with.

7.4.7.1. Substitute or Foundation for a Binding Instrument

Codes of Conduct may serve dual roles. First, in the absence of the necessary political will to conclude a binding instrument, they can act as a substitute or foundation for a binding instrument until such time as the political will emerges.

For example. the 2003 RSs CoC and the 2004 RRs Code are examples of Codes of Conduct acting as a substitute for a legally binding instrument. In addition, the CoP on the International Transboundary Movement of Radioactive Waste of 1990 is an example of a Code of Conduct providing a foundation for legally binding provisions. More particularly, the provisions of the 2003 RSs CoC were consolidated in Article 27 (on the transboundary movement of radioactive waste and spent fuel) of the JC adopted in 1997 [13]. It is recalled that the Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention) is aimed at reducing the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries[45]. Article 1(3) excludes from the scope of the Basel Convention "wastes which, as a result of being radioactive, are subject to other international control systems, including international instruments, applying specifically to radioactive materials". However, no such instrument existed at the time the Basel Convention was opened for signature on 22 March 1989[46]. Development of the 1990 TM CoP went some way to addressing this issue, however, it was only with the adoption of the JC did the issue become addressed through a legally binding instrument[13].

On the one hand, a Code of Conduct may reflect the lack of political will on the part of States to allow more meaningful and binding international interventions in the field under consideration. On the other hand, the adoption of such a Code of Conduct demonstrates the acknowledgement that the existing normative documents are insufficient and need to be supplemented by an additional instrument. A Code of Conduct represents efforts by governments to formulate certain expectations and induce certain behaviour. It can create expectations of potential behaviour and sway the attitudes of the international actors. Often a Code of Conduct encompasses strong political commitments or moral obligations, indeed commitments and obligations that may well be stronger than many legal obligations. It cannot be denied therefore that non-legally binding Code of Conduct have practical or legal effect — a Code of Conduct can still have a significant impact on state action. By codifying "best practice", a Code of Conduct has the potential for broad-based adherence.
Experience has shown that when States explore new areas of international cooperation which have been heretofore reserved as a matter of domestic jurisdiction, a trial period is often required for States to satisfy themselves that it is "feasible" to undertake a legal commitment. The different labels used for such trial period commitments, " Code of Conduct ", "Guiding

[44] Blix, H., The role of the IAEA in the development of international law, 58(Issues 3-4) Nordic J. Int'l L. 231 (1989).
[45] Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1673 UNTS 5, 28 ILM 657 (1989), United Nations Environment Programme (UNEP).
[46] The Basel Convention entered into force on 5 May 1992.

Principles", etc., are merely to indicate that the international community is feeling its way through a new area of international cooperation.

Looking forward, we should recognize that there is no guarantee in moving from a Code to a convention that the latter would include the same detailed provisions as found in the two current IAEA Codes of Conduct or that it would attract a similar number of States to those currently supporting the RSs CoC. Questions may also be raised regarding how a convention might be introduced in parallel with the ongoing implementation of the existing Code of Conduct. In addition, there would be a need to consider whether the level of resources available to MSs under an IAEA Code of Conduct may be lowered if the code was converted to a convention.

Over the years, the question has been raised periodically as to whether States wish to convert the instruments into conventions. However, states have to-date not felt so inclined. There is recognition that the level of commitment is considerably higher in the case of a legally binding convention. Also, in the case of the 2003 RSs CoC some states consider that that the legal basis establishing an expectation by which national regulators are assured of receiving the necessary resources to execute their functions, is stronger if codified in a convention rather than a non-binding Code of Conduct. Nonetheless, views on the need for a legally binding convention for the safety and security of RSs remain limited and there continues to be no clear consensus or even majority in favour of such evolution.

7.4.7.2. Supplementary and/or Complementary to a Binding Instrument

Secondly, a CoC can be used to further elaborate, supplement and/or complement, albeit in a non-binding form, the provisions and scope of an existing legally binding instrument.

For example, the CPPNM (and the Amendment thereto) which does not cover RSs is supplemented, indirectly, by the 2003 RSs CoC. Likewise, the Code does not apply to nuclear material as defined in the CPPNM[8], except for RSs incorporating plutonium-239. It is also recalled that the Amendment of the CPPNM extends the scope of the CPPNM to cover, inter alia, the physical protection of nuclear material and nuclear facilities, including RRs, against sabotage. The safety of RRs being covered by the 2004 RRs CoC. In addition, regarding RRs, it is noted that the CNS [10] is supplemented, indirectly, by the 2004 RRs CoC. The CNS establishes the fundamental safety principles for achieving and maintaining a high level of nuclear safety worldwide through the enhancement of national measures and international cooperation for NPPs but does not apply to RRs.

Further, as concerns the safety and security of disused sealed RSs, the 2003 RSs CoC and its Guidance supplement the rather brief safety provisions contained in Article 28 of the earlier JC adopted in 1997[13]. The JC and the RSs CoC, whilst different in their nature, complement each other as regards the management of disused sealed sources but only insofar as safety aspects are concerned. Although the 2003 RSs CoC and the JC have their own legally distinct scope, they both cover the management of disused sources and orphan sources once they are designated as radioactive waste. In the case of the RSs CoC, the focus is on sealed RSs sealed RSs that may pose a significant risk to health. These are referred to as Category 1, 2 and 3 sources and are defined in Annex I of the Code. The scope of the JC covers, inter alia, RSs (not just sealed ones) from the point at which they become disused to their final disposal.[47] Synergies

[47] The JC defines radioactive waste as “radioactive material in gaseous, liquid or solid form for which no further use is foreseen by the Contracting Party or by a natural or legal person whose decision is accepted by the

clearly exist between the RSs CoC and the JC. In this context, it is also important to highlight how the two instruments have over the years come to co-exist with each other.

The management of disused sealed RSs has been a longstanding topic of interest and an overarching theme at previous Review Meetings of the JC. It was for this reason that during the international meeting of the 2003 RSs CoC held in May 2010, agreement was reached that it would assist participants' preparation for future meetings on the 2003 RSs CoC, if JC Contracting Parties attending the meetings of the 2003 RSs CoC, provided relevant parts of their National Reports prepared for the preceding review meeting under the JC. The aim being to allow the wider group of states participating in the meeting of the 2003 RSs CoC to be aware of issues faced under the JC. In the same vein, participants in the meeting of the 2003 RSs CoC also felt that efforts should be made to harmonise the application of the export/import criteria under the supplementary Guidance. More recently, the co-existence of the 2003 RSs CoC and the JC has been tested further with the development of the supplementary Guidance on the Management of Disused RSs. In addition, it is recalled that the proposed 2013 Metal Recycling CoC took account of the provisions of the JC applicable to "radioactive waste" and disused "sealed sources" as defined therein.

With regard to the elaboration of a Code of Conduct addressing the provisions of an existing legal instruments, mention can be made of the proposed draft 2006 International Emergency Code of Conduct which was intended to supplement the Early Notification and Assistance Conventions. Although the GC welcomed the initiative to develop the proposed Code of Conduct to strengthen the international EPR framework, efforts to elaborate it met with some resistance from some MSs, who considered that the focus should be on maintaining and reinforcing the legal foundations of the current international EPR system. They considered that adoption of the proposed Code of Conduct could lead to confusion over the status of the existing Conventions as binding texts with clear obligations, as well as the non-binding IAEA safety standards guides, prepared and reviewed through the relevant IAEA safety standards committees. The support of some States for the development of a text was not for a Code of Conduct but rather a text within the IAEA safety standards series or a standalone guideline. Furthermore, these States did not support the proliferation of the proposed Code of Conduct, the status of which they viewed as being unclear and considering that such a Code would distract the scarce resources of the Secretariat and IAEA MSs.

In reconsidering this initiative, it should be clear that there is no legal objection to the elaboration the proposed International Emergency Code of Conduct to supplement or complement the existing Early Notification and Assistance Conventions. Clearly, however it could not amend or supersede the provisions of the Conventions. Rather, the proposed Code of Conduct or an overarching guideline could have supplemented or complemented the existing provisions of the Conventions and consolidated and supplemented the related operational arrangements. It is a question of substantive content, rather than nomenclature, as to the distinction between a Code of Conduct and a guideline. A guideline can equally be used, to the extent that States agree on the substance, to supplement or complement a Convention. Like a Code of Conduct, however, it cannot amend or supersede the provisions of a Convention and adherence would be entirely voluntary and non-binding.

Contracting Party…". Further, Article 28 of that Convention obliges each Contracting Party to "allow for re-entry into [its] territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources".

7.4.8. 2003 RS CoC and its Supplementary Guidance

7.4.8.1. Support for and Implementation of the 2003 RS CoC and its Supplementary Guidance

As a counterbalance to its legally non-binding nature, States have an opportunity to provide political support for the 2003 RS CoC pursuant to the relevant resolutions of the GC[48, 49]. The GC has also encouraged states to make so-called 'political commitments' of support when endorsing the 2004 RSs Import/ Export Guidance[50], its 2011 revised version [51] and the 2017 Guidance on the Management of Disused RSs[52].

While a political commitment to support and apply the 2003 RS CoC and its Guidance is legally non-binding it can be understood as creating an international pact with other states. However, since it is non-binding, there are no legal consequences for not fulfilling such a commitment. Expressing political support does not necessarily imply necessarily implementation, nor translation of the 2003 RS CoC and its Guidance into the legislative and regulatory framework, even if this is the logical expected outcome.

To date, 140 MSs have made a political commitment to implement the 2003 RS CoC and 123 MSs have made a political commitment to the 2004/11 RSs Import/ Export Guidance but only 39 to the 2017 Guidance on the Management of Disused RSs[53]. The GC continues to encourage all IAEA MSs to make such political commitments, and to implement the 2003 RS CoC and its

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[48] In endorsing the 2003 RSs CoC, the General Conference in operative paragraph 4 of Resolution GC(47)/RES/7.B (2003) "[u]rge[d] each State to write to the [DG] that it fully supports and endorses the IAEA's efforts to enhance the safety and security of [RSs], is working toward following the guidance contained in the [2003 RS CoC], and encourage[d] other countries to do the same". The GC in operative paragraph 5 also "[r]equest[ed] that the [DG], subject to the availability of resources, compile, maintain and publish a list of States that have made a political commitment […]" and [r]ecognize[d] also that that the procedure [seeking such commitments and such a list was] an exceptional one, having no legal force and only intended for information, and therefore d[id] not constitute a precedent applicable to other Codes of Conduct of the Agency or of other bodies belonging to the United Nations system".

[49] The following year, the GC in operative paragraph 7 of GC(48)/RES/10 (2004) "[c]ontinue[d] to endorse the principles and objectives of the [2003 RS CoC], while recognizing that the Code is not a legally binding instrument, welcome[d] the fact that more than 60 States ha[d] made political commitments with respect to the Code in line with resolution GC(47)/RES/7.B, and encourage[d] other States to do so".

[50] In operative paragraph 8 of GC(48)/RES/10.D (2004) the GC "Further welcome[d] the approval by the Board of Governors of the [2004 RSs Import/ Export Guidance] (GC(48)/13), endorse[d]this Guidance while recognizing that it is not legally binding, note[d] that more than 30 countries have made clear their intention to work towards effective import and export controls by 31 December 2005, and encourage[d] States to act in accordance with the Guidance on a harmonized basis and to notify the [DG] of their intention to do so as supplementary information to the [2003 RS CoC], recalling operative paragraph 6 of resolution GC(47)/RES/7.B".

[51] In operative paragraph operative paragraph 74 of GC(55)/RES/9 (2011) the GC "Underline[d] the important role of the 2004 RSs Import/ Export Guidance for the establishment of continuous control of [RSs], note[d] that, as at 5 September 2011, 66 States had notified the [DG] of their intention to act in accordance with the Guidance, encourage[d] other States to make such a notification, reiterate[d] the need for States to implement the Guidance in a harmonized and consistent fashion, and request[ed] the Secretariat to continue to provide support to facilitate States' implementation of the Guidance".

[52] In operative paragraph 27 of GC(61)/RES/8.2 (2017) the GC "Call[ed] on all Member States to make a political commitment to implement the [2003 RS CoC] and its supplementary [2011 RSs Import/ Export Guidance]and its supplementary Guidance on the Management of Disused Radioactive Sources, further call[ed] on all Member States to act in accordance with the Code and the Guidance, and request[ed] the Secretariat to continue supporting Member States in this regard".

[53] The List of State that have made political commitments to the 2003 RS CoC and/or its supplementary Guidance can be accessed here < https://www-ns.iaea.org/downloads/rw/imp-export/status-list.pdf >. (Last change of status: 11 September 2018).

supplementary Guidance, as appropriate, in order to maintain effective safety and security of RSs throughout their life cycle. In addition, the GC continues to request the Secretariat to support MSs in this regard[54]. To facilitate the giving of such commitments to the 2003 RS CoC and its supplementary Guidance, the Secretariat has developed a model text of a letter of support.

If the measure of the effectiveness of an instrument is the number of states that have expressed a commitment to support and apply it, then the 2003 RSs CoC may be considered as being an effective instrument. However, we should also note that not all States have made a political commitment to the 2003 RSs CoC, and some States which have done so have made little progress in implementing its provisions[16]. Further, some States support the Code but not its supplementary Guidance[16]. The Secretariat continues to organise international, interregional and regional meetings to identify concerns and challenges to implementing the Code in those States which have not yet expressed political support states to implementing the Code 2003 RSs CoC (and its supplementary Guidance).

Unlike the two IAEA Codes of Conduct, the 1990 TM CoP was adopted by the GC only and not by the Board which merely requested the DG to transmit it to the GC with a recommendation that the Conference adopt the Code, ensure its wide dissemination and monitor its implementation.

7.4.8.2. Review Meetings of the 2003 RS CoC and its Supplementary Guidance

The effectiveness of a Code of Conduct can be strengthened if supported by procedures and mechanisms to promote and review and enable the practical reporting of their effective, full and prompt implementation. Since the adoption of the 2003 RS CoC and its supplementary Guidance much has been achieved regarding discussions at the international and regional levels concerning its implementation and that of its supplementary Guidance.

During the 2005 Bordeaux International Conference, 24 national reports were voluntarily submitted and discussed covering national implementation of the 2003 RS CoC [20]. The call at the Conference for consultations on a possible formal review mechanism was echoed some months later in resolution GC(49)/RES/9/A of the GC which, inter alia, requested the Secretariat to undertake consultations with MSs with a view to establishing a more formalized process for a periodic exchange of information and lessons learned and for the evaluation of progress made by States towards implementing the provisions of the Code of Conduct. This process was elaborated upon in June 2006 and subsequently endorsed by the Board. In its resolution GC(50)/RES/10, the GC recognized the value of information exchange on national approaches to controlling radioactive sources and took note of the Board's endorsement of the process.

The formalized process governs the preparation and performance of the meetings organized by the IAEA to discuss the implementation of the 2003 RS CoC and its supplementary Guidance. In 2019, the formalized process was updated to include the 2017 Guidance on the Management of Disused RSs and the organization of interregional meetings[55]. There are two elements to the formalized process. First, dedicated international meetings, organised by the Secretariat and held every three years (ideally, in the year not currently used for the review processes under the

[54] IAEA, GC Resolution GC(64)/RES/9 (2020).
[55] The revised version of the 'formalized process' is enclosed as Attachment 1 to Annex 1 of GOV/2020/35-GC(64)/7 (2020).

CNS [10] and the JC [13]). The meetings provide a forum for a wide exchange of information on national implementation of the Code of Conduct and Guidance. They enable countries to report on progress, exchange lessons learned and discuss areas in need of improvement. Secondly, the formalized process enables the holding of regional and inter-regional meetings to share information on experiences on implementing the Code of Conduct and Guidance. Such meetings are held on an as needed basis and preferably prior to the international meeting. The reports from such regional meetings are presented to the opening plenary of the international meeting.

Taking into account the non-binding character of the Code of Conduct and its supplementary Guidance, States participating in these meetings are invited to submit, on a voluntary basis, a National Paper, whether or not they have made a political commitment to the Code of Conduct and/or Guidance. According to the process, National Papers are made available by IAEA's Secretariat to other participants through the distribution among States' experts participating in the international meeting. States are not expected to report on implementation of the Code using a provision-by-provision approach in each section of the National Paper. Rather, States are invited to provide overviews as described in each section of the suggested template, with a focus, where appropriate, on recent changes, achievements, ongoing challenges and plans for improvement, using the section-specific guidance in the template.

However, the limited length and technical depth of the national papers as well as their preparation every three years do not facilitate on-going and specific exchange of experience between states. Indeed, the analysis of the CoC meetings' reports and national papers revealed that mostly practices are described in the national papers without specific details. This does not allow implementation of good practices by the other MSs. As a result, MSs expressed a wish that further work be undertaken to develop a system for the sharing of the CoC implementation practices among MSs. The Secretariat responded with a suggested initiative of establishing a system by which MSs submit implementation practices (IPs) in a succinct and standardized format. IPs are descriptions of how a MS successfully implemented one concrete and specific provision of the CoC and its Supplementary Guidance, together with lessons-learned in successfully achieving this goal. This initiative was presented and explained during CoC meetings. Since 2018, IPs have been submitted to IAEA, the number of IPs and time of submission being not limited. The Secretariat is currently working on the establishment of the procedure of IPs processing and uploading into a searchable database for dissemination among all MSs. The system of IPs will constantly and broadly inform MSs on the Code, its Supplementary Guidance and good practices and will allow MSs to implement similar practices into their own safety and security infrastructure.

Further to the 2013 Abu Dhabi International Conference, the Secretariat developed guidance for States in the preparation of their national papers on the implementation of the 2003 RS CoC and its supplementary Guidance. The guidance aims to facilitate the drafting of National Papers; to optimize resources for their preparation; to improve consistency of the information; and to facilitate comparison between States' National Papers. States are furthermore invited to use this template for National Papers. The template is structured in accordance with the main topics of the 2003 RS CoC, with emphasis on those topics from which States may benefit the most by sharing their experience. In addition, various IAEA tools and information management systems are available to States to facilitate a thorough self-assessment of the level of implementation of the 2003 RS CoC and its supplementary Guidance prior to preparing their National Papers, namely the Nuclear Security Information Management System (NUSIMS), the Radiation Safety Information Management System (RASIMS), the Emergency Preparedness and Response Information Management System (EPRMIS) and the source specific module of Self-assessment of the Regulatory Infrastructure for Safety (SARIS) tool.

One of the benefits in preparing a National Paper is that each State can assess its own actual status/progress/challenges in implementing the Code and the Guidance. Some of the benefits in sharing National Papers, notably: each State can gain insights into the status of implementation of the 2003 RS CoC and its supplementary Guidance in its neighbouring States and in other States; States can identify common trends and common areas for further bilateral, regional and international assistance and cooperation; and the effectiveness of the subsequent periodic international meetings can be increased; and planning and prioritization of the IAEA Secretariat's technical assistance and cooperation programmes may be informed.

In line with the non-legally binding nature of the 2003 RS CoC and its supplementary Guidance, participation in the meetings and presentation of papers is on a voluntary basis and the meetings are open to all Member and non-MSs of the IAEA, whether or not they had made a political commitment to the 2003 RS CoC and/or to its supplementary Guidance.

To-date, 5 international meetings have been held, in 2007, in 2010, 2013 (this being in the form of the Abu Dhabi International Conference [16]), 2016 and 2019. At the time of the 2019 international meeting, 137 States had made a political commitment to implement the Code and a total of 47 States submitted national papers. At the time of the 2016 international meeting, 131 States had made political commitments and a total of 59 States submitted national papers to the meeting (overall 76 states shared information regarding their implementation of the Code and Guidance). At the time of the 2013 Abu Dhabi Conference [16], 119 States had made political commitments and a total of 68 States submitted national papers to the conference. At the time of the 2010 international meeting, 99 States had made a political commitment to implement the Code and a total of 68 States submitted national papers. At the time of the 2007 international meeting, 89 States had made a political commitment to implement the Code and a total of 53 States submitted national papers.

National Papers may serve as a basis for the preparation of voluntary national presentations as described in the process. National voluntary presentations can also be offered without a national paper. At the last international meeting in 2019, participants concluded that the initiative of presenting papers on implementation practices, in addition to national papers, was valuable and States should be encouraged to submit such papers and that the IAEA should put in place and effective process to analyse and disseminate the corresponding information[56]. The meeting encouraged States that have expressed a political commitment to the 2003 RS CoC and/or its supplementary Guidance but have not submitted a National Paper or/and have not delivered an oral presentation, to participate more actively in the formalized process. Further, States were encouraged to submit such implementation practices papers, whenever they are ready, and the IAEA should develop process and tools to review them and disseminate them in an effective way.

To facilitate close cooperation and coordination between MSs, the IAEA has developed a directory of national regulatory bodies responsible for the control of radiation sources. All States, through these bodies, are requested to verify the directory's accuracy and completeness. In addition, in accordance with paragraphs 4 and 19 of the 2011 RSs Import/ Export Guidance, a List of State Points of Contact for facilitating the export and/or import of Category 1 and 2 RSs in accordance with the 2003 RS CoC and the 2011 RSs Import/ Export Guidance is

[56] IAEA, Report of the Chairman, Open-ended Meeting of Technical and Legal Experts to Share Information on States' Implementation of the CoC on the Safety and Security of RSs and its Supplementary Guidance Vienna, Austria, 27–31 May 2019, GOV/2020/35-GC(64)/7, Annex 1, Attachment 2.

maintained by the Secretariat. The purpose of this list is primarily for facilitating the import and export of RSs in accordance with the Code of Conduct and its supplementary Guidance. Further, a so-called "Aiding Document" is available for use on a voluntary basis for the development of the role and responsibilities of the Point of Contact. The document is based on the 2011 RSs Import/ Export Guidance and current good practices of the Points of Contact. Finally, a group of technical and legal experts prepared the text of model forms to facilitate the exchange of information in relation to the import and/or export of Category 1 and 2 RSs, pursuant to the 2011 RSs Import/ Export Guidance[57]. To-date, only 105 states have submitted answers to the "Importing and Exporting States Questionnaire" in Annex 1 of the 2011 RSs Import/ Export Guidance[58].

7.4.9. 2004 RRs Code of Conduct

7.4.9.1. Support for and Implementation of the 2004 RRs Code of Conduct

The GC continues to encourage MSs to apply the guidance in the 2004 RRs CoC at all stages in their life, including planning, and encourages MSs to freely exchange their regulatory and operating information and experience with regard to RRs[59]. Further, the GC continues to request the Secretariat to continue to support MSs, upon request, in application the 2004 RRs CoC[60].

7.4.9.2. Meetings of the 2004 RRs CoC

Unlike the 2003 RSs CoC and its supplementary Guidance, there is no process foreseen by which States can make political commitments to apply the guidance in the 2004 RRs CoC[61], and nor has a formal information exchange mechanism been established. Nonetheless, developments since the adoption of the 2004 RRs CoC efforts are aimed at strengthening its effectiveness. Efforts continue to implement meetings through an informal process. In addition, it is also noted that those countries operating RRs that are Contracting Parties to the CNS are voluntarily reporting on RRs in CNS review meetings.

In 2005, the Contracting Parties to the CNS [10] in clarifying the scope of the CNS and considering the positive impact of the incentive nature and the benefits of the CNS review process, requested that the DG to convene meetings to which all MSs would be invited to discuss how best to assure effective application of the 2004 RRs CoC[62]. This request reflected their strong interest in enhancing *RR* safety through applying the 2004 RRs CoC. An Open-ended Meeting on Effective Application of the 2004 RRs CoC was held in December 2005. It was agreed to organise periodic meetings to discuss topics related to the application of the code, to exchange experience and lessons learned, to identify good practices in applying it and to

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[57]Three forms have been prepared: (1) Request to the importing state for consent to import category 1 RSs or to import Category 1 and 2 sources under exceptional circumstances form; (2) Request to the importing State for confirmation that the recipient is authorized to receive and possess Category 2 RSs form; and (3) Notification to the importing state prior to shipment of Category 1 or 2 RSs form. These forms are available in six languages and are provided for information only. They can be downloaded here: < https://nucleus.iaea.org/sites/ns/code-of-conduct-radioactive-sources/guidance/SitePages/Home.aspx >.

[58] The answers are available on a restricted IAEA website.

[59] IAEA, GC Resolution GC(64)/RES/9 (2020) para. 21.

[60] IAEA, GC Resolution GC(64)/RES/9 (2020) para. 22.

[61] See the GC resolution GC(48)/RES/10/A.8 of September 2004 which welcomed the adoption of the Code by the Board of Governors in March 2004 and encouraged states to apply the guidance in the Code to the management of RRs.

[62] IAEA, para. 9, Summary Report, 3rd Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 11-22 April 2005, Vienna, Austria CNS-RM-2005?08 FINAL.

discuss future plans related to its use. Similar to the process for the RSs CoC, a number of international meetings to discuss its application have been held. The meetings are attended by experts who share their experience of applying the 2004 RRs CoC in different areas, including regulatory supervision, refurbishment and modernization of reactor components for safety improvements, as well as safety infrastructure for new *RR* projects. The participants also share and discuss the results of self-evaluations of their application of the 2004 RRs CoC.

Until today, five international meetings on the application of the 2004 RRs CoC have been held, in 2008, 2011, 2014,2017 and 2021 (the last being held virtually)) due to pandemic situation). These meetings enable countries to report on safety of their facilities and self-assessment on application of the 2004 RRs CoC. In addition, between the international meetings, the Secretariat organizes regional meetings on application of the 2004 RRs CoC. In these meetings the focus on application of specific areas of the 2004 RRs CoC where there is a common interest within the region[63].

Finally, it is recalled that some 20 operating RRs are under IAEA Project and Supply Agreements (PSAs) which specify the health and safety standards that apply to the project, as required by Article XI.E.3 of the IAEA Statute. At the IAEA Meeting of 25 June 2009 on the safety of *RR* under PSAs, it was recommended that MSs with RRs under such agreements should join the IAEA's follow-up system for these reactors, in particular to apply the 2004 RRs CoC. Since 2009, all meetings on safety of PSAs which are being held biannually on the basis of the 2004 RRs CoC, have also addressed this point. Meetings include submission of safety performance indicators (SPIs) of the facilities for peer review. The latest meeting on the safety of RR under PSA was held in July 2019 with the participation of delegates from 17 Member States. During this meeting, participants exchanged information and experience on the safety status of their research reactors, discussed their SPIs reports, and explored options to enhance the safety of their research reactors. The next meeting on the safety of research reactors under PSA is planned for 2021.

7.5.IAEA ASSISTANCE TO FACILITATE COMMITMENTS TO AND NATIONAL IMPLEMENTATION AND PARTICIPATION IN INTERNATIONAL AND REGIONAL EXCHANGES OF INFORMATION

7.5.1. IAEA Legislative and Technical Assistance including Capacity-Building

The IAEA works with MSs to ensure their RRs have the highest safety and security level. The Agency is present in every phase of a facility's lifetime, from the planning to the decommissioning stage. The Agency also assists MSs in the management of RSs including in establishing and implementing cradle to grave control of RSs, including through authorization and inspections programmes, as well as national registers and inventories of RSs. Further, the Agency continues to promote awareness at the appropriate level of government to encourage states to make political commitments to the 2003 CoC (and/or its Guidance) and to assist in the effective implementation of both IAEA Codes of Conduct.

Generally speaking, the Agency assists MSs in their efforts to build capacity to fully implement the provisions of the 2004 RRs CoC through developing safety standards, and security and

[63] The Agency held a meeting on the application of the 2004 RR CoC for the Europe region in Brussels in March 2019, attended by 25 participants from 14 Member States. The Agency held a Regional Meeting on the Application of the 2004 RR CoC for the African region in Rabat, Morocco, in July 2018, attended by 15 participants from 10 Member States. Both activities enabled participants exchanged information on the safety status of their research reactors and on their experience in applying the provisions of the 2004 RRs CoC.

technical publications, implementing peer review and advisory service missions, convening international, regional and inter-regional meetings. The IAEA also organizes capacity building activities, including meetings, workshops and training activities.
In order to achieve their objectives, both IAEA Codes of Conduct require States to create adequate national systems of regulatory control. MS continue to actively benefit from IAEA assistance in helping them to effectively implement the Code of Conduct and supplementary Guidance into national legislative and regulatory frameworks. IAEA legislative and technical activities and services assistance, available upon request, provides valuable support to states including in their efforts to build capacity to implement the provisions of both IAEA Codes of Conduct. In this regard, the Agency assists MSs regulatory bodies in developing the programmes and competences necessary to ensure effective regulatory control of RRs and RSs. Moreover, the IAEA supports MSs in the application of the Codes of Conduct through a wide-range of services and activities by organizing periodic international and regional meetings, seminars, symposia and conferences, training courses and workshops, publishing safety standards and technical guides in all areas of *RR* safety and the safety and security of RSs as the foundation for a global safety and security framework, as well as by facilitating the sharing of experience and the conducting peer reviews and safety missions based on the standards and guidance.

Further, the Agency provide assistances to MSs, through a wide range of services, including the Integrated Safety Assessment for Research Reactors (INSARR) peer review, to support their preparation for implementation of safety upgrades resulting from safety assessments of RRs, managing ageing of research facilities, enhancing regulatory supervision, and strengthening application of the 2004 RRs CoC in all areas including design, construction, and operation. In addition, the IAEA provides a wide range of services to assist MSs improve safety and security of RSs, such as training courses to help guide strategies for regaining control over sealed RSs and the Emergency Preparedness Review (EPREV) to independently appraise the EPR capabilities in MSs. In addition, the Agency assists MSs in addressing ageing management and periodic safety reviews by conducting peer review and advisory service missions to examine projects for the refurbishment and upgrading of RRs, and by organizing training activities and workshops.

Both the RSs and *RR* communities have raised their standards through seeking to become a ‘learning community’ through sharing of experience which has become an accepted practice. In addition to the formalized and informal processes associated with the Code of Conduct, various mechanisms for sharing of operating experience exist. In the context of RR, they address the reporting of incidents and operational events; the follow-up with analysis of events; and the dissemination of lessons learned through operation of the Agency’s Incident Reporting System for Research Reactors IRSRR (Incident reporting System for RRs), publications, and organization of meetings and workshops. There is also the Global Nuclear Safety and Security Network, GNSSN), as well as regional and international meetings and networks, such as the Asian Nuclear Safety Network, the ANNuR (Arab Network for Nuclear regulators), the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO) and FNRBA (Forum for Nuclear regulatory Bodies in Africa). The Agency continues to foster global and regional cooperation in *RR* safety and the safety and security of RSs. Since 1999, the IAEA has been organizing major international conferences on topics of interest to the research reactor community every four years, with the last, held in 2019[64].

[64] International Conference on Research Reactors: Addressing Challenges and Opportunities to Ensure Effectiveness and Sustainability, Buenos Aires, Argentina, 25–29 November 2019.

The Agency provides various tools to assist regulatory bodies in strengthening the effectiveness of their activities, including the Self-Assessment of Regulatory Infrastructure for Safety (SARIS), the Regulatory Authority Information System (RAIS), the Control of Sources Network (CSN) and the Radioactive Waste Management Registry (RWMR) for operators. CSN is a platform designed for regulators with the objective of providing an instrument for enhancing the sharing of knowledge and experience in the establishment and maintenance of a system for regulatory control of radiation sources.

Further, the Agency assists MSs in developing operating experience programmes and facilitates the exchange of safety information and dissemination of operating experience via the Incident Reporting System for RRs a web-based system through which participating countries exchange operating experience to improve the safety of RRs. Established in 1997, the system, has 60 participating countries in 2020 (more than 95% of the facilities are covered). The system is modelled after a similar reporting system for NPPs (IRS (International Reporting System for Operating Experience)). In addition, there is RRDB (Research Reactor Database) an authoritative IAEA database containing technical information on RRs world-wide, including critical and sub-critical assemblies. Finally, the Secretariat continues to foster regional and international efforts in ensuring wide access to existing multi-purpose RRs to enhance RR utilization. In this regard, the IAEA designated International Centre based on Research Reactors (ICERRs) scheme was launched to facilitate Member States, mainly without research reactors, access to research reactor infrastructure and options to carry out nuclear research and development as well as build capacity. The ICERR is intended to help Member States gain timely access to relevant nuclear infrastructure based on RRs to achieve their capacity building and R&D objectives[65].

7.5.2. IAEA Safety Standards and Nuclear Security Guidance and other Publications

The two Codes of Conduct provides guidance for management of *RRs* safety and RSs safety and security, but they do not provide detailed technical guidance. Technical guidance is provided in the Safety Standards and other guidance and other technical documents. Under the terms of its Statute[66], the Agency is authorized to establish or adopt standards of safety for the protection of health, life and property; and to provide for the application of these standards to its own operations as well as to other operations and, at the request of the parties, to operations under any bilateral or multilateral arrangement, or, at the request of a State, to any of that State's activities in the field of atomic energy. Under the Nuclear Safety Standards (NUSS) Programme, which was the initial phase of the IAEA's normative activity from 1974 through to the late 1990s, the IAEA did use the term 'code' for some texts similar in content to the guides category that give practical advice on how to implement the technical standards[67].

Today, there exists a Safety Standards Series categorized as: Safety Fundamentals; Safety Requirements; and Safety Guides. The Safety Fundamentals, SF-1 (2006) [25] establishes the

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[65] Currently, there are seven IAEA-designated ICERRs: The Institute for Nuclear Research in Romania, the Korea Atomic Energy Research Institute (KAERI), the French Alternative Energies and Atomic Energy Commission (CEA), the Russian Research Institute of Atomic Reactors State Scientific Centre (RIAR), the Belgian Nuclear Research Centre (SCK CEN), and both Idaho National Laboratory (INL) and Oak Ridge National Laboratory (ORNL) in the United States.

[66] Statute of the International Atomic Energy Agency (IAEA), 23 October 1956 (as amended up to 23 February 1989).

[67] Three International Atomic Energy Agency Codes, International Nuclear Law: History, Evolution and Outlook, 10th Anniversary of the International School of Nuclear Law, NEA No. 6934, OECD 2010.

fundamental safety objective and ten fundamental safety principles that provide the basis for requirements and measures to protect people and the environment from harmful effects of ionizing radiation and for the safety of facilities and activities that give rise to radiation risks. Specific safety requirements, SSR-3 (2016), have been established for all areas of safety for RRs, with particular emphasis on requirements for design and operation [23]. Eleven safety guides covering all technical areas for RRs have been also published during 2006–2015 and are all currently under revision to incorporate the lessons learned from the Fukushima accident. Two were approved for publication in 2020, and the remaining are expected to be approved in 2021. Supporting the safety standards are safety publications named Safety Reports and Technical Documents (TECDOC).

The arrangements provided between the IAEA Secretariat, IAEA Member States and/or Parties to one or both of the Emergency Conventions, relevant international intergovernmental organizations (hereinafter referred to as 'international organizations') and other States for facilitating the implementation of these Conventions — specifically concerning those articles that are operational in nature — are documented in the Operations Manual for Incident and Emergency Communication (EPR–IEComm). In addition, the IAEA established the Response and Assistance Network (RANET) in 2000 as the Operational tool to implement the Assistance Convention (EPR-RANET 2018).

Since 2006, the IAEA has developed the Nuclear Security Series (NSS), a set of publications which address nuclear security issues relating to the prevention and detection of, and response to, theft, sabotage, unauthorized access and illegal transfer or other malicious acts involving nuclear material and other radioactive substances and their associated facilities. Similar to the Safety Standards Series, the primary publication of the NSS is a fundamentals-level document which provides the objective and essential elements for a State's nuclear security regime. Several publications in the NSS deal with the security of sealed RSs[68] and RRs[69]. The IAEA Nuclear Energy Series comprises reports designed to encourage and assist R&D on, and application of, nuclear energy for peaceful uses. Some of the publications in this series address research reactors [24,26]. Finally, it is noted that there is an increasing recognition in Member States of the need for effective management of the interface between safety and security in all RRs activities throughout the life cycle of a facility. In 2016, guidance on the management of the interface was published as part of the IAEA TECDOC Series[70].

[68] For example, NSS 14: Nuclear Security Recommendations on Radioactive Material and Associated Facilities; NSS 15: Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control; NSS 5: Identification of and Measures for the Detection of in International Mail Transported by Radioactive Sources and Devices Nuclear and Other Radioactive Material Public Postal Operators Border Monitoring Equipment.

[69] The existing IAEA Nuclear Security Series (NSS) publications did not provide specific guidance for RRs and Related Facilities (RRRF). In 2016, the IAEA published Nuclear Security Management for Research Reactors and Related Facilities (IAEA, Vienna (2016)). This publication builds on the recommendations of NSS publications No. 13 Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev5) and No.14 Nuclear Security Recommendations on Radioactive Materials and Associated Facilities. This publication is intended to provide a single source guidance to assist those responsible for the implementation of nuclear security measures at a RRRF in developing and maintaining an effective and comprehensive programme covering all aspects of nuclear security (for all nuclear and other radioactive material and the related facilities) on the site.

[70] IAEA, Management of the Interface between Nuclear Safety and Security for Research Reactors, IAEA-TECDOC-1801, IAEA, Vienna (2016).

7.5.3. IAEA Peer Reviews and Advisory Services

The IAEA provides for the application of the safety standards and security recommendations, which in respect of the safety standards are carried-out further to an express Statutory basis (Article II.A.6). The Agency assists MSs by reviewing and assessing the legal and governmental infrastructure, the legislative and regulatory frameworks, and the safety of RRs and the safety and security of RSs. Peer reviews and advisory services have been particularly helpful in identifying the strengths and weaknesses of national infrastructures for safety and security of RSs and RRs.

The upon request Integrated Regulatory Review Service (IRRS) is a peer review service designed to strengthen and enhance the effectiveness of national regulatory infrastructure for nuclear, radiation, radioactive waste and transport safety and the security of radioactive sources[71]. IRRS teams evaluate a State's regulatory infrastructure for safety against IAEA safety standards. SARIS is available for Member States to facilitate the self-assessment of national regulatory infrastructure for nuclear and radiation safety.

The IAEA has been sending missions to review the safety of RRs in MSs since 1972. Some of the reviews have been conducted pursuant to the IAEA's functions and responsibilities regarding RRs that are operated within the framework of Project and Supply Agreements (PSAs) between MSs and the IAEA. Other reviews, like IRRS and INSARR (Integrated Nuclear Safety Assessment of Research Reactor)[72] are conducted upon request of MSs. The objective of the INSARR service is to conduct a comprehensive safety review of the *RR* facility. It includes a pre-INSARR to plan the review, the INSARR mission itself and a follow-up INSARR to assess progress on the implementation of the recommendations. The INSARR reviews are based on the provisions of the 2004 RRs CoC and relevant IAEA safety standards, in particular, SSR-3 (2016) [23] and GSR Part 1 (Rev.1) (2015) [14]. As part of the INSARR service, the IAEA developed guidelines in 2018 for MSs, regulatory bodies and operating organizations to perform self-assessment of their application of the provisions of the 2004 RRs CoC[73]. The publication includes a mapping of safety requirements to the provisions of the Code to assist States, regulatory bodies and operating organizations to identify areas needing improvements and formulate an action plan to strengthen application of the Code. These self-assessments have also typically been done by MSs in preparation for the triennial international meetings on application of the 2004 RRs CoC. The enhancement of the efficiency and effectiveness of the INSARR has been acknowledged by the General Conference and international conferences[74].

Initiated in 2012, the upon request Operational and Maintenance Assessment for Research Reactors (OMARR) review mission is designed to assist Member States in improving the operational and maintenance (O&M) practices of RRs[75]. The main objective of an OMARR

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[71]IRRS missions fall into only two categories: Reduced Scope and Full Scope, both follow the same process defined in the IRRS Guidelines: preparatory meeting, self-assessment phase, conduct of the mission, and follow-up mission after 24 to 48 months of main IRRS mission. See IAEA, Integrated Regulatory Review Service Guidelines, Services Series No. 37, IAEA, Vienna (2018).

[72] IAEA, Guidelines for the Review of Research Reactor Safety: Revised Edition, IAEA Services Series 25, IAEA, Vienna (2013).

[73] IAEA, Guidelines for Self-assessment of Research Reactor Safety, Services Series No. 35, IAEA, Vienna (2018).

[74] IAEA, Conclusions and Recommendations, International Conference on Research Reactors: Addressing Challenges and Opportunities to Ensure Effectiveness and Sustainability, 25–29 November 2019, Buenos Aires, Argentina, STI/PUB/1927 (2020).

[75] The OMARR Mission addresses the topical areas described in IAEA Nuclear Energy Series No. NP-T-5.4.

mission is to conduct an O&M review of a research reactor facility. Planning and conduct of OMARR is coordinated with INSARR as to avoid duplication, and to ensure complementarity for maximizing the benefits to recipient research reactor organizations.

It is also highlighted that the 2004 *RRs* CoC is included within the context of the IAEA Milestones Approach for a *RR* project, pursuant to which States are expected to implement the provisions of the Code[24]. The IAEA *RR* Milestones Approach helps countries effectively and holistically develop their research reactor programmes so they can safely and reliably utilize their research reactors. The *RR* Milestones Approach is supported by the upon request INIR-RR review launched in 2018 and been implemented in Nigeria and Viet Nam[76]. Member States planning or implementing new programmes are encouraged to benefit from INIR-RR review[77].

7.6.CONCLUSION

The international legal frameworks for the safe and secure use of nuclear technology and its applications are characterised by a mix of legally binding rules, agreements and regulations and, non-binding advisory standards and codes. There are no legally binding undertakings on the safety and security of radioactive sources or the safety of research reactors. Codes of Conduct have grown to become an integral part of IAEA normative activity.

Some readers may agree that what counts the most is the effectiveness of a legally non-binding Code of Conduct as an instrument for improving and harmonising national practices. Experience shows that the 2003 CoC and 2004 CoC reflecting genuine consensus, can be useful even though they are not legally binding. These IAEA Codes of Conduct have been convenient when recourse to the lengthy process of concluding a convention would not have permitted the prompt action expected by the MSs. Past efforts to establish other Codes of Conduct have not always been unsuccessful due to a lack of political will of some states.

Efforts continue to increase transparency and international co-operation and co-ordination amongst states and with the IAEA and other relevant international organizations, as well as to strengthen the effective implementation of both IAEA Codes of Conduct. Together with the high number of commitments entered into in respect of the 2004 RSs CoC, the formalized and informal processes of regularised voluntary meetings enable continuing improvements, fosters identification of globally acknowledged good practices, challenges, trends and issues. These meetings to share experiences of both Codes of Conduct, the prior-submitted national papers and the presentations made during the meetings, show progress in implementation.

Some States are challenged in their implementation of both Codes by a lack of human and other resources. What remains clear is that the degree of implementation of the Codes of Conduct remains varied from one State to the next. Challenges lie in identifying those needs, prioritizing activities to address them and implementing the solutions into national frameworks. The IAEA continues to stand ready to provide legislative and technical assistance to States, upon request, to facilitate States effective, full and prompt implementation of both IAEA Codes of Conduct.

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[76] IAEA, Specific Considerations and Milestones for a Research Reactor Project, Nuclear Energy Series No. NP-T-5.1, IAEA, Vienna (2012).

[77] In addition, the upon request Integrated Research Reactor Utilization Review (IRRUR) mission, initiated in 2019, is designed to assist IAEA Member States in improving the utilization of research reactors facilities. The main objective of the IRRUR service is to assist Member States in performing a thorough assessment of the utilization of a research reactor, of its existing and potential capabilities, and to identify further utilization areas, research and development, as well as products and services that the research reactor can provide. The IRRUR Mission addresses the topical areas described in IAEA Nuclear Energy Series Nos. NP-T-5.3 and NG-T-3.16.

As former DG Hans Blix states, “If States are ready to voluntarily undertake to comply with international norms that they formally view as recommendations, they should be accorded every opportunity to do so”[78]. The IAEA Secretariat stands alert to the moment when States may be ready to move from "soft" law to "hard" law by converting the voluntary commitments in the IAEA Codes of Conduct, into binding legal undertakings.

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8. RELATIONSHIP BETWEEN LEGALLY BINDING AND NON-BINDING INSTRUMENTS IN THE INTERNATIONAL LEGAL FRAMEWORK FOR NUCLEAR SECURITY

J. HERBACH[1]
Office of Legal Affairs, International Atomic Energy Agency

8.1.INTRODUCTION

The international legal framework for nuclear security is comprised of both legally binding and non-binding instruments. The relevant legally binding instruments include multilateral treaties, such as the Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 Amendment (A/CPPNM), the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), as well as United Nations (UN) Security Council resolutions dealing, inter alia, with preventing non-State actors from developing, acquiring, transferring or using weapons of mass destruction and their means of delivery. On the non-binding side, there is the Code of Conduct on the Safety and Security of Radioactive Sources (Code of Conduct) along with supplementary guidance on the import and export of radioactive sources and on the management of disused sources, as well as a body of technical guidance on establishing and maintaining a national nuclear security regime developed under the auspices of the International Atomic Energy Agency (Nuclear Security Series, NSS).

Notwithstanding the form, scope and legal status, both categories of instruments play an important role in the overall legal framework. The relevant legally binding instruments are limited in terms of scope, with no single instrument covering nuclear security in a comprehensive manner. The IAEA Nuclear Security Series provides international consensus guidance on all aspects of nuclear security. In addition, aside from certain provisions of ICSANT described in more detail below, the security of radioactive sources is covered primarily in the non-binding Code of Conduct. Therefore, to a certain extent, the non-binding instruments supplement the binding instruments by providing guidance beyond the scope of the relevant legally binding instruments.

There is also a complementary aspect of the relationship between the legally binding and non-binding instruments that make up the legal framework for nuclear security. This is made explicit through cross-references in the texts, with both the A/CPPNM and ICSANT making direct references to “internationally formulated physical protection recommendations” and IAEA recommendations, respectively, and Nuclear Security Series documents directly stating that the technical guidance contained therein will help States implement their obligations under relevant treaties. The symbiotic relationship between the CPPNM and its Amendment and the recommendations on physical protection of nuclear material and nuclear facilities (published as INFCIRC/225 in various revisions, the fifth revision being also known as Nuclear Security Series No. 13), in particular, is illustrated by the historical development of each instrument over the years.

[1] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

This article provides an overview of the relationship between the key legally binding and non-binding instruments in the area of nuclear security, thereby demonstrating the importance of this relationship to the strength of the nuclear security legal framework as a whole.

8.2.MAIN NON-BINDING INSTRUMENTS IN THE AREA OF NUCLEAR SECURITY

The following sections provide a brief overview of the main non-binding instruments in the area of nuclear security that have been developed under the auspices of the IAEA.

8.2.1. Code of Conduct on the Safety and Security of Radioactive Sources

The Code of Conduct is aimed generally at ensuring adequate safety and security throughout the lifecycle of radioactive sources, from the stage of initial production to final disposal [1]. The Code of Conduct provides guidance on the development and implementation of national policies, laws and regulations, and on fostering international co-operation, with respect to radioactive sources, referred to in its Annex I, that may pose a significant risk to individuals, society and the environment. Its security-related objectives include: (1) preventing unauthorized access or damage to, and loss, theft or unauthorized transfer of, radioactive sources; and, (2) mitigating or minimizing the radiological consequences of accidents or malicious acts involving a radioactive source.

While, as mentioned above, the Code of Conduct covers both safety and security of radioactive sources, it sets out a number of basic principles related to radioactive source security, including:

- Every State should create confidential, national registries of high risk (including, at a minimum, Category 1 and 2) sources to track them during their use by licensees;
- States should define domestic threats, and assess vulnerabilities with respect to this threat for the variety of sources used within its territory, based on the potential for loss of control and malicious acts involving one or more radioactive sources;
- States should have in place effective national legislation and regulations containing security measures;
- Such legislation and regulations should provide for the establishment of a regulatory body, whose functions are effectively independent of other functions with respect to radioactive sources;
- States should ensure that its regulatory body has the authority to require a security plan or assessment, as appropriate, and to promote the establishment of a security culture among all individuals and in all bodies involved in the management of radioactive sources; and
- States should have national strategies for gaining or regaining control over orphan sources and should ensure that the regulatory body is prepared to recover and restore control over stolen or otherwise misplaced radioactive sources.

8.2.2. IAEA Nuclear Security Series

The Nuclear Security Series, which is developed and maintained by the IAEA, was launched in 2006 and is updated regularly in cooperation with experts from Member States. The Series is comprised of various types of documents arranged in a hierarchy — nuclear security fundamentals, recommendations, implementing guides and technical guidance — and it is consistent with, and helps States implement, obligations under the relevant legally binding instruments in the area of nuclear security. The top-level document in the Nuclear Security Series is the *Objective and Essential Elements of a State's Nuclear Security Regime* (NSS No. 20), which lays out objectives, concepts and principles of nuclear security and provides the

basis for the security recommendations. The next level of documents in the Series, the recommendations, presents measures that should be taken by States to achieve and maintain effective national nuclear security regimes consistent with the fundamentals. On the next level, the set of implementing guides, then, provide guidance to assist states with implementing the measures contained in the recommendations. Lastly, the technical guidance documents supplement the implementing guides by providing additional guidance on specific technical issues. For the purposes of this article, it suffices to discuss the fundamentals and, in particular, the recommendations documents in the Nuclear Security Series.

8.2.2.1. Objective and Essential Elements of a State's Nuclear Security Regime (NSS No. 20)

The Fundamentals document sets out the primary objective of a state's national nuclear security regime, which is "to protect persons, property, society, and the environment from harmful consequences of a nuclear security event" [2]. To achieve this objective, the document, being non-binding, recommends the establishment, implementation, maintenance and sustainment of an effective and appropriate nuclear security regime to prevent, detect and respond to these types of nuclear security events. The document goes on to describe a set of twelve essential elements for an appropriate and effective nuclear security regime. These are adapted from the fundamental principles of physical protection of nuclear material extracted from the fourth revision of the recommendations on the physical protection of nuclear material and nuclear facilities (INFCIRC/225/Rev.4), which in turn formed the basis for the fundamental principles contained in the Amendment to the CPPNM, as will be discussed further below.

8.2.2.2. Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (NSS No. 13, INFCIRC/225/Rev.5)

For decades, INFCIRC/225 has been a key instrument in the area of physical protection of nuclear material and nuclear facilities. The fifth revision has been incorporated into the Nuclear Security Series as NSS No. 13, while maintaining its dual titling as INFCIRC/225/Rev.5 in order to preserve its special character, with for instance physical protection provisions having been incorporated in various agreements by reference to INFCIRC/225 [3]. The document sets out recommendations for physical protection against unauthorized removal of nuclear material in use and storage, for physical protection against sabotage of nuclear facilities and of nuclear material during use and storage, as well as for physical protection of nuclear material during transport. The original catalyst for the development of these recommendations was: (1) the recognition of the need to protect nuclear material against theft and unauthorized diversion and nuclear facilities against sabotage; and, (2) the acknowledgement that, while the responsibility for establishing and maintaining a system to protect nuclear material and facilities within a State rests entirely on that State, other States have an interest in the fulfilment of this responsibility[2]. NSS No. 13 is designed to assist States with implementing obligations related to the physical protection of nuclear material and nuclear facilities under relevant international instruments, namely the Amendment to the CPPNM. In other words, if a State implements the recommendations of NSS No. 13, it will have implemented the physical protection obligations it has if its party to the Amendment to the CPPNM.

[2] See preface by then Director General of the IAEA, Sigvard Eklund, to the first revision of INFCIRC/225, published in June 1977.

8.2.2.3. Nuclear Security Recommendations on Radioactive Material and Associated Facilities (NSS No. 14)

Nuclear Security Series No. 14, then, sets out recommendations on the security of radioactive material[3] throughout its lifecycle, from manufacture to recycling or disposal [4]. It is designed to assist states with implementing, inter alia, obligations and commitments with respect to relevant international instruments related to the security of radioactive material, associated facilities and associated activities, such as ICSANT and the security elements of the Code of Conduct, as well as the supplementary Guidance on the Import and Export of Radioactive Sources. NSS No. 14 is complementary to the other recommendation-level documents in the Nuclear Security Series, providing guidance to States and competent authorities on how to develop or enhance, to implement and to maintain a nuclear security regime for radioactive material, associated facilities and associated activities. Radioactive material under NSS No. 14 includes nuclear material, but there is not an overlap with NSS No. 13. For instance, whereas NSS No. 14 applies to the protection of nuclear material against unauthorized removal for potential subsequent off-site exposure or dispersal, NSS No. 13 addresses physical protection of nuclear material against unauthorized removal for use in a nuclear explosive device. In addition, the provisions of NSS No. 14 regarding protection against sabotage apply only to other radioactive material (not nuclear material), associated facilities and associated activities; protection of nuclear facilities against sabotage falls under NSS No. 13.

NSS No. 14 provides guidance, inter alia, on developing, implementing and maintaining a legal and regulatory framework, establishing domestic institutions tasked with implementing the framework, as well as practices and systems for detection of and response to criminal or unauthorized acts involving radioactive materials and/or facilities. It describes the role of the State in assigning responsibilities for security, including designating a regulatory body and empowering it with the necessary authority; assessing the threat; and providing cooperation and assistance in locating and recovering radioactive material; among other responsibilities.

8.2.2.4. Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control (NSS No. 15)

The focus of NSS No. 15 is security measures related to nuclear and other radioactive material out of regulatory control, either having been reported as such, having been lost, missing or stolen but not having been reported, or having been in some other way discovered [5]. This differs from the other two recommendations documents discussed above, which concern nuclear and other radioactive material that is under regulatory control. This recommendation document provides 1) guidance to States and their competent authorities on deterring, detecting and responding to a criminal or unauthorized act involving material out of regulatory control, as well as 2) guidance directed at facilitating international cooperation to ensure that regulatory control is regained over such material and the appropriate action — prosecute or extradite — is taken with respect to the alleged offenders.

A number of paragraphs of NSS No. 15 relate to elements of the relevant international treaties. For instance, there are recommendations on response measures that describe notifying international organizations and other potentially affected States, which relate to provisions in

[3] Defined in the document as: any material designated in national law, regulation, or by a regulatory body as being subject to regulatory control because of its radioactivity (includes nuclear material, sealed sources, unsealed radioactive material and radioactive waste).

the CPPNM and its Amendment, as well as ICSANT[4]. Other paragraphs on criminalization of certain offenses are linked to the criminalization provisions of the CPPNM and its Amendment and ICSANT[5]. The same goes for recommendations related to recovery and control of materials, which relate to the provisions of the CPPNM and its Amendment and ICSANT on, inter alia, rendering material, devices and facilities harmless, as well as having regard to physical protection recommendations[6]. The guidance describing requesting and providing assistance, both as part of a national response plan and with respect to legal proceedings (mutual legal assistance) is contained in NSS No. 15, which relates again to relevant provisions of the CPPNM and its Amendment and ICSANT[7].

8.3.THE ROLE OF NON-BINDING INSTRUMENTS IN THE LEGAL FRAMEWORK FOR NUCLEAR SECURITY

Parties to the multilateral treaties, and UN Member States in the case of the Security Council resolutions adopted under Chapter VII of the UN Charter, are obligated to comply with the provisions of the legally binding instruments to which they are party, including adopting national laws and regulations giving effect to the instruments where necessary. That is not the case for the non-binding instruments, though they can become binding if national law or a separate international agreement, so provides, or if incorporated into national law. For instance, several binding agreements explicitly incorporate INFCIRC/225. These include, inter alia, Project and Supply Agreements concluded between the IAEA and Member States, requiring physical protection measures that as a minimum provide protection comparable to INFCIRC/225, recognizing that INFCIRC/225 may be revised from time to time; the physical protection provisions of Model Revised Supplementary Agreements Concerning the Provision of Technical Assistance by the IAEA, requiring that the State in taking measures necessary for the physical protection of nuclear facilities, equipment and materials relating directly to the technical assistance provided by or through the IAEA be guided by the recommendations of INFCIRC/225, also recognizing that they may be revised from time to time; and a large number of bilateral agreements concerning international cooperation with regard to aspects of peaceful uses of nuclear energy.

Two main characteristics of the non-binding instruments help explain their role in the broader legal framework for nuclear security: the possibility to update them from time to time to provide timely, up-to-date guidance on various aspects of nuclear security, and the technical detail they include.

The key binding legal instrument in the area of nuclear security is the CPPNM and its Amendment. The original CPPNM, which entered into force in 1987, establishes legal obligations for Parties regarding the physical protection of nuclear material used for peaceful purposes during international transport [6]. It also requires the criminalization of certain offences, including a number of intentional unauthorized acts involving nuclear material, the threat to use nuclear material to cause harm, theft or robbery of nuclear material, as well as ancillary offences such as the attempt to commit a listed offence and participation therein. The CPPNM further contains provisions on international cooperation, for example, in the case of theft, robbery or any other unlawful taking of nuclear material or credible threat thereof.

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[4] Para. 6.12 of NSS No. 15, Art. 5 of the CPPNM and its Amendment, and Art. 7 of ICSANT.
[5] Paras. 4.1 and 4.2 of NSS No. 15, Art. 7 of the CPPNM and its Amendment, and Art. 2 of ICSANT.
[6] Paras. 7.12 and 7.13 of NSS No. 15, Art. 5 of the CPPNM and its Amendment, and Art. 18 of ICSANT.
[7] Paras. 7.6-7.16 of NSS No. 15, Articles 11A and 11B of the CPPNM Amendment, and Art. 14 of ICSANT.

The Amendment to the CPPNM, which entered into force in 2016, extends the scope of the original treaty to cover physical protection of nuclear facilities and nuclear material used for peaceful purposes in domestic use, storage and transport [7]. It also criminalizes additional offences related to illicit trafficking and sabotage of nuclear material or nuclear facilities, as well as ancillary offences related to organization or direction of others to commit a listed offence, and it provides for strengthened international cooperation in light of the expanded scope, such as assistance and information sharing in the event of sabotage.

The CPPNM and its Amendment also contain provisions for considering application of the treaty in light of changing circumstances, as well as for treaty modification. Article 16 of the CPPNM and of the CPPNM as amended requires the convening of a conference of States Parties to review the Convention's implementation "and its adequacy as concerns the preamble, the whole of the operative part and the annexes in the light of the then prevailing situation" five years after entry into force of the CPPNM and of the Amendment, respectively. Consideration of implementation of the Convention in light of the prevailing situation could, for example, lead to agreement among the Parties with respect to interpretation of the Convention taking account of technological changes or changes in physical protection approaches. In considering the adequacy of the Convention in light of the prevailing situation, Parties could, for instance, decide that the Convention is no longer adequate and consider modification through the amendment process, as foreseen in Article 20. That said, the review mechanism under the Convention requires the convening of a single conference under the original Convention and a single conference under the CPPNM as amended, though a majority of Parties may request the convening of further such conferences at intervals of not less than five years. A single conference under the original CPPNM was convened in 1992 with no requests for further such conferences, and a conference under the CPPNM as amended is set to be convened in 2021, five years after entry into force of the Amendment. The Amendment process pursuant to Article 20 of the CPPNM has been invoked, which led to the 2005 Amendment expanding the scope of the Convention in terms of physical protection, criminalization of certain offenses and international cooperation. It took 11 years from the adoption of the Amendment in 2005 to its entry into force in 2016. In other words, while consideration of treaty implementation in light of changing circumstances and the possibility of treaty modification via amendment are covered in the CPPNM and its Amendment, these provisions are not regularly invoked, and the threshold, for instance, for treaty amendment is indeed high, requiring ratification, acceptance or approval of two-thirds of Parties for entry into force.

Not being subject to procedures for ratification, acceptance or approval or to entry into force requirements, non-binding instruments can more readily be updated to reflect technological advances, changing best practices and security approaches and other prevailing circumstances, with INFCIRC/225 for instance having been revised five times since its first publication in 1975. The non-binding instruments can also provide additional detail on measures to help implement obligations under legally binding instruments to which they are Party, namely when particular measures are not specified in the legally binding instrument. One of the roles of the non-binding instruments in the area of nuclear security, therefore, is to support implementation of the related legally binding instruments. Reflecting the role of providing updated, contemporary guidance that helps support implementation of binding instruments, the non-binding instruments are sometimes referred to into legally binding instruments. Non-binding instruments can also inform the development of the binding instruments, with provisions of the Amendment to the CPPNM (e.g. Article 2A) for example being derived from the non-binding recommendations on the physical protection of nuclear material and nuclear facilities (INFCIRC/225), as discussed in the following section. A further role of non-binding instruments is providing detailed guidance on a range of topics related to nuclear security, such

as computer security and nuclear security culture, to support the establishment, implementation and maintenance of a national nuclear security regime. States are not legally obligated to act in accordance with these non-binding instruments but, as mentioned above, may apply them as appropriate in their domestic systems.

With respect to radioactive sources, the Code of Conduct is a different type of instrument than the instruments that make up the Nuclear Security Series. International codes of conduct are a common type of regulatory instrument used in relation to a range of issues from corporate responsibility of transnational corporations (e.g. OECD Guidelines for Multilateral Enterprises) to the environment (Code of Conduct for Responsible Fisheries) to food and health (International Code of Conduct on the Distribution and Use of Pesticides). Under the IAEA's auspices, there is a Code of Conduct on the Safety of Research Reactors, adopted by the Board of Governors in March 2004 and endorsed by the General Conference at its 48th regular session. The Code of Conduct on the Safety of Research Reactors provides guidance on the development and harmonization of laws, regulations and policies on the safety of research reactors. In addition, in 1990, the General Conference adopted a Code of Practice on International Transboundary Movement of Radioactive Waste, which was largely incorporated into the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (see Article 27). Although the Code of Conduct on the Safety and Security of Radioactive Sources is not legally binding, a process is foreseen by which States express political commitment. States are urged to write to the Director General of the IAEA indicating support and endorsement of the Agency's efforts in the area of radioactive source security and safety, and indicating that they are working toward following the guidance set forth in the Code of Conduct [8]. The Director General has been requested to compile, maintain and publish a list of those states having made such a political commitment.

ICSANT covers all radioactive material including nuclear material, and it does not only apply to material and facilities used for peaceful purposes [9]. It requires Parties to criminalize the unlawful and intentional possession and use of radioactive material or radioactive device and the unlawful use or damage of nuclear facilities. ICSANT also contains an obligation for Parties to "make every effort" to adopt appropriate measures for ensuring the physical protection of radioactive material, as defined under the Convention, taking into account the guidance and functions of the IAEA. Unlike the CPPNM, ICSANT does not, however, establish any specific obligations on adopting necessary legislative and regulatory measures to ensure the physical protection of materials and facilities. Pursuant to the Code of Conduct, on the other hand, States should inter alia have in place effective national legislation and regulations containing security measures to deter, detect and delay the unauthorized access to, or the theft, loss or unauthorized use or removal of radioactive sources during all stages of management, as well to reduce the likelihood of malicious acts, including sabotage, consistent with the threat defined by the State. For the States that have indicated that they are working toward following the guidance set forth in the Code of Conduct, this is the only such (political) commitment with respect to specific measures aimed at security of radioactive sources. It should be mentioned, the material covered under the Code of Conduct is narrower than the material covered under ICSANT. A radioactive source under the Code of Conduct refers to radioactive material that is permanently sealed in a capsule or closely bonded, in a solid form and which is not exempt from regulatory control. The Code of Conduct does not apply to nuclear material as defined in the CPPNM, except for sources incorporating plutonium-239.

8.4.DEVELOPMENT OF THE CPPNM, ITS AMENDMENT AND THE RECOMMENDATIONS ON PHYSICAL PROTECTION OF NUCLEAR MATERIAL AND NUCLEAR FACILITIES

The development of recommendations on physical protection of nuclear material (INFCIRC/225) predates the CPPNM. Acknowledging the need for some guidance to assist States in developing physical protection systems for nuclear material, the IAEA published a booklet entitled “Recommendations for the Physical Protection of Nuclear Material” in 1972. These recommendations were subsequently revised upon review by a group of experts in order to reflect progress in physical protection as well as challenges posed by the increasing use of nuclear material for peaceful purposes, and were published in 1975 as INFCIRC/225, with the intention to review and regularly update the recommendations to reflect changing circumstances [10]. Subsequent consultations between the IAEA and its Member States as well as the work of an Advisory Group on Physical Protection of Nuclear Material indicated a growing recognition that there was a need for an international legally binding instrument on physical protection of nuclear material, in particular during international transport. In addition, at the 1975 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the Conference called upon all States to “enter into such international agreements and arrangements as may be necessary to ensure” the physical protection of nuclear material in use, storage and transit, “including principles relating to the responsibility of States, with a view to ensuring a uniform, minimum level of effective protection for such material” and “in the framework of their respective physical protection systems, to give the earliest possible effective application to the IAEA’s recommendations [INFCIRC/225]” [11].

Following the circulation, in June 1977, of a draft convention on physical protection of nuclear facilities, material and transports, the IAEA General Conference endorsed efforts by the Director General to facilitate development of this legal instrument. Though explicit references to INFCIRC/225, which was revised in 1977 and published as INFCIRC/225/Rev.1, that were included in the original draft text were eventually removed during treaty negotiations, the INFCIRC/225 recommendations informed the discussions and the drafting of what became the CPPNM, for instance with respect to the categorization table of nuclear material [12]. While INFCIRC/225, even in this early incarnation, provided recommendations on physical protection of nuclear material in use, storage and transport, the original CPPNM covers the physical protection of nuclear material for peaceful use during international transport.

At the sole conference to review the implementation and adequacy of the original CPPNM, convened pursuant to Article 16 thereof, Parties recognized that the, at that point, second revision of INFCIRC/225 provided useful guidance on physical protection measures for nuclear material in use, storage and transport [13]. Furthermore, the Parties in the Final Statement of the conference requested the IAEA to convene a meeting to examine INFCIRC/225, both to ensure consistency between the Convention’s categorization of material and the categorization table in INFCIRC/225, as well as to consider revision of INFCIRC/225 to include further guidance on certain issues such as irradiated fuel and waste. The IAEA subsequently convened such a meeting of a technical committee, which led to the third revision of INFCIRC/225 in September 1993, demonstrating the efforts taken towards harmonization of the CPPNM and the INFCIRC/225 recommendations, which is important to ensuring consistency in the legal obligations under the Convention and related guidance.

The fourth revision of INFCIRC/225, published in 1999, was the product of a thorough review of the recommendations, taking into account certain technological changes and developments with respect to physical protection approaches [14]. In this revision, a chapter was added

providing specific recommendations on sabotage of nuclear facilities and nuclear material, which led to the title of the document being changed to reflect this addition: “The Physical Protection of Nuclear Material and Nuclear Facilities”.

Consideration of the possible need to amend the CPPNM began in 1999, with the Director General convening an Informal Open-ended Expert Meeting to discuss whether there was a need to undertake such a revision. As part of its deliberations, the Open-ended Expert Meeting tasked a Working Group with examining all issues relevant for reaching a conclusion on whether there was a need to revise the CPPNM. The Working Group identified several recommendations with the aim of promoting the effective implementation and improvement of physical protection worldwide. Among these was a recommendation for the IAEA Secretariat, with assistance of Member States, to analyse the recommendations, concepts and terminology of INFCIRC/225/Rev.4 and compile therefrom a set of fundamental principles of physical protection [15]. This resulted in a document containing “Physical Protection Objectives and Fundamental Principles,” endorsed by the IAEA Board of Governors in 2001. The Open-ended Expert Meeting concluded in 2001 that there was a clear need to strengthen the international physical protection regime and recommended that a range of measures be undertaken, including the drafting of an amendment to strengthen the CPPNM. Included in its final report, the Open-ended Expert Meeting adopted a recommendation that the CPPNM should cover, inter alia, the content of the “Physical Protection Objectives and Fundamental Principles.”

Following on the work of the Open-ended Expert Meeting, the Director General convened an Open-ended Group of Legal and Technical Experts to prepare an amendment to the CPPNM. The Group finished its work in 2003, submitting a final report which, inter alia, sets out possible amendments to the Convention [16]. The Director General subsequently circulated proposed amendments to all Parties, after which requests were received from a majority of Parties to convene an amendment conference pursuant to Article 20 of the CPPNM.

Pursuant to the Amendment to the CPPNM, Parties are required to set up an appropriate physical protection regime applicable to nuclear material and nuclear facilities. The aim of the physical protection regime is to:

- Protect against theft and other unlawful taking of nuclear material in use, storage and transport;
- Ensure the rapid and comprehensive measures to locate and recover missing or stolen nuclear material;
- Protect nuclear material and nuclear facilities against sabotage;
- Mitigate or minimize the radiological consequences of sabotage.

The Amendment goes on to list a set of 12 Fundamental Principles the Parties shall apply insofar as is reasonable and practicable in implementing a physical protection regime. The aim of the physical protection regime and the Fundamental Principles are derived from the “Physical Protection Objectives and Fundamental Principles,” and through incorporation in the Amendment to the CPPNM, these become binding on Parties thereto.

The fifth revision of INFCIRC/225 was commenced following adoption of the Amendment, so as to take into account the provisions of the Amendment and be able to examine how the recommendations could support the Amendment. INFCIRC/225/Rev.5, which, as already mentioned, has been incorporated into the Nuclear Security Series as NSS No. 13, provides guidance to States on developing or enhancing, implementing and maintaining a physical protection regime for nuclear material and nuclear facilities, inter alia through legislation and regulatory measures, with the aim of reducing the risk of malicious acts involving these

materials and facilities. It lays out recommended requirements to realize the four physical protection objectives and to apply the set of 12 Fundamental Principles in the operative text of the Amendment. As such, NSS No. 13 (INFCIRC/225/Rev.5) will help States implement their obligations as applicable under the Amendment with respect to the protection of nuclear material and nuclear facilities. The guidance contained in NSS No. 13 is relevant to the implementation of the CPPNM and its Amendment, not only because of the reference to physical protection recommendations which can provide guidance on means of achieving effective levels of physical protection in the amended preamble to the Convention as discussed below, but also because unlike in the case of physical protection during international transport, the CPPNM as amended does not lay out specific measures for physical protection of nuclear material in domestic use, storage and transport. For that reason, the guidance can be useful for Parties in establishing, implementing and maintaining an appropriate physical protection regime applicable to nuclear material and nuclear facilities under their jurisdiction as required under the Amendment. The role of NSS No. 13 as implementation guidance for the Amendment to the CPPNM is explicitly stated in the text of NSS No. 13.

As shown in this section, there is a close relationship between the CPPNM and its Amendment and non-binding recommendations on the physical protection of nuclear material and nuclear facilities. A cursory historical examination demonstrates how the development of one has informed the development of the other. This has involved, inter alia, the incorporation of elements of the recommendations in the legally binding text of the Convention, as well as the modification of the recommendations to help Parties implement their obligations under the Convention.

8.5.REFERENCES TO NON-BINDING INSTRUMENTS IN TREATY TEXTS

As alluded to above, both the Amendment to the CPPNM and ICSANT make direct reference to non-binding instruments, namely recommendations. These references are each of a different nature. The reference in the Amendment to the CPPNM is limited to the preamble, which recognizes “internationally formulated physical protection recommendations that are updated from time to time which can provide guidance on contemporary means of achieving effective levels of physical protection.” ICSANT, on the other hand, refers specifically to recommendations of the IAEA in two of its operative articles. Article 8 sets out a general obligation of conduct, requiring Parties to take into account relevant recommendations of the IAEA in making “every effort to adopt appropriate measures to ensure protection of radioactive material”. Article 18.1 of ICSANT is applicable to the specific situation in which radioactive material, devices or nuclear facilities are seized or otherwise taken control of, following the commission of an offence set forth in the convention. The State Party that is in possession of said material shall “have regard to physical protection recommendations … published by the International Atomic Energy Agency”.

8.5.1. Cross-References in Nuclear Safety Conventions

The cross-reference to non-binding instruments is not unique to the area of nuclear security. In the area of nuclear safety, both the Convention on Nuclear Safety (CNS) and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) refer in their respective preambles to non-binding instruments. In the case of the CNS, in fact, the obligations for Contracting Parties are based to a large extent on the application of the fundamental safety principles for nuclear installations contained in the IAEA publication “The Safety of Nuclear Installations” [17]. The preamble of the CNS, in a way similar to the reference to recommendations in the preamble of the Amendment to the CPPNM, invokes “internationally formulated safety guidelines, which are updated from time

to time and so can provide guidance on contemporary means of achieving a high level of safety" [18]. Compared to the preamble of the Amendment to the CPPNM, the reference in the CNS is more direct in describing the possible role of the internationally formulated safety guidelines in relation to the Convention, noting in the same preambular paragraph that the CNS entails a commitment for Contracting Parties to the application of fundamental safety principles for nuclear installations *instead of an application of detailed safety standards* (emphasis added). In this sense, with the Convention obligating Contracting Parties to apply fundamental principles, the safety guidelines are positioned as providing detail on methods for helping to achieve the objectives of the CNS, which include achieving and maintaining a high level of nuclear safety worldwide through the enhancement of national measures and international cooperation. As in the Amendment to the CPPNM, the fact that the guidelines are updated regularly and thus provide contemporary guidance is noted.

A key difference with the CPPNM and its Amendment is the review process foreseen in the CNS. The CNS entails a peer review process that takes place on a three-year cycle. For each review meeting, Contracting Parties are required to submit for review a report on the measures they have taken to implement each of the obligations of the Convention. The purpose of the review meetings, then, is to review the reports. The Contracting Parties review the reports submitted by other Contracting Parties and are able to seek clarification of reports. Pursuant to Article 22, guidelines regarding the form and structure of national reports have been established and revised a number of times [19]. As part of the general suggestions on the content of the national report, the guidelines note that the IAEA Safety Standards, and in particular the Safety Fundamentals and Requirements, "provide a basis for what constitutes a high level of safety and are objective, transparent and technologically neutral, which gives valuable guidance on how to meet the obligations of the Convention." The guidelines further state that reference could be made the IAEA Safety Fundamentals and Requirements in reporting on the obligations of the CNS. The Safety Fundamentals document, in turn, recognize that the IAEA safety standards are a useful tool for Contracting Parties to certain international conventions, including the CNS and the Joint Convention, to assess their performance under those conventions [20]. This does not impact the legally non-binding nature of the safety standards instruments, but should Contracting Parties incorporate them in assessments and national reports which are then part of the peer review process as suggested in the reporting guidelines, the safety standards would be integrated into the consideration of treaty implementation.

The Joint Convention, by establishing fundamental safety principles, addresses the issue of spent fuel and radioactive waste management safety worldwide [21]. It applies to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors, as well as to the safety of radioactive waste management when the radioactive waste results from civilian applications. The Joint Convention does not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of the Convention by the Contracting Party. In establishing general safety requirements for both the safety of spent fuel management and the safety of radioactive waste management, the Joint Convention requires Contracting Parties to take appropriate steps to provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards[8]. The Joint Convention thus incorporates due regard for the relevant non-binding instruments in the national legal

[8] Articles 4(iv) and 11(iv).

framework in its operative text. Again, this does not change the non-binding status of the standards themselves but does make them part of a Contracting Party's implementation of the Convention. In terms of review, the Joint Convention establishes a peer review process similar to that under the CNS. Contracting Parties submit national reports on how they meet their obligations under the Convention to all other Contracting Parties, that then can seek clarification on the national reports through a system of written questions and answers. The national reports are presented and discussed during the review meeting in country group sessions. Also similar to the CNS, pursuant to Article 29 of the Joint Convention, Contracting Parties establish guidelines regarding the form and structure of the national reports [22]. In these guidelines, as in those for the CNS, it is noted that IAEA safety standards, namely the safety fundamentals and requirements, give valuable guidance on how to meet the obligations of the Convention, and that reference to the safety fundamentals and requirements could be made when reporting on the obligations under the Convention.

As illustrated by the preceding paragraphs, the CNS and Joint Convention both make direct reference to relevant non-binding instruments, but due primarily to the peer review process foreseen in both conventions, the non-binding instruments are more clearly and structurally embedded in the consideration of treaty implementation. Without such review processes in place, the relationship with non-binding instruments is different with respect to the nuclear security-related treaties.

8.5.2. Reference to Physical Protection Recommendations in the Amendment to the CPPNM

Though there are clear linkages between the CPPNM and its Amendment and INFCIRC/225 as detailed above, including elements derived from INFCIRC/225 that have been made legally binding through incorporation in the Amendment to the CPPNM, INFCIRC/225 is not explicitly named in the Amendment text. Rather, the reference in the preamble of the Amendment, which is an added element from the original CPPNM, is more generally to "internationally formulated physical protection recommendations." In the final report of the Informal Open-Ended Expert Meeting to Discuss Whether there is a Need to Revise the Convention on the Physical Protection of Nuclear Material, mentioned in section 8.4 above, in confirming the need to strengthen the international physical protection regime including through a "well defined amendment" to the CPPNM, the experts laid out what an amendment should and should not cover [23]. The Expert Meeting specifically concluded that a peer review mechanism, such as that contained in the CNS and Joint Convention, as well as a mandatory application of INFCIRC/225, either through direct reference or through "due consideration" should be excluded.

It seems clear that "internationally formulated physical protection recommendations that are updated from time to time which can provide guidance on contemporary means of achieving effective levels of physical protection" would at least include, if not refer primarily to, INFCIRC/225, a document which reflects broad international consensus and specifically lays out recommendations on physical protection of nuclear material and nuclear facilities, albeit with definitions that sometimes slightly differ from the Amendment to the CPPNM[9]. NSS No.

[9] For instance, the definition of "nuclear facility" under the Amendment to the CPPNM reads: "facility (including associated buildings and equipment) in which nuclear material is produced, processed, used, handled, stored or disposed of, if damage to or interference with such facility could lead to the release of significant amounts of radiation or radioactive material." The definition of "nuclear facility" in NSS No. 13 (INFCIRC/225/Rev.5) is

13 (INFCIRC/225/Rev.5) provides recommended requirements for achieving the physical protection objectives and applying the 12 fundamental principles, discussed above, that were endorsed by the Board of Governors and the General Conference in 2001, and which were incorporated in the Amendment to the CPPNM. In other words, NSS No. 13 provides more detail on means to achieve the aims of an appropriate physical protection regime applicable to nuclear material and nuclear facilities under a State's jurisdiction, as well as to apply the Fundamental Principles of Physical Protection of Nuclear Material and Nuclear Facilities as set forth in Article 2A of the Amendment to the CPPNM. NSS No. 13 goes on to describe requirements for measures against unauthorized removal of nuclear material in use and storage, including requirements for Categories I, II and III material. The categorization table is the same in NSS No. 13 as it is in the CPPNM, though in the CPPNM the categorization is used as the basis for levels of physical protection to be applied in international transport of nuclear material whereas the categorization in NSS No. 13 is the basis for a graded approach for protection against unauthorized removal of nuclear material, not only during international transport, that could be used in a nuclear explosive device. NSS No. 13 goes further in elaborating recommendations for physical protection measures for each of the three categories that could be used in establishing and maintaining a legislative and regulatory framework to govern physical protection pursuant to Article 2A of the Amendment to the CPPNM. NSS No. 13 also provides requirements for measures against sabotage of nuclear facilities and nuclear material in use and storage, as well as requirements for measures against unauthorized removal and sabotage of nuclear material during transport.

With internationally formulated physical protection recommendations being mentioned in the preamble rather than the operative text, in addition to the general way in which the paragraph is written, this reference to recommendations does not create any obligations for Parties. Instead, it represents a recognition by Parties that the recommendations can provide guidance on contemporary means of achieving effective levels of physical protection, which aligns with the characteristics of non-binding instruments introduced in Section 3 above. The direct reference in the preamble in principle brings the topic of the role of international formulated physical protection recommendations in relation to the Amendment to the CPPNM within the purview of the review process foreseen in Article 16.1 of the CPPNM as amended, pursuant to which Parties review implementation and adequacy of the Convention "as concerns the *preamble*, the whole of the operative part and the annexes in the light of the then prevailing situation" (emphasis added).

8.5.3. IAEA Recommendations and ICSANT

As mentioned above, IAEA physical protection recommendations are specifically referred to in the operative text of ICSANT. Neither reference makes the recommendations as such legally binding on Parties to ICSANT. Rather, Parties are to take relevant recommendations into account in making every effort to ensure protection of radioactive material for the purposes of preventing offences under the Convention, and they are to have regard to physical protection recommendations having seized or otherwise taken control of radioactive material, devices or nuclear facilities following the commission of an offence under the Convention. This leaves it

nearly identical, but it does not include the element of the possible release of significant amounts of radiation or radioactive material if the facility is damaged or interfered with. The definition under NSS No. 13 only mentions that a nuclear facility is one for which a specific license is required. The definition in NSS No. 13, therefore, is broader than under the Amendment to the CPPNM.

to the discretion of the Parties precisely how and to what extent they make use of the recommendations.

Compared to the CPPNM and its Amendment, ICSANT covers a broader range of material: radioactive material, including nuclear material, as well as other radioactive substances, not only used for peaceful purposes.[10]

With the focus on radioactive material, the most closely associated set of IAEA recommendations is contained in NSS No. 14. As noted above, NSS No. 14 explicitly mentions that the recommendations will assist States in implementing obligations and commitments they may have under ICSANT[11]. NSS No. 14 applies to the security of radioactive material, as well as associated facilities and associated activities, for the prevention of malicious acts intended or likely to cause harmful radiological consequences. While NSS No. 14 is in principle intended for use in the security of radioactive material, associated facilities and associated activities for "civil purposes", like NSS No. 13, it explicitly states that States may decide to extend the use of the publication to other purposes[12]. This is applicable in the case of providing implementing guidance for ICSANT, which is not restricted in application to material and facilities used for peaceful purposes.

The term radioactive material under NSS No. 14 is broad, including nuclear material, as well as sealed radioactive sources, unsealed radioactive material and radioactive waste. The Code of Conduct, on the other hand, applies specifically to radioactive sources, a narrower category than radioactive material, which as defined in the Code, means radioactive material permanently sealed in a capsule or closely bonded, in a solid form and which is not exempt from regulatory control. NSS No. 14 will also help States that have made a political commitment to do so to implement the Code of Conduct.

The recommendations contained in NSS No. 14 related to the security of radioactive material can logically be considered in the context of the obligation of conduct with respect to protecting radioactive material pursuant to Article 8 of ICSANT. In this context, taking account of the recommendations could entail establishing, implementing and maintaining an effective national and regulatory framework to regulate the security of radioactive material, which, inter alia, assigns responsibilities to relevant governmental agencies including the regulatory body to implement the framework, as well as establishes an authorization process for radioactive material including inspections and enforcement. Taking the recommendations of NSS No. 14 into account could also mean adopting security measures including the assessment of a national threat to radioactive material, as well as the design of security requirements for radioactive material in use, storage and transport based on a categorization system, incorporating a graded approach that takes into consideration such issues as the level of threat and relative attractiveness of the material for a malicious act.

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[10] "Radioactive material" as defined in Article 1 of ICSANT "means nuclear material and other radioactive substances which contain nuclides which undergo spontaneous disintegration (a process accompanied by emission of one or more types of ionizing radiation, such as alpha-, beta-, neutron particles and gamma rays) and which may, owing to their radiological or fissile properties, cause death, serious bodily injury or substantial damage to property or to the environment." Although the definition of "nuclear material" under ICSANT is identical to that under the CPPNM and its Amendment, the CPPNM and its Amendment apply only to nuclear material used for peaceful purposes, whereas ICSANT applies to nuclear material in non-peaceful uses as well.

[11] Para. 1.9 of NSS No. 14.

[12] Para. 1.18 of NSS No. 14.

Article 18 of ICSANT applies in the case of a Party having seized or otherwise taken control of radioactive material, devices or nuclear facilities following a commission of an offence under the Convention, in which case the Party in possession of the item is to have regard to physical protection recommendations published by the IAEA. Unlike the obligation of conduct under Article 8, Article 18 applies not only to radioactive material but also to nuclear facilities, as defined under ICSANT. Nuclear facility as defined under ICSANT is different from the term nuclear facility defined under the Amendment to the CPPNM, and therefore also different from the definition in NSS No. 13[13]. NSS No 14 defines the term "associated facility" very generally as "a nuclear facility or radioactive material facility". As such, physical protection recommendations to which Parties must have regard pursuant to Article 18 would logically be the relevant aspects of NSS No. 14, such as for instance the recommendations for the security of radioactive materials in use and storage, as applicable, and the recommendations for the security of radioactive material in use and storage. In addition, because Article 18 concerns seizure or taking control of material and/or facilities following the commission of an offence, the recommendations contained in NSS No. 15 could also apply. Relevant recommendations under NSS No. 15 could include ensuring the safe and secure storage of the radioactive material and, where appropriate, working with the State in which regulatory control has been lost to arrange for the safe and security return of the material; as well as applying nuclear forensic techniques to seized nuclear or other radioactive material using a graded approach based on the quantity and nature of the material for the purpose of identifying the source, history and the route of transfer[14].

8.6.CONCLUSION

The relevant non-binding instruments discussed above are an integral part of the international legal framework for nuclear security. They serve to help States implement various obligations under the legally binding instruments in the area of nuclear security, namely the CPPNM and its Amendment and ICSANT. They also supplement the binding instruments by providing guidance on all aspects of nuclear security, going beyond the scope of the binding instruments. While the binding instruments establish legal obligations for the Parties to them, the non-binding instruments in the area of nuclear security provide guidance on contemporary means of achieving nuclear security aims, including those laid out by the respective treaties. The relationship between the binding and non-binding instruments is clear from the cross-references in the treaties and guidance documents, as well as in the interconnected development of in particular the CPPNM and its Amendment and the recommendations on the physical protection of nuclear material and nuclear facilities (INFCIRC/225). For the foregoing reasons, understanding the relationship between the legally binding and non-binding instruments that comprise the international legal framework for nuclear security is key to understanding the framework as a whole, as well as to establishing and maintaining an effective national nuclear security framework.

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9. LEGAL FRAMEWORKS FOR NUCLEAR SECURITY AND SAFEGUARDS

Developments and Synergies

J. HERBACH and S. FANIELLE[1]
International Atomic Energy Agency

9.1.INTRODUCTION

Over the past several years, the international legal frameworks for nuclear security and safeguards have been adapted and strengthened in order to address developments and challenges in each of these areas. The entry into force of the Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM) in 2016 marked an important milestone as it substantially expanded the scope of the main multilateral treaty in the area of nuclear security. The increasing number of guidance documents published in the International Atomic Energy Agency's (IAEA) Nuclear Security Series continue to support States in strengthening their national systems to protect nuclear material, as well as other radioactive material, and related facilities from unauthorized use. In the field of safeguards, which are applied to increasing quantities of nuclear material and facilities, the implementation of additional protocols based on the Model Additional Protocol significantly improved the effectiveness and efficiency of safeguards by providing the IAEA with additional tools to verify the peaceful use of all nuclear material in States with comprehensive safeguards agreements.

Though the legal frameworks for nuclear security and safeguards are distinct, with scopes founded in separate international instruments and with the IAEA playing a different role in each area, they both share a common goal: exercising control over nuclear material. This means that certain elements and approaches of the respective legal frameworks may serve the objectives of both nuclear security and safeguards. When it comes to national implementation of the international instruments in the areas of nuclear security and safeguards, there are elements of national laws and regulations, including systems of nuclear material accountancy and control and the role of the regulatory body, where security and safeguards may be addressed in an integrated manner.

This article first provides an overview of the relevant nuclear security and safeguards instruments, as well as of the way their different requirements are reflected in national legal frameworks. On the basis of recent practices in the application of nuclear law, it then identifies and discusses areas where both security and safeguards requirements have synergies, i.e. exercising control over nuclear material.

[1] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

9.2.THE LEGAL FRAMEWORK FOR NUCLEAR SECURITY: MAIN OBLIGATIONS AND ELEMENTS UNDER INTERNATIONAL INSTRUMENTS AND NATIONAL IMPLEMENTATION

Nuclear security focuses on preventing, detecting and responding to criminal or intentional unauthorized acts involving nuclear or other radioactive material and/or related facilities. In other words, nuclear security aims at addressing the misuse of nuclear and other radioactive material by non-State actors, causing or with the intent to cause harm. Currently, no single international legal instrument addresses nuclear security in a comprehensive manner. Rather, the international legal framework is comprised of multilateral treaties that cover various aspects of nuclear security, United Nations (UN) Security Council resolutions on international terrorism and weapons of mass destruction, and an extensive body of legally non-binding instruments that provide further guidance on developing, implementing and maintaining a national nuclear security regime. The following subsections briefly describes the main elements of the key international instruments, including the legally binding and non-binding instruments, and looks at aspects of national legislation incorporating specific provisions on nuclear security that give effect to a State's international obligations under the relevant treaties as supplemented by relevant international guidance. The focus here is on the instruments that cover nuclear material and nuclear facilities, as this is where synergies with safeguards legal instruments arise.

9.2.1. Main obligations under the key legally binding instruments

The legal instruments comprising the framework for nuclear security have not only been adopted under IAEA auspices but also under the auspices of the UN and its specialized agencies, notably the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO). However, the instruments adopted outside of IAEA auspices focus primarily on criminalization of certain acts involving nuclear or other radioactive material. For the purposes of this chapter, the following discussion focuses on three of the key legally binding instruments that cover aspects of nuclear security more broadly: the CPPNM and its Amendment, the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT) and UN Security Council resolution 1540. The international conventions have contributed toward establishing and strengthening the mandate and functions of the IAEA in the area of nuclear security through assigning certain roles to the IAEA, which have been approved by the IAEA Board of Governors (hereafter referred to as "the Board"), and its role and expertise in strengthening nuclear security and in the prevention of nuclear terrorism has also been recognized in relevant UN Security Council resolutions. More broadly, the IAEA's mandate and activities in the area of nuclear security are derived from Article II of the IAEA Statute, being related to the acceleration and enlargement of the contribution of atomic energy to peace, health and prosperity throughout the world [1]. The role of the IAEA in promoting nuclear security and combatting nuclear terrorism is further legally anchored and confirmed in resolutions of the Board and the General Conference, including in the quadrennial Nuclear Security Plans, approved by the Board and laying out proposed IAEA nuclear security activities that respond to the priorities and requests of Member States to assist them in improving their national nuclear security infrastructures as well as their regional and international cooperation. Moreover, several of the IAEA's nuclear security activities can be attributed directly to specific statutory functions including, inter alia, providing training and technical advice; providing equipment or supplies; and facilitating exchange of information and related services. The IAEA's policy-making organs have also recognized the synergies between measures to strengthen nuclear security and measures to strengthen safeguards, as well as safety, noting for instance the contribution of State systems of accounting for and control of nuclear material to

preventing loss of control and illicit trafficking and to deterring and detecting the unauthorized removal of nuclear material [2].

9.2.1.1. Convention on the Physical Protection of Nuclear Material and its Amendment

Of the multilateral treaties in the area of nuclear security, the CPPNM and its Amendment are the only internationally legally binding undertakings in the area of physical protection of nuclear material and, under the Amendment, of nuclear facilities used for peaceful purposes, establishing specific obligations on adopting legislative and regulatory measures to ensure the physical protection of such material and facilities.

The original CPPNM [3] entered into force in 1987 and establishes a three-pronged approach, setting out obligations of Parties with respect to: (1) physical protection of nuclear material used for peaceful purposes while in international transport; (2) criminalization of certain acts in national legislation; and, (3) international cooperation. The CPPNM requires Parties to ensure that, during international transport, nuclear material is protected at certain levels (described in the Convention's Annex I), and not to export or import, or authorize the export or import of, nuclear material unless assurances have been received that the material will, during international transport and storage incidental to such transport, be protected at these levels.

In terms of criminal offences, the CPPNM covers a broad range of activities including, inter alia, the receipt, possession, use, transfer, alteration, disposal or dispersal of nuclear material, without lawful authority and with intent to commit such an act. Such acts must also cause or must be likely to cause death or serious injury to any person or substantial damage to property. Furthermore, theft or robbery of, embezzlement or fraudulent obtaining of and a demand by threat or use of force or through intimidation for nuclear material are also to be criminalized under national jurisdictions. The threat to use nuclear material to cause harm is also covered, as are ancillary offences including an attempt to commit one of the listed offences and participation therein. Parties are required to make the specified acts involving nuclear material punishable offences under national law, with appropriate penalties taking into account their grave nature, and to establish of jurisdiction over such offences. They are further obligated to ensure the prosecution or extradition of alleged offenders.

The CPPNM, as a third pillar, contains provisions for international cooperation. This includes cooperation and assistance with respect to recovery and protection of nuclear material in the case of theft, robbery or other unlawful taking of such material, or threat thereof; and cooperation and consultation as appropriate with respect to design, maintenance and improvement of systems of physical protection of nuclear material in international transport. In addition, with regard to the criminal provisions, Parties are to provide assistance in connection with criminal proceedings relating to such offences, including the supply of evidence necessary for the proceedings. For the purposes of facilitating international cooperation, Parties are required to identify and make known their central authority and point of contact responsible for physical protection of nuclear material and for coordinating the recovery and response operations. A role in facilitating international cooperation under the Convention is foreseen for the IAEA, serving primarily as a conduit of information when it comes to maintaining and communicating an up-to-date list of points of contact and central authorities, to protecting or recovering nuclear material and to cooperation on physical protection systems.

The Amendment to the CPPNM [4], which entered into force in 2016, extends the scope of the Convention in all three pillars. It establishes obligations for Parties with respect to cover physical protection of nuclear facilities and nuclear material used for peaceful purposes in domestic use, storage and transport. Pursuant to the Amendment, Parties thereto are required,

inter alia, to set up an appropriate physical protection regime applicable to nuclear material and facilities with the aim of: protecting against theft and other unlawful taking of nuclear material in use, storage and transport; ensuring the rapid and comprehensive measures to locate and recover missing or stolen nuclear material; protecting nuclear material and nuclear facilities against sabotage; and, mitigating or minimizing the radiological consequences of sabotage.

The CPPNM Amendment expands on the list of criminal offenses under the Convention in two important ways. First, it adds a new criminal offence relating to illicit trafficking of nuclear material. The intentional commission of an act which constitutes the carrying, sending, or moving of nuclear material into or out of a State without lawful authority is to be criminalized. The second expansion has to do with the addition of offences related to sabotage of nuclear material or a nuclear facility. This encompasses the intentional commission of an act directed against a nuclear facility, or an act interfering with the operation of a nuclear facility, where the offender intentionally causes, or where he knows that the act is likely to cause, death or serious injury to any person or substantial damage to property or to the environment by exposure to radiation or release of radioactive substances. Substantial damage to the environment is included in the Amendment as an effect or potential effect of a criminal act. Additionally, the threat to commit these new offences is also to be criminalized. The Amendment also adds new ancillary offences, including the organization or direction of others to commit a listed offence.

The provisions on international cooperation are also expanded under the Amendment. For instance, assistance may be requested in the case of sabotage of nuclear material or a nuclear facility or a credible threat thereof. The Party in which such sabotage of nuclear material or a nuclear facility has taken place must take appropriate steps to inform as soon as possible State(s) which are likely to be radiologically affected. Furthermore, Parties may consult and co-operate, as appropriate, with a view to obtaining their guidance on the design, maintenance and improvement of its national system of physical protection of nuclear material in domestic use, storage and transport and of nuclear facilities. The obligation to identify and make known a point of contact remains, through under the Amendment, the point of contact is more broadly for all matters within the scope of the Convention as amended. The IAEA also assumes certain additional functions under the Amendment, in line with the expanded scope. These include, inter alia, exchanging information and facilitating coordination and cooperation in the case of sabotage of nuclear material or a nuclear facility or credible threat thereof, and facilitating consultation and cooperation with respect to obtaining guidance on physical protection systems for nuclear material in domestic use, storage and transport and for nuclear facilities. In addition, in the depositary role, the IAEA will convene a conference of the Parties in 2021, five years after entry into force of the Amendment, to review the implementation of the CPPNM as amended and its adequacy as concerns the preamble, the whole of the operative part and the annexes in light of the then prevailing situation, as foreseen in Article 16.1 thereof.

As of 31 July 2020, there were 161 Parties to the CPPNM, of which 124 have also joined the Amendment.

9.2.1.2. International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)

ICSANT [5] covers all radioactive material, including nuclear material, and is not limited to material and facilities used for peaceful purposes. While it is clearly focused on the establishment of criminal offences, ICSANT contains an obligation for States Parties to "*make every effort*" to adopt appropriate measures for ensuring the physical protection of nuclear and other radioactive material, and thereby to take into account relevant recommendations and functions of the IAEA. These measures are aimed at preventing the criminal offences under the

Convention, which include the unlawful and intentional possession and use of radioactive material or radioactive devices, and the unlawful use or damage of nuclear facilities. However, ICSANT does not establish any specific obligations that States Parties, inter alia, adopt legislative, administrative and/or technical measures to ensure the physical protection of materials and facilities. The other physical protection related provisions under ICSANT are found in Article 18, pursuant to which radioactive material, devices or nuclear facilities seized or taken control of following the commission of a criminal offence must, inter alia, be handled with regard to IAEA physical protection recommendations, and nuclear material must be held in accordance with applicable IAEA safeguards.

9.2.1.3. UN Security Council resolution 1540

Adopted unanimously in 2004, resolution 1540 is, by virtue of its having been adopted under Chapter VII of the UN Charter, binding on all UN Member States, and contains provisions aimed at enhancing security of materials (including nuclear materials), equipment and technology that can be used for the design, development, production or use of weapons of mass destruction and their means of delivery, which for the purposes of resolution 1540 are termed "*related materials*" [6]. The resolution exemplifies the common thread between nuclear non-proliferation and security by supporting the goals of each, including combatting the spread of nuclear weapons and materials, as well as addressing the acquisition of such items by and transfer of such items to non-State actors.

Nuclear security-related elements of resolution 1540 are primarily set forth in operative paragraph 3, and include the requirements to develop and maintain: appropriate effective measures to account for and secure nuclear materials in production, use, storage or transport; appropriate effective physical protection measures over nuclear materials; appropriate effective border controls and law enforcement efforts to address illicit trafficking; and appropriate effective export and trans-shipment controls, with appropriate legal penalties for violations, over nuclear material. Many of the nuclear security-related obligations have synergies with the other legally binding and non-binding instruments that make up the international legal framework for nuclear security, with inter alia the CPPNM being mentioned in the resolution's preamble, and adherence to and full implementation of the CPPNM and its Amendment and application of IAEA guidance would, for instance, contribute to the fulfilment of a State's obligations under resolution 1540.

9.2.2. 2.2. Overview of relevant non-binding instruments

As mentioned above, the body of legally non-binding instruments developed under the auspices of the IAEA plays an important role in the broader legal framework for nuclear security, providing guidance on developing and implementing a legal and regulatory framework in a State. As such, a number of non-binding instruments complement the binding instruments and provide guidance that will support States in implementing its international legal obligations under, inter alia, the CPPNM and its Amendment.

The IAEA establishes and maintains the Nuclear Security Series (NSS), comprised of nuclear security fundamentals, recommendations, implementing guides and technical guidance. The NSS provides international consensus guidance on all aspects of nuclear security. The instruments provide guidance to assist States in implementing measures of regulatory control over nuclear material, other radioactive material and facilities using those materials, and they are consistent with and help States implement obligations under the legally binding instruments, including the CPPNM and its Amendment. They are not legally binding as such, but they can

become binding if national law or a separate international agreement so provides, or if incorporated into national law.

There are three recommendation documents in the NSS that present measures that should be taken by states to achieve and maintain effective national nuclear security regimes. The Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (NSS No. 13, or IAEA document INFCIRC/225/Rev.5) [7] contains recommendations for physical protection against unauthorized removal of nuclear material in use and storage, for physical protection against sabotage of nuclear facilities and of nuclear material during use and storage, and for physical protection of nuclear material during transport. The guidance provided in NSS No. 13 will help States implement obligations they may have under the Amendment to the CPPNM related to the physical protection of nuclear material and nuclear facilities. In the development of the recommendations, a connection was drawn with safeguards, namely that a State's physical protection measures should take into account the relevant aspects of a system of accounting for and control of nuclear material as part of the safeguards framework.[2]

The Nuclear Security Recommendations on Radioactive Material and Associated Facilities (NSS No. 14) [8] provides guidance on the elements of a national nuclear security regime applicable to radioactive material (including nuclear material), associated facilities and activities. This includes guidance on developing, implementing and maintaining a legal and regulatory framework, establishing domestic institutions tasked with implementing the framework, as well as practices and systems for detection of and response to criminal or unauthorized acts involving the materials and/or facilities.

The focus of Nuclear Security Recommendations on Nuclear and Other Radioactive Material Out of Regulatory Control (NSS No. 15) [9] are security measures related to nuclear and other radioactive material out of regulatory control, either having been reported as such, having been lost, missing or stolen but not having been reported, or having been in some other way discovered. This recommendation document provides guidance to States and their competent authorities on deterring, detecting and responding to a criminal or unauthorized act involving material out of regulatory control, as well as guidance directed at facilitating international cooperation to ensure that regulatory control is regained over such material and the appropriate action is taken with respect to the alleged offenders.

Though not directly related to the synergies with safeguards yet important for a complete overview of the main non-binding instruments in the area of nuclear security, when it comes to the security of radioactive sources, the primary international instrument is the legally non-binding Code of Conduct [10]. The Code of Conduct provides guidance on the development and implementation of national policies, laws and regulations, and on fostering international co-operation, with respect to radioactive sources, referred to in its Annex I, that may pose a significant risk to individuals, society and the environment. Its objectives include: (1) preventing unauthorized access or damage to, and loss, theft or unauthorized transfer of, radioactive sources; and (2) mitigating or minimizing the radiological consequences of accidents or malicious acts involving a radioactive source. To meet these objectives, the Code of Conduct establishes basic principles applicable to the security of radioactive sources. For instance, States should have in place effective national legislation and regulations containing security measures to deter, detect and delay the unauthorized access to, or the theft, loss or unauthorized use or removal of radioactive sources during all stages of management. In

[2] See preface by then Director General of the IAEA, Sigvard Eklund, to the first revision of INFCIRC/225, published in June 1977.

addition, the Code of Conduct, similar to IAEA recommendations in areas of safeguards and safety, provides that a regulatory body for the effective control of radioactive sources should be established with appropriate authority, inter alia to establish and enforce regulatory requirements relating to the security of radioactive sources and to require authorizations for the management of radioactive sources.

9.2.3. Nuclear security in the national legal framework

It is up to the individual State to establish a national legal framework for nuclear security in accordance with its international obligations, including for Parties thereto implementing laws and regulations giving effect to the CPPNM and its Amendment. In so doing, the national law will be adapted to the nature and extent of the materials, facilities and activities to be regulated.

Pursuant to the above-described instruments, and depending on the national situation, a number of elements applying to nuclear law more generally, as well as specific provisions on nuclear security, and in particular physical protection, would be included in national legislation to give effect to nuclear security commitments, prescribed as appropriate by international guidance.

Parties to the CPPNM and its Amendment are obligated, inter alia, to implement the set of 12 Fundamental Principles set out in the Amendment in so far as reasonable and practicable. These include the establishment and maintenance of a national legislative and regulatory framework to govern physical protection that provides for the establishment of applicable physical protection requirements and includes a system of evaluation, authorization (licensing) and inspection of nuclear facilities and transport to verify compliance with applicable requirements, as well as a means to enforce the requirements, including effective sanctions. To implement the legal and regulatory framework, the Party should establish or designate a competent authority (e.g. the regulatory body), which is provided with adequate authority, competence and resources to fulfil its assigned responsibilities. National legislation should also ensure that the prime responsibility for the implementation of physical protection of nuclear material or of nuclear facilities rests with the holders of the relevant authorization, and should further clearly establish responsibilities for physical protection during international transport, for regularly evaluating the threat, and for providing international cooperation and assistance, among other responsibilities. Provisions criminalizing and establishing jurisdiction over offences involving nuclear material and nuclear facilities, including illicit trafficking and sabotage, must also be established.

The establishment of import and export controls are also required to fulfil obligations under the CPPNM and its Amendment as well as pursuant to UN Security Council resolution 1540, as mentioned above. The CPPNM and its Amendment require Parties not to import or export, nor authorize the import or export of nuclear material unless it has received assurances that the material will be protected during international transport at the levels set out in Annex I of the Convention. Again, prime responsibility for the physical protection during transport will rest with the respective license holders, such as shippers. Such assurances must also be obtained in order to allow transit of material across a Party's territory.

A State's system of nuclear material accountancy and control to record and monitor quantities and locations of nuclear material under a State's jurisdiction also contributes to nuclear security [10]. Such a system, established in national legislation, helps inter alia to protect nuclear material against unlawful acts, deter and detect theft of material, as well as prevent and respond to unauthorized activities involving the material, including illicit trafficking. Furthermore, accurate accounting of the quantity of nuclear material and locations at which material is held will help the State to evaluate potential threats to material and facilities in a timely manner. The

role of material accountancy and control in the area of nuclear security is illustrated by NSS No. 13, inter alia, in assessing the threat and in establishing defence in depth.

9.3.THE LEGAL FRAMEWORK FOR SAFEGUARDS: MAIN OBLIGATIONS AND ELEMENTS UNDER INTERNATIONAL INSTRUMENTS AND NATIONAL IMPLEMENTATION

This chapter looks at the instruments constituting the IAEA legal framework for safeguards. On the basis of the obligations contained in those instruments, it then provides an overview of the main legal components of the national legal framework which supports the States' effective implementation of safeguards, thereby facilitating the fulfilment of their international obligations.

9.3.1. The IAEA legal framework for safeguards

Safeguards are as a set of technical measures which enable the IAEA to verify that States are respecting their international commitments to use nuclear material and technology exclusively for peaceful purposes. The IAEA's role in the field of safeguards is based on a number of international legal instruments which include: the IAEA Statute; safeguards agreements, additional protocols and subsidiary arrangements concluded between the IAEA and States. In contrast to nuclear security instruments, the IAEA is a Party to safeguards agreements and additional protocols and therefore has rights and obligations thereunder.

9.3.1.1. The IAEA Statute

Under Article III.A.5 of its Statute [12], the IAEA is authorized to establish and administer safeguards to ensure that nuclear material, services, equipment, facilities and information made available by it or at its request or under its supervision or control, are not used with the objective of furthering any military purpose. This article also provides that the IAEA applies safeguards at the request of the parties to any bilateral or multilateral arrangement, or to any of the nuclear activities of a State, at that State's request.

Fundamental features of IAEA safeguards are provided in Article XII of the Statute. It requires, inter alia, the IAEA to establish a staff of inspectors with the purpose of conducting verification activities as prescribed in the relevant agreements and describes the roles of inspectors, the IAEA Director General and the Board in the reporting of non-compliance.

The safeguards provisions in the Statute are not self-executing. Safeguards can be implemented in connection with assistance provided by the Agency to its Member States in connection with a project for research on, or development or practical application of, atomic energy for peaceful purpose, which require the conclusion of a project and supply agreement. They can be also implemented on the basis of safeguards agreements concluded by the Agency with States in connection with their bilateral cooperation agreements in nuclear field, with States Parties to multilateral treaties such as the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) or treaties establishing nuclear-weapon free zones.

9.3.1.2. Safeguards agreements

Safeguards agreements concluded between the IAEA and States (and regional organizations in two cases) contain the rights and obligations of the parties as well as the relevant safeguards procedures and definitions. Those are of three types: item-specific safeguards agreements; comprehensive safeguards agreements; and voluntary offer agreements.

- *Item-specific safeguards agreements*

One of the earliest safeguards documents, approved by the Board and published as IAEA document INFCIRC/66/Rev.2 [13], which contains principles and procedures for the application of safeguards, has been used as a basis to conclude safeguards agreements under which the IAEA applies safeguards equipment, facilities, nuclear or non-nuclear material specified in those agreements, with the purpose of verifying that such items are not used for the manufacture of nuclear weapons or other nuclear explosive device, or to further any other military purpose and are used exclusively in peaceful activities. While the original safeguards document contained procedures for safeguarding small and large nuclear reactors, they were extended to cover reprocessing plants (Annex 1, 1966) and conversion and fuel fabrication plants (Annex 2, 1968). The safeguards agreements containing procedures set out in INFCIRC/66/Rev.2 are also referred to as "INFCIRC/66-type agreements" or "item-specific safeguards agreements".

As of 31 July 2020, the IAEA implements safeguards pursuant to item-specific safeguards agreements in three States which are not party to the NPT.

- *Comprehensive safeguards agreements*

Following the adoption of the NPT in 1968, the IAEA was entrusted with verification responsibilities in light of the Treaty [14]. Article III.1 of the NPT provides that each non-nuclear-weapon State Party has to accept safeguards, as set forth in an agreement with the IAEA and in accordance with its Statute, to enable the IAEA to verify the fulfilment of the State's obligations under the Treaty. In 1972, two years after entry into force of the NPT, the Board approved the safeguards document entitled 'The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons' (published as IAEA document INFCIRC/153 (Corr.) [15]) and requested the IAEA Director General to use it as a basis for negotiating safeguards agreements in connection with the NPT.

Under safeguards agreements concluded on the basis of INFCIRC/153 (Corr.), the IAEA applies safeguards on all source or special fissionable material[3] in all peaceful nuclear activities within a State's territory, under its jurisdiction or carried out under its control anywhere, with the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices. Those agreements, also referred to as "full-scope" or "comprehensive safeguards agreements" (CSA), contain two parts: Part I, which describes the basic rights and obligations of parties to the agreement; Part II, which specifies the procedures to be applied for safeguards implementation; and Definitions. As of 31 July 2020, 176 non-nuclear-weapon States parties to the NPT had concluded a comprehensive safeguards agreement with the IAEA. INFCIRC/153 (Corr.) has also been used as a basis to conclude safeguards agreements with States Parties to regional treaties establishing nuclear-weapons-free zones.

In 1974, the IAEA Secretariat developed the text of a protocol to CSAs available to States which had small amounts or no nuclear material and no nuclear material in a nuclear facility. The effect of such protocol, referred to as "small quantities protocol" (SQP), is to hold in abeyance the implementation of most of the safeguards procedures provided in Part II of INFCIRC/153 (Corr.). Based on the advice of the IAEA Director General, the Board approved

[3] Defined in Article XX of the IAEA Statute [12].

in 2005 the revision of the text of the original SQP therefore modifying the eligibility criteria for the conclusion of an SQP. Since 2006, an SQP based on the revised text has been available to States which decided to conclude a comprehensive safeguards agreement and had small amounts or no nuclear material and had no plans to construct or authorize the construction of a facility. States which concluded an SQP prior to the approval of the modified SQP were asked by the Board to agree by an exchange of letters to modify or rescind their SQP based on the original standard text.

- *Voluntary offer agreements*

INFCIRC/153 (Corr.) also provided the basis for the conclusion of voluntary offer agreements (VOAs) with the five nuclear-weapon States (NWS) Parties to the NPT. Pursuant to those agreements, the IAEA has the right to apply safeguards to nuclear material in civilian nuclear facilities that each NWS has voluntarily offered and that the IAEA has selected for the application of safeguards. Under such agreements, the IAEA verifies that nuclear material to which safeguards are applied remains in peaceful activities and is not withdrawn from safeguards, except under the conditions provided for in the agreement.

9.3.1.3. Additional Protocol

In the beginning of the 1990s, the IAEA undertook efforts, together with its Member States, to strengthen its safeguards system, which, inter alia, led to the approval by the Board in May 1997 of the Model Additional Protocol (published as IAEA document INFCIRC/540 (Corr.)) [16]. The Model Additional Protocol strengthens the safeguards system by providing the IAEA with additional tools for verification. Under such protocols, the IAEA is granted expanded rights of access to information on all aspects of a State's nuclear fuel cycle and locations in the States. It also improves certain administrative arrangements necessary for safeguards implementation, such as simplified inspector designation procedures or the issuance of multiple entry visas valid for at least one year.

INFCIRC/540 (Corr.) is not a stand-alone document and was designed to be voluntarily concluded by all States which have a safeguards agreement in force. When the Board approved it, it also requested the IAEA Director General to use it as a standard text for the conclusion of an additional protocol to CSAs.

As of 31 July 2020, 136 States had an additional protocol in force and one State is provisionally implementing it, pending its entry into force.

9.3.1.4. Subsidiary arrangements

Concluded between the IAEA and States, subsidiary arrangements to safeguards agreements contain more detailed technical and administrative procedures specifying how safeguards provisions laid down in the safeguards agreements are to be implemented. They consist of a General Part, with procedures applicable to all nuclear facilities and locations outside the facility (LOFs) of a State, and Attachment(s), with procedures describing verification arrangements specific for each individual facility or LOF.

Under CSAs and VOAs States and the IAEA are required to conclude subsidiary arrangements. This obligation is held in abeyance for States with an SQP. Item-specific safeguards agreements also require the States and the IAEA to conclude subsidiary arrangements concerning the implementation of the safeguards procedures specified in the agreements. For additional

protocols concluded on the basis of INFCIRC/540 (Corr.), subsidiary arrangements may be concluded if requested by one of the parties to the protocol.

9.3.2. Safeguards in the national legal framework

The IAEA legal framework for safeguards is composed of a number of instruments enabling the IAEA to verify that States are meeting their obligations to use nuclear material and technology exclusively for peaceful purposes. Those instruments contain rights and obligations for both Parties thereto — the IAEA and the State(s). As a principle of international law, the responsibility of meeting the obligations arising from safeguards agreements and protocols thereto rest upon the Parties to such instruments. Under safeguards agreements and protocols thereto, States are required to establish and maintain national systems of accounting for and control of nuclear material (SSAC). Such systems facilitate the implementation of safeguards at national level, through collection and submission of safeguards relevant information to the IAEA, support IAEA in field verification activities and interact with the IAEA on any other safeguards implementation matter. The SSAC are established through the development of national legislation. The development of a national legal framework for safeguards through primary (e.g. statutes, laws, etc.) and secondary (e.g. decrees, regulations, etc.) legislation contributes to the States' fulfilling their obligations under such instruments.

The scope of a national legal framework for safeguards is determined by the type of safeguards agreement concluded between the IAEA and State(s), and whether protocols thereto have been concluded. States generally include safeguards provisions in a comprehensive nuclear law which covers in a single piece of legislation all subjects pertaining to nuclear law. While the main safeguards provisions are included in such a law to facilitate the implementation of the State's obligations under safeguards agreements and protocols thereto at the national level, details pertaining to safeguards implementation are usually included in the secondary legislation (e.g. regulations or regulatory documents).

Like other areas of nuclear law, an essential element of the national legal framework for safeguards is the inclusion of provisions establishing a nuclear regulatory body as well as general provisions and principles authorizing such entity to exercise the necessary regulatory functions (i.e. licensing, inspection and enforcement) with the purpose of regulating the conduct of any person engaged in activities involving the use of nuclear material and technology. For example, the nuclear regulatory body verifies that the safeguards conditions in a license are met by operators.

The provisions listed below are those relevant to States with a comprehensive safeguards agreement in force and, where applicable, a protocol additional thereto [17] [18].[4] [5]

For States with a comprehensive safeguards agreement, the nuclear law shall include, inter alia:

- A basic undertaking of the general principle affirming the exclusively peaceful use of nuclear energy in the State;
- Clear definitions of key terms used in implementing the comprehensive safeguards agreements;

[4] Safeguards provisions applicable to item-specific safeguards agreements have not been outlined in this publication as safeguards under such agreements are only applied in few States.
[5] Some States may prefer having some of those elements set forth in regulations.

- The designation of a competent authority (e.g. regulatory) body to coordinate the implementation of safeguards;
- The establishment and maintenance of a State system of accounting for and control of nuclear material (SSAC);
- Arrangements for supporting verification activities conducted by the IAEA;
- Requirements for record keeping by licensees and requirements for the reporting of information to the competent authority and to the IAEA;
- An obligation for all State entities and licensees to fully cooperate with the IAEA to facilitate the implementation of safeguards, including the provision of access to any location or facility to designated IAEA inspectors;
- Provisions related to the notification of international transfers of nuclear material and the prohibition of such transfers without prior authorisation.

For States that have concluded an additional protocol, their comprehensive nuclear law shall include provisions enabling them to comply with the additional obligations thereunder. The nuclear law shall also include, inter alia:

- Clear definitions of key terms used in implementing the additional protocol;
- Provisions for the State on the submission of declarations to the IAEA (e.g. on nuclear fuel cycle research and development activities not involving nuclear material; site of each facility and LOF; estimated production capacities of uranium and thorium mines and concentration plants, etc.);
- Provisions on the submission of information updates related to declarations (e.g. exports of nuclear equipment and non-nuclear material listed in Annex II of the additional protocol and the related imports, upon request from the IAEA; information on changes in the location of intermediate and high-level radioactive waste; advance information on the intended processing of such material, etc.);
- Provisions for the IAEA to access to sites and locations to conduct complementary access;
- Provisions for the competent entity to issue, where required and within a month of IAEA's request, the designated IAEA inspectors with appropriate multiple entry/exit and/or transit visas, valid for at least one year.

9.4.WHERE SECURITY AND SAFEGUARDS CONNECT

The foregoing discussion of both international legal framework for nuclear security and for safeguards provided an overview of the main rights and obligations of the parties under the relevant international instruments, as well as described the provisions to be incorporated in national legal frameworks to enable States to fulfil their obligations under these instruments. The Amendment to the CPPNM was an important recent development in the field of nuclear law. For the first time, an international agreement entails an obligation for States Parties to establish a legal and regulatory framework at the national level for the security of nuclear material and facilities under their jurisdiction. The new obligations under the Amendment have led to consideration of how those requirements fit with existing obligations under comprehensive safeguards agreements. As part of establishing the new framework for nuclear security, several elements and measures have a connection to safeguards, and while the legal basis is different, the resulting synergies should be taken into account. These synergies, which include for instance the role and functions of the regulatory body and nuclear material accounting and control measures, are described below.

Though outside the scope of this article, it bears mentioning that in addition to nuclear security and safeguards, nuclear safety is an integral part of establishing an adequate legislative and regulatory framework to ensure the peaceful uses of nuclear energy and ionizing radiation, and similarly has synergies with the other technical areas of nuclear law. While both nuclear security and safeguards share common objectives related to the control of nuclear material, some important differences may be observed. Therefore, before discussing the synergies in more detail, it is useful to mention the general differences.

One of the differences is the role of the IAEA. Under the CPPNM and its Amendment, the IAEA's role is primarily that of depositary, for which it serves as a repository and conduit of information made available by Parties and, where applicable, to be circulated to Parties, as well as convener of meetings pursuant to the treaty, including the aforementioned review conference to take place in 2021 pursuant to Article 16 of the CPPNM as amended, though it also fulfils certain other functions related to facilitating international cooperation. The IAEA serves as the main facilitator under the CPPNM and its Amendment, including in encouraging universal adherence. In contrast, the IAEA's role in the context of safeguards instruments is different as it is authorized by its Statute as an international organization to conclude safeguards agreements with States. In doing so, the IAEA becomes Party to such instruments and, as such, has rights and obligations thereunder. Furthermore, different from nuclear security instruments, the IAEA has a verification role under safeguards agreements and additional protocols. Through safeguards, the IAEA verifies that States implement their obligations under the relevant instruments to use nuclear material and technology exclusively for peaceful purposes and not for the development of nuclear weapons or other nuclear explosive devices.

Another difference is that safeguards are applied in accordance with the terms of each agreement to nuclear material, facilities or other items subject to safeguards, to deter the spread of nuclear weapons through the early detection of diversion or the misuse of nuclear material or technology, whereas nuclear security is broader, covering not only nuclear material, facilities and activities, but also other radioactive material, related facilities and activities, whether used for peaceful or, under ICSANT, non-peaceful purposes. Related to this, safeguards focus on State activities (diversion to non-peaceful activities by States), whereas nuclear security is about misuse of material by non-State actors, which is why criminalization of certain offenses is a key element of the nuclear security instruments. The conduct of non-peaceful activities involving nuclear material may also be criminalized in the national legal framework to enable the State to fulfil its international obligations to use nuclear material and technology exclusively for peaceful purposes.

Notwithstanding these differences, this chapter looks at areas in which nuclear security and safeguards converge. The synergies are shown by the fact that certain provisions and approaches in the comprehensive nuclear law are of relevance to both nuclear security and safeguards, therefore enabling the States to fulfil their obligations under the respective international instruments. This is particularly the case with regard to the functions of the regulatory body, as well as the State systems of accounting for and control of nuclear material, which play a role inter alia in preventing illicit trafficking.

9.4.1. Functions of the regulatory body in relation to nuclear security and safeguards

One of the key elements of the national legal framework for nuclear energy is the establishment of a regulatory body [17]. The regulatory body is essential to ensuring that operators of nuclear facilities and other licensees are using nuclear material in a peaceful, secure and safe manner.

It has been common practice for legal drafters to dedicate a chapter in the comprehensive nuclear law to the responsibilities of the regulatory body. A number of those responsibilities enable States to fulfil their international obligations under the CPPNM and its Amendment, as well as under the comprehensive safeguards agreement and the additional protocol. For example, the regulatory body has the responsibility to establish regulatory measures for the security of nuclear material and other radioactive material, and their associated facilities, including measures for the detection, prevention and response to unauthorized or malicious acts involving such material and facilities. In the field of safeguards, one of the responsibilities of the regulatory body is to provide the IAEA with information on nuclear material and facilities and to provide designated IAEA inspectors with an access to nuclear material and facilities, as required under the comprehensive safeguards agreement and the additional protocol.

In order for those responsibilities to be met, the regulatory body needs to exercise its regulatory authority through certain regulatory functions. Even though they may be exercised differently, those functions are common to nuclear security and safeguards and enable States to meet their respective obligations under the relevant international instruments.

- *Licensing*

Licensing enables the regulatory body to exercise its authority over regulated persons or entities through a system of licenses (or authorization). Such licenses create responsibilities for licensees which also allow the regulatory body to ensure that all nuclear material and activities are under the State's regulatory control. Provisions in the comprehensive nuclear law should therefore give the legal authority to the regulatory body to grant, amend, suspend and revoke licenses and to establish prerequisites for granting them and conditions to keep them.

In order for applicants to be granted a license to use nuclear material or technology, they have to meet certain prerequisites. It is important to note that a distinction should be made between the prerequisites to be granted a license and the actual license conditions, which may be imposed to licensees in order for them to keep their license. The prerequisites to obtain a license typically include some of those which are related to nuclear security and safeguards. For example, in the context of safeguards, an applicant would have to demonstrate its capability to conduct physical inventories and perform measurements of nuclear material to obtain a license. For nuclear security, an applicant would have to demonstrate that certain levels of physical protection are met. Meeting such requirements enables the State to provide the IAEA with the information required under a comprehensive safeguards agreement, and to fulfil its obligation to impose levels of physical protection on nuclear material, as required under the CPPNM and its Amendment.

While it is up to States to decide their approach to licensing, nuclear security and safeguards requirements to obtain and keep a license may be included in separate licenses or in a single license.

- *National inspections*

Verification by the national regulatory body of the licensees' performance is central to an effective regulatory system. Establishing a licensing process for the use of nuclear material and technology would be ineffective without the power to determine whether licensees comply with the conditions of the license. For this reason, the regulatory body needs to have an inspection capability and therefore have sufficient legal authority to have access to sites and facilities using nuclear material and technology. Through an inspection programme, inspectors from the

regulatory body verify that conditions provided in the license, including those related to nuclear security and safeguards, are met by the licensees.

While regulatory bodies were originally performing nuclear security and safeguards inspections separately, recent practice shows that more and more States now aim to combine both type of inspections, where possible. This approach has the advantage of reducing the burden of inspections for licensees, as they can disturb the conduct of operations at facilities. Combining nuclear security and safeguards responsibilities is also an approach being applied at the institutional level, as regulatory bodies often group relevant tasks within a single department or office. This has the effect of better using resources by centralizing the nuclear security and safeguards expertise and capabilities. Furthermore, it enables the regulatory body to centralize all coordination matters, therefore also facilitating the communication pertaining to nuclear security and safeguards with licensees, other relevant authorities, as well as with the IAEA.

- *Enforcement*

The purpose of enforcement is to ensure compliance with the conditions set out in the license, including those pertaining to nuclear security and safeguards. In order for the regulatory body to ensure compliance, the comprehensive nuclear law should clearly provide for enforcement measures, whether that be the imposition of monetary fines or penalties or the suspension or revocation of the license. In some States, not meeting the license conditions can also result in the imposition of criminal penalties.

9.4.2. Accountancy and control

The State system of accounting for and control of nuclear material (SSAC) is a key component of the safeguards system and is crucial to nuclear security as well. Paragraph 7 of INFCIRC/153 (Corr.) provides for the obligation for the State(s) "*(...) to establish and maintain a system of accounting for and control of nuclear material subject to safeguards (...), and that such safeguards shall be applied in such a manner as to enable the Agency to verify, in ascertaining that there has been no diversion of nuclear material from peaceful uses to nuclear weapons or other nuclear explosive devices, findings of the State's system*" [13]. The IAEA relies on the SSAC findings which are reflected in the reports required to be submitted to the IAEA under the safeguards agreement. Based on the SSAC reports and IAEA independent verification of such reports at the Headquarters and in the field, the IAEA can ascertain that there has been no diversion of nuclear material from peaceful purposes. To that end, an SSAC requires, for example, the maintenance of accounting records by the operators and the submission to the IAEA of accountancy and material balance records and reports on a regular basis. The obligation for States to establish and maintain an SSAC is commonly implemented in the national legal framework by making it one of the responsibilities of the regulatory body to ensure the effective implementation of safeguards by establishing and maintaining an SSAC.

Protection as well as control of nuclear material is also essential for the purpose of nuclear security, and while the CPPNM and its Amendment do not contain a specific obligation for States parties to establish and maintain such a system, in effect such measures are often included in a State's nuclear security framework. Also, such an obligation may be found in UN Security Council resolution 1540 (2004), requiring States to "*(...) develop and maintain appropriate effective measures to account for and secure* [nuclear-related material] *in production, use, storage or transport*". The resolution does not, however, provide further specifications related to such measures. The role and recognized contribution of the State's of nuclear material accountancy and control to the State's nuclear security regime are noted in the IAEA guidance, including in NSS No. 13, where existing material accountancy and control measures in a State

are considered as being supportive to the State's nuclear security framework, inter alia, when it comes to measures to detect unauthorized removal of nuclear material in use and storage.

In other words, nuclear material accountancy and control measures in a State that are part of the States' SSAC, in addition to being necessary to fulfil the State obligations under a comprehensive safeguards agreement, contribute to a State's ability to deter and detect the unauthorized removal of nuclear material, an objective shared by nuclear security and safeguards. This synergy enables an efficient use of accounting and control measures at the national level. For instance, inspectors of the regulatory body, when performing nuclear material verification activities at a facility, have an opportunity to look at the accounting and control measures in place at the facility from the perspective of both security and safeguards. In addition, there is a possibility for the regulatory body to develop security and safeguards regulations which support each other when it comes to accounting and control provisions, while limiting the risk of contradictions between those regulations. For example, this would help avoid that the collection of information under nuclear security regulations contradicts or interferes with the collection of information required under comprehensive safeguards agreements or State safeguards regulations.

9.5.CONCLUSION

Together with nuclear safety, nuclear security and safeguards share the fundamental and general objective of protecting people society and the environment from the harmful effects of ionizing radiation.

Nuclear security focuses specifically on the protection of nuclear material and other radioactive material and associated facilities against malicious acts involving non-State actors, whereas safeguards aim at preventing the diversion of nuclear material from peaceful activities. While the Agency's role and legal basis for security and safeguards differs, both aims at exercising control over nuclear material, therefore contribution to the prevention, deterrence and detection the unauthorized removal and/or diversion of nuclear material.

In its activities to support Member States in developing their national legal frameworks for the safe, secure and peaceful use of nuclear energy, the IAEA considers and makes use of the synergies between nuclear security and safeguards. An example is the inter-disciplinary approach to the IAEA legislative assistance programme, in the context of which experts of the IAEA Office of Legal Affairs discuss both nuclear security and safeguards obligations when supporting States in drafting or amending their national nuclear legislation, while highlighting synergies and differences, including in relation to the regulatory functions of the regulatory body. Another example of this synergistic approach is in the context of State System of Accounting for, and Control of Nuclear Material (ISSAS) review missions conducted by the IAEA Department of Safeguards. While these missions focus primarily on assessing the SSAC from a safeguards point of view, they also allow the requesting State to ask for the participation of a nuclear security expert in the ISSAS team in order to review the contribution of accountancy and control measures to the security of nuclear material.

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10. DAMAGE GIVING RISE TO COMPENSATION UNDER THE INTERNATIONAL NUCLEAR LIABILITY REGIME

A. GIOIA[1], [2]
Former Senior Legal Officer,
Office of Legal Affairs, IAEA

10.1. INTRODUCTORY REMARKS

The international nuclear liability regime is based on uniform rules on civil liability for nuclear damage which are laid down in a number of multilateral treaties. These are, first of all, the 1960 Paris Convention on Third Party Liability in the Field of Nuclear Energy [1] and the 1963 Vienna Convention on Civil Liability for Nuclear Damage [2], both revised following the 1986 Chernobyl nuclear accident through Protocols adopted, for the Vienna Convention, in 1997 [3] and, for the Paris Convention, in 2004 [4]. In addition, the 1997 Convention on Supplementary Compensation for Nuclear Damage [5], which aims to serve as an 'umbrella' covering States party to either the Paris Convention or the Vienna Convention and States party to neither, also contains uniform rules on civil liability for nuclear damage. Finally, the nuclear liability picture is completed by the 1963 Brussels Convention Supplementary to the Paris Convention [6], also revised by a Protocol adopted in 2004 [7], and the 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention [8], but these treaties do not contain uniform rules on civil liability for nuclear damage and are, therefore, not relevant for the purposes of this article.

The uniform rules laid down in the above-mentioned treaties apply to civil liability for "nuclear damage" caused by a "nuclear incident" occurring at a "nuclear installation" or in the course of transport of "nuclear material" to or from such an installation. The treaty definitions of all of these terms are, therefore, crucial to correctly understand the scope of application of the international nuclear liability regime in general and of the specific treaty, or treaties, that may apply in the event of a nuclear incident. However, the definition of "nuclear damage" plays an especially important role in this context, in particular for the victims of a nuclear incident seeking compensation: as a rule, only damage qualifying as "nuclear damage" under the applicable treaty may in fact be compensated on the basis of that treaty and of national implementing legislation; damage other that "nuclear damage" may be considered from the point of view of the international nuclear liability regime as 'non-nuclear damage', and may only be compensated under that regime on an exceptional basis and under specific conditions.

This article will examine the definitions of "nuclear damage" contained in the relevant treaties and the heads of damage therein envisaged as they evolved from the original definitions adopted in the 1960s to the revised definitions adopted following the discussions originated within the international community by the 1986 Chernobyl accident. It will also examine the distinction between "nuclear damage" and 'non-nuclear damage', and the conditions upon which this latter category of damage may be compensated under the international nuclear liability regime.

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[1] Mr Andrea Gioia is a former senior legal officer at the Nuclear and Treaty Law Section, IAEA Office of Legal Affairs. *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

10.2. THE 1960 PARIS CONVENTION

The Paris Convention [1] was adopted in 1960 under the auspices of the organization now known as Organization for Economic Co-operation and Development (OECD), and entered into force in 1968. It currently has 17 Parties[3], most of which are in Western Europe and is open for accession by OECD Member States: other States can only accede "with the unanimous assent" of the Parties (Article 21). The text of the Paris Convention currently in force is the result of amendments adopted in 1964 and 1982 which, however, did not modify the heads of damage covered by the Convention.

Unlike the Vienna Convention [2], which was adopted later, the Paris Convention does not specifically define "nuclear damage" together with other terms defined in Article 1 thereof, and indeed does not even use that expression. It does, however, indirectly define damage giving rise to compensation when dealing with the liability of the operator of a nuclear installation. Article 3(a) of the Paris Convention states in fact that the operator shall be liable, in accordance with the Convention, for: (i) damage to or loss of life to any person; and (ii) damage to or loss of any property (other than certain kinds of property damage or loss which will be referred to shortly). As a rule, such damage can only be compensated if caused by a "nuclear incident" as defined, but I shall revert to this aspect in Section 6 below. What matters here is that, in principle, only the two above-mentioned heads of damage can be compensated under the Paris Convention as currently in force.

In this respect, the *Exposé des Motifs* for the Paris Convention [9] clarifies, in paragraph 39, that while "the Convention contains no detailed provision determining the kind of damage or injury which will be compensated" and merely provides "that damage must be to persons or property and related causally to a nuclear incident", what should be considered as damage to persons or property and the extent to which compensation will be recoverable is "left to be decided by the competent court in accordance with the national law applicable"[4]. The *Exposé des Motifs* [9] also specifies that this choice was made "in view of the very wide divergence of legal principles and jurisprudence in the law of torts of European Countries". In practice, therefore, national courts have a wide discretion in determining the kinds of damage that may be compensated under either of the two heads of damage envisaged by Article 3 of the Paris Convention. On the other hand, it will be seen in Section 3 below that the same reasoning, i.e. the wide divergence of national conceptions of compensable damage in tort cases, was at the basis of the more flexible approach adopted by the 1963 Vienna Convention [2].

In view of this "wide divergence" of national legal principles and jurisprudence, it does not seem helpful to elaborate on what may be compensated under the two above-mentioned heads of damage. However, it may safely be assumed, for example, that in most legal systems loss of life would lead to the compensation of at least funeral costs and the costs of maintenance for dependent persons, and that personal injury would lead at least to the compensation of medical and pharmaceutical expenses and costs of personal assistance, if needed; moreover, in both cases certain kinds of non-pecuniary damages, such as loss of consortium or pain and suffering,

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[3] In addition, Switzerland ratified the Paris Convention in 2009 but the Convention will only enter into force for Switzerland once the 2004 amending Protocol [4] enters into force on 1 January 2022.

[4] In this respect, Article 14 of the Paris Convention defines "national law" and "national legislation" as "the national law or the national legislation of the court having jurisdiction under this Convention over claims arising out of a nuclear incident" and provides that that law or legislation "shall apply to all matters both substantive and procedural not specifically governed by this Convention." The *Exposé des Motifs* explains, in paragraph 60, that national law or legislation includes "rules of private international law, which are not affected by the Convention". Therefore, the applicable law does not necessarily coincide with the *lex fori.*

would probably also be compensated. As for loss of or damage to property, the concept of property usually includes both movable and immovable property, and damage thereto would lead at least to the costs of restitution in kind, of reconstruction or reparation, if possible, or to pecuniary compensation for the lost or damaged property. But, in addition, account must be taken of national conceptions relating to 'real' property, as opposed to 'personal' property, 'public' property, as opposed to 'private' property, or 'tangible' property, as opposed to 'intangible' property (e.g. patents or intellectual property or similar rights), which may considerably widen the scope of this head of damage. Moreover, in most legal systems loss of income deriving from both personal injury and damage to property would also be compensable, but I shall revert to this aspect in section 10.4 below.

Irrespective of national conceptions of property damage, Article 3(a)(ii) of the Paris Convention excludes the operator's liability for damage to: "1. the nuclear installation itself and any other nuclear installation, including a nuclear installation under construction, on the site where that installation is located; and 2. any property on that same site which is used or to be used in connection with any such installation". The *Exposé des Motifs* [9] explains (in paragraph 40) that the exclusion of damage to the installation(s) involved in an incident is due to the limited amount of the financial security available to cover the operator's liability and aims at avoiding that financial security "from being used principally to compensate damage to such installations to the detriment of third parties." As for other on-site property, the *Exposé des Motifs* [9] clarifies (in the same paragraph) that the exclusion "does not affect the personal property of any person employed on the site".

On the other hand, as concerns incidents occurring outside a nuclear installation in the course of carriage of nuclear substances, Article 3 of the Paris Convention does not exclude the compensation of damage to the means of transport upon which the nuclear substances involved were at the time of the incident. However, also in view of the limited amount of money available under the Convention, Article 7(c) provides that compensation for such damage "shall not have the effect of reducing the liability of the operator in respect of other damage to an amount less than" 5 million SDRs, i.e. the minimum amount envisaged by the Convention for low-risk activities, or "any higher amount established by the legislation of a Contracting Party"[5].

Of course, both the exclusion of compensation of damage to the nuclear installation(s), and other on-site property damage, and the limitation of compensation of damage to the means of transport relate to property not owned by the liable operator, since the Paris Convention, like all liability conventions, applies to *third-party liability* and therefore excludes by definition damage to all kinds of property owned by the liable person itself.

10.3. THE 1963 VIENNA CONVENTION

The Vienna Convention [2] was adopted in 1963 under the auspices of the International Atomic Energy Agency (IAEA), and entered into force in 1977. It currently has 43 Parties, coming from all areas of the world except Western Europe, and is open for accession by all Members of the IAEA or of the United Nations or of any of its specialized agencies. Although, to some extent,

[5] The *Exposé des Motifs* [9] clarifies (in paragraph 40) that, if the damage other than that to the means of transport is less than 5 million SDRs, or the higher amount established by national legislation, "the part of the amount not used is available, if necessary, for compensation of damage to the means of transport."; if, on the other hand, such damage is higher than 5 million SDRs, or the higher amount established by national legislation, "there may be proportional distribution of the total amount available to cover all the damage including damage to the means of transport. This might involve paying compensation of more than 5 million SDRs for other damage but cannot result in reducing the amount of compensation for such other damage below 5 million SDRs."

the Paris Convention [1] served as a model when drafting the Vienna Convention, which is based on the same fundamental principles, there are some important differences between the two conventions, including as concerns compensable damage.

It has already been mentioned that, unlike the Paris Convention [1], the Vienna Convention uses the term "nuclear damage" and defines it together with the other terms defined in Article I thereof. But the main difference of substance between the two conventions is that the definition in the Vienna Convention (Article I.1(k)) does not only cover the two heads of damage already covered by the Paris Convention, namely "loss of life, any personal injury or any loss of, or damage to property", but also "any other loss or damage … if and to the extent that the law of the competent court so provides". As a rule, such damage can only be compensated if it arises out of or results from "the radioactive properties or a combination of radioactive properties with toxic, explosive or other hazardous properties of nuclear fuel or radioactive products or waste in, or of nuclear material coming from, originating in, or sent to, a nuclear installation." Section 10.6 will revert to this aspect. What matters here is that the Vienna Convention covers a residual category of "nuclear damage" which is not covered by the Paris Convention, but only if this additional category is also covered by the applicable national law[6].

As concerns the two traditional heads of damage, there is no need here to give specific examples other than those that were already given in Section 2 above. Also, as specifically concerns property damage, the Vienna Convention, like the Paris Convention [1], excludes the operator's liability for nuclear damage "to the nuclear installation itself or to any property on the site of that installation which is used or to be used in connection with that installation" (Article IV.5(a)), and the reasons for this exclusion as the same are those already referred to in section 10.2 above. However, unlike the Paris Convention, the Vienna Convention does not exclude, in addition to damage to the nuclear installation itself, damage to other installations, including those under construction, that may on the same site. On the other hand, unlike the Paris Convention, the Vienna Convention also excludes, as a rule, nuclear damage "to the means of transport upon which the nuclear material involved was at the time of the nuclear incident" (Article IV.5(b)). However, Article IV.6 of the Vienna Convention allows the Installation State to provide by legislation that this rule "shall not apply," i.e. that the operator's liability also covers damage to the means of transport, but in this case the amount of the operator's liability for other kinds of damage cannot be reduced to less than the minimum liability amount provided for by the Convention, i.e. 5 million US $. As will be explained in Section 4 below, these differences between the Vienna Convention and the Paris Convention no longer exist in the Vienna Convention as revised in 1997 [3].

As for the residual category of "nuclear damage," the preparatory works [10] show that this was already envisaged in the draft convention that was presented to the conference where the Vienna Convention was adopted (Article I, paragraph 9, at p. 42). The article-by-article comments on that draft prepared by the IAEA Secretariat explain (at pp. 70–72) that, under the definition, "the question of whether damage other than death, personal injury, loss of or damage to property give rise to civil liability, and the related question of who may claim compensation, are left to the applicable national law." By way of examples, these comments specifically refer to "moral damages and indirect economic loss", such as "loss of profits" or "damage to

[6] Article I.1(e) of the Vienna Convention defines the "law of the competent court" as "the law of the court having jurisdiction under this Convention, *including any rules of such law relating to conflicts of laws*" (emphasis added). Therefore, as is also the case under the definition of "national law" or "national legislation" under the Paris Convention [1], the applicable national law is not necessarily the *lex fori.*

fisheries," but the open-ended nature of this residual category of damage potentially leaves a wide discretion to the applicable national law: as the comments point out, "the scope of civil remedies is intimately tied to the general legal concepts and traditions of each country and varies with the social function reserved to such remedies."

Of course, the practical importance of the residual category of "nuclear damage" depends to some extent on how widely, or how narrowly, the concepts of personal injury and damage to property are understood in the applicable national law. Thus, it may well be the case that in some legal systems such damages as moral damages and indirect economic loss, or indeed any other damages caused by a nuclear incident, can be compensated as personal injury or damage to property. However, the Vienna Convention, unlike the Paris Convention [1], allows the law of the competent court to compensate such damages quite irrespective of whether or not they can be qualified as personal injury or damage to property.

10.4. THE 1997 PROTOCOL TO AMEND THE VIENNA CONVENTION AND THE CSC

Following the 1986 Chernobyl nuclear accident, negotiations started in Vienna aimed at revising the international nuclear liability regime. The outcome of these negotiations was the adoption, in 1997, of a Protocol to Amend the Vienna Convention [3], which entered into force in 2003 and currently has 15 Parties, and of a Convention on Supplementary Compensation for Nuclear Damage (CSC) [5], which entered into force in 2015 and currently has 11 Parties. The Protocol to Amend the Vienna Convention is open for accession by any State: it was in fact adopted as a separate treaty and any State may become a Party thereto, irrespective of whether or not it is a Party to the 1963 Vienna Convention [2]. As for the CSC, this was conceived as an 'umbrella' convention and is open for accession not only by any State party to either the Vienna Convention [2] or the Paris Convention [1], and of any amendment thereto [3, 4], but also by any State not party to either of those conventions, provided that it has national legislation consistent with the nuclear liability rules contained in an Annex to the CSC and which are based on the same fundamental principles underlying both the Vienna Convention and the Paris Convention: Parties to the CSC belonging to this latter category may be described as 'Annex States'.

10.4.1. General features of the revised definition of "nuclear damage"

The definition of "nuclear damage" is identical in both treaties and is contained in Article 2.2 of the Protocol (Article I.1(k) of the revised Vienna Convention) and in Article I(f) of the CSC. It is important to point out, as far as the CSC is concerned, that Article I(f) is situated the main body of the Convention and not in the Annex thereto: as a result, all Parties to the CSC are bound to apply this definition, irrespective of whether they are also party to the Vienna Convention [2] or the Paris Convention [1] — in either their original or revised version [3, 4] — or are 'Annex States'[7]. As Section 2.3.1 of the Explanatory Texts for the 1997 Vienna Protocol and the CSC [11] recalls, this definition was the outcome of long and difficult negotiations: in fact, following the Chernobyl accident, several States were of the view that the corresponding definitions in the existing nuclear liability conventions were too narrow and,

[7] The only exception is envisaged in a so-called 'grandfather clause' contained in Article 2 of the Annex to the CSC, which allows a State whose legislation contained certain provisions at a certain date (in practice, only the United States of America) to derogate from a number of provisions of the Convention, including the definition of "nuclear damage" in Article I(f). However, this exception merely envisages that, *in addition* to all the heads of damage listed in Article I(f), that State is allowed to cover "any other loss or damage" caused by a nuclear incident, provided that this does not affect its supplementary compensation undertakings under the CSC.

consequently, the question of compensable damage was one of the central aspects of the process that eventually led to the revision of the Vienna Convention and to the adoption of the CSC.

Leaving aside, for the time being, the question of what makes damage "nuclear damage", as opposed to other kinds of damage, which will be examined in Section 10.6 below, the main feature of the new definition is that, in addition to the two traditional heads of damage, i.e. (i) loss of life and personal injury and (ii) loss of or damage to property, it lists a number of other heads of damage, each of which is to be compensated "to the extent determined by the law of the competent court". These additional heads of damage are: (iii) economic loss arising out of personal injury or property damage; (iv) the costs of measures of reinstatement of impaired environment; (v) loss of income deriving from an economic interest in the use or enjoyment of the environment; (vi) the costs of preventive measures; and (vii) any other economic loss "if permitted by the general law on civil liability of the competent court".

The proviso that each of these additional heads of damage is to be compensated "to the extent provided by the law of the competent court"[8] was the result of a difficult compromise between different conceptions that were backed by different States during the negotiations and, as a result, may give rise to ambiguities. It is, therefore, important to point out that the Explanatory Texts [11] clarify (in Section 2.3.1) that "the question of the admissibility of claims for most of the new heads of damage "is not left to the discretion of national law" and that "the law of the competent court will have to be referred to primarily in order to determine their precise meaning, especially in relation to the concept of property damage." This explanation outlines the major difference between the new definition of "nuclear damage" and the definition in the 1963 Vienna Convention [2] which, as was explained in Section 10.3 above, covers "any" damage other than personal injury or property damage but only "*if* and to the extent that the law of the competent court so provides" (emphasis added) ": under the new definition, the additional heads of damage are in fact mandatorily covered, the only exception being the residual category of economic loss referred to under (vii) above, which may be covered "*if* permitted by the general law on civil liability of the competent court" (emphasis added).

Another general feature of the new definition is that most of the additional heads of damage have to be compensated *as such* only if they are not already included, under the applicable national law, in either of the two traditional heads of damage, i.e. loss of life and personal injury or loss of or damage to property. This confirms that, since national conceptions of what may constitute personal injury or, especially, property damage vary from country to country, the practical value of most of the new heads of damage depends to a large extend on how broad, or how narrow, those national conceptions are. However, the important feature of the new definition is that, in a country where the additional heads of damage would *not* be covered as personal injury or property damage, they would *have* to be covered *as such*, i.e. in addition to those two heads of damage. Under the Paris Convention as presently in force [1], this would not be possible whereas, under the 1963 Vienna Convention [2], this would be allowed under the residual category of "any other damage" which, however, is only covered *if* so provided by the applicable national law.

[8] The definition of the "law of the competent court" in Article I.1(e) of the 1963 Vienna Convention [2] as "the law of the court having jurisdiction under this Convention, *including any rules of such law relating to conflicts of laws*" (emphasis added), was not changed by the 1997 Protocol, and Article I(k) of the CSC contains an identical definition. Therefore, as is also the case for the definition of "national law" or "national legislation" under the Paris Convention as currently in force [1], the applicable national law is not necessarily the *lex fori.*

10.4.2. Loss of life and personal injury and loss of or damage to property

As was the case when examining the definition of "nuclear damage" in the 1963 Vienna Convention [2] in Section 3 above, there is no need here to elaborate on the two traditional heads of damage beyond what was already stated when examining compensable damage under the Paris Convention [1]. As specifically concerns property damage, the only notable feature of the 1997 Protocol is that it brings the Vienna Convention in line with the Paris Convention in respect of the operator's liability for certain kinds of damage, whereas the CSC lies somewhere in between.

First of all, whereas Article IV.5(a) of the 1963 Vienna Convention [2] excludes the operator's liability for damage to the nuclear installation itself, or to any property on the site of that installation which is used or to be used in connection with that installation, the 1997 Protocol (Article 6.2) amends the Vienna Convention to also exclude liability for damage to other nuclear installations, including those under construction, that may be on the same site, thus bringing the Vienna Convention in line with the Paris Convention [1]. The same solution is adopted by Article 3.7(a) and (b) of the Annex to the CSC.

Secondly, whereas Article IV.5(b) and 6 of the 1963 Vienna Convention [2] also excludes damage to the means of transport on which the nuclear material is being carried at the time of a nuclear incident unless otherwise provided by the Installation State, the 1997 Protocol (Article 6.2 and 3) amends the Vienna Convention to include liability for such damage provided that compensation does not have the effect of reducing the operator's liability for other damage to an amount less than that established as the limit of its liability, thus bringing the Vienna Convention in line with the Paris Convention [1] in this respect also. On the other hand, Article 7.(c) of the Annex to the CSC still follows the 1963 Vienna Convention and provides that the operator's liability for damage the means of transport is excluded "unless otherwise provided by national law."

10.4.3. The costs of measures of reinstatement of impaired environment

Among the additional heads of damage envisaged under the 1997 definition, an especially important one relates to impairment of the environment. As the Explanatory Texts [11] point out (in Section 2.3.3), one of the central aspects of the post-Chernobyl negotiations was in fact the question of whether and how to include environmental damage within compensable nuclear damage: some pointed out the difficulties involved in the monetary compensation of such damage and, therefore, in its inclusion within the concept of civil liability; others were of the view that, at least in some cases, environmental damage could already be covered as property damage under the applicable national law. The compromise solution was not to cover environmental damage as such, but rather the costs of measures of reinstatement of impaired environment together with loss of income deriving from an economic interest in the use or enjoyment of the environment.

Leaving aside, for the time being, loss of income deriving from an environmental impairment, which is covered as a distinct head and will be examined in Section 4.5 below, "measures of reinstatement" are specifically defined in Article 2.4 of the Protocol (Article I.1(m) of the Vienna Convention as amended) and in Article I(g) of the CSC as "any reasonable measures which have been approved by the competent authorities of the State where the measures were taken and which aim to reinstate or restore damaged or destroyed components of the environment or to introduce, where reasonable, the equivalent of these components into the environment." The definition further provides that "the law of the State where the damage is suffered shall determine who is entitled to take such measures". Under this definition, possible

examples of measures of reinstatement could therefore be the decontamination of soils, buildings or installations through clean-ups or the removal of topsoil layer, weed, grass or pastures and management of the subsequent radioactive waste, the reintroduction of wildlife or the restoration of the ecological functions of the environment.

However, the costs of such measures can only be recovered under the revised definition upon certain conditions. First of all, such costs are covered if they cannot already be compensated under the traditional concept of property damage and provided that the impairment of the environment caused by a nuclear incident is "not insignificant": in the absence of specific indications in the revised definition, both aspects are left to be determined by the "law of the competent court." Secondly, costs are recoverable only in so far as measures of reinstatement "are actually taken or to be taken" and have been approved by the competent authorities of the State where they are taken; in this respect, therefore, the competent court will have to apply the law of a foreign State in case of measures taken abroad, and the same goes for the question of who is entitled to take such measures. Finally, only costs of "reasonable" measures are recoverable: in this latter respect, Article 2.4 of the Protocol (Article I.1(o) of the Vienna Convention as amended) and Article I(l) of the CSC define "reasonable measures" as "measures which are found under the law of the competent court to be appropriate and proportionate having regard to all the circumstances" such as, for example, "(i) the nature and extent of the damage incurred … ; (ii) the extent to which, at the time they are taken, such measures are likely to be effective; and (iii) relevant scientific and technical expertise."

10.4.4. The costs of preventive measures

Another very important feature of the new definition of "nuclear damage" is the inclusion, as a specific head of damage, of "the costs of preventive measures" and of "further loss or damage caused by such measures". As pointed out in the Explanatory Texts (Section 2.3.3) [11], the inclusion of this head of damage may in part be explained by the fact that "in many legal systems the compensation of damage resulting from a tort may be refused or at least reduced" if the claimant fails to take reasonable steps to avoid or mitigate damage". On the other hand, under the 1997 Protocol and the CSC, the costs of preventive measures may be recovered if taken by "any person", i.e. irrespective of whether they are taken by a private person trying to prevent or minimize damage to itself or by public authorities, and their purpose is to prevent or minimize other kinds of "nuclear damage". "Preventive measures" are in fact specifically defined in Article 2.4 of the Protocol (Article I.1(n) of the Vienna Convention as amended) and in Article I(h) of the CSC as "any reasonable measures taken by any person after a nuclear incident has occurred to prevent or minimize damage referred to [under other heads of damage], subject to any approval of the competent authorities required by the law of the State where the measures are taken."

Examples of preventive measures may range from medical testing, the taking of iodine pills or the provision of non-contaminated food, to the evacuation of entire areas, from the limitation of movement of contaminated animals to the disposal of such animals. As seen above, the revised definition of "nuclear damage" also allows for the compensation of loss or damage that may be caused by the taking of preventive measures, and this may include consequential loss of life or personal injury, property damage or economic loss: therefore, if not already causally linked to the nuclear incident, in which case it would be compensated under other heads of damage, such loss or damage is to be compensated if causally linked to the preventive measures that have been taken.

The costs of preventive measures — and consequential damage caused thereby — can, however, be recovered upon certain conditions. First of all, such measures must have been taken

"after a nuclear incident has occurred": in this respect, it was recognized in the negotiations that, in order to prevent or minimize nuclear damage, measures may have to be taken before an actual emission of ionizing radiation occurs and, therefore, the 1997 Protocol and the CSC contain a revised definition of "nuclear incident" that allows compensation of the costs of preventive measures in the absence of such an emission, provided that there is a "grave and imminent danger" thereof. Secondly, as is the case for measures of reinstatement of impaired environment, the costs of preventive measures can only be recovered if such measures have been approved by the competent authorities of the State where they are taken and the competent court will therefore have to apply the law of a foreign State in case of measures taken abroad. Finally, as is also the case for measures of reinstatement, only the costs of "reasonable" measures are recoverable and the definition of "reasonable measures" already referred to in Section 10.4.3 above applies to preventive measures also, the only difference being that, among the circumstances to be taken into account when determining the reasonableness of preventive measures, account may have to be taken, instead of the "nature and extent of the damage incurred", of the "nature and extent of the risk" thereof.

10.4.5. Categories of economic loss

Finally, among the new heads of damage to be covered under the new definition there are three categories of economic loss. The first category is consequential economic loss arising from loss of life, personal injury or loss of, or damage to, property which is incurred by" a person entitled to claim in respect of such loss or damage". The Explanatory Texts (Section 2.3.2) [11] mention as examples loss of income due to illness or death, as well as loss of income deriving from the destruction of contaminated crops or from the halt in production consequential to damage to a factory. However, they also point out that this kind of economic loss is to be compensated under this head only in so far as it is not already included in the concepts of loss of life, personal injury or loss of, or damage to, property under the "law of the competent court", and it may safely be assumed that in most legal systems it would be in fact so included.

The second category of economic loss is an aspect of the compromise solution adopted in respect of the compensation of environmental damage: in addition to the costs of measures of reinstatement of impaired environment and of preventive measures (which were examined in Sections 4.3 and 4.4 above), the new definition of "nuclear damage" also includes "loss of income deriving from an economic interest in any use or enjoyment of the environment, incurred as a result of a significant impairment of that environment". In this respect, the Explanatory Texts (Section 2.3.2) [11] mention as examples the loss of income that may be suffered by fishermen, who do not own the sea, as a result of the impossibility to fish or to sell fish because of sea contamination, as well as the loss of income that may be suffered by a hotel owner or manager, who does not own the beach near the hotel, as a result of customers no longer coming to that hotel for fear that the beach may be contaminated. It may be that in some legal systems an "economic interest in the use or enjoyment of the environment" could be included in a wide conception of "property" and that, therefore, loss of income deriving from an impairment of the environment could be compensated as "loss of or damage to property". But in other legal systems this might not be the case and this kind of loss of income might instead be labelled as 'pure economic loss'. In any event, under the new definition of "nuclear damage", if this kind of loss is not compensable as property damage, it must be compensated under this head.

Of course, the loss of income must still be causally linked to a nuclear incident which, except for preventive measures, requires an emission of ionizing radiation (see Section 10.6 below): therefore, if a ship with nuclear substances sinks in the vicinity of the above-mentioned fisheries

or beach but there is no emission, loss of income suffered as a result of widespread public fear of contamination will not be covered. Moreover, even if there has been an emission of ionizing radiation, causation is linked to the concept of 'remoteness' of claims which is left to be decided by the "law of the competent court": in case of disputes, the competent court will therefore have to decide whether the claims for compensation are not too remote from their alleged cause, i.e. the nuclear incident: for example, in the case of the hotel owner that was mentioned above, whether the hotel is sufficiently close to the contaminated beach so that the hotel business depended upon guests being able to use that beach.

The third and final category of economic loss is the residual category of "any other economic loss, other than any caused by the impairment of the environment". This kind of economic loss is neither consequential economic loss deriving from loss of life and personal injury or loss of or damage to property, nor loss of income incurred as a result of environmental impairment, and is often, therefore, labelled as 'pure economic loss'. In this respect, the Explanatory Texts [11] mention as a possible example the loss of wages suffered by the employees of a factory who lose their jobs as a result of a loss of production by that factory. But probably the most important example of what might be covered under this head is the so-called 'rumour-related damage' which did play a role, e.g., in the compensation of damage caused by the 2011 Fukushima Daiichi accident: the Guidelines adopted in Japan for damage compensation [12] define such damage as damage resulting from "concern about the risk of contamination with radioactive material in relation to products or services, due to facts that are widely known through media reports, leading consumers or trading partners to refrain from purchasing the product or service, or stop trading in the service or product" (Part 5). Thus, even if the products or services concerned are in fact not contaminated, this kind of economic loss is to be compensated under this head, provided that there is a sufficient causal link to the nuclear incident.

As was pointed out in Section 10.4.1, this residual category of economic loss can, however, only be compensated if permitted by the "general law on civil liability of the competent court". Therefore, unlike for the other new heads of damage, which have to be mandatorily covered, although the extent of their coverage is to be determined by the "law of the competent court", the question of whether or not this residual category of economic loss can is compensable is entirely dependent on national torts law: as explained in the Explanatory Texts (Section 2.3.2) [11], the primary motive behind this solution at the time of the adoption of the new definition was "a concern that compensation should not be available under this head unless it could also be available for damage arising from sources other than a nuclear incident, e.g. an oil spill or a release of a hazardous substance"[9].

10.5. THE 2004 PROTOCOL TO AMEND THE PARIS CONVENTION

Following the revision of the Vienna Convention [3] and the adoption of the CSC [5], negotiations started under the auspices of the OECD leading to the adoption, in 2004, of two Protocols to amend, respectively, the Paris Convention [4] and the Brussels Supplementary Convention [7], both of which have entered into force on 1 January 2022. Whereas, as already stated, the Brussels Convention is not relevant for the purposes of this article, it is, therefore, necessary to refer to the changes envisaged by the 2004 Protocol to Amend the Paris Convention [4] in respect of compensable damage.

[9] As for the reference to the "general law on civil liability of the competent court", as opposed to the "law of the competent court", the Explanatory Texts (ibidem) add that this otherwise undefined expression may be interpreted as referring to the substantive law of the forum (i.e. the *lex fori*), thereby excluding the rules of private international law.

As concerns drafting, whereas, as pointed out in Section 10.2, Article 3(a) of the Paris Convention [1] indirectly defines damage giving rise to compensation when dealing with the liability of the operator of a nuclear installation, the 2004 Protocol [4] amends the Convention by introducing a specific definition of "nuclear damage" in Article 1(a)(vii) thereof, thus bringing the Paris Convention in line with the Vienna Convention [2], the Protocol to Amend the Vienna Convention [4] and the CSC [5]. More importantly, as concerns the substance of the definition, this was clearly inspired by the corresponding definitions in the revised Vienna Convention [4] and the CSC [5] and is almost identical thereto[10]. There is, therefore, no need to elaborate here on the new heads of damage envisaged in the revised Paris Convention since these were already examined in detail in Section 10.4. There are, however, a couple of significant differences which need to be pointed out[11].

In the first place, unlike the revised Vienna Convention [3] and the CSC [5], the revised Paris Convention requires a "direct" economic interest in the use or enjoyment of the environment in order to allow compensation for loss of income caused by a significant impairment of that environment. The *Exposé des Motifs* [13] explains (in paragraph 60.(b)) that the use of this term "is intended to ensure that compensation will not be awarded for nuclear damage that is too remote". By way of example, it states that, although fishermen may be compensated if they lose business because they no longer fish as a result of environmental contamination, "a supplier of goods to those fishermen who loses business because they are no longer fishing will receive no compensation for that business". Be that as it may, as it was noted in Section 10.4.5 that the concept of 'remoteness' of claims is closely linked to the concept of causation and that it will ultimately be for the law of the competent court to determine whether or not a particular claim is too 'remote' from its cause to allow for compensation.

Secondly, there is no reference to the residual category of economic loss envisaged in both the revised Vienna Convention [3] and the CSC [5], i.e. "any other economic loss, other than any caused by the impairment of the environment, if permitted by the general law on civil liability of the competent court". In this respect, the *Exposé des Motifs* [13] states (in paragraph 56.(b)) that "this head of damage is generally considered to be covered by other heads of damage already included in the definition", but it is at best unclear whether the so-called 'rumour-related damage', to which was referred to in Section 10.4.5 above, could in fact be covered under the revised Paris Convention.

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[10] Article 1(a)(vii) of the revised Paris Convention defines "nuclear damage" as: "1. loss of life or personal injury; 2. loss of or damage to property; and each of the following to the extent determined by the law of the competent court, 3. economic loss arising from loss or damage referred to in paragraph 1 or 2 above insofar as not included in those sub-paragraphs, if incurred by a person entitled to claim in respect of such loss or damage; 4. the costs of measures of reinstatement of impaired environment, unless such impairment is insignificant, if such measures are actually taken or to be taken, and insofar as not included in sub-paragraph 2 above; 5. loss of income deriving from a direct economic interest in any use or enjoyment of the environment, incurred as a result of a significant impairment of the environment, and insofar as not included in sub-paragraph 2 above; 6. the costs of preventive measures, and further loss or damage caused by such measures[.]"

[11] Another minor difference relates to the applicable law. The revised definition refers to the "law of the competent court" but this expression is not defined in the revised Paris Convention. Although, as was pointed out in Section 4 above, both the revised Vienna Convention [3] and the CSC [5], like the original Vienna Convention [2], define the "law of the competent court" as including conflict of laws rules, it appears that this is not the case under the revised Paris Convention. In fact, Article 11 thereof states from a general point of view that the "extent of compensation, within the limits of this Convention" is to be governed by "national law" and Article 14(b) now defines "national law" as "the law […] of the court having jurisdiction under this Convention over claims arising out of a nuclear incident, *excluding the rules on conflicts of laws relating to such claims*."(emphasis added). Thus, unlike in the case of the original Paris Convention [1], the applicable law under the revised Convention is always the *lex fori*.

According to the IAEA International Expert Group on Nuclear Liability (INLEX), these differences between the definition of "nuclear damage" in the revised Paris Convention and the corresponding definitions in the revised Vienna Convention [3] and the CSC [5] may be explained as an attempt to narrow the discretion of the competent court in granting compensation: see Section 2.3.2 of the Explanatory Texts for the revised Vienna Convention and the CSC [11],. Alternatively, given the justifications given in the *Exposé des Motifs* [13] and referred to above, it must be pointed out that it will be for that competent court to interpret the definition in order to make sure that all economic losses causally linked to the nuclear incident are in fact covered by the heads of damage therein included. In any event, the *Exposé des Motifs* [13] recognizes (in paragraph 56.(b)) that " this difference in definitions does not touch upon possible obligations which a Contracting Party [to the revised Paris Convention] may have under other international liability conventions to which it is also a Party, such as e.g. the Convention on Supplementary Compensation for Nuclear Damage": in fact, as noted in Section 10.4.1, a Party to the CSC [6] is bound to apply the definition of "nuclear damage" in Article I(f) thereof, irrespective of any other liability convention(s) it may also be a Party to.

10.6. NUCLEAR AND NON-NUCLEAR DAMAGE

In order to qualify as "nuclear damage" and, therefore, be eligible for compensation under the international nuclear liability regime, all of the above-mentioned treaties require damage to arise out of, or result from, the radioactive properties — or a combination such properties with toxic, explosive or other hazardous properties — of nuclear fuel or radioactive products or waste in a nuclear installation, or of nuclear material coming from, originating in or sent to, such an installation[12]. In other words, such damage must be causally linked to an emission of ionizing radiation occurring either inside a nuclear installation or in the course of transport of nuclear material to or from such an installation. The only exception, as noted in Section 10.4.4, is constituted by the costs of preventive measures which, under the post-Chernobyl treaties, can be compensated if causally linked to either an emission of ionizing radiation or "a grave and imminent threat" thereof[13].

More specifically, there needs to be an emission of ionizing radiation from "nuclear fuel"[14] or "radioactive products or waste"[15]; in case of an incident in the course of transport, the emission must originate from "nuclear material", but such material is defined as including both "nuclear

[12] See: Article 1(a)(i) of the Paris Convention [1]; Article I.1(k) of both the 1963 Vienna Convention [2] and its 1997 revision [3]; Article I(f) of the CSC [5]); and Article 1(a)(vii) of the Paris Convention as revised by the 2004 Protocol [4]. Unlike the other treaties, which specify this aspect in their definition of "nuclear damage", the Paris Convention as currently in force [1] refers to it in its definition of "nuclear incident".

[13] See: Article I(k) and (l) of the revised Vienna Convention [3]; Article I(f) and (i) of the CSC [5]); and Article 1(a)(vii) and (ix) of the Paris Convention as revised by the 2004 Protocol [4].

[14] "Nuclear fuel" is defined as "any material which is capable of producing energy by a self-sustaining chain process of nuclear fission": see Article I.1(f) of both the 1963 Vienna Convention [2] and its 1997 revision [3] and Article 1.1(a) of the Annex to the CSC [5]). The definition in Article 1(a)(viii) of the Paris Convention [1] is different but also refers to "fissionable material".

[15] "Radioactive products or waste" is defined as "any radioactive material produced in, or any material made radioactive by exposure to the radiation incidental to, the production or utilization of nuclear fuel, but does not include radioisotopes which have reached the final stage of fabrication so as to be usable for any scientific, medical, agricultural, commercial or industrial purpose": see Article I.1(g) of both the 1963 Vienna Convention [2] and its 1997 revision [3] and Article 1.1(e) of the Annex to the CSC [5]). The definition in Article 1(a)(iv) of the Paris Convention [1] is very similar.

fuel" and "radioactive products or waste"[16]. It results from the definitions of these terms and, in particular, of "radioactive products or waste" that damage caused by an emission of ionizing radiation from "radioisotopes which have reached the final stage of fabrication so as to be usable for any scientific, medical, agricultural, commercial or industrial purpose" is, in principle, not included within the concept of "nuclear damage". The justification given for this exclusion is usually that the nuclear liability conventions provide for an exceptional regime whose scope is limited to risks of an exceptional character: for example, the *Exposé des Motifs* for the Paris Convention [9] states in general that "whenever risks, even those associated with nuclear activities, can properly be dealt with through existing legal processes, they are left outside the scope of the Convention" (paragraph 7) and adds, with specific reference to 'radioactive sources', that, "despite the rapidly increasing use of radioisotopes in many fields, which will require continual and careful observance of health protection precautions, there is little possibility of catastrophe" (paragraph 10). However, despite these general statements, a distinction must in fact be made depending on whether 'radioactive sources' are inside or outside a "nuclear installation".

As regards radioactive sources inside a "nuclear installation", namely a reactor or other nuclear-fuel-cycle-related facility[17], the Paris Convention [1] covers damage caused by "ionizing radiations emitted by any source of radiation" inside such an installation (Article 1(a)(i)). The 1963 Vienna Convention [2] only covers such damage "if the law of the Installation State so provides" (Article I.1(k)(iii)), but both the Protocol to Amend the Vienna Convention [3] (Article I.1(k) of the revised Vienna Convention) and the CSC [5] (Article I.(f)) are in line with the Paris Convention and cover such damage irrespective of the law of the Installation State. Therefore, leaving aside the 1963 Vienna Convention, damage caused by an emission of ionizing radiation originating from a 'radioactive source' inside a "nuclear installation" is in fact covered by the nuclear liability regime. In contrast, damage caused by 'radioactive sources' outside a "nuclear installation", i.e. in the course of transport or inside a facility that does not qualify as a "nuclear installation" (e.g., a hospital), is excluded from the definition of "nuclear damage" in all of the nuclear liability treaties and is, therefore, treated like any other kind of 'non-nuclear damage'.

As a rule, 'non-nuclear damage' is outside the scope of the nuclear liability regime and its compensation is exclusively governed by the provisions of national torts law. The nuclear liability conventions do not in fact apply to damage other than "nuclear damage", as defined: therefore, whereas liability for "nuclear damage" is legally channelled by the conventions to the operator of a "nuclear installation", to the exclusion of any other person who might otherwise be liable, any person might be held liable for 'non-nuclear damage' under domestic torts law; moreover, whereas the operator's liability for "nuclear damage" under the conventions is "absolute", i.e. it is a strict or objective liability not based on the operator's fault or negligence, the liability of any person for 'non-nuclear damage' under domestic torts law is usually based on fault or negligence on the part of the tortfeasor. Finally, whereas the operator's

[16] "Nuclear material" is defined as "i) nuclear fuel, other than natural uranium and depleted uranium, capable of producing energy by a self-sustaining process of nuclear fission outside a nuclear reactor, either alone or in combination with some other material; and (ii) radioactive products or waste": see Article I.1(h) of both the 1963 Vienna Convention [2] and its 1997 revision [3] and Article 1.1(c) of the Annex to the CSC [5]). The Paris Convention [1] uses the term "nuclear substances" instead of "nuclear material" but the definition of that term in Article 1(a)(iv) also includes "nuclear fuel" (other than natural uranium and other than depleted uranium) and radioactive products or waste".

[17] See the definition of "nuclear installation" in Article 1(a)(ii) of the Paris Convention [1]; Article I.1(j) of the 1963 Vienna Convention [2] and of its 1997 revision [3]; and Article 1.1(b) of the Annex to the CSC [5].

liability under the conventions must be covered by insurance, or other financial security, this is not necessarily the case for liability for 'non-nuclear damage' under domestic torts law.

There is, however, a minor exception to the clear-cut distinction between liability for "nuclear damage" under the conventions and liability for other kinds of damage under domestic torts law: in a situation where "both nuclear damage and damage other than nuclear damage have been caused by a "nuclear incident" or jointly by a nuclear incident and one or more other occurrences, damage other than "nuclear damage" will be deemed to be "nuclear damage" for the purposes of the conventions to the extent that it is "not reasonably separable" therefrom[18]. Such a situation may occur, for example, when both "nuclear material" and other radioactive material are on the same means of transport: in case of an incident causing radiation damage which cannot "reasonably" be traced to either the "nuclear material" or the other radioactive material which is being transported, the operator of the "nuclear installation" involved in the transport of the "nuclear material" will be liable for that radiation damage.

On the other hand, although the rule under the nuclear liability conventions is that no person other than the operator of a "nuclear installation" can be held liable for "nuclear damage", in a situation such as the one just described where the distinction between "nuclear damage" and 'non-nuclear damage' cannot "reasonably" be applied in practice, the conventions do not exclude the possibility that "any person" may be held liable under domestic torts law for damage other than "nuclear damage"[19]. Another minor exception to the legal channelling of all liability for "nuclear damage" to the operator relates to "nuclear damage" in respect of which the operator is not liable under the international nuclear liability regime, i.e. certain kinds of property damage to which is referred to in Sections 10.2–10.4 above and all damage caused by incidents due to armed conflicts or similar events which exonerate the operator from liability: the conventions do not exclude that "any individual" who acted with intent to cause damage may be held liable for such damage under general torts law[20].

Finally, another important aspect of the international nuclear liability regime is that it excludes the operator's liability for "nuclear damage" under domestic torts law: just as liability for 'non-nuclear damage' is, in principle, exclusively governed by domestic torts law, liability for "nuclear damage" is, in principle, exclusively governed by the international nuclear liability regime, and domestic torts law only applies to those aspects of nuclear liability in respect of which the treaties themselves give some discretion to national law. Article 6(c)(ii) of the Paris Convention [1] expressly provides that "the operator shall incur no liability outside this Convention for damage caused by a nuclear incident" and a similar provision is contained in Article 3.10 of the Annex to the CSC [5]; the absence of corresponding provisions in both the

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[18] See: Article IV.4 of the 1963 Vienna Convention [2] and its 1997 revision [3], and Article 3.4 of the Annex to the CSC [5]. Article 3(b) of the Paris Convention [1] refers instead to "damage caused jointly by a nuclear incident and by an incident other than a nuclear incident" but then adopts the same solution. The term "nuclear incident" is defined in Article I.1.(l) of the 1963 Vienna Convention [2] as "any occurrence or series of occurrences having the same origin which causes nuclear damage, and Article 1(a) of the Paris Convention [1] has a similar definition which is brought entirely in line with the 1963 Vienna Convention by the 2004 Protocol [4]. The corresponding definitions in Article I.1.(l) of the revised Vienna Convention [3] and in Article I(a) of the CSC [5] are identical except that they add, in respect of preventive measures only, the case where there is a "grave and imminent threat" of nuclear damage: see Section 4.4 above.

[19] Ibidem.

[20] See: Article 6(c)(i)1 of the Paris Convention [1]; Article IV.7(a) of the 1963 Vienna Convention [2]; and Article IV.7 of the revised Vienna Convention [3]. There is no corresponding provision in the Annex to the CSC [5].

1963 Vienna Convention [2] and its Amending Protocol [3] should not lead to a different conclusion in respect thereof[21].

10.7. CONCLUDING REMARKS

The broader definition of "nuclear damage" is undoubtedly one of the main aspects of the revision of the international nuclear liability regime that was undertaken following the 1986 Chernobyl accident. On the other hand, the practical impact of this broadened definition largely depends on the amount of compensation available: since one of the cornerstones of the international nuclear liability regime is the possibility for the Installation State to limit the amount of the operator's liability and to determine the extent to which that amount has to be covered by insurance, or other financial security, it has to be emphasized that a low amount of liability and/or of financial security coverage will result in the inability to compensate much of the damage caused by a nuclear incident, unless the State provides additional public funds under an international supplementary compensation regime and/or at the national level.

It is, therefore, important to recall at the end of this brief analysis of the heads of damage envisaged by the nuclear liability conventions that, following the 2011 Fukushima Daiichi accident, the IAEA policy-making organs adopted an Action Plan on Nuclear Safety [11] where they inter alia called on Member States to "work towards establishing a global nuclear liability regime that addresses the concerns of all States that may be affected by a nuclear incident with a view to providing *appropriate compensation* for nuclear damage" (emphasis added).

The Action Plan also requested INLEX to "recommend actions to facilitate achievement of such a global regime" and in the recommendations adopted in 2012 [12] the Group recommended to States with nuclear installations that they "establish compensation and financial security amounts significantly higher than the minimum amounts envisaged in the existing instruments". INLEX also recommended that such States "undertake regular reviews of the adequacy" of such amounts in order to "ensure that their value is maintained and that they reflect developments in the understanding of the possible impact of incidents involving the installations in their territory", and that financial security amounts "reflect available capacity in the insurance markets, as well as other sources of financial security". Finally, the Group recommended that such States "be prepared to set up an appropriate funding mechanism in cases where the amount of damage to be compensated exceeds the available compensation and financial security amounts".

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[2] Vienna Convention on Civil Liability for Nuclear Damage, INFCIRC/500, IAEA, Vienna (1966).

[21] A limited exception is envisaged in Article IV.7(b) of the 1963 Vienna Convention [2] and Article 7(c) of the Annex to the CSC [5] which do not exclude the operator's liability outside the applicable convention for a specific category of property damage for which it is not liable, i.e. damage to the means of transport upon which "nuclear material" is being transported at the time of a nuclear incident, unless otherwise provided by the law of the Installation State: see Sections 3 and 4 above. The Paris Convention [1] and the revised Vienna Convention [3] do not provide for such an exception since, as was pointed out in Sections 2 and 4 above, they envisage the operator's liability for this category of damage as well.

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11. OVERSIGHT OF NUCLEAR ACTIVITIES

K.S. NICK[1], [2]
OECD Nuclear Energy Agency

11.1. INTRODUCTION

Both the Convention on Nuclear Safety (CNS) [1] and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) [2] lay out the main regulatory functions necessary to ensure safety. These functions can be grouped into four main categories: standard setting, licensing and permitting, inspection and assessment, and enforcement. Much time is spent analysing the legal aspects of the first two, but the final two regulatory functions also contain key legal components that can be addressed more comprehensively.

Even if the regulatory body sets the highest standards and binds the licensee to comprehensive licences, authorisations and permits, continued regulatory oversight remains critical to ensuring nuclear safety. In this vein, Article 7(2) of the CNS explains that the legislative and regulatory framework shall provide for:

— A system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;
— The enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

Thus, the regulator must be empowered to verify compliance with their standards and regulations through inspections or other means and should be able "to enforce [compliance with] established [standards and] regulations by imposing the appropriate corrective measures", whether the noncompliance is the result of mere inadvertence, negligence "malpractice or wrongdoing by those persons/organizations under regulatory oversight" [3]. Therefore, although the licensee maintains the prime responsibility for safety under Article 9 of the CNS, the regulatory body must ensure continued compliance, meaning safe operation.

The hard law requirements of the conventions do not provide much detail as to how a regulatory oversight framework is to be structured, simply that one must be enacted. And the International Atomic Energy Agency's (IAEA) Fundamental Safety Principles echo the same: "Governments and regulatory bodies … have an important responsibility in establishing standards and establishing the regulatory framework for protecting people and the environment against radiation risks" [4]. At a high level, the IAEA's *Governmental, Legal and Regulatory Framework for Safety* also states the same, that "The government shall promulgate laws and statutes to make provision for an effective governmental, legal and regulatory framework for safety. This framework for safety shall set out the following: … Provision for the inspection of facilities and activities, and for the enforcement of regulations, in accordance with a graded

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[1] Kimberly S. Nick is the Deputy Head of the Office of Legal Counsel of the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD) in Paris.
[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

approach" [5]. However, digging deeper into the General Safety Requirements (GSR), as well as the General Safety Guides (GSG), a great deal more can be learnt.

This article will first provide an overview of the general requirements and guidance for inspection and enforcement. Then, it will analyse some legal and policy aspects of both, addressing the independence of inspectors, evaluating state of mind or *mens rea* in regulatory enforcement actions, challenging enforcement actions, and finally legislating and regulating nuclear safety culture. The article will conclude with a discussion of the need for effective oversight and the role well-trained legal staff play in its achievement.

11.2. INSPECTION

The first aspect of nuclear regulatory oversight is inspection and assessment. Requirements 25-29 of the IAEA's *Governmental, Legal and Regulatory Framework for Safety* provide the general outlines, stating that:

- The graded approach should be applied to both assessments and inspections;
- Assessments and inspections should be performed before and throughout the lifetime of a facility; and
- "[i]nspections of facilities and activities shall include programmed inspections and reactive inspections, both announced and unannounced" and should ensure "compliance with the regulatory requirements and with the conditions specified in the authorization" [5].

Focusing solely on inspections[3], it is specified that an inspection programme must allow for "free access by regulatory inspectors to any facility or activity, at any time … These inspections may include, within reason, unannounced inspections" [5]. To facilitate this, both the regulator and the operator have roles and responsibilities. The regulatory body must have the ability to:

- Come without any prior notice, day or night, weekday or weekend, holiday or not, so as to have a realistic view of operations;
- To inspect documents (including possibly taking them offsite), interview personnel, observe activities, monitor practices, examine procedures and perform tests;
- Make the inspections findings publicly available.

The operator, on the other hand, "shall provide the regulatory body with all necessary assistance to enable it to perform its duties, including enabling unhindered access to the plant and providing documentation." [6] In the simplest terms possible, this provides that regulatory inspectors, in the course of an official inspection, should be able to show up unannounced, go anywhere, look at anything, talk to anyone and report out.

While the ability for inspectors to show up unannounced in the middle of the night on a Saturday to inspect the control room may seem like government overreach, it should be noted that most inspections are announced and planned with the operator. Further, inspectors must take into consideration the impact an unannounced inspection may have on the safe operation of a facility and adjust their plans accordingly [7].

Although many inspections are carried out by inspectors who travel to a facility, especially if it is a facility other than a nuclear power reactor, a number of countries provide for so-called

[3] This article will only address inspections as regulatory assessment is a dense enough subject for a standalone article.

"resident inspectors". These inspectors have their offices at the facility, spending their days onsite. Resident inspectors typically have access to all areas of the facility and perform daily monitoring of the activities, acting as the regulatory body's "eyes and ears" on the ground. In addition to daily monitoring, inspectors can identify safety issues, check corrective actions and receive concerns from facility employees, among other tasks.

Some countries, like the Czech Republic, Finland, Japan, Republic of Korea, Romania, Spain and the United States, provide for at least one, if not two to three, onsite resident inspectors at each nuclear power plant, with some even stationed at plants under construction. Not all nuclear power countries, like France and Sweden, however, provide for this type of inspection programme in their oversight regime. Whether to utilise the resident inspector system is a policy choice, with countries like France deciding not to permanently station inspectors at facilities based on the determination that it is better for inspectors to visit multiple facilities and share experiences more widely [8].

11.3. ENFORCEMENT

The second aspect of regulatory oversight is enforcement. In a perfect world, enforcement would not be necessary; however, in the real world, mistakes can happen, errors are made and violations occur. As such, regulatory bodies must have a well-reasoned enforcement policy in place to handle these eventualities.

Just as when enacting a criminal law, governments must determine at the outset the purpose of regulatory enforcement over nuclear activities. Is the purpose to:

- Deter or prevent noncompliance before it happens?
- Encourage early identification of violations and prompt comprehensive corrective actions by the licensee?
- Compel the licensee into compliance?
- Punish the licensee for noncompliance?

The purpose does not necessarily have to be one or the other of the above; in fact, the policy should be comprehensive and flexible enough to include all of the above depending on the nature and severity of the noncompliance [7]. For example, while an enforcement action that seeks to encourage identification and remediation is appropriate for minor, first-time violations, one that seeks to punish the licensee — for example with the levying of a large fine — may be more appropriate for a continuous violation where no effort is made to remedy the situation. This is consistent with the graded approach.

Echoing the requirements in the CNS, Requirements 30 and 31 of the IAEA's *Governmental, Legal and Regulatory Framework for Safety* state that:

- The regulatory body shall establish and implement an enforcement policy within the legal framework for responding to non-compliance; and
- The regulatory body must be able to require corrective actions in the event risks are identified.

Consistent with the graded approach, depending on the nature of the violation, the IAEA explains that:

> "Enforcement actions by the regulatory body may include recorded verbal notification, written notification, imposition of additional regulatory requirements

and conditions, written warnings, penalties and, ultimately, revocation of the authorization. Regulatory enforcement may also entail prosecution, especially in cases where the authorized party does not cooperate satisfactorily in the remediation or resolution of the non-compliance" [5].

In general, regulatory bodies have discretionary authority within a defined system of graduated sanctions that look a lot like those specified in Requirement 31. Looking at the systems that exist in countries around the world like Canada, Finland, France, Republic of Korea, Romania, Russia and the United States, most provide for some type of:

— Written notification or warning;
— Orders for amendment, suspension, or some other specific licensing action;
— Civil monetary penalties (some provide for both daily and lump sum penalties); and
— Revocation of the authorisation.

Some also include criminal prosecution.

Even if most countries largely provide the same structure for their enforcement policy, much differentiation exists, however, in the robustness of the enforcement programme and the ease in which regulatory authorities have in taking enforcement action. Issues may arise over whether a regulator has full legislative enforcement authority for violations of regulatory requirements. In addition, where a violation may be both administrative/regulatory and criminal or administrative/regulatory and civil, competition between governmental departments may emerge and the regulatory body may have to take a back seat to a criminal or civil prosecution. Further, countries with more prescriptive regulatory frameworks, with detailed regulatory requirements indicating how to obtain desired technical outcomes, have a more direct path to proving what has been violated and how. On the other hand, countries with more performance-based regulatory frameworks, where the emphasis is on what must be achieved rather than how to achieve it, may not be able to prove regulatory violations as easily and may instead emphasise corrective actions over penalties.

11.4. LEGAL AND POLICY ASPECTS OF OVERSIGHT

Often, oversight is seen as a purely technical specialty, without much of a role for lawyers, or possibly even policy makers. However, there are certain issues where it is critically important for policy makers, if not also specialised lawyers, to be the driving force behind the analysis and decision making.

11.4.1. Independence of resident inspectors

Article 8(2) of the CNS requires there to be "an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy." Although the word "independence" is not used in this instance, the requirement is clarified in the Joint Convention where Article 20(2) states that the legislative and regulatory framework shall "ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation". Often this requirement is analysed from a governmental structure standpoint: is the nuclear regulatory body functionally separated from the part of the government that promotes nuclear energy?

One way that the independence requirement comes into play in the oversight context is in the regulatory body's need to be able to make independent regulatory decisions.

> "There are many types of regulatory decision to be made, such as decisions on the issuing of regulations and licences, the approval of design changes and enforcement actions. Each of these types of decision is prepared by means of regulatory activities of various kinds, such as reviews, assessments and inspections. Even if an inspection is found not to give grounds for any enforcement action, this conclusion is in itself a regulatory decision" [3].

This is not so difficult to achieve for inspectors in their normal course of business performing planned or reactive inspections; however, a question arises as to how resident inspectors, who are permanently stationed at nuclear facilities, can maintain their independence. These individuals spend the majority of their time with the licensee, living in their community and working in their facility. This is where the "effective" in "*effective* separation" and "*effective* independence" comes in. Just like a regulatory body existing in the same governmental structure as the body promoting nuclear energy can never be fully independent, neither can a resident inspector existing in the same world as a licensee. They will cross paths with employees in the real world — in fact they may be neighbours — and they will interact onsite.

Because the truest type of independence in this area will always be effective rather than absolute, laws, regulations and/or policies should be implemented to counteract any potential for a conflict of interest. In acknowledgement of the potential for, at the very least, the appearance of a conflict of interest and at worst an actual lapse in regulatory independence, countries provide checks and balances to guard against these possibilities. Some measures include [9]:

- Limitations on the number of years an inspector can be stationed at a facility;
- Restrictions on employing the families of plant personnel in the resident inspector's office;
- Restrictions on members of the resident inspector family from working at the plant;
- Restrictions on socialisation between the resident and the resident's family with facility employees and their families;
- Disclosure of previous existing relationships with facility employees;
- Ban on stationing residents at a site owned by a company they previously worked for;
- Ban on the ownership of stocks in the owner of the site.

While some of these may seem quite concrete and easily implementable — such as the time limitation — issues can and do arise over how to implement and oversee these measures. At the outset, measures can include:

- Signed ethics commitment by all resident inspectors;
- Formal financial and relationship disclosure forms updated every year that are reviewed and approved by a governmental ethics official (usually a lawyer) and made publicly available;
- Mandatory updates when material changes to finances or relationship change mid-year;
- Periodic assessments by the regulatory body; and
- Reporting on the programmatic measures taken to ensure effective independence in the national CNS reports.

Maintaining flexibility though is critical, as issues inevitably arise requiring adaptation. Some examples where flexibility might be needed are: if a resident's seven-year time limit expires, but a child has three months left in a school year; if the site is located in a small close-knit community centred around the nuclear power plant and a resident's child becomes good friends

with the child of the site vice president and wants to socialise together; or the best candidate for a secretarial position at the plant is the sibling of a plant employee. In such circumstances, formal waivers of the restrictions could be provided for with public disclosure of any such waiver issued by the regulatory body. Transparency in these matters is critical for ensuring public trust in the resident inspectors and ultimately the regulatory body.

11.4.2. Evaluating state of mind or *mens rea* in regulatory enforcement actions

State of mind, or *mens rea*, is typically addressed in a criminal context, where one must prove a certain criminal intent based on the requirements of a statute. But, state of mind is not just an issue in criminal law. In fact, an IAEA General Safety Guide provides a list of seven factors to be taken into account by the regulatory body in deciding what enforcement action is appropriate and one of the factors is the determination of "[w]hether there has been a willful violation or a willful non-compliance" [7]. Because this is a legal determination, the IAEA does not provide criteria to establish such wilfulness. Therefore, national lawmakers must determine those elements. As national circumstances, and in particular legal frameworks, differ from country to country, national implementation of this factor can be quite diverse.

11.4.2.1. United States

The Enforcement Policy of the US Nuclear Regulatory Commission (NRC) provides four factors for assessing the significance of a violation, one of which is whether there were any wilful aspects [10]. The US NRC's Enforcement Manual, which is used by NRC staff to implement the Enforcement Policy, states that "A wilful violation is one in which an NRC requirement has been breached through a voluntary and intentional action or lack of action other than a mistake or error." [11] There are two different types of wilful violations, which are entirely separate and distinct, as shown in Figure 1:

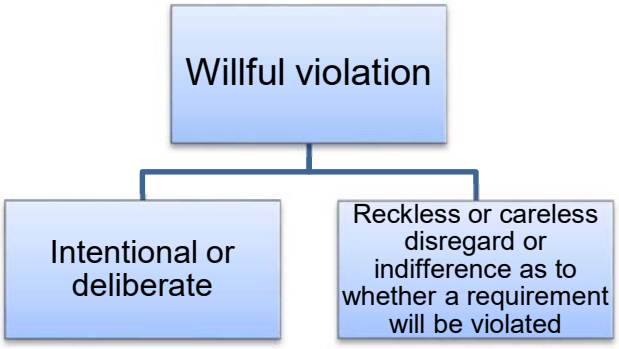

FIGURE. 1. Types of willful violations under the enforcement policy of the US NRC.

The first three elements of both a deliberate violation as well as a violation caused by careless or reckless disregard are the same, that: (1) requirement exists, (2) the requirement was violated and (3) the person's actions were voluntary as opposed to inadvertent [11]. But, they differ in that knowledge must be proven for a deliberate violation, which are that:

— The person committing the violation knew a requirement existed, understood the requirement, and knew the requirement was applicable at the time; and
— The person knew that his or her actions were contrary to the requirement. [11]

On the other hand, a wilful violation still exists if a "person acted with reckless disregard or indifference to: (a) The existence of the requirement; (b) The meaning of the requirement; or (c) Whether the intended conduct conformed to the requirement" [11].

This distinction is quite important because in the United States, action can be taken against not only licensed entities and licensed individuals, but also against any individual engaged in licensed activities. This is provided for in the so-called "Deliberate Misconduct Rule", which can be found in the US NRC's regulations at 10 *Code of Federal Regulations* (CFR) Part 50.5. However, while the existence of wilfulness is an aggregating factor in determining the appropriate enforcement action against licensees, action can only be taken against non-licensed individuals if the individual:

— Deliberately causes or would have caused, if not detected, a licensee to be in violation of a legal requirement; or
— Deliberately submits materially inaccurate or incomplete information to the NRC, a licensee, an applicant or a licensee, or a contractor or subcontractor [12].

Wilful determinations are very fact-specific and the legal distinctions between a deliberate violation and one committed with careless disregard can sometimes be quite narrow. Because appeals of enforcement actions are provided for under NRC regulations, cases have turned entirely on state of mind [13].

11.4.2.2. Other countries

The United States is not alone in this. Switzerland has also incorporated state of mind into its oversight of nuclear activities. According to the Swiss Nuclear Energy Act of 21 March 2003 (RS 732.1), the licensing (Federal Council and the Federal Department of the Environment, Transport, Energy and Communication – DETEC) and regulatory authorities (Swiss Federal Nuclear Safety Inspectorate – ENSI and the Swiss Federal Office of Energy – SFOE) have enforcement powers and "can order any measure necessary to protect persons, property and other important rights, to safeguard Switzerland's national security, to ensure compliance with its international commitments and check that measures have been implemented" [14]. In particular, Chapter 9 of the Nuclear Energy Act contains a number of articles that speak to wilful offences. One, Article 88, actually specifies three different types of sanctions depending on whether the offence was committed: wilfully, knowingly or negligently.

Under Republic of Korea's Nuclear Safety Act, consideration in enforcement is made for whether a permit, approval or licence has been obtained, or a report has been filed, by "fraudulent or other illegal means". In order to prove fraud, it is most likely that one would have to prove knowledge (or at least deliberate ignorance) of a falsity and intent to commit a fraud. Canada's Nuclear Safety and Control Act, S.C. 1997, c. 9, provides in Article 48(d) that it is considered an offence to "knowingly make[ ] a false or misleading written or oral statement to the Commission, a designated officer or an inspector". In Spain, Article 88(2)(i) of the Nuclear Energy Act (Law 25/1964 of 29 April) specifies that one of the fourteen factors to be taken into account is: "The existence of intent or negligence in the commission of the offence".

11.4.2.3. Findings of fact and determinations of law

Investigations of potential violations should be carried out by technical staff, and depending on the nature of the violation, potentially with the assistance of trained investigators. Once the findings of fact have been made, the case file — documents, notes, interview transcripts, evidence, etc. — should be turned over to the legal staff of the decision-making body for an

ultimate determination of law, i.e., whether there has been a wilful violation or a wilful non-compliance. A lawyer's review is needed at the initial decision-making stage because in most countries, appeals of enforcement decisions are allowed (see section 11.4.3 below) and an appeal could be raised against both the factual determination as well as the legal determination.

11.4.2.4. Conclusion

If the enabling statute of a regulatory body does incorporate a wilfulness element into its enforcement programme, it is critically important that a regulatory body has the full regulatory authority to take action on that basis. This means ensuring that a regulatory body has the investigatory and legal competence, financial and human resources to fulfil this responsibility, as required under Article 8(1) of the CNS.

11.4.3. Challenging enforcement actions

The need to have access to justice does not apply only to civil and criminal governmental decisions and actions. It applies to administrative decisions and actions as well. *Governmental, Legal and Regulatory Framework for Safety* provides that the laws and statutes setting out the framework for safety shall include "[p]rovision for appeals against decisions of the regulatory body". While this mainly relates to authorisation decisions in that document, this requirement is expanded upon in a General Safety Guide.

The IAEA acknowledges that if enforcement actions are going to be taken, countries should provide the opportunity, at the very least, to respond to the enforcement action but also to appeal an enforcement action [7]. In some instances, states may provide a prior opportunity for a hearing to allow a challenge before the enforcement action is taken [7]. Appropriate legal procedures must be set up that allow for these types of challenges to be raised [3]. These procedures generally fall into two main approaches.

The first, and most prevalent approach, is governed by a country's main administrative or civil procedure law. In countries like Japan, Korea, Slovenia, Spain and Switzerland, the procedure to raise a challenge is not unique to nuclear energy-related activities and is instead governed by the law on administrative procedure. In that instance, any person whose rights have been affected by a governmental decision may raise a challenge before the same body that issued the decision. Appeals of those first-level decisions may often be raised before either a federal administrative court or a federal civil court. The advantage of this approach is that there is only one main procedure that must be understood; however, it could be more difficult for individuals to know of this opportunity and challenge it within the nuclear context.

In some countries, like the United States, the right to raise a challenge is enshrined in the main law on nuclear energy. Further nuclear-specific administrative procedures are provided for in the regulations issued by the nuclear regulatory body; in the United States these are found in 10 CFR Part 2. The US NRC has even set up its own independent adjudicatory body, called the Atomic Safety and Licensing Board, composed of legal and technical judges to preside over licensing and other types of hearings. The nuclear-specific procedures, however, are largely based on the country's main administrative procedure law, the Administrative Procedure Act, 5 *United States Code* (USC) § 551 et seq. (1946). The advantage of this approach is that it makes clear to the public that providing a specific forum to challenge agency decision making and allowing the formal opportunity to be heard is important not only to the government as a whole but also to the nuclear regulatory body. But, while this approach may prove easier to understand how to raise a challenge, the difficulty is that one must be well-versed in the nuclear-specific procedures to do so properly.

If the opportunity to raise a challenge to an enforcement action is not available, a number of different factors should be considered when determining how to institute such a policy:

— What are the procedures for the appeal: are the procedures unique to nuclear power or are the appeals conducted under general administrative, civil or constitutional law;
— What is the nature of the appeal process: is the appeal only in writing or are full hearings allowed with direct and cross examination of witnesses;
— Who is the appeal raised to: is the appeal directed in the first instance to the decision maker or is the appeal made to a civil or administrative body;
— Are further appeals possible: if the first instance decision is not satisfactory, are there additional bodies to bring further appeals before.

As noted by INSAG, "Independence in regulatory decision making does not obviate the need for an appeal process … to challenge regulatory decisions by means of appropriate legal procedures" [3]. Providing an opportunity to appeal an enforcement action should be clearly integrated into the regulatory process and openly communicated to the individual or entity such action is being brought against so that they may easily avail themselves of such right.

11.4.4. Legislating and regulating nuclear safety culture

11.4.4.1. Defining nuclear safety culture

The term "nuclear safety culture" originated 30 years ago following the Chernobyl accident, where IAEA's International Safety Advisory Group (INSAG) found that "[t]here is a need for a 'nuclear safety culture' in all operating nuclear power plants" [15]. For the first five years, there was no commonly accepted definition until the IAEA put out its definition in 1991 [16]. The IAEA's current definition has changed since then, with a revision in 2007 that widened its scope from "nuclear plant safety issues" to "protection and safety issues" stating that nuclear safety culture is: "The assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance." [17] [18]

The IAEA definition represents an international governmental consensus. But, the definition does not change much when viewed by international nuclear operators. The definition provided by the World Association of Nuclear Operators (WANO) states that: "Nuclear safety culture is the core values and behaviours resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment" [19]. The definition is virtually the same at a national operator level as well [20].

11.4.4.2. Nuclear safety culture historical events

The IAEA has explained that while "the definition relates Safety Culture to personal attitudes and habits of thought, and to the style of organizations" and "that such matters are generally intangible; … nevertheless such qualities lead to tangible manifestations" [16]. A number of events demonstrate that there is a pattern where weak safety culture leads to declining safety performance and this manifests itself in safety problems, which can and often do have safety consequences. Since Chernobyl, safety culture continues to be cited either as a contributing

factor or a root cause in lessons learnt from major accidents to near-misses, security incidents, as well as vendor and supplier issues[4]. For example:

- United States, 2002, Davis-Besse reactor pressure vessel head incident: a cavity approximately the size of an American football was discovered on the head of the reactor pressure vessel (RPV) that extended all the way through the carbon steel RPV head, leaving only the stainless steel cladding to protect the RPV, which it is not designed to do [22]. Had the cladding failed, a loss-of-coolant accident would have occurred [23].
- United States, 2004–2007, Peach Bottom and Turkey Point sleeping security officers: multiple instances of security officers at two nuclear power plants found to be wilfully inattentive to duty and other security officers either failing to report the inattention to duty and in some instances even serving as "look outs" [24] [25].
- Sweden, 2006, Forsmark-1 voltage transient event: a short circuit occurred in the offsite electrical switchyard caused by a maintenance error "that disabled half of the emergency core cooling systems and half of the information systems in the control room." [26] The systems that were not disabled could have failed in the same way. [26]
- Japan, 2011, Fukushima Daiichi nuclear power plant accident: often called a "manmade disaster", a deficient organisational and social culture, exhibited by both the operator and regulator, over time created an environment where the 11 March 2011 earthquake and resulting tsunami was able to cause a severe accident [27].
- Korea, 2012, Kori nuclear power plant station blackout event: while in cold shutdown during a refuelling outage, a worker's error led to a loss of off-site power and the only in service emergency diesel generator failed to start, resulting in a station blackout [28] [29]. Multiple safety culture contributing factors can be noted, including the failure of the plant manager and other control room staff to report the incident [28].
- France, 2016, Le Creusot Forge document falsification: employees at the Forge were discovered to have been falsifying records for decades, rounding numbers so that they fell within technical safety limits [30]. In addition, a special set of concealed files was kept documenting manufacturing problems with nuclear components dating back to 1965 and those documents were never given to either the safety regulator or their customers [31].

All of these cases show that safety culture issues are not only found in certain countries or certain parts of the world. Safety culture issues can happen anywhere, at any time and in any aspect of the nuclear fuel cycle[5]. Schedule pressures, cost pressures, bad management practices and bad managers can all combine to create an atmosphere where unacceptable practices are accepted over time and ultimately lead to major issues.

11.4.4.3. Addressing safety culture at an international level

Although it is clear that safety culture plays a critical role in the safe operation of nuclear installations, safety culture is specifically mentioned only once in each of the main international

[4] The IAEA does emphasise that safety culture inspections should include not only licensees but also vendors and contractors [21].

[5] In acknowledgement of this fact, in 2018, the NEA and WANO jointly established the Country-Specific Safety Culture Forum (CSSCF) "to begin creating an understanding of how a national context relates to safety culture and how operators and regulators could think about these effects in their day-to-day activities." To date, two CSSCFs have been held – in Sweden and Finland – with more to be held in the future with countries around the world. As explained in the Swedish report: "The goal of the CSSCF is not to change the national attributes but rather to create awareness of how they manifest in organizational behaviours. The aim is to work within the national context for sustainable change." [32]

safety conventions, and even then only in the preamble, with a passing reference to a "desir[e] to promote an effective nuclear safety culture" as one of many objectives of the convention [1] [2]. Neither of the conventions elaborate how the provisions advance this objective though the concept is interwoven throughout the various articles.

Some guidance can be found in the IAEA's General Safety Requirements. Requirement 1 of *Governmental, Legal and Regulatory Framework for Safety* provides that the national policy and strategy should take account of "[t]he promotion of leadership and management for safety, including safety culture." [5] This clearly highlights the importance of the issue, and also establishes that safety culture is a subcomponent of leadership and management for safety. Therefore, more information is provided in GSR Part 2, *Leadership and Management for Safety* [33].

Requirement 2 provides that managers by "establishing behavioural expectations and fostering a strong safety culture" [33] demonstrate leadership for safety. Requirement 6 provides that the "management system shall be applied … to foster a strong safety culture", among other goals. Requirement 12 provides that "All individuals in the organization shall contribute to fostering and sustaining a strong safety culture" and that certain actions that promote a strong safety culture should be supported by management. Finally, Requirement 14 ties directly back into oversight for nuclear activities by ensuring that "self-assessments and independent assessments of leadership for safety and of safety culture" are performed and the results "communicated at all levels in the organization".

While this provides some direction, there is still no specific, treaty- or convention-based obligations directly related to safety culture. Therefore, the onus ultimately falls onto regional bodies and national governments to take action to address the problem.

11.4.4.4. Legislating and regulating nuclear safety culture at regional and national levels

If safety culture is intangible but can lead to tangible outcomes, surely it should be possible to legislate and regulate safety culture. This is not, however, a universally acknowledged truth. There is no worldwide consensus that laws can be written to mandate a healthy safety culture. And there are those in regulatory bodies that believe it cannot even be regulated – that it is not possible to write standards, apply them to licensees, inspect and assess against them, and then ultimately, if necessary, take enforcement action. But, these individuals are in the minority. Even in those countries where there are no strict laws mandating a certain nuclear safety culture, or even regulatory standards outlining nuclear safety culture requirements, there is often still some type of regulatory oversight of safety culture carried out through the inspection programme.

Despite the sceptics, regional and national bodies are addressing this issue in legislation. First, at a regional level, the preamble of the European Union's 2014 Amended Safety Directive states that "The establishment of a strong safety culture within a nuclear installation is one of the fundamental safety management principles necessary for achieving its safe operation" [34]. Article 8(b)(2) requires that the regulatory authorities and licensees in its member states "take measures to promote and enhance an effective nuclear safety culture". Some of those required measures include, among others, management systems that give due priority to safety and promote a questioning and reporting attitude, as well as arrangements for education and training. Member States were required to bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by August 2017. Therefore, the 13 EU countries that also have operating nuclear power plants already provide for this in their respective legislation.

Some may question, however, whether Article 8(b)(2) is truly related to the culture of safety. Even though safety culture is a component of leadership and management for safety, this Directive appears to relate less to the safety culture aspect and more to management responsibilities. The same can be said for some national approaches as well, like in the United Kingdom where Licence Condition 17, "Management Systems", is part of the UK approach to implementing Article 8(b)(2). While the licence condition is brief, and only relates to the high level requirement that management systems must be established and implemented "which give due priority to safety", the Office for Nuclear Regulation's (ONR) "Safety Assessment Principles for Nuclear Facilities" goes into far greater depth regarding the expectations for leadership and management for safety and the framework for regulatory inspection in that matter. "Four high-level inter-related principles" (leadership, capable organization, decision making and learning) are described as well as characteristics of a positive safety culture, which indicate the desired outcomes rather than an expected pathway to success. Thus, safety culture is still being regulated, though it is through the inspection programme rather than through strict standards.

The situation is similar in Switzerland. Although the Nuclear Energy Act of 21 March 2003 (RS 732.1) mandates that licensees foster "a strong safety awareness" and the Nuclear Energy Ordinance of 10 December 2004 (RS 732.11) provides that the licensee's organizational documents must include a mission statement on safety culture (Articles 28 and 41, and Annex 3), the detailed requirements are to be found in regulatory guidelines. ENSI-G07, "The Organisation of Nuclear Installations", stipulates that measures must be incorporated within the management system in order to observe, assess and promote a good safety culture [35]. It goes on to state that one characteristic of a good safety culture is a "working atmosphere that encourages trust, cooperation and open communication, and one which attaches value to the communication of problems" [35]. ENSI provides oversight of these guidelines through its supervisory activities largely based on observation, inquiries and document analysis [36].

The countries with a more formal approach tend to rely on characteristics or behaviours outlined in regulatory requirements that are then inspected against and assessed in the regulatory oversight programme. Finland's Radiation and Nuclear Safety Authority (STUK) issued Regulation STUK Y/1/2018 Section 25(1), which states that "When designing, constructing, operating and decommissioning a nuclear facility, a good safety culture shall be maintained." Further binding requirements are contained in a number of STUK Guides, including STUK Guide YVL A.3 (2019). Section 3.2 "Safety culture" provides seven behavioural requirements that must be provided for in "an organisation applying for a construction or operating licence for a nuclear facility or one constructing or operating a nuclear facility" (Section 2, para. 201). STUK provides regulatory oversight of safety culture by conducting specific inspections, analysing licensee self-assessments and utilised independent safety culture assessments[6].

Similarly, Canada's Regulatory Document 2.1.2, "Safety Culture", which is meant to form part of the licensing basis for regulated facilities, sets out "requirements and guidance for fostering and assessing safety culture". [38] First, the Regulatory Document requires licensees to "document their commitment to fostering safety culture in their governing documentation" [38]. Second, and key to the CNSC's safety culture framework, are their five characteristics of a healthy safety culture and the "observable and measurable indicators for each safety culture

[6] For more information on Finland's approach to nuclear safety culture see the NEA's Country-Specific Safety Culture Forum for Finland [37].

characteristic" [38]. Licensees are required to "conduct comprehensive, systematic and rigorous safety culture assessments at least every five years" [38].

11.4.4.5. Environment for raising concerns

Therefore, taking an approach like Finland and Canada, it seems that in order to effectively regulate safety culture, one must first know what a healthy safety culture looks like and be able to describe it in some way. Some organizations, like the WANO, have compiled traits or characteristics of a healthy safety culture. WANO's are [19]:

— Personal accountability;
— Questioning attitude;
— Safety communication;
— Leadership accountability;
— Decision-making;
— Respectful work environment;
— Continuous learning;
— Problem identification and resolution;
— Environment for raising concerns; and
— Work processes.

These describe "pattern[s] of thinking, feeling, and behaving that [emphasize]safety, particularly in" situations where there are conflicts with goals, such as when safety goals conflict with production, schedule or cost goals [39]. These ten traits are fairly universally recognised, with national organizations like INPO [20] and NEI [40] in the United States, national regulatory bodies like the US NRC, as well as international organizations like the OECD Nuclear Energy Agency [41] and the IAEA [42] all essentially agreeing with them either directly or indirectly.

While all ten are important, one of critical significance for lawyers is environment for raising concerns. This trait states that "A safety-conscious work environment (SCWE) is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment or discrimination" [19]. WANO is not alone in calling attention to this safety culture trait. The US NRC's definition is the exact same as WANO's (though the US NRC definition came first) [39]. Belgium's Bel V also provides that one necessary condition to achieving a healthy safety culture is a "work environment where safety problems may be brought up without fear for sanction" [43]. In addition, KINS in Korea lists a safety conscious work environment as one of "five areas for implementation of nuclear safety" [44].

It's not just regulatory organizations that address this topic. Nuclear companies like TVO (Finland) [45], Orano (France) [46] and the Emirates Nuclear Energy Corporation (United Arab Emirates) [47] also highlight the importance of providing an environment for raising concerns. In addressing this subject directly, these organizations acknowledge that ensuring an environment for raising concerns is necessary because "[a] reluctance on the part of employees to raise concerns is detrimental to nuclear safety" [48].

There are laws in most countries that speak to these issues. Often it is the national whistle-blower protection laws or employee protection laws that come into play. Although they do not cover all aspects of safety culture, it does provide a legal basis to help promote and protect a safety-conscious work environment. Until recently, only nine EU countries (France, Hungary, Ireland, Italy, Lithuania, Malta, Netherlands, Slovakia and Sweden) provided comprehensive legal protection for whistle-blowers. In an effort to strengthen protections, the EU approved in

2019 new standards to protect whistle-blowers who reveal breaches of EU law in a wide range of areas including radiation protection and nuclear safety [49]. It also aims to "strengthen the enforcement" of the nuclear safety culture requirements in Article 8(b)(2) of the 2014 Amended Safety Directive [49]. The Directive explicitly prohibits retaliation, outlining fifteen types of prohibited actions [49]. Member states have until mid-December 2021 to comply with the rules [49].

Nuclear-specific whistle-blower protection already exists in a number of countries. In the United States it is included in both legislation and regulation. Section 211 of the US Energy Reorganization Act of 1974, as amended (ERA), speaks to employee protection, specifically legislating that no employer may discharge or otherwise discriminate against any employee because the employee has engaged in a number of enumerated activities [50]. The NRC implemented additional agency-specific regulations in 1982 in order to take its own enforcement action for similar violations. The current version of the NRC's Employee Protection Rule traces its origins back to 1993. One example of those regulations can be found in title 10 of the *Code of Federal Regulations* at 50.7, stating that "Discrimination … against an employee for engaging in certain protected activities is prohibited"[7]. Japan also has a nuclear-specific whistle-blower protection law laid down in Article 66, "Allegation to the Nuclear Regulation Authority", of the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (Reactor Regulation Act). The Act stipulates that licensees shall not dismiss an employee or give an employee other disparate treatment due to the employee having made an allegation of wrongdoing to the Nuclear Regulation Authority.

11.4.4.6. Conclusion

The intangible nature of nuclear safety culture creates challenges but legislating and regulating it is not impossible and it is already being done in countries around the world. For those countries that choose not to draft legislation or regulations on safety culture, many still include safety culture components — especially those that speak to leadership and management for safety — in their inspection programme. Additionally, the safety conscious work environment or environment for raising concerns element of safety culture is one element that is easier to codify and enforce though whistle blower protection laws.

11.5. FINAL CONCLUSIONS

Oversight is about ensuring compliance with the applicable requirements, and ultimately, nuclear safety. Both the CNS and the Joint Convention require that member countries incorporate oversight — namely in the form of inspection, assessment and enforcement — into their legal and regulatory frameworks, but there are no binding detailed international oversight requirements. Soft law, mainly in the form of the IAEA Safety Standards Series, provides general principles of oversight. National implementation of these varies, however, especially with enforcement, due to differences in national legal frameworks. While optimistically one hopes that enforcement is never needed, it is critical that regulatory bodies have full legal authority to take any action necessary to ensure nuclear safety.

There are a number of important legal and policy issues associated with regulatory oversight. While the four issues discussed in this article are all quite disparate — ensuring the effective

[7] The regulation contained in 10 CFR 50.7 is also contained in similar provisions in Title 10, specifically Parts 19, 30, 40, 52, 60, 61, 63, 70, 71, 72 and 76. While entitled "Employee protection", "[t]his regulation is commonly known as a 'whistleblower' protection provision" [51].

independence of inspectors, evaluating an individual's state of mind in regulatory enforcement actions, providing the opportunity to challenge enforcement actions, and regulating nuclear safety culture through effective oversight — all have distinct legal elements that require careful consideration by subject matter experts. In addition to well-trained technical staff, it is critical that regulatory bodies hire a reasonable number of legal staff to fulfil the human resources requirements under Article 8(1) of the CNS and Article 20 of the Joint Convention.

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12. FROM CONTROL LIST TO DUE DILIGENCE: WHEN OPERATORS BECOME ACTORS OF THE FIGHT AGAINST THE PROLIFERATION OF NUCLEAR WEAPONS

Pr. Dr. Quentin Michel[1], [2]
ESU-ULg

The question to authorize or not the export of nuclear material, equipment or technology to a third country raises always the difficulty to balance commercial interests, security interests and foreign policy in terms of peace and security. In short, how to counter the risk that the items that are sold today will not contribute eventually to the proliferation of nuclear weapons?

The objective of this contribution is to outline the major changes of nuclear trade control measures and highlight how the international community has attempted to balance nuclear weapons non-proliferation and peaceful development of nuclear applications.

It could be said that nuclear trade is the victim of an "original sin" since the first nuclear applications were dedicated to the building and development of an explosive device (the three nuclear bombs exploded during World War II)[3]. Consequently, nuclear technology was considered, after the conflict, as a military technology — rather than civil — although peaceful applications had been foreseen and potential developments were considered.

The development of peaceful application of nuclear energy encountered difficulties since the military applications could not be split from the peaceful ones. Therefore, the US, which had the monopoly of detention of nuclear weapons at the end of World War II, decided to prevent other States from developing nuclear weapons by adopting a full prohibition on all nuclear trade. It was in this context of "security dilemma" that, in July 1946, the *Atomic Energy Act* (also called *McMahon Act*)[4] was adopted establishing a prohibition of nuclear transactions with third countries.

Unfortunately, the *McMahon Act* was based on the assumption that a third country will never be able to elaborate indigenously a nuclear weapon. This assumption fell short of the reality. The first Soviet nuclear bomb detonated in 1949 was originated partly from US technology obtained by its intelligence service, while the first Soviet fusion bomb tested in 1953 was based on indigenous technology more advanced than the one developed by the US.

Moreover, the Soviet Union was contrary to the US, ready to share peaceful applications of nuclear technology with third States. In the Cold War context, with the international community split into two main alignments, the access to nuclear technology as source of energy was a very attractive tool to convince States to enhance cooperation with the Warsaw Pact. This was

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[1] Quentin Michel is a Professor of European Studies at the Department of Political Science at the University of Liege.
[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*
[3] Aside from the two nuclear bombs used against Japan, in July 1945 the US detonated a 20-kiloton atomic bomb named "Trinity" at its test site in Alamogordo, New Mexico.
[4] Named after the Senator Brien McMahon, who sponsored the Act.

particularly problematic for the US, now facing not only military competition, but also a political one.

The prohibition on nuclear trade imposed by the US was detrimental also from a commercial point of view. While US industries, even in the medical sector, could not export nuclear-related materials, other countries did export, which means that US industries faced competition not only from the Soviet Union, but also from NATO members, such as Canada, France, UK and later Germany.

For all these reasons (strategic, political and commercial) the US, had to reverse their prohibition policy. The process started with through the *Atoms for Peace Plan*, presented by the President Dwight D. Eisenhower at the UN General Assembly in December 1953.

In his speech, Eisenhower warned of the dangers of nuclear weapons and the arms race, calling nuclear technology the "greatest of destructive forces"[5]. He said America would share its nuclear knowledge and help the world "to apply atomic energy to the needs of agriculture, medicine, and other peaceful activities. Its special purpose would be to provide abundant electrical energy in the power-starved areas of the world"[6].
In a way, *Atoms for Peace* was about cooperation, but it had a very strategic aim, framed in the Cold War logic: to establish and strengthen strategic ties, especially with developing countries, by promising to share what was seen as the most modern of technologies. *Atoms for Peace* also served a policy to build domestic support and foreign markets for U.S. nuclear technology.

The key principle at its basis was that the international exchange of nuclear technologies was possible only if fissile materials were produced, transferred and used under adequate safeguards. More specifically, the US was ready to give open access to peaceful nuclear applications in exchange of the submission by the end user of adequate safeguards controlling the use of fissile materials and assumed by the supplier State or by an international organization. Between 1955 and 1958, the US signed more than forty nuclear cooperation agreements with many governments, including: South Africa, Spain, Iran, Pakistan, India, Israel and many others as well as the European Atomic Energy Community (EURATOM)[7].

The *Atoms for Peace Plan* offered the main argument to create the International Atomic Energy Agency (IAEA) in 1957, as there was a need to take over from supplier States the task of safeguarding the peaceful use of nuclear materials. Some recipient States were considering that the control of the use of the transferred nuclear material had to be done by a neutral international organization and not by the supplier State, who might not necessarily share the same political views with the recipient one.

At the same time, under the initiative of the US and other Western European suppliers States, a Coordinating Committee for Multilateral Export Controls (COCOM) was created to avoid that US technologies could be transferred directly or indirectly to a Warsaw Pact Member or

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another US sensitive country, such as China. The COCOM was an informal organization coordinating the trade policy of a very limited number of countries.

As a way of exerting control, operators were required to apply for an authorisation to export items listed on a so-called strategic list. Decisions on those applications were taken by consensus, thereby granting a veto power to each participant.

As consequence, the East/West division of the international scene during the Cold War was visible also in terms of nuclear technology employment: while all Warsaw Pact Members were using Russian technology, NATO Members used essentially US technology.

With the entry into force of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[8] in 1970, it appeared necessary for nuclear suppliers countries to coordinate their understanding of provision III.2 that requires from State Parties "not to provide: (a) source or special fissionable material, or (b) equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material shall be subject to the safeguards". Unfortunately, the Treaty does not define precisely the list of items that falls under this provision.

In order to avoid the risk of diverging interpretations between suppliers States, an informal group called the Zangger Committee[9] (ZC) was formed in 1971[10] to draft a common list of items usually known as the "trigger list". The export of listed items would have triggered a requirement of safeguards to ensure that the exported nuclear items would be used for peaceful use only.

In spite of the ZC commitments, India succeeded to conduct its first nuclear test in 1974. Such programmes have been made possible partly due to the non-ratification of the NPT by certain supplier countries, which consequently were not bound by the ZC Guidelines.

To fill up this gap, a new informal group of suppliers including non-NPT Member States (in particular China and France) was set up. This group known as the Nuclear Suppliers Group (NSG) adopted guidelines rather similar to those of the ZC.

However, with the discovery of the Iraqi nuclear weapons research program at the end of the first Gulf War[11], it appeared that export controls could not be limited to "especially designed" materials. The use of outdating technology and items that are not especially designed for nuclear use but could contribute to the elaboration of nuclear weapons raised the need to extend the scope of control. To face this concern, in 1992, the NSG adopted a list of items that had both nuclear as well as non-nuclear uses. The NSG was followed by the Wassenaar Arrangement[12](WA) which, in 1996, adopted also a "dual-use goods and technologies" control list. For this latter, the concept of dual-use was enlarged to more than nuclear weapons-related

[8] Further information is available at: https://www.un.org/disarmament/wmd/nuclear/npt/ .
[9] The Committee was named after its first Chairman, Professor Claude Zangger.
[10] The Zagger Committee was founded following the entry into force of the NPT to help States Parties to the Treaty to implement and share common understanding about the interpretation of the provisions of the Treaty. Further information is available at: http://zanggercommittee.org
[11] The Persian Gulf War, also called Gulf War was an international conflict that was triggered by Iraq's invasion of Kuwait on 2 August 1990. It ended with the Iraqi defeat and retreat from Kuwait on 28February 1991.
[12] COCOM was replaced by the Wassenaar Arrangement in 1994, due to the end of the Cold War and the following joining of many East countries (Russian Federation, Czech Republic, Hungary, Poland, Slovak Republic, Romania) to the export control regime.

items. For the WA "dual-use items" were any equipment and technology that are largely used by peaceful industries but could also contribute to the elaboration of weapons, including nuclear explosive devices.

The extension of export controls to dual-use items, however, was not even sufficient to prevent proliferation of nuclear weapons as new proliferators emerged on the international scene.

All these years of proliferation showed that, maybe, the principle of controlling only listed items was not sufficient to prevent the risk of proliferation. Therefore, it appeared necessary to focus not only on items and technical parameters but also on end-uses of non-listed items. Some items might not be listed from the beginning due to unknown potential contribution to weapons program. It could be the case of new technological developments or items that are broadly used by industries and that could also, in certain circumstances, contribute to the proliferation of nuclear weapons. It is also the case of certain out-dated technologies that have been decontrolled as they were considered to be too expensive to be attractive by proliferators. However, it does not exclude the risk that certain end-users might use it. For instance, the financial cost might not be a barrier for certain proliferators, and out-dated technology might be selected even if it takes longer to achieve the development of a nuclear explosive device. Therefore, the idea to enlarge the scope of control (to items normally not listed) by considering the proliferation risk resulting from the combination of a none highly sensitive item used by a sensitive end-user (individual or country) has been progressively included in trade control regimes and systems.

The European Union (EU) initiated the process by including a so called "catch-all clause" in its dual use trade control Regulation, stating that if an exporter has been informed, knows or is aware that not listed items which he proposes to export are intended, in their entirety or in part, for any of the weapons of mass destruction (WMD) related uses, he must notify to his authorities, which will decide whether or not it is expedient to make the export concerned subject to authorisation[13]. Under the initiative of some EU countries, which intended to universalize the new constraint imposed to their industries by the Regulation, catch-all provisions have been progressively included in most of trade control regimes. The NSG was the first to insert it in its Dual-Use Guidelines. The text essentially acknowledges Participating States commitment to ensure that their national legislation requires an authorisation for the transfer of items not listed if the items in question are or may be intended, in their entirety or in part, for use in connection with a nuclear explosive activity[14]. Contrary to other provisions, the guidelines didn't detail how such commitments should be implemented by participating state. It only underlines that it should be in accordance with their domestic licensing practices.

The adoption of catch-all provisions constituted a major turnover in the principles ruling nuclear trade control by introducing the concept of uncertainty for suppliers. Previously, suppliers had only two options. Either the item concerned by the transaction was listed and a licence was necessary or the item was not listed and it could be exported without a licence. However, with the new provision, suppliers were confronted with a third option: if the item was not listed it might not necessary be licence exempted. Therefore, before finalizing the transaction for the not listed items, the supplier should assess — on the base of information at their disposal — whether the transaction could raise proliferation concerns. They should consider the conformity

[13] Council Regulation (EC) No 3381/94 of 19 December 1994 setting up a Community regime for the control of exports of dual-use goods (Official Journal L 367, 31/12/1994 P. 0001 – 0007).
[14] Paragraph 5 of the Guidelines for transfers of nuclear-related dual-use equipment, materials, software, and related technology published by the IAEA under the reference INFCIRC/254Part2 available on IAEA.org

of technical parameters of the items that they intend to transfer in regards of what their customer has declared to use it for and inform their authorities whether there is any inadequacy or unusual application. They should also be non-proliferation proactive and inform their authorities if they are aware of any involvement of the end users in any nuclear suspicious activities.

This new approach to trade control was grounded on the concept that manufacturers, exporters and other economic actors of the supply chain are those who best know the technical parameters of their productions and its potential end-uses. As consequence, they may detect unusual requests or unusual customers earlier than their authorities could do it.

The adoption of the United Nations Security Council Resolution 1540 on 28 April 2004, under Chapter VII of the United Nations Charter, was a major switch in the ruling of nuclear trade control by the international community[15]. It was the recognition that trade control was not only a subcategory of non-proliferation instruments dedicated to a specific category of risks (nuclear, biological, …) established by a closed group of countries but could be a transversal and universal tool in the fight against the proliferation of nuclear weapons and other WMD.

The Resolution requests to all States, member or not of the different trade control regimes, to take and enforce "effective measures to establish domestic controls to prevent the proliferation of nuclear, chemical, or biological weapons and their means of delivery, including by establishing appropriate controls over related materials"[16]. It identifies the core elements of a national trade control system but it does not define, like the NSG, a list of items to control. However, it highlights that a national system should control items especially designed for nuclear uses as well as "related materials" that are usually understood as dual-use items[17].

If the Resolution didn't mention or define the catch-all clause, the 1540 Matrix[18] — to be fulfilled by States to report on steps they have taken to comply with the Resolution — includes questions on national provisions related to such clause[19]. This indirect acknowledgement of the catch-all principle constituted the international formalisation of the slow evolution of the role of operators in the fight against the proliferation of nuclear weapons. Starting in the 1950s, when operators were essentially implementing the rules defined by authorities, the trade control system has slowly and unvoluntary changed his passive role to a proactive one. By including a catch-all in its Matrix, the Resolution follows and supports this ongoing trend.

The Resolution also enlarges or defines more precisely the scope of transactions that should be covered by a State trade control system. The NPT as well as the NSG refer to the term "transfers", which they do not define and which consequently have been commonly understood as "export" by most of participating States[20]. Some States have started unilaterally to enlarge

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[15] UN Resolution 1540 (2004) adopted by the Security Council at its 4956th meeting, on 28 April 2004. The Resolution is available on the United Nations website at https://www.un.org .

[16] Paragraph 3.d of the UN Resolution 1540 (2004).

[17] Related materials: materials, equipment and technology covered by relevant multilateral treaties and arrangements, or included on national control lists, which could be used for the design, development, production or use of nuclear, chemical and biological weapons and their means of delivery.

[18] Further information available at https://www.un.org/en/sc/1540/national-implementation/1540-matrices.shtml

[19] Question 12 of VII. OP 3 (c) and (d) and related matters from OP 6 - Controls of NW, CW and BW, including Related Materials of the Approved 1540 Matrix available at https://www.un.org/en/sc/1540/documents/Final%20Matrix%20Template%20(E).pdf

[20] The understanding was also supported by the fact that trade control regimes and systems have been named until recently "export" control regime and system.

the scope by including "import" to facilitate their reporting obligations in particular to the IAEA, "transit", "transhipment", "brokering" and finally "financing". However, this issue remains controversial and no definition of the term transfer has been adopted by an international instrument until the Resolution 1540. By including a comprehensive the Resolution has ended this controversial[21].

The scope of controls has further evolved over the years to face the evolution of the industrial reality. The development of technology and, more specifically, its process of transfer have raised the necessity to reconsider the process of controlling transactions. In the nuclear sector the transfer of technology has always been sensitive, as it was revealed in the seventies by the AQ Khan case[22]. However, it was considered that the control of access by foreign researchers to laboratories and the control process of transfers of documents like blueprints, models, engineering designs and specifications, manuals and instructions was sufficient to face the risks of nuclear proliferation.

Nevertheless, the development of internet and the transfer of technology by intangible means have made this approach partly obsolete. The difficulty was that traditional trade control tools (licences and custom) were not appropriate to face this new reality. Those new transfers were essentially crossing the border by virtual means: via uploading and downloading to a webserver or more simply attached to an email. Besides, the development of international collaboration and cooperation via online common platforms raised concerns regarding the difficulty to identify were the technology was located and who has access to it.

It was technically impossible for customs authorities to control all those intangible transfers of technologies as long as they were not passing physically through the border, unless the operator was aware that the transfer required an authorisation and he has applied for it accordingly.

Moreover, it was almost impossible for authorities to detect and prosecute potential infringements.

Therefore, there was and still remains a need to rethink trade control process. The principle to involve and increase the responsibility of operators initiated by the introduction of catch-all clause in the NSG and national systems was a first response to these concerns.

Recently the concept of "due diligence" — used by the Kimberley Process[23] and by the EU[24]— to stem the trade in conflict minerals (tin, tantalum, tungsten and gold) and diamonds, which sometimes finance armed conflict or are mined using forced labour, have been considered as a potential answer to face the new risks of intangible transfers of technology in the nuclear sector as well.

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[21] Paragraph 3(d) of the Resolution : *Establish, develop, review and maintain appropriate effective national export and trans-shipment controls over such items, including appropriate laws and regulations to control export, transit, trans-shipment and re-export and controls on providing funds and services related to such export and trans-shipment such as financing, and transporting that would contribute to proliferation, as well as establishing end-user controls; and establishing and enforcing appropriate criminal or civil penalties for violations of such export control laws and regulations;*

[22] For a short comprehensive explanation of the case, see: A. Q. Khan Nuclear Chronology ; Micheal Laufer, September 07, 2005, Carnegie Endowment for International Peace available at https://carnegieendowment.org/2005/09/07/a.-q.-khan-nuclear-chronology-pub-17420

[23] https://www.kimberleyprocess.com

[24] https://ec.europa.eu/trade/policy/in-focus/conflict-minerals-regulation/regulation-explained/

Furthermore, the enlargement of the definition of "operators" by formally including the scientific research community and the raising awareness among this particular group, who didn't consider itself as potential operators, contribute to reinforce the intention of public authorities to share the responsibility of fighting the proliferation of nuclear weapons.

To face their new responsibility, operators — including universities and research centres — have started to develop internal measures that are taken to ensure that their transactions take place in conformity with current trade control regulation. This measures usually known as Internal Compliance Program (ICP) contain a clear definition of the chain of responsibilities, the necessary checks and inspections to make sure that intended end use of the items to be transferred is guaranteed and legitimate as well as to ensure compliance with the applicable trade regulations.

In the nuclear sector some companies have individually taken the initiative to develop some system to cope with their proliferation responsibility. An attempt to coordinate the response — by proposing dedicated models for nuclear proliferation - have been initiated by a consortium of nuclear industries[25].

In conclusion, nuclear proliferation has slowly moved or expanded from tangible transfers of nuclear material and equipment to intangible transfers of technology. As indirect consequence of the technical impossibility for public authorities to counter such new risk, they have had to progressively increase the role of operators and indirectly switch the whole system based on list of items to a system based on the liability of operators.

[25] The project was called Botticelli. It was launched in 2014 with the objective to enhance cooperation between industry and governments. The companies taking part in the initiative were Airbus Helicopters, Air Liquide, Boeing, Alstom, Areva, EDF Energy, Ericsson, GE, Hitachi, Merck, Philips, Rolls-Royce, Safran, Siemens, Thales and Westinghouse. See https://www.world-nuclear-news.org/V-Towards-smarter-nuclear-export-controls-0610151.html

13. THE GROWING IMPORTANCE OF ENVIRONMENTAL PROTECTION AND ENVIRONMENTAL LAW FOR NUCLEAR ACTIVITIES

Sam EMMERECHTS[1], [2]
Council of the European Union

13.1. INTRODUCTION

The International Atomic Energy Agency (hereinafter the "Agency") was established in 1957 by a multilateral treaty as an autonomous intergovernmental organization. For many years the Agency has assisted its Member States in developing their respective national laws for the peaceful uses of nuclear energy and ionizing radiation. In 2011 the Office of Legal Affairs in cooperation with the Department of Technical Cooperation of the Agency organised the first edition of a two-week intensive training course on nuclear law, known as the Nuclear Law Institute, with the aim to strengthen the knowledge in all areas of nuclear law of some 60 national officials from various professional backgrounds in the nuclear field and enhance their skills in drafting comprehensive nuclear legislation for their respective countries. It was decided to dedicate a special session in the training course to the relationship between nuclear law and environmental law because environmental protection was considered to be of growing importance in the nuclear field. Ten years later legislative decision-making on environmental protection still figures on the programme of the annual sessions of the Nuclear Law Institute and it will most likely remain so in the years to come.

Ever since the late 1970s the protection of the environment has gained importance in the minds of millions of people, political decision-makers and legislators around the world, albeit not always equally intensive in all regions of the world and not always in a linear way. Indeed, concerns had been expressed world-wide over the detrimental impact of industrial activities on the environment, often as a result of major accidents including in chemical plants in Seveso, Italy (1976) and Bhopal, India (1984) but also in the nuclear power plant of Chornobyl, Ukraine (1986). While at the end of the last century it was essentially accidents in individual installations that were a cause for environmental concern, lately it is also the combined effect of all industrial installations in normal operation mode and the impact on climate change that is gaining attention. In 1988 the United Nations set up the Intergovernmental Panel on Climate Change (IPCC) to provide the world with objective, scientific information for understanding the scientific basis of the risk of human-induced climate change, its natural, political, and economic impacts, and possible response options. In a report of 2018 that received world-wide attention the IPPC showed that maintaining a temperature rise to below 1.5 °C remains possible, but only through "rapid and far-reaching transitions in energy, land, urban and infrastructure [...] and industrial systems" as well as "deep emissions reductions", and "unprecedented transitions in all aspects of society" [1]. With regard to energy specifically, governments will thus need to consider all low-carbon sources of energy, including nuclear, in order to limiting the rise in global temperatures. Nuclear power plants produce practically no greenhouse gas emissions or

[1] Mr. Emmerechts (LL.M) is a Legal Adviser with the Council of the European Union. Mr Emmerechts previously worked as Senior Legal Counsel with the OECD Nuclear Energy Agency and with utility company ENGIE. The views expressed by the authors in this article are their own and in no way reflect the views of the Council of the European Union or the European Council, the IAEA or its Member States.
[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

air pollutants during their operation and emissions over their entire life cycle are considered low. Aware of the potential role of nuclear power plants in limiting global temperature increases, the Agency decided to focus on the role that nuclear energy could play for combating climate change and organized in 2019, in cooperation with the Nuclear Energy Agency of the Organisation for Economic Cooperation and Development, the IAEA International Conference on Climate Change and the Role of Nuclear Power ("Atoms4Climate conference"), the first on this topic to be organized by the Agency, to exchange science-based information and conduct objective discussions on the role of nuclear power in mitigating climate change [2].

13.2. ENVIRONMENTAL LAW AND NUCLEAR LAW GOVERNING NUCLEAR ACTIVITIES

The protection of the environment in the nuclear sector is one of the primary aims both of nuclear law and of environmental law. Both branches of law do apply to nuclear activities, but they are not only different in nature, but they have also developed differently.

Nuclear law is a branch of law that is not only older than environmental law, it also contains much more detailed and complex rules of a technical nature. This is of course not surprising since nuclear energy legislation applies to a highly technical field of the economy, with some activities and materials posing unusual risks to human health, safety and the environment, as well as national and international security risks. It applies to a variety of technical fields, from nuclear power generation to the use of radioactive sources in hospitals, industry and agriculture. Safety is the principal requisite for the use of nuclear energy and the applications of ionizing radiation and nuclear law therefore essentially aim at preventing nuclear accidents that may cause harm to individuals, society and the environment. The primary objective of nuclear law is broader than the one of environmental law. Unlike environmental law, it also takes into account the protection of individuals and property: "To provide a legal framework for conducting activities related to nuclear energy and ionizing radiation in a manner which adequately protects individuals, property and the environment [3]." Core nuclear law conventions such as the IAEA Nuclear Safety Convention (1994) [4] and the IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997) [5] aim at reaching a higher level of safety worldwide, including preventing the occurrence of nuclear accidents that would negatively impact people, property and the environment.

Environmental law is a branch of law that was developed later than nuclear law and that, unlike nuclear law, is not specific to one type of industry. The primary objective of environmental law is focused exclusively on the protection of the environment: "To provide substantive, procedural and institutional rules […] that have as their primary objective the protection of the environment [8]." After a number of industrial accidents in the second half of the twentieth century that had devastating consequences for the environment, governments and lawmakers realized that there was an urgent need to take action. Environmental law entered the gates of international law through the 1972 Stockholm ("Stockholm Declaration") and the 1992 Rio de Janeiro ("Rio Declaration") Declarations of the United Nations Conference on the Environment [9]. Both declarations constitute major milestones for recognizing explicitly the right to a healthy environment and to affirm the need to protect, preserve and improve the state of the environment and to ensure sustainable and environmentally sound development. They were an attempt at forging a basic common outlook on how to address the challenge of preserving and enhancing the human environment.

One of the most relevant principles of the Stockholm Declaration for nuclear activities is embodied in its Principle 21 which provides in its first part that States have, in accordance with

the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies. It acknowledges that States with uranium mines, oil reserves or gas wells on their national territory have the right to use these resources for their economic benefit. However, if these States decide to do so, they must respect the second part of Principle 21 which relates to the prevention of environmental harm. The second part of Principle 21 stresses that States also have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. This part is particularly important for nuclear activities, as evidenced by the 1986 Chernobyl accident that had an impact on the environment in a multitude of States. Immediately after this nuclear accident two international nuclear law conventions were adopted under the auspices of the Agency that aimed at mitigating environmental damage. The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1986) and the Convention on Early Notification of a Nuclear Accident (1986) requiring States to cooperate and facilitate prompt assistance and support in the event of nuclear accidents or radiological emergencies and to report the accident's time, location, nature, and other data essential for assessing the situation are strong illustrations of Principle 21 of the Stockholm Declaration. In its Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons [10], and later in the Pulp Mills on the River Uruguay case [11], the International Court of Justice considered the obligation not to cause damage to the environment of other States to constitute a rule of international customary law.

The Rio Declaration very much resembles the Stockholm Declaration but makes an explicit reference to some of the most fundamental principles of environmental law such as the precautionary principle ("In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation") [12] and the polluter pays principle ("National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment") [13]. Both the precautionary principle and the polluter pays principle play indeed a very significant role in the nuclear field. The precautionary principle is most visible in the optimization of protection against radioactive emissions as illustrated by the term ALARA ("as low as reasonably achievable, economic and social factors being taken into account"), as required by the International Commission on Radiological Protection (ICRP), which indicates that the purpose of radiation protection is to ensure that the hazards from radiation are kept low. The polluter pays principle has been at the heart of the development of international nuclear third party liability legislation which in essence holds the operator of a nuclear installation ("the polluter") liable for the damage that is caused by a nuclear accident. The first 'generation' of international nuclear third party liability conventions, including the Vienna Convention on Civil Liability for Nuclear Damage that was concluded under the auspices of the Agency (1963) [14] and the Paris Convention on Nuclear Third Party Liability that was concluded under the auspices of the OECD (1960) [15], focus on property damage and personal injury. Neither of the first generation conventions contained a specific or explicit reference to environmental damage but this did not mean that environmental damage could not be compensated as property damage or otherwise. After the 1986 Chernobyl accident lawmakers realized that international nuclear third party liability legislation needed to be reformed, in particular to increase the liability amounts. The polluter pays principle was maintained in the second 'generation' of international nuclear third party liability conventions, including the Protocol to amend the Vienna Convention on Civil Liability for Nuclear Damage (1997) [16] and the Protocol to amend the Paris Convention on Nuclear Third Party Liability

(2004) [17], but amendments were made to ensure compensation for environmental damage subject to a range of qualifying elements to determine to what extent costs shall be compensated. Costs of measures to reinstate significantly impaired environment, loss of income from an economic interest in the use of the environment and costs of measures to prevent nuclear damage as defined have become compensable to some extent [18]. The polluter pays principle is also widely applied when funding costs for decommissioning nuclear power facilities and when managing radioactive waste. This may be illustrated by legislation in the European Union where Article 37 of the Euratom Treaty obliges each European Union Member State to provide the European Commission with such general data relating to any plan for the disposal of radioactive waste in whatever form will make it possible to determine whether the implementation of such plan is liable to result in the radioactive contamination of the water, soil or airspace of another EU Member State [19].

But the Rio Declaration also goes further than the Stockholm Declaration by supporting the development of procedural techniques to protect the environment including most notably the obligation to conduct environmental impact assessments. The obligation to organize environmental impact assessments also applies for nuclear installations and was later reproduced in the IAEA Convention on Nuclear Safety:

> "Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented: […] for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation [20]."

Another procedural technique is the obligation to notify and provide information to other States of emergencies that are likely to produce effects on the environment of other States and the obligation to consult with these States at an early stage and in good faith. The obligation to notify other States of harmful events that have taken place on national territory had already explicitly been integrated in international nuclear law as a result of the 1986 Chernobyl accident with the adoption of the abovementioned IAEA Convention on Assistance in the Case of a Nuclear Accident or a Radiological Emergency (1986) and the IAEA Convention on Early Notification of a Nuclear Accident (1986).

Since the adoption of the Stockholm and Rio Declarations international and national environmental law have further developed with the objective to limit activities that are harmful for the environment and to ensure remediation of environmental damage. Several international environmental law conventions do apply to nuclear activities as illustrated for example by the London Dumping Convention (1972 and 1996) which prohibits the dumping of radioactive waste at sea [21], the United Nations Convention on the Law of the Sea (UNCLOS, 1982) which obliges its contracting parties to minimize to the fullest possible extent the release of toxic, harmful or noxious substances, especially those which are persistent such as nuclear substances [22] and the Convention for the Protection of the Marine Environment for the North-East Atlantic (OSPAR, 1992) which imposes an obligation on contracting parties to take all possible steps to prevent and eliminate pollution to the maritime area, including radioactive substances and waste [23]. In developing their respective national programs for the peaceful uses of nuclear energy and ionizing radiation, national legislators will therefore bear in mind the importance of protecting the environment.

A very effective way to ensure environmental protection in the nuclear field has proven to be public access to information and involvement of stakeholders in nuclear decision-making. Since the soil, the air, the water and the biodiversity are not owned by anyone individually but are considered to belong to all of us, one of the principal tools of environmental law is to ensure transparency of environmental information and to involve various stakeholder in the decision-making of industrial projects, including not only the public who is affected or likely to be affected by the environmental consequences of these projects, but also non-governmental organizations that aim at preserving the state of the environment. In the nuclear area this objective of environmental law has been implemented in various ways such as, for example, by actively informing the public and other stakeholders on the risks of nuclear activities and the impact of radioactive emissions on human health and the environment, by allowing stakeholders to get involved in decision-making regarding nuclear licensing, by involving the public when assessing the environmental impact of new nuclear installations and by concluding long-term partnership agreements with local communities for hosting radioactive waste facilities and repositories. Several States with nuclear installations have made a giant step between the early days of nuclear development and now in terms of participation of stakeholders in nuclear decision-making. Whereas in the 1960s and 1970s most governments adhered to a "decide, announce and defend" model to build and operate nuclear installations whereby there was hardly any possibility for stakeholders other than the operator, the regulator and the government to have a say, many governments have now substantially moved to a model of "engage, interact and cooperate" [24]. In the broadest sense, “stakeholders” now include the public, businesses and corporations, economic actors, representatives from non-governmental organizations, local, regional and national public authorities and nuclear regulators. Two conventions in the environmental law domain have served as a source of inspiration on transparency of information and stakeholder involvement for States worldwide [25].

Under the United Nations Economic Commission for Europe Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters ("Aarhus Convention", 1998) contracting parties are required to make the necessary provisions so that public authorities (at national, regional or local level) will contribute to these rights to become effective, including the right of the public to access environmental information, the right of the public to participate in environmental decision-making and the right the public to accede to court. The right of access to environmental information includes the right to receive environmental information that is held by public authorities [26]. This may include information on the state of the environment prior to the construction of a new radioactive waste repository or a nuclear power plant or a nuclear research reactor, but also on policies or measures taken, or on the state of human health and safety where this can be affected by the state of the environment. In addition, public authorities are obliged to actively disseminate environmental information in their possession such as, for example, on the impact of the discharging of a nuclear power plant's cooling water on the temperature of the nearby river or sea. The Aarhus Convention also foresees the right to participate in environmental decision-making including making arrangements by public authorities to enable the public affected and environmental non-governmental organizations to comment on, for example, proposals for new nuclear installations affecting the environment, or plans and programmes relating to the environment, these comments to be taken into due account in nuclear decision-making, and information to be provided on the final decisions and the reasons for it. Finally, the Aarhus Convention also contains the right to challenge decisions by public authorities that have been made without respecting the two aforementioned rights or environmental law in general before a court.

The United Nations Economic Commission for Europe Convention on Environmental Impact Assessment in a Transboundary Context ("Espoo Convention", 1991) imposes obligations on contracting parties to assess the environmental impact of certain activities at an early stage of planning, including nuclear activities [27]. It lays down the general obligation of contracting parties to notify and consult each other, as well as the public in these contracting parties, on all major projects for individual installations under consideration that are likely to have a significant adverse environmental impact across boundaries. Such notification of and consultation with other contracting parties is done on the basis of environmental impact assessments whereby the environmental effects of a particular facility or plan are analysed and recorded in a report together with corrective measures to limit the negative effects. The comments of these contracting parties and their public must be taken into account prior to licensing the facility. The Espoo Convention is particularly important for nuclear activities for two reasons. Firstly, because the entire nuclear sector and all fuel-cycle facilities are based on a regulatory model of licensing and authorisations. The IAEA Convention on Nuclear Safety mentions that:

> "The legislative and regulatory framework shall provide for: […] (ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence" [28].

The Espoo Convention obliges contracting parties to ensure that environmental impact assessments are organised and that transboundary consultations take place prior to granting specific licenses in the nuclear field. Secondly because a substantial number of nuclear facilities has been built near borders with neighbouring States and because nuclear accidents cause radiological emissions and environmental effects that may go far beyond national borders. The Espoo Convention obliges States to notify and consult with other States prior to licensing nuclear facilities that may affect the environment of these other States either as a result of normal operation or as a result of an accident. In this regard it is also worth mentioning that in 2017 good practice recommendations on the application of the Espoo Convention to nuclear energy activities have been published [29].

A decade after the adoption of the Espoo Convention several States decided to extend the idea of conducting environmental assessments, transboundary consultations and public participation beyond the level of individual installations and to apply it to certain governmental plans, programmes and policies which are likely to have significant environmental effects. The Protocol on Strategic Environmental Assessments ("Kiev Protocol", 2003) covers plans, programmes and policies that set the framework for future consent of individual installations [30]. A strategic environmental assessment is the evaluation of the likely environmental, including health, effects which comprises the determination of the scope of an environmental report and its preparation, the carrying out of public participation and consultations, and the taking into account of the environmental report and the results of the public participation and consultations in a plan or programme. A specific illustration of the application of the Kiev Protocol to the nuclear field is, for example, a governmental plan for selecting a particular method for the long term management of low, intermediate or high level radioactive waste or a governmental program on whether or not nuclear should be part of the national energy fuel mix to secure electricity supply in the future [31].

13.3. TRENDS AND DEVELOPMENTS IN THE NUCLEAR FIELD

Globally we see two major trends and developments that are significant for nuclear facilities and activities, one relating to stakeholder involvement and another relating to the attention that is paid to protecting the environment.

13.3.1. Enhanced stakeholder involvement

Although political, legal and cultural backgrounds do of course vary amongst nuclear States and lead to different levels of stakeholder involvement, there is a general trend in the nuclear field towards enlarged stakeholder engagement, public participation in decision-making and transparency that is largely pushed by environmental law. In the early days of nuclear development, the less the public knew about nuclear, the better it was for society as a whole seemed to be the leading philosophy. In 2011 the Agency wrote that "It is fair to say that siting and other decisions in the past were not always examples of what would now be regarded as appropriate stakeholder involvement" [32]. This approach has changed significantly, and it will continue to do so in the future. Incorporating societal input into nuclear decision-making has proven to help to achieve better-informed and more sustainable choices. It is considered an effective means to increase public awareness, understanding and acceptance of decisions in the nuclear field that may impact society beyond generations. For States embarking on nuclear power programmes effective communication with citizens and other stakeholders is often considered challenging. Creating awareness and promoting understanding among stakeholders has turned out to be paramount to build mutual trust. Designing stakeholder involvement programmes not only covers communication about energy policies but also strengthening stakeholders' understanding of nuclear power, including its benefits and risks and most importantly making them part of the decision-making process. Public participation helps to strengthen the legitimacy of regulatory decisions, but it also creates trust and understanding in decisions by policy-makers. Enhanced access to nuclear information, substantive public participation and engagement are increasingly considered as necessary for delivering sustainable decisions that are supported by citizens.

Stakeholder involvement will probably develop most significantly in specific domains of nuclear activities, notably radioactive waste management and decommissioning, nuclear regulation and radiation protection. In radioactive waste management many States seeking to site deep geological repositories or interim storage or disposal facilities have discovered that the involvement of local communities in deliberating choices has been a much better recipe for long term success than a top-down approach. Such involvement includes initiating open and transparent decision processes and collaboration with local stakeholders to build partnerships from the very start of the project. This evolution is also particularly significant for decommissioning because over the next decades many nuclear facilities will retire and it will be important to adequately face public concerns in this regard [33]. In nuclear regulation stakeholder involvement and dialogue are increasingly considered as means to improve knowledge and build mutual trust. A key issue for the regulatory body is to succeed in establishing a relationship of confidence with the stakeholder. The establishment of regular communication and consultation with stakeholders has proven in many States to contribute to more effective communication by the regulatory body. In this regard it is illustrative to point to Principle 2 of IAEA Safety Standards Series No. SF-1, Fundamental Safety Principles, which states in para. 3.10 that:

> "The regulatory body must: […]
>
> – Set up appropriate means of informing parties in the vicinity, the public and other interested parties, and the information media about the safety aspects (including health and environmental aspects) of facilities and activities and about regulatory processes;
>
> – Consult parties in the vicinity, the public and other interested parties, as appropriate, in an open and inclusive process" [34].

It is also illustrative to point to requirement 36 of the safety requirements established in IAEA Safety Standards Series No. GSR Part 1 (Rev. 1) which obliges the regulatory body to promote the establishment of appropriate means of informing and consulting interested parties and the public about the possible radiation risks associated with facilities and activities, and about the processes and decisions of the regulatory body" [35]. With regard to radiation protection there is also an increasing desire and need for society to understand decisions made by governments, regulatory bodies and industry, and to participate more actively in decision-making processes that involve environmental and public health issues. Nuclear operators and regulators increasingly realize that proactive and transparent communication on radiation protection and nuclear safety is key to reassuring citizens. Accidents such as the ones of Chernobyl (1986) and Fukushima Daiichi (2011) have taught that radiological protection must adapt to meet the needs of society, and not the reverse, and that stakeholders should be involved in decision-making on radiation protection rather than relying on approaches whereby radiation experts just explain radiation protection decisions to the public, particularly in emergency management situations, before, during and after an accident.

13.3.2. Increasing attention for environmental protection

As is mentioned in the introduction to this contribution, the protection of the environment is one of the main objectives of nuclear law. For a long time the predominant focus of nuclear law has been on protecting human health and property though. Often it was implicitly assumed that the ecosystem (air, soil, water and biodiversity) would be sufficiently protected from radiological hazards by adopting nuclear legislation and regulation that adequately protects people and property. In other words it was held that the standards of environmental control that are needed to protect the general public would ensure that other species are not placed at risk. But over the last decades one notices a substantial move in nuclear law towards focusing more actively on protecting the environment and granting a specific status to the environment. This evolution may be illustrated by the Recommendations of the ICRP. The 1977 ICRP Recommendations (Publication 26) noted that "Radiation protection is concerned with the protection of individuals, their progeny and mankind as a whole, while still allowing necessary activities from which radiation exposure might result", hereby limiting the scope of radiation protection to human health [36]. The environment was not mentioned as a separate interest that deserved protection. Thirty years later the 2007 ICRP Recommendations (Publication 103) acknowledged that "[…] it has also become apparent that the radiological protection of the environment should receive more emphasis than in the past" and proposed the use of reference animals and plants to provide a sound framework for environmental protection in all exposure situations [37]. The 2007 ICRP Recommendations now also contain a specific chapter that is dedicated to the protection of the environment[3] [38].

[3] ICRP 2007. See Chapter 8.

The increasing attention for environmental protection is also driven by global warming. The Kyoto Protocol to the United Nations Framework Convention on Climate Change (1998) was the first international treaty which aims at constraining CO_2 releases [39]. However, it did not recognise nuclear energy as an accepted technology under its Clean Development Mechanism or its Joint Implementation scheme. Its successor, the Paris Climate Agreement (2015), has the ambition to hold the increase in global average temperature from pre-industrial levels to well below 2°C, the threshold at which most experts believe the worst impacts from climate change can still be avoided, and pursue efforts to limit the rise to 1.5°C [40]. Energy-related emissions make up three-quarters of global greenhouse gases. Implementing the Paris Agreement thus implies a radical transformation of energy production and usage. Nuclear power installations may well play an increasing role in the world-wide discussions on solutions to combat climate change. Climate change mitigation is one of the leading reasons for the deployment of nuclear power. Much more than in the past 50 years will society start to realize that nuclear energy is a virtually CO_2-free source of electrical power and therefore needs to be part of the solution if we want to limit the disastrous effects of global warming. The European Union aims to be climate-neutral by 2050 meaning an economy with zero greenhouse gas emissions. This objective is at the heart of the European Green Deal and is in line with the European Union's commitment to global climate action under the Paris Climate Agreement [41]. Driven by its rapidly growing electricity needs, large States such as China and India have ambitious plans to develop electric power installations, including nuclear power installations, in the next decades in order to meet their national climate objective.

Many nuclear States also move towards ensuring better compliance with environmental protection regulation. Governments world-wide have enacted environmental laws and set environmental standards to protect the environment. Yet the mere existence of laws is rarely sufficient to ensure their success. For environmental law to be effective, it is important to make sure that it is properly implemented and enforced. Although several States are reluctant to adopt adequate tools to ensure compliance with environmental legislation, there is a slow but growing trend amongst many States towards ensuring implementation and enforcement of the environmental legislative framework and this also impacts nuclear activities. This evolution is not so much based on hard measures and sanctions but often on a softer approach to give States incentives to respect environmental legislation. One particular soft approach that could serve as a model is the compliance mechanism under the Aarhus and Espoo Conventions. The compliance mechanism is based on two main pillars. Under the first one a periodic meeting of all the contracting parties is organised to keep under continuous review the implementation of the conventions ("Meeting of the Parties") [42]. There is some resemblance with the peer review mechanism under the IAEA Safety Convention and the IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Parties submit a periodical national report on the implementation of their obligations under the Convention, the Meeting of the Parties reviews national policies, exchanges information on experience gained and makes recommendations to individual or all Parties on the application of the Conventions. In this regard it is noteworthy to mention that the Meeting of the Parties to the Espoo Convention endorsed in 2017 the Good Practice Recommendations on the Application of the Espoo Convention to Nuclear Energy Activities to describe good practice in the application of the transboundary environmental impact assessment procedures in the field of nuclear energy and facilitate the exchange of information and assist Parties, both nuclear and non-nuclear States, in the consistent practical application of the Espoo Convention. Under the second pillar Parties may submit complaints about non-compliance by other Parties to a dedicated body or procedures may be launched at the initiative of the dedicated body itself on the basis of information obtained from other sources (most often NGOs) or in the national

reports[4]. Both the Implementation Committee under the Espoo Convention and the Compliance Committee under the Aarhus Convention are non-adversarial, non-judicial bodies that assist Parties in achieving the aims of the Conventions on the basis of a bilateral exchange of information between the Committee and the Party concerned and potentially a statement of non-compliance together with a recommendation to the Meeting of the Parties to urge a Party to comply with the obligations under the Convention [43]. By way of example, a recommendation to a Party could be to respect the obligation to wait to select the location for a new nuclear power plant until all environmental documentation has been shared with affected Parties and the full environmental impact assessment process is terminated.

Two other evolutions also illustrate the increasing attention for environmental protection in the nuclear domain. Firstly, one notices a growing tendency to invoke human rights in order to protect the environment. Principle 1 of the Stockholm Declaration already established a foundation for linking human rights, health, and environmental protection, declaring that: "Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being […]" [44]. Even though the European Convention on Human Rights does not enshrine any right to a healthy environment as such, the European Court of Human Rights has been called upon to develop its case-law in environmental matters on account of the fact that the exercise of certain Convention rights may be undermined by the existence of damage to the environment and exposure to environmental risks, including those that are posed by nuclear installations. For example, in one case applicants living in the vicinity of a nuclear power plant in Mühleberg (Switzerland) complained of having been denied access to a court regarding the decision of the public authorities to grant the nuclear power plant an extension of its operating license. The European Court of Human Rights held that Article 6 § 1 ("Right to a fair trial") of the European Convention on Human Rights was not applicable because the connection between the decision by the authorities and the rights invoked by the applicants (life, physical integrity, property) had been too tenuous and remote [45]. In the late 1990s applicants living in the vicinity of a nuclear power plant in Beznau (Switzerland) claimed in a similar case that their civil rights to life and physical integrity and their right to a fair trial under Article 6 § 1 of the Convention had been violated by a decision granting an extension of the operating licence of the nuclear power plant. The European Court of Human Rights also denied the claim [46].

Secondly, many nuclear power plants reactors in "old" nuclear States have now reached the end of their original design life (usually: 30– 40 years). Since investments in new nuclear facilities require large financial commitments and face long construction times, an increasing number of national governments are looking into the long-term operation of their nuclear power plants reactors — extending their lifetime beyond what they had originally been designed for three or four decades ago. Legal requirements to perform environmental impact assessments for "new" nuclear power reactors have been enacted under national, European and international legislation and have gained the status of international customary law. But in many States there is no obligation to conduct an environmental impact assessment when extending the operation of "existing" nuclear power reactors or it is unclear whether such assessment needs to take place, notably because their national legislative and regulatory frameworks appear to leave substantial room for interpretation. This process of extending the operation of "existing" nuclear power reactors is sometimes denominated “long-term operation (LTO)” or “life extension” or “lifetime extension” or “refurbishment” or “licence renewal” [47]. In 2019 the Court of Justice of the European Union held in relation to the long-term operation of two nuclear power reactors

[4] Under Appendix IV the Espoo Convention also establishes an Inquiry Commission to advise Parties on the likelihood of significant adverse transboundary impact of industrial installations.

in Belgium that there was indeed an obligation to conduct an environmental impact assessment [48]. The Court hereby confirms an ongoing trend whereby environmental procedural requirements for long term operation of nuclear power reactors are increasing. This trend is also confirmed by the adoption in 2020 of the Guidance on the applicability of the Espoo Convention to the lifetime extension of nuclear power plants [49]. The guidance aims at identifying the conditions that must be met for the Espoo Convention to apply to decisions authorizing long-term operation of nuclear power reactors. If these conditions are met, a transboundary environmental impact assessment must be conducted prior to authorizing long-term operation.

13.4. CONCLUSION

The Nuclear Law Institute has been designed to support Member States in the challenging task of legislating in a highly technical field in which a broad and complex range of international instruments need to be considered. When drafting legislation and legal frameworks to regulate nuclear activities, both nuclear law and environmental law must be taken into account. Both branches of law are bodies of special legal norms that have been designed to regulate the conduct of legal and natural persons that are engaged in activities that may have a considerable impact on the environment. A number of specific industrial accidents at the end of the last century together with world-wide concern for the effects of industrial development on climate change have provided an impetus for environmental law to develop. Its impact on the nuclear sector will continue to grow, albeit perhaps not equally intensive in all regions of the world nor in a linear way. In the coming years the increasing importance of environmental law is expected to be most visible in the involvement of stakeholders in nuclear decision-making, in the growing attention for the role of nuclear power plant reactors in the debate on climate change and in the intensifying focus of nuclear policy-makers and regulators on ensuring environmental protection.

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14. MAKING ADEQUATE FINANCIAL ARRANGEMENTS FOR NUCLEAR DECOMMISSIONING – LEGAL ASPECTS

M. BEYENS & G. VANDEPUTTE[1], [2]
Engie Electrabel

14.1. INTRODUCTION

When a country embarks in a nuclear programme, a crucial aspect is the timely making of adequate financial arrangements for nuclear decommissioning and for the management of nuclear waste resulting from a decommissioning project. When a nuclear power plant is in its decommissioning phase, it no longer generates any income that can be used for financing decommissioning operations; it is therefore vital to reflect upon the issue of the financing of decommissioning from the very outset of the planning process.

After having briefly recalled the general legal principles at an international level, the present contribution reflects on minimum criteria for adequate financing mechanisms and the way several national legislators have tried in different ways to implement them.

14.2. INTERNATIONAL AND EU LAW ON DECOMMISSIONING FINANCING: GENERAL REQUIREMENTS

Article 9 of the Convention on Nuclear Safety [1] requires that "*each contracting party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility*". Article 11 of the same Convention specifies that "*each contracting party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life*".

In application of Article 4(vii) of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [2], which imposes on its contracting parties to "*aim to avoid imposing undue burdens on future generations*", Article 22 states that "*Each Contracting Party shall take the appropriate steps to ensure that […]adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning*". In the same spirit, Contracting parties must ensure according to Article 26 (i) of the Joint Convention that "*qualified staff and adequate financial resources are available*" for decommissioning of a nuclear facility.

These general principles, fully in line with the "Polluter-Pays Principle" stated in the 1992 Rio Declaration on Environment and Development [3], are echoed in the IAEA Safety Standards [4] as Principle 1 (*Responsibility for Safety*) stipulating that "*The person or organization responsible for any facility or activity that gives rise to radiation risks or for carrying out a programme of actions to reduce radiation exposure has the prime responsibility for safety*" [5]

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[1] Marc Beyens is General Counsel of ENGIE Electrabel. Godelieve Vandeputte works as Senior Legal Counsel for ENGIE Electrabel. *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

and Principle 7 (*Protection of Present and Future Generations*) calling for the avoidance of "*imposing an undue burden on future generations*" [6].

Requirement 10 (*Provision for the decommissioning of facilities and the management of radioactive waste and of spent fuel*) of the IAEA Safety requirements specifies that "*The Government shall make provision for the safe decommissioning of facilities, the safe management and disposal of radioactive waste arising from facilities and activities and the safe management of spent fuel*" [7].

In the European Union, the 2014 Amended Safety Directive [8] and the Waste Directive [9] establish legally binding rules for EU Member States.

After reiterating the prime responsibility of the licence holder for the nuclear safety of nuclear installations in Article 6 a) of the Amended Safety Directive, Article 6 f) requires licence holders to "*provide for and maintain financial and human resources with appropriate qualifications and competences, necessary to fulfil their obligations with respect to the nuclear safety of a nuclear installation (…)*"

Article 9 of the Waste Directive states that "*Member States shall ensure that the national framework require that adequate financial resources be available when needed for the implementation of national programmes (…), especially for the management of spent fuel and radioactive waste, taking due account of the responsibility of spent fuel and radioactive waste generators*".

Reference can also be made to the Commission Recommendation of 24 October 2006 on the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste [10], stipulating in its Section 5 that :

"[…] 7) Nuclear installations should set up adequate decommissioning funds on the basis of the revenues obtained from their nuclear activities during the designed lifetime.

8) A segregated fund with appropriate control on prudent use should be the preferred option for all nuclear installations. The review of the national body provided for in this Recommendation should play a key role in ensuring proper management and use of the funds.

9) New nuclear installations should set up segregated decommissioning funds with appropriate control on prudent use".

Section 7 makes further recommendations on transparency, prudent investment, a State guarantee for shortfalls in external decommissioning funds and a responsibility of the operator in case of underperformance of an internal fund.

Although international and EU law therefore contain certain important general principles, few practical guidance is in fact provided relating to the setting up of arrangements for the financing of decommissioning, a matter largely left to the discretion of the respective national legislators. Therefore, it is useful to analyse on a national level the issues raised by decommissioning financing.

14.3. IMPLEMENTATION BY NATIONAL LEGISLATION OF GENERAL REQUIREMENTS ON DECOMMISSIONING FINANCING

14.3.1. **Definition of minimum criteria for adequate financial arrangements for decommissioning**

An Expert Group of the IAEA laid down criteria for the financing of decommissioning based upon principles best summarized as the Polluter-Pays Principle, sufficiency, availability and transparency, in the following terms [11]:

" It is internationally accepted that legal requirements are required to form the basis to ensure financial resources are sufficient and available to cover all decommissioning and waste management costs. These funds need to meet the following minimum criteria:

- Contributions to the fund are to be made by facilities using radioactive material during their operation to ensure sufficient funds are available at the time of final shutdown to cover all decommissioning and waste management expenses.
- Contributions are to be in line with the estimated service life, defined time schedule, and chosen strategy, to cover (1) decommissioning of the facility, (2) long-term management of conventional and radioactive wastes, and spent fuel and wastes from reprocessing operations not already fully covered in legal requirements or as operational costs.
- The funds are to be managed and reviewed periodically in a manner ensuring liquidity compatible with the timetable for decommissioning obligations and their costs.
- The funds are to be used only to cover the costs of the decommissioning obligations in line with the decommissioning strategy, and not be used for other purposes. To this end, the funds are to be established under a legal framework".

14.3.2. Polluter-Pays Principle: national implementation

Most national legislators provide for the financing of nuclear decommissioning by the sole licence holder, i.e. the nuclear operator, in order to avoid all need for public intervention, except in cases where the nuclear power plants are publicly owned.

14.3.2.1. Funding by the nuclear operator

Several types of financial assurance to be provided by the nuclear operator can be identified.

In the United States of America**,** the Code of Federal Regulations [12] requires licensees to demonstrate financial assurance for decommissioning by one or more of the following methods:

- Prepayment: a deposit made preceding the start of operation or the transfer of a license into an account that is segregated from licensee assets and outside the administrative control of the licensee and its subsidiaries or affiliates such as a trust, escrow account or Government fund. The amount would be sufficient to pay decommissioning costs at the time permanent termination of operations is expected;

- External sinking fund: a separate fund, equally outside the licensee's control and in the form of a trust, escrow account or Government fund, established and maintained by setting funds aside periodically in order to accumulate decommissioning funds over time;
- A surety method, insurance or other guarantee method (such as a parent company guarantee) providing assurance that the cost of decommissioning will be paid by another party in case of default by the licensee;
- For certain types of licensee, a statement of intent containing a cost estimate for decommissioning, and indicating that funds for decommissioning will be obtained when necessary;
- Contractual obligation(s) on the part of a licensee's customer including provisions that the electricity buyer(s) will pay for the decommissioning obligations, the proceeds of which contracts being deposited in an external sinking fund (subject to conditions and evaluation by the NRC).

Some countries e.g. Sweden require payment by the operator to an external decommissioning fund, i.e. a decommissioning fund managed by a dedicated body independent in its decisions from the contributors to the fund. The legal framework on decommissioning in Sweden requires the licence holder to pay a fee per delivered kWh of electricity to the Nuclear Waste Fund, managed by a separate government agency. The Fund aims at covering all expenses for the safe handling and disposal of spent fuel, for dismantling nuclear facilities and disposing of the decommissioning waste and for research and development [13].

In contrast, in France the nuclear operators are required [14] to assess, in a conservative manner, the costs for decommissioning their installations or for their radioactive waste storage facilities, their final shutdown, maintenance and monitoring costs. They must set up internal restricted funds covered by dedicated assets, earmarked exclusively to cover the provisions for decommissioning, managed under separate accountability. These funds must account for all future costs related to decommissioning as well as waste management and must be at least equal to the discounted cost from the beginning of operation of each given nuclear installation.

The realization value of the dedicated assets (which must present a sufficient degree of security and liquidity to respond to their objective) must be at least equal to the amount of the provisions corresponding to the charges for decommissioning and waste management (with the exclusion of the provisions linked to the exploitation cycle).

Belgium operates a system [15] that can be described as a segregated internal fund. Operators and companies who have a share in the production of electricity generated by nuclear fission contribute to a nuclear provisions company, Synatom, which is the subsidiary of operator Electrabel and which received a legal mission to manage the provisions for decommissioning and for the management of spent fuel of the nuclear power plants. The nuclear provisions company is overseen by the Nuclear Provisions Commission (composed of the heads of the Treasury, the electricity regulator CREG, the federal public service for the Budget and Management Control, the National Bank of Belgium and the general directorate for Energy, or their delegates), and the Belgian State holds a "golden share" which gives it the power to veto certain decisions. 75% of the funds that are the counterpart of the provisions can be lent back by the nuclear provisions company to the operators which fulfill certain solvency criteria that are agreed in a convention between the Belgian State, operator Electrabel and the nuclear provisions company Synatom. Such loan agreements are to be approved by the Nuclear

Provisions Commission. The Nuclear Provisions Commission can order the reimbursement of the loans if the operators do not fulfill the legal and contractual conditions.

14.3.2.2. Funding by the levying of a general fee on the electricity tariff

In Japan costs of decommissioning are to be covered by the operator of the nuclear facility. Funds are accumulated through surcharges on the retail prices for electricity. Whereas in the past these surcharges were based on the output of the facility, in reaction to the Fukushima accident, which caused unusually long shutdown of the nuclear power plants as well as early shutdown of certain power plants before the end of their operational licence, fixed surcharges independent from actual plant operation were introduced [16].

Inversely, in Spain provision of funds was originally based on a general fee on the electricity tariff, but this system evolved towards a system [17] where nuclear utilities bear the expenses through the payment of fees, the amount of which results from multiplying the gross kilowatt-hours generated by each plant in each calendar month by a unit value specific to each plant established by law.

14.3.2.3. Public intervention

In the Russian Federation, where the federal policy in the field of decommissioning and management of spent nuclear fuel and radioactive waste is developed and implemented by State Corporation "Rosatom", sources of funding include [18], in addition to funds of "Rosatom", also targeted federal budgetary funds allocated for federal programmes and grants, regional budgetary funds, funds originating from international scientific and technical cooperation, etc.

Similarly in the United Kingdom, government funds enable the Nuclear Decommissioning Authority (NDA) to decommission the eight State-owned Magnox reactors according to the NDA's statutory obligation.

In contrast, for former British Energy sites a Nuclear Liabilities Fund was created in 1996 as a segregated fund to which current operator EDF makes periodic contributions for decommissioning and waste disposal. However, there is no certainty that the assets in the segregated fund will be sufficient; therefore the fund is underwritten by the UK Government to ensure safety and environmental protection [19]. This regime, according to which the Government is liable for shortfalls in the fund, was designed when British Energy was rescued by the Government from insolvency and then sold to EDF. These circumstances could explain why the UK Government has been prepared to assume financial responsibility in order to permit the takeover to go through.

With respect to new build plants, the Energy Act 2008 [20] introduced mandatory funded decommissioning arrangements for new nuclear power plants, to ensure that the operator makes prudent provision for the full cost of decommissioning their installations, as well as their full share of the costs of waste management, thus making the risk of recourse to public funds remote.

14.3.2.4. Parent company intervention

In Germany, the decommissioning financing regime has been modified by the law of 27 January 2017 on the rearrangement of the responsibility for nuclear disposal [21], which introduced potential financial liability of mother companies of the operators in case of default of the operator, and this even after they would have sold the nuclear power subsidiary. The operator retains operational and financial responsibility, obliging it to make additional payments in case

of shortfall, for the dismantling of the nuclear power plants and for the packaging of nuclear waste and spent fuel. Therefore, it makes internal non-segregated provisions.

14.3.3. **Sufficiency**

14.3.3.1. Decommissioning strategy

In order to cover the costs of decommissioning of the installation and the long-term management of decommissioning radioactive wastes, due account must be taken of the total fund collection period (requiring the funds to be managed to keep pace with inflation and cost escalation) and of the strategy chosen for decommissioning.

Possible strategies for decommissioning that can be chosen depending on the legal system are one or more of the following [22]:

- Immediate or early dismantling, i.e. the — increasingly preferred — strategy for decommissioning according to which decontamination and dismantling take place immediately after the operation period;
- Deferred dismantling, involving the postponement of dismantling by several decades during which the nuclear power plant is kept intact and placed in protective storage in order to enable the decay of radionuclides' activity — this strategy may be necessary where there are insufficient nuclear waste disposal facilities or when more time is needed for collecting decommissioning funds after the lifetime of the nuclear power plant;
- Entombment, i.e. a strategy for encapsulating the facility on site while keeping it isolated until the radionuclides have decayed to levels that allow the site to be released from nuclear regulatory control. This emergency option has been chosen for the Chernobyl power plant after the accident in 1986.

Immediate dismantling is the reference scenario in many countries and is imposed by more and more legislators. For instance, in Germany the dismantling strategy is no longer at the option of the operator but would be immediate dismantling [23]; Spain adopted a strategy for early dismantling three years after shutdown, except for the Vandellós I nuclear power plant, which is already partly decommissioned and due to remain in safe enclosure for 30 years [24]; Belgium also uses immediate dismantling as reference scenario for the calculation of nuclear provisions [25], etc.

In contrast, the dismantling strategy remains optional subject to regulatory approval in the United States [26], Japan [27] and Sweden [28]. In the United States licensees may choose from three decommissioning strategies: DECON (immediate dismantling), SAFSTOR (deferred dismantling) or ENTOMB (entombment). In Japan most shut down nuclear power plants combine immediate dismantling of secondary facilities with deferred dismantling of the reactor. In Sweden no binding time limits are set for dismantling, but storage facilities must be available before dismantling. Deferral could be justified for twin reactors with common safety systems when both reactors are not shut down at the same moment.

The Russian Federation chooses to defer decommissioning. A large number of nuclear- and radiation-hazardous facilities are currently shut down but not decommissioned, although the most urgent decommissioning activities are in the process of being conducted [18].

14.3.3.2. Accountability for shortfalls

National legislation should specify how shortfalls in the decommissioning funds are to be avoided.

In the United States this goal is achieved by the requirement for each licensee to report to the Nuclear Regulatory Committee every two years the status of its decommissioning funding. The minimum amount to be covered must be estimated in the report by using at least the formulas found in the Code of Federal Regulations. However, licensees may determine a site-specific funding estimate provided its amounts are superior to those reflected in the said formula [29].

In Sweden guarantees must be issued by the operators for shortfalls in case of early closing and for contingencies, taking into account that costs may be higher than expected. These guarantees are renegotiated between the operators and the Swedish State every three years [30].

In France, the Environmental Code foresees the responsibility of the producers of nuclear fuel and radioactive waste without limitation in time [31].

Similarly, in Belgium the operators must pay for any shortfall in the nuclear provisions constituted in the nuclear provisions company Synatom, when the expenses for dismantling or nuclear waste management must be made [32]. In the meantime, the Nuclear Provisions Commission revises every three years the method for provisioning Synatom [33].

Japan has been confronted with a funding gap caused by the shutdown of power plants after the Fukushima Daiichi accident. This will be remedied by continuing to levy surcharges on electricity prices, independent of the output of the nuclear power plants, during a ten-year safe storage period of deferred dismantling after a lifetime extension of up to 20 years of the nuclear power plants. The safe storage period might be extended as long as funds are insufficient [34].

14.3.4. Availability

In order for the funds to be available at the appropriate time, it is important not only to manage them but also to periodically review them. This should ensure that the funds present a level of liquidity compatible with the timetable foreseen for expenditure for decommissioning.

For example, in the United States the operators are required to report to the Nuclear Regulatory Commission every two years on the status of decommissioning funding (cfr. supra).

Similarly, in Belgium the Nuclear Provisions Commission reviews every three years the methods for cost calculation of nuclear decommissioning. The Nuclear Provisions Commission can issue opinions (that are binding on the nuclear provisions company) on the existence, the sufficiency and the availability of the provisions for nuclear decommissioning and the management of irradiated fissile materials [35].

In the United Kingdom, section 48 of the Energy Act 2008 allows modifications to the funded decommissioning programme to be proposed by the Secretary of State, the operator or persons “associated with” the operator. The meaning of “associated” is clarified in section 67 of the Energy Act 2008 and implies among others a 20% or more shareholding interest or voting control over the operator. The proposed modifications can require an increase in contributions to the fund, even during the decommissioning process. According to section 49 (7) of the Energy Act 2008, the Secretary of State must exercise its power to decide whether the proposed modification is to be made with the aim of securing that prudent provision is made for the

technical matters (including the financing of the designated technical matters) related to decommissioning. A proposed modification under section 48 may include the extension or removal of obligations imposed on a body corporate associated with the operator.

14.3.5. Transparency

Decommissioning funds should be used exclusively to cover the costs of the decommissioning obligations according to the decommissioning strategy, and they are not to be used for other purposes. Accumulated in accordance with national tax laws, the funds must be transparent to the respective national authorities and other stakeholders with respect to the accumulation of money, the expenses and the financial management.

As an illustration reference could be made to the major changes in the way decommissioning provisions have been collected in the United Kingdom, where initially provisions were set up as internal unsegregated provisions which were not passed on to successor companies and where a consumer subsidy (named Fossil Fuel Levy introduced in the 1990s in order to finance inter alia decommissioning costs) was used by the government for purposes other than nuclear decommissioning [36]. In contrast, the 2008 Energy Act provided for a much more transparent system with a requirement for new build plants of a funded decommissioning programme [37]. A funded decommissioning programme contains a decommissioning and waste management plan (which sets out the operator's costed plans for dealing with its liabilities) and a funding arrangements plan (which sets out how the operator will make financial provision to meet its liabilities through a contract between the operator and the independent fund company that has been set up).

A similar move towards more transparency led to the adoption in 2003 of a nuclear provisions law in Belgium [15], where initially provisions were set up in the accounts of the operator, but where transparency was enhanced by transferring the decommissioning provisions and associated funds to the nuclear provisions company Synatom, a company held almost totally by the operator in which the State can block certain decisions under mechanism of golden share, and placed under the supervision of the Nuclear Provisions Commission.

14.4. INVESTMENT POLICY FOR DECOMMISSIONING FUNDS

It is generally accepted that undue investment risk should be avoided even if this results in lower performance. This prudence principle is consistent with the principle that decommissioning funds should be established to avoid a burden on the future generations.

Here again there are differences in the requirements of the national legislators. Whereas in some countries nuclear operators are entitled to borrow back (part of) the capital of the externalized fund, at current interest rates (either against securities or on condition that they fulfil criteria of minimum financial credit ratings by an international rating agency), other countries require (part of) the investments to be in Government or other bonds, even if this approach may limit the profitability of the funds. Alternatively, some countries require the operator to obtain a bank guarantee for decommissioning costs.

As mentioned above, national legislation needs to indicate whether in case of shortfall, it is ultimately the operator which has to cover the deficit, if the legislator wishes to avoid a burden on either the consumer or the taxpayer.

14.5. CONCLUSION

Although, at first sight, it may not seem to be the prime preoccupation of a legislator of a newcomer country in the nuclear field to deal with issues such as the financing of the decommissioning of new build nuclear facilities — that are still to be planned or under construction — it is an issue that inevitably needs to be tackled. It is even unavoidable to reflect on this issue from the outset of any nuclear programme, since the funds for decommissioning need to be provided up front or at least to be generated during the lifetime of the nuclear installation. Only by apprehending this issue in the early days such legislator can avoid a burden on the future electricity consumer or taxpayer.

The international conventions make clear that the Contracting Parties must ensure that adequate financial resources must be available for decommissioning nuclear installations without burdening the future generations. They inspired European Union and national legislators to reflect on how these aims should be attained.

Minimum criteria for making adequate financial arrangements include the polluter pays principle, sufficiency, availability at the appropriate time and transparency. But there are many different ways to ensure that these criteria are met. Funds can be managed by government agencies, internally by the operators (provided that the assets in the fund should be separated from other assets and liabilities) or externally by a private or state-owned independent body.

When investing the financial resources earmarked for decommissioning the prudence principle should be respected at all times.

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15. DEVELOPING INTERNATIONALLY AND NATIONALLY AN ENABLING ENVIRONMENT FOR A POTENTIAL FUTURE INTERNATIONAL SMR DEPLOYMENT

A. WETHERALL and C. SCOTTO DE CESAR [1], [2]
International Atomic Energy Agency

15.1. INTRODUCTION

Some ten per cent of the world's electricity is generated by nuclear power plants (NPPs). However, the contribution of nuclear energy for the specific peaceful application of the generation of electric power in the developing world continues to still be very modest. Rather, it is limited to only a few technologically advanced countries, albeit that this is increasing.[3] This situation can be partly explained by the high capital costs associated with funding a nuclear power programme and the limited technology options for many developing countries.[1] Driven by the needs of industrialised States and economies of scale (which do not favour small and medium reactors), the nuclear technology development path taken since the late 1960s has tended to focus on the deployment of reactor designs of increasing size, leading to designs today with power levels of up to 1700 MW(e).[4] However, access to civil nuclear power should not be the sole prerogative of developed countries: it should also be available to developing countries.[5]

Significantly, during the past two decades advanced novel reactor technologies have emerged with the potential of meeting the common needs and concerns of many developing countries. These advanced technologies include a group of low power (electric power less than 300 MW per reactor)[6] reactors for commercial use, frequently referred to as small modular reactors (SMRs). SMRs can be used for a variety of purposes and applications including both base load electricity generation in an interconnected electricity grid and non-electric applications such as district heating and sea-water desalination. SMRs "could make nuclear power feasible on

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[1] Mr. Anthony Wetherall is a Legal Officer in the Nuclear and Treaty Law Section, IAEA Office of Legal Affairs. Ms. Camille Scotto De Cesar is a Legal Officer in that Office.

2 The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.

[3] According to the IAEA's Power Reactor Information System (PRIS), as of July 2021 there were 443 nuclear power reactors in operation in 32 IAEA Member States, contributing 393 241 MW(e) total net installed capacity. Furthermore, 51 nuclear power reactors under various stages of construction in 19 Member States, will in due course contribute 53 905 MW(e). These power reactors can trace their lineage back to small prototype or demonstration reactors: one is in China, a high temperature gas cooled reactor, and one is in India, a sodium cooled fast reactor. 32 of these reactors are in 10 developing countries and of those, 25 are located in five countries, four of which possess nuclear weapons (China, India, Pakistan and the Russian Federation). IAEA, Power Reactor Information System (PRIS), reactors under construction (2020-08-11).

[4] IAEA, Proceedings of the International Seminar on Small and Medium Sized Reactors: Status and Prospects, Cairo, Egypt, 27-31 May 2001, IAEA, Vienna, 2002. Economies of scale, based on maximizing megawatts against operating and maintenance (O&M) costs, drove nuclear power reactor technology developers to produce ever larger designs.

[5] IAEA, Statement by IAEA Director General Yukiya Amano, International Conference on Access to Civil Nuclear Energy, 8 March 2010, Paris, France.

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smaller grids, and in remote settings, and for non-electrical applications.[7] Significantly, some SMRs may be deployed internationally as fuelled reactors (with fuel in the core)[8] and/ or marine based operated.

As submitted in this paper, several inter-related developments need to be made over the next decade at the international and national levels with the aim of developing an enabling environment in order to realise a potential future international SMR deployment and for potential target countries, including, developing countries, to benefit from them. Central to this enabling environment for successful international SMR deployment is the need for strengthened bilateral cooperation between SMR vendors (including industry) and recipients including their regulatory bodies. As considered here, this enabling environment concerns the following four elements in the context of a scenario involving a potential mid-term (mid 2030s) deployment of LWR SMRs to developing countries.

The first element concerns the developments needed to demonstrate the availability of proven technology e.g. to move from FOAK (First-of-a-kind) local deployment to NOAK (Nth-of-a-kind) international deployment. The second element concerns overcoming several technical and regulatory issues such as those related to the fundamental principles of defence in depth and graded approach. The third element concerns addressing the applicability of international legal frameworks to SMRs considering their specific characteristics such as potential deployment models. The final element concerns addressing the fulfilment of recipients' obligations, standards and normative expectations. In this context, the enabling environment concerns the development and implementation of the needed national nuclear infrastructure in SMR recipient countries that includes not only facilities and equipment but also the human and financial resources and the legal and regulatory framework within which the programme will be carried out.

A potential future SMR deployment to developing countries considered in this paper, gives rise to some SMR specific challenges and issues. Readers should be aware that many of the identified challenges and issues are inter-related. Some are technology orientated and concern potential deployment scenarios, whereas others are generic that need to be addressed by all SMR designs. Many SMR recipients will face the dual challenge of addressing issues associated with implementing the SMR programme and projects and the important need to establish the necessary infrastructure, including the legislative and regulatory framework and knowledge base. Depending on the perspective, the challenges and issues present, on the one hand, obstacles to a successful future SMR deployment and on the other, they offer potential opportunities that could be exploited to facilitate such a deployment. Addressing some of the challenges and issues may require creative thinking to match the novelty posed by SMRs.

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[7] IAEA Director General's Remarks, COP 25 Side Event on Accelerating the Energy Transformation in Support of Sustainable Development and the Paris Agreement, UN Climate Change Conference (COP 25), Madrid, Spain, 11 December 2019.

[8] Some SMRs may be factory manufactured, fuelled, tested (at its commercial power levels) and sealed in a facility(ies) in an SMR vendor country. Then, they could be transported, for example, by sea to an SMR recipient for operation. During this relocation the reactor would stay in shutdown condition but some equipment such as its residual heat removal system or its I&C (at least its monitoring part) would need to be kept running. Since the potential for criticality may exist after a reactor has been tested, subcriticality must be maintained during the transport. Upon completion of their operating cycle in the recipient country, they would be returned loaded with irradiated fuel to the vendor state for refuelling and maintenance. They could then be returned to the SMR recipient, sent to another State or utilized in the vendor state.

Some of the identified challenges and issues are not necessarily specific to SMRs or developing countries such as the issue of political risk, with nuclear projects typically being topics of political and/or public controversy, as well as of international interest. Rather, they also arise more broadly in the context of a traditional NPP newbuild programmes (and even first-time research reactor projects). Much of the same infrastructure essential for larger plants is still needed for these smaller types of facilities, albeit scaled commensurate with risk.[35] These include the regulatory framework; operator capacity to oversee safe conduct of its activities; emergency planning; and security. As example, while the proposed final element is clearly relevant for embarking countries launching traditional nuclear power programmes, there are some specific aspects which can be highlighted in the context of a potential future SMR deployment. For example, there is an increased need for regulatory certainty in the deployment of standardised modules in different countries. Further, considering a shorter construction time for SMRs, there is an increased need to ensure an alignment of SMR programme and infrastructure development schedules to address the steeper learning curve for SMR recipient countries in creating the infrastructure and knowledge base.

With these points in mind, the reader should consider the leading guidance document for the development of infrastructure for a nuclear power programme:[9] the IAEA Milestones Approach [16] (and for a research reactor project [17]).[10] In addition, there are related IAEA safety and security infrastructure guides, namely SSG-16 [18] and NSS-19 [19], as well as INSAG-22.[20] The IAEA Milestones Approach covers nineteen infrastructure elements that should exist to create an enabling environment leading to successful nuclear programme and mitigating project risks (over three phases). This infrastructure includes not only a so-called hard infrastructure (such as an adequate electrical grid) but also a soft infrastructure (such as a regulatory framework, policies on radioactive waste management, human resources policies, etc.). Readers should also take note of the experience in the case of traditional NPP newbuild programmes gained from some thirty IAEA Integrated Nuclear Infrastructure Review (INIR) missions over the past decade in reviewing the infrastructure for nuclear power deployment and expansion.[11] The IAEA evaluation methodology used in INIR Missions is also applicable for the evaluation of the infrastructure for SMR deployment.[35]

This paper focuses primarily on nuclear safety, security and liability in the context of international and national legal frameworks. Although the topics of non-proliferation and IAEA safeguards are extremely important in the context of a potential SMR deployment, they are not

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[9] The Milestones Approach recommends a systematic approach to preparing the infrastructure for nuclear facility deployment which is relatively high level — and thus generally applicable across technologies ranging from traditional large reactors of various types through research reactors to SMRs. The Milestones Approach has its origins in the IAEA guidebook named "Steps to Nuclear Power" published in 1975 and which found wide acceptance and extensive use. That publication was replaced by the Introduction of Nuclear Power: A Guidebook, Technical Reports Series No. 217, IAEA, Vienna (1982).

[10] The consideration of SMRs in this guidance is being further explored subject to the work done by the SMR Regulators' Forum and the expected near-term deployment of first-of-a-kind (FOAK) SMR design. IAEA, GOV/2019/26-GC(63)/3, 19 September 2019.

[11] The INIR service covers the nuclear infrastructure development in a comprehensive way, addressing all 19 issues. INIR helps IAEA Member States in how to create enabling environment for nuclear new build in applying the international legal framework, safety standards and security guidance. All NPP newcomers are developing their programmes in light of the INIR Milestones Approach and all are befitting from or seeking to benefit from INIR missions. In this context, they have either have or seeking to have an IAEA Integrated Work Plan describing the relevant IAEA assistance activities to support them in addressing any gaps identified through self- evaluation and/or an INIR mission. See IAEA, Evaluation of the Status of National Nuclear Infrastructure Development, Nuclear Energy Series No. NG-T-3.2 (Rev. 1), IAEA, Vienna (2016). A revised publication including phase 3 methodology is expected to be published by the IAEA in late 2021.

addressed here. To the extent that development aspects of an SMR programmes and projects are addressed, our intent is merely to provide context to a potential deployment and identified issues.

Finally, since this paper is included in a publication marking the 10th anniversary on the annual IAEA Nuclear Law Institute (NLI), it is somewhat forward looking to the 20th anniversary, in 2030. While a potential future SMR deployment considered in this paper is certainly not expected to materialise by then, it is reasonable to expect that some SMRs will be in operation in potential SMR vendor countries. Importantly, it is also reasonable to hope that some of the issues and needed developments raised here, have also either been satisfactorily solved by this time, or at least close to being resolved.

15.2. ELEMENT 1: DEMONSTRATING THE AVAILABILITY OF PROVEN TECHNOLOGY

At the outset, readers should recognise that without a proven, safe, secure, affordable and economically competitive technology (not only vis-a-vis large NPPs but also other energy sources), a future SMR deployment is unlikely to materialise.[12]

15.2.1. Current Status of Deployment and Utilization

Today, there are some 72 SMRs are at different stages of research, design and development in several IAEA Member States, representing both industrialized and developing countries.[13] Twenty-five of the SMRs have planned demonstration dates by 2030. While recent years have witnessed a significant acceleration in the pace of the technology progression by many of the major reactor vendors world-wide, SMR development and deployment is at a very early stage in terms of maturity of technologies and varying degrees of activity.[6] Local deployment of SMRs and operational experience is limited, licensing activities are at different phases and only a few concepts have been and are close to deployment. Several of SMR designs are going through pre-licensing activities and licensing activities. In some case the SMR reactor types are a different reactor technology than what the national regulators are familiar with or currently regulating. Some regulators have already granted design certifications or construction licences to SMR prototype and demonstration plants, as well as an operational licence.

At present, there are only three SMR designs from different categories operational or at an advanced stage of construction as prototype and demonstration plants. In May 2020, a major milestone was reached in SMR technology deployment. The Akademik Lomonosov, the first-floating NPP (FNPP) or Transportable Nuclear Power Plant (TNPP) of the Russian Federation, was connected to the grid and started commercial operation in Pevek, in the Chukotka region

[12] See IAEA, Technical Report for IAEA Nuclear Energy Series (NP-T-1.10): Nuclear Reactor Technology Assessment for Near Term Deployment (IAEA, Vienna, 2013). NP-T-1.10 provides the following definition of "proven technology": "The level of experience through operation of a certain component or a certain nuclear power plant design for a certain length of time demonstrating the capabilities of those technologies." The need for a proven, robust and efficient technology licensed in the technology holder's country expressed by developing countries in the case of NPPs can be expected to be of equal if not of increased importance in the case of SMRs. See **[5]**. The "proven technology" technical criterion is typically assigned a significant weighting factor in the process of reactor technology assessment (RTA).

[13] IAEA, Advances in Small Modular Reactor Technology Developments, 2020 Edition, A Supplement to: IAEA Advanced Reactors Information System (ARIS) (2020), IAEA, Vienna.

of the Russian Federation.[14] Two industrial demonstration SMRs are in advanced stage of construction: in Argentina (CAREM, an integral PWR) with start-up and criticality aimed for 2024; and in People's Republic of China (HTR-PM, a high temperature gas cooled reactor) which is completing hot functional tests, with the aim of connecting to the electricity grid towards the end of 2021.

SMR vendors are at various levels of maturity in their serial manufacturing approach, and modularisation and advanced manufacturing thinking. Common procurement processes and strategies specific for SMRs have either not yet been identified or are unavailable.[35] Further, while there are plans and aspirations, there are no concrete examples of SMRs being deployed overseas. Realistically, the IAEA expects that when deployment challenges and issues are resolved, the first commercial fleet of SMRs could be in operation in the time frame of 2025–2035.[35] If the global deployment environment, including fuel cycle, is fully enabled, there could be about 1.6 additional GW(e) contributed from SMRs.

SMRs comprise both evolutionary and innovative reactor technologies,[3] in all major reactor lines and coolant types, the latter falling within the framework of Generation IV nuclear energy systems.[15] Some of these innovative reactors use different coolants (gas, liquid metal, or molten salt), different moderators, and, in many cases, apply simplified, passive, or other innovative means to achieve their essential safety functions. Some utilize a fast neutron spectrum. Some of them use fuel of higher enrichment and of different chemical and physical form from LWR fuel. Limited experience is available for the licensing of these technologies by national regulators. Information in this respect is also limited at the IAEA, where safety requirements and guidelines were to a large extent developed mainly for LWRs.[35]

These innovative reactor technologies will require longer development timelines, with efforts focused on identifying and resolving technology gaps. However, SMRs closest to commercial operation are light water reactors (LWRs, i.e. pressurized water reactors (PWRs) and boiling water reactors (BWRs)), the leading reactor-type currently deployed world-wide. Dozens of LWR SMR designs are being prepared for near term deployment and are expected to come on-line in the next 10–15 years, including the ACP-100 in China ((Linglong One) construction was approved in June 2021, aiming for start-up commissioning by 2025) and NuScale in the U.S.A (deployment is aimed for 2029). Many LWR SMRs are of the integral pressurized water reactor (iPWR) type and

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[14] The KLT-40S is a 40S compact PWR-type SMR with a capacity of 35 MW(e) per module. The design is an advanced version of the commercial KLT-40 marine propulsion plant used for Russian icebreakers together generating up to 70 MW(e) and 50 gigacalories of heat per hour, which is sufficient to supply power to a town of about 100 000 residents. The Russian Federation has several other near term deployable SMR designs for floating TNPPs, including the RITM200 to produce 50 MW(e), the ABV6-M - a natural circulation SMR to generate 6 MW(e) - and the VBER-300 with an electric power output 300 MW(e). The developer is also considering a modified version of the FPU for export outside the Russian Federation, based on the RITM-200M design and possibly adapting a simplified and innovative refueling approach consisting of FPU replacement.[35] See the IAEA Power Reactor Information System (PRIS) < https://pris.iaea.org/PRIS/CountryStatistics/CountryDetails.aspx?current=RU >.

[15] Reference [3] provides that: "[a]n innovative design is an advanced design which incorporates radical conceptual changes in design approaches or system configuration in comparison with existing practice. Substantial R&D, feasibility tests, and a prototype or demonstration plant are probably required." In this context, there are six Gen-IV designs: Gas-Cooled Fast Reactor (GFR); Very-High-Temperature Reactor (VHTR); Supercritical-Water-Cooled Reactor (SCWR); Sodium-Cooled Fast Reactor (SFR); Lead-Cooled Fast Reactor (LFR); and Molten Salt Reactor (MSR). Examples of advanced reactor prototypes (steps towards Gen IV designs) currently under construction in China is the HTR-PM (an industrial demonstration plant of high temperature pebble bed gas cooled reactor (HTGR)); and in Russia the BN-800 (SFR). See Generation IV International Forum - GIF for more information < https://www.gen-4.org >.

combine features from large PWRs designs and marine propulsion reactors.[16] Each iPWR design having a specific operation and maintenance procedure.

LWR SMRs bear many similarities to large-scale LWRs in operation today. LWR SMRs are generally at a higher degree of technology readiness and pose fewer challenges to current licensing processes in comparison to other SMR designs. However, they also have different design characteristics to many large scale LWRs such as passive safety systems, as well as alternative production, assembly and testing requirements. As a result, meeting current regulatory expectations can be a challenge.

15.2.2. SMRs Common and Novel Characteristics

Although all SMRs are not equal, as compared to conventional stationary large NPPs, many share common specific and often novel characteristics, which are for the most part inter-related. The characteristics can be grouped into four categories: facility size, use of novel technologies, modular design and deployment approaches.

On the one hand, SMRs specific characteristics are the driving forces in their development. There are many positive features associated with the potential of these newer generation and small reactors. SMRs are touted as being of a simpler and of standardized modular design, requiring reduced construction times, lower upfront capital costs and offering flexible deployment options for a wider range of users and applications, as compared to traditional NPPs. Such advantages could lead to revisiting the current financial models used for large NPPs. Further, they offer the possibility of replacing fossil fuel fired power plants or enhancing a grid which contains more intermittent renewables. They offer enhanced safety performance through inherent and passive safety features. They provide options for remote regions with less established electricity grid infrastructures. In addition, they offer possibilities for synergetic energy systems that combine nuclear and alternative energy sources. With a potential reduced EPZ size and less cooling water requirements, SMRs could be deployed at locations inaccessible for large NPPs. They may be located closer to population centre and to industrial activities to provide process heat for non-energy applications. At the same time, arrangements will be needed to ensure that practical and effective mitigative actions are implemented in the case of an event.

The purported better financial affordability with a smaller initial capital investment and economic competitiveness can make them an attractive option to those countries with limited or no experience of the unique requirements of complex nuclear technologies by offering a way to overcome some of the barriers, such as concerns the difficulties in financing the high upfront capital costs (and negative public attitudes).[5] These novel reactor technologies could therefore be especially advantageous for those countries unable to develop an NPP newbuild programme, such as many developing countries, whether it be due to the significant upfront costs involved, a limited grid capacity or other reason.[4] Optimistically, they have the potential

[16] In March 2017, U.S.A. Nuclear Regulatory Commission (NRC) accepted NuScale Power's SMR design certification application. In August 2020, the NRC issued its final safety evaluation report. This accomplishment is the first of its kind for a SMR and puts NuScale on track to receive a full design certification from the regulator by August 2021. Upon receiving full certification, utilities will be able to reference the design when applying for a combined license to build and operate the new reactors in the U.S.A. The first plant owner, the Utah Associated Municipal Power Systems, has a target commercial operation date of 2027 for the first plant, to be built in Idaho. NuScale has signed agreements with entities in Canada, Romania, the Czech Republic, and Jordan to build future plants. The NRC is also reviewing the nation's first boiling water SMR design developed by GE-Hitachi.

to finally enable such countries to benefit from nuclear technology and serve as an appropriate option in addressing sustainable development goals.

On the other hand, SMRs characteristics differentiate them from newbuild programmes and projects of large traditional NPPs, as well as from the common international transport of radioactive material. As such, they raise several important potential policy, legal, regulatory and technical challenges and issues. Some SMRs employ evolutionary (and others even innovative) design features presenting new design philosophies and safety systems not widely analysed or licensed by regulatory bodies internationally. Some IAEA Member States are increasingly interested in the construction and deployment of transportable nuclear power plants (TNPPs), including marine based floating and seabed based SMRs **[2]** - a subset of SMRs.**[35]** A transportable NPP is defined as a factory manufactured, transportable and/or relocatable NPP which, when fuelled, is capable of producing final energy products such as electricity, heat and desalinated water. A TNPP includes the nuclear reactor (with or without fuel, depending on the TNPP option considered), the balance of the plant (e.g. turbine, generator) and fuel storage facilities, if necessary. The TNPP is physically transportable (e.g. by rail, truck or barge) to an appropriately selected site, but is not designed to either produce energy during transportation or provide energy for the transportation itself.**[43]**

In addition, a future broad scale international deployment can be expected to lead to the location of more nuclear reactors in more countries than the 32 currently relying on nuclear power or the nearly 30 countries which are considering, have started planning or are well advanced in introducing nuclear power for the first time. Coupled with this is a future increase in the international transport of nuclear material and possibly factory fueled reactors. Notwithstanding the current high safety record for international transports of radioactive material and the safe operation of nuclear installations, this setting raises the potential for public concern in many countries about nuclear safety and security around the globe. This concern may be exacerbated with the potential entry into the existing community of countries relying on nuclear energy, by those countries with limited or no experience of the unique requirements of complex nuclear technologies.

15.2.3. SMRs and Modularisation

In this context, SMRs leverage the benefits of modularisation as a build technique. An important hallmark of most SMR designs is that they are built as modules in a factory located in a vendor country. Such modules would be designed as identical serial engineered modules and then transported (with or without fuel in the core) to a site in an SMR recipient for installation as demand arises.[17] The intent behind factory manufacturing is to deliver a 'ready to install and operate' module, to facilitate efficient construction and commissioning. It is important to recognize that a module will vary from one reactor design to the next. In some designs, such as an integrated LWR, a module may consist of an entire reactor assembly, including all primary systems and associated instrumentation. Others may use more traditional but integrated components designed to be easily assembled in the field such as an instrumentation and control (I&C) system module that can be tested and partially commissioned in factory or major civil structure module.[35]

[17] Modularization is not only a feature of SMRs but it has been implemented in different degrees for large reactor designs and construction. Reactor designers differ on the accepted definition with some focusing on shop fabricated components to ease transport whereas others on integrating the systems for simplification.

When used in reference to a design activity, the term ‘modular design’ is often related to an approach whereby the design of a component, assembly or structure is subdivided into modules that can be more easily assembled and may be replaced over time to facilitate ease of maintenance. In reference to construction, ‘modular construction’ refers to a technique in which modules are constructed on-site or off-site and shipped to their final destination where they are assembled in a building. Factory built modules (as opposed to stick-built construction in the field) refer to modules that are built in a factory. These modules typically have been designed to be all inclusive with regard to mechanical, electrical and instrumentation features, and can be assembled in a more controlled plant environment, by fully trained labour, using the same materials, codes and standards for each subsequent module. Some SMR designers, as part of their effort to enable modularization, have integrated the various components of a reactor coolant system (e.g. core, pressurizer, steam generator and pumps) into a single reactor pressure vessel (RPV).[35]

Modularisation in design and deployment is a key element of SMRs purported affordability and a key driving force in their development. SMRs show the promise of significant cost reduction through modularization and factory construction which should further improve the construction schedule and reduce costs. Over the next decade, there will be a need to demonstrate that modularity will achieve the promised lower levelized costs through economy of serial production, and that design simplification and short time of construction will lead to easier and more affordable financing schemes.[2]

15.2.4. Next Steps

In order to realize a potential future international SMR deployment and to enable SMRs to compete in the economic marketplace with other energy sources, it will be critical to ensure, rather than limit, economic efficiency, while simultaneously ensuring adequate safety and security. Although SMRs have lower upfront capital cost per unit and even if given their smaller size SMRs are proven to be more affordable than large NPPs, they need to be economically competitive per kWh with other sources. Indeed, achievement of improved economics is likely to be essential if SRMS are to play a major role in the future. SMRs lower costs are believed to be achievable as a result of serial factory fabrication (thereby minimizing costly on-site construction), modular construction and standardization, advanced construction techniques, and simplified designs. Yet, while numerous studies have been published on the economics related to SMRs, the economic case has yet to be proven. Perhaps the most important goal of SMR technology is to significantly reduce the scheduling risk associated with nuclear reactor construction and its associated cost of debt.[35]

Many of the desired features of nuclear power technology are driven by similar concerns and general desires amongst all potential user countries of nuclear technology.[5] While not all designs and concepts are expected to materialise over the current decade and beyond, SMR developers and vendors will need to demonstrate as a first step, ‘proof of concept’, by way of successful local deployment of SMR prototypes and first-of-a-kind (FOAK) demonstration plants. They will need to show the ability to build on time and to budget, and to reduce the costs of new designs. The technology to be selected will need to be well developed, based on proven technologies and have a sufficiently established component supplier base. Successful local deployment will be very important to encourage recipients to adopt SMRs. Many, recipients, if not all, will want to see successful on schedule local SMR projects which meets the design

objectives of SMRs.[18] Significant, will be integrating lessons learnt from recent FOAK experiences in project management and planning, human resource allocation, supply chain set-up, qualification and oversight, as well as reactor design, construction simplification and optimisation. Operating experience will need to be gained from the first series of the reactor design. A systematic approach to recording all major design modifications, upgrades, safety decisions and the methodology or bases upon which decisions were made, will be critical to build regulatory confidence in the design process.[42]

In moving to the next step of wide-scale deployment, some SMR developers and vendors are likely to face a catch-22 conundrum faced by many tech start-ups or new businesses. Moreover, many SMR developers and vendors will be unlikely to bear the development cost by themselves. Rather, over the next decade they will need to work towards obtaining, if not done already, the support of their governments through significant and sustainable investment, incentives and sustained political support to facilitate the establishment of costly SMR production facilities and to create an environment conducive to exporting reactors, including licensing and financing. Based on experience in the context of traditional NPP newbuild, the availability of qualified SMR design/technology developers and vendors teaming with experienced engineering, procurement and construction (EPC) contractor(s) with strong track records, appears to be critical to ensure project success.[35]

The economics of building SMR production facilities may be considered as hinging upon the actual or potential number of SMR orders a vendor has, this in turn being particularly important for achieving SMR competitiveness.[19] Until there is evidence of a sufficient number of SMR orders, a full module manufacturing environment (e.g. factory) is not likely to exist. In this context, the major capital investment of an SMR manufacturing factory can only be recovered over time from the fleet to be deployed. SMR developers and vendors will likely thus need to identify potential buyers before committing to building such costly factories.[35] In such a scenario, the economies of serial production will not be realized until the 'nth of a kind' (NOAK) case, if a number of orders exist to justify the factory manufacturing approach. To attract the first few utilities to adopt the technologies, they would need an incentive in lieu of the NOAK economies being promised by the manufacturer. Looking further forward and as discussed further in this paper it will be important to develop an enabling environment for SMR deployment which addresses the apparent need for regulatory certainty in different countries and the needs and limitations of many recipient countries, including, developing counties.

The good news is that interest in this technology is considerable and many countries would like to purchase and build NOAK reactor plants.[35] However, for recipients' interest in SMRs to increase over the next decade, the current gaps that remain wide with regard to achieving a common understanding of the requirements and criteria of feasible SMR design and technology, need closing.[2] In this context, while most SMR concepts are from traditional reactor vendors, readers should also be aware that some others are being developed by industry recipients with little to no experience in nuclear safety and security. This situation necessitates an effective knowledge acquisition, as well as a transfer from the designer or vendor to recipients.[20] It may also be considered as emphasising to better articular the responsibilities of vendor countries and

[18] However, it is noted that Saudi Arabia has agreed to collaborate on the commercialization of the South Korean-designed SMART reactor. While the reactor received standard design approval from the Korean regulator, NSSC, in mid-2012, there is no demonstration plant in operation in South Korea or elsewhere.
[19] OECD/NEA, Small Modular Reactors: Nuclear Energy Market Potential for Near-term Deployment, OECD Nuclear Energy Agency, NEA No. 7213, OECD 2016.
[20] IAEA, Small Modular Reactors Regulators' Forum Licensing Issues Working Group Report on Key Regulatory Interventions during a Small Modular Reactor Lifecycle, Interim Report, 15 December 2019.

industry. Importantly here though, we can highlight that different forums already exist promoting collaboration, knowledge, and experience sharing among technology holder countries and potential SMR recipients or among regulators. For example, the Dialogue Forums of the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) provide a platform for technology holders, potential SMR recipients and other stakeholders to discuss various aspects of SMRs, as well as other advanced nuclear technologies.[21]

15.3. ELEMENT 2: REACHING COMMON POSITIONS ON SEVERAL TECHNICAL AND REGULATORY ISSUES

Several technical and regulatory issues stemming from SMRs specific characteristics (facility size, use of novel technologies, modular design and deployment approaches) will need resolving over the next decade and beyond. Issues include those related to the fundamental principles of defence in depth (DiD) and graded approach, as well validation of enhanced passive safety systems, multi-modular deployment, staff requirements for operation (control-room) and security, emergency planning zone (EPZ) requirements, as well as the interface between construction, commissioning and operation and other site related issues.

Many SMRs employ evolutionary (and others even innovative) design features presenting new design philosophies and safety systems using novel technologies and inherent safety features for example in terms of passive cooling mechanisms and integral design. They have been not widely analysed or licensed by regulatory bodies internationally.[6] There is an expectation that the safety of SMRs will be demonstrated to be improved when compared to existing installations. Some national regulators are already either engaging or are preparing to engage with SMR proponents who are preparing safety cases that will involve the use of SMR technologies. These proposals are being anticipated to contain safety claims using novel approaches and technologies that will be based on present or alternate interpretations of existing regulatory requirements or present new safety approaches where regulatory requirements may not exist.

On the one hand, SMRs small size (smaller plant footprint and mall power of the core) makes them possibly better suited to small electrical grids with less developed infrastructure, enabling the location of nuclear reactors in electricity markets otherwise inaccessible to larger NPPs.[22] On the other hand, the small size gives rise to the consideration of the need amend regulations to create an alternate emergency preparedness and response framework for SMRs. Some vendors assert that their designs are sufficiently safe or that the consequences of an accident are sufficiently small that a modification of the current siting approach can be justified. Such relaxation is essential if some of the proposed uses of SMRs are to be realized. With a potential reduced EPZ size and less cooling water requirements, SMRs could be deployed at locations inaccessible for large NPPs. In fact, some SMR vendors are currently working with regulatory bodies to demonstrate the ability to reduce the size (scalability) of the required EPZs, which

[21] International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) was launched in the year 2000, based on resolution GC (44)/RES/21 of the International Atomic Energy Agency (IAEA) General Conference. Since 2010, seventeen INPRO Dialogue Forums have been held. For more information on the forums see: < https://nucleus.iaea.org/sites/INPRO/Pages/df.aspx >.

[22] IAEA, General Conference Resolution, GC(64)/RES/12, (2020), 25 September 2020. Note that as a rule of thumb, no power plant should constitute more than about 10% of the capacity on a grid so as to enable the plant to shut down for refueling or for safety reasons without seriously disrupting power availability.

will also allow more flexibility in future siting if the technology can be better accepted by the local public. [23]

Some SMR proponents are proposing different and unique approaches to plant lifecycle, which may pose challenges to the traditional view of the approach to licensing nuclear installations. SMR modularity presents new challenges arising from the introduction of novel approaches to plant lifecycle, mainly associated with the construction, commissioning and decommissioning stages. In this context, SMRs shift the balance of construction activity from the plant site to a factory, such as a manufacturing facility and/or an assembly facility. Several nuclear facilities located at different sites, and even in different countries may be involved. Unlike other nuclear installations such as a conventional NPP that implements all its functions including fuel management on a single site, the lifecycle of an SMR can be implemented differently, ranging from factory manufacturing and testing, to new construction and commissioning methods, to new programs for long-term operation and maintenance. Further, some SMRs may not require on-site refuelling and there may be no storage of fresh or spent fuel the site during reactor operation.

The approach questions the capability of a regulatory body to ensure oversight of the entire life cycle of the SMR and to fulfill its main regulatory functions, licensing, inspection and enforcement. First, most licenses would be granted based on verification performed by the regulatory body. As most regulators would rely on the licensee commercial agreements to be able to perform inspection and verification in the supplier country and as in some SMR deployment scenarios, the SMR design may be already agreed upon through bilateral governmental agreements without a licensee being identified yet, the capability of a regulator to inspect, typically factory fueled SMRs, in another country would be limited. In this context, regulatory bodies capability to grant license and to ensure that the supplier adapt the design to the regulatory requirements of the recipient State is uncertain. Furthermore, access to components and safety systems may be internationally well accepted, but access to the entire production chain of modules may raise the question of industrial property and confidentiality.

Additionally, some SMRs are designed to be deployed either as a single plant or multi-module plant utilising either shared systems or structures including safety systems, safety features for design extension conditions, or supporting services.[39] They can thus be built incrementally to closely match increasing energy demand resulting in a moderate financial commitment for countries with smaller electricity grids.[24] However, there is a need for careful consideration of

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[23] For example, the U.S.A. Nuclear Regulatory Commission (NRC) is proposing to amend its regulations to include new alternative emergency preparedness requirements for SMRs and other advanced and new technologies in reactor plant design by adopting a scalable plume exposure pathway EPZ approach and address ingestion response planning. The size of the EPZ is to be determined according to dose assessments made from plume exposure pathway evaluations that take into account the time dependent and isotopic characteristics of potential releases. See Emergency Preparedness for Small Modular Reactors and Other New Technologies, A Proposed Rule by the Nuclear Regulatory Commission, 85 FR 28436, NRC-2015-0225 on 05/12/2020. In August 2020, the Agency conducted the Third Research Coordination Meeting on Development of Approaches, Methodologies and Criteria for Determining the Technical Basis for Emergency Planning Zone for Small Modular Reactor Deployment. The meeting concluded that the methodologies proposed by many designers and sometimes already accepted by the regulators for SMRs may be substantially different from the methodology currently published by the Agency on large nuclear power plants

[24] SMRs also include micro-reactors designed to generate electrical power of typically up to 10 MW(e) and being factory-built SMRs that can be easily transported by trucks, ships, airplanes or railcars. Microreactors can serve future niche electricity and district heat markets in small islands or remote regions, mining, industries and fisheries that for decades have been served by diesel power plants. Micro-sized SMRs are from different types of coolant,

possible interactions among modules during transients and accident. It is important to differentiate this approach from the more traditional multi-unit site approach employing large nuclear reactors, where a nuclear site can have more than one unit, with each unit having one large reactor housed inside.[35] SMR developers need to carefully work through the technical details associated with developing the safety basis for the operation of multi-module units while assessing both common cause and multi-module failure scenarios.

These and other issues continue to be the subject of discussion in various fora, at the international, regional, national, industry and civil-society levels. Importantly, the Agency continues considering the legal, regulatory, technical, licensing safety and security aspects of SMRs throughout their life cycle. It continues to foster international cooperation in undertaking studies of the social and economic impacts of SMR deployment in developing countries, their potential integration with renewables, and their non-electric application. Further, it continues to promote effective international exchange of information on options as regards SMRs available internationally. Various Agency activities are ongoing, including through the INPRO, created in 2001, the Technical Working Group on Small and Medium Sized or Modular Reactors (TWG-SMR), established in 2018, and the SMR Safety Working Group established in 2020 to review the applicability of the Safety Standards to SMR and other novel advanced reactors.

Further, the IAEA is organizing a series of meetings on "Next Generation Reactors and EPR" where discussions may be held among new reactor technology developers, regulators and EPR experts and grounds be built for consensus on approaches to definition of necessary EPR arrangements for these new reactors. In April 2021, the Agency also launched a new project aimed at addressing codes and standards, design engineering, testing and manufacturing of components of SMRs. Importantly, in August 2021 the Agency published a technology roadmap for the deployment of SMRs of all major types for electricity production and non-electric applications, and their integration with other energy resources.[35] In 2018, a methodology to evaluate 18 indicators for deploying SMRs in a national energy portfolio by analysing the key factors has also been published.[40] Further, the Agency has assessed the applicability of the design safety requirements to SMR technologies intended for near term deployment i.e. LWRs and HTGRs.[43]

Importantly, the Agency also continues supporting the Small Modular Reactor Regulators' Forum (SMR Reactor Regulators' Forum) created in 2015, to identify and enhance understanding of key regulatory and licensing challenges that may emerge in future SMR regulatory discussions.[25]

The initial pilot project of the Forum resulted in a report on (i) examination of existing practices and strategies for understanding how flexible (i.e. risk informed) EPZs are in Member States; (ii) discussions on the applicability of DiD principles to SMRs; and (iii) the examination of existing practices employed by regulators for the application of the graded approach and the

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including HTGRs and designs that use heat pipes for heat transport. Several designs are undertaking licensing activities in Canada and the U.S.A. for planned near-term deployment. In 2019 a site application was submitted by Global First Power for a single small modular reactor using USNC's Micro Modular Reactor (MMR) technology at the Chalk River Laboratories site.

[25] The current members of the Forum are Canada, China, Finland, France, Korea, Russia, Saudi Arabia, South Africa, United Kingdom and U.S.A. The Joint Research Centre (JRC) of the European Commission and the OECD Nuclear Energy Agency are designated as Observers within the Forum. (The Cooperation in Reactor Design Evaluation (CORDEL) Working Group of the World Nuclear Association (WNA) is invited to participate and provide expertise/information on a case-by-case basis.

influence that SMRs have on these practices.[6] In addition, reports were also made available and complemented in 2021 [36] by: (i) the report of the Working Group on Licensing Issues covering Key Regulatory Interventions (KRIs) during an SMR life cycle, FOAK versus NOAK of a kind designs and licensing of multiple module/unit facilities [37]; (ii) by the report of the Working Group on Design and Safety Analysis focusing on multi-unit, multi-module aspects of SMRs, considerations in the use of passive inherent safety features in SMR designs and aspects of beyond design basis analysis relevant to SMRs [38]; and (iii) by the Working Group on Manufacturing, Construction, Commissioning, and Operations which addressed manufacturability, supply chain management and commissioning of SMRs, collection and use of experience in the lifecycle of SMR facilities, conduct of maintenance in an SMR, conduct of co-activities and combined activities on a multiple unit.[39]

On a final note, the regulatory guides and processes to assess this emerging technology are lagging and, in some cases, are not yet available. Discussions can therefore be expected over the next decade to continue on these and other technical and related regulatory issues.

15.4. ELEMENT 3: ENSURING APPLICABILITY AND ADEQUACY OF THE INTERNATIONAL NUCLEAR LEGAL INSTRUMENTS, STANDARDS AND GUIDANCE

An absolute precondition for a successful SMR deployment is the need to ensure that there is no lowering of the high-levels of nuclear safety and security. The common object of both safety and security being to protect people – individually and collectively – and the environment. In this regard, there is a need for assurances by the states involved, as well as of the availability of adequate and prompt compensation in the event of a nuclear incident. International legal instruments should represent the basis on which recipients establish and implement a responsible SMR programme, including, the needed safety and security infrastructure such as the national legislative and regulatory framework. The international legal frameworks can play an important role in this regard, not least through establishing minimum obligations and providing a means to assure safety and security. A fundamental lesson of the 2011 Fukushima Daiichi NPP accident is that in addition to having an adequate national nuclear safety framework, an effective international legal framework supported by effective international mechanisms and arrangements needs to be in operation to ensure that the relevant national institutions fulfil their roles.

It is recalled that in the midst of the period of so-called great expectations and renewed interest in nuclear power during the 2000s *Professor Pelzer* asked *"Does the projected multiplication of global nuclear capacity at the same time entail or require a likewise dramatic revision of the currently existing legal framework on nuclear power?"* [7][26] After a thorough analysis of the existing legal frameworks and while identifying fields where enhancements were desirable, such as in increased participation in the nuclear liability instruments and enhanced transparency, *Professor Pelzer* quite rightly concluding in the negative that *"There is a sound and comprehensive corpus of specific national and international law available which is suitable to cope with the challenges of the use of nuclear energy including nuclear new build."* [27] This

[26] See also Pelzer, N. (2009), "Nuclear New Build – New Nuclear. Law?", Nuclear Law Bulletin, No. 84, NEA, Paris, p. 5. 11.

[27] At that time, in 2009, over 60 IAEA Member States had expressed to the IAEA interest in considering the introduction of nuclear power. IAEA Nuclear Technology Review, 2010 IAEA, Vienna (2010).

conclusion was made considering the extensive body of international legal instruments and texts addressing the safe and secure uses of nuclear power, as well as nuclear liability.

In the context of a scenario of a potential future world-wide SMR deployment as considered in this paper, it would be appropriate to reconsider *Professor Pelzer's* question. In this context, there is a need to ensure that the instruments embrace the internationally agreed fundamental principles and provisions necessary to govern the safe and secure use of SMRs, as well as address potential questions of civil liability for nuclear damage.

In considering the matter, we should recall that for SMR recipients, demonstration of compliance with the applicable international legal instruments, internationally accepted safety standards and nuclear security guidelines will be essential in establishing a responsible SMR programme and creating an enabling infrastructure for deployment and utilisation. Every country that uses nuclear technology has a responsibility to create a robust framework for safety and security. There is a need for assurances that any country undertaking a civil SMR programme is not only willing but also capable of fulfilling its safety and security obligations and commitments and responsibilities by possessing adequate resources, expertise, authority, and capacity to assure safety and security in a complete and effective manner and is committed to doing so.

There is also a need to be mindful that while all potential SMR recipients will be clearly far from homogeneous, similar for NPP recipients, many with limited to no experience are likely to face significant challenges and share common limitations. In the case of some developing countries, such challenges may stem, for example, from a lack of less-developed national infrastructure which is typically less sophisticated and extensive than industrialized countries and shortage of a skilled workforce. Further common challenges can be expected regarding the completion of a national policy and strategy for the programme, strengthening project management and building.[28] Deployment in such countries will likely give rise to greater uncertainties, and therefore greater risks, when compared to other potential development opportunities, such as to States with an existing national nuclear power programme and a mature regulatory framework. However, the potential for deployment to such countries cannot be ruled out.

We should be mindful that one issue is whether the instruments and texts apply to SMRs. In the case of a positive outcome, the next logical determination is whether the instruments and texts are what you could call, "fit for purpose". This is a question of adequacy. It is one thing to squeeze an SMR into a definition and the scope of application an instrument or text but it is another to ascertain whether they are appropriate and adequate, for example in light of their object and purpose and the prevailing situation.

We should also note that as with any nuclear reactor technology, the public continues to have concerns about reactor safety, waste disposal, and nuclear security. Significantly, a potential future world-wide SMR deployment will require the confidence of the public. SMRs need a social licence and heeding to public concerns, will be a *sine qua no*n for a future international deployment. Transparency and public information will be a key to public acceptability. Also, having in place effective and coherent nuclear liability mechanisms to ensure prompt, adequate and non-discriminatory compensation for damage due to a nuclear incident, should not be

[28] IAEA, Newcomer countries face common challenges in nuclear infrastructure development, Decommissioning and Environmental Remediation, IAEA Bulletin Vol. 57-1, page 27-29, April 2016, IAEA.

understated in this regard. Support for nuclear power is generally correlated with the level of knowledge of a recipient country, and its experience with, nuclear energy.[35]

Confronted with the above points, it is most prudent to consider whether the existing body of international legal instruments and texts will provide an adequate backstop to cope with the potential challenges of SMR deployment world-wide.

On the one hand, some readers may be of the view that the existing legal frameworks are insufficient and indeed need strengthening. They may consider that SMRs create uncertainty as to how the existing instruments and texts should be applied and interpreted. They may be of the view that the instruments need to be updated, clarified and sharpened to respond to a potentially legally disruptive technology. They may consider there is a need to strengthen the existing nuclear safety and security legal frameworks, texts and international implementation mechanisms to address the challenges expected to face those countries with limited or no experience of the unique requirements of complex nuclear technologies. Here, emphasis may be placed on the need for binding minimum safety and security standards and mandatory international safety and security peer reviews with enforcement mechanisms to address deficiencies, as well as increased transparency of national implementation. Considered more positively, these readers may even consider SMRs and their potential deployment as providing an opportunity to strengthen the existing frameworks.

On the other hand, some readers, may consider the existing body of international legal instruments, texts and implementation mechanisms as being suitable to cope with the challenges of SMR deployment, newbuild and utilisation, as they are for traditional NPPs. For them, reaching the same outcome as *Professor Pelzer,* could be a foregone conclusion. However, such a quick assessment is incomplete and may already lead to refutation by others.

Other readers may even contend that SMRs do not need to be subject to all the currently existing international legal instruments and texts. As explanation, they may highlight, for example, the purported lower risks posed by these advanced reactors, due to the small power of the core, smaller inventory of radionuclides and incorporation of new novel design principles and features such as the incorporation of inherent and passive safety features and passive systems,[29] as well as post-Fukushima design enhancements.[30] Moreover, based on the potentially enhanced safety performance from inherent and passive safety features, the source term released into the environment in the event of an accident would be much smaller than it would be for large power reactors (LWRs). The quantity and hazard of radioactive material would accordingly be much lower, leading to less serious consequences for the surrounding area and safety of the public. Consequently, there is a need to consider using a graded approach as a basis for adopting off-site EPR arrangements commensurate with these SMR features.[35] As we shall point out later, some may consider these points as even justifying reductions in SMR operator liability amounts under the international nuclear liability instruments.

Reduced risk is also considered to be very important in obtaining public acceptance to proceed with SMR projects.[35] Indeed, it is realistic to expect that SMRs will offer solutions that significantly reduce off-site radiological consequences from accidents: all claim significant

[29] IAEA, Design Features to Achieve Defence in Depth in Small and Medium Sized Reactors (SMRs), Nuclear Energy Series No. NP-T-2.2, IAEA, Vienna (2009).
[30] As provided, for example, in the IAEA Action Plan on Nuclear Safety, IAEA, 2011. The Action Plan was approved by the IAEA Board of Governors on 13 September 2011, as endorsed by the IAEA General Conference during its 55th regular session on 22 September 2011. See also the Vienna Declaration on Nuclear Safety, INFCIRC/872 February 2015.

safety advantages over existing designs and many have cores with less radionuclide content (and hence a smaller accident source term).[6][31] But safety is never absolute in any endeavour. The operation of an SMR involves the use of radioactive material. From a safety perspective, there is a need to control radiation exposure and the release of radioactive material. Site and non-site feasibility studies need to be conducted, as well as in many case preparation of the electricity grid infrastructure.

Albeit of advanced design, these reactors still pose radiation risks and generate waste. There is also a need to restrict the likelihood of loss of control of the core and to mitigate the radiological consequences should such loss occur. Further, designs need to be proven and accepted, not least through careful analyses backed by test data and validated codes and simulation tools to establish that systems are effective in the variety of circumstances in which there is dependence on them. We should not become complacent by "safety by design": experience has demonstrated that reliance on robust design and engineered safety systems alone is insufficient.[20][32]

Further, no matter how low the risk of accidents is, scalable arrangements for confinement and emergency response are essential to cover the unexpected. While SMR designs adopt advanced engineered safety features that further minimize the probability of radiation release from the plant, experience from past accidents at plants has demonstrated the importance of EPR as the fifth layer of DiD for the protection of plant personnel, emergency workers and the public.[35]

In addition, experience unfortunately shows that even countries with well-developed national nuclear infrastructures can be confronted with challenges. The three major NPP accidents - Three Mile Island in 1979, Chernobyl in 1986, and Fukushima Daiichi in 2011[33] - occurred in technically sophisticated countries with well-established nuclear power programmes.[34] An advanced nuclear industry, an experienced nuclear regulator and international peer reviews were not sufficient to prevent the 2011 Fukushima Daiichi NPP accident from happening.[21] Deficiencies in the design basis of the Fukushima Daiichi NPP, in the national institutional framework, and in EPR (at both the operator and governmental levels), were overlooked because of a prevailing belief in Japan that the plant was adequately safe.

Further, there is the potential for the international transport of (fresh and spent) fuelled reactors, and the potential for reactors to be marine based during operation. In these circumstances, it would be remiss to forget that SMRs (whether as a facility or during transport), may also be a target of terrorism. The threat of nuclear terrorism demands that they are within the scope of international legal instruments for nuclear security, such as the CPPNM and Amendment thereto, as well as the other relevant instrument comprising the universal legal framework against terrorism. From a nuclear security perspective, there is a need to protect them against the risk of unauthorized removal and against sabotage, as well as to mitigate or minimize the radiological consequences of sabotage. However, we should also acknowledge that intrinsic SMR design features, such as additional barriers, may provide security advantages and limit vulnerabilities for sabotage.

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[31] See supra note 255.
[32] INSAG, Annual Letter of Assessment to the IAEA Director General, 2008 and 2021.
[33] IAEA, The Fukushima Daiichi Accident, IAEA, Vienna (2015); NEA/OECD, Impacts of the Fukushima Daiichi Accident on Nuclear Policies, Nuclear Energy Agency of the Organisation for Economic Co-Operation and Development, Paris, France (2017).
[34] INSAG, Annual Letter of Assessment to the IAEA Director General, INSAG 2011.

15.4.1. IAEA Safety Standards Safety and Nuclear Security Guidance

Starting with the IAEA safety standards safety and nuclear security guidance, a review is currently ongoing at the IAEA. This paper offers some insights that may be confirmed or elaborated further as part of the ongoing IAEA work. The standards and guidance reflect an international consensus on what constitutes a high level of safety and security for protecting people and the environment from the harmful effects of ionizing radiation. Generally speaking, the situation appears to be relatively clear since for the most part, IAEA Safety Standards provide a technology neutral framework. The flexibility of the safety fundamentals and the safety requirements is considered as allowing for their case-by-case application as required, enabling them to be applicable to innovative technical developments that might not have been considered at the time of drafting.[22] Those applicable to existing nuclear power reactors as well as those under construction are considered to be mostly applicable to SMRs. For the purpose of the IAEA Safety Glossary, an SMR is a nuclear fuel cycle facility; being classified as a "facility", "nuclear facility" (being one in which nuclear material is used) and a "nuclear installation" (which includes NPPs). For both nuclear safety and security, SMRs are classified as a "nuclear facility". Despite being built and operated using different approaches, the IAEA and some regulators consider these concepts to be smaller NPPs that should still address the requirements specified in the IAEA safety standards and guides.[6] [35] It is generally accepted that a graded approach may be applied to SMRs. The starting point in use of the graded approach and in determining what is necessary to demonstrate 'proven-ness',[6][35] would therefore be the safety requirements established for NPPs.[36]

Development of new safety requirements for a specific SMR technology is not being considered, for now.[37] However, there will be some areas where further discussion is necessary, for example, the applicability of the design safety standards to innovative technologies. As raised below one area where further discussion appears needed concerns the application of the IAEA Transport Regulations and relevant international legal instruments to transportable fuelled reactors.

15.4.2. International Legal Instruments

Before discussing the potentially relevant international legal instruments, it is recalled that the cornerstone rule of international environmental law is that states are under an obligation not to

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[35] So-called 'proven' approaches and concepts are generally well supported and lend themselves to a more straightforward safety case assessment. The issue in the context of SMRs is that some SMR designs seek to employ passive and inherent behaviors. The argument made by some vendors, developers and proponents is that this should lend itself to a more straightforward safety case assessment based on a greater use of grading. At the same time, however, the necessary evidence to demonstrate 'proven-ness' is being developed in practice. Until proven-ness has been established, regulators consider it difficult to recognize those features in a safety proposal because uncertainties still need to be addressed and factored into the safety demonstration. There is therefore a need to develop an understanding of how to demonstrate the safety of these designs, and moreover, how to determine an appropriate level of uncertainty where unproven methods are utilized.

[36] It is imperative that certain reactor safety design standards be adopted. One of the primary references is IAEA Safety Standards Series No. SSR-2/1 (Rev. 1), Safety of Nuclear Power Plants: Design. With regard to technical design considerations, there are several key requirements that must be met: Requirement 4: Fundamental safety functions; Requirement 5: Radiation protection in design; Requirement 6: Design for a nuclear power plant; Requirement 7: Application of defence in depth; Requirement 8: Interfaces of safety with security and safeguards; Requirement 9: Proven engineering practices; Requirement 10: Safety assessment; Requirement 11: Provision for construction; Requirement 12: Features to facilitate radioactive waste management and decommissioning.

[37] Already in 2007 the IAEA published a proposal for a risk-informed and less prescriptive technology neutral safety approach for new reactor designs: IAEA, Proposal for a Technology-Neutral Safety Approach for New Reactor Designs, IAEA-TECDOC-1570, IAEA, Vienna (2007).

cause harm to the environment of other states, or to the areas beyond national jurisdiction. The essence of this obligation, often referred to as the 'no-harm principle'[38] or 'prevention principle' , is that states have a duty to prevent, reduce, and control pollution and transboundary environmental harm 'causing significant damage' arising from activities within their territory, jurisdiction or control, including the operation of an NPP.[39] The origins of the obligation lie in the old principle of international law that states are obliged not to inflict damage on, or violate the rights of other states, which is often expressed by reference to the *sic utere tuo ut alienum non laedas* principle (use your own property in such a way that you do not injure other people's). The nature of this customary international law obligation to prevent significant transboundary harm is one of due diligence that is required of a state in its territory. In this context, NPP recipients for example, need to take the necessary legislative, administrative or other action including the establishment of suitable monitoring mechanisms. Prior authorization of a State is required for activities which involve a risk of causing significant transboundary harm undertaken in its territory or otherwise under its jurisdiction or control, based on an assessment of the possible transboundary harm caused by that activity, including any environmental impact assessment.

Beyond the abovementioned general parameters of customary law, the management of transboundary nuclear risks is today, largely and indirectly, governed by an elaborate treaty-based regime. The existing corpus of instruments, texts and implementation mechanisms provide a basis, albeit an indirect one, for transboundary risk management in the context of nuclear installations. They further clarify the due diligence a recipient may have to adopt in any given situation in order to comply with its customary international legal obligation.

Over the past decades, several international legal instruments in the nuclear field have been established and progressively strengthened by and, under the auspices of the IAEA. It is recalled that the cornerstone of the international legal framework for nuclear safety is the Convention on Nuclear Safety (CNS) [8] and its sister convention, the Joint Convention [9] and the post-Chernobyl instruments, the Early Notification [10] and Assistance Conventions.[11] In the field of nuclear security, there is the CPPNM and its Amendment.[12] [13] These instruments establishing high-level principles, objectives and requirements are respectively underpinned by a comprehensive suite of detailed legally non-binding technical safety standards and nuclear security guidance. To facilitate national implementation, they are also supported by voluntary practical implementation mechanisms such as IAEA services and reviews, and other assistance activities, including that provided under the IAEA Legislative Assistance Programme. Together the instruments, standards, guidance and services form the key elements of the so-called global nuclear safety and security framework.[40] Finally, in the field of nuclear liability, there are the 1963 and 1997 Vienna Conventions,[14] the 1997 CSC [14] and the 1988 Joint Protocol,[15] all adopted under IAEA auspices and in parallel the 1960 Paris Convention adopted under the OECD Nuclear Energy Agency auspices. These instruments and texts address the importance of having in place effective and coherent nuclear liability mechanisms to ensure prompt,

[38] It has been endorsed for example, in judicial decisions (e.g. the ICJ's 1996 Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion), in a number of multilateral environmental agreements (e.g. United Nations Framework Convention on Climate Change), by the UN General Assembly (1974 Charter of Economic Rights and Duties of States) and by the International Law Commission (ILC) (e.g. the ILC Prevention Articles), as well as being enunciated in soft law declarations (Principle 21 of the Stockholm Declaration and Principle 2 of the 1992 Rio Declaration.

[39] The ICJ in the 2010 Pulp Mills case confirmed the threshold of significant harm or damage. The ILC reflected the current state of international law in referring to the threshold of 'significant' (ILC Prevention Articles).

[40] With respect to safety see Strengthening the Global Nuclear Safety Regime, INSAG-21, IAEA, Vienna (2006).

adequate and non-discriminatory compensation for nuclear damage resulting from a nuclear incident.[41]

Turning to the international legal instruments, a proper analysis with a view to assessing whether SMRs fall within the scope of the instruments is beyond the restricted limits of this paper. Addressing questions of treaty interpretation and application is a very complex task and, in this paper, an impossible one. That said, most readers will be aware that Articles 31–33 of the Vienna Convention on the Law of Treaties (VCLT) codify which means of interpretation are to be applied in an interpretation process, and in which order they are to be applied.[42] The Vienna rules represent existing customs on treaty interpretation and desirable methods of treaty interpretation. What is important to highlight in the context of this paper and at this point, is that authoritative treaty interpretation and application are matters for the parties to the relevant treaty.

Notwithstanding, a simple approach in determining the potential applicability of a legally binding international instrument to SMRs, can be based on a good faith-based interpretation of the text bearing in mind the purpose of the treaty and the remaining text of the entire treaty. The approach is aimed at determining whether an SMR, its nuclear material and/or related activities such as transport or spent fuel and radioactive waste management, fall within the scope of application and existing legal definitions of an instrument. An SMR may be considered, say as a 'nuclear installation' when in use in a fixed position in a recipient country and simply as a transport of nuclear (or radioactive) material when being sent to or from this country. The advisory group of the IAEA Director General on Nuclear Liability - INLEX (International Expert Group on Nuclear Liability) followed this approach when assessing the applicability of the 1963 and 1997 Vienna Conventions and the 1997 CSC [14] to TNPPs - a sub-set of SMRs.[43] Taking this approach further and applying it to the CPPNM as amended, the transport of an SMR to or from a recipient could be deemed as constituting an 'international nuclear transport' and once the SMR is in operation in a recipient, it could be considered as being a 'nuclear facility'.[12] [13][44]

As may be expected, most of the international legal instruments and texts do not expressly address SMRs and are silent on them. However, the fact that SMRs are not expressly defined in a treaty clearly does not mean they may not fall within its scope of application. Some instruments, like the Early Notification Convention, [10] have been crafted to address a broad

[41] In the area of nuclear liability see the recommendations and best practices on establishing a global nuclear liability regime, including through the identification of actions to address gaps in and enhance the existing nuclear liability regimes: 2012 Recommendations on how to facilitate achievement of a global nuclear liability regime, as requested by the IAEA Action Plan on Nuclear Safety by the International Expert Group on Nuclear Liability (INLEX).

[42] UN, Vienna Convention on the Law of Treaties (23 May 1969) UNTS 1155, 331. Moreover, the primary criteria for interpreting a treaty are the ordinary meaning of the terms, the context of the treaty, its object and purpose, and the general rules of international law, together with authentic interpretations by the parties (Article 31, VCLT). Recourse to extrinsic (supplementary) means of interpretation, such as travaux preparatoires, may be had if the general rule has disclosed no clear or reasonable meaning (Article 32, VCLT). According to the VCLT rules, treaty interpretation must rely primarily on the terms of a treaty while context and the treaty's object and purpose must inform its meaning.

[43] For a discussion see IAEA, Nuclear Safety Review 2019 GC(63)/INF/3, 2019.

[44] Provided that it is treated as one, *"damage to or interference with, could lead to the release of significant amounts of radiation or radioactive material"* (Article 1(d), CPPNM as amended).

range of facilities and activities under which SMRs may fall.[45] They are of a generic and comprehensive nature, being technology neutral. They make no distinction between the type of material, facilities and activities that fall within their scope of application. The Assistance Convention is a prime example. Its focus is on facilitating the prompt provision of assistance in the event of a nuclear accident or radiological emergency to minimize consequences and to protect life, property and the environment from the effects of radioactive release. The Assistance Convention does not define the terms 'nuclear accident' and 'radiological emergency', or the material, facilities or activities from which an accident or emergency may originate.

In other cases, the drafters expressed themselves in language which was carefully chosen rather than in loose and general terms. For example, the CNS [8] was thoughtfully crafted to limit its scope of application to land based NPPs only. Likewise, the drafters of the nuclear liability instruments purposely limited the scope of application of the instruments, so as not to apply to questions of civil liability for nuclear damage arising from a nuclear incident during the operation of nuclear ships.[46]

It is not possible to go through all the instruments in this concise paper but essentially the result is that sometimes, within a single instrument, an SMR may be defined differently for the purposes of transport, as to when it is in a fixed position in a recipient country. For the most part, SMRs, whether as a facility, material or in relation to an activity like transport, appear to fall within the scope and definitions of the existing corpus of international instruments, standards and guidance, as well as other texts. However, when applied across the broad spectrum of international legal instruments, one may consider that a rather imprecise picture emerges. It is one, in which a SMR can have many different and albeit similar meanings, within the same and different instruments. This result is perhaps not ideal and for some, this alone may be a matter of concern. For lawyers, however, an approach driven by legal definitions appears a logical one. We should recall that as concerns legal definitions in an international legal instrument, they are adopted for the specific purpose of implementing that instrument under international law. It is thus common practice that other instruments may define similar or related subjects or activities using different terminology.[22]

While this may be so, even in the case of the nuclear liability instruments, INLEX recognizes the need, in certain cases, for a degree of interpretation to be applied when deployment of a reactor involves States not party to the same nuclear liability convention.[47] Moreover, INLEX

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[45] The Early Notification Convention's main focus is on the need for states to provide relevant information about nuclear accidents as early as possible with the aim of minimising transboundary radiological consequences. Here though, the Convention specifies a list of facilities and activities including any nuclear reactor wherever located (Article 1.2(a)) and the transport and storage of nuclear fuels or radioactive waste (Article 1.2(e)). The purpose of the reactor whether to produce electricity or heat is immaterial. This list of facilities and activities reflects a carefully negotiated comprise of the negotiators to delineate the notification obligation of accidents (those in Article 1 and those in Article 3 i.e. those not covered in Article 1). Given that the Early Notification and Assistance Conventions were crafted at the same time as a response to the 1986 Chernobyl accident, it seems plausible, at its simplest level, that the meaning of nuclear accident in the Assistance Convention has the same meaning as that used in the broadest sense in the Early Notification (i.e. Article 3).

[46] Handrlica J., The Rijeka Draft of a Convention on the Liability of Operators., Zbornik Pravnog fakulteta Sveučilišta u Rijeci, vol. 40, br. 3, 1153-1174 (2019). However, there is nothing in the conventions that restricts the definition of reactors to those that are non-mobile or land based. In fact, during the drafting of the 1963 Vienna Convention, consideration was given to the issue of low and medium power mobile power plants that could be transported with the conclusion that such reactors should be included in the convention since the reactors would be mobile solely for the purpose of transport and would operate only in a stationary condition.

[47] For a discussion see IAEA, Nuclear Safety Review 2020, GOV/2020/2, 2020.

considered that the Vienna Conventions and the 1997 CSC should be interpreted to mean that, in the particular case of the transportation of a TNPP when no unloading of fuel from the vessel occurs before its operation, the sending operator would cease to be liable when the TNPP is taken charge of by the authorised person in the State of destination. This may be considered as not being ideal. A lack of proper interpretation can lead to a breach of that treaty by the State Party. Further, the Parties may well have different opinions about the meaning conveyed of an instrument,[48] which in extreme cases, may give rise to a disagreement of a legal nature concerning interpretation or application.[49] In the case of the nuclear liability instruments, the need for legal certainly is self-evident as they are intended to determine liability of an operator, lend protection to victims, are to be invoked before the municipal courts and may involve supplementary contributions of public funds of the Parties.

Account may also be taken of subsequent practice and interpretation along with other instruments of interpretation concluded by the States Parties. Subsequent agreements and subsequent practice of the parties can play a role in the interpretation of treaties within the framework of the rules set forth in Articles 31 and 32 of the 1969 VCLT.[50] Meetings of parties could act as the responsible organs for the dynamic evolution of an instrument. This may be considered as being a more effective alternative to ad hoc diplomatic conferences negotiating specific issues. In the context of the peer review process of the Contracting Parties to the CNS, it should be noted that the Parties having in mind the safety objectives of the CNS, expressly agreed that they could follow the guidelines for reporting on a voluntary basis the safety of other types of civilian nuclear reactors i.e. not land based NPPs[8].[51] Another possible way forward envisaged by Contracting Parties to the CNS is to make an authoritative interpretation of the definition of nuclear installation so as to include SMRs and specifically transportable

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[48] Handrlica J., Transportable nuclear power plants: an enigma of international nuclear liability law, The Journal of World Energy Law & Business, Volume 12, Issue 6, December 2019, Pages 465–479. The paper contends that a TNPP cannot be considered a 'nuclear installation' in the sense of the existing nuclear liability conventions, when stationary and anchored at the coast.

[49] Indeed, the instruments include provisions in the event of disagreement between parties concerning their interpretation or application. For example, the CNS, in keeping with its incentive character, foresees consultations occurring within the framework of a meeting of the Contracting parties with a view to resolving a disagreement (Article 29, CNS). Its siter convention, the Joint Convention, goes a step further by providing for recourse to mediation, conciliation and arbitration mechanicals provided for in international law including the rules and practice prevailing within the IAEA (Article 38, Joint Convention). Albeit that such disagreements have never been invoked and can be expected to be rare, there would appear to be a need for further clarity and precision. This need may be particularly required in respect of questions of compensation and liability for nuclear damage. This can help to explain why significantly more robust dispute settlement provisions can be found in the modernised Vienna nuclear liability instruments, with the possibility, for example, for a Party to unilaterally refer a dispute which has not be resolved within six-months through negotiation or by other peaceful means, to the International Court of Justice for decision (Article XX A, 1997 Vienna Convention and the identical Article XVI,1997 CSC). In fact, such provisions are also provided for in the amended CPPNM but without such a six months period (Article 17, amended CPPNM), as well as in the Early Notification and Assistance Conventions but with a one year period (Article 11, Early Notification Convention and Article 13, Assistance Convention). Notwithstanding, it is a well-known fact that under general international law there is no obligation to settle international disputes and all procedures for such settlement rest on the consent of the Parties.

[50] See the draft conclusions and commentaries on subsequent agreements and subsequent practice in relation to the interpretation of treaties adopted by the International Law Commission (ILC) and transmitted to the UN General Assembly (UNGA) which welcomed the conclusion of the ILC's work in its Resolution A/RES/73/202 adopted by on 20 December 2018. The ILCs draft conclusions and commentaries thereto are provided in the Official Records of the UNGA, Seventy-third Session, Supplement No. 10 (A/73/10), 2018.

[51] IAEA, Guidelines regarding the National Reports under the Convention on Nuclear Safety, INFCIRC/572/Rev.5, 16 January 2015.

ones. The outcome of any possible further discussions of the Contracting Parties, remains to be seen.

15.4.2.1. Special Case of Factory Fueled SMRs and Marine Based SMRs

Significantly, some SMRs may be deployed internationally as fuelled reactors (with fuel in the core) and/ or marine based operated. Transportable fuelled SMRs and those that may be marine based represent a special case, giving rise to specific issues and challenges, particularly, in the context of international maritime transport.[52]

SMRs may cross multiple international borders and travel through international waters. Multiple SMR transports may arise, as concerns the initial delivery of a fuelled SMR to an operator in the recipient country, after operation for maintenance of an SMR to the operator in the vendor state, thereafter to the operator in the recipient country and at the end of life to the operator in the vendor state. Such transport will be an integral part of their lifecycle and essential for their development and utilisation world-wide.

For many decades, radioactive materials have been transported for use in medicine, industry, research and for production of power. Transport of radioactive material is generally agreed as amply justified. Transport of radioactive material is governed by national and international regulations. A robust international regulatory framework has been established for the transport of radioactive material that applies to all modes of transport. The record of the world-wide transport of nuclear fuel cycle material, such as fresh and spent nuclear fuel, high-level waste and mixed oxide fuel (MOX) is a successful and safe one, with tens of thousands of safe shipments over more than fifty years.[53]

The potential for international transports of a fuelled reactor can be expected to pose challenges to the regime for the international safe and secure transport of radioactive material. Such transports are not identical to the world-wide transport of nuclear fuel cycle material such as fresh and spent nuclear fuel and MOX.[54] Further, although the maritime transport of a fuelled reactor or a TNPP may have similarities to nuclear-powered vessels, they are nonetheless distinct and may possibly represent a new category for which nuclear safety norms, standards, or best practices will need to be developed.[55] Additionally, the possibilities clearly differentiate

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[52] For a discussion of some of the legislative and regulatory issues regarding TNPPs see **[43]**. Also, for a discussion on licensing issues see, 13th INPRO Dialogue Forum on "Legal and Institutional Issues in the Global Deployment of Small Modular Reactors", 18-21 October 2016, IAEA, Vienna and 6th INPRO Dialogue Forum on "Licensing and Safety Issues for Small and Medium Sized Reactors, 29 July - 2 August 2013, IAEA, Vienna.

[53] IAEA estimates that 20 million shipments of radioactive materials are transported annually. Only five per-cent relate to fuel cycle transports, the rest relate to non-fuel cycle transports such as the transport of smoke detectors, and cobalt sources for medical purposes.

[54] The IAEA estimates that 20 million shipments of radioactive materials are transported annually. Only 5% relate to fuel cycle transports, the rest relate to non-fuel cycle transports such as the transport of smoke detectors, and cobalt sources for medical purposes.

[55] UNCLOS does not include a specific definition for "ship" or "vessel". Under IMO's existing regulatory framework, there is no unified definition for "ship" and the status of a TNPP i.e. as a ship or not, is undefined. Under the 1974 SOLAS Convention there is no definition for "ship". However, a "nuclear ship" is defined as one provided with a nuclear power plant. Furthermore, Chapter VIII (Nuclear ships) of the 1974 SOLAS Convention specifically applies to nuclear powered ships (not ships carrying radioactive material, the carriage of which is covered in Chapter VII (Carriage of dangerous goods)) which are required to conform to the IMO Code of Safety for Nuclear Merchant Ships (IMO Assembly, Resolution A.491(XII), adopted on 19 November 1981). The Code was adopted as a guide on internationally common safety standards for the design, construction, operation, maintenance, inspection, salvage and disposal of nuclear merchant ship. The Code superseded the

these SMRs from newbuild programmes and projects of large traditional NPPs. Transportable fuelled SMRs represent a significant nuclear island component manufactured and likely tested, or even commissioned, to some degree off-site. They characterise a transfer of a significant nuclear construction activity offsite, which is novel in the civilian nuclear power sector. Such novel characteristics challenge traditional licensing processes including legal and regulatory frameworks.[6]

In this context, two issues can be raised. First, is the need to ensure application of safety requirements for the safe international transport of SMRs. This is important because transports of radioactive material should be conducted in accordance with international law. Considering maritime transport we can note that , UNCLOS effectively guarantees freedom of navigation of the high seas and exclusive economic zone (EEZ) and guarantees the right of innocent passage of ships carrying nuclear material provided they are conducted in conformity with the relevant provisions of UNCLOS. However, pursuant to UNCLOS States are also under the general obligation to protect and preserve the marine environment everywhere in the oceans.

Safety Requirements: Transport Package and INF Cargo

There are two considerations with respect to the transport of certain types of nuclear material. The **first** consideration is the transport package which provides protection against the hazards of the material under all conditions of transport, including accident conditions. This matter is addressed by the IAEA Transport Regulations which are principal requirements for the safe transport of radioactive material. In addition, requirements for EPR during maritime transport of these reactors are applicable but practical implementation of these requirements needs to be further defined. Unirradiated reactor fuel is required to be transported in a Fissile design package type which meets prescribed requirements and performance testing criteria, whilst irradiated reactor fuel is required to be contained in a Type B Fissile package which meets other requirements and performance testing criteria. The IAEA Transport Regulations, are incorporated as Class 7 (Radioactive Material) into the UN Recommendations on the Transport of Dangerous Goods Model Regulations,[56] which in turn is incorporated into the IMO International Maritime Dangerous Goods (IMDG) Code,[57] which is made mandatory through Chapter VII of the 1974 SOLAS Convention (as amended).[58]

The second consideration specific to the maritime transport of certain nuclear material, is the transport vessel which will convey the cargo. This matter is addressed by the IMO INF Code which is also mandatory through Chapter VII, Part D of the 1974 SOLAS Convention (as

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Recommendations Applicable to Nuclear Ships annexed in Attachment 3 to the Final Act of the 1974 SOLAS Convention. It should be noted that barges that have no propulsion system (and platforms), are not covered by the 1974 SOLAS Convention (Chapter 1, Part A, Regulations 3(a)(ii)). Note that no reactor power is used for the propulsion system of of the Akademik Lomonosov, which is a floating power unit (FPU) with two KLT-40S reactor modules. Under the IAEA Transport Regulations, a "vessel" is defined as any sea-going vessel or inland waterway craft used for carrying cargo.

[56] UNECE, UN Recommendations on the Transport of Dangerous Goods - Model Regulations, Twenty-first revised edition (2019). The Recommendations are developed by the United Nations Economic and Social Council's Sub-Committee of Experts on the Transport of Dangerous Goods. The Recommendations are presented in the form of Model Regulations on the Transport of Dangerous Goods, which are an annex to the Recommendations. Since 2001, the IAEA Transport Regulations are directly implemented into the UN Model Regulations as Class 7.

[57] IMO, IMDG code: International maritime dangerous goods code, London: International Maritime Organization.

[58] IMO, Part A, Regulation 3, International Convention for the Safety of Life at Sea (SOLAS), International Maritime Organisation, 1974.

amended).[59] The INF Code addresses the construction, equipment and operation of new and existing ships engaged in the carriage of INF Cargo. In addition to the 1974 SOLAS Convention (as amended) and the IMDG Code, the requirements of the INF Code apply to a ship carrying certain nuclear material or so-called INF Cargo i.e. packaged irradiated nuclear fuel, plutonium and high-level radioactive wastes carried as cargo in accordance with Class 7 (Radioactive Material) of the IMDG Code.

Pursuant to Article 23 of UNCLOS,[60] a ship carrying nuclear material through the territorial sea (and a nuclear powered ship) is required to carry the documents and observe the precautionary measures stipulated in "international agreements". Undoubtedly, the 1974 SOLAS Convention (as amended), is one of the “international agreements” stated in Article 23 of UNCLOS, in particular its Chapter VII, which governs the carriage of dangerous goods (and Chapter VIII dealing with nuclear powered ships),[61] which applies the IMDG Code as concerns Class 7 (Radioactive Material) and the INF Code as concerns INF Cargo.[62]

In light of these two considerations, the issue with respect to the transport of fuelled reactor, is whether it can be considered as an appropriate package type for its contents (i.e. fresh, used with spent fuel or used with spent fuel removed) and in doing so address the prescriptive package performance requirements for routine transport and transport accident conditions, consistent with requirements of the IAEA Transport Regulations as made mandatory through the IMDG Code. This matter should also be considered in light of the requirements stemming from the INF Code in respect of the carriage of INF Cargo.

Freedom of Navigation

The second issue concerning a future international maritime transport of fuelled reactors is the potential to reignite the debate concerning fundamental principles of territorial sovereignty of a costal state and the freedom of the seas by a flag State. SMR transports, the same as for the international maritime transport of radioactive material, are likely to be of concern to the international community requiring an internationally coordinated effort and response to ensure an acceptable level of protection and control in transport.

Care should be taken to avoid strong opposition like that voiced internationally against the international sea transport of spent fuel, high level vitrified waste and mixed oxide fuel (MOX) by foreign-flagged vessels from the early 1990s to the mid-2000s. Calls mainly stemmed from costal states which lay along or close to the actual or potential transport routes, many of which were concerned about lack of information which could inhibit their timely and effective response to an accident or incident. Two basic types of claims were made: the first, amounts to an outright denial of the right of innocent passage. The second, sought to condition the exercise of innocent passage on the coastal State’s prior consent or in-advance notification.

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[59] IMO, International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships, Resolution MSC.88(71), International Maritime Organisation, 1999. In January 2001, the INF Code was made mandatory through amendments adopted to Chapter VII of SOLAS Convention (Reg. 15 in Part D of Chapter VII (Carriage of dangerous goods)).

[60] UN, Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397.

[61] IMO, Implications of the United Nations Convention on The Law of the Sea for the International Maritime Organization, Study by the Secretariat of the International Maritime Organization (IMO), LEG/MISC.8 30, January 2014.

[62] UNCLOS rules on navigation in the exclusive economic zone (EEZ), as well as those concerning transit passage through straits (applicable also to archipelagic sea lanes passage) do not mention navigation of ships carrying radioactive material.

Since that time much has been done to allay concerns. Today, there exists enhanced voluntary dialogue between flag and costal states, bilaterally and within the framework of the IAEA. Already in the early 2000s, the informal consultation Coastal State-Shipping State Dialogue mechanism was established in the margins of the annual IAEA General Conference, by a group of States with an interest in nuclear maritime transport. Additionally, since 2014, Best Practices for Voluntary and Confidential Government to Government Communications on the Transport of MOX Fuel, High Level Radioactive Waste and, as appropriate, Irradiated Nuclear Fuel by Sea (IAEA INFCIRC/863 (2014)) have been in place. Significantly, the practice of some shipping states has been to avoid the territorial seas and EEZs of costal states.

Looking forward, it will clearly be essential that activities involving potential radiation exposure, such as the potential future international transport of SMRs, be subject to certain standards of safety and security and that adequate compensation mechanisms are in place. The current high level of safety (and security) in the international maritime transport of radioactive material has been achieved on a worldwide basis through adoption of the IAEA Transport Regulations as one of the nine classes of dangerous goods. A potential future world-wide SMR deployment, including fuelled reactors, should not undermine the current level of confidence that agreed levels of safety are complied with when radioactive material is being transported around the world.

15.4.3. Next Steps

It is necessary to ensure that the existing status of international nuclear law on nuclear safety, security and liability is not only maintained in full but adapted as needed, and that recipient countries join and fully implement their obligations. Further consideration over the next decade will be needed to determine whether the current frameworks adequately address SMRs and their future deployment. There should be no major gaps or ambiguities when it comes to the framework necessary to limit the risks of the use of nuclear energy.

Efforts should be based on seeking to achieve a shared goal: to assist countries embarking on an SMR programme to do so knowledgeably, safely and securely, as well as addressing questions of nuclear liability in line with best international practices. Efforts should also be based on a residual interest of all SMR vendors in ensuring that SMR programmes are carried-out successfully. There must be a collective interest that deployment does not entail a weakening of the current frameworks or give the impression of weakening the control mechanisms, say for economic advantages. Rather, the goal must be to promote civil nuclear energy development that is responsible, in other words, that complies with the most demanding safety and security obligations, requirements and expectations.

It is reasonable to expect that if such a deployment starts to become more certain, the roles, responsibilities and obligations of potential SMR recipients and vendors, will become an even higher priority issue than ever before. It may therefore become increasingly important to better articulate the shared and common interest of all IAEA Member States in assuring the global public that nuclear facilities - SMRs - will be operated and, activities conducted, safely and securely. Moreover, the future may call for all IAEA Member States to consider whether, peaceful use considerations aside, there is a need for those states involved, to more clearly demonstrate their commitments to achieve the highest standards in SMR deployment and utilisation. In this context, many readers may also recall that a similar focus on roles, responsibilities and obligations of newcomers and vendors arose during the so-called nuclear renaissance of 2000s. An outcome, from the nuclear industry at that time, was an acknowledgement of their concern for responsible nuclear supply, as reflected in the Nuclear Power Plant and Reactor Exporters' Principles of Conduct, finalized in May 2011. It remains

to be seen whether a potential future international SMR deployment gives rise to new multilateral initiatives focused on roles, responsibilities and obligations of potential SMR recipients and vendors.

Finally, any effort to amend existing treaties requires a clear goal and a high degree of probability that the negotiations will be successful, and the result will be adopted by as many States as possible. In moving forward, caution should be taken in considering any revision of the existing international legally binding instruments. It should be clear that efforts for improvements which fail, will be counterproductive with the potential to undermine the existing regime. It is reasonable to expect that any future effort to strengthen the frameworks, if indeed considered necessary, will be driven in part by the actual scale of SMR deployment around the world. Should there not be such a deployment, we can expect that multilateral efforts to be limited, with recourse being made to bilateral arrangements.

15.5. ELEMENT 4: SUPPORTING FULFILMENT OF NEWCOMERS' OBLIGATIONS AND NORMATIVE EXPECTATIONS: NATIONAL LEGISLATIVE AND REGULATORY FRAMEWORK

Based on the experience of NPP newbuild programmes, the enabling environment for SMR deployment including to developing countries should address a major challenge expected to face many SMR recipients in developing the infrastructure and knowledge base. In the case of some developing countries, challenges are likely to be exacerbated due to inherent limitations, including, a lack of an adequate level of state capacity and institutional framework with adequate financial and administrative power, accountability and transparency.

Notwithstanding the potential use of alternative approaches to SMR deployment, the enabling environment should therefore support fulfilment of SMR recipient's obligations and normative expectations. Some international SMR deployment albeit not all, will be based on an SMR recipient adopting a strategy of early engagement and partnering with an SMR vendor country instead of procuring an NPP "on the market" through a competitive bidding process. This approach may lead to early SMR technology selection based on a sole supplier or strategic partner codified in an inter-governmental agreement(s) (IGA(s)), underpinned by commercial contracts.[23] The strength of the bilateral government to government relationship will be fundamental to the success of an SMR programme and project(s). Such strategic partnerships may not be limited to solely technical issues and the desire to acquire a specific reactor design. Rather, they may encompass more strategic general considerations of a geo-political or economic nature, as well forming part of a wider scope of cooperation, for example, on energy issues in general. The important role of financing arrangements in determining the choice of an SMR technology must also be highlighted.

Some SMR vendors will offer, and some recipients will also be interested in different ways of overcoming development challenges associated with a highly sophisticated technology for example, in terms of operational capability. Alternative approaches to SMR ownership, contracting and lifecycle management may be reasonably expected. Moreover, some SMR recipients may seek to outsource significant elements of an SMR programme and project(s), with the aim of leveraging their limited human and financial resources to focus on core

competencies such as nuclear safety, security and licensing. Support for human resource development is likely to be a key factor.[63]

However, even in the case of early technology selection and even where an SMR vendor may operate and take back the SMR, it is well understood that nuclear safety and security are considered national responsibilities that cannot be outsourced. The concept of national authority and responsibility is an important one. It means that the SMR recipient must assume the responsibility for carrying out a national safety programme and must prepare itself to do so early in the course of the SMR programme activities. This authority and responsibility cannot be outsourced.

It follows that the decision to embark on an SMR programme, the same as for an NPP programme includes a strong national leadership and governmental commitment to use nuclear energy for peaceful purposes, in a safe and secure manner. In this light, the decision must be an informed, responsible and knowledgeable one based on social and economic considerations. In this context, the decision should be driven by the energy policies set by the government. Such policies may include decarbonization of electricity or heat production, guaranteeing the power supply in remote areas, or promoting macroeconomic growth by developing a local industry to manufacture components and support SMR operations.[35] It may well be that SMRs can facilitate national decision making due to the low power, lower radiological risk and the lower upfront capital cost for recipient countries with small electricity grids. Ultimately, the decision must be made within and by the SMR vendor country, cognizant of both its needs and available resources.

A fundamental role of government is to protect and promote the health and safety of the public in its jurisdiction. The introduction and implementation of an SMR programme, including the acceptance by the population in general, is a matter to be handled primarily by an SMR recipient, albeit that it may benefit from external programs such as those aimed at raising acceptance. The same as for an NPP recipient, an SMR recipient will continue to have several significant obligations and responsibilities not only to protect the welfare of its own peoples but also to meet its obligations to the wider international community.[64] Indeed, there are wide responsibilities that arise from the national commitment and SMR recipients will be expected to take appropriate and timely actions to fulfill those responsibilities. This entails full adherence to and effective implementation of the relevant international legal instruments, standards and guidance, as well as participation in the relevant international arrangements, including international peer reviews. It includes fulfilling the required national and international obligations, enabling the country to effectively move forward to other phases of its SMR programme preparation and implementation process. All States are of course expected to fulfil in good faith their international undertakings and obligations.

This commitment also entails the development, implementation, and maintenance of a strong national infrastructure (for the governmental, legal, regulatory, managerial, technological, human and industrial support) and knowledge base to support the successful introduction of SMRs and their safe, secure, and efficient use.[24] Government support is facilitated by stakeholder support, which is in turn facilitated by effective stakeholder involvement.

[63] IAEA, Alternative Contracting and Ownership Approaches for New Nuclear Power Plants, IAEA-TECDOC-1750, IAEA, Vienna (2014). NPPs have been contracted in a wide variety of ways but the following three types of contractual approach have generally been used: turnkey approach, split package approach and multi-contract approach.

[64] UN, A more secure world: our shared responsibility, Report of the High-level Panel on Threats, Challenges and Change, United Nations, [A/59/565], 2 December 2004.

Maintaining open and timely interaction regarding all aspects of the programme can help in obtaining and retaining the confidence of the country and the international community. Experience shows that involving stakeholders in decision making processes, can enhance public confidence in the application of nuclear science and technology. Traditional NPP newbuild programmes are following this trend. Indeed, stakeholder involvement is one of the 19 infrastructure issues of the Milestones Approach.[16] Engaging stakeholders early, substantively and frequently will also support the development and deployment of SMRs.

In fulfilling their commitments, SMR recipients will need to educate themselves to intelligent, competent and knowledgeable customers. No different to the requirements in the case of an NPP programme, a sufficient level of technical, legal and commercial knowledge will be required. However, an SMR recipient can obtain assistance in response to questions or problems which may arise and in helping it to become self-sufficient. Such assistance must be satisfied in a manner fully consistent with their sovereign authority and responsibility. This means that SMR recipients must assume the responsibility for carrying out a national safety programme, and must prepare itself to do so early during the SMR programme. Recipients should therefore acknowledge that sole reliance on technical support from the SMR vendor or other bodies from outside the country for long periods is neither possible nor practicable. Finally, in the case of future SMR programmes in developing countries, there is no variation of the required due diligence standards on the basis of common but differentiated responsibilities according to a State's level of development and capacities.[65]

15.5.1. Supporting the Development and Implementation of National Legislative and Regulatory Frameworks

A critical element of the needed infrastructure is a comprehensive and effective national legislative and regulatory framework to ensure the safe and secure introduction of an SMR programme. For regulation to be effective, it needs to be embodied in the national legal framework. The national legislation should establish or designate a regulatory body(ies) as an effectively independent authority for regulatory control, with clear legal authority and sufficient financial and human resources to conduct its important responsibilities to carry out its mission, including, preparing and issuing regulations and guides, licensing, inspection and enforcement. [66] Various international legal instruments and IAEA standards and guidance set out the core functions that the regulatory body should perform for effective regulatory control. There should also be a clear allocation of responsibilities and effective coordination of different authorities with responsibilities for safety within the regulatory framework for safety. An aim being to avoid any omissions or undue duplication and to avoid conflicting requirements being placed on authorized parties.

The need for adequate and comprehensive nuclear legislation, and for effective, and independent, regulation at the national level is emphasized in several of the relevant international legal instruments, standards and guidance, in the context of NPPs. It is also articulated in various fora, including, annual resolutions of the IAEA General Conference and

[65] Activities which may be considered ultrahazardous require a much higher standard of care in designing policies and a much higher degree of vigor on the part of the State to enforce them. The economic level of States is one of the factors to be taken into account in determining whether a State has complied with its obligation of due diligence. But a State's economic level cannot be used to dispense the State from its obligation.

[66] GSR Part 1 (Rev.1) **[32]** establishes the requirements for an effective regulatory body, the implementation of the requirements is supported by Safety Guides. Appendix I to INSAG-26 **[29]** provides a summary of 14 characteristics of a fully mature and effective regulatory body.

relevant international conferences.[67] Furthermore, the 2011 Fukushima Daiichi NPP accident highlighted how essential such a framework is in ensuring a high-level of safety of NPP, for States to effectively implement the relevant international legal instruments and fully implement IAEA safety standards. Further, the accident highlighted the imperative of establishing an effective regulatory framework, including an independent (in law, practice and culture) effective regulatory body that is credible, trusted, competent and adequately resourced.

Experience from countries embarking on a nuclear power programme shows that developing a comprehensive and effective national legislative and regulatory framework for effective regulatory control and oversight (including supervision and regulation) is typically complex and takes time. Even in the case of NPP newbuild, experience shows that the existing legislative framework in some NPP recipients continues to be inadequate to support the planned nuclear power programme since it does not fully reflect the provisions of the relevant international legal instruments.[25] Further, eexperience from IAEA missions including International Regulatory Review Service (IRRS), International Physical Protection Assessment Service (IPPAS) and INIR missions include a lack of an appropriate regulatory framework, including, insufficient regulatory independence, lack of competent regulatory staff, insufficient financial resources of the regulatory body, and inability of the regulator to hire external experts. In addition, challenges observed are the development and implementation of regulations and guides, a licensing process and an inspection programme on a timescale consistent with the NPP implementation schedule.[25]

In respect of the development and implementation of the needed framework, the enabling environment for an international SMR deployment, as considered in this paper, should be based on strengthened bilateral cooperation and assistance. This includes by the vendor country's regulatory body in supporting an SMR recipient's efforts to establish the regulatory framework and licensing. Further, supplementary to bilateral cooperation, it should be based on strengthened international cooperation and assistance, including, increased multinational regulatory cooperation.

In this light, the enabling environment needs to address the following two issues. Firstly, the apparent need for regulatory certainty in the deployment of standardised modules in different countries. Secondly, the apparent steeper learning curve for SMR recipient countries in creating the necessary national nuclear infrastructure and knowledge base considering a shorter construction time for SMRs. In this regard, SMR vendor countries and potential recipients need to fully understand, plan and incorporate into their SMR programme and project plans, the time required for the development of the framework and knowledge base.

15.5.1.1. Ensuring an Alignment of SMR Programme and Infrastructure Development Schedules: Timely Development of the National Legal Framework

It is recalled that in the context of the NPP Milestones Approach [16], early technology selection could take place either during Phase 1 as part of the consideration to make a knowledgeable commitment (i.e. pre-programme phase), at the end of this Phase 1 which is marked by Milestone 1 being the point when a country may make such a commitment, or early in Phase 2 when the preparatory work is typically being undertaken (i.e. preparatory phase).[23] This alternative strategy of early technology selection is different to the usual competitive

[67] A series of five IAEA conferences on Effective Nuclear Regulatory Systems have been held in: The Hague, the Netherlands in 2019; in Vienna, Austria in 2016; in Ottawa, Canada, in 2013; in Cape Town, South Africa, in 2009; and in Moscow, Russian Federation, in 2006.

bidding approach, in which the invitation for bids would normally be at the end of Phase 2 marked by Milestone 2, being the point when the country would be ready to invite bids or negotiate a contract for an NPP.

A benefit of modularisation is the shortening of schedules by enabling parallel construction activities and reducing construction time of some systems and equipment, since testing may be conducted at the factory. SMRs aim to significantly reduce the typically lengthy construction period for large NPPs that span 6 to 7 years,[28] to approximately 3 to 5 years.[68] Considering the indicative timeframe in the NPP Milestones Approach [16] (and [18]), early SMR technology selection could potentially take place some 4-6 years earlier than Milestone 2.[69]

While clearly several years will be needed from the initial consideration of an SMR programme to its operation, long lead and construction times may not occur in the case of some SMRs, as compared to traditional NPP newbuild programmes.[70] In the case of SMRs, the engineering design of long lead items and components will need to be finalized prior to module procurement. Potentially shorter lead time (planning, construction, etc.), perceived as a benefit of SMRs, needs to be properly addressed since it magnifies the need for the emerging country to have implemented obligations and responsibilities in due time. Further, a potential mismatch between project development and infrastructure development may be exacerbated where SMR developers seek to deploy SMRs pursuant to aggressive schedules with short lead times which do not take into account the necessary early regulatory activities, such as establishing the regulatory framework and conducting the licensing process.**[29]** Early attention to all relevant issues is therefore needed to facilitate the efficient development of a successful SMR programme.

National Nuclear Legislation

The enabling environment should address the need of some potential SMR recipients to adopt a new nuclear law or amend existing legislation to comprehensively provide the legal foundation for the system of regulatory. Ideally, as in the case of NPP newbuild, comprehensive nuclear legislation should be in force prior to inviting bids, since failure to do so is considered as significantly increasing the risk of subsequent costly delays.[22] However, we should also recognise that some SMR recipients, including, those following a strategy of early technology selection, may not have in place the needed nuclear legislation, as well as all additional legislation that may affect the SMR programme, for example, legislation on environmental protection, occupational health and safety, foreign investment, financial guarantees or other financial legislation.

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[68] This may be attributed to a reduction in scale (smaller footprint), learning through experience, increase modular construction, use of advanced manufacturing techniques, integration of all nuclear components into a single factory-built module with the possibility of off-the-shelf reactors manufactured offsite and then transported to the site for final inspection and installation, with reduced complexity of the balance of plant.

[69] It is recalled that according to the Milestones guidance document, a newcomer following such an approach should interpret 'bid invitation specifications' as 'specifications for negotiating with a sole supplier'.

[70] One of the main aspects of nuclear power development programmes and the implementation of NPP projects is the fact that long lead times are involved mainly due to preparatory actions and unanticipated construction delays.[34] Experience suggests that the time from the initial consideration of the nuclear power option by a country to the operation of its first nuclear power plant is about 10-15 years.[18] In the context of a research reactor programme, this period is about 5-10 years.[27] These periods may clearly vary depending on the resources devoted to the programme and projects.

Elements of Legislation

Some potential SMR recipients may already have nuclear legislation in place limited to non-power uses of ionizing radiation, such as those utilizing radiation sources for medical, agricultural and industrial purposes, thereby addressing the country's existing facilities and activities, including radioactive waste management and transport. They may wonder what changes, if any, are needed to ensure that the most basic objective of nuclear legislation as applied to SMRs is fulfilled, that being to establish regulatory control over a subject that can pose a risk to safety, security or the environment.[22] Albeit that some relevant legislation may be in existence, establishing an SMR programme, the same as for NPP programmes (and research reactor projects), typically requires dedicated legislation which is usually not in place. Such legislation, like any other, must comply with the constitutional and institutional requirements of each State's political system and overall legal and regulatory structure, as well as reflect the level and direction of its facilities and activities.[22]

Similar to traditional NPP newcomers, a fundamental issue for an SMR recipient can be expected to concern whether to adopt nuclear legislation as a single, unified or comprehensive law, or to adopt separate laws for different subjects. State practice in this regard can differ widely among countries with differing legal systems. Experience in several Member States shows that this may best be achieved through the elaboration of a comprehensive national nuclear law covering all relevant aspects of nuclear regulation and control i.e. nuclear safety, security, safeguards and civil liability for nuclear damage. Notwithstanding, whether in a prescriptive or non-prescriptive environment, legislative drafters should be aware that the nuclear law will normally not contain much detail on any particular technical or organizational safety requirements, leaving this area to regulations. Nevertheless, legislative drafters may find it useful to be aware of the regulatory approach that will be adopted by the regulatory body since this will help to determine the level of detail in the law.

It is unnecessary here to set-out the elements of a comprehensive national nuclear law. The model provisions in Volume II of the IAEA Handbook provide a useful resource for countries drafting nuclear legislation covering the key elements needed in a comprehensive "3S" national nuclear law.[22][71] An SMR recipient which has already adopted such a law may well wonder what changes will be needed to the law, if any, in the context of its SMR programme. In this context, the innovative design features of SMRs, their potential novel deployment scenarios and potential different and unique approaches to plant lifecycle, do not appear to necessarily raise any major specific considerations in respect of national nuclear law. However, five general issues that may arise regarding the needed national nuclear legislation, can be flagged.[72] These matters concern the scope and definitions, licensing process, nuclear liability limits, spent fuel, radioactive waste and decommissioning and external support to the regulatory body. Some of the matters stem from the novel characteristics of some SMRs including their potential applications and deployment scenarios. The matters are minor but certainly not inconsequential and should not be dismissed.

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[71] In addition, all NPP newcomers are benefitting from assistance under the Legislative Assistance Programme. This includes legislative assistance in drafting national nuclear legislation which facilitates the implementation of their international obligations and commitments.

[72] In addition, potential SMR recipients will likely need to consider related laws such as concerns intellectual property, foreign ownership and investment regulation, general environmental laws, taxation
As for NPP new-build, there is the potential for related laws not to be fully developed. Failure to adequately address such other laws, could result in gaps, duplications, conflicts, ambiguity and inconsistencies.

Firstly, of course, it goes without saying that drafters should take care to ensure that the scope of application and definitions of existing or draft nuclear legislation covers SMRs. While it may not be necessary to expressly refer to SMRs in key definitions of "facility" and "nuclear facility", there is a need to ensure that they fall under their typically broadly drafted scope. For example, SMR recipients should also be aware that for the purpose of the nuclear liability instruments, an SMR - being a nuclear reactor - may also be considered as a "nuclear installation".

Secondly, drafters should carefully assess the provisions on licensing in existing or draft nuclear legislation. While there is no specific licensing process for SMRs, a fundamental decision to be taken in drafting legislation is the sequence of licences related to the lifecycle stages of a facility.[73] It is not necessary to reflect detailed substantive or procedural licensing matters, since they can be more efficiently handled in regulations. Nevertheless, the basic legal requirements for the most significant aspects of the licensing process covering all stages can be provided for. Drafters may need to consider whether those steps are still relevant considering SMR deployment scenario and especially the importance of international transport in the context of SMR licensing, as well as the ability of the regulatory body to carry-out regulatory inspections overseas prior granting a license for construction or prior commissioning for example. For example, performing final inspection on an assembled reactor module may be challenging if the regulatory body (and/or the buyer) desire to view components internal to the assembled reactor module.

Thirdly, SMR recipients may also need to consider the nuclear liability limits established in existing or draft national legislation. Some SMR proponents are highlighting the need to align the current nuclear liability limits and corresponding operator financial security requirements as implemented in national legal frameworks, with the risks posed by SMRs considering, for example, their small size and purported low inherent risk of many SMR designs.[74] Should governments follow such an approach this may require changes to national legislation and/or regulations. SMR recipients should be particularly sensitive to such action in the context of a nuclear incident causing damage more than the SMR operator's liability limit for those SMR that are not state owned and/or operated. In this instance, the government of the SMR recipient will need to make public funds available to compensate that damage up to the limit provided for in the relevant nuclear liability instrument(s) to which they are party such as the 1997 CSC.[14] Drafters may also need to consider the liability limits in the context of the deployment of multi-modules at the same site.

Fourthly, it can be expected that many SMR programmes will not justify a national repository. Many SMR recipients will face a substantial challenge toward developing cost effective national spent fuel (SNF) and high-level waste (HLW) disposal solutions. Progress in the disposal of spent fuel has been extraordinarily slow and most existing NPP countries have no disposal path in place.[26] Countries with small or newly established programmes will be faced with fundamental strategic spent fuel management options facing which can be categorized as follows: national storage and disposal (early or late); reprocessing abroad, recycling and waste disposal nationally; reprocessing, recycling and waste disposal abroad; national storage,

[73] For NPPs, State practice for licensing NPPs varies widely in terms of the number of licences issued and the time at which they are issued. However, the licensing process typically involves the following general seven stages: siting and site evaluation, design, construction, commissioning, operation, decommissioning and release from regulatory control. See IAEA, Licensing Process for Nuclear Installations, IAEA Safety Standards Series No. SSG-12, IAEA, Vienna (2010).

[74] Canadian Small Modular Reactor Roadmap Steering Committee (2018). A Call to Action: A Canadian Roadmap for Small Modular Reactors. Ottawa, Ontario, Canada.

disposal in a shared disposal facility; fuel leasing; and retention of spent fuel as a valuable commodity.[41] Indeed, some SMR recipients may benefit from arrangements enabling the take-back of supplied SNF and HLW, as well as the SMR for decommissioning. Interest can also be expected to grow in multinational collaborative efforts of recipients in seeking to establish multi-national repository (MNRs).[75] Regardless of approach, the need for a national policy and strategy and a national long-term programme or approaches for SNF and HLW can be expected. Drafters should therefore consider the government national policy and strategy for the safe management of SNF and HLW in the context of the SMR programme. Care will be needed regarding the provisions on import of radioactive waste generated outside the country and the funding mechanisms for radioactive waste management and decommissioning.

Finally, consistent with the normative guidance applicable to NPP newbuild, it is not be realistic to expect a recipient's regulatory body to develop early-on all the competencies required to perform critical tasks nor to have all the required characteristics of an effective regulator in place before the construction license is needed.[29] Similar to NPP recipients, the regulatory bodies in most if not all SMR recipient's will need to benefit from external support, whether it be from a Technical and Scientific Support Organization or a regulatory body(ies) in other countries experienced with the regulation of the technology.[23] In the case of the early deployment of SMRs as considered in this paper, other than the SMR vendor country, such other experienced countries may be limited. To strengthen the basis for obtaining such support, nuclear legislation can address this matter in two ways.

Firstly, the legislation should specifically authorize the regulator to exchange information and cooperate with regulatory bodies in other States and with relevant international organizations concerning matters arising from the exercise of its functions. Substantial initial and ongoing support of the experienced regulatory body from the SMR vendor country will be critical. Secondly, the draft nuclear law should also specifically grant the regulator the right to obtain technical or other expert professional advice or services (from both individuals and organizations, whether within the state or outside), to augment and reinforce its staff's capabilities by assisting in the performance of its regulatory functions.[29][76] For example, part of the review and assessment activities or the inspection activities may be performed under a supervised contract to specialized dedicated support bodies such as TSOs.[30] It is recalled that where external support is to play an important role, the management system of the SMR recipient's regulatory body should ensure proper supervision of activities.[18] Finally, notwithstanding the approach, the draft nuclear law should ensure that the SMR recipient's regulatory body is provided with adequate human and financial resources to fulfil its prescribed responsibilities and functions.

Law-Making Process

Any needed strengthening of the existing legislative and regulatory framework in SMR recipients is likely to occur in parallel with the SMR programme and project level commercial decisions. If not carefully managed, undue pressures to draft and adopt national nuclear legislation could arise due to the need to have it in place to match the schedules of the SMR programme and projects.

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[75] IAEA, Sharing Nuclear Power Infrastructure, TECDOC-1522, IAEA, Vienna (2006).

[76] In this context, provisions may authorise the regulator to establish a continuing institutional advisory body composed of outside experts that is charged with providing independent advice, whether technical or non-technical in nature

The process of developing and adopting nuclear legislation law is often lengthy, complex and specialized. Many Member States developing national nuclear legal frameworks face common challenges, in part due to the specificities of nuclear law and sometimes the need to make changes to long-standing institutional frameworks when it comes to the regulatory framework.[25] Exacerbating this challenge can be a dearth of legal professionals with training and experience in either nuclear technology or nuclear law. These points aside, it is noted that the actual process is not significantly different from the law-making processes in any other field of national interest. There is an overall need to allow enough time and devote sufficient resources to completing it on schedule.

During the legislative drafting stage, there is the potential for tension to arise due to the need to have a law in place to match the schedules of the SMR programme and projects, which as mentioned may be implemented with shorter construction and lead times. This situation could result in several problems. For example, there may be insufficient time given to stakeholder engagement with the aim of obtaining a clear perspective on how a new or revised law could affect persons and institutions having an interest in the nuclear field. In addition, the benefits to be gained through an independent review, such as through IAEA legislative assistance, to assess the adequacy of the draft legislation in relation to the international normative guidance, may also not be fully realised.[77] Significantly, if not carefully managed there is the potential for undue pressures to arise in the context of the legislative stages. This situation may lead to a lack of a thorough (institutional and public) legislative scrutiny through a deficiency of consideration, debate and review. Such fast-tracking may risk undermining the democratic legitimacy of the legislation and of the parliament or legislature. Such a situation could arise, for example, if motivated by political considerations when the government needs to or is pressured to act quickly due to SMR programme and project schedules.

Regulatory Body Competence

The enabling environment for SMR deployment as considered in this paper also needs to consider the apparent steeper learning curve for SMR recipient countries in establishing competent regulatory bodies considering shorter construction and lead times for SMRs.

Competence of regulatory staff is one of the prerequisites for the safety and security of nuclear facilities. Significantly, a recipient's regulatory body will need to develop the competencies and capabilities to make safety and security-focused decisions to respond to programme development in a timely manner without compromising safety. The IAEA's competence model is based on a quadrant structure of: competences for legal, regulatory and organizational basis; competences for technical disciplines; competences for regulatory practices; and personal and behavioural competences.[78]

Achieving a fully competent and functional national regulator body for a nuclear power programme is acknowledged as taking a considerable period of time and that external support would be required even post-operation to help maintain a high level of safety regulation Once a nuclear law has been adopted that provides the regulatory body with a clear mandate and authority to carry out its mission, the regulatory body needs to develop the regulatory

[77] As an activity under the Legislative Assistance Programme, the IAEA can assist a Member States, upon request, in establishing, implementing and maintaining comprehensive national nuclear legal frameworks which implement a state's international obligations and commitments.

[78] SARCoN (Systematic Assessment of Regulatory Competence Needs for Regulatory Bodies of Nuclear Facilities) is an IAEA methodology and tool (used extensively by Member States' regulatory bodies) to facilitate the analysis of competence needs, available competences and competence gaps.

framework and to undertake the initial activities including the development of regulations, guides and a licensing process.[29] The regulatory body should establish a comprehensive human resources programme to develop the specialized areas of competence to conduct its activities in Phases 2 and 3 of the Milestones Approach.[16]

In the context of licensing the first traditional NPP, the recipient's regulatory body has the benefit over a period of some years from the start of construction to the start of commissioning, to implement an intensive programme to enhance its managerial and technical competencies. Licensing in the context of the NPP Milestones Approach is a major regulatory activity in Phase 3, with the practice in many States to issue a construction licence and an operation licence during this phase. However, experience shows that some NPP recipient regulatory bodies, even those in Phase 2 of the Milestones Approach,[16] continue to lack technical capability, skilled personnel and core competences.

Even in the context of a traditional NPP with typically long lead and construction times, it is recognised that it is not realistic to expect a regulatory body to develop early-on all the competencies required to perform critical tasks such as establishing the licensing framework including the issuing of the licensing requirements, reviewing the design and issuing licences. The potential for a mismatch between what the regulatory body needs to do and what it is indeed capable of doing, has been recognised.[29] Furthermore, even if the regulator has experience with research reactors, it is accepted that there is likely to be a mismatch between the schedule for issuing a construction licence and the ability of a recipient's regulator to carry out an independent review of the preliminary safety analysis report (PSAR).[29] At the same time, it is acknowledged that the regulatory body must take progressive steps to improve its technical competence.

SMR designers claim enhanced safety characteristics that require technically qualified regulators to assess, certify and license them. The use of new technologies such as SMRs introduces additional considerations in judging whether a future licensee is competent to perform licensed activities. SMR technologies do not represent any shortcuts to establishing a competent, effective and trusted regulatory body.[35] There is a need therefore for SMR recipient countries to fully understand, plan and incorporate into their SMR programme and project plans, the time required for the development of such a competent body.

In the context of SMR deployment, the recipient country's regulator facilitates the safe conduct of licensed activities by ensuring that the licensee carries out activities in compliance with the licence, thereby keeping risks reasonably low and at a level that is generally acceptable to the Member State. It needs for example to ensure that the licensee has plans and processes in place to build technical competencies to understand the new technologies being considered. The regulator will need to provide significant guidance to enable a licensee to establish a programme for developing technical competency. Further, the regulator will need to provide detailed guidelines to help the licensee establish management system programmes and processes. In addition, the regulator should have the capability to evaluate the licensee's organization to confirm that it understands which programmes and competencies need to be in place to support the licensing process and ensure that activities are being conducted in accordance with a licence.

The time to develop the needed competencies may not be available to an SMR recipient: potential future SMRs deployment would appear to require a steeper learning curve. In the case of an SMR deployment, it is not necessarily the case that a smaller reactor design means a shorter duration for technical assessment. Any shortening of the timeline could reduce the credibility of the licensing process.[6] Furthermore, the regulatory framework in a recipient country may be untested. Whether adopting processes from other countries or building a

regulatory framework from scratch, pre-licensing and licensing timelines need to provide additional time to test and interpret the regulatory framework. It follows that if not carefully managed, a potential misalignment of the schedules for the SMR programme and the regulatory framework may result in conflicts which could result in undue pressure being placed on the relevant organizations, including SMR recipient's regulator, to make sure that staff are recruited in time and trained. Such undue pressure could impact the regulator's effectiveness as concerns its safety and security responsibilities.[29]

Cleary, there is a strong need to avoid any undue pressure on the regulatory body which could unduly impact its effectiveness and independence, including, increased pressure to prematurely grant licences. SMR recipients should therefore ensure that the regulator be given sufficient financial resources to recruit and train staff so that at the appropriate stages of the SMR development there are regulatory staff that can carry out their statutory regulatory obligations in a competent and timely manner. There is also an apparent need for an SMR recipient's regulatory body to receive substantial ongoing support from an experienced nuclear regulatory body, reducing over the lifetime of the plant as the regulator gains experience and enhances its capabilities.

15.5.2. Enhanced Assistance of an SMR Vendor Country and its Regulatory Body

The area of regulatory development and licensing can be considered as one the most important challenges to SMR deployment.[35] The choice of an SMR vendor will not only impact the development and implementation (including schedule) of the SMR programme and projects but can also impact the design of the legislative and regulatory framework including the licensing process. Significantly, in developing and implementing the framework many SMR recipients can be expected to rely heavily on the support of an SMR vendor country and its regulatory body.

In addition to the need for support for financing, many SMR recipients may seek long-term safety cooperation packages. There should be a close technical and regulatory relationship between the vendor country and the receiving country.[26] Moreover, there should be a smooth and clear interface between the regulatory bodies on technical questions related to the design, manufacture, construction and operation of the exported reactor. Assistance by SMR vendor countries to new operating organizations in recipient countries can be expected to help in establishing the necessary competencies to operate the technologies they are exporting. However, the new operating organization should recognize differences in the legal framework of its country versus the vendor country.[35]

Bilateral 'arrangements' or 'agreements' with safety-related agencies or ministries may cover the exchange of regulatory and safety research generally and co-operation on specific safety research projects. Areas to be addressed may cover, for example, the establishment of the legislative and regulatory framework including, support in the establishment of a fully competent and functional regulatory body (such as through training of selected staff at the vendor's regulatory organization, provision of experts for short and long-term periods, assistance and education in adapting safety evaluations), provision of safety documentation and on a continuing basis information on any significant design or operating changes, developing national regulations and requirements, licensing and inspection, joint meetings to review safety and regulatory questions, as well as capacity-building through education and training, as well

as technical assistance, maintenance and operational know-how and experience feedback. [79] Support may be also needed for the regulator to develop enhanced regulatory guidance, skill sets and the capacity to assess a future SMR licensee's programmes, essential competencies and abilities to conduct activities.

Further, on-going international transports of SMRs can be expected between recipient and vendor countries during a reactor's lifetime, in particular, for relocation (transport), maintenance, and decommissioning.[80] There is then a need for close cooperation between vendors and recipients, as well as concerns manufacturing, testing and operation. Regulatory requirements will need to provide clarity on what legally constitutes construction versus manufacturing. This legal definition may vary between States.

Effective licensing in part depends on the technology readiness or maturity level of the SMR design. Licensing risks are in fact a combination of the adequacy of the safety documentation provided by the licensee and the preparedness of the regulators to review the reactor technology. An SMR recipient's regulator must be prepared for a significant challenge in analyzing the safety case for an advanced reactor. Adjusting or developing regulatory requirements, particularly, in the case of non-LWR SMRs will also be particularly demanding.

15.5.2.1. Establishing Regulations and Requirements

The current international normative guidance provides for an approach by which NPP recipients adapt or adopt key elements of the regulatory framework of the vendor country (or an experienced country that has licensed the same type of technology).[29] We should expect also that the regulatory framework of some SMR recipients to be modelled on that of the SMR vendor.[29]

National safety requirements need to take into account the specific features of SMRs, not only in terms of applying a graded approach to existing safety requirements due to their smaller size and lower risk impact, but also in updating them when new features may represent a risk to safety e.g. siting requirements for underground or underwater reactors.[6] Similar to traditional NPP recipients, inexperienced regulator's in SMR recipients will clearly be challenged in seeking to licence their first SMRs.[81] In the case of SMRs however this issue may arise due to uncertainties regarding applicable safety requirements, which at present focus mainly on the reactor designs commercially deployed. For these countries, the development of a comprehensive set of regulations and guides addressing nuclear safety and security will require significant efforts.[25]

In developing regulations and guides, consideration should be given to initially adopting, either directly or as a reference, the IAEA's safety standards to form a set of technology neutral regulations for siting and design (later complemented by more design specific technical

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[79] For recent examples of how traditional NPP newcomers and expanding countries have addressed some of the issues see IAEA, Experiences of Member States in Building a Regulatory Framework for the Oversight of New Nuclear Power Plants: Country Case Studies, IAEA-TECDOC-1948, IAEA, Vienna (2021). Also see IAEA (2009) Common User Considerations (CUC) by Developing Countries for Future Nuclear Energy Systems: Report of Stage 1, Nuclear Energy Series No. NP-T-2.1, IAEA Vienna; and IAEA (2000) Guidance for Preparing User Requirements Documents for Small and Medium Reactors and their Application, TECDOC No. 1167, IAEA Vienna.

[80] However, it is not necessary the case that the same SMR will be returned back to a recipient country.

[81] See the Tallinn Declaration on the Future of SMR Licensing signed by nine European organizations of February 2021 which in identifying issues important to overcoming licensing and regulatory challenges faced in SMR deployment, sets-out nine principles to promote SMR licensing.

guides/standards). In the context of a deployment scenario as considered in this paper and where technology selection has been decided early on, an option is to start the development of national regulations and guides by adopting or adapting those from the vendor country (or an experienced country that has licensed the same type of technology, if one exists), albeit this would not necessarily lead to a set of technology neutral regulations.

The full adoption of an SMR vendor countries regulations and requirements may not be economical and practical. Further, owing to differences between the two countries' legal and governmental infrastructures, and available resources, it is unlikely that the SMR recipient's regulator will be able to adopt the regulations without revision. In order to do so, the regulator will need to have an understanding of the basis for the regulations in terms of their technical background and significance and the legal and regulatory framework in the SMR vendor state, not least so that subsequent regulatory actions or changes can be fully and knowledgably evaluated.[16] [23] Further, where there is interest in different designs coming from different SMR vendor countries, SMR recipient's regulator should particularly take care of those safety requirements that are not technology neutral. In any case, there is a clear need for national regulations to be developed to cover the localisation of the plant and the analysis of site-specific issues.

15.5.2.2. Utilising Assessments of the SMR Vendor's Regulatory Body

In the context of the first NPP, it is expected that the 'reference plant' concept will be employed whereby the country's first NPP would have essentially the same design and safety features as a NPP that is already licensed by an experienced regulator.[29] The concept of reference plant has been used for long in many countries for traditional NPPs to describe a plant design which has been licensed in one country (the vendor country), which assessment is later relied upon by the regulatory body of another country to inform its own licensing decision when licensing that plant design.[29][82]

Regulatory review and assessment of reference or generic facilities and activities, and of similar facilities or activities in a vendor state, should be considered, if this would contribute to the licensing process.[31] In addition to the common practice of a recipient's regulator considering international good practice and IAEA safety standards, the assessments undertaken by an overseas regulatory body, including of the vendor country, are also considered. This on the basis that the standardized (i.e. not site specific) safety case be later supplemented by site specific and installation specific safety assessments (e.g. environmental impact assessments).

While design review and acceptance is just one part of the licensing process for nuclear reactors, the approach can facilitate the licensing process in an informed manner by the recipient regulator notwithstanding the country specific licensing for the specific site-plant interface safety issues. In the evaluation of the PSAR, the regulatory body could learn considerably from the existing Safety Evaluation Report (SER) written as part of the licensing process for the reference plant and could obtain important insights from the results of various safety analyses that were completed for the reference plant.[29] Such an approach will also help ensure coherence and internal consistency, which will be of importance for licensing the SMR. It also

[82] In 2008, INSAG introduced the reference plant concept to encourage new entrant countries to base their first construction on this concept: IAEA Nuclear Safety Infrastructure for a National Nuclear Power Programme supported by the IAEA Fundamental Safety Principles, INSAG-22, IAEA, Vienna (2008).

enables the transferring of knowledge between regulatory bodies and facilitates the licensing process through a close collaboration between them.

The approach offers the potential for harmonized approaches between the countries including utilising the regulatory framework and regulatory assessments. Sharing elements of design assessments can be expected by an SMR recipient's regulator and a recipient's regulator. While it is possible for the recipient regulator to review information used in the country of origin's process, it should however be able to understand the rationale for the country of origin's decisions, recognizing that the laws in that country and the rules on the application of codes and standards can be substantially different. Thus, this is not necessarily a straight-forward task.[83] Achieving this may be more straightforward in countries that do not have a well-developed framework in place. The use of the existing work from the SMR vendor country's regulator will be most effective if the new SMR recipient's regulatory body follows the same regulatory approach as the experienced regulator. However, the regulatory approach is based on the national laws of the SMR vendor country and the feasibility of this option would depend on the laws in the SMR recipient country. In this context, an SMR recipient' regulator should be aware that the development of the regulatory framework involves maintaining a balance between the different regulatory approaches which can be prescriptive or non-prescriptive or goal setting. The type of approach chosen can have a major impact on the necessary number and qualifications of the regulatory staff, as well as implications for the need for external expert support for the regulatory body. For an SMR recipient, each regulatory approach may be considered as having benefits and disadvantages.

15.5.3. Strengthening Regulatory Certainty

A precursor for successful SMR modularisation and a critical design philosophy is standardisation of design.[84] To become cost-effective, economies of factory fabrication and serial mass production of standardised modules need effectively and efficiently exploiting.[85] Standardised SMRs will need deploying in significant numbers world-wide: multiple units need developing and multiple SMR programmes and projects need nurturing. Restraining the potential of a future deployment of an internationally standardised SMR design and undermining the potential economic competitiveness, is the danger of country specific regulation-driven design changes due to a lack of international consistency and harmonization of regulatory requirements.[26]

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[83] The system of regulations (and guides) for facilities and activities are developed (and issued) by each national regulatory body based on the national legislative framework. When deciding on the structure and style of the regulations, the SMR recipient's regulator should consider the country's legal system, the nature and extent of the facilities and activities to be regulated, the availability of technical expertise and other national circumstances. Where the regulatory body is not authorised to issues regulations, the legislative and governmental mechanisms shall ensure that such regulations are developed and approved in accordance with appropriate time-scales.

[84] For a discussion of International Standardization of Nuclear Reactor Designs: A Proposal by the World Nuclear Association's Working Group on Cooperation in Reactor Design Evaluation and Licensing (CORDEL Group), 2010. Efforts continue in different fora towards international standardization of reactor designs, licensing and international harmonization of safety requirements. Notable is the work of the World Nuclear Association through its CORDEL working group (Cooperation in Reactor Design Evaluation) and Licensing (CORDEL), as well as the activities of MDEP (Multinational Design Evaluation Programme) and ERDA (European Reactor Design Approval).

[85] A new 3-year, Coordinated Research Project (CRP) has been launched focusing on the economics of SMRs, including micro-reactors, by providing Member States with an economic appraisal framework for their development and deployment. IAEA Press Release, 25 March 2020.

Predictability of licensing is a key regulatory risk in any nuclear new build project. The risk of design changes may of course arise in the context of modular traditional NPPs. However, a potential future international SMR deployment may not materialise in the absence of a strong likelihood of being able to build standardised modules, which will not need (significantly) adapting pursuant to non-identical national requirements in different recipients. Without certainty, SMRs potential affordability and economic competitiveness appears to be undermined, as is the whole premise of SMR modularization and standardization and the prospects of any potential future SMR deployment, being unduly nipped in the bud.[26]

The enabling environment should address the need for regulatory certainty which is apparently essential for successful deployment of standardised modules in different countries but is considered by some SMR proponents to be lacking under the current system. There is an apparent need for a licensing system which facilitates deployment of fuelled SMRs modules produced in one country, for transport to and operation in another country including the need to address issues of design extension conditions and design change management. Even the IAEA International Nuclear Safety Group (INSAG)[86] considers that if the contemplated benefits of advanced designs are to be realized, the licensing system should be modernized.[27] While members of the SMRs' Regulators Forum agree that while efficiencies can be gained in existing processes, they consider that in many cases, it is not necessary to develop new licensing processes for SMRs as they are sufficient.[6]

The key reasons as to why adaptation of reactor designs may occur, are well understood and established. There exists diversity of overall national regulatory frameworks, a wide variety of national licensing processes and the number of licensing steps. In this context, to strengthen regulatory certainty, multilateral approach can represent a way forward.

15.5.3.1. Inherent Limitations to Enhanced Regulatory Certainty

Differences in regulatory frameworks stem for example from constitutional and general legal frameworks, legal traditions, cultural and social norms, scientific, technical and industrial capacities, and financial and human resources. Regulating safety is a national responsibility as embodied in the relevant international legal instruments. National regulatory bodies are prescribed the statutory obligation for the regulatory control of facilities and activities with the aim of fulfilling the common fundamental safety and security objective to protect people and the environment from harmful effects of ionizing radiation. The regulatory body should have clearly defined regulatory functions, particularly, authorization; review and assessment, inspection and enforcement, as well as the development of regulations and guides.

The regulatory body, as the licensing body, has to be able to license and regulate SMR designs to ensure that all safety, environmental, regulatory and policy issues are addressed and resolved. Each regulatory body is bound by law to apply their national safety requirements and licensing procedures. The licensing process is the principal means by which the regulatory body is able to initially apply the legal and regulatory framework and by which the responsibilities of the SMR applicant or operator are clearly connected to the legal framework. The licensing process and requirements have their basis in each country's legislation which invariably differ from country to country.

[86] Created by the IAEA Director General in 1985, INSAG is a group of experts with a high level of professional competence in the field of safety. INSGA has the objective to provide authoritative advice and guidance on nuclear safety approaches, policies and principles.

Licences are granted or denied in accordance with the legal and governmental framework in each country. The objective of granting authorizations is for the regulatory body to establish effective regulatory control for safety throughout the lifetime of the SMR or conduct related activities. After the initial license is granted, the license may be amended, renewed, or otherwise modified. In addition to the reactor design, the initial licensing process covers, assessments of the site and applicant, as well as construction and operation. The recipient's regulatory body must have confidence that the SMR is constructed in a way that meets the design requirements. This is typically accomplished by examining design documents and performing construction inspections onsite and at vendor facilities.

Diversity in regulatory control and oversight is generally considered acceptable if it is supported by an effective national framework developed on the basis the applicable international obligations, principles, and standards of regulation. Already, there is a degree of harmonisation of basic safety requirements in high-level regulatory documents and, at least partially, in legal provisions which are based on the fundamental principles and addressing common elements. In parallel with the IAEA's recommendations to assess the site characteristics and basic safety features of the reactor's design, the construction, the pre-operational test programme and the operations, most countries have developed their own licensing processes. However, safety regulations and requirements do vary at different levels of detail based on the different philosophies or approaches (regimes) to regulation, ranging between "prescriptive" (which is the most common), "performance based" and "goal-setting".[87] Generally, drafters of the nuclear legislation should have a clear understanding of the regulatory approach chosen.

Further, depending upon the national legal framework or administrative practices, the number of steps in a licensing process can also differ, ranging from a one-step process with several regulatory hold points through to multiple-step processes with specific site or commissioning licences required.[88] While it is not necessary to reflect in the text of the law, detailed substantive or procedural matters regarding licensing, such matters being more efficiently handled in regulations, it can still be useful to set forth in the law basic legal requirements for the most significant aspects of the authorization process. In any event, it is clear that in a given lifecycle stage, there may be several Key Regulatory Interventions (KRIs) set by national legislation and regulatory requirements.

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[87] For example, the UK is well known for its non-prescriptive, goal-setting approach. The development of the regulatory framework involves maintaining a balance between the different regulatory approaches which can be prescriptive or non-prescriptive or goal setting. The type of approach chosen can have a major impact on the necessary number and qualifications of the regulatory staff, as well as implications for the need for external expert support for the regulatory body. The goal setting (or performance based) approach is typical of countries that base their nuclear programme on open market principles (rather than a country development strategy promoting the domestic industry. While the U.S.A. licensing approach is sometimes considered a prescriptive based approach, it also contains elements of goal setting. For an SMR recipient, each regulatory approach may be considered as having benefits and disadvantages. Both approaches, or combinations thereof, can be used to establish versatile regulatory approaches but there will always be a need to balance the need for flexibility in technological innovation with the need for regulatory certainty.

[88] State practice for licensing NPPs varies widely in terms of the number of licences issued and the time at which they are issued. The licensing process for nuclear installations can typically be divided into the following seven stages: (1) siting and site evaluation; (2) design; (3) construction; (4) commissioning; (5) operation; (6) decommissioning; and (7) release from regulatory control). Experience has shown that there is some overlapping of these stages. Each step of the licensing process may be divided into several sub-steps or may be merged or combined as appropriate to facilitate the regulatory process. Licensing processes can generally be divided into two groups: two-step licensing, (including Preliminary Safety Analysis Report and Final Safety Analysis Report phases); and one-step licensing, consisting of a single combined licensing phase. See IAEA, Licensing Process for Nuclear Installations, IAEA Safety Standards Series No. SSG-12, IAEA, Vienna (2010).

Additionally, there may or may not be pre-licensing process where a generic approval is given for a design (and or site), independently of a particular reactor project e.g. certifications, acceptance confirmations or other terms. Pre-licensing an licensing activities may occur in parallel, but typically licensing follows pre-licensing. The basis for such generic assessment of designs may or may not be established in the nuclear law or by the regulatory body.[89]. Where they exist, pre-licensing processes vary greatly between countries. Nonetheless, pre-licensing activities generally fall into two categories: design review and early site approval or permit. Generally, pre-licensing of designs or sites is seen by the nuclear industry as an effective means of enhancing the predictability of the duration and outcome of licensing processes.[42] The experience gained to-date highlights the importance of pre-licensing activities in SMR deployment. Pre-licensing applicants may either be a reactor vendor or designer, a prospective owner-operator organization or a combination of these.[42] Pre-licensing design reviews serve to identify potential barriers to granting the new design the required construction and operating licences. Certification of a standardized design could help to ensure that two nuclear installations of the same design would not vary significantly from each other, except for variations required due to site requirements. However, while certification of an SMR reactor or module designs is an acceptable approach to use in a licensing process, it is not necessary to have it in place to have an efficient licensing process. Furthermore, the decision to adopt a certification regime is a national decision.[6] Finally, it is also noted that there are also a number of non-nuclear permits which are typically required for nuclear power projects including environmental permitting processes.

15.5.3.2. Enhanced Regulatory Certainty Through Multinational Safety Review of SMR Designs

Inexperienced regulator's in SMR recipients will clearly be challenged in seeking to licence their first SMRs. Relevant assistance from the IAEA will prove invaluable to many SMR recipients and their regulatory bodies. Moreover, regulators' be expected to participate in the various multiple international and regional networks, initiatives, technical cooperation forums of regulatory bodies and other cooperation activities which contribute to increased info sharing among embarking countries and their regulators, as well as future SMR operators. For example, there is the Global Nuclear Safety and Security Network (GNSSN) and in addition to regional networks of regulators and the SMR Regulators Forum, there is the Regulatory Cooperation Forum (RCF) established in 2010 as a mechanism by which recipients can attain efficient regulatory bodies through support from countries with established nuclear power programs.[90]

Supplementary to enhanced bilateral cooperation (with an SMR vendor's regulatory body), a potential future international deployment of SMRs may provide a catalyst for increased multinational regulatory cooperation, supplementary to bilateral cooperation. A multi-national approach can serve to streamline and strengthen the process, augmenting the capacities that any SMR recipient's regulator could bring to the table. It is recalled that back in 2006 INSAG

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[89] The NRC has the legally defined process, the design certification and early site permit process. Other countries may have informal non-legally binding process, the review of which cannot be relied on for licensing purpose. For example, the UK ONR established non-binding GDA (Generic Design Assessment) additional to the Nuclear Site Licence process. The French regulator ASN's review of "review of safety options" is non-binding, additional to the authorization decree (DAC) as the main licence plus the operating permit.

[90] The RCF is open to all IAEA Member States. As of September 2020, the RCF comprised: 12 providers: Canada, China, Finland, France, Japan, Korea, Pakistan, Russia, UK, USA, EC and IAEA. 14 recipients: Jordan (2010 active), Viet Nam (2012 active), Poland (2014 active), Belarus (2014 active), Bangladesh (2018 active), Chile, Egypt, Iran, Nigeria (2018 active), South Africa, Sudan (2018 active), UAE, Ghana (2017 active) and Morocco (2017 active). 3 observers: Germany, Kenya and OECD/NEA.

already was highlighting that the multinational cooperation among regulators for the safety review of new reactor designs intended for construction in their respective countries, was considered timely.[91] Since that time, cooperation of regulators in the assessment of reactor designs for new NPPs is being carried-out, in particular, by a multinational initiative - the Multinational Design Evaluation Programme (MDEP).[92] Recently, there is an advanced proposal on an EU common pre-licensing reactor design evaluation process and "acceptance" with a specific focus on the scope and content both of the review and the resulting statement by the participating authority/authorities.[93]

A good example of how two national regulators can cooperate towards the harmonization of reactor design review and licensing processes is the bilateral level cooperation between the Canadian Nuclear Safety Commission (CNSC) and the United States Nuclear Regulatory Commission (USNRC). In August 2019, they concluded a Memorandum of Cooperation which foresees cooperation in the "[d]evelopment of shared advanced reactor and SMR technical review approaches that facilitate resolution of common technical questions to facilitate regulatory reviews that address each [of their] national regulations;" as well as "collaboration on pre-application activities;" [and] "the development of regulatory approaches to address unique and novel technical considerations for ensuring the safety of advanced reactors and SMRs."[94] In December 2019, the CNSC and NRC, established a mechanism that allows an SMR design to be jointly reviewed by the two regulators.

Extending such bilateral cooperation to a multilateral/international level can be foreseen in order to fully realize the benefits of harmonizing requirements across national borders. Over the next decade, it can be expected that like-minded potential SMR recipients' regulators (supported by the collaboration of TSOs who could perform joint design reviews under the auspices of a group of regulators) will voluntarily cooperate by undertaking non-project specific design reviews and assessments of SMR designs to support national decision making. SMR vendor countries support to international co-operative activities, including those of the IAEA, can be expected to build the confidence and competence of SMR recipients' regulatory bodies. Such support may include SMR vendor countries making available to the IAEA general regulatory expertise and information which has broad applicability or utility. Further, the effort to undertake non-project specific design reviews and assessments should be supported by an SMR vendor country's regulator and other regulators experienced in licensing the technology. Clearly, site- or country-specific issues must be considered separately, as should the capabilities of each applicant.

An alignment of the national regulatory requirements of the participating states, would clearly greatly facilitate such work from the outset but in the absence thereof, the technology neutral IAEA standards on safety assessment and on reactor design would be a useful starting point. Covering generic reactor design requirements, the activity would need to be made considering

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[91] IAEA, International Nuclear Safety Group. Strengthening the Global Nuclear Safety Regime (INSAG-21), (2006).

[92] The Multinational Design Evaluation Programme (MDEP) is an initiative under the NEA (Nuclear Energy Agency of the Organisation for Economic Co-operation and Development) to develop innovative approaches to leverage the resources and knowledge of national regulatory authorities who are, or will shortly be, undertaking the review of new reactor power plant designs.

[93] ENCONET, Benchmarking of Nuclear Technical Requirements against Wenra Safety Reference Levels, EU Regulatory Framework and IAEA Standards (ENER/2017/NUCL/SI2/760935) Ref: ENER/D2/2016-677, February 2019.

[94] Memorandum of Cooperation on Advanced Reactor and Small Modula Reactor Technologies Between the United States Nuclear Regulatory commission and the Canadian Nuclear Safety Commission, 15 August 2019.

the scope and level of detail of such reviews and assessments, as well as the different regulatory frameworks (licensing processes, requirements and approaches).

Possibly being carried out under IAEA auspices, an initiative can be expected to be carried-out in light of IAEA Generic Reactor Safety Review (GRSR) or tailored generic or specific SMR design service which provide a high-level initial evaluation of the safety case against IAEA standards on safety assessment and on reactor design. GRSR is an example, albeit of a very reduced scope and limited depth, of a design review having an international effect, independent of a national project. Upon application by a Member State, a team of IAEA experts reviews a reactor design against IAEA safety standards and issues a report stating whether or not compliance has been achieved. However, this review is not comparable to a full scope design review as performed by a national regulator, especially as the IAEA review does not consider national safety requirements and does not have any binding effect on any national licensing procedure.**[35]**

Enhanced multilateral cooperation on safety reviews of SMR designs would not lead to design approvals which would be issued by the participating regulators separately. The current situation seems unlikely to change in the future. Rather, each regulator would still retain its sovereign authority and responsibility for licensing decisions. Instead, the approach may be considered as providing a useful exercise for each recipient's formal licensing process, irrespective of whether pre-licensing exists.

Notwithstanding the potential utilisation of the regulations and requirements of a vendor country, the sharing of design assessments and a potential increased in multinational safety reviews of SMR designs, several proponents of SMR technologies are seeking harmonisation of codes, standards and regulatory requirements. They highlight that standardization of SMR reactor designs necessitates an alignment of national safety standards, in addition to strengthened increased cooperation among regulators. Also, they state that the current design and licensing rules are applicable to mostly large LWRs and there are no accepted rules in place for design, safety assessment and licensing for new innovative reactors. In this context, there are calls for licensing processes to be modified, adapted or even simplified to address unique features presented by SMRs such as smaller size, difference in design and alternative approaches for construction e.g. modularity. Purported benefits to be realized from streamlining licensing efforts include improved safety, enhanced design efficiency, avoidance of unnecessary design complexities, regulatory efficiency, and lower costs.[42]

Some proponents also consider SMRs as an early opportunity for seeking multi-lateral or international regulatory approvals. They have proposed international licensing solutions ranging from validating and accepting design approvals, to an international design certification being separate from site-specific approvals and operational requirements. [32][95] Analogies have been drawn to the aviation industry where international standardisation and harmonisation of

[95] See [32] and [42]. Also: WNA, Aviation Licensing and Lifetime Management – What Can Nuclear Learn?, A Report by the World Nuclear Association's Working Group on Cooperation in Reactor Design Evaluation and Licensing (CORDEL Group), World Nuclear Association, January 2013;. WNA, Licensing and Project Development of New Nuclear Plants, Licensing and Permitting Task Force, World Nuclear Association, January 2013, reprinted August 2015; WNA, Harmonization of Reactor Design Evaluation and Licensing: Lessons Learned from Transport, World Nuclear Association in cooperation with CANDU Owners Group, Report No. 2020/012, December 2020; Christian Raetzke and Michael Micklinghoff, Regulatory challenges in the licensing of new nuclear power plant – From CORDEL to ERDA, atw 57. Jg. (2012) Heft 12 | December; and Kristina Soderholm, Licensing Model Development for Small Modular Reactors (SMRs) – Focusing on the Finnish Regulatory Framework, Lappeenranta University of Technology, September 2013.

design approval and change management procedures have been adopted. Even in the case of an international design certification, it is still claimed that each country's regulator would remain responsible for a comprehensive licensing and oversight process. Moreover, it is stated that national regulatory processes would not be subordinated or limited by foreign decisions.**[32]** Further, that any reactor design with design certification in its country of origin would still have to be licensed by the recipient's regulator, although the regulator should be able to utilise technical assessments completed in the country of origin.

Progress in harmonization of national safety requirements across different countries is apparently needed to eliminate the need for customization of designs in order to adapt them to the regulations of every country separately.[96] For some, such harmonisation is a prerequisite for common reactor design acceptance. Another view is that common reactor design acceptance can be achieved without harmonizing all requirements.

While there are various international cooperation mechanisms and while regulators often consider standards and requirements stemming from the NPP vendor's country, there is no mutual acceptance or endorsement, even partially, of design approvals or licences.[6] Each regulatory body's licensing decisions are based on its own processes and national legislation. There exists no mutual acceptance of approvals or licences. Moreover, there is no "importing" of licensing decision from a foreign regulatory body. This being against the principle of independence of the regulatory body and its decisions, as enshrined in international legal instruments and embedded in IAEA Safety Standards. To accept imported licensing decisions, implies to ignore the basic principle of regulatory independence.

Although nuclear licensing will no doubt remain a sovereign activity, harmonization of national safety requirements will allow greater international standardization, which serves both safety and economic objectives.[24] However, while greater harmonizing of requirements on an international scale appears desirable not least to improve SMR economic viability, it will be a significant long term and complex challenge that will require significant cooperative investments by governments.

Further, a paradigm shift in global licensing despite increasing the market and potential for SMR deployment, seems unlikely and a potential SMR deployment will not lead to SMR recipient states relinquishing their obligations and responsibilities for safety and security. It will remain the exclusive right and duty of national regulators to formally accept the standardized designs and to make a full assessment of the suitability of the site and of the operators' capabilities before issuing the operating licence for any given SMR. For it to be otherwise, fundamental changes would be needed to existing national legislative and regulatory frameworks, as well as relevant international legal instruments, standards and guidance.

Nonetheless, over the next decade it can be expected that SMR recipients will seek to further harmonize their regulatory approaches and requirements, with due consideration of national arrangements and national safety policies. The aim should be to improve understanding, minimize regulatory uncertainties, and facilitate regulatory decision-making processes. Such efforts may be driven by the desire, if not the need, of both to seek an alignment of a recipient's regulatory framework with that of the vendor country. A potential challenge to the pursuit of

[96] There is also a need to pursue internationally common codes and standards as many countries have developed their own such as mechanical codes or instrumentation and control (I&C). There are common standards in defining overarching utility requirements for new reactor designs such as in the US the Utility Requirements Document (URD) and in Europe the European Utility Requirements (EUR).

regulatory certainty across different countries, is the need to ensure that SMR recipients' obligations and responsibilities for ownership of licensing is maintained. We should be mindful that SMR deployment may push the limits as to what is currently understood as being acceptable. Some SMR recipients may be interested in considering the acceptance of a design certification given by the SMR vendor's regulator as it "would relieve the strain on regulators' resources."[97]

15.6. CONCLUSION

In 1953, a declared special purpose of atoms for peace would be to provide abundant electrical energy in the power-starved areas of the world.[98] "That vision has yet to be realized."[99] As the developing world advances, the demand for energy is growing significantly. Significantly, SMRs could possibly fulfil the long-held and unfulfilled promise of nuclear technology to the developing world as a whole: "energy for development".[100] That is, to play a significant role in providing long-term energy security as a source of clean, affordable, reliable, sustainable and modern energy that meets growing energy demands for development and provides a basis for sustainable economic growth and improved human well-being.[101] SMRs may be particularly attractive to developing countries because their total cost should be more manageable than that of a GWe scale traditional LWR reactor and the electrical output may be more appropriate for smaller grids, in addition to the promised safety advantages, faster construction, and reduced operational costs.

As submitted in this paper, several inter-related developments need to be made over the next decade at the international and national levels with the aim of developing an enabling environment in order to realise a potential future international SMR deployment and for potential target countries, including, developing countries to benefit from them. In realising such a deployment, there is a need for the nuclear community, including, States, IGOs, national regulators, operators, vendors, contractors, equipment suppliers, TSOs, standards organizations, and architect-engineers to confront the challenge before it. This paper has considered four elements of the needed enabling environment as concerns a scenario involving a potential mid-term (mid 2030s) deployment of LWR SMRs to developing countries.

Creating an enabling environment for nuclear deployment is more than ever relevant should SMRs play significant role in the future. Central to this enabling environment for successful international SMR deployment is the need for strengthened bilateral cooperation between SMR vendors (including industry) and recipients including their regulatory bodies. It is clear that governments, regulatory bodies, vendors and recipients of nuclear technology must work together to give nuclear power a meaningful role in the developing world. The IAEA can also be expected to continue assisting countries embarking on an SMR programme and projects to do so knowledgeably, safely and securely. Any adaptions of national regulatory frameworks for licensing SMRs needs to respect both national sovereignty and the independence of the regulatory body in SMR recipient countries.

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[97] Supra note 67.
[98] Address by Mr. Dwight D. Eisenhower, President of the United States of America, to the 470th Plenary Meeting of the United Nations General Assembly, Tuesday, 8 December 1953, 2:45 p.m. The Atoms for Peace speech paved the way for the creation of the IAEA.
[99] IAEA, Statement by the IAEA Director General Dr. Mohamed ElBaradei, Addressing the Global Challenges of Energy Security, 6 September 2007.
[100] IAEA, Fulfilling the Atomic Promise, IAEA Bulletin Vol. 9-5, October 1967, IAEA, Vienna.
[101] IAEA, Nuclear Power for Sustainable Development, IAEA November 2017; and Rogner, H. (2010). Nuclear Power and Sustainable Development. Journal of International Affairs, 64(1), 137-163.

On a final note, the first session of the IAEA Nuclear Law Institute (NLI) held in 2010 was a year in which interest in starting new nuclear power programmes remained high, with over 60 IAEA Member States having indicated to the Agency their interest in considering the introduction of nuclear power.[102] The publication in which this paper is included commemorating the first decade of the NLI in 2020 is a year in which interest is growing in a potential future deployment of SMRs world-wide. By the time of the second decade of the NLI in 2030 it may be expected that the needed enabling environment is maturing.

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16. ENACTING THE KENYA NUCLEAR REGULATORY ACT 2019

Eddie Omondi [1], [2]
Humphrey & Company LLP

16.1. INTRODUCTION

16.1.1. Background

Developing good quality national legislation still remains a challenge in most jurisdictions, even in developed countries. It goes without saying that the international nuclear law regime poses an even more daunting task in this context because of its complexity, technicality and prescriptivity. It is critical that legislative bodies, policy makers and drafters of national legislation appreciate the 'specialty' of nuclear law. At the same time, it is important that the public and stakeholders sufficiently understand its complexity so as to be able to meaningfully participate in the legislative process and to have the capacity to analyze and ensure strict adherence to established standards and protocols.

16.1.2. Energy Outlook in Kenya

Kenya has an estimated population of 48 million people, with a 38% electrification rate with an urban uptake of 83%. With over 46% of the population living below a dollar a day, 30% without access to improved water sources and a paltry 30% with access to improved sanitation services, electricity as a macro enabler to better infrastructure, industrialization, better health facilities, access to water and improved sanitation remains the government's priority.

The Vision 2030's Kenya's development blueprint seeks to transform it from a low-income agrarian-based economy into an industrialized country of middle-income status that provides high-quality life to its citizens in entirety. It is on this background that its expansive and somewhat ambitious energy plan is based. Currently, thermal plants, hydropower, diesel powered, and geothermal plants provide the country with most of its power needs. Even with increased uptake and vast untapped potential of geothermal, its energy mix still lacks the much needed reliable, affordable and vast energy for industrialization. Table 1 provides an overview of the installed capacity as of May 2020.

Out of this, the GoK identified nuclear energy as a safe, reliable and clean alternative of electric power generation for the country's baseload. Prescriptively, the National Energy Policy (2018) recognizes the potential of nuclear energy as an option for the generation of electricity in order to power the country towards realizing the aspirations of Kenya's Vision 2030.

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[1] Managing Partner of the law firm of Humphrey & Company LLP and previously an Asst. Director, Legal & Regulatory Affairs, Kenya Nuclear Electricity Board. He led the Technical Working Group that drafted the Kenya Nuclear Regulatory Act 2019. He is a Nuclear Law Expert with OLA, IAEA, has been involved in several missions and is currently a legal expert in the Project 60 on strengthening of nuclear security regulations in Africa.
[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

TABLE 1. INSTALLED GENERATION CAPACITY, MAY 2020

Generation Type	May 2020		
	Installed MW	**Effective MW**	**% contribution (Effective)**
Hydro	826.23	805.00	29.67%
Geothermal	828.44	816.04	30.08%
Thermal (MSD)	660.32	640.42	23.61%
Thermal (GT)	60.00	56.00	2.06%
Wind	335.50	325.50	12.00%
Biomass	2.00	2.00	0.07%
Solar	50.25	50.25	1.85%
Interconnected System	**2,763**	**2,695**	**99.35%**
Off grid thermal	26.4	16.7	0.62%
Off grid wind	1.51	0.93	0.03%
Off grid solar	0.55	0.00	0.00%
Imports	0	0	0.00%
Total Capacity MW	**2,791**	**2,713**	**100.00%**

(Source: Least Cost Power Development Plan, Ministry of Energy, Kenya, May 2020)

16.1.3. Commencement of Kenya's Nuclear Power Programme

In April 2010, the National Economic and Social Council proposed the introduction of nuclear electricity into the Kenyan energy mix as a national priority leading to the formation of the Nuclear Electricity Project Committee under the then Ministry of Energy.[3] In November 2012, the Kenya Nuclear Electricity Board was established *vide* the State Corporations Act[4] later on being transitioned to the Nuclear Power and Energy Agency (NuPEA) under the Energy Act 2019. NuPEA's core mandate is to fast track the development of nuclear electricity in Kenya.

The Least Cost Power Development Plan projected the peak demand to grow to about 5000 MW in 2020 and over 18 000 MW in 2030.[5] GoK plans to commission the first 1000 MW nuclear power plant in 2026 with an additional 3000 MW by 2035.

[3] The Kenya Gazette Notice No.14188 of 19th November 2010.
[4] Cap 446, Laws of Kenya.
[5] Least Cost Power Development Plan (LCPDP) is an energy sector indicative plan intended to guide stakeholders with respect to how the sector plans to meet the energy needs of the nation for subsistence and development at least cost to the economy and the environment.
The plan is categorized into 3 key areas; Load forecasting – Encompasses review of load forecast assumptions, pertinent variables, historical data set and methodology, taking cognizance of the future macro-economy; Generation Planning – Involves review and update of the power system simulation data including committed generation projects, candidate plant types, capital and operational costs and system constraints to ensure system expansion is optimal. Transmission Planning - Involves power system simulations to ensure optimal transmission system expansion and a stable power system.
A World Bank commissioned study by Lahmeyer International queried the LCPDP figures as *"too optimistic as they are based on annual electricity demand rate growing at least 11% which has largely been unachieved due to a diminished uptake capacity"*. The Ministry of Energy & Petroleum, through its Cabinet Secretary remains adamant that *"the cumulative net growth rate will be achieved as committed projects have only been delayed and will progressively be completed"*

16.1.4. Kenya's Legal and Regulatory Framework for Nuclear Energy

The Government of Kenya established the Radiation Protection Board in 1982 as a regulatory body for radiation safety.[6] The Act however did not provide for a comprehensive legal and regulatory regime for nuclear applications.[7] The regulator was also established as a semi-autonomous agency under the Ministry of Health hence its biggest challenge was lack of functional, operational and financial independence.

16.1.4.1. Various uses/applications of nuclear energy

Nuclear technology and applications in Kenya cover food and agriculture, human health and nutrition, water resources management, industrial applications, sustainable energy development and environmental management.

16.1.4.2. Ratified Conventions/Treaties[8]

A web of international legal instruments help ensure the safe, environmentally sound and secure uses of nuclear technology applications.[9] The regime covers four key areas; safety, safeguards, security and civil liability for nuclear damage.

The international nuclear law regime can be domesticated into a national regime through a *'transformation'* or *'incorporation'* approach. Under the Kenyan law, any treaty or convention ratified by it forms part of the laws of Kenya.[10] However the provision is not *'self-executing'* and must be actualized through a ratification process involving adoption by the Cabinet and consideration by the National Assembly.[11] An important part of the treaty ratification process is the mandatory engagement of the public in the processes both at the Ministerial and National Assembly level.[12]

16.1.4.3. Kenya Nuclear Regulatory Authority

The Nuclear Regulatory Act 2019 establishes a comprehensive framework for the regulation of safe, secure and peaceful utilization of atomic energy and nuclear technology; the production and use of radiation sources and the management of radioactive waste. It also establishes the

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[6] Radiation Protection Act, Cap 243, Laws of Kenya

[7] Act did not cover safeguards and security and only had 2 basic regulations - Radiation Protection *(Standards)* Regulations, 1986 (LN54/1986) and Radiation Protection *(Safety)* Regulations, 2010 (LN160/2010).

[8] Kenya has ratified/signed/is bound by the following treaties/conventions and agreements/resolutions - The Convention on the Physical Protection of Nuclear Material; The Amendment to the Convention on the Physical Protection of Nuclear Material 2005, CPPNM; International Convention for the Suppression of Acts of Nuclear Terrorism; The International Convention for the Suppression of the Financing of Terrorism; The Treaty on Non-Proliferation of Nuclear Weapons; Comprehensive Test Ban Treaty; IAEA Comprehensive Safeguards Agreement and Additional Protocols; UN Security Council Resolutions 1373 (2001); UN Security Council Resolutions 1540 (2004)

[9] Includes Conventions, Treaties, Agreements and UN Security Council Resolutions.

[10] Article 2(6) of the Constitution of Kenya.

[11] Part III of the Treaty Making and Ratification Act 2012

[12] Under Section 7(m) of the Treaty Making and Ratification Act, Cabinet Memorandum must outline the outline *'the views of the public on the ratification of the treaty'* and Section 8(3), the National Assembly must *'ensure public participation in the ratification process in accordance with laid down parliamentary procedures'*.

Kenya Nuclear Regulatory Authority a successor of the Radiation Protection Board as the nuclear regulator.[13]

16.2. ROADMAP TO NUCLEAR REGULATORY ACT

16.2.1. Global and Kenyan Perspective towards the Enactment of Nuclear Energy Policies and Laws

Ernest Moniz on what is plaguing nuclear energy once remarked that "*it is the world's complete and utter lack of energy literacy".*[14] Lack of nuclear knowledge remains a global challenge — take farming for instance and imagine a child who does not know that meat comes from animals, or that manure can be used as a fertilizer. Maybe they have a rough idea of the issue at hand, but it's very much at the *"food comes from farms"* level.

The foregoing is roughly the level of ignorance that most people have about nuclear energy. There's no real understanding of the processes, limitations, economics, or practical applications of it. Besides the fact that the government is desirous of introducing nuclear into its energy mix, nuclear science and technology remains a relatively new and contentious subject.

Even at a policy level, there is very little knowledge and effort towards understanding the critical components of establishing a nuclear power programme in a manner different from establishment of other energy plants such as coal, gas, hydro and other renewables.

16.2.2. Policy Formulation Process and the Law

The Constitution recognizes in several instances the necessity to formulate, debate, approve and implement policies. As a matter of fact, Parliament is obligated to discuss and approve a number of policies. Importantly the Constitution recognizes the need for all arms of government to engage the public in formulation of policies.[15]See figure 1.

The best practice is for policy to precede the law. In fact, most legislations, including subsidiary legislation trace their anchorage on an agreed policy framework. In Kenya, save for Bills emanating from respective Houses (Senate or National Assembly), commonly known as *'Private Member Bills'*, the bulk of other Bills spring from policy proposals of the Executive, civil society, professional bodies, private sector and other organized groups.

The Cabinet adopted the National Energy Policy in 2018.

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[13] Sections 6(a) & (b) of the Nuclear Regulatory Act provides for the objects and functions of the authority as *'(a) ensure the safe, secure and peaceful use of nuclear science and technology (b) provide for the protection of persons, property and the environment against the harmful effects of ionizing radiation through the establishment of a system of regulatory control'*.

[14] Ernest Moniz is an American nuclear physicist and a former United State Secretary of Energy.

[15]Article 10 recognizes public participation as one of the national values. Article 118 requires parliament to conduct its businesses in an open manner and to facilitate public participation.

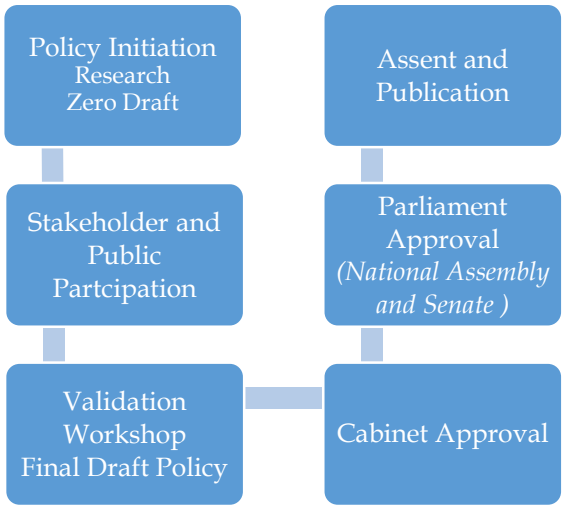

FIGURE 1. Stages of Policy Formulation

16.2.3. Legislative Process

The government established an *ad-hoc* high-level Inter-Ministerial Committee on the Development of a Legal and Regulatory Framework for Nuclear Energy *(Committee)* in November 2013.[16] The Committee membership drew representatives from various Ministries, constitutional commissions, county government and civil organization.

The Committee thereafter constituted the Technical Working Group (TWG) on Policy and Regulatory Affairs drawing membership from both the public and private sectors. It comprised technical persons — lawyers, physicists, engineers, environmentalists, and economists amongst others, all whom were part of the Kenyan energy mix in one way or another. The TWG was responsible for drafting and engagement of stakeholder and the public.

The President assented to the Bill on 23rd December 2019 with the same commencing on the 10th January 2020.[17]See figure 2.

[16] Membership of the Technical Working Group drew from the Office of the Attorney General Ministries of Energy, Education, Health, Water, Foreign Affairs, Defence, National Treasury and Agriculture and Office of the Attorney General; Parastatals including, Kenya Nuclear Electricity Board, Radiation Protection Board, National Council of Science and Technology, Kenya Bureau of Standards, Kenya Electricity Generating Company, Kenya Power & Lighting Company, Energy and Petroleum, Kenya Electricity Transmission Company; Institute of Nuclear Science & Technology – University of Nairobi

[17] The Act is yet to fully operationalize as the Board of the Authority in not established and members of the Secretariat hired. Part of the reason for this, is the Act commenced within a financial year without financial provisions having been made for the same.

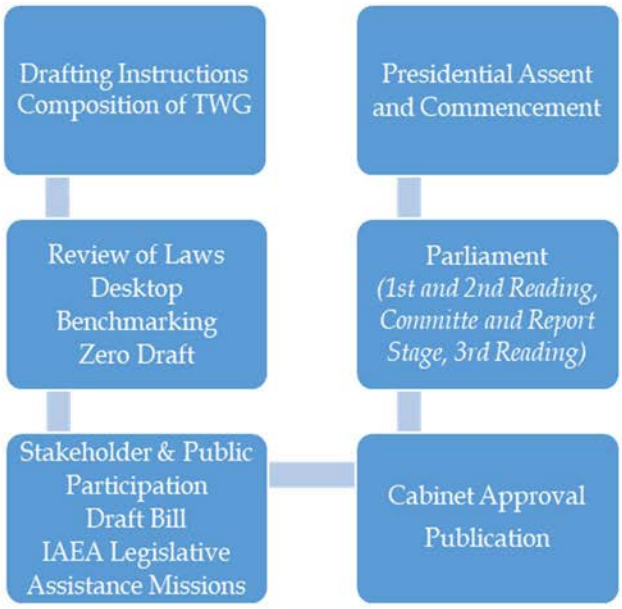

FIGURE 2. Stages of Legislative Process

16.3. CHALLENGES AND LESSONS LEARNT

16.3.1. Domestication of international treaties and conventions into national law

It remains desirable that any country seeking to embark on a nuclear energy journey needs to needs to ratify all relevant treaties and conventions. In Kenya, the process of ratification of a treaty and enacting an act of parliament are very much similar in processes and financial cost, hence the energy, time and effort to be expended is always going to be the same. Thus, the dilemma whether to expend the same effort and resources to ratify treaties or to enact an act of parliament domesticating into national law the international treaties?

Enacting an act of parliament domesticating the treaties and conventions into a national law was thus a more viable option, as even upon ratification of the relevant treaties and conventions, there was still going to be a need to domesticate the same in an act of parliament.

The question remaining unanswered then is, is there need to expend resources, time and effort in ratifying treaties and conventions whose provisions are already enacted in an act of parliament and have the full effect of the law in Kenya?

16.3.2. Challenges Regarding Public and Stakeholder Misconceptions

There are still a lot of global misconceptions relating to nuclear energy. One of the most asked questions during the public and stakeholder engagement related to *'Hiroshima and Nagasaki'*. This to most laymen was their total conceptualization of nuclear energy. Interestingly, even amongst professionals, including engineers and lawyers, their appreciation of nuclear was largely shrouded in negativity based on incidents like Chernobyl and Fukushima Daiichi.

It is not contested that nuclear energy poses special risks to persons and the environment but at the same time, it holds promise of significant benefit in a variety of fields from medicine, agriculture to power production and industry. It is the lack of articulation of the balance between its risks and benefits that largely runs the global nuclear debate and which skewed debate often finds its way into national jurisdictions.

With nuclear energy jostling for a position into national energy mixes, against better understood sources of energy with potentially lesser risks to persons and the environment, nuclear energy continues to be a hard and painful sell.

16.3.3. Complexity and technicality of nuclear law

Traditional drafting is generally characterized by legal jargon, long sentences and dull lacklustre provisions. Nuclear technology and applications by itself is still struggling to shed its tag of complexity and intricacy even within the scientific arena. Similarly, the international law regime comprising treaties, conventions, agreements and UN Security Council Resolutions further complicates nuclear law both as a legal and scientific concept. Thus, the biggest challenge to a drafter remains simplifying in law, a scientific concept that still yearns global demystification.

Also, the expansive and technical regime is largely referenced through many technical standards and guidance documents developed by the IAEA and other international organizations. Whilst these documents are invaluable to a drafter, their sheer volume, content and duplicity provides a challenge even to a seasoned drafter. The international codification which seeks uniformity across various differing jurisdictions also possess another hurdle to drafters struggling to domesticate the regime into national laws.

16.3.4. Get the public and all stakeholders in early enough

Like in any country, even developed ones, nuclear acceptance is always going to be a challenge and it remains important that any opposition to the project is minimal and objective otherwise it can easily derail the project.

Unlike all other forms of energy, nuclear is special and is largely perceived secretive. So that the involvement of the public and stakeholders must be deliberate, systematic and transparent. The intent of engaging the public and stakeholders must not be to merely meet a legal requirement *per se* but to advocate the general acceptance of the idea of nuclear energy as a viable and safe project whilst debunking myths that have been synonymous with nuclear energy.

Amongst activities undertaken by the nuclear energy programme implementing organization (NEPIO) to improve nuclear acceptance within the public was participation in trade fairs throughout the whole country, running of paid adverts and features in both print and television media, engaging students in both primary and secondary schools and random sponsoring of corporate and sports events.

16.3.5. Fragmentation of the national and regulatory framework

The ideal scenario for any jurisdiction would be to enact a comprehensive law that addresses all the aspects of a national nuclear law. However, it is becoming increasingly clear that a nuclear energy programme is a systematic phased programme that more often than not overlaps. Consider that whilst a country may have made a knowledgeable commitment to pursue a nuclear power programme, there are several decisions as to the *'how'* which are usually pending at the time of drafting and enacting the law, when it is expected that the very law should be addressing the *'how'*. It is thus unlikely that a lot finer decisions relating to for example

decommissioning and nuclear liability will have been made at the point of drafting or enactment.[18]

Relatedly and largely based on whether a country adopts a prescriptive or outlining drafting method, it is important that a functional balance is struck so as to allow the nuclear regulator to play a pivotal role in the development of technical regulations and plans under the Act.

Because of the technical and prescriptive nature of regulations and plans under a regulatory regime, it is important that the regulator who will be responsible for regulatory control under an act fully participates in its development. This may then further push a case for an outlining mode of drafting as opposed to a prescriptive mode.

16.3.6. Capacity building within policy makers

Competent human and technical capacity is a critical component of the successful construction and operation of a nuclear power plant. What is understated is the competency amongst policy makers as that is the first hurdle to a nuclear power programme. Policy makers must specifically be enlightened as to the special nature of nuclear energy necessitating the need for a special legal and regulatory regime. Without this in-depth appreciation and understanding of the special nature of nuclear energy, policy makers are likely to consider nuclear in the same manner and breadth as other sources of energy.

Developing the capacity of policy makers is best done through first-hand experiences of visits to nuclear power plants, IAEA legislative assistance missions and high level workshops to specifically raise awareness and appreciation amongst senior officials and policy makers.

16.3.7. The IAEA is a good friend in development of national nuclear law

With nuclear science and technology being a novel and technical area in law, newcomer states generally lack the technical and human capacity requisite for a successful nuclear power programme.

Through publications, assistance missions, meetings, trainings and workshops, the IAEA is not only singularly able to bridge the knowledge and competency gap needed for the successful operation of nuclear power plant, but also develop capacity for development of a comprehensive legal and regulatory regime for a nuclear power plant.

It is a practicable repository of knowledge needed for the development of a comprehensive national legal and regulatory framework.

[18] The Nuclear Regulatory Act makes has no provisions on nuclear liability for the reason that no decision had been made on the same at the point of drafting/enactment. Another reason was the fact that inclusion of liability provisions would have hugely increased the financial implication of the Act at the point of enactment. Also because of the non-prescriptive drafting of the Act, it conferred on the Regulator powers to make at least 25 subsidiary legislations under the Act covering all 15 Parts of the Act with the exception of Part V – Radiation Protection.

17. SERBIA'S EXPERIENCE IN UPDATING ITS NATIONAL LEGISLATION THROUGH THE LEGISLATIVE ASSISTANCE BY THE IAEA

BRANKO BRAJI Ć[1], [2]
Serbian Radiation and Nuclear Safety and Security Directorate

17.1. INTRODUCTION

The International Atomic Energy Agency (IAEA) within its mandate provides high quality and efficient support for its Member States in upgrading their respective national frameworks in the area of nuclear law. One of the most important modes and mechanisms of providing such support is the Nuclear Law Institute (NLI), which gathers every year more than 60, mostly legal experts from all countries for a two-week period with the aim of their training, that is, additional education in this area.

This year is the tenth anniversary since the establishment of NLI, which is a significant jubilee and an opportunity for certain Member States, having used such IAEA support, to underline all its benefits and impact on the appropriate formation of their national legal and regulatory frameworks in this area.

Bearing in mind the fact that Serbia has actively participated in the abovementioned process, the aim of this writing is to point at the most important achievements Serbia has made in nuclear law development, which results from both the high quality and the scope of assistance and support received so far from the IAEA through NLI.

17.2. CONTEXT, OBJECTIVES AND CHALLENGES IN THE PROCESS OF UPGRADING NATIONAL LEGISLATIVE FRAMEWORK

Throughout the years of its full membership to the IAEA, Serbia has invariably and clearly showed its permanent and deep commitment to the fundamental principles and goals of the IAEA aiming at the safe and secure use of nuclear energy for peaceful purposes.

Consequently, Serbia has always attached great importance to strengthening its legal and regulatory framework in the area of radiation and nuclear safety and security, with the primary aim of aligning with all relevant international standards and rules in this area. It is necessary to bear in mind that Serbia is in the process of accession to the European Union and, as a result, is obliged to align its legislation with the EU acquis that is greatly comparable to, that is, compatible with the standards and rules adopted under the auspices of the IAEA.

In this regard, Serbia has always relied on the fact that the construction of nuclear power plants, nuclear fuel production facilities and spent nuclear fuel processing facilities is strictly forbidden in this country. Nuclear energy is mostly applied in medicine, agriculture and scientific and research activities. On the other hand, Serbia has two research nuclear reactors, not in operation however, three solid radioactive waste (RAW) storages, one secure storage for disused sources, and four underground tanks for liquid RAW. Comprehensive recognition of the existing

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[1] Branko Brajić is Assistant Director at the Serbian Radiation and Nuclear Safety and Security Directorate (SRBATOM).

[2] *The views expressed remain the responsibility of the named author and do not necessarily reflect those of the IAEA or its Member States.*

infrastructure in the area, followed by adequate decisions by the competent state authorities, was crucial in the process of planning and carrying out the activities directed at upgrading legal and regulatory framework in Serbia.

The onset of NLI work is, in terms of time, parallel with the entry into force of the previous Law on Radiation Protection and Nuclear Safety.

Based on the above Law, Serbia established regulatory body in this field for the first time but with limited powers and insufficient human and financial capacities. The above regulatory authority under the name of Serbian Radiation Protection and Nuclear Safety Agency first functioned within the ministry responsible for energy, and then the ministry responsible for environmental protection and the ministry responsible for education, science and technological development. Additionally, the terminology of the Law was in some segments incomplete (e.g., it contained no definitions for orphan source, disused source, etc.), while in the other it was imprecise. There were also hindrances in the implementation of certain provisions, as well as some leaks in the Law itself. By considering all the above-mentioned, and by establishing the necessary political circumstances, two years following the adoption of the Law, we launched the preparation of the new version of the law.

As previously said, the entry into force of the earlier version of Serbian law in this area came along with the start of NLI activities, which means that Serbian representatives have regularly used this mode of the IAEA's assistance for 10 years now.

It is important to note that, besides the jurists, NLI sessions were occasionally attended by the technical staff so that they could get acquainted with the fundamentals of nuclear law. The knowledge they acquired on such occasions was of key importance for their full comprehension of the basic legal assumptions underlying nuclear law, and for their full engagement in the working bodies enhancing the legislative framework in this area.

In addition to the fact that the IAEA experts' lectures were organized on a high level during NLI, and, thus, underlined the basic elements of nuclear law and the importance of acceding to all relevant conventions concluded under the auspices of the IAEA, a particularly important segment of NLI is the organization of work in groups, and the final session during which the participants, including those from Serbia, were given an opportunity to give presentations showing their level of understanding and knowledge acquisition from the lectures given by the experts.

Another important point that needs to be highlighted is the fact that the participation in NLI was a great opportunity for Serbian representatives to exchange their experience with other colleagues, and, at the same time, establish stronger relationships, which has proven to be exceptionally useful in case of Serbia (good business and collegial relationships with the representatives form Lithuania, The Czech Republic, Austria and other EU Member States, as well as countries in the region, and Canada, Russia, USA and other developed countries).

All the above elements interactively led to undeniable upgrade of professional and human capacities in Serbia in this area, which, in addition to already confirmed insufficiencies of the old law, definitely accelerated the decision on the necessity to adopt a new law in this area.

In this context in particular and following the initial activities on the preparation of the new law, the key role of the IAEA and NLI had been recognized in vigorous and quality strengthening of Serbian regulatory and legal framework in this area. With respect to the

previously stated, we would like to particularly emphasise the importance of the bilateral meeting with the OLA representatives held by the end of 2018.

Namely, during the preparations for the above meeting, Serbia delivered the draft of the Law on Radiation Protection and Nuclear Safety and Security to the OLA representatives for review with the aim of obtaining specified remarks and suggestions. Afterwards, the representatives of the Republic of Serbia and the OLA organized a one-week bilateral meeting in order to analyse jointly the entire text of the Law, taking into account the OLA's remarks and suggestions. On balance, due to a specific infrastructure in this area and the obligation to observe certain principles of nomotechnics in Serbia, not all suggestions by the OLA could have been implemented in practice. Notwithstanding, the exceptional know-how and professionalism by the OLA representatives had their full effect, which consequently resulted in the establishment of the consolidated and final version of the Law that was before long adopted in Serbian Parliament.[3]

Regarding the context of upgrading national legal framework in this area, as already mentioned the field of ionizing radiation protection and nuclear safety was regulated by the Law on Radiation Protection and Nuclear Safety, and a number of relevant bylaws.

This Law was adopted in 2009, and in the meantime, Serbia had ratified four international conventions imposing certain obligations in this area, namely, Amendment to Convention on the Physical Protection of Nuclear Material, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Convention on Nuclear Safety, and Additional Protocol (AP) to the Safeguards Agreement in connection with Non-Proliferation Agreement.

Serbia had also started accession negotiations with the EU and thus taken the obligation to align its legislation with the EU regulations.

It is important to note that since the adoption of the above Law there have been significant technical upgrades and new information in the area governed by this Law, whose recognition and normative regulation required a new Law to be adopted.

In respect of the objectives of the adoption of new Law, first and foremost, the new Law was to provide new conditions ensuring full constitutional powers of the Republic of Serbia in terms of protecting the public and members of the public from the harmful effect of ionizing radiation, protecting and enhancing the environment, production, trade and transport of radioactive material, as well as conditions for safe and secure performance of radiation and nuclear practices and activities, and radiation protection duties in the Republic of Serbia.

Additionally, the new Law should have represented a solid basis for Serbia to join all European and global processes in the field of radiation and nuclear safety and security successfully, and for the introduction and application of the international regulations, standards and technical rules, including the acceptance of the international practice as a guarantee of reaching the highest standards in the area of radiation and nuclear safety and security in Serbia.

Another important objective of the adoption of the Law was the establishment of Serbian Radiation and Nuclear Safety and Security Directorate, as a separate and functionally

[3] Exposition of the Bill of Law on Radiation and Nuclear Safety and Security by the Speaker of Serbian Parliament, Ms. Maja Gojkovic.

independent regulatory body intended to conduct regulatory, expert, inspection and other related duties in the field of radiation and nuclear safety and security, with clearly defined competences and precisely determined powers, as well as necessary financial and human resources.

The adoption of the new Law should have been the first step towards aligning Serbian legislation with acquis communautaire in this area, and the abovementioned ratified international conventions.

The route towards reaching the above stated and proclaimed goals was paved with a number of challenges whose overcoming might have been impossible without the IAEA's legislative assistance.

17.3. IAEA OLA CONTRIBUTION TO THE PROCESS OF UPGRADING NATIONAL LEGISLATIVE FRAMEWORK

In hindsight, the presence of Serbian representatives in NLI sessions was indispensable, particularly as they had the opportunity to get acquainted with the basic elements of comprehensive nuclear law, that is, the areas covered by such law, as well as the method serving to connect such elements consistently.

Likewise, the NLI sessions served to give a comprehensive account of the fundamental principles underlying nuclear law, and to provide definitions of their essence and rationale, as well as to emphasize and explain how a regulatory body can conduct its duties in terms of inspection and enforcement.

In addition, the insight into the relevant conventions in this area significantly raised the awareness in our country of the importance of their ratification, which is acknowledged by the fact that Serbia in the period 2016—2018 ratified the Amendment to Convention on the Physical Protection of Nuclear Material, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Convention on Nuclear Safety, and Additional Protocol (AP) to the Safeguards Agreement in connection with Non-Proliferation Agreement. In this respect, Serbia joined the circle of the countries standing for a responsible, safe and credible partner in the area of radiation and nuclear safety and security.

It is my great pleasure to take this opportunity to emphasize the significance of a bilateral meeting with OLA representatives by the end of 2018. Following the detailed analysis of the Law draft, the representatives of OLA during a multiple-day meeting with Serbian representatives, offered a number of constructive remarks and suggestions aiming at higher quality of the draft[4]. I would like on this occasion to point out only some of them that refer to:

- Subject matter;
- Suggestion to use generic language when drafting the objectives of the law;
- Suggestion to refer throughout the text in all provisions of general applications the generic terms of "activities", "practices" and "facilities", which are defined in the law;
- Replace "nuclear explosives" with "nuclear weapons and nuclear explosive devices"
- Ensure that the language used does not preclude the import of by-products resulting from reprocessing of spent fuel;

[4] Final Report from the Legislative Assistance Meeting with Serbia to Review the Draft Law on Radiation and Nuclear Safety and Security conducted in Vienna on 6–9 November 2018.

- Definitions that are not used in the text of the law should be deleted, e.g. “emergency management system”, “operator”;
- Adding a definition of the Safeguards Agreements and the Additional Protocol;
- Ensuring consistency of definitions and terminology, in line with the comprehensive scope of the law;
- Clarifying the definition of a “nuclear and radiological emergency”;
- Clarifying the definition of “nuclear facility”;
- Use of the generic term “authorization holder” throughout the law, instead of licensee or operator;
- Listing the radioactive waste management facilities separately;
- Including a generic definition of radiation and nuclear safety and the use of definition in line with the definition of “protection and safety” from the IAEA Safety Standards (GSR, Part 3);
- Revision of the definition of radioactive source;
- Ensuring that the definition of “enforcement” includes all core regulatory activities;
- Suggestion to change some provisions regarding the Serbian Radiation and Nuclear Safety and Security Directorate in sense of underlining effective independence of the Directorate;
- Clarifying the provisions regarding the Directorates self-assessment;
- Possibility for the law to provide that the Directorate may receive donations or grants, where it should be stated that these shall not originate from regulated persons;
- A list of suggestions regarding the Directorate responsibilities:
- A suggestion to add a provision on the taking of enforcement action by the regulatory body in the event of non-compliance with the law, regulations, and conditions of authorizations;
- Considering the provision for the establishment of safeguards requirements by the Directorate and of safeguards related responsibilities on the part of authorization holders:
- Ensuring that the general obligations of authorization holders include the obligation not to cease the authorized activity or practice unless authorized by the Directorate or subject to the conditions established by the Directorate;
- A suggestion regarding ionising radiation protection duties;
- Clarifying the term of volunteers;
- Consolidating and clarifying the articles regarding the environmental monitoring programme, radioactivity monitoring report and existing exposure situations;
- A suggestion that the objective of preventing emergencies should also be reflected in the establishment of related requirements by the regulatory body;
- The authorization process of commissioning of nuclear facilities, particularly of facilities in extended shutdown, may need other prior authorization steps;
- A suggestion to add a provision clarifying that the authorization holder shall have the prime responsibility for the safety and security of radioactive waste and spent fuel until its transfer to the central storage facility in the manner provided by the Directorate or in accordance with the rules established;
- Clarifying that the export of radioactive waste and spent nuclear fuel are strictly prohibited and cannot therefore be authorized by Directorate, in line with the international obligations of the Republic of Serbia under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
- A need to ensure that provisions in line with the safeguards agreement and the additional protocol are included in the law to provide for the effective implementation of safeguards and the establishment of the necessary infrastructure;

- Suggestions regarding liability for nuclear damage;
- Suggestions regarding inspectional supervision and rights and obligations of the inspectors.

17.4. CONCLUSION

This is only one segment of extremely useful and professional remarks and suggestions by OLA to the Draft since the overall reference to them would by all means overcome the scope of the text. However, only one section confirms the high quality and know-how of OLA experts, whose assistance was pivotal in the fact that Serbia now has the Law on Radiation and Nuclear Safety and Security which sets an example to other countries of similar internal infrastructure.

Based on their personal experience, the representatives of Serbia use every opportunity to support and encourage the representatives from other countries intending to amend the existing or adopt new laws in this area, to use the IAEA's legislative assistance as much as possible in order to have the guarantee of future laws in this area that are altogether of high quality, comprehensive and provide for the necessary level of implementation.

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