Principles and Practice of International Nuclear Law

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Legal Affairs

Principles and Practice of International Nuclear Law

Kimberly Sexton Nick and Stephen G. Burns, Editors

NEA No. 7599

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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NUCLEAR ENERGY AGENCY

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The mission of the NEA is:

– to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally sound and economical use of nuclear energy for peaceful purposes;

– to provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD analyses in areas such as energy and the sustainable development of low-carbon economies.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management and decommissioning, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.

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Foreword

For the past ten years, *International Nuclear Law: History, Evolution and Outlook* has served as the source of reference for students and professionals wishing to learn more about international nuclear law. Written by key lecturers from the International School of Nuclear Law (ISNL), its articles have been assigned as required reading for the past decade. Despite the intervening years since its original publication, *International Nuclear Law: History, Evolution and Outlook* has continued to prove its value.

But, an eventful decade has passed and nuclear law has progressed. New lecturers have joined the ISNL and the content of the curriculum has evolved. One cannot help but see that each element of the safety, security, safeguards and liability model has been affected by events that have unfolded in recent years. From the impacts of the TEPCO Fukushima Daiichi nuclear power plant accident on nuclear regulation, to events in the Islamic Republic of Iran and the Democratic People's Republic of Korea on international safeguards, to the entry into force and the upcoming entry into force of various conventions on nuclear security, safeguards and nuclear third party liability, it has been an eventful ten years. Further, one must look to the future to consider the ways that the law may need to adapt to the potential for new nuclear technologies as well as the worldwide focus on the impacts of climate change, among other issues.

Not only has nuclear law changed in these ten years, but so has the education model itself. There is no greater indication of this than the innovations required this past year. In August 2020, the ISNL would have celebrated a major milestone: its 20th anniversary. But, circumstances surrounding the global pandemic forced the NEA and University of Montpellier to take the difficult decision to cancel that year's session. In the ensuing year, a great deal of modernisation was necessary to continue to deliver on our educational missions. Our organisations were forced to find new ways to reach an international audience in need of education and training in nuclear law.

As a result, more than a mere update was required; instead, an entirely new publication was needed. With this, we are pleased to now present to you *Principles and Practice of International Nuclear Law*, which will prove to be the new foundational textbook of international nuclear law. Written by ISNL lecturers not only for the ISNL but also for anyone wishing to expand their knowledge in this highly specialised, highly technical subject, we trust you will find this to be a valuable resource.

This publication would not be possible without the dedication of the named authors and countless others who contributed to the articles. Twenty years on from the founding of the ISNL, the need for nuclear law education and training has not waned, and we remain forever grateful for the continued commitment to, and enthusiasm for, our educational programmes from our lecturers and authors.

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Avant-propos

Depuis dix ans, l'ouvrage *Le droit nucléaire international : histoire, évolution et perspectives* est la source de référence des étudiants et professionnels qui souhaitent approfondir leurs connaissances du droit nucléaire international. Rédigé par les principaux conférenciers de l'École internationale de droit nucléaire (EIDN), les articles qui le composent font partie des lectures obligatoires de ce programme d'enseignement depuis dix ans. En dépit du temps qui s'est écoulé depuis sa parution, *Le droit nucléaire international : histoire, évolution et perspectives* n'a rien perdu de sa pertinence.

Une décennie riche en événements s'est écoulée et le droit nucléaire a évolué. De nouveaux conférenciers ont rejoint l'EIDN et le contenu du programme a été modifié. Il n'a échappé à personne que les régimes de sûreté, de sécurité, des garanties et de la responsabilité ont tous affectés par les événements de ces dernières années. Depuis les impacts de l'accident de la centrale de Fukushima Daiichi de TEPCO sur la réglementation nucléaire aux événements en République islamique d'Iran et en République populaire démocratique de Corée sur les garanties en passant par l'entrée en vigueur de différentes conventions (à venir pour certaines) sur la sûreté nucléaire, les garanties et la responsabilité civile nucléaire, les événements n'ont pas manqué. Il faut aussi se tourner vers l'avenir et envisager les évolutions du droit qui pourront être nécessaires pour s'adapter à de nouvelles technologies nucléaires ainsi qu'à l'intérêt croissant pour les conséquences du changement climatique, entre autres.

Les évolutions de la décennie écoulée n'ont pas concerné que le droit nucléaire, le modèle éducatif a aussi changé, comme on a pu notamment s'en rendre compte au cours de l'année écoulée. En août 2020, l'EIDN devait célébrer un jalon majeur : son 20e anniversaire. Mais les circonstances liées à la pandémie mondiale ont contraint l'AEN et l'Université de Montpellier à prendre la difficile décision d'annuler la session 2020 de l'EIDN. Dans l'année qui a suivi, de nombreuses modernisations ont été nécessaires pour que nous puissions poursuivre notre mission éducative. Nos organisations ont dû trouver de nouvelles modalités pour s'adresser à un public international dont le besoin de formation et d'éducation en matière de droit nucléaire subsiste.

Face à cela, une simple mise à jour ne suffisait pas. Il fallait proposer une publication entièrement nouvelle. Nous sommes donc fiers de vous présenter *Principes et pratique du droit nucléaire international*, qui sera le nouveau manuel de référence en matière de droit nucléaire international. Écrit par des conférenciers de l'EIDN, pas uniquement pour l'EIDN, mais également pour toute personne souhaitant approfondir ses connaissances dans ce domaine hautement spécialisé et technique, nous espérons qu'il représentera une source précieuse pour le lecteur.

Cette publication n'aurait pas pu voir le jour sans l'engagement des auteurs référencés, mais aussi de nombreuses autres personnes qui ont contribué aux articles. Vingt ans après la fondation de l'EIDN, le besoin d'éducation et de formation en droit nucléaire n'a pas disparu, et nous sommes particulièrement reconnaissants envers nos conférenciers et auteurs pour leur engagement et leur enthousiasme en faveur de nos programmes d'enseignement.

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Acknowledgements

This publication is dedicated to the memory of Dr Odette Jankowitsch-Prevor, one of the founding lecturers of the International School of Nuclear Law (ISNL). Odette passed away in February 2021 after a lifetime dedicated to international law, and nuclear law in particular. She leaves behind an immeasurable legacy, touching the hearts and minds of every participant and lecturer with whom she came in contact. We are forever grateful for her dedication both to the ISNL and nuclear law education.

This book would not have been possible without the strong and enthusiastic support of the authors and contributors who donated their time, knowledge and passion to this project. Special recognition should also be made of the 14 original authors who first launched this project 10 years ago, as well as the founding ISNL lecturers, some of whom are still contributing today:

- André Bouquet
- Odette Jankowitsch-Prevor
- Edward Lazo
- Quentin Michel
- Norbert Pelzer
- Sebastiaan Reitsma
- Laura Rockwood
- Julia Schwartz
- Carlton Stoiber
- Wolfram Tonhauser

Principles and Practice of International Nuclear Law was co-edited by Ms Kimberly Sexton Nick, Deputy Head, NEA Office of Legal Counsel (OLC) and Mr Stephen G. Burns, former Chairman, United States Nuclear Regulatory Commission (NRC) and former Head, OLC. In addition, many current and former members of the NEA staff made invaluable contributions to the development of this publication, in particular Ms Chiara Petroli, Ms Robyn Jordan, Ms Elisabeth Villoutreix, Mr Carlo Piovano, Mr Laurie Moore, Ms Fabienne Vuillaume and Ms Rhiann Pask.

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Chapter 1

History of the International School of Nuclear Law

History of the International School of Nuclear Law (2000-2010)

*by Patrick Reyners**

The plan to set up a school for international nuclear law resulted from the coming together of many positive factors, some owing to circumstances and others to personal encounters. Although the International School of Nuclear Law (ISNL) was officially born in 2000, the story starts much earlier.

Changes in the 1990s: An opportunity for the NEA

The decade of the 1990s began under most unfavourable auspices following the Chernobyl accident. Nevertheless, it provided the OECD Nuclear Energy Agency (NEA) and its (at the time) Legal Affairs Section with the opportunity to redeploy its activities in the nuclear law field – activities which, up until then, were principally dedicated to a programme of studies and of legal publications, and to its role as the guardian of the Paris and Brussels Supplementary Conventions on nuclear third party liability.

The dissolution of the Soviet Union, the emancipation of its former "satellites" and the shocking revelation of the precarious state of nuclear safety in that region led to the mobilisation of an important programme of technical and economic assistance by Western states. In this context, the NEA was invited, notably by the G7, to contribute to this international effort by helping to reinforce nuclear legislation and to train the staff of nuclear regulatory bodies in these countries. This undertaking took the form of bilateral co-operation, particularly with Russia and Ukraine, or a series of annual training seminars on the various aspects of nuclear law which benefitted from the active co-operation of the International Atomic Energy Agency (IAEA) and the European Commission.

By the end of this series of seminars, in which dozens of future nuclear regulatory officials from Central and Eastern Europe participated, the NEA had acquired substantial expertise in providing training.

A noticeable absence

It is worth remembering that at the end of the 1990s, when the idea of the ISNL was born, nuclear energy was still in a downturn and the trauma following the accident at Chernobyl had not dissipated.

Back then, the inevitable ageing of skilled personnel at nuclear organisations raised concern about its eventual impact on the safety of installations; although the problem was not of the same nature, this phenomenon was also experienced in connection with the replacement of a generation of lawyers specialised in nuclear law, raising the issue of knowledge transfer in this recent discipline.

* Patrick Reyners is the Secretary General of the International Nuclear Law Association and former Head of Legal Affairs at the OECD Nuclear Energy Agency.

The International Nuclear Law Association (INLA) held up the flame but was at pains to attract young lawyers. This situation was exacerbated by the fact that education in nuclear law was, even in "active" nuclear countries, practically non-existent. Universities were largely disinterested and nuclear institutions, both public and private, did not have the vocation to fill the gap.

Intuition and encounters

In spite of these hardly encouraging perspectives, I had the intuition that there was a need to be satisfied, a case of the supply producing the demand principle so dear to economists. What was, at the beginning, no more than an impression had to be tested and shared. The colleagues to whom I spoke of the idea, and I refer particularly to the members of the INLA Board of Management at the Congress in Washington, DC in 1999, encouraged me to explore this possibility.

Many encounters would prove to be decisive, first of all those with Katia Boustany and Odette Jankowitsch-Prevor. Professor Katia Boustany, a Lebanese-Canadian with a charismatic personality who taught at the University of Québec, and who was on secondment to the IAEA, was always interested in legal issues relating to advanced technologies. Odette Jankowitsch-Prevor, an Austrian lawyer of European culture, a world citizen and heartfelt supporter of third world countries, was herself at the point of completing an internationally distinguished career at the IAEA in Vienna. They both showed a great deal of enthusiasm for this project, provided me with their advice and promised to co-operate.

For its part, the NEA management agreed to support this doubtful initiative and allowed me to call upon the resources of the Agency. In this respect, I owe a vote of special gratitude to my colleagues at the NEA for their constant support and dedication to this project. I would also pay tribute to Pierre Strohl, former Head of Legal Affairs and subsequently Deputy Director-General of the NEA, who with his usual intellectual curiosity was interested in the idea of the School and committed himself from the beginning as part of the team.

Why Montpellier?

It had always been obvious to me that the implementation of a teaching programme in nuclear law had to be based – even if led by an international organisation such as the NEA – on the support of an academic institution in order to be fully legitimate. Various possibilities were envisaged during this short "incubation" period, both in France and abroad (notably in Budapest with a Soros foundation university).

However, it was my encounter with Professor Pierre Bringuier from the University of Montpellier 1 that proved to be decisive. This internationalist was strongly interested in legal issues associated with hazardous activities and thus in nuclear activities. Another quality was his remarkable ability to make the wheels of the university machinery turn and finally, he had the advantage of heading Dideris (now SFC, *Service de formation continue*), the permanent training institute of Montpellier 1 that had experience with "summer universities".

Dideris and Professor Bringuier offered the location and the necessary logistical support for the future school. One visit convinced me that the future students and lecturers could not but appreciate the charm of this beautiful city, and this impression has never been proved wrong.

During 2000, a decision in principle was taken and the Statute of the ISNL was quickly adopted by the University of Montpellier 1. The creation of the ISNL would be accompanied by an agreement concluded in 2002 between the NEA and the President of the University of Montpellier 1 providing the framework for a co-operation that has continued smoothly ever since.

Establishing the school

In a rather short period of time, the parameters of the school were defined: a two-week intensive introductory programme alternating traditional courses and practical sessions, covering all aspects of nuclear law and taking place every year during the same time period (the last week of August and first week of September). Teaching would be done in English by a small group of lecturers and would focus particularly on international nuclear law. The capacity of the school was fixed at 50 to 60 participants in order to ensure better mentoring.

It is worth noting that these decisions, which were taken in a relative hurry and were partially dictated by practical considerations such as the availability of premises, duration of the course or the use of English only, proved to be so right that the functioning of the school has changed very little over the years. Only the programme has changed, as explained below.

First session – first experience

The first session, in the summer of 2001, took place on boulevard Henri IV close to the university district, in the Écusson, the name by which the citizens of Montpellier call the old city. Even if participants from Eastern Europe were relatively numerous, thanks notably to financial assistance from the European Commission, the 50 participants came from all around the world, giving the school a truly international character. Several members of the IAEA Office of Legal Affairs agreed to come and deliver lectures in their personal capacity, heralding a commitment that would only be enhanced during the years to come. The three “nuclear agencies” were hence present and collaborating right from the first year. Another stroke of luck for the school was that apart from the representatives of these international organisations, other lecturers chosen from among the best experts in the nuclear law world responded to my request positively. Without naming them individually, I would like to pay homage to their talent, their generosity and their loyalty to this project.

Besides the courses, which took place during the intense heat of the Mediterranean summer, a technical visit was organised to the nuclear research centre of Marcoule, and a tradition was inaugurated that would become a must – a visit to cultural sites and vineyards of the region, followed by wine tasting, for many a real discovery.

The diploma in international nuclear law

The idea that an exam would be a logical extension of this training and would give it credit occurred to the founders of the school very early on in the process. However, for many students it would have been impossible to extend their stay in Montpellier to sit for an exam as they came from far away and were often under time pressure to return to their professional or academic activities. This led to the implementation of a remote, open-book, “take-home exam”, combined with the drafting of a dissertation on a subject of choice and evaluation of the quality of participation during the course. This idea was submitted to the university, which agreed to create an official diploma in international nuclear law.

The diploma process was put on trial for the first time following the summer session in 2003, and since that time an increasing number of students opt for this challenge, attesting to its validity.

The adjustment to change: A necessity

Over the years, the school has enjoyed an ever increasing success, taking advantage of "word of mouth" publicity ensured by the students themselves. This success does not, however, take away from the need to evolve both in terms of teaching methods and subject matter. It was in this vein that following the events of September 2001, an important place was reserved for nuclear security issues. Lectures dealing with the impact of environmental laws on the regulation of nuclear activities were also added. In so doing, new lecturers joined the team. Another tradition was established: namely to invite at the end of every session, well-known speakers to talk about interesting and topical subjects in the nuclear world. In the meantime, the school left the old law faculty building and moved to the new university site at Richter to take advantage of enhanced facilities. On the other hand, the tightening of security measures at nuclear sites, linked to the enactment of the plan "*Vigipirate*", led to the suspension of the technical visits, hopefully only temporarily. Finally, Professor Pascale Idoux replaced Professor Bringuier in his capacity of Director of the ISNL in 2009.

Conclusions on the first ten years

It was in 2010 that I entrusted the school to other hands at the NEA, knowing that it had reached its initial objectives. In its first ten years, some 500 students passed through Montpellier, many of whom remain active in the nuclear sector. This was, of course, a source of great satisfaction. The only regret is that the school was, and still is, a victim of its own success since its limited capacity to accommodate participants makes it impossible to satisfy all applicants.

In February 2010, I wrote that I was no less confident about the ISNL's future success than I was at the outset. My continued involvement with the ISNL since that time has only shown that this statement remains just as true now as it was then.

History of the International School of Nuclear Law (2010-2020)

*by Paul Bowden**

In his account of the International School of Nuclear Law's (ISNL) first ten years, Patrick Reyners writes modestly about the "intuition" he had in 2000 that there was an unmet demand for the transfer of knowledge to the next generation of nuclear lawyers. There was perhaps more keen foresight than mere intuition. With the uncertainties that the nuclear sector faced in the 1990s, following the Chernobyl accident and during the "dash for gas" as a new major energy source, creating a dedicated space for international learning of nuclear law was also a statement of faith and of continued commitment to the future of nuclear energy.

The ISNL, from its beginning, was unique in that Patrick assembled a group of the world's leading experts in the field of nuclear law – many of whom had framed the laws themselves – to lead the programme in what is really a structured assembly of "master classes". More than 20 years on, this still remains the format and essence of "the Montpellier experience". We are particularly indebted to Norbert Pelzer, Carlton Stoiber and Odette Jankowitsch-Prevor who provided leadership in teaching and mentoring from the earliest years. It is with sadness that we recall Odette's death earlier this year. Odette, throughout her career at the IAEA and in her work at Montpellier, was committed to the cause and ambitions of those looking to a future in the nuclear law field. She is a loss to us all and we can think of her only with fondness and gratitude.

It was indeed to several hands, and not just to one, that Patrick entrusted the ISNL after 2010. None but Patrick could have done Montpellier single-handed. The programme thus passed to a team: Julia Schwartz and, successively, Stephen G. Burns and Ximena Vásquez-Maignan, as Heads of the Office of Legal Counsel (OLC) at the OECD Nuclear Energy Agency (NEA); Professor Laurence Weil of the University of Montpellier, who succeeded Professor Pasqual Idoux in 2013; and myself as Programme Leader since 2011.

This handover in 2010-2011 also coincided with a perceived change in outlook for the world's nuclear industry, one quite different from that in 2000. There were renewed ambitions for the development of new nuclear generating capacity, both in countries with no existing nuclear power plants and in those countries that had appeared to be moving away from nuclear energy. The face of the sector was changing with new entrants. Major energy suppliers, nationally-based but operating globally, were all taking advantage of electricity market liberalisation. Some had no previous track record in nuclear but were willing to turn their financial and commercial expertise to nuclear power generation. Nuclear power, since its inception, having been in most countries part of a "state-industrial complex", was beginning to look like a global "public-private finance initiative", with new roles for private sector companies, particularly in emerging markets, as joint venture partners with state-owned utilities and even as new in-country owners and operators. Capital markets, it was hoped, would replace tax payers' dollars as the source of funding for new developments. The title of the keynote speech at the 2010 ISNL session, "Nuclear Law's New Age Concerns", seemed to sum up the new mood.

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* Paul Bowden is Honorary Professor of Law, Nottingham Trent University and Programme Leader of the International School of Nuclear Law.

The ISNL "curriculum" developed progressively during 2012-2013 to respond to these circumstances. The whole programme became structured, explicitly and thematically, around the International Atomic Energy Agency's (IAEA) well-known "3-S's": Safety, Security and Safeguards (plus, a fourth "S" – "Special regimes for nuclear third party liability"). This was important messaging for lawyers in all areas of the nuclear sector. The pace and the economics of modern infrastructure development posed questions, if not challenges, for maintaining the absolute aims and standards of safety and security that have been, from the outset, the precepts of nuclear law. At the same time, the content of the ISNL programme was expanded, beyond the core of the international conventions regime, to explore in more detail the ways in which (informed by the expanding body of IAEA principles, standards and guidance) that regime plays out in national laws.

The course also developed to reflect the fact that in the changing sectoral environment, nuclear lawyers, whether corporate counsel or those acting in a regulatory role, could no longer advise on security and safeguards without also understanding trends in international trade and intellectual property law. Assisting in the implementation of Basic Safety Standards now also called for an appreciation of modern procurement and contracting practices. Without disturbing the central and "classic" core of the programme, it has been adapted to explain and debate these connections, notably in a presentation, first introduced at the end of the programme in 2011, on nuclear project development and contracting.

It is always a priority to reflect events and changing circumstances to ensure that each session of the ISNL is salient and helpful to the participants. The programme's movement to engage with legal questions arising from new nuclear development coincided with what has become, in some ways, its counterpoint: the Fukushima Daiichi nuclear power plant accident in 2011. The ISNL programme that year was reoriented on short notice to respond to the events at Fukushima, including a lengthy panel session on the second day of the course to debate the potential legal implications. In the following years, Fukushima became a theme running through the programme in lectures on the health risks and international radiological protection standards; in considering the impacts of nuclear accidents on the development of nuclear law; and in an examination of nuclear civil liability in practice.

At the same time, the programme began to engage more closely on the legal questions around illicit trafficking and nuclear terrorism, as well as the safety and security of radioactive sources, in the light of heightened global security concerns. Reflecting the ageing demographic of nuclear power plants in established installation states, there are now new elements on the "legacy" issues of decommissioning and radioactive waste management (their importance is such that they are likely to be an increasing focus of the programme). The course also looks in more detail at the "front end" of the nuclear fuel cycle with a regulatory perspective on uranium and fuel supply. Recognising the new geographic dynamics, the ISNL faculty has, over the past 11 years, also expanded with special sessions on the legal and regulatory regimes in the People's Republic of China, India, the Russian Federation and the United Arab Emirates.

The Montpellier "curriculum" has to continue to keep pace with time and change. As nuclear law responds to the introduction of new nuclear technologies and practices, so must the learning of the law at Montpellier. The nuclear sector has a role in meeting the challenges of climate change and security of energy supply. This may be in the form of with small modular and advanced reactors; new types of co-generation, such as "pink" hydrogen production; the manufacture of synthetic fuels and the potential use of nuclear technologies in direct air capture of carbon dioxide. New legal infrastructures will be needed to enable and facilitate these new nuclear activities. We can expect all of this to feature at future Montpelliers with a need to explore more deeply the interplay between nuclear law and mainstream international energy and environmental law.

These developments in the ISNL programme have not, as mentioned, displaced the fundamental elements of the course built around the "great nuclear conventions": the Convention on Nuclear Safety, the Joint Convention, the Convention on Physical Protection, the Non-Proliferation Treaty and the nuclear civil liability conventions. But these key international instruments are now taught in context, students considering their place and dynamic in the "pyramid" of nuclear law sources and learning how they came to be operational in regional and national laws and, for example, in undertaking the practical work of developing and licensing new nuclear facilitates.

The delivery of the programme has undergone changes too. Great efforts have been made over time to integrate every element of the programme into an appreciation of the larger whole. Moving from each lecture being a standalone element into showing how each session topic relates to the others and how they actually create a coherent legal framework. To that end, the NEA educational team has created numerous "teaching tools" and ways of weaving infographics and vignettes into discussions before and after lectures to "orient" participants. As the content of the course has enlarged, the 2-3-hour case study working group sessions that students from earlier years will remember as a feature of the second week of the programme have been replaced by more plenary sessions and interactive panel discussions. Group preparation has now become a lunchtime and evening activity. The pace, like the times, is probably faster than it was back in 2001. But technology, which barely existed in 2001, helps. Presentations and resources are now available online before the programme starts; these are updated throughout the programme and "the Compendium" (just for itself always a reason to join the ISNL) now runs to four volumes of hard copy and goodness knows how many megabytes online. This is all the result of the innovation and careful work of the NEA's education team. It is a reflection too of the oversight and personal interest in the ISNL by the NEA Director-General, Mr William D. Magwood, IV, who has since 2015 been giving the keynote speech at the beginning of the programme.

The COVID-19 pandemic meant that it was not possible to meet in Montpellier in the summer of 2020. Nevertheless we did get together. Many alumni and members of the faculty met virtually two months later for panel sessions and discussion on topical issues in nuclear law. Exigencies of the pandemic have brought about unintentional, but innovative new approaches and ways of learning that we will continue to make use of when we are once again in Montpellier.

Unlike Patrick, I hesitate to write a conclusion in the expectation that the ISNL will be making the same vibrant contribution to nuclear legal learning in another 20 years, with another Montpellier team as well as another generation of students. But, I will offer just an interim reflection. There are few teaching organisations that have welcomed and engaged a relatively small cohort of students (Montpellier numbers have remained at around 60) but who have, year on year, come together from more than 30 countries with a common purpose. There are probably even fewer that have, over time, taught over 1 000 specialist professionals, of whom so many have gone on to be not just "the next generation in their field", but leaders of that generation.

Chapter 2

Introduction to nuclear law

The law of the International Atomic Energy Agency

by Peri Lynne Johnson[*]

The primary purpose of this article is to provide the reader with an overview of the law created by, or specific to, the International Atomic Energy Agency (IAEA). This includes treaties to which the IAEA is a party and those adopted under its auspices, as well as individual instruments of particular significance to the IAEA mandate. This article will also touch upon non-binding sources of law developed by the Agency that supplement and implement the treaty framework. Though decisions of the IAEA Policy-Making Organs will be referenced from time to time, these will not constitute the focus of the contribution. The administrative law of the IAEA related to personnel matters, and contractual arrangements are excluded from the scope of the present examination.

The instruments discussed below relate, predominantly, to what are known as the four main pillars of nuclear law, i.e. nuclear safety, nuclear security, safeguards (nuclear non-proliferation) and civil liability for nuclear damage. In addition, treaties governing the relationship between the IAEA and other intergovernmental organisations or states, such as those relating to its headquarters, privileges and immunities or specific projects, will be addressed as well. To contextualise the discussion of these instruments, a brief overview of the origins, mandate, structure and activities of the IAEA will be followed by a review of key developments, with a particular focus on the past ten years, since Ms Odette Jankowitsch-Prevor published her piece entitled "The Normative Role of the International Atomic Energy Agency (IAEA), Legal Basis and Legal Sources", in the 10th ISNL anniversary publication, *International Nuclear Law: History, Evolution and Outlook* (2010). The article closes with an outlook.

1. Origins, mandate, structure and activities of the IAEA

The IAEA traces its origins to the "Atoms for Peace" address, a historic speech delivered by United States (US) President Dwight D. Eisenhower to the General Assembly of the United Nations on 8 December 1953. Calling for the establishment of an international atomic energy agency that would contribute to "the peaceful pursuits of mankind", President Eisenhower foresaw the Agency as a guardian of nuclear material. Four years later, with the entry into force of the IAEA Statute, his vision became a reality when the IAEA began its work in Vienna, Austria.

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The Statute is the constituent instrument of the organisation and provides, whether express or implied, the basis for all Agency activities, including those of a normative character. It sets out the IAEA's objectives to "seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world" and "ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose."[1] This reflects the dual mandate of the IAEA to manage the nuclear dilemma by, on the one hand, develop*ing* and *facilitating the application* of peaceful uses of nuclear technology, while on the other, *preventing* the spread of nuclear *weapons throughout the world.* Elaborating upon the functions of the IAEA, Article III of the Statute outlines how the IAEA may contribute to utilising peaceful uses of atomic energy, while authorising the Agency to "establish and administer safeguards" to ensure that assistance made available by the Agency or at its request does not "further any military purpose" and "to apply safeguards, at the request of the parties, to 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".[2] As concerns promoting nuclear energy, the Agency was foreseen to act between its member states as an "intermediary" and provider of materials, services, equipment and facilities, as well as a nuclear "pool" into which states would deposit special fissionable and source materials.[3]

Since its inception, the IAEA has more than doubled its initial 80 members to a nearly universal membership counting as many as 173 states.[4] These member states make up the two Policy-Making Organs of the IAEA, i.e. the General Conference and the Board of Governors. The General Conference is the plenary policy making body composed of representatives of all member states.[5] Similar to the General Assembly of the United Nations, it is also the forum in which all member states adopt resolutions and conduct a general debate on relevant current issues as well as the IAEA's policies and programmes. The Board of Governors is composed of 35 member states and serves as the executive organ of the IAEA.[6] It generally meets five times per year: in March and June, twice in September (before and after the General Conference) and in November. The third principal organ of the IAEA is its Secretariat. It is headed by the Director General, currently Mr Rafael Mariano Grossi, and presently comprises more than 2 500 multidisciplinary professional and support staff from across the globe.[7] In addition to the Director General, the management team of the Secretariat includes six Deputy Directors General, appointed, upon consultation with the Board of Governors, by the Director General, each heading one of the Secretariat's Departments, i.e. Nuclear Energy, Nuclear Sciences and Applications, Nuclear Safety and Security, Safeguards, Management and Technical Cooperation.

The Agency is perhaps best known for verifying states' undertakings to use nuclear material and technology only for peaceful purposes, and this is certainly one of its core tasks. At the same, the Agency's broad mandate endows it with a wide range of further responsibilities, linked to peaceful uses, not least nuclear power generation and other peaceful applications of nuclear technology. The Agency carries out its statutory objectives to promote "health and prosperity throughout the world" primarily through its Technical Cooperation Programme, which, as of the end of 2019, supported

1. Statute of the International Atomic Energy Agency (1956), 276 UNTS 3, entered into force 29 July 1957, Art. II (IAEA Statute).
2. *Ibid*., Art. III.A.5.
3. See *ibid*., Arts. VIII (exchange of information), IX (supplying of materials), X (services, equipment and facilities), XI (Agency projects) and XII (safeguards).
4. As of 28 May 2021.
5. IAEA Statute, *supra* note 1, Art. V.
6. *Ibid*., Art. VI.
7. *Ibid*., Art. VII.

147 countries or territories. It aims to facilitate, upon request, the use of nuclear science and associated technologies to meet the socioeconomic needs of member states in a safe, secure and sustainable manner. Technical co-operation projects, whether devoted to nuclear power, food and agriculture, human health, water management, environment, industrial applications or similar endeavours, assist member states in addressing a variety of eminently important matters. With respect to nuclear power, the most well-known nuclear application, interest remains high and is expected to increase with the pursuit of reducing reliance on fossil fuel. In this context, the IAEA has a unique role in assisting governments, operators and regulators with respect to international obligations and national responsibilities, as well as adopting international standards and best practices. In recent years, resources have been devoted to supporting so-called newcomer countries, for example, in establishing the necessary national infrastructure for launching a nuclear power program, including the required legislative framework.

2. Key events in the evolution of nuclear law

a. The first 50 years

The IAEA has evolved considerably since the organisation was established, in order to both meet the shifting needs and interests of its member states and to adapt to technological progress. Similarly, the intervening years have considerably modified the legal landscape, with the tenets of international nuclear law sometimes experiencing anticipatory progressive development, but more often being stimulated by galvanising moments. Several of these moments are particularly noteworthy, not only for triggering enhancement of the corresponding legal framework but also profoundly amplifying the normative contribution of the IAEA.

A case in point is the rapid expansion of nuclear power in the 1960s and 1970s, which, together with the adoption of the 1968 Treaty on the Non-Proliferation of Nuclear Weapons (NPT),[8] led to the development of safeguards agreements between the IAEA and states required in connection with the NPT (commonly referred to as comprehensive safeguards agreements or CSAs). In a moment of significant impact in many respects, including with a view to the augmentation of international nuclear law, the Chernobyl accident of 1986 prompted the international community to develop new international legal instruments and establish the international legal framework for nuclear safety as it exists today. At the same time, the event also acted as a catalyst for the expansion of the IAEA's role. Prior to the accident, the IAEA was most frequently utilised as a vehicle for the development of legally non-binding safety standards. After Chernobyl, this changed, with a fundamental expansion of the IAEA's safety programme, as reflected, not least, in the safety-related conventions adopted under IAEA auspices. There is now an extensive set of international legal instruments relating to nuclear safety, which includes both legally binding and non-binding sources, primarily adopted under the auspices of the IAEA. The Chernobyl accident also caused a re-evaluation of the international framework on civil liability for nuclear damage, resulting in the adoption of new and modernised instruments.

In the wake of the 1990 Gulf War, the international community recognised that Iraq had been covertly developing a nuclear weapons programme in addition to the peaceful programme, which it had declared to the IAEA. This led to reinforcement of the IAEA's safeguards system, particularly, through the approval of the Model Additional Protocol in 1997. The strengthened safeguards system enhances the Agency's ability to provide assurances not only of the "correctness" but also of the "completeness" of states' declarations of nuclear material and activities under CSAs.

8. Treaty on the Non-Proliferation of Nuclear Weapons (1968), IAEA Doc. INFCIRC/140, 729 UNTS 169, entered into force 5 Mar. 1970.

Similar to nuclear safety, ensuring nuclear security is a responsibility and prerogative of individual states at the national level, but this area of law, too, has seen a reactive shift towards international co-operation. In the 1950s, the threat of nuclear terrorism was not considered a serious risk and there was a comparatively modest interest in properly securing nuclear and other radioactive material. The terrorist attacks of 11 September 2001 led to a rapid and dramatic re-evaluation of the risks of terrorism in all its forms, including the threat of nuclear terrorism. Today, the threat of nuclear terrorism is a priority for world leaders and the role of the IAEA in the field of nuclear security has been significantly strengthened, as has the corresponding international legal framework, in particular by the 2005 Amendment to Convention on the Physical Protection of Nuclear Material (CPPNM).[9]

From the perspective of the IAEA, the award of the 2005 Nobel Peace Prize constitutes a notable moment that emphasises the importance of the Agency's work. It recognised the efforts of the IAEA to prevent nuclear energy from being used for military purposes and to ensure that nuclear energy for peaceful purposes is used in the safest possible way. Thus, the award honoured not only the IAEA's endeavours to prevent nuclear proliferation but also its efforts to enlarge the contribution of atomic energy to health and prosperity throughout the world and to address the global challenges related to nuclear technology, including energy security, human health and food security, water resource management and nuclear safety and security.

b. The past decade

Most recently, the accident of 11 March 2011 at the Fukushima Daiichi nuclear power plant was an acute reminder that safety should not be taken for granted, even in an advanced industrial state. After initially exploring amendments to the nuclear treaty framework, states instead opted to augment it, by strengthening the effectiveness of existing treaties through revised safety standards and enhanced peer review, including by the IAEA.

As noted above, one of the effects of the 1986 Chernobyl accident was the adoption of new instruments in the area of nuclear liability, including the 1997 Convention on Supplementary Compensation for Nuclear Damage (CSC).[10] In April 2015, the international community came one step closer to achieving a global nuclear liability regime with the entry into force of the treaty. With the recent ratification by Canada, the CSC is now the instrument covering the greatest number of nuclear power reactors worldwide.

With respect to nuclear security, the entry into force of the Amendment to the CPPNM on 8 May 2016 represents a further landmark in addressing nuclear terrorism and enhancing the international legal framework. Now that the treaty is in force, the IAEA has shifted its focus towards the objectives of universalisation and full implementation.

With regard to safeguards, it is of particular note that the Director General has, in the past ten years, issued reports on safeguards implementation matters in individual states, such as the Syrian Arab Republic and the Democratic People's Republic of Korea, as well reports addressing the implementation of Agency safeguards in the Islamic Republic of Iran (Iran). The Agency's work in verifying and monitoring Iran's nuclear-related commitments under the Joint Comprehensive Plan of Action (JCPOA) – which was originally agreed in 2015 between Iran, the People's Republic of China (China), France, Germany, the Russian Federation (Russia), the United Kingdom, the United

9. Amendment to the Convention on the Physical Protection of Nuclear Material (2005), IAEA Doc. INFCIRC/274/Rev.1/Mod.1, entered into force 8 May 2016.

10. Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 Apr. 2015.

States and the High Representative of the European Union for Foreign Affairs and Security Policy – is addressed in the reports of the Director General dedicated to that topic.[11]

Finally, there have been recent developments regarding President Eisenhower's vision of utilising the IAEA as a "nuclear pool" or "fuel bank". In the early years of the IAEA's establishment,[12] the organisation did not take possession of material and thus, notwithstanding numerous individual Project and Supply Agreements, its originally envisaged role as a clearinghouse for most nuclear assistance and co-operation between members states never fully came to fruition. This changed, fundamentally, with the December 2010 approval of the IAEA Board of Governors to proceed with the establishment of the IAEA Low Enriched Uranium Bank (LEU Bank). Owned and controlled by the IAEA, the LEU Bank – a reserve of LEU – is located in Kazakhstan and, since 17 October 2019, fully operational. It provides a stock of last resort for eligible member states to be used in the event of exceptional circumstances causing the disruption of supply to nuclear power plants, with the affected member state being unable to secure LEU from the commercial market or by any other means.

As illustrated, the past decade has brought reinforcements to the international legal framework, ranging from matters of nuclear safety and security, to safeguards and civil liability for nuclear damage. At the same time, it has also been a period during which the role of the IAEA has been further enhanced, be it in the context of peer review mechanisms or as a safekeeper of LEU.

The previous sections have provided a brief introduction to the IAEA, seminal moments that drove the development of the nuclear legal framework and recent corresponding events of particular note. The following sections will now turn to the instruments themselves.

3. Treaties to which the IAEA is a party

The agreements addressed under this section were concluded by the Agency acting in its capacity as a subject of international law vested with treaty-making powers. This category includes treaties with states, such as those governing safeguards,[13] Revised Supplementary Agreements concerning the provision of technical co-operation, the treaty regime supporting the recently inaugurated IAEA LEU Bank or the establishment of Agency Headquarters. The IAEA has also entered into a host of treaties with other intergovernmental organisations, ranging from its Relationship Agreement with the United Nations and agreements with the specialised agencies of the United Nations to treaties with regional organisations such as the European Atomic Energy Community (Euratom).

11. This issue is addressed in Vez Carmona, M.d.L. and C. de Francia (2021), "Legal developments in the implementation of safeguards agreements and other IAEA verification activities", *infra*, pp. 379-406.

12. In its early years, several states made available specified stocks of nuclear material to the IAEA pursuant to Article IX of the IAEA Statute, *supra* note 1. In considering potential supply arrangements (e.g. modalities for sale by the IAEA) of such material to its member states, it was noted in a paper prepared by the Secretariat in 1958 that the Agency "could not at present assume any legal or financial commitments in respect of such materials or any responsibility for storage." These circumstances did not change in the ensuing years. See IAEA (1958), "The Board's Policy with Respect to the Acceptance and Supply of Fissionable, Source or Other Materials", GOV/72, para. 2.

13. As provided in Article III.A.5 of the IAEA Statute, *supra* note 1, the IAEA is authorised to establish and administer safeguards; and to apply safeguards, *inter alia*, at the request of the parties to any bilateral or multilateral arrangement (for example, the NPT and nuclear-weapon-free-zone-treaties, such as the Tlatelolco Treaty, which will be addressed below). Further information about the IAEA Statute and IAEA safeguards is addressed below.

a. Agreements with states

i. Safeguards agreements

One of the primary functions of the Agency is to apply safeguards in order to prevent the diversion of nuclear material from peaceful activities to nuclear weapons or other nuclear explosive devices. In this respect, the IAEA verifies that states use nuclear material only for peaceful purposes and abide by obligations stipulated within safeguards agreements concluded with the IAEA.

There are three types of safeguards agreements that are concluded between the Agency and states and/or regional organisations: (i) item-specific safeguards agreements, (ii) comprehensive safeguards agreements and (iii) voluntary offer agreements. Additional protocols may be concluded to each of these types of safeguards agreements. Small quantities protocols may be concluded to comprehensive safeguards agreements. Agency safeguards under treaties the IAEA has concluded with parties including regional organisations,[14] or treaties to which the IAEA is not a party, will be addressed in a separate section.

Item-specific safeguards agreements

Agency safeguards developed on the basis of "Safeguards System" documents that were approved by the Board of Governors between 1961 and 1968, containing standard provisions that could be incorporated into safeguards agreements.[15] The last of these documents was INFCIRC/66/Rev.2, which contained standard provisions applying to all types of nuclear facilities with the exception of enrichment plants. Safeguards agreements based on these documents are applied to specifically identified nuclear or non-nuclear material, equipment or facilities, and hence are often referred to as "item-specific" or "INFCIRC/66-type" safeguards agreements.

Item-specific safeguards agreements were the only type of safeguards agreements concluded with the IAEA until after the NPT entered into force. Item-specific safeguards agreements remain in force with states that later concluded comprehensive safeguards agreements, although comprehensive safeguards agreements for those states contain a provision that suspends the application of safeguards under other safeguards agreements so long as the comprehensive safeguards agreement is in force.[16] In such situations, the safeguards requirements of the item-specific safeguards agreement are satisfied through the application of safeguards under the more broadly applicable comprehensive safeguards agreement. Item-specific safeguards agreements continue to be applied, however, in three states that are not parties to the NPT, namely India, Israel and Pakistan.

14. This includes the Agreement between Belgium, Denmark, the Federal Republic of Germany, Ireland, Italy, Luxembourg, the Netherlands, the European Atomic Energy Community and the Agency in implementation of Article III (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons (1973), signed 5 Apr. 1973, IAEA Doc. INFCIRC/193; and the Agreement of 13 December 1991 between the Republic of Argentina, the Federative Republic of Brazil, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials and the International Atomic Energy Agency for the Application of Safeguards, IAEA Doc. INFCIRC/435 (Mar. 1994).

15. Safeguards agreements, other treaties, and a variety of further IAEA documents of note are published as information circulars, recognisable by the abbreviation "INFCIRC" in the document title and may be found at the Agency's corresponding web page: www.iaea.org/publications/documents/infcircs (accessed 21 May 2021). See IAEA (1961), "The Agency's Safeguards", IAEA Doc. INFCIRC/26; IAEA (1964), "The Agency's Safeguards – Extension of the system to large reactor facilities", IAEA Doc. INFCIRC/26/Add.1; IAEA (1965), "The Agency's Safeguards System (1965)", IAEA Doc. INFCIRC/66; IAEA (1967), "The Agency's Safeguards System (1965, as provisionally extended in 1966)", IAEA Doc. INFCIRC/66/Rev.1; IAEA (1968), "The Agency's Safeguards System (1965, as provisionally extended in 1966 and 1968)", IAEA Doc. INFCIRC/66/Rev.2.

16. See IAEA (1972), "The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/153 (Corr.), para. 24.

Comprehensive Safeguards Agreements

The NPT and the five treaties establishing nuclear-weapon-free-zones in which states are located (the Tlatelolco, Rarotonga, Bangkok, Pelindaba and Semipalatinsk treaties) require, *inter alia*, that non-nuclear-weapon states parties conclude agreements with the Agency for the application of safeguards. Under the NPT, safeguards must apply "on all source or special fissionable material in all peaceful nuclear activities within the territory of such State, under its jurisdiction, or carried out under its control anywhere."[17] Similar requirements are contained in the nuclear-weapon-free-zone treaties.[18]

A document entitled "The Structure and Content of Safeguards Agreements Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons" was approved by the IAEA's Board of Governors on 20 April 1971 as the basis for negotiating safeguards agreements with non-nuclear-weapon states parties to the treaty (INFCIRC/153 (Corr.)). With a view to simplifying the procedure for submitting proposals for this type of safeguards agreement to the Board of Governors, a standard text for conclusion of such safeguards agreements was published by the IAEA Director General in 1974.[19]

The state's undertaking as reflected in paragraph 1 of INFCIRC/153 (Corr.) is:

> to accept safeguards, in accordance with the terms of the Agreement, on all source or special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices.

As reflected in paragraph 2, the Agency has a corollary "right and obligation to ensure that [such] safeguards will be applied, in accordance with the terms of the agreement." Due to the use of the word "all" under these agreements, they are commonly referred to as "comprehensive" safeguards agreements.[20] As of 30 June 2021, such agreements were in force with 177 states. In addition, the IAEA has concluded safeguards agreements with regional organisations, which will be addressed further below.

17. NPT, *supra* note 8, Article III.1.

18. Article 13, Treaty for the Prohibition of Nuclear Weapons in Latin America (1967), 634 UNTS 326, entered into force 22 Apr. 1968 (Treaty of Tlatelolco); Annex 2, para. 3, South Pacific Nuclear Free Zone Treaty (1985), 1445 UNTS 177, entered into force 11 Dec. 1986 (Rarotonga Treaty); Article 5, Treaty on the Southeast Asia Nuclear Weapon-Free Zone (1995), 1981 UNTS 129, entered into force 27 Mar. 1997 (Bangkok Treaty); Annex 2, para. 2, African Nuclear-Weapon-Free Zone Treaty (1996), 35 I.L.M. 698, entered into force 15 July 2009 (Pelindaba Treaty); Article 8, Treaty on a Nuclear-Weapon-Free Zone in Central Asia (2006), No. 51633, entered into force 21 Mar. 2009 (Semipalatinsk Treaty or CANWFZ Treaty) (this article also requires states having territory within the zone to conclude an additional protocol based on INFCIRC/540 (Corr.), *infra* note 26, with the Agency).

19. IAEA (1974), "The Standard Text of Safeguards Agreements in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. GOV/INF/276.

20. It is interesting to note that there is no prohibition against non-explosive military applications of nuclear material under the NPT. Accordingly, comprehensive safeguards agreements with non-nuclear-weapon states parties to the NPT contain provisions for non-application of safeguards to nuclear material while in use in non-proscribed military activities (e.g. nuclear propulsion for submarines). See INFCIRC/153 (Corr.), *supra* note 16, para. 14.

Small Quantities Protocols

In the early 1970s, the Agency developed the text of a protocol available to states that concluded a comprehensive safeguards agreement and had little or no nuclear material and no nuclear material in a facility.[21] The text of the Small Quantities Protocol (SQP) holds in abeyance, or suspends, the application of many of the procedures in Part II of a comprehensive safeguards agreement until such time as the state meets the criteria specified in the SQP. Once those criteria are no longer met by the state, the SQP becomes non-operational.

The Board of Governors decided on 20 September 2005 that, although SQPs should remain part of the Agency's safeguards system, they should be subject to modifications in the standard text and a change in the SQP criteria. The Board also decided that, henceforth, it would approve only SQP texts that were based on the revised standard text.[22] The modifications referred to in paragraph 7 of GOV/2005/33 have the effect of (i) making an SQP unavailable to a state with a planned or existing facility; (ii) requiring states to provide initial reports on nuclear material, and to provide early design information in line with the Board's interpretation reflected in GOV/2554/Att.2/Rev. 22; and (iii) allowing for inspections.[23] As of 30 June 2021, 95 states had operational SQPs in force to their comprehensive safeguards agreements, of which 67 were based on the revised standard text.

Voluntary Offer Agreements

Nuclear-weapon states parties to the NPT are not required to conclude safeguards agreements thereunder. However, each of the five nuclear-weapons states parties to the treaty have concluded "voluntary offer agreements" with the Agency.[24] Under such agreements, the state offers a list of facilities or parts thereof from which the Agency may choose to apply safeguards. The Agency chooses from this list the facilities at which it wishes to apply safeguards.

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21. See e.g. IAEA Doc. GOV/INF/276, *supra* note 19, Annex B, Standard Text of a Protocol to an Agreement. Several small quantities protocols to comprehensive safeguards agreements entered into force prior to the issuance of the standard text in 1974. The first two comprehensive safeguards agreements with a small quantities protocol entered into force with Malaysia and New Zealand, respectively, on 29 Feb. 1972. IAEA (1973), "The Text of the Agreement between Malaysia and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/182; IAEA (1973), "The Text of the Agreement between New Zealand and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/185.

22. IAEA (2006), "The Standard Text of Safeguards Agreements in connection with the Treaty on the Non-Proliferation of Nuclear Weapons – Revision of the Standardized Text of the 'Small Quantities Protocol'", IAEA Doc. GOV/INF/276/Mod.1 and Corr.1.

23. *Ibid*., Annex B. See IAEA (2005), "Strengthening Safeguards Implementation in States with Small Quantities Protocols", IAEA Doc. GOV/2005/33; IAEA (1992), "Strengthening of Agency Safeguards: The Provision and Use of Design Information", IAEA Doc. GOV/2554/Att.2/Rev.2.

24. Each nuclear-weapon state provided reasons for doing so in the preamble to its voluntary offer agreement. Agreement of 20 September 1988 between the People's Republic of China and the International Atomic Energy Agency for the Application of Safeguards in China, IAEA Doc. INFCIRC/369 (Oct. 1989); Agreement between France, the European Atomic Energy Community and the International Atomic Energy Agency for the Application of Safeguards in France (27 July 1978), IAEA Doc. INFCIRC/290 (Dec. 1981); Agreement between the Union of Socialist Soviet Republics and the International Atomic Energy Agency for the Application of Safeguards in the Union of Soviet Socialist Republics (21 Feb. 1985), IAEA Doc. INFCIRC/327 (July 1985); Agreement between the United Kingdom of Great Britain and Northern Ireland and the International Atomic Energy Agency for the Application of Safeguards in the United Kingdom of Great Britain and Northern Ireland in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (7 June 2018), IAEA Doc. INFCIRC/951 (12 Jan. 2021); Agreement between the United States of America and the International Atomic Energy Agency for the Application of Safeguards in the United States of America (18 Nov. 1977), IAEA Doc. INFCIRC/288 (Dec. 1981).

The Agency's current criteria for the selection of such facilities for the application of safeguards under a voluntary offer agreement include whether (i) the selection of the facility would satisfy legal obligations arising from other agreements concluded with the Agency by the state, (ii) whether useful experience may be gained in implementing new safeguards approaches or in using advanced equipment and technology, and (iii) whether the cost efficiency of Agency safeguards may be enhanced by applying safeguards, in the exporting state, to nuclear material being shipped to states with comprehensive safeguards agreements in force.[25] The precise scope and provisions of voluntary offer agreements vary from state to state, but their procedures are based on the structure and content of INFCIRC/153 (Corr.).

Additional Protocols

As previously noted, the discovery of the covert Iraqi nuclear weapons programme after the 1990 Gulf War, led to the strengthening of IAEA safeguards, most notably, through the adoption of the Model Additional Protocol in 1997, which is reproduced in document INFCIRC/540 (Corr.).[26]

The Additional Protocol does not modify a state's basic undertaking under a safeguards agreement but provides the Agency with additional tools (broader access to information and locations in the state) to verify the state's undertaking under that agreement. A state is required to provide the Agency with a much broader spectrum of information covering all aspects of its nuclear fuel cycle-related activities, including research and development, uranium mining, manufacturing of listed components as well as the import and export of listed equipment and non-nuclear material. States are also required to grant the IAEA broader access to relevant locations under the Additional Protocol, including locations specified by the Agency to carry out location-specific environmental sampling. The complementary access available to the Agency under the Additional Protocol is distinguished from inspections and design information verification, which are provided for under safeguards agreements. An additional protocol is not a standalone document. It can only be concluded in conjunction with a safeguards agreement, and they are to be read together.

As indicated by its foreword, the Model Additional Protocol is a model for states with comprehensive safeguards agreements. Such states must accept all measures in order to be able to conclude such a protocol with the Agency. The Board also requested the Director General to negotiate additional protocols with other states, i.e. states with item-specific and voluntary offer safeguards agreements in force, that are prepared to accept the measures provided thereunder in pursuance of safeguard effectiveness and efficiency objectives.[27] As of 30 June 2021, additional protocols were in force with 137 states: 131 states with comprehensive safeguards agreements in force, 5 states with voluntary offer agreements in force, and 1 state with an item-specific safeguards agreement in force.

ii. Technical assistance

While the IAEA Statute establishes the Agency's functions and the overarching objective of accelerating and enlarging the contribution of atomic energy to peace, health and prosperity, it also indicates that the Agency is obliged to conduct its activities in accordance with the purpose of

25. See IAEA (2020), "The Safeguards Implementation Report for 2019", IAEA Doc. GOV/2020/9, "Background to the Safeguards Statement and Summary", p. 8, para. 29.

26. IAEA (1998), "Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards", IAEA Doc. INFCIRC/540 (Corr.).

27. See *ibid*., Foreword.

international co-operation.[28] Thus, the IAEA pursues a great variety of activities falling within the ambit of its mandate through technical co-operation. The applicable legal framework is based upon principles and rules established by the IAEA Board of Governors, which stipulate, *inter alia*, that the Agency must conclude an agreement with each government before providing such assistance.[29]

These bilateral arrangements are called Revised Supplementary Agreements Concerning the Provision of Technical Assistance by the IAEA (RSAs) and constitute the main legal instruments for providing co-operation to individual member states. They are "supplementary", insofar as they complement the terms of the United Nations Development Programme's Standard Basic Assistance Agreement (SBAA). At the same time, prior conclusion of an SBAA is not a prerequisite for Agency co-operation – its terms may also simply be applied by reference.[30] The purpose of an RSA is to establish the mutual responsibilities of the parties and ensure that Agency assistance is provided in a safe, secure and peaceful context. There are now 141 RSAs in force.[31]

There are a variety of further agreements and arrangements that operationalise IAEA technical assistance or provide regional frameworks for co-operation.[32] In addition, practical arrangements as well as a particular type of treaty that the IAEA concludes for certain meetings outside Headquarters, so-called Host Government Agreements (HGAs), are of similar significance for technical assistance activities. These instruments will be addressed further below.

iii. IAEA Low Enriched Uranium Bank

A more recent development, that has brought to fruition what the founders of the IAEA had envisaged, is the establishment and operation of the IAEA LEU Bank. The legal framework for the establishment and operation of the LEU Bank is based upon two documents issued by the

28. IAEA Statute, s*upra* note 1, Art. II.B.1: "In carrying out its functions, the Agency shall […] Conduct its activities in accordance with the purposes and principles of the United Nations to promote peace and international co-operation"; Charter of the United Nations (1945), 1 UNTS XVI, entered into force 24 Oct. 1945, Art. 1.3 (UN Charter): "The Purposes of the United Nations are: […] To achieve international co-operation in solving international problems of an economic, social, cultural, or humanitarian character, and in promoting and encouraging respect for human rights and for fundamental freedoms for all without distinction as to race, sex, language, or religion […]".

29. IAEA (1979), "The Revised Guiding Principles and General Operating Rules to Govern the Provision of Technical Assistance by the Agency", IAEA Doc. INFCIRC/267, were adopted by the Board of Governors in February 1979. These indicate, in Section D 7: "Before technical assistance is provided, the Agency and the Government concerned shall conclude an agreement which shall provide for application of the basic agreement currently used to govern the provision of technical assistance under UNDP. The agreement between the Agency and the Government shall further set forth the specific conditions required under the Agency's Statute for the provision of technical assistance by the Agency to its Members."

30. See, in this respect, Article I of the RSA for states that are not parties to an SBAA: "The Government and the Agency shall apply to the technical assistance provided to the Government by or through the Agency the provisions of the United Nations Development Programme Standard Basic Assistance Agreement, a copy of which is set out in Annex A to this Agreement." Model texts of the different RSAs can be found on the IAEA website at www.iaea.org/resources/treaties/rsa (accessed 21 May 2021).

31. Status as of 21 May 2021.

32. At an operational level, the key documents for implementing co-operation with individual member states are Country Programme Frameworks, or "CPFs". At the regional level, agreements such as the African Regional Co-operative Agreement provide a framework for African IAEA member states to collaborate through programmes and projects that focus on shared needs. See IAEA (2020), "The Text of the African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA)", IAEA Doc. INFCIRC/935 (revised AFRA, entered into force on 4 Apr. 2020).

Board of Governors,[33] and comprises three treaties concluded with IAEA member states that govern, respectively, the establishment of the LEU Bank in Kazakhstan and transit of low enriched uranium through Russia and China.

The Host State Agreement with the Government of Kazakhstan regarding the establishment of the LEU Bank in the Republic of Kazakhstan was concluded on 27 August 2015 for an initial period of ten years, renewable for additional periods of ten years.[34] Consistent with the applicable resolution of the Board of Governors,[35] the Agreement contains provisions similar to the IAEA Headquarters Agreement with Austria, such as those regulating legal status and privileges and immunities, or technical provisions related, *inter alia*, to the definition of the IAEA LEU Bank and to safety, security, and safeguards necessary for the functioning of the IAEA LEU Bank. To guarantee the transit of LEU and other Agency property to and from the IAEA LEU Bank, the Agency has also concluded transit agreements with states neighbouring the host state.[36]

iv. Headquarters and similar agreements

While the IAEA operates throughout its member states and beyond, its primary centre of operations lies at its Headquarters in Vienna, Austria, which is governed by a Headquarters Agreement with the host state.[37] The Agreement ensures that the Agency, its officials, experts, representatives of member states and participants in Agency meetings are accorded the status, privileges and immunities necessary for the performance of their functions. The Headquarters Agreement and related treaties also contain provisions governing the Seat of the IAEA, located at the Vienna International Centre, which hosts several other Vienna-based international organisations as well. In addition, the Agency operates laboratories in Seibersdorf, Austria, which are part of the IAEA's Headquarters Seat, and further governed by an additional set of treaties.[38] Finally, the IAEA Marine Environment Laboratory in Monaco is subject to a separate Seat Agreement.[39]

33. IAEA (2010), "Assurance of Supply – Establishment of an IAEA Low Enriched Uranium (LEU) Bank for the Supply of LEU to Member States", IAEA Doc. GOV/2010/67, paras. 15-16; IAEA (2010), "Assurance of Nuclear Fuel Supply – Resolution adopted by the Board of Governors on 3 December 2010", IAEA Doc. GOV/2010/70, para. 22.

34. In addition, the IAEA and the Republic of Kazakhstan have also signed two technical agreements subsidiary to the HSA, which were required for the establishment and operation of the IAEA LEU Bank.

35. GOV/2010/70, *supra* note 33, referring to GOV/2010/67, *supra* note 33, para. 16.

36. The Agreement with the Government of Russia regarding the transit of low enriched uranium to and from the IAEA LEU Bank through its territory was signed on 18 June 2015 and entered into force on 31 May 2017. In accordance with the Transit Agreement, the IAEA has concluded a Transport Contract with Russia's appointed authorised organisation for the implementation of the Transit Agreement. A similar agreement with China was signed on 5 Apr. 2017 and entered into force on 15 Feb. 2018. It too is supplemented by a Transport Contract with China's appointed authorised organisation for the implementation of the Transit Agreement.

37. This comprises a series of more than a dozen treaties, including, in particular, the Agreement between the International Atomic Energy Agency and the Republic of Austria Regarding the Headquarters of the International Atomic Energy Agency, which entered into force on 1 Mar. 1958, as well as a series of Supplemental Agreements, Revisions and Addenda under INFCIRC/15. See IAEA (1959), "The Texts of the Agency's Agreements with the Republic of Austria", IAEA Doc. INFCIRC/15, p. 3; subsequent additions and modifications to INFCIRC/15 can be found at www.iaea.org/publications/documents/infcircs/texts-agencys-agreements-republic-austria (accessed 21 May 2021).

38. See, in particular, IAEA (1990), "The Text of the Agreement between the International Atomic Energy Agency and the Federal Government of the Republic of Austria Regarding the Laboratories at Seibersdorf", entered into force 1 Aug. 1985, IAEA Doc. INFCIRC/15/Rev.1/Add.2.

39. IAEA (1987), "The Text of the Agreement of 16 May 1986 between the Government of Monaco and the IAEA Concerning the International Laboratory of Marine Radioactivity and the Privileges and Immunities of the Agency Within the Principality", IAEA Doc. INFCIRC/337.

A related, less comprehensive, but more frequently employed type of agreement, is the HGA. These are concluded by exchange of letters to address specific arrangements for meetings outside of Headquarters and ensure, *inter alia*, that adequate privileges and immunities are accorded in the context of such Agency events abroad. Two other agreements that serve more permanent purposes relate to the Agency's Regional Offices in Tokyo and Toronto, which perform safeguards-related activities.[40] It should also be noted that the IAEA operates a Liaison Office in Geneva, as well as a Liaison Office in New York, governed by the Relationship Agreement between the United Nations and the IAEA, which will be addressed below.

b. Agreements with other intergovernmental organisations

Despite its intimate links to the United Nations and various organisations of the United Nations System, the IAEA is an autonomous intergovernmental organisation. The IAEA Statute contains a variety of provisions setting out its relationship to the United Nations, including, for example, Article III.B.1, which aligns the Agency's activities with purposes, principles and policies of the United Nations', and Article XII.C, which stipulates reporting obligations of the IAEA to the Security Council and General Assembly of the United Nations in the event of non-compliance in the context of the implementation of Agency safeguards.[41] This relationship is further elaborated upon in a designated treaty and there are also several further agreements between the Agency and the United Nations as well as its specialised agencies[42], which will be outlined under this section. Moreover, the Agency has concluded treaties with regional organisations, such as Euratom, which will also be briefly touched upon below.

i. Relationship agreement with the United Nations and similar agreements

The establishment of an "appropriate relationship" between the Agency and the United Nations is explicitly envisaged under Article XVI.A of the IAEA Statute. The corresponding agreement contains provisions that specify what is foreshadowed under the IAEA Statute, such as reports to the United Nations, but it also governs such matters as exchange of information, reciprocal representation and co-operation between the organisations.[43] A protocol to this agreement recalls that "the Agency, which is established for the specific purpose of dealing with the peaceful uses of atomic energy, will have the leading position in this field".[44] In addition, the organisations have concluded an administrative arrangement for use of United Nations *laissez-passer*, a type of travel document, and IAEA admission to the United Nations Joints Staff Pension Fund.[45]

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40. Agreements between the IAEA and the Government of Canada of 17 October 1979 and 21 December 1987; Agreements between the IAEA and the Government of Japan of 3 May 1984 and 7 December 1989.

41. In addition, the IAEA Statute, *supra* note 1, envisages collaboration with organs of the United Nations (Art. III.A.6) and further reporting obligations to the General Assembly and Security Council, as well as the Economic and Social Council and other organs of the United Nations (Arts. III.B.4 and III.B.5, respectively).

42. The IAEA is not a specialised agency of the United Nations as it is not in relationship with the United Nations on the basis of Article 63 of the UN Charter, *supra* note 28.

43. Agreement Governing the Relationship between the United Nations and the International Atomic Energy Agency, entered into force 14 Nov. 1957, in IAEA (1959), "The Texts of the Agency's Agreements with the United Nations", IAEA Doc. INFCIRC/11, p.2.

44. Protocol Concerning the Entry into Force of the Agreement between the United Nations and the International Atomic Energy Agency, signed on 10 Aug. 1959 and 19 June 1959 respectively, INFCIRC/11, *supra* note 43, p. 9.

45. Administrative Arrangement Concerning the Use of the United Nations *Laissez-Passer* by Officials of the International Atomic Energy Agency of 16 June 1958, in *ibid*., INFCIRC/11, p. 10; Agreement for the Admission of the International Atomic Energy Agency into the United Nations Joint Staff Pension Fund, entered into force on 29 Sept. 1958, in *ibid*., INFCIRC/11, p. 13.

ii. Agreements with specialised agencies of the United Nations

Today, the most significant body for the purpose of co-ordination among organisations of the UN System is the Chief Executives Board for Coordination (CEB), previously known as the Administrative Committee on Co-ordination.[46] It is a forum where the Secretary-General of the United Nations, the Director General of the IAEA, and, currently, 29 other Executive Heads of UN System Organisations meet on a biannual basis to discuss inter-agency priorities and initiatives. At an operational level, a number of activities have been carried out through CEB mechanisms for greater harmonisation in programmes leading to joint or common programmes and projects, such as those conducted in the context of technical co-operation. In addition, these organisations are connected by a network of mutual agreements that largely govern formal mechanisms for their interaction. Regarding the bilateral treaties between the IAEA and specialised agencies, including the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Labour Organization (ILO), the World Health Organization (WHO), the World Meteorological Organization (WMO), International Civil Aviation Organization (ICAO), Food and Agriculture Organization of the United Nations (FAO), the International Maritime Organization (IMO) and the United Nations Industrial Development Organization (UNIDO), these agreements consist of a set of agreements with similar features, regulating matters such as mutual representation, exchange of information, or co-operation and consultation.[47] The IAEA is also connected to UNESCO through several treaties governing the establishment and operation of the International Centre for Theoretical Physics (ICTP) in Trieste, Italy, which includes a tripartite agreement with the Government of the Host State.[48]

iii. Agreements with regional organisations

Other intergovernmental organisations with a mandate linked to nuclear energy include, most notably, Euratom and the Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA).[49] While the treaty relations between Euratom and the Agency are characterised by the safeguards-related responsibilities of the two organisations,[50] the

46. The CEB was established by UN Economic and Social Council (24 Oct. 2001), "Further consideration of the annual overview report of the Administrative Committee on Coordination", ECOSOC Decision No. 2001/321, and performs the functions previously exercised by the Administrative Committee on Co-ordination (ACC). The participation of the Agency in the ACC/CEB is governed by Article XI of Agreement Governing the Relationship between the United Nations and the International Atomic Energy Agency, *supra* note 43.

47. See IAEA, "The Texts of the Agency Relationship Agreements with Specialized Agencies", IAEA Doc. INFCIRC/20 (23 Sept. 1960), INFCIRC/20/Add.1 (10 Apr. 1962) and INFCIRC/20/Add.3 (Mar. 1988).

48. For the Agency, these are the Agreement with the United Nations Educational, Scientific and Cultural Organization, concerning the joint operation of the International Centre for Theoretical Physics, Trieste of 1969, in IAEA Doc. INFCIRC/132 (20 Oct. 1969) and multiple extending addenda; the Agreement between the Agency, the United Nations Educational, Scientific and Cultural Organization and the Government of the Republic of Italy Concerning the International Centre for Theoretical Physics at Trieste of 1996, in IAEA Doc. INFCIRC/498 (Feb. 1996); and the Agreement between the International Atomic Energy Agency and the United Nations Educational, Scientific and Cultural Organization concerning the Joint Operation of the International Centre for Theoretical Physics at Trieste of 1996, in IAEA Doc. INFCIRC/499 (Feb. 1996).

49. Agreement between the International Atomic Energy Agency and the Organisation for European Economic Co-operation (superseded in 1961 by the OECD), entered into force 30 Sept. 1960, in IAEA (1961), "The Texts of the Agency's Co-operation Agreements with Regional Intergovernmental Organizations", IAEA Doc. INFCIRC/25 p. 3; Co-operation Agreement between the European Atomic Energy Community and the International Atomic Energy Agency, entered into force 1 Jan. 1976, in IAEA (1976), "The Texts of the Agency's Co-operation Agreements with Regional Intergovernmental Organizations", IAEA Doc. INFCIRC/25/Add.5.

50. See the final paragraph of this section, *supra* note 49, for the safeguards-related agreement to which both the Agency and Euratom are parties, and, on the various types of Safeguards Agreements, Section 3.a.*i*. above.

substance of the Agency's co-operation agreements with Euratom and the OECD is otherwise similar to the bilateral agreements illustrated above between the IAEA and the specialised agencies of the United Nations, in that they focus on mechanisms for formal representation, co-operation and exchange between the respective organisations.

Further co-operation agreements between the IAEA and regional organisations include those with the Inter-American Nuclear Energy Commission, the African Union (AU), the League of Arab States, the Agency for the Prohibition of Nuclear Weapons in Latin America (OPANAL), the Council for Mutual Economic Assistance (CMEA), the Arab Atomic Energy Agency (AAEA), the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), as well as the ITER International Fusion Energy Organization (for corresponding treaties adopted under Agency auspices see below).[51]

Finally, it should be noted that treaties concluded between the IAEA and regional organisations may also include safeguards agreements, as alluded to above. For example, the NPT provides specifically in Article III.4 that parties may conclude safeguards agreements "individually or together with other States". Accordingly, the (currently 26) non-nuclear-weapon states of Euratom, Euratom itself and the Agency have concluded one comprehensive safeguards agreement that applies in all of those states.[52] Additionally, the Agency has concluded a quadripartite comprehensive safeguards agreement with Argentina, Brazil and the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials.[53]

4. Treaties adopted under the auspices of the IAEA

With respect to the treaties enumerated under this section, the concept of "auspices" encompasses two notions, linked to the adoption and status of an agreement. For one, the IAEA contributed to the genesis of these treaties, meaning that they were negotiated and concluded by IAEA member states with the support of the Agency's Secretariat. For another, there is an ongoing responsibility of the IAEA Director General to act as their depositary, entailing various functions of a notarial type, including custody over original texts, taking instruments of consent or

51. Agreement between the International Atomic Energy Agency and the Inter-American Nuclear Energy Commission, entered into force 21 Dec. 1960, in INFCIRC/25, *supra* note 49; Co-operation Agreement Between the International Atomic Energy Agency and the Organization of African Unity (in 2002 the OAU was succeeded by the African Union), entered into force 26 Mar. 1969, in IAEA (1969), "The Texts of the Agency's Co-operation Agreements with Regional Intergovernmental Organizations", IAEA Doc. INFCIRC/25/Add.2; Co-operation Agreement between the International Atomic Energy Agency and the League of Arab States, entered into force 15 Dec. 1971, in *ibid*., IAEA Doc. INFCIRC/25/Add.3 (1972); Co-operation Agreement Between the International Atomic Energy Agency and the Agency for the Prohibition of Nuclear Weapons in Latin America, entered into force 3 Oct. 1972, in *ibid*., IAEA Doc. INFCIRC/25/Add.4 (1972); Agreement on Co-operation between the International Atomic Energy Agency and the Council for Mutual Economic Assistance, entered into force 26 Sept. 1975, in *ibid*., IAEA Doc. INFCIRC/25/Add.5 (1976); Agreement on Co-operation between the International Atomic Energy Agency and the Arab Atomic Energy Agency, entered into force 12 Nov. 1990, in IAEA Doc. INFCIRC/25/Add.6 (1990); Co-operation Agreement between the International Atomic Energy Agency and the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials, entered into force 25 May 1998, in IAEA (1998), "Co-Operation Agreement", IAEA Doc. INFCIRC/25/Add.7; Cooperation Agreement between the International Atomic Energy Agency and the ITER International Fusion Energy Organization, entered into force 13 Oct. 2008, in IAEA (2009), "Cooperation Agreement", IAEA Doc. INFCIRC/25/Add.8.

52. Agreement between Belgium, Denmark, the Federal Republic of Germany, Ireland, Italy, Luxembourg, the Netherlands, the European Atomic Energy Community and the Agency in implementation of Article III(1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons , INFCIRC/193, *supra* note 14.

53. Agreement of 13 December 1991 Between the Republic of Argentina, the Federative Republic of Brazil, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials and the International Atomic Energy Agency for the Application of Safeguards, INFCIRC/435, *supra* note 14.

reservations into deposit, notifying parties of the current level of adherence and sometimes facilitating the resolution of sensitive questions of treaty law. This section divides the relevant agreements into those governing nuclear safety, nuclear security, civil liability for nuclear damage, other agreements relating to technical co-operation at the regional level, and privileges and immunities.

a. Nuclear safety

The international nuclear safety regime primarily consists of four treaties adopted under IAEA auspices, two codes of conduct and one regulation. The relevant treaties governing the safety of nuclear power plants (Convention on Nuclear Safety), radioactive waste and spent fuel (Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management), as well as emergency preparedness and response (Early Notification and Assistance Conventions) are addressed in this section and the cited codes of conduct further below, with other non-binding instruments.

i. Convention on Nuclear Safety

The Convention on Nuclear Safety (CNS) was adopted under the auspices of the Agency in 1994[54] and constitutes the cornerstone of the framework for the safety of nuclear power plants. It seeks to ensure that land-based civil nuclear power plants are operated and managed in a safe, well-regulated and environmentally sound manner for the purpose of achieving and maintaining a high level of safety at nuclear power plants worldwide. Almost all states that operate nuclear power plants are parties to the CNS.[55] It is often referred to as an "incentive convention".[56] One of the main elements of the CNS is its peer review mechanism, whereby contracting parties meet under the auspices of the IAEA, for the purpose of reviewing national reports on the measures taken to implement each of the obligations of the Convention.

In the wake of the Fukushima Daiichi nuclear power plant accident, states have recently undertaken various efforts to strengthen the CNS. In this respect, subsequent to a 2013 amendment proposal, the CNS parties adopted the Vienna Declaration on Nuclear Safety instead.[57] It includes a number of principles with the objective of preventing and mitigating accidents with radiological consequences.[58] The parties have also adopted proposals to improve

54. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996.

55. As of 21 May 2021, it has 91 contracting parties.

56. It should be noted that the term "incentive convention" is not a precise legal term. Rather, it was created during the early drafting process of the Convention and reflects the Convention's reliance on its parties' co-operation to achieve its goals. See also preambular paragraph (vii) of the Convention and preambular paragraph (ix) of the Joint Convention *infra* note 61.

57. Further to the 6th Review Meeting, a Diplomatic Conference at IAEA Headquarters on 9 February 2015 was attended by 71 contracting parties who thoroughly considered a proposal made by Switzerland in December 2013 to amend Article 18 of the CNS (which addresses the design and construction of both new and existing nuclear power plants). The contracting parties concluded that it would not be possible to reach consensus on the proposed amendment. Instead, to attain the objectives of the proposed amendment, they adopted the Declaration. See Diplomatic Conference to consider a Proposal by Switzerland to amend the Convention on Nuclear Safety (9 Feb. 2015), "Summary Report", Doc. CNS/DC/2015/3/Rev.2, para. 11.

58. IAEA (2015), "Vienna Declaration on Nuclear Safety: On principles for the implementation of the objective of the Convention on Nuclear Safety to prevent accidents and mitigate radiological consequences", IAEA Doc. INFCIRC/872.

the peer review process, focusing on issues relating to transparency, participation and promotion of the Convention,[59] and revised the corresponding guidance documents.[60]

ii. Joint Convention

The adoption of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) in 1997 represented a further important step towards establishing a comprehensive international legal framework for nuclear safety.[61] It is often referred to as the "sister" convention to the CNS for various reasons. It shares the objective of achieving and maintaining a high level of safety as part of a global regime for ensuring the protection of people and the environment, its scope of application begins where that of the CNS ends and it provides for a peer review mechanism similar to that of the CNS.[62] As with the CNS, the Agency also provides the Secretariat for the meetings of the parties. Although relevant to all states in which there is radioactive waste, for example, even to those where waste is generated exclusively by the use of radioactive material in medicine and research, the Joint Convention currently only has 84 parties.[63] In recent years, the parties have sought to achieve greater transparency and strengthen the effectiveness of the peer review process,[64] for example, by adjusting the submission and content of national reports or the pursuit of video conferencing.[65]

59. The 7th Review Meeting, which was held from March to April 2017 included, for the first time, new features such as a peer review of the incorporation of appropriate technical criteria and standards used by contracting parties for addressing the principles of the Vienna Declaration on Nuclear Safety in national requirements and regulations. See 7th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety (7 Apr. 2017), "Summary Report", Doc. CNS/7RM/2017/08/Final, p. 6, para. 22.

60. This includes, for example, the guidelines regarding the form and structure of national reports, IAEA (2018), "Guidelines regarding National Reports under the Convention on Nuclear Safety", IAEA Doc. INFCIRC/572/Rev.6. Adjustments have also been made over the years to the procedural and financial Rules, IAEA (2015), "Convention on Nuclear Safety: Rules of Procedure and Financial Rules", IAEA Doc. INFCIRC/573/Rev.6) and the guidelines for the review process, IAEA (2015), "Guidelines regarding the Review Process under the Convention on Nuclear Safety", IAEA Doc. INFCIRC/571/Rev.7.

61. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001 (Joint Convention).

62. The Convention applies to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors, the safety of radioactive waste management when the radioactive waste results from civilian application, and certain discharges.

63. As of 21 May 2021. In this context, past General Conference Safety Resolutions have consistently urged: "all Member States that have not yet done so, particularly those managing radioactive waste or spent fuel, to become Contracting Parties to the Joint Convention." See e.g. IAEA (2020), "Nuclear and Radiation Safety Resolution adopted on 25 September 2020 during the eleventh plenary meeting", IAEA Doc. GC(64)/RES/9, para. 15.

64. See IAEA (2014), "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management: Rules of Procedure and Financial Rules", IAEA Doc. INFCIRC/602/Rev.5; IAEA (2017), "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management: Guidelines regarding the Review Process", IAEA Doc. INFCIRC/603/Rev.7; and IAEA (2014), "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management - Guidelines regarding the Form and Structure of National Reports", IAEA Doc. INFCIRC/604/Rev.3.

65. In the context of the 6th Review Meeting held from May to June 2018 at IAEA Headquarters, the contracting parties accepted recommendations whereby, *inter alia*, "each national report should highlight the significant changes from the previous national report", that these reports should generally be submitted "no later than thirty days before the start of the Review Meeting, to allow other Contracting Parties sufficient time to review proposals", and that the IAEA Secretariat be requested "to ask the CNS for approval to share the report to be presented to the CNS on its findings regarding video conferencing" 6th Review Meeting of the Contracting Parties, "Final Summary Report", Doc. JC/RM6/04/Rev.2, paras. 78, 79 and 81. As of 28 May 2021, the CNS contracting parties have not yet agreed to use video conferencing.

iii. The Early Notification and Assistance Conventions

As an immediate reaction to the Chernobyl accident of April 1986, the IAEA General Conference adopted two instruments to facilitate emergency preparedness and response, i.e. the Convention on the Early Notification of a Nuclear Accident (Early Notification Convention) and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention).[66] The purpose of these conventions is to minimise the consequences of accidents or emergencies, by providing for the notification of accidents, the exchange of information and the prompt provision of assistance in the event of a nuclear accident or radiological emergency. They also establish the international emergency preparedness and response framework of the IAEA, which assigns a variety of responsibilities to the Agency, including notification through designated contact points, provision and facilitation of international assistance upon request and co-ordination of the inter-agency response.[67]

The Conventions are supplemented by IAEA safety standards,[68] as well as a number of mechanisms and practical arrangements established by the IAEA Secretariat, the Policy-Making Organs of the Agency, and the Meetings of the Competent Authorities identified under the Conventions.[69] Further to the Fukushima Daiichi nuclear power plant accident, some of these underlying practical arrangements and mechanisms, such as the Response and Assistance Network (RANET) were further strengthened.

b. Nuclear security

Similar to questions of nuclear safety, matters of nuclear security were originally considered to be reserved for the national domain and thus almost exclusively governed by domestic law. In recent years, however, not least after the events of 11 September 2001, the international

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66. Convention on Early Notification of a Nuclear Accident (1986), IAEA Doc. INFCIRC/335, 1439 UNTS 276, entered into force 27 Oct. 1986; Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1986), IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987. Both were adopted by the IAEA General Conference at its Special Session, held from 24 to 26 September 1986. As of 21 May 2021, the Early Notification Convention has 127 parties (four of which are organisations, Euratom, FAO, WHO and WMO). It establishes the duty of States to notify nuclear accidents, including those arising from nuclear power plants, with actual or possible transboundary effects. As of 21 May 2021, the Assistance Convention at present has 122 parties (four of which are organisations, Euratom, FAO, WHO and WMO). The Assistance Convention provides an international framework to facilitate requests for and provision of assistance in the event of a nuclear accident or radiological emergency and to promote, facilitate and support co-operation between states parties to that end.

67. Today, the IAEA has a "central role" in the international emergency and response system (EPR). The operational focal point of the EPR system is the IAEA's Incident and Emergency Centre (IEC).

68. In particular, the safety requirements in IAEA et al. (2015), *Preparedness and Response for a Nuclear or Radiological Emergency*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 7, IAEA, Vienna.

69. For example, there is the IAEA (2019), *Operations Manual for Incident and Emergency Communication,* IAEA Doc. EPR-IEComm 2019, which defines mechanisms and channels for communication among the Secretariat, States and relevant international organisations. There is also the IAEA (2018), *IAEA Response and Assistance Network*, IAEA Doc. EPR-RANET 2018, which provides mechanisms for international assistance, as well as IAEA (2017), *Joint Radiation Emergency Management Plan of the International Organizations*, IAEA Doc. EPR-JPLAN 2017, which, *inter alia*, describes the practical arrangements of the organisations involved in a response. Further, there is also the IAEA (2014), *IAEA Response Plan for Incidents and Emergencies*, IAEA Doc. EPR-REPLIE 2014, which provides the high-level basis for the Secretariat's own emergency preparedness and response to a radiation-related event. Finally, there are relevant bilateral or regional agreements on emergency preparedness and response between neighbouring States.

community has recognised the severity and distinct nature of the terrorist threat. This has given rise to an accelerated and comprehensive reassessment of the risks emanating from non-state actors and particularly terrorism in all its forms, including nuclear and radiological terrorism.

Whereas the first generation of international instruments dealing with nuclear security primarily consisted of the CPPNM[70] as well as several non-binding sources, including the *Code of Conduct on the Safety and Security of Radioactive Sources* (with supplementary *Guidance on the Import and Export of Radioactive Sources*),[71] and the Agency's Recommendations for the Physical Protection of Nuclear Material,[72] the framework was significantly reinforced after the 11 September 2001 events. These instruments are part of the universal legal framework against terrorism, connected by common features such as the requirement to criminalise and penalise acts of terrorism. In addition to the Amendment to the CPPNM[73] and legally binding resolutions of the UN Security Council[74] this framework includes a total of 19 terrorism-related treaties adopted under the auspices of the UN, IMO and ICAO.[75]

i. CPPNM

As noted, prior to the adoption of the CPPNM, at the international level, the realm of nuclear security was governed by non-binding instruments only. Thus, the signing of the CPPNM in 1980 marked the emergence of the first internationally legally binding undertaking in the area of physical protection of nuclear material. It regulates matters such as physical protection during international transport, penalisation of acts such as theft of nuclear material and international co-operation, in particular, in the case of theft of nuclear material. While eminently important, the CPPNM does not set out a comprehensive nuclear security regime, meaning that non-binding sources of law continue to play a pivotal role.

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70. See Convention on the Physical Protection of Nuclear Material (1980), IAEA Doc. INFCIRC/274 Rev. 1, 1456 UNTS 125, entered into force 8 February 1987 (CPPNM). As of 21 May 2021 the CPPNM has 162 parties (one of which is an organisation, Euratom).

71. IAEA (2004), *Code of Conduct on the Safety and Security of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/2004; IAEA (2012), *Guidance on the Import and Export of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/IMO-EXP/2012.

72. IAEA (2011), *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities*, IAEA Nuclear Security Series, No. 13, INFCIRC/225/Revision 5. This text is particularly important, as it provides a basis for states to implement the CPPNM and its Amendment, as well as to establish national legislative frameworks. Similarly, for Agency-assisted projects (such as Project and Supply Agreements) or for its own operations, the requirements are mandatory.

73. As of 21 May 2021, the Amendment to the CPPNM has 125 parties (including Euratom).

74. These resolutions were adopted under Chapter VII of the UN Charter, *supra* note 28. Pursuant to Article 48(2) of the UN Charter, "[s]uch decisions shall be carried out by the Members of the United Nations directly and through their action in the appropriate international agencies of which they are members." See UN Security Council Resolution (UNSCR) 1373 (2001), "Threats to international peace and security caused by terrorist acts", UN Doc. S/RES/1373, adopted 28 Sept. 2001, which focusses on preventing and suppressing the financing and preparation of any acts of terrorism, as well as UNSCR 1540 (2004), "Non-proliferation of weapons of mass destruction", UN Doc. S/RES/1540, adopted 28 Apr. 2004, wherein the Security Council affirms "that proliferation of nuclear […] weapons, as well as their means of delivery, constitute a threat to international peace and security", as well as "its resolve to take appropriate and effective actions against any threat to international peace and security caused by the proliferation of nuclear […] weapons and their means of delivery" and "its support for multilateral treaties whose aim is to eliminate or prevent the proliferation of nuclear […] weapons."

75. These include, for the IAEA, the 1980 CPPNM and its 2005 Amendment, as well as a number of further treaties under the auspices of the United Nations, the IMO and ICAO.

ii. Amendment to the CPPNM

Recognising some limitations of the CPPNM, at a Diplomatic Conference in 2005, parties decided to bolster the Convention by amending it in three respects. The Amendment extends protection to domestic use, storage and transport rather than mere protection during international transport, and introduces new offences such as "sabotage" and "nuclear smuggling". It also expands co-operation to locate and recover stolen or smuggled nuclear material, as well as mitigate any radiological consequences of sabotage. By 2016, further to substantial Agency efforts, two-thirds of state parties had consented to the Amendment, thus meeting the threshold for its entry into force.[76] The IAEA has since shifted its focus to achieving "universalisation" of the CPPNM and its Amendment, i.e. adherence by all states, to ensure that nuclear material does not fall into the hands of terrorists or other criminals, and that there is no "safe haven" for terrorists.[77]

c. Civil liability from nuclear damage

Ensuring that there is both adequate and prompt compensation in the event of a nuclear accident is an equally significant element of the international nuclear safety framework. It consists of multiple instruments seeking to harmonise domestic legislation, in two parallel regimes. While the Paris regime comprises treaties concluded under the auspices of the OECD,[78] the Vienna regime consists of the instruments adopted under IAEA auspices. The latter is based upon the 1963 Convention on Civil Liability for Nuclear Damage and its 1997 Protocol.[79] Overall, these treaties espouse common principles with the objective to establish minimum standards of legal and financial protection against damage resulting from the peaceful uses of nuclear energy, especially in a cross-border context. The main difference between the two arrangements thus lies less in their substance than their geographic scope, which is reflective of the limited membership of the OECD.

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76. The instrument is therefore relevant to all states regardless of whether they have nuclear material and nuclear facilities. Given the high threshold for its entry into force (ratification, acceptance or approval by two-thirds of the states parties to the CPPNM was required, pursuant to Article 20 of the Convention), the Amendment took an extended period of time to enter into force, which, conversely, contributed to the creation of a strong framework.

77. The Second Technical Meeting of Representatives of States Parties to the Convention on the Physical Protection of Nuclear Material (CPPNM) and the CPPNM Amendment was held from 30 November to 2 December 2016 at IAEA Headquarters, focussing, in particular, on the mechanisms for information sharing and promoting universalisation of the CPPNM and the Amendment thereto.

78. These include the Convention on Third Party Liability in the Field of Nuclear Energy of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1960), 1519 UNTS 329 (Paris Convention); Protocol to Amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004), entered into force 1 Jan. 2022, available at: www.oecd-nea.org/law/paris_convention.pdf (2004 Paris Protocol) (accessed 21 May 2021); Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1963), 1041 UNTS 358 (Brussels Supplementary Convention); Protocol to Amend the Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004), entered into force 1 Jan. 2022, available at: www.oecd-nea.org/law/brussels_ supplementary_convention.pdf (2004 Brussels Protocol).

79. Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977; Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997), IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force 4 Oct. 2003.

After the 1986 Chernobyl accident, the efforts of the international community to link and enhance these parallel systems led to the adoption of two further treaties and a particularity with respect to their negotiation. The Joint Protocol Relating to the Vienna and Paris Conventions of 1988 performs a bridging function that connects the instruments under the auspices of the IAEA – but also under those of the OECD, in what is referred to as the joint auspices of both organisations.[80] In addition, the 1997 Convention on Supplementary Compensation, adopted under IAEA auspices, increases available funds, reinforces the unification of these regimes and extends its applicability to states that otherwise only govern questions of nuclear liability in their domestic legislation, rather than by international agreements.[81]

The current focus of the IAEA in this respect is to promote accession to existing instruments and establish a global nuclear liability regime. For example, the IAEA Director General's expert group on nuclear liability, INLEX, has issued recommendations to this effect.

d. Regional technical co-operation agreements

The primary legal bases for technical co-operation involving nuclear sciences and technology between the Agency and its member states are bilateral agreements. At the same time, the Agency also seeks to facilitate regional activities, including collaboration between its member states through programmes and projects that focus on shared needs and existing capabilities. At the regional level, there are four treaties of this type that have all been concluded under IAEA auspices, for Africa, Asia and the Pacific, Latin America and the Caribbean, as well as for Arab States in Asia.[82]

e. Privileges and immunities

Like other intergovernmental organisations, the IAEA enjoys a particular type of protection to ensure that it can properly exercise its functions without undue interference by or incidental undue advantage to any individual state. These protections extend not only to the organisation itself, but also the representatives of its members, its officials and experts participating in missions on its behalf. While the corresponding obligations are binding upon each member state by virtue of Article XV of the IAEA Statute, paragraph C of that same Article envisages that these are to be "defined in a separate agreement or agreements". This agreement, elaborating in greater detail upon the content of Article XV of the IAEA Statute, is the Agreement on the Privileges and Immunities of the IAEA, for which the Director General is the depositary.[83] Although the treaty closely mirrors the conventions adopted for similar purposes on behalf of the United Nations and its specialised agencies, there are discrepancies between their texts, including such that account for the significance of ensuring protection of safeguards inspectors.

80. Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (1988), IAEA Doc. INFCIRC/402, 1672 UNTS 293, entered into force 27 Apr. 1992.

81. Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 Apr. 2015.

82. African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) *supra* note 32; Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA); Regional Cooperation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL); and Cooperative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA).

83. IAEA (1959), "Agreement on the Privileges and Immunities of the Agency", IAEA Doc. INFCIRC/9, adopted 1 July 1959.

5. Treaties and other instruments of particular significance to the IAEA

A third and final type of instrument that should be mentioned includes those to which the IAEA is neither a party nor the Director General the depositary, but that nonetheless assign rights and responsibilities to the IAEA or otherwise specifically impact the organisation. Most importantly, these are the treaties assigning safeguards-related tasks to the Agency, but there are also further notable instruments that fall within this category, as will be illustrated below.

a. Treaty on the Non-Proliferation of Nuclear Weapons

The NPT, which entered into force on 5 March 1970, is the most widely adhered to treaty in the nuclear field, with 191 states parties.[84] The treaty provides a global legal framework for nuclear non-proliferation. Articles I and II of the treaty contain the non-proliferation undertakings of the nuclear-weapon states parties to the treaty, and the non-nuclear-weapon states parties, respectively. In general terms, the nuclear-weapon states agree not to transfer nuclear weapons or other nuclear explosive devices to any other state, and not to assist, encourage or induce any non-nuclear-weapon state to manufacture or otherwise acquire such weapons or devices, or control over them. The non-nuclear-weapon states, for their part, undertake not to manufacture or acquire nuclear weapons or other nuclear explosive devices, or to seek or receive assistance in their manufacture.

As discussed above in the context of comprehensive safeguards agreements, the Agency plays an important role in the verification of non-nuclear-weapon states parties' obligations not to divert nuclear material from peaceful nuclear activities to the development of a nuclear weapon or other nuclear explosive device. As the Agency is not a party to the NPT, this is achieved through the requirement of Article III of the treaty that non-nuclear-weapon states parties conclude safeguards agreements with the Agency.

b. Joint Comprehensive Plan of Action

On 14 July 2015, subsequent to extensive negotiations, Iran, China, France, Germany, Russia, United Kingdom, United States, and the High Representative of the European Union for Foreign Affairs and Security Policy reached a milestone agreement by concluding the JCPOA. The JCPOA was endorsed by UNSCR 2231 (2015) and is included as Annex A to the resolution. This resolution requested the Director General, *inter alia*, to undertake the necessary verification and monitoring of Iran's nuclear-related commitments for the full duration of those commitments under the JCPOA, as well as to provide regular updates to the Board and, as appropriate, in parallel to the Security Council on Iran's implementation of its commitments under the JCPOA.[85]

On 25 August 2015, the Board of Governors authorised the Director General to undertake such verification and monitoring of Iran's nuclear-related commitments under the JCPOA, as set out in the JCPOA, and report accordingly, for the full duration of those commitments in light of UNSCR 2231 (2015), subject to the availability of funds and consistent with the Agency's standard safeguards practices. On 15 December 2015, the Board adopted a resolution in respect of the Director General's "Final Assessment on Past and Present Outstanding Issues Regarding Iran's Nuclear Programme", which related to all past and present outstanding issues, as set out in the Director General's report in November 2011 contained in GOV/2011/65.[86] This resolution

84. NPT, *supra* note 8. Status as of 21 May 2021.

85. UNSCR 2231 (2015), "Iran Nuclear Issue", UN Doc. S/RES/2231, adopted 20 July 2015, operative paragraphs 3-4.

86. IAEA (2015), "Joint Comprehensive Plan of Action implementation and verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015): Resolution adopted by the Board of Governors on 15 December 2015", IAEA Doc. GOV/2015/72, operative paras. 8-9.

paved the way for the Agency to take preparatory steps for the implementation of the JCPOA, which began on the JCPOA "Implementation Day" on 16 January 2016.[87] Since 2016, the Agency has continued to report on its verification and monitoring activities in light of the JCPOA, which complement the Agency's work implementing safeguards under Iran's comprehensive safeguards agreement as well as its provisionally applied additional protocol.[88]

The Agency's verification and monitoring of Iran's JCPOA-based nuclear-related commitments correspond to Iran's activities related to heavy water and reprocessing; activities related to enrichment and fuel; centrifuge research and development, manufacturing and inventory; Iran's enriched uranium stockpile, as well as transparency measures such as the use of online enrichment monitors and electronic seals. Additionally, simultaneous with the implementation of the JCPOA, since 16 January 2016, Iran has provisionally applied the Additional Protocol to its Safeguards Agreement.[89]

c. Nuclear-weapon-free-zone treaties

Nuclear-weapon-free-zone treaties requiring the application of safeguards, i.e. the Tlatelolco, Rarotonga, Bangkok, Pelindaba and Semipalatinsk treaties,[90] each stipulate that states parties located or having territories within the zone of application of the treaty, are obliged to conclude comprehensive safeguards agreements with the Agency. In the case of the Treaty of Semipalatinsk, an additional protocol to the comprehensive safeguards agreement of a state party is also required.[91] Under each treaty, every state party undertakes, *inter alia*, to use nuclear material and facilities exclusively for peaceful purposes and is required to accept the application of comprehensive Agency safeguards to verify that undertaking.

d. Other agreements

There are also a variety of further agreements outside the safeguards-specific context that assign individual responsibilities to the IAEA or are intimately linked to its mandate. These include three treaties under the auspices of the IMO that govern marine pollution by dumping of waste, safety of life at sea and liability for maritime carriage of nuclear material.[92] Under these agreements, or upon request of their parties, the IAEA, for example, developed definitions of radioactive waste unsuitable for dumping at sea as well as a database of relevant disposals, and established model regulations for incorporation into specialised maritime safety instruments. With respect to civil liability, the IAEA joined forces with the IMO and OECD, convening a conference at which states negotiated a treaty to avoid conflicts that may arise from the simultaneous application of the respective regimes.

87. See IAEA (2016), "Verification and Monitoring in the Islamic Republic of Iran in Light of United Nations Security Council Resolution 2231 (2015): Report by the Director General", IAEA Doc. GOV/INF/2016/1, p. 4. See also paragraph 34.ii of the JCPOA, Annex A to UNSCR 2231, *supra* note 85.

88. See e.g. IAEA (2020), "Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015): Report by the Director General", IAEA Doc. GOV/2020/51, para 32.

89. *Ibid*.

90. For an overview of these treaties, see *supra* section 3.a. "Agreements with States".

91. Article 8(b), CANWFZ Treaty, *supra* note 18.

92. These three conventions are referred to as the London Convention, SOLAS and NUCLEAR: London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972), 1046 UNTS 120, entered into force 30 Aug. 1975; (London Convention); International Convention for the Safety of Life at Sea (1974), 1184 UNTS 2, entered into force 25 May 1980 (SOLAS); Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (1971), 974 UNTS 255, entered into force 15 July 1975 (NUCLEAR).

Similarly, instruments that relate primarily to the work of other organisations, including the OECD or the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), are also of significance to the IAEA.[93]

6. Safety standards, codes of conduct and guidance

The instruments addressed under the previous sections, whether those to which the Agency is a party, negotiated under its auspices or of notable import to its mandate, are of a legally binding nature. This means that failure by their parties to comply with the respective terms, whether states or intergovernmental organisations, will give rise to international responsibility.[94] At the same time, treaties are not the only instruments of a normative character which the Agency develops that serve to regulate its own conduct, that of states or others. At a more technical, operational level, the Agency has produced different types of documents that, despite their non-binding character, enjoy significant practical relevance and a high degree of acceptance.

These are based, predominantly, upon two provisions of the IAEA Statute. The first requires the Agency to conduct its activities in accordance with the purpose of international co-operation.[95] The second, more specific, provision, authorises the Agency to "establish or adopt […] standards of safety for protection of health and minimisation of danger to life and property […] and to provide for the application of these standards".[96]

These documents also differ from treaties governing related questions of law, insofar as multilateral agreements are generally adopted subsequent to formal negotiations exclusive to states, while IAEA safety standards and similar documents are primarily developed by experts, in an inclusive and transparent process in which member states play a pivotal role as well. Although not formally binding per se, safety standards may acquire an obligatory character where either the IAEA itself is involved, or there has been a request for IAEA standards to be applied to arrangements between states or to activities of individual states.[97] In addition, the text of safety standards is frequently integrated into treaties or domestic legislation, thus acquiring a binding quality by virtue of its transformation.

In addition to safety standards, the IAEA also develops codes of conduct and practice, as well as guidance documents, which share the objective of international harmonisation, but are designed more as recommendations for best practices by individual states. These will also be briefly illustrated below.

93. In addition to the Comprehensive Nuclear-Test-Ban Treaty (1996) (not yet entered into force), available at: www.ctbto.org/fileadmin/content/treaty/treaty_text.pdf (accessed 21 May 2021), these include the aforementioned liability instruments under the auspices of the OECD, i.e. the Paris and Brussels Conventions, as well as amendments and protocols thereto, *supra* note 78.

94. In this context it should also be noted that the safety-related "incentive Conventions" examined above possess a distinct regime for ensuring compliance with their terms.

95. See Article II.B.1 of the IAEA Statute, *supra* note 1, in conjunction with Article 1(3) of the UN Charter, *supra* note 28.

96. IAEA Statute, *supra* note 1, Art. III.A.6.

97. *Ibid*. A case in point can be found in IAEA (1979), "Revised Guiding Principles and General Operating Rules to Govern the Provision of Technical Assistance by the Agency", IAEA Doc. INFCIRC/267, which stipulates, under section I.A.1.(h) that "[t]he Agency's Safety Standards and Measures shall be applied, where relevant, to operations making use of technical assistance provided" (footnote omitted).

a. *Safety Standards Series*

Keeping pace with technological developments and the continuous pursuit of harmonisation in the interest of safety requires regulation with respect to matters that may not be addressed comprehensively, or at all, within existing treaties. Thus, lending currency and granularity to rules contained in binding instruments, safety standards add additional levels of detail. At the time of writing, there are 132 established and published IAEA safety standards, with a further 42 drafts under development. These standards address particular types of facilities and activities, such as nuclear power plants, research reactors or radioactive waste management, decommissioning and remediation. They are addressed, first and foremost, to national authorities, most importantly regulators, but also organisations such as operators. The documents consist of three categories, i.e. fundamentals, requirements and guides. Substantively, these range from establishing the fundamental safety objective and principles to ensuring protection of people and the environment, to compliance with the corresponding requirements.

It is worth noting that while nuclear safety and nuclear security generally address distinct concerns, there are standards, such as the Basic Safety Standards, which reflect an interface between safety and security, i.e. by requiring states to keep sources secure for the purpose of preventing theft or damage.[98] Further primary IAEA safety standards include those governing the safe transport of nuclear material,[99] the legal and governmental infrastructure for nuclear radiation, radioactive waste and transportation safety,[100] as well as preparedness and response for nuclear or radiological emergencies.[101]

b. *Codes of conduct and practice*

As noted above, the treaty regime for nuclear safety is augmented not only by safety standards, but also codes. These are of a more recommendatory character and addressed by IAEA member states to all states. These include the 1990 Code of Practice on the Transboundary Movement of Radioactive Waste,[102] the 2003 *Code of Conduct on the Safety and Security of Radioactive Sources* and the 2004 *Code of Conduct on the Safety of Research Reactors*.[103] They are further supplemented by guidance documents such as the 2018 *Guidance on the Management of Disused Radioactive Sources*[104] and the 2012 *Guidance on the Import and Export of Radioactive Sources*.

98. IAEA et al. (2014), *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 3, IAEA, Vienna, p. 46, para. 3.55.

99. IAEA (2018), *Regulations for the Safe Transport of Radioactive Material*, IAEA Safety Standards Series, Specific Safety Requirements, No. SSR-6 (Rev. 1), IAEA, Vienna.

100. IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 1 (Rev. 1), IAEA, Vienna.

101. IAEA (2015), *Preparedness and Response for a Nuclear or Radiological Emergency*, *supra* note 68.

102. IAEA (1990), Code of Practice on the International Transboundary Movement of Radioactive Waste, IAEA Doc. INFCIRC/386.

103. IAEA (2006), *Code of Conduct on the Safety of Research Reactors*, IAEA Doc. IAEA/CODEOC/RR/2006.

104. IAEA (2018), *Guidance on the Management of Disused Radioactive Sources*, IAEA/CODEOC/MGT-DRS/2018, IAEA, Vienna.

c. *Guidance documents*

Finally, one should also note a third type of non-binding law – IAEA guidance documents containing recommendations prepared by the Agency upon advice of experts, such as the Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities, setting out administrative and technical nuclear security measures.[105] While this latter document predates the CPPNM, it has since been revised multiple times and applied, for example, in the context of nuclear co-operation between states conducted on the basis of references contained in pertinent treaties. As noted above, with respect to safeguards, the Agency has developed guidelines that constitute a type of blueprint for safeguards agreements to be concluded between the IAEA and individual non-nuclear weapon states under the NPT.[106] A similar document has been prepared for the negotiation of Additional Protocols to Comprehensive Safeguards Agreements.[107]

7. Non-binding co-operation arrangements

In addition to treaties and the noted non-binding sources of law, two further types of instruments, which are of particular importance for the Agency at the operational level, should be mentioned here as well. These are non-legally binding and flexible co-operation frameworks.

Practical Arrangements and, more rarely, Memoranda of Understanding (MoU), are concluded for a variety of purposes, under different designations and often contain technical, operational or practical details further to commitments such as may be set out within treaties or decisions of the IAEA's Policy-Making Organs. MoU, as opposed to practical arrangements, tend to be employed where the counterpart is a UN Agency, other intergovernmental organisation, or an IAEA member state signing at the ministerial level. While the Agency has recently begun to more clearly distinguish between these two instruments, MoU have generally been employed for rather higher level programmatic as opposed to more routine operational (technical) purposes and exhibit a broader scope than practical arrangements. One feature common to many practical arrangements is that they are concluded for particular projects and thus also for a limited period of time, often a duration of three years, while MoU are more largely of an indefinite duration.

As noted above, counterparts for these instruments may include states and intergovernmental organisations, but also various public bodies or private entities, including non-governmental organisations and research institutions. Arrangements with IAEA member states are most frequently concluded with national nuclear regulatory bodies and typically govern aspects of technical co-operation, such as capacity building through education and training. Other counterparts include individual ministries, such as those responsible for matters of energy, health or foreign affairs. In terms of substance, arrangements with states, individual ministries, provincial authorities or similar public bodies at the national level often have a rather broad scope and may encompass, comprehensively or individually, aspects of nuclear applications, energy, safety, security and safeguards. Others are linked to more specific purposes, such as lending support with respect to nuclear security measures for individual events or addressing harmful algal blooms. As regards international organisations, the respective counterparts are often regional organisations with broad or highly specialised functions that engage in practical arrangements pertaining to matters such as combatting marine environment problems, establishing dosimetry laboratories, implementing

105. IAEA (2011), *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities* (INFCIRC/225/Revision 5), *supra* note 72.

106. INFCIRC/153 (Corr.), *supra* note 16.

107. INFCIRC/540 (Corr.), *supra* note 26.

nuclear techniques in food and agriculture, or cancer control. With respect to arrangements with private entities, counterparts are most frequently universities, research centres or non-governmental organisations, but may also include hospitals, scientific societies, laboratories, foundations or corporations. Substantively, these arrangements concern, for example, matters relating to the operation of nuclear power plants, comprehensive cancer control, environmental monitoring, knowledge management, mosquito population control, non-destructive testing or crop management.

8. Outlook

This contribution has provided a birds-eye view of the law created by, or specific to, the IAEA. A brief look at the dates of adoption of the cited treaties, whether it is those to which the Agency is a party, concluded under its auspices or otherwise of particular significance to its mandate, will suffice to recognise that few are recent. This phenomenon is by no means unique to the nuclear domain. An optimist might infer that the legal foundations have been laid and there is little left to do. The opposite perspective would be to consider that current challenges do not necessarily lend themselves to treaty-based solutions or there is little inclination among states to pursue this type of endeavour.

Yet, as the preceding sections have illustrated, there is a lot to do and it is being done. Now that the treaty foundations have been established, the focus is on making proper use of them. This includes not only their supplementation in a normative respect, through the illustrated standards, codes and guidelines, but also pursuing specific initiatives that realise the treaty regime – be it through arrangements that channel technical co-operation projects, or the operationalising instruments for the advancement of nuclear applications noted above. Similarly, for the existing treaty regime to be most effective, it requires a high level of adherence. For this reason, Director General Grossi has – both in his capacity as the Chief Administrative Officer of the IAEA and depositary for various treaties – encouraged states to accede to the appropriate treaties. With the deposit of every additional instrument of consent, and full implementation of the obligations under such instruments, the risks emanating from ionising radiation are further mitigated, and the safety and security of the international community as a whole, including its population, enhanced.

At the outset of this article, it was observed that the normative activity of IAEA member states is driven, to a significant degree, less by anticipatory than reactive state initiatives. It was the use of a new type of technology that led to the genesis of the organisation, the Chernobyl and Fukushima Daiichi accidents that drove the evolution of nuclear safety and liability, and the terrorist attacks of 11 September 2001 that reinforced the nuclear security regime. Thinking in terms of these three categories – technological evolution, accidents and malicious threats – may provide guidance on which normative projects the international community may focus next.

Looking forward on the technological front, the advent of small modular reactors and transportable nuclear power plants, as well as the introduction of new technologies in radioactive waste management and uranium processing, raise the question as to whether addressing these developments through non-binding or domestic law will be sufficient. Similarly, with progress in fusion and plasma physics, one may ask whether treaty interpretation techniques will be able to carry the legal framework into an age of nuclear fusion, or there will be a need to adjust definitions and questions of scope, and perhaps introduce new rules.

Similarly, with a view to accidents, whether based upon human error or natural events, the introduction of new variables may test the existing framework. With the long-term operation of nuclear power plants, comprehensive discharge into the oceans and cumulative effects of climate change, humanity is stepping into *terra* – and *aqua* – *incognita*. How nuclear law, at the treaty level, will address this new environment remains to be seen. One direction that this may take is further integration with the international treaty framework that is not specific to the nuclear realm.

As cited above, rules of nuclear law are found in instruments such as those devoted to safety in transport or aviation and it should be noted that international environmental law, such as that governing environmental impact assessments, is already applied in a cross-sectoral manner. At the same time, perhaps further synthesis with the law of the sea, environmental law, and the climate change framework will bolster the ability to avoid incidents and accidents.

Finally, there is the matter of addressing threats of an intentional nature. Enhancing the nuclear security framework through new rules and greater participation has been at the forefront of developments over the past two decades, and this is bound to continue. With heightened caution of malicious actors and the underlying dynamics, perhaps, the nuclear security mindset will unlock new paradigms. In this context, the upcoming 2021 Conference of the Parties to the Amendment to the CPPNM will provide a first opportunity to assess the adequacy of the Convention as amended.

There is no doubt that the world is on the cusp of an age characterised by rapid technological evolution, environmental stress and the rise of non-state actors. States will certainly react to the risks that these developments present, but also to the promise that nuclear technology holds.

The OECD Nuclear Energy Agency

by Julia A. Schwartz and Ximena Vásquez-Maignan[*]

The Organisation for European Economic Co-operation (OEEC), the predecessor of today's Organisation for Economic Co-operation and Development (OECD) came into being on 16 April 1948.[1] It was created under the OEEC Convention[2] as a permanent organisation for economic co-operation, primarily to administer aid under the Marshall Plan, the post-World War II programme for the reconstruction of Europe initiated in 1947. Its founding convention also calls on it to assist sound economic expansion in other countries and to contribute to growth in world trade on a multilateral, non-discriminatory basis.

The OEEC originally had 18 participants: Austria, Belgium, Denmark, France, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, United Kingdom and Western Germany (originally represented by the combined American/British occupation zones and the French occupation zone).[3] The headquarters of the Organisation was established at the Château de la Muette in Paris, France, where it remains today.

During the immediate post-World War II period, one of the issues facing European countries as they took up the challenges of national economic reconstruction was energy availability and cost. The Organisation's structure already included a Special Committee on Nuclear Energy that had been established in 1956, but the OEEC Council further pursued the idea of establishing within the Organisation an agency that would take charge of all nuclear energy issues. This idea was largely motivated by the fact that the Council recognised the rapid increase in its member countries' energy needs and the possibilities that nuclear energy presented in that regard.

The European Nuclear Energy Agency (ENEA) was created by a decision of the OEEC Council made on 17 December 1957;[4] it came into force on 1 February 1958 as provided in Article 21 of the Statute.[5] As defined in Article 1, the purpose of the Agency is "to further the development of the

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1. More information on the OEEC is available at: www.oecd.org/general/organisationforeuropeaneconomicco-operation.htm.

2. Convention for European Economic Co-operation of 16 April 1948 (1948), 888 UNTS 141 (OEEC Convention).

3. The Anglo-American zone of the Free Territory of Trieste was also a participant in the OEEC until it returned to Italian sovereignty. See *supra* note 1.

4. OEEC Doc. C(57)255. The NEA Statute was subsequently amended by several decisions of the OECD Council, dated respectively 23 February 1965 [OECD Doc. C(65)17(Final)], 17 May 1972 [OECD Doc. C(72)106(Final)], 9 May 1975 [OECD Doc. C(75)68(Final)], 12 October 1976 [OECD Doc. C(76)172(Final)], 5 April 1978 [OECD Doc. C(77)183(Final)], 10 December 1992 [OECD Doc. C(92)220] and 13 July 1995 [OECD Doc. C(95)157/FINAL].

5. It is worth noting that the year 1957 also witnessed the establishment of the European Atomic Energy Community (Euratom) and the International Atomic Energy Agency (IAEA). The Treaty establishing the European Atomic Energy Community was signed on 25 March 1957 and entered into force on 1 January 1958; its consolidated version is available in the *Official Journal of the European Union* (OJ) C 327 (26 Oct. 2012), pp. 1-107. The Statute of the IAEA was approved on 23 October 1956 by the Conference on the Statute of the International Atomic Energy Agency, which was held at the Headquarters of the United Nations. Statute of the International Atomic Energy Agency (1956), 276 UNTS 3, entered into force 29 July 1957. It came into force upon the fulfilment of the relevant provisions of paragraph E of Article XXI.

production and uses of nuclear energy, including applications of ionizing radiation, for peaceful purposes by the participating countries, through co-operation between those countries and a harmonization of measures taken at the national level", taking due account of the public interest and mindful of the need to prevent the proliferation of nuclear explosive devices. The original ENEA membership included all European OEEC countries as well as Canada and the United States as associate members.

The Steering Committee for Nuclear Energy was designated as the ENEA's governing body (NEA Statute, Article 2) and was given the task, among other things, of promoting technical and economic studies (NEA Statute, Article 4), joint undertakings to collaborate on technical issues for the benefit of the production and use of nuclear energy for peaceful purposes (NEA Statute, Article 5), nuclear research (NEA Statute, Article 7), and the harmonisation and development of legislation in the nuclear field, primarily in the area of civil liability and insurance against nuclear risks (NEA Statute, Article 8).

From the very beginning, the Agency focused on a selection of co-operation themes, compatible with its resources. Its first act was to develop the Convention on the Establishment of a Security Control in the Field of Nuclear Energy, which was adopted on 20 December 1957 (the "Security Control Convention").[6] The security control system established under this convention was designed "to ensure that the operation of joint undertakings established by two or more Governments … on the initiative or with the assistance of the Agency, and that materials, equipment and services made available by the Agency or under its supervision … shall not further any military purpose". Eventually, with the creation of similar systems by Euratom and the IAEA, the Steering Committee for Nuclear Energy decided to suspend the application of the security control system established by the Security Control Convention to avoid unnecessary duplication.[7]

In September 1961, the OEEC was superseded by the OECD, a worldwide body whose founding convention was signed on 14 December 1960 by the 18 member countries of the OEEC together with Canada and the United States.[8] Since then, the OECD's mission has been to help its member countries achieve sustainable economic growth and employment and to raise the standard of living in member countries while maintaining financial stability by building "better policies for better lives".[9] The OECD's focus has progressively broadened to include other countries with 18 additional nations having since joined the Organisation: Australia, Chile, Colombia, Costa Rica, the Czech Republic, Estonia, Finland, Hungary, Israel, Japan, Korea, Latvia, Lithuania, Mexico, New Zealand, Poland, the Slovak Republic and Slovenia. In addition, five countries participate in OECD activities as key partners (Brazil, the People's Republic of China (China), India, Indonesia and South Africa).[10]

6. 351 UNTS 235, entered into force 22 July 1959.

7. The NEA Steering Committee adopted this decision on 14 October 1976. NEA Doc. NE/M(76)2. The need to suspend the Convention is explained in the note by the Secretariat, NEA Doc. NE(76)15.

8. Convention on the Organisation for Economic Co-operation and Development (with Supplementary Protocols Nos. 1 and 2) (1960), 888 UNTS 179, entered into force 30 Sept. 1961 (OECD Convention).

9. "Better policies for better lives" has been the OECD motto since the celebration of its 50th anniversary on 24 May 2011, during which the OECD Secretary-General declared that "After 50 years, our objective is and remains to help member and partner [countries'] governments to formulate and implement better policies for better lives". OECD (2011), *Better policies for better lives: The OECD at 50 and beyond*, OECD Publishing, Paris, p. 5.

10. For more information on the status of key partners at the OECD, see: www.oecd.org/global-relations/keypartners/.

In keeping with the OECD's enlargement, the ENEA's membership expanded as well, such that in 1972, when Japan became the first non-European country to join the Agency as a full member, the ENEA changed its name to the OECD Nuclear Energy Agency (NEA). Today, NEA membership totals 34 countries and the new scope of its increased membership confers upon it a unique position between the limited membership of the European Union and the extended membership of the IAEA (i.e. 27 and 173 member states respectively in July 2021). Its current membership covers different geographical areas (North and South America, Western and Eastern Europe, Eastern and Southeast Asia) that together account for approximately 82% of the world's installed nuclear capacity. The NEA's membership will continue to expand if the Steering Committee for Nuclear Energy decides to do so "on the basis of a careful evaluation of potential mutual benefit and of possible impacts on the NEA's traditional strengths".[11]

One of the particularities of the NEA is that its members do not need to be OECD members (this is currently the case of Argentina, Bulgaria, Romania and Russia) and that all OECD members are not members of the NEA (this is the case of Chile, Colombia Costa Rica, Estonia, Israel, Latvia, Lithuania and New Zealand). A country interested to join the Agency may notify the OECD Secretary-General and the NEA Director-General of its wish to do so. OECD candidates will effectively join the NEA upon approval of the Council on the recommendation of the Steering Committee for Nuclear Energy (Article 17(b), NEA Statute); and non-OECD candidates will effectively join the NEA upon formal acceptance of the invitation to join the NEA that will have been sent to their relevant authorities by the OECD Secretary-General after approval by the Council on the recommendation of the Steering Committee for Nuclear Energy (NEA Statute, Article 17(c)). The latest accessions to the NEA have been of non-OECD members, i.e. the Russian Federation (2012), Argentina and Romania (2017) and Bulgaria (2021).

OECD and NEA membership

• Argentina	• Greece	• Poland
• Australia	• Hungary	• Portugal
• Austria	• Iceland	• Romania
• Belgium	• Ireland	• Russia
• Bulgaria	• Israel	• Slovak Republic
• Canada	• Italy	• Slovenia
• Chile	• Japan	• Spain
• Colombia	• Korea	• Sweden
• Costa Rica	• Latvia	• Switzerland
• Czech Republic	• Lithuania	• Turkey
• Denmark	• Luxembourg	• United Kingdom
• Estonia	• Mexico	• United States
• Finland	• Netherlands	30 OECD and NEA members
• France	• New Zealand	8 OECD members, not NEA
• Germany	• Norway	4 NEA members, not OECD

Figure 1. Comparison of membership in the OECD and NEA

When acceding to the OECD or the NEA, candidate countries need to state their position with regard to one of the OECD legal instruments that have been adopted in the field of nuclear energy, i.e. the 1983 Recommendation of the OECD Council concerning the Operation of a Nuclear

11. Under the chapter "Co-operating with partner countries", the NEA Strategic Plan for 2017-2022 provides that "new membership or outreach should provide significant added value to NEA member countries, provided certain conditions are met. Any proposal for co-operation or membership will be considered by the Steering Committee on the basis of a careful evaluation of potential mutual benefit and of possible impacts on the NEA's traditional strengths." NEA (2016), *The Strategic Plan of the Nuclear Energy Agency 2017*-2022, NEA Doc. NEA/NE(2016)3/FINAL, OECD Publishing, Paris, p. 34.

Power Plant Incident Reporting System.[12] The other OECD legal instruments in the field of nuclear energy, which are all optional for the OECD and NEA member countries, are the 1962 Council Decision on the Adoption of Radiation Protection Norms,[13] the 2014 Joint Declaration on the Security of Supply of Medical Radioisotopes,[14] several decisions and recommendations on the application of the Paris Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy (the "Paris Convention") and the Brussels Convention of 31 January 1963 Supplementary to the Paris Convention[15] that will be discussed later in this article, and the international conventions for which the OECD Secretary-General is the depositary, i.e. the Security Control Convention (*supra* note 6), the Paris Convention,[16] the 2003 Framework Agreement on a Multilateral Nuclear Environmental Programme in the Russian Federation (MNEPR) and its Protocol on Claims, Legal Proceedings and Indemnification,[17] and the 2005 Framework Agreement for International Collaboration on Research and Development of Generation IV Nuclear Energy Systems (the "GIF Framework Agreement").[18]

In addition, the NEA has gradually developed a policy of extending links with a number of non-member countries and economies involved in nuclear energy development and use, on the basis of co-operation and mutual benefit. According to the Revised Resolution of the Council on Partnerships in OECD Bodies,[19] "Substantive committees shall develop Global Relations Strategies providing frameworks for the participation of non-Members in their work and that of their subsidiary bodies, with a view to enhancing the quality, relevance and impact of the Organisation's work and hence its capacity to fulfil its mandate as defined in the OECD Convention." The Steering Committee for Nuclear Energy has therefore adopted a Participation Plan and a Global Relations Strategy, which are submitted on an annual basis to the OECD Council and frame the NEA's relationship with non-members (or partners). Currently, Brazil, China, India, Indonesia, South Africa, Chinese Taipei, Ukraine, the United Arab Emirates and Viet Nam can participate in the NEA's official meetings as "invitees" on an *ad hoc* basis, for non-

12. OECD Doc. OECD/LEGAL/0201. There are five categories of OECD legal instruments: "Decisions", which are legally binding on all members except those that abstain at the time of adoption; "Recommendations", which are not legally binding but practice accords them great moral force as representing the political will of Adherents; "Declarations", which are prepared within the Organisation, generally within a subsidiary body, and are not legally binding, to usually set general principles or long-term goals; "International Agreements", which are negotiated and concluded within the framework of the Organisation; and "Arrangement, Understanding and Others", which are ad hoc substantive legal instruments that have been developed within the OECD framework. For more information, see the OECD online Compendium of OECD Legal Instruments available at: www.oecd.org/legal/legal-instruments.htm.

13. OECD Doc. OECD/LEGAL/0052.

14. OECD Doc. OECD/LEGAL/0409.

15. Recommendation of the Council on the Application of the Brussels Supplementary Convention, in the Field of Nuclear Liability (1992), OECD Doc. OECD/LEGAL/0272.

16. Convention on Third Party Liability in the Field of Nuclear Energy of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1960), and by the Protocol of 12 February 2004, entered into force 1 Jan. 2022.

17. MNEPR (2003), 2265 UNTS 7, entered into force 14 April 2004; Protocol (2003), OECD Doc. OECD/LEGAL/0315, entered into force 25 July 2007.

18. 2879 UNTS 141, entered into force 28 Feb. 2005, as extended under the Agreement Extending the Framework Agreement for International Collaboration on Research and Development of Generation IV Nuclear Energy Systems, entered into force 26 Feb. 2015.

19. OECD Doc. C(2012)100/REV1/FINAL (2015), pp. 2-3, available at: www.oecd.org/global-relations/partnershipsinoecdbodies/C(2012)100-REV1-FINAL-En.pdf. For the latest information on partnerships in OECD bodies, see: www.oecd.org/global-relations/partnershipsinoecdbodies/.

confidential matters. However, India has been accepted to participate in meetings of the Committee on Nuclear Regulatory Activities (CNRA) and of the Committee on the Safety of Nuclear Installations (CSNI) as a "participant" since 2018 and 2019 respectively, i.e. India can be invited on a regular basis to all official non-confidential committee meetings, and those of their subsidiary bodies, upon payment of an annual fee. The NEA has to date no "associates", who may participate in a committee, a project or the development or discussion of a legal instrument with the same rights and obligations as an NEA member, also upon payment of an annual fee.

Apart from the European Commission statutorily taking part in the work of the NEA,[20] the Agency has developed strong working links with international organisations and institutions active or interested in peaceful nuclear energy, such as the IAEA,[21] the World Health Organization (WHO), the International Commission on Radiological Protection (ICRP), the International Radiation Protection Association, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the World Nuclear Association and the World Association of Nuclear Operators.

Early accomplishments: 1960s and 1970s[22]

The first phase of the NEA's programme mainly consisted of laying the foundations for nuclear co-operation, focusing on the launch of several joint research and development undertakings with ambitious objectives and significant financial requirements. Such projects included the Halden and Dragon reactor projects and the prototype Eurochemic plant for the reprocessing of spent nuclear fuels. This period came to a natural end as the experimental phase of nuclear energy evolved into broader commercial industrial development. However, while the Eurochemic and Dragon projects ceased operations in the 1970s, the Halden Reactor Project evolved gradually into an important international technical network that performed research and development programmes in various areas of nuclear safety until 2019.

As early as 1957, the OEEC Council had anticipated that civil liability for damage that could result from the peaceful uses of nuclear energy, as well as the difficulty of obtaining insurance or other financial security to cover that liability, were likely to become significant issues in the years to come. Consequently, the OEEC Special Committee on Nuclear Energy (which later became the Steering Committee for Nuclear Energy) established a working group to develop proposals for harmonising legislation in the nuclear liability and insurance fields.

The working group was subsequently transformed into the Group of Governmental Experts on Third Party Liability in the Field of Nuclear Energy ("Group of Governmental Experts"). That group, comprised of lawyers, insurers and technical specialists, was asked to draft an international convention on nuclear third party liability, compensation and financial security that would set out

20. In accordance with the provisions of Article 13 of the OECD Convention and the Supplementary Protocol No. 1 to the Convention, the European Commission takes part in the work of the Organisation actively and not as a mere observer. In addition, Article 18 of the NEA Statute provides that "The provisions of Supplementary Protocol No. 1 to the Convention on the Organisation for Economic Co-operation and Development shall apply to the representation of the European Atomic Energy Community (EURATOM) in the Agency and in its Steering Committee as well as to the participation of the Commission of the European Communities in the work of the Agency and of its Steering Committee."

21. Article 8(c) of the NEA Statute provides that "The Agency shall undertake its activities …, as far as possible in collaboration with the International Atomic Energy Agency and the Commission of the European Communities."

22. This section draws on NEA (2008), *NEA 50th Anniversary*, OECD Publishing, Paris, pp. 12-19; see also NEA (2007), "Colloquium on the Past, Present and Future of the Nuclear Law Committee", NEA Doc. NEA/SEN/NLC(2007)2.

the basic principles underlying subsequent national legislation in this field. The group's work was carried out in close consultation with the United States, Euratom, the IAEA, the European Insurance Committee, the International Union of Producers and Distributors of Electrical Energy (EURELECTRIC) and other relevant bodies, particularly in the transport field.

The resulting Paris Convention on Third Party Liability in the Field of Nuclear Energy was adopted under the auspices of the OEEC Council in July 1960.[23] Throughout the ensuing decade, the NEA's Group of Governmental Experts devoted its work to harmonising that convention with another similar convention, the Vienna Convention on Civil Liability for Nuclear Damage (the "Vienna Convention"), which had been adopted under the auspices of the IAEA in 1963.[24] They accomplished this harmonisation primarily by means of an Additional Protocol to the Paris Convention, which was adopted in 1964.[25]

In addition, 1963 saw the realisation under the auspices of the ENEA of the Brussels Convention Supplementary to the Paris Convention (the "Brussels Supplementary Convention") aimed at enabling additional compensation to be made available from public funds for nuclear damage incurred as a result of an accident to which the Paris Convention would apply. On the basis of the modifications made to the Paris Convention by the Additional Protocol of 1964, a further Additional Protocol was also drafted and adopted for the Brussels Supplementary Convention in 1964.[26]

Towards the end of the 1960s, with the Paris Convention and its Additional Protocol having entered into force,[27] the Group of Governmental Experts devoted its time and energy to studying issues relating to the interpretation and implementation of the international liability and compensation conventions. A model certificate of financial guarantee was drafted and became the subject of a recommendation of the NEA Steering Committee in 1968; shortly thereafter the Committee adopted recommendations concerning the application of the Paris Convention to nuclear incidents occurring, or damage suffered, on the high seas and to damage suffered in a contracting state even if the incident causing the damage has taken place in a non-contracting state. Other NEA Steering Committee recommendations and interpretations during this period covered a carrier's renouncing of its right of subrogation where it has accepted the obligations of an operator as well as simplifying the issue of insurance policies for the transport of nuclear substances, confirming the obligation to financially secure third party liability regardless of other insurance that may be in place and excluding small quantities of nuclear substances from the scope of the Paris Convention.[28]

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23. Paris Convention, *supra* note 16, 956 UNTS 264.

24. Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977.

25. 956 UNTS 335.

26. Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, 1041 UNTS 358, as amended by the Additional Protocol of 28th January 1964, 1041 UNTS 410.

27. The Paris Convention and its 1964 Additional Protocol came into force on 1 April 1968.

28. The noted decisions, recommendations and interpretations adopted by the NEA Steering Committee in relation to the Paris Convention are contained in NEA (1990), *Paris Convention, Decisions, Recommendations, Interpretations,* OECD Publishing, Paris, pp. 7-14, 23-27 and are also available at NEA (n.d.), "2004 Protocol to Amend the Paris Convention", www.oecd-nea.org/jcms/pl_20382 (accessed 9 Aug. 2021). Decisions are legally binding upon the contracting parties to that convention; recommendations and interpretations are not. For more information on these decisions, see Schwartz, J.A., "Liability and compensation for third party damage resulting from a nuclear incident", pp. 409-444.

The Committee also carried out considerable research on issues relating to the maritime transport of nuclear substances, this time in co-operation with the International Maritime Organization (IMO). An international conference was organised in December 1971 by the ENEA, the IMO and the IAEA during the course of which the Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material was adopted.[29] The purpose of this convention is to resolve conflicts that might arise from the simultaneous application to nuclear damage of certain maritime conventions dealing with ship owners' liability and other conventions that place liability for such damage on the operator of the nuclear installation from or to which the material was being transported. The Convention provides that a person otherwise liable for damage caused by a nuclear incident shall be exonerated from liability if the operator of the nuclear installation is also liable for such damage by virtue of the Paris Convention, the Vienna Convention or national law that is similar in the scope of protection given to the persons who suffer damage.

Other important NEA accomplishments took place during the Agency's formative years, particularly in the field of radiological protection. Public health and safety have always been a high priority for governments and in the first instance, a Working Party on Public Health and Safety was established to contribute to the development of radiological protection policies and regulations for workers and the public. Basic norms for the protection of workers and the public, including emergency measures, were adopted by the OEEC Council in 1959 and revised in 1962 to take into account recent work and recommendations developed by the ICRP.

The decade of the 1970s also saw a number of legally binding OECD Council decisions adopted in the radiological protection field.[30] Radiological protection standards were adopted in respect of radioluminous timepieces and for gaseous tritium light devices. Interim radiological protection standards were adopted for the design, construction, testing and control of radioisotopic cardiac pacemakers, and the Council also took a legally binding decision to establish a multilateral consultation and surveillance mechanism for the sea dumping of radioactive waste. The NEA Steering Committee, for its part, established Guidelines for Controlling Consumer Products containing Radioactive Substances and Guidelines for the Sea Dumping of Packages of Radioactive Waste.

These decisions and guidelines were abrogated by the OECD Council and NEA Steering Committee respectively in 1996 when it was recognised that such matters would be better dealt with by other international organisations in the radiological protection field, such as the ICRP or, in the case of sea dumping of radioactive waste, the IMO. In fact, the NEA has routinely provided authoritative guidance and advice to member countries on the interpretation of the ICRP recommendations in this field and has taken steps to assure that the needs and concerns of radiological protection policymakers, regulators and practitioners are appropriately addressed in those recommendations.

By the mid-1970s, the international context was changing, with industrialised countries being hit hard by the first shock of oil price increases. A significant redirection of the NEA's priorities took place; both government and public attitudes towards nuclear energy were beginning to be influenced by environmental and safety concerns. Increasing attention was paid to radiological protection, the safety of nuclear installations, radioactive waste management and the legal and administrative framework needed to regulate these activities. New committees were established to

29. Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (1971), 974 UNTS 255, entered into force 15 July 1975.

30. See OECD Docs. OECD/LEGAL/079 (1966) (radioluminescent timepieces), OECD/LEGAL/110 (1973) (gaseous tritium light devices); OECD/LEGAL/120 (1974) (radioisotopic cardiac pacemakers), OECD/LEGAL/156 (1977) (sea dumping of radioactive waste). These decisions were all abrogated in March 1996.

carry out the work envisaged in these areas; the Committee on the Safety of the Nuclear Installations (CSNI), the Committee on Radiation Protection and Public Health (CRPPH), the Radioactive Waste Management Committee (RWMC) and the Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle (NDC) were all established during this time frame.

A time of change: the 1980s and 1990s[31]

During this era, the NEA's efforts in promoting international co-operation remained strong. The Incident Reporting System for the exchange of information on incidents in nuclear reactor operations was set up by the NEA's CSNI, the Joint NEA/IAEA Uranium Group was established and the CNRA was formed. Another substantial contribution of the NEA was the development in 1989 of an international nuclear event scale of safety significance. Subsequently, the NEA joined the IAEA in a common effort to develop such a scale and as of 1990 the International Nuclear Event Scale has been providing a standard instrument to characterise and report nuclear incidents or accidents and communicate with the public.

It was during this decade as well that the Group of Governmental Experts in Third Party Liability, which later became the Nuclear Law Committee, after having studied the modernisation of both the Paris and Brussels Supplementary Conventions, concluded that to maintain the efficiency of the regime instituted by these instruments, a number of amendments should be made to their texts. First, it was agreed to replace the unit of account, which was based on the official price of gold, with the Special Drawing Right of the International Monetary Fund. Second, to counteract the effects of inflation, it was agreed to increase the compensation amounts provided for under the Brussels Supplementary Convention, both as regards the state compensation tier and the collective contribution tier. Third, it was agreed to make a number of amendments whose purpose was to facilitate the implementation of the two conventions or to further harmonise their application. Protocols to amend both the Paris and Brussels Supplementary Conventions were thus adopted by the contracting parties to those instruments on 16 November 1982. The Paris Convention Protocol came into effect on 7 October 1988 and the Brussels Supplementary Convention Protocol on 1 August 1991.[32]

The Group of Governmental Experts also studied the application of a nuclear civil liability regime to the long-term management of radioactive waste, a study that eventually led the Group to examine the means of applying the Paris Convention to radioactive waste management installations. That study terminated with the adoption, by the NEA Steering Committee in 1984, of a legally binding decision relative to the inclusion of radioactive waste disposal installations within the scope of the Paris Convention.

During the early- to mid-1980s the Group of Governmental Experts also spent considerable time drafting a new recommendation on liability for damage to nuclear substances in the course of transport, which was adopted by the NEA Steering Committee in 1981, and a new interpretation in 1987 determining that nuclear installations in the course of being decommissioned are covered by the Paris Convention regime.[33] That interpretation was followed a few years later in 1990 by a

31. This section draws on *NEA 50th Anniversary*, *supra* note 22, pp. 21-31; see also NEA Doc. NEA/SEN/NLC(2007)2, *supra* note 22.

32. Paris Convention Protocol, *supra* note 16, 1519 UNTS 329; 1650 UNTS 451 (Brussels Supplementary Convention Protocol).

33. *Paris Convention, Decisions, Recommendations, Interpretations*, *supra* note 28, pp. 6, 10. With the progressive ageing of nuclear installations, the issue of decommissioning was becoming an increasingly real and relevant challenge.

legally binding decision of the NEA Steering Committee permitting installations in the course of being decommissioned to be exempted from the application of the Paris Convention when certain technical criteria are met.[34]

On 26 April 1986, the tragic accident at the Chernobyl nuclear power plant in Ukraine (in the former Union of Soviet Socialist Republics) brought to light the limitations and deficiencies of the legal regimes that were in place at that time, both in terms of preventing nuclear accidents and in terms of compensating victims thereof in the event of their occurrence. When coupled with the Three Mile Island accident that took place in 1979, it became apparent that refined approaches to safety and regulatory aspects were needed, as was increased international co-operation to ensure that such events were prevented or at least properly remedied in the future.

The NEA Steering Committee met in September 1986 to examine the information to be derived from the accident and it decided, among other important initiatives, to reinforce the NEA's work in the area of civil liability for nuclear damage. The Group of Governmental Experts was thus instructed to reorient its work to address the gaps in the nuclear liability regime made evident by the Chernobyl accident.

That instruction would be transformed into, among other things, interfaces with other international regulatory bodies in charge of developing norms and guides affecting nuclear activities. For example, following the completion of the new recommendations of the International Commission on Radiological Protection (ICRP 60), experts from nuclear safety and radiological protection communities met to review the implications of these recommendations on nuclear safety and regulatory policies as well as to discuss issues of interface between their respective disciplines. In the course of this time period, the NEA, the European Commission, the Council for Mutual Economic Assistance, the Food and Agriculture Organization, the IAEA, the International Labour Organization, UNSCEAR and the WHO co-operated to revise the joint Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources.

That instruction would also be transformed into a reactivation of work in co-operation with the IAEA aimed at establishing a link between the Paris and Vienna Conventions through means of a Joint Protocol relating to the Application of the Vienna Convention and the Paris Convention (Joint Protocol).[35] Work on the development of this instrument concluded with its adoption in 1988 and its entry into force in 1992. Under its terms, rights of compensation granted to victims in states party to the Joint Protocol and one of those two conventions will be the same as the rights granted to victims in states party to the Joint Protocol and the other of the two conventions, thereby effectively extending the geographic scope of application of each convention to cover victims in states party to the other. At the same time, the Joint Protocol ensures that only one of the two conventions will apply to any particular nuclear accident.

Yet another study undertaken by the Group of Governmental Experts in the context of the Chernobyl accident addressed the issue of including the cost of preventive measures in the concept of nuclear damage and about the same time the Committee began to consider increasing the amount of the operator's liability and required financial security.

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34. *Ibid*., pp. 8, 22. On 30 October 2014, the Steering Committee for Nuclear Energy adopted a Decision, NEA Doc. NEA/SUM(2014)2, that updated the technical criteria for exempting installations undergoing decommissioning from the Paris Convention.

35. Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (1988), IAEA Doc. INFCIRC/402, 1672 UNTS 293, entered into force 27 Apr. 1992.

Within the IAEA, a revision of the Vienna Convention was undertaken in the late 1980s and early 1990s with negotiating states being determined that any revision of that convention should be accompanied by the adoption of a supplementary compensation system for nuclear damage. The Group of Governmental Experts closely followed that work, including the drafting of both the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage and the new Convention on Supplementary Compensation for Nuclear Damage, both of which were adopted in September 1997.[36]

These new instruments prompted the Group of Governmental Experts to examine revising the Paris Convention and its accompanying Brussels Supplementary Convention, but before doing so, the NEA Steering Committee agreed to two recommendations designed to serve on an interim basis: first, that contracting parties should establish a lower liability amount for reduced risk activities and, second, that facilities should arrange for public funds to be made available to compensate any excess damage up to the general liability amount and that contracting parties adopt a significantly increased maximum liability amount.

Subsequently, work on modernising the two conventions began in 1998 and was carried out by the contracting parties to the Paris Convention (the "CPPCs") together with invited experts from Slovenia and Switzerland, countries that had indicated their intention to join the revised conventions (the "CPPC Group"). Throughout the negotiations, the CPPC Group kept the Group of Governmental Experts, and then the Nuclear Law Committee, informed of its progress until the work of the CPPC Group came to an end with the adoption, on 12 February 2004, of Protocols to amend both the Paris and Brussels Supplementary Conventions.[37]

The 21st century: 2000-2010[38]

For the first time, the NEA adopted in 1999 a strategic plan defining the Agency's role as a forum for exchanging information and experience, a centre of nuclear competence and a contributor of nuclear policy analyses and assessments. International co-operation through the NEA contributed significantly to keeping the nuclear energy option open during the early part of this period by helping preserve and develop scientific and technical know-how and by maintaining adequate human resources in both quantity and quality. The NEA is active in a wide variety of topical areas including nuclear safety and regulation, radioactive waste management, radiological protection and public health, economics, resources and technology, nuclear science, legal affairs, data bank and information and communications.

In 2000, the Group of Governmental Experts on Third Party Liability in the Field of Nuclear Energy was renamed the Nuclear Law Committee (NLC) to reflect its broadened mandate over the range of nuclear law topics and issues. Since then, the NLC has been addressing different areas of nuclear law, to encourage the development, strengthening and harmonisation of nuclear legislation and regulation governing the safe and peaceful uses of nuclear energy, particularly in

36. Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997), IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force 4 Oct. 2003; Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 Apr. 2015.

37. Protocol to Amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004), entered into force 1 Jan. 2022; Protocol to Amend the Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004), entered into force 1 Jan. 2022.

38. This section draws on *NEA 50th Anniversary*, *supra* note 22, pp. 31-35; see also NEA Doc. NEA/SEN/NLC(2007)2, *supra* note 22.

the areas of liability and compensation, nuclear safety, radioactive waste management and environmental law as applied to nuclear activities.

The events that took place in the United States on 11 September 2001 represented another new challenge for the NEA, this time focusing on questions related to terrorism. To address these new concerns, the NLC carried out a study devoted to the availability of insurance to cover an operator's liability for damage resulting from a nuclear accident caused by a terrorist act and how obstacles to limitations on that cover could be overcome. Other new subjects also emerged, reflecting national concerns and developments in technology. A study on liability and financial security issues applicable to nuclear fusion installations was carried out at the request of the French delegation, whose country is hosting the ITER reactor. This is when the NLC also started to study the Aarhus Convention[39] and the Espoo Convention,[40] their implementation and influence on nuclear projects and activities.

This panorama of activities would not be complete without mentioning the NLC's important role as a forum for the exchange of information among states, international organisations and non-governmental organisations, not just in the field of international third party nuclear liability but also in relation to nuclear law in general. The NLC aims to regularly share information on the drafting of new international nuclear law instruments or regulations that may impact nuclear energy activities (in particular European Union legislation and IAEA conventions and codes). The NLC also looks regularly at developments in national legislation and regulations in member and non-member countries.

In the early 2000s, the NEA set up a Forum on Stakeholder Confidence to facilitate the sharing of member country experience in addressing the societal dimension of radioactive waste management. Comprehensive stakeholder participation activities were also carried out in the radiological protection field, particularly in connection with the role played by the CRPPH in the development of the new ICRP recommendations that significantly influence national regulations and international standards in radiological protection.

It was during this period that the Information System on Occupational Exposure was founded, the Fuel Incident Notification and Accident System was created, the first International Nuclear Emergency Exercise was conducted and the International School of Nuclear Law was launched.

In addition, the NEA was invited to provide technical secretariat services to the Generation IV International Forum (GIF), an international co-operative effort to carry out the necessary research and development needed to bring promising new reactor systems to the point of commercialisation and for which the OECD Secretary-General is designated as depositary under the GIF Framework Agreement.[41] Similarly, the NEA was invited to provide legal and secretariat services to the committee established under the framework agreement and protocol concluded for the Multilateral Nuclear Environmental Programme in the Russian Federation and for which the OECD Secretary-General is designated as co-depositary.[42] Finally, the NEA was also invited to provide technical secretariat services to the Multinational Design Evaluation Programme under which 16 countries share resources and knowledge in the course of assessing new reactor designs to improve both the efficiency and effectiveness of that process.

39. Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (1998), 2161 UNTS 450, entered into force 30 Oct. 2001 (Aarhus Convention).

40. Convention on Environmental Impact Assessment in a Transboundary Context (1991), 1989 UNTS 310, entered into force 10 Sept. 1997 (Espoo Convention).

41. See *supra* note 18.

42. See *supra* note 17.

A turning point: 2011-2020

This last decade started with the occurrence of the TEPCO Fukushima Daiichi nuclear power plant accident (the "Fukushima Daiichi accident") that occurred on 11 March 2011 due to the combination of an earthquake of magnitude 9.0 that occurred off the eastern coast of Japan and the ensuing tsunami. As the Fukushima Daiichi nuclear power plant units 1, 2 and 3 shut down automatically and off-site power was lost, the emergency diesel generators were able to provide power for the emergency core cooling systems for a short time, until they were flooded by the tsunami that struck the facility. Several hydrogen explosions occurred in the following days,[43] and thousands of residents living in a radius of 20 km were evacuated. There were no casualties among the public directly linked to high radioactivity releases and until now no transboundary damage has been detected; however, the surrounding population suffered severe economic loss and mental anguish, sometimes leading to suicides, and a significant area near the plant site had been contaminated.

The Fukushima Daiichi accident had a substantial impact not only in Japan, but also on the international nuclear community, even though the accident did not approach the same magnitude as Chernobyl in terms of the release of radioactive material or casualties. The international community not only strived to assist Japan in addressing the consequences of the accident, but it also aimed to understand the reasons behind the accident to strengthen safety standards all over the world. The NEA immediately endeavoured to be a forum for discussion on how to reinforce international co-operation, safety standards and international legal frameworks on nuclear safety. As soon as 7 June 2011, the NEA and the French Presidency of the G8 held a ministerial meeting,[44] which was the first international regulatory meeting with industry that focused exclusively on the Fukushima Daiichi accident and the path forward. Since then, all the NEA standing technical committees have been assessing the Fukushima Daiichi accident from different perspectives in order to draw lessons learnt for the benefit of the international community. Such works have been presented in several NEA reports: in 2012 (*Japan's Compensation System for Nuclear Damage As Related to the TEPCO Fukushima Daiichi Nuclear Accident*), in 2013 (*The Fukushima Daiichi Nuclear Power Plant Accident: OECD/NEA Nuclear Safety Response and Lessons Learnt*), in 2016 (*Five Years after the Fukushima Daiichi Accident: Nuclear Safety Improvements and Lessons Learnt*) and in 2021 (*Fukushima Daiichi Nuclear Power Plant Accident: Ten Years On*). The latter report provides an overview of the achievements of the international community and the NEA, and it looks into the future by suggesting international programmes of co-operation based on the still current challenges. There is indeed a lot to learn from the Fukushima Daiichi accident and the NLC has organised a series of workshops on nuclear liability[45] to explain how the Japanese government addressed the nuclear liability and compensation issues through a series of innovative schemes that other countries could take into account.

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43. On 12 and 14 March, a hydrogen explosion occurred in units 1 and 3 reactor buildings respectively destroying the upper structure of the buildings and exposing both spent fuel pools to the atmosphere. On 15 March, another hydrogen explosion occurred in the unit 4 upper portion of the reactor building. NEA (2021), *Fukushima Daiichi Nuclear Power Plant Accident: Ten Years On,* OECD Publishing, Paris, pp. 18-20.

44. See NEA (2011), "Proceedings of the Forum on the Fukushima Accident: Insights and Approaches", NEA Doc. NEA/CNRA/R(2011)12, OECD Publishing, Paris.

45. The Third International Workshop on the Indemnification of Damage in the Event of a Nuclear Accident, held on 18-20 October 2017, in Bratislava, Slovak Republic (report forthcoming) and the Fourth International Workshop on the Indemnification of Damage in the Event of a Nuclear Accident, held on 8-10 October 2019, in Lisbon, Portugal (report forthcoming).

Before the Fukushima Daiichi accident, there was hope among the international community that a "nuclear renaissance" was possible, with numerous nuclear power projects anticipated. The *Technology Roadmap: Nuclear Energy*, a joint publication released in 2010 by the International Energy Agency (IEA) and the NEA, estimated that almost one quarter of global electricity could be generated from nuclear power by 2050 and thereby make a major contribution to cutting greenhouse gas emissions. Under that scenario, nuclear generating capacity would need to more than triple over the following 40 years, a target the roadmap described as ambitious but achievable. Such expectations were then shattered by this latest accident. However, nuclear energy is again a matter of interest today given the few options available to generate electricity in a reliable manner while combatting climate change. The 2015 edition of the IEA/NEA's *Technology Roadmap* explained the advantages provided by nuclear energy in terms of reduction of greenhouse gas emissions, competitiveness in electricity production and security of supply. [46] The report provided several key actions that could ensure the conditions for a safe, publicly accepted and affordable deployment of nuclear technology in countries that already have the technology as well as in newcomer countries. Notwithstanding the Fukushima Daiichi accident, the number of reactors then under construction was the highest in 25 years.[47] As the discussion of the benefits of having nuclear energy in the mix continues, countries are looking at maintaining or developing such a source of energy, either by extending the operational lifetimes of existing plants[48] or working on innovative nuclear reactor technologies (such as generation IV reactors, small modular reactors and floating nuclear power plants), and by addressing public concerns. The NEA has been actively assisting member countries in such endeavours, and has also launched several activities relating to the feasibility of harmonising the licensing of technologies[49] and nuclear economics.[50]

In an effort to involve major nuclear players in the discussions held at the NEA, the Steering Committee for Nuclear Energy decided to strengthen ties with China, India and Russia. Russia became an NEA member in 2012, and India became a participant in the CNRA and CSNI in 2018 and 2019 respectively. Even though an "invitee", China's participation in NEA activities has been increasing during the past decade.

One of the major challenges today is the human aspects of nuclear safety, and developing and training the workforce that will be necessary to initiate new nuclear power programmes, and to maintain or decommission existing nuclear installations. The Fukushima Daiichi accident underscored the importance of the human aspects of nuclear safety, which led the NEA to focus even more intensely on the issue. Even though the topic was already being addressed by certain standing technical committees, the Agency set up a specific division in 2016 on the subject, which was later merged with the radiological protection division and became the Division of

46. IEA and NEA (2015), *Technology Roadmap: Nuclear Energy*, OECD Publishing, Paris.

47. According to the report, a total of 72 reactors were under construction at the beginning of 2014, the highest number in 25 years. *Ibid*., p. 5. There are today 51 reactors under construction. IAEA (2021), "Power Reactor Information System", https://pris.iaea.org/PRIS/home.aspx (accessed 9 Aug. 2021).

48. NEA (2019), *Legal Frameworks for Long-Term Operation of Nuclear Power Reactors*, OECD Publishing, Paris; NEA (2021), *Long-Term Operation of Nuclear Power Plants and Decarbonisation Strategies*, OECD Publishing, Paris.

49. Multi-sector workshop on innovative regulation: Challenges and benefits of harmonising the licensing process for emerging technologies held on 14-18 December 2020 (report forthcoming).

50. NEA (2020), *Unlocking Reductions in the Construction Costs of Nuclear*, OECD Publishing, Paris; NEA (2019), *The Costs of Decarbonisation: System Costs with High Shares of Nuclear and Renewables*, OECD Publishing, Paris; NEA (2018), *The Full Costs of Electricity Provision*, OECD Publishing, Paris.

Radiological Protection and Human Aspects of Nuclear Safety. As mentioned in the *Fukushima Daiichi Nuclear Power Plant Accident: Ten Years On* report,

> addressing the human aspects of nuclear safety, including organisational factors and safety culture, is fundamental for the safe operation of nuclear installations as well as for the effectiveness of regulatory authorities. These aspects also have an important impact on the potential future uses and regulation of nuclear technology. The NEA has continued to assist its member countries in their efforts to enhance focus and improve the understanding and the technical basis for treating these elements.[51]

The NEA also emphasised the promotion of the education of women in STEM (science, technology, engineering and mathematics) by organising several mentoring workshops to which young female students were invited to meet female scientists and engineers, and of gender balance. In order to lead by example, the NEA's division heads are in majority women and the technical and legal professionals in the NEA's programme divisions are 41% female. In addition, the Steering Committee on Nuclear Energy decided at its October 2020 meeting to authorise a group of representatives from NEA member countries to undertake a rapid effort to: collect and analyse data to understand the challenges to gender balance in the nuclear sector; examine the need for an international policy instrument to support countries working to enhance the contribution of women; and develop targeted communications to improve gender balance in the nuclear energy field. A major joint undertaking addressing the needs to train skilled nuclear engineers was also established in 2019, the Nuclear Education, Skills and Technology (NEST) Framework, which aims to address important gaps in nuclear skills capacity building, knowledge transfer and technical innovation in an international context. Currently, ten countries are participating in the NEST Framework. Two educational programmes were also launched: the International Nuclear Law Essentials in 2011 and the International Radiological Protection School in 2018.

With nuclear energy in existence for more than 60 years, the NEA is also addressing a wide range of issues relating to waste management and decommissioning.[52] In fact, given the importance of this last topic, the Steering Committee for Nuclear Energy established in 2018 the Committee on Decommissioning of Nuclear Installations and Legacy Management (CDLM) bringing to eight the number of standing technical committees at the Agency.[53] The aim is to more effectively integrate the Agency's activities concerning the decommissioning of nuclear installations and management of legacy sites contaminated due to historic radiological activities.

The Agency has been extremely active during this period, as evidenced by the considerable number of working parties and expert groups created under the standing technical committees (more than 80 today). The NLC itself established in 2016 the Working Party on the Legal Aspects of Nuclear Safety, the Working Party on Nuclear Liability and Transport, and the Working Party on Deep Geological Repositories and Nuclear Liability to answer the need to have more in-depth discussions on the legal aspects of cross-cutting issues throughout the Agency.

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51. NEA (2021), *Fukushima Daiichi Nuclear Power Plant Accident: Ten Years On*, *supra* note 43, p. 46.

52. There are currently 446 reactors in operation and 197 reactors in permanent shutdown, of which the vast majority still need to be decommissioned. IAEA (2021), "Power Reactor Information System", https://pris.iaea.org/PRIS/home.aspx (accessed 9 Aug. 2021).

53. The NEA's standing technical committees are as follows: the NLC, the CRPPH (established in 1957), the CSNI (established in 1973), the RWMC (established in 1975), the NDC (established in 1977), the Nuclear Science Committee (established in 1991), the CNRA (established in 1982) and the CDLM.

Looking towards tomorrow

The NEA now holds more than a half century of experience to its credit. The years stand witness to the NEA's record in emphasising safety as a key concern for the safe utilisation of nuclear energy, its competence and stamina in conducting its programmes in a constantly evolving political, economic and social environment, and its capacity to offer new services to a membership desirous to contribute, in a multilateral context, to the development of the next generation of nuclear power plants and related nuclear fuel cycles. The NEA's aim has been to respond in an efficient and timely manner to the challenges posed by international events.

The NEA is recognised as an important actor in intergovernmental nuclear energy co-operation, gathering interested OECD members and non-member countries and economies across the globe. Its current initiative for enlarging co-operation with emerging countries that will need large energy production capacities to nurture their economic development, while minimising the impact on the environment, comes at a time when nuclear energy is increasingly recognised as an indispensable component of the world energy mix.

Many important tasks remain to be accomplished by the Agency as its member countries face new challenges. The NEA Secretariat looks forward to working with all of the Agency's committees on those important tasks and to addressing the challenges that lie ahead.

The Euratom Treaty and its secondary legislation

*by Andrei I. Florea**

I. The Euratom Treaty: Introduction

Of the three initial European Communities,[1] the European Atomic Energy Community (Euratom) is the only one that has survived in its original form. Euratom is also the only reason why it is still correct to speak of "Community law", a separate body of special provisions that currently gravitate around – and coexist with – the more general provisions of the Treaty on the European Union (TEU) and the Treaty on the Functioning of the European Union (TFEU), *infra* note 4.

The Treaties of Rome, which were signed on 25 March 1957 and entered into force on 1 January 1958, laid the foundations for two new Communities: the European Economic Community (EEC) and the European Atomic Energy Community (Euratom). These two new Communities were initially served by two distinct executive bodies called Commissions (the EEC Commission and the Euratom Commission) as opposed to the High Authority already serving as executive at the time for the existing European Coal and Steel Community.

However, in 1965 an agreement was reached to merge the three Communities under a single set of institutions, and hence the "Merger Treaty" was signed in Brussels and came into force on 1 July 1967 creating the European Communities served by a single executive body, which remains to the present day the European Commission.[2]

The Euratom Community is governed by the Treaty on the European Atomic Energy Community (Euratom Treaty), which gave the Euratom Community a legal personality that remains distinct from that of the European Union (EU), while sharing the same member states and institutions as indicated above. The Euratom Treaty provisions enjoy a *lex specialis* status, which means that its rules prevail in case of conflict with rules based on the TEU and on the TFEU.[3] However, all areas related to nuclear energy that are not specifically covered under the Euratom Treaty are still governed by the *lex generalis*, namely the TEU and TFEU, as amended

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1. The European Coal and Steel Community (ECSC) was set up by the Treaty of Paris signed in 1951. Treaty Establishing the European Coal and Steel Community (1951), 261 UNTS 140, entered into force 23 July 1952. This treaty expired on 23 July 2002. The European Economic Community (EEC) and the European Atomic Energy Community (Euratom) were established in 1957 by the Treaties of Rome, i.e. the Treaty Establishing the European Economic Community (1957), 298 UNTS 11, entered into force 1 Jan. 1958 and the Treaty Establishing the European Atomic Energy Community (1957), 298 UNTS 167, entered into force 1 Jan. 1958 (Euratom Treaty) (consolidated version in *Official Journal of the European Union* (OJ) C 203 (7 June 2016), p. 1). The European Union (EU) is the legal successor to the EEC while Euratom continues to the present day in its original form as a Community.

2. Treaty Establishing a Single Council and a Single Commission of the European Communities (1965), OJ 152 (13 July 1967), p. 2, 4 ILM 776, entered into force 1 July 1967.

3. According to Article 106a (3) of the Euratom Treaty, *supra* note 1: "The provisions of the Treaty on European Union and of the Treaty on the Functioning of the European Union shall not derogate from the provisions of this Treaty."

by the 2007 Treaty of Lisbon,[4] and their secondary legislation (for instance in matters such as environmental law or state aid).

The Euratom Treaty was amended slightly in 2009 by Protocol No. 2 to the Treaty of Lisbon but the amendments were limited to adapting the Euratom Treaty to certain new rules laid down in the TFEU, in particular in the institutional and financial fields.

II. Basic notions of EU and Euratom law

Before proceeding to a more detailed analysis of the Euratom Treaty and its secondary legislation, a brief introduction to certain basic notions of EU and Euratom law and the relevant EU institutions is presented to ensure a better understanding of the terms used in this article and the legal context.

A. Primary law versus secondary law

The EU Treaties (TEU, TFEU and Euratom) are at the top of the hierarchy of norms in EU law. They are primary law and prevail over any secondary legislation (regulations, directives, etc.).

The body of law that is based on the principles and objectives of the treaties is known as "secondary law" and includes regulations, directives, decisions, recommendations and opinions. The most commonly used types of secondary legislation are the directives and regulations.

Regulations are legal acts that apply automatically and uniformly to all EU/Euratom member states as soon as they enter into force, without needing to be transposed into national law. They are binding in their entirety on all EU countries.

Directives require EU/Euratom member states to achieve a certain result, but leave them free to choose how to do so. EU/Euratom member states must adopt measures to incorporate a directive into national law (transpose) in order to achieve the objectives set by the directive. National authorities must communicate these measures to the European Commission within a set deadline (transposition deadline).

B. Primacy of EU/Euratom law

The principle of the primacy (also referred to as "precedence") of EU law is based on the idea that if a conflict arises between an aspect of EU/Euratom law and an aspect of national law in an EU country, EU/Euratom law will prevail.

The principle of the primacy of EU law has developed over time by means of the jurisprudence of the Court of Justice of the European Union (CJEU). The principle is not enshrined in the EU Treaties, although there is a brief declaration[5] annexed to the Lisbon Treaty in its regard. As early as 1963, in the Van Gend en Loos case,[6] the CJEU declared that the laws adopted by European institutions must be integrated into the legal systems of EU countries, which are obliged to comply with them. EU law therefore has primacy over national laws.

4. TEU, OJ C 202 (7 June 2016), p. 13 (consolidated version); TFEU, OJ C 202 (7 June 2016), p. 47 (consolidated version); See Treaty of Lisbon Amending the Treaty on European Union and the Treaty Establishing the European Community, OJ C 306, (17 Dec. 2007) p. 1, entered into force 1 Dec. 2009. The Treaty Establishing the European Community was renamed the TFEU in the Treaty of Lisbon. *Ibid.*, Art. 2.1, p. 42.

5. See Declaration 17 to the TFEU, in Declarations annexed to the Final Act of the Intergovernmental Conference which adopted the Treaty of Lisbon, signed on 13 December 2007, OJ C 115 (9 May 2008), p. 334.

6. Judgment of the Court of 5 February 1963, Van Gend en Loos v. Nederlandse Administratie der Belastingen, C-26/62, ECLI:EU:C:1963:1.

C. EU/Euratom institutions

There are three main institutions involved in the adoption of EU and Euratom legislation:

- the European Parliament, which represents the EU's citizens and is directly elected by them;
- the Council of the European Union, which represents the governments of the individual member countries. The Presidency of the Council is shared by the member states on a rotating basis every six months; and
- the European Commission, which represents the interests of the Union as a whole and is the guardian of the EU Treaties.

As regards the EU secondary legislation, these three institutions produce through the "Ordinary Legislative Procedure" (the procedure formerly known as "co-decision") the policies and laws that apply throughout the EU. In principle, the Commission proposes new laws, and the Parliament and Council adopt them. The Commission and the member states then implement them, and the Commission ensures that the laws are properly applied and implemented.

As regards Euratom secondary legislation, the procedure is similar to the one described above with the notable difference that the European Parliament is only consulted in the process and the Council alone adopts the legislation (the "consultation procedure").

Other EU/Euratom institutions are:

- the CJEU, which upholds the rule of European law;
- the Court of Auditors, which checks the financing of the EU's activities; and
- the European Central Bank, which is responsible for European monetary policy.

III. Short overview of the Euratom Treaty by chapter

A. Promoting research and ensuring the dissemination of technical information (Chapters 1 and 2)

One of the aims of the Euratom Community is to contribute to the raising of the standard of living in the member states, including by facilitating nuclear research in the member states, and complementing it with a Euratom research and training programme.

It is notable that under this chapter a special regime for the protection of classified information is established under Article 24 of the Euratom Treaty as further detailed under Regulation No. 3 (1958)[7] (governing the protection of the Euratom classified information), which derogates from the general regime of the EU classified information governed by Commission Decision (EU, Euratom) 2015/444.[8]

For the period 2021-2025, research in nuclear matters is covered through the new Euratom Research and Training Programme,[9] which complements the EU research and innovation

7. Regulation (Euratom) No 3 of 31 July 1958 implementing Article 24 of the Treaty establishing the European Atomic Energy Community, OJ 17 (6 Oct. 1958), p. 406.

8. Commission Decision (EU, Euratom) 2015/444 of 13 March 2015 on the security rules for protecting EU classified information, OJ L 72 (17 Mar. 2015), p. 53 (see in particular recital (8) thereof, at p. 54).

9. Council Regulation (Euratom) 2021/765 of 10 May 2021 establishing the Research and Training Programme of the European Atomic Energy Community for the period 2021-2025 complementing Horizon Europe – the Framework Programme for Research and Innovation and repealing Regulation (Euratom) 2018/1563, OJ L 167 I (5 May 2021), p. 81.

framework programme "Horizon Europe". This new programme will allow for the continuity of nuclear research activities carried out under the former Euratom programme (2019-2020).[10]

The new Euratom Research and Training Programme complements the achievement of Horizon Europe's objectives in the context of the energy transition, contributes to the implementation of the European fusion roadmap, and supports research and innovation in areas such as cancer treatment and diagnostics, nuclear safety and fusion. Through this research programme, the conditions are created for Europe to maintain world leadership in fusion, nuclear safety, radiological protection, waste management and decommissioning, safeguards and security with the highest standards.

The programme has a significant budget of EUR 1.38 billion distributed mainly for actions in fusion research and development, in nuclear fission, safety and radiological protection as well as for actions undertaken by the Commission Joint Research Centre (JRC).[11]

B. Protection of the health of workers and of the general public (Chapter 3)

Chapter 3 of the Euratom Treaty contains the legal basis for the Euratom Community's legally binding acts on basic standards for protecting the health of workers and the general public against ionising radiation. Chapter 3 is the basis for all directives in the field of nuclear safety and waste management, in line with the case law of the CJEU,[12] which defined in a broad way the competences of the Euratom Community on the basis of this chapter.

Indeed, based on Articles 31 and 32 of the Euratom Treaty, the Euratom Community was able to adopt a first directive on radiological protection as early as 1959, which has been amended several times, lastly in 2013. This last directive (the so-called Basic Safety Standards or BSS Directive)[13] applies to all situations that involve a risk from ionising radiation, whether from an artificial or from a natural source.

Following the landmark judgment in 2002 of the CJEU in case no. C-29/99, *supra* note 12, in which the Euratom Community was recognised as sharing competence with its member states in setting basic nuclear safety standards, the Euratom Community eventually succeeded in regulating nuclear safety in two very important areas: the safety of nuclear installations with the adoption of Directive 2009/71/Euratom[14] and the safe management of spent fuel and radioactive waste with the issuance of Directive 2011/70/Euratom.[15] However, a first legal act concerning

10. Council Regulation (Euratom) No 2018/1563 of 15 October 2018 on the Research and Training Programme of the European Atomic Energy Community (2019-2020), OJ L 262 (19 Oct. 2018), p. 1. Since the Euratom Treaty, *supra* note 1, Art. 7, limits the duration of the research and training programmes to five years, the Euratom programmes are extended to seven years by separate Council decision in order to match their duration with the Multiannual Financial Framework.

11. The JRC is established under Article 8 of the Euratom Treaty, *supra* note 1, in order to ensure that the research programmes and other tasks assigned to it by the Commission are carried out as well as to ensure that a uniform nuclear terminology and a standard system of measurements are established.

12. Judgment of the Court 10 December 2002, Commission of the European Communities v. Council of the European Union, C-29/99, EU:C:2002:734.

13. Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom, OJ L 13 (17 Jan. 2014), p. 1.

14. Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations, OJ L 172 (2 July 2009), p. 18.

15. Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste, OJ L 199 (2 Aug. 2011), p. 48.

radioactive waste and spent fuel had already been adopted before the CJEU's 2002 judgment, namely the so-called "Shipment Directive"[16] on the harmonisation of requirements, in particular administrative ones, for the transport of radioactive waste and radioactive substances.

As already mentioned, the Fukushima Daiichi nuclear power plant accident triggered the need to enhance the first Nuclear Safety Directive (NSD), and an amendment to the directive[17] was prepared and eventually adopted in July 2014. This new directive contributed to strengthening the nuclear safety requirements applied to member states, in particular by introducing the safety objective requirement, reinforcing powers of national regulators, calling for topical peer reviews and enhancing nuclear safety culture.

As regards radioactivity in the environment, member states monitor levels of radioactivity in the air, water and soil and report to the Commission.[18] Also, member states must provide the Commission with detailed information with respect to any plan to construct, modify or dismantle an installation that may release radioactive effluents.[19]

C. Nuclear investment (Chapter 4)

In accordance with Article 40 of the Euratom Treaty, the Commission needs to periodically publish illustrative nuclear programmes (referred to as PINC; in French, *Programme Indicatif Nucléaire Commun*) on investment in the nuclear fuel cycle for the Euratom Community; the latest one was published in 2017.[20] In addition, under this chapter of the Euratom Treaty, following mandatory notifications by the investors, the Commission needs to deliver its point of view on new individual investment projects in a member state for the construction of new power plants, waste management facilities, decommissioning facilities and major plant upgrades.[21]

Two Council Regulations have so far been adopted on the basis of Article 41 of the Euratom Treaty.[22] These regulations list the types of projects which must be notified and provide that notification is mandatory if the total cost of the project exceeds threshold amounts contained in an annexed table.

To date, the Commission has issued around 300 points of view. In terms of content, a point of view generally sets out the procedure followed, places the project in the national and European energy policy context, and provides technical details of the project. It then outlines the topics that were subject to discussion with the investor and finally sets out the Commission's views. The length and detail of a point of view will vary according to the importance and complexity of a given project.

16. Council Directive 92/3/Euratom of 3 February 1992 on the supervision and control of shipments of radioactive waste between Member States and into and out of the Community, OJ L 35 (12 Feb. 1992), p. 24.

17. Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, OJ L 219 (25 July 2014), p. 42.

18. See Art. 35 of the Euratom Treaty, *supra* note 1.

19. See *ibid*., Art. 37.

20. European Commission (2017), "Communication from the Commission - Nuclear Illustrative Programme presented under Article 40 of the Euratom Treaty - Final (after opinion of EESC)", COM(2017) 237 final.

21. See Arts. 41 to 43 of the Euratom Treaty, *supra* note 1.

22. Regulation No 4 defining the investment projects to be communicated to the Commission in accordance with Article 41 of the Treaty establishing the European Atomic Energy Community, OJ 17 (6 Oct. 1958), p. 417-18; and Council Regulation (Euratom) No 2587/1999 of 2 December 1999 defining the investment projects to be communicated to the Commission in accordance with Article 41 of the Treaty establishing the European Atomic Energy Community, OJ L 315 (9 Dec. 2007), p. 1.

D. Joint Undertakings (Chapter 5)

Joint Undertakings are foreseen when projects of common interest are needed or duplication of works or research in different Euratom member states should be avoided. The Council establishes them on the basis of a Commission or a member state proposal. Joint Undertakings can include Community, national and private resources for achieving specific goals. They can also enjoy specific benefits in terms of taxation or other measures.

In the past, a large European research facility on nuclear fusion located in the United Kingdom, the Joint European Torus, was established using this option. Fusion for Energy, the European domestic agency in charge of, among other matters, delivering the European contribution to the ITER Organization, was also established as a Joint Undertaking by a Council Decision in 2007.[23]

E. Ensuring the regular and equitable supply of nuclear materials in the Euratom Community by establishing a supply agency (Chapter 6)

The Euratom Treaty established the Supply Agency of the European Atomic Energy Community (Euratom Supply Agency, or ESA) with a legal personality and financial autonomy, and the ESA has been operating since 1 June 1960.

The ESA's main task under the Euratom Treaty is "to ensure that all users in the Community receive a regular and equitable supply of ores and nuclear fuel".[24] Chapter 6 is devoted to the supply policy for nuclear materials in the Euratom Community; in particular it establishes the tasks and obligations of the ESA. Under Article 52 of the Euratom Treaty, the ESA has the exclusive right to conclude contracts for the supply of ores, source materials and special fissile materials within the Community.

In practice, contracts for the supply of nuclear materials must be submitted to the ESA for conclusion (with co-signature by the ESA). This requirement applies to producers (mining companies and uranium enrichment companies) and users (utilities and research reactor operators) whenever one of the parties involved is based in the territory of the Euratom Community. When assessing the contracts submitted for co-signature, the ESA seeks to reach a reasonable diversification of supply sources, thereby aiming to avoid overdependence on any single source.

Enrichment, conversion and fabrication are considered to be processing activities and therefore need only to be notified to the ESA.[25]

In addition, the ESA acts as an observatory of the global nuclear fuel market and tries to anticipate potential problems for the security of supply.

In this context, the European Observatory on the Supply of Medical Radioisotopes was established on 29 June 2012 to assess, monitor and support the Euratom Community supply of medical radioisotopes with the emphasis on the most vital molybdenum-99/technetium-99m radioisotope that is used in 80% of all nuclear medicine diagnostic procedures. The Observatory is co-chaired by the ESA and the industry association Nuclear Medicine Europe. Its members are representatives of the European Commission services, international organisations and various stakeholders from member states, industry and nuclear medicine organisations.

23. Council Decision 2007/198/Euratom establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and conferring advantages upon it, OJ L 90 (30 Mar. 2007), p. 58.

24. See Art. 2(d) of the Euratom Treaty, *supra* note 1.

25. See *ibid*., Art. 75.

Exports of nuclear materials produced in the Euratom Community must be authorised by the Commission. Furthermore, the Commission can decide to build material stocks to facilitate supplies or normal deliveries by the Euratom Community and in emergency cases.

Following the adoption of a new ESA Statute in 2008,[26] it was increasingly clear that new rules for the ESA to determine the manner in which demand is to be balanced against the supply were necessary (the last update of the ESA's Rules dated back to 1975). Therefore, the Commission approved in 2021 new rules adopted by the ESA.[27] These new rules are intended to provide more process transparency and clarity for the member states, operators and suppliers, contribute to better administrative practices, and increase the efficiency of the ESA's work. They aim as well at enabling the ESA to collect appropriate data for the nuclear fuel market observatory.

F. Ensuring that nuclear materials are used only for the purposes for which they are intended (Safeguards) (Chapter 7)

Nuclear materials such as uranium, plutonium and thorium can be used for both peaceful and military purposes. Consequently, at an international level, in particular following the entry into force in 1970 of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), nuclear safeguards were established under the aegis of the International Atomic Energy Agency (IAEA) to guarantee that civil nuclear facilities are not misused and nuclear material is not diverted from peaceful uses. States accept these measures through the conclusion of safeguards agreements with the IAEA.[28]

In the Euratom Community, an advanced system of nuclear safeguards was established under the Euratom Treaty in 1957, well ahead of the establishment of nuclear safeguards at the international level. Under Article 77 of the Euratom Treaty, the European Commission is mandated to satisfy itself that, in the territories of member states, nuclear materials are not diverted from the intended and declared use, and that agreements with third states and international organisations are complied with.

Chapter 7 of the Treaty provides for a series of obligations on the holders of nuclear materials[29] and on the member states. For example, holders of nuclear materials are obliged to report to the European Commission the "basic technical characteristics" of their installations and to establish a system of operating records in order to permit accounting for the nuclear materials. The European Commission has the corresponding right to carry out inspections to verify the accuracy of the nuclear operators' nuclear material accounts.[30]

26. Council Decision of 12 February 2008 establishing Statutes for the Euratom Supply Agency, OJ L 41 (15 Feb. 2008), p.1.

27. Commission Decision (EU) 2021/986 of 29 April 2021 approving the Decision of the Supply Agency of the European Atomic Energy Community adopting new Agency Rules to determine the manner in which demand is to be balanced against the supply of ores, source materials and special fissile materials (notified under document C(2021) 2893), OJ L 218 (18 June 2021), p. 1.

28. Under Article 3 of the NPT (1968), IAEA Doc. INFCIRC/140, 729 UNTS 169, entered into force 5 Mar. 1970, each non-nuclear weapon state is required to conclude a safeguards agreement with the IAEA.

29. In principle these are uranium, plutonium and thorium, as provided in the detailed definition of ores, source materials and special fissile materials under Article 197 of the Euratom Treaty, *supra* note 1.

30. Nuclear materials designated for defence purposes (the case for a part of the stocks in France and, until its withdrawal from Euratom and the end of the transition period on 1 January 2021, in the United Kingdom) are not subject to Euratom safeguards. See *ibid*., Art. 82.

The obligations of nuclear operators under Chapter 7 are set out in more detail in Regulation No 302/2005.[31] This Regulation specifies the information to be declared by nuclear operators to the European Commission and how and when these declarations must be produced. It also specifies the records that nuclear operators are obliged to produce, in order to allow the European Commission to fulfil its duties imposed by Article 77 of the Euratom Treaty.

The powers given to the European Commission by the Euratom Community in this field are considerable, because all nuclear installations and material within the Euratom Community are subject to inspection and the Euratom safeguards inspectors have the right of access at all times to all nuclear material in the installations concerned. As a consequence of its exclusive competence to carry out verifications related to Euratom nuclear safeguards, the European Commission also possesses extraordinary legal rights to address non-compliance by member states or holders of nuclear materials located in the territory of the Euratom Community. Among those rights are the following:

- to apply to the President of the CJEU if a nuclear safeguards inspection is opposed and to obtain an order within three days to ensure that the inspection is carried out compulsorily;[32]
- to issue a decision to proceed with the inspection, if there is a risk of delay;[33]
- to issue directives calling upon the member state concerned to bring any infringement found by the inspectors to an end by a time limit set by the Commission;[34]
- to apply an extraordinary infringement procedure in derogation from Articles 258 and 259 of the TFEU, by referring a matter directly to the CJEU;[35]
- to impose sanctions directly on persons or undertakings if the infringement is on the part of such persons or undertakings. These sanctions range from a warning to the withdrawal of nuclear materials from an installation.[36]

G. Property ownership (Chapter 8)

The Euratom Treaty gives *de jure* ownership of special fissile materials to the Euratom Community.[37] This right has strong links to both the obligation of the Euratom Community to ensure the security of supply of nuclear materials and to the obligation to safeguard these materials to prevent them from being diverted from their intended use.

Member states and their operators retain the right of unlimited use and consumption of the material, subject to the safeguards provisions, the health and safety provisions and the right of option of the ESA under the Euratom Treaty.[38] The Commission may require that materials not actually being used be deposited with the ESA or in other stores that can be supervised by it.[39]

31. Commission Regulation (Euratom) No 302/2005 of 8 February 2005 on the application of Euratom safeguards, OJ L 54 (28 Feb. 2005), p. 1.
32. See Art. 81 of the Euratom Treaty, *supra* note 1.
33. See *ibid*., Art. 81.
34. See *ibid*., Art. 82.
35. See *ibid*., Art. 82.
36. See *ibid*., Art. 83.
37. See *ibid*., Art. 86.
38. See *ibid*., Art. 87.
39. See *ibid*., Art. 80.

A very specific application of the provisions in Chapter 8 was made under Article 83 of the United Kingdom Withdrawal Agreement.[40] Under this provision, it was foreseen *inter alia* that, in order to protect the integrity of the common supply policy and of the nuclear common market established under the Euratom Treaty, including the level of safeguards applicable to the materials concerned, the Euratom Community would retain its rights deriving from property ownership of all special fissile materials located in the United Kingdom after its withdrawal when those materials are still held at that date[41] by a Euratom member state, or by persons or undertakings established in the territory of a member state.

H. The nuclear common market (Chapter 9)

The Euratom Treaty also provides for a nuclear common market guaranteeing the free movement of goods and products, of skilled persons and capital in the field of nuclear energy, as well as the right of establishment as regards nuclear installations of a scientific or industrial nature. As for the EU, common custom tariffs are applicable.

This chapter also contains provisions empowering the Council to issue directives on insurance contracts covering nuclear risks. Such measures have not been undertaken to date, as emphasis has been put on promoting ratification of international conventions in this field by the member states. Indeed, nuclear third party liability is governed at the national level, though supplemented by a number of international conventions to which not all member states are party, thereby leading unfortunately to a patchwork of obligations within the Euratom Community.

I. Relations with third countries and international organisations (Chapter 10)

Under Article 101 of the Euratom Treaty, the Commission can negotiate and conclude international agreements on behalf of Euratom, with the approval of the Council. Several nuclear co-operation agreements between Euratom and third countries have been concluded on this basis.

The Euratom co-operation agreements on peaceful uses of nuclear energy are designed to ensure strong non-proliferation and nuclear safeguards guarantees with third countries with which nuclear materials, technology and equipment are exchanged. The agreements cover areas such as nuclear safety, trade in nuclear materials and nuclear fuel cycle services, non-proliferation, safeguards and physical protection. Such agreements create a stable and predictable legal framework, both for the governments and the industrial operators, ensure a corresponding level of safety and security standards, facilitate trade between the parties, and ensure diverse supply of nuclear fuel to the Euratom Community.

To date, Euratom has concluded ten nuclear co-operation agreements with Australia, Canada, Kazakhstan and the United States (major suppliers of uranium) as well as with Argentina, Japan, South Africa, Ukraine, the United Kingdom and Uzbekistan. There are also Euratom agreements covering research and development only, e.g. with the People's Republic of China, the United States and the international fusion project ITER.[42] Together with its member states, Euratom is

40. Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, OJ C 384 I (12 Nov. 2019), p. 1.

41. As of 1 January 2021, i.e. the end of the transition period.

42. ITER ("the way" in Latin) is an experimental device located in France that aims to prove the feasibility of nuclear fusion as an energy source. As the host member, Europe is responsible for 45% of ITER's construction costs. The ITER Agreement, signed in 2006, established an international organisation (the ITER Organization) to implement the project. Agreement on the Establishment of the ITER International Fusion Energy Organization for the Joint Implementation of the ITER Project (2006), IAEA Doc. INFCIRC/702, entered into force 24 Oct. 2007.

also party to several international conventions concluded under the aegis of the IAEA.[43] Euratom member states retain the right to conclude agreements or contracts with third countries or international organisations. However, under Article 103 of the Euratom Treaty, the Commission has a right of scrutiny over any such draft agreement or contract to the extent that such agreements concern matters within the purview of the Euratom Treaty. Should such an agreement contain clauses that impede the application of the Euratom Treaty, the European Commission must object to its conclusion within a month of notification of such agreement.

The Euratom Community has long-standing relations with the IAEA,[44] a specialised agency of the United Nations charged with overseeing the peaceful use of nuclear energy worldwide. Euratom has the status of observer with the right to speak at the annual sessions of the IAEA General Conference.[45] Commission representatives, on behalf of the Euratom Community, may also participate in deliberations on items of interest for Euratom. In addition, the European Commission performs joint nuclear safeguards inspections on Euratom territory with the IAEA under the remaining 2 "safeguards agreements"[46] between the IAEA, the Euratom Community and its member states (an agreement with France, the only EU nuclear weapon member state after the UK's withdrawal from Euratom, and an agreement with the other 26 EU non-nuclear weapon member states).

Euratom also has observer status within the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development. The Commission regularly attends its steering committee and various other standing technical committees and working groups covering in particular nuclear safety, radioactive waste management, decommissioning and radiological protection.

43. These are: Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996; Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001; Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, (1986), IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987; Convention on Early Notification of a Nuclear Accident (1986), IAEA Doc. INFCIRC/335, 1439 UNTS 276, entered into force 27 Oct. 1986; Convention on the Physical Protection of Nuclear Material (1980), IAEA Doc. INFCIRC/274 Rev. 1, 1456 UNTS 125, entered into force 8 Feb. 1987; and Amendment to the Convention on the Physical Protection of Nuclear Material (2005), IAEA Doc. INFCIRC/274/Rev.1/Mod.1, entered into force 8 May 2016.

44. Cooperation Agreement between the European Atomic Energy Community and IAEA, OJ L 329 (23 Dec. 1975), p. 28, entered into force on 1 Jan.1976.

45. The European Union, contrary to Euratom, has no formal status at the IAEA.

46. Agreement of 27 July 1978 between France, the European Atomic Energy Community and the International Atomic Energy Agency for the Application of Safeguards in France, IAEA Doc. IAEA INFCIRC/290, entered into force on 12 Sept. 1981; and the Agreement between Belgium, Denmark, the Federal Republic of Germany, Ireland, Italy, Luxembourg, the Netherlands, the European Atomic Energy Community and the [International Atomic Energy] Agency in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (1973), IAEA Doc. INFCIRC/193, entered into force on 21 Feb. 1977. A number of revisions and addendums to the original agreement have been issued over the years, most often to reflect new adherents to the Agreement and it protocol, the most recent being in 2017 to reflect the accession of Croatia. See IAEA (2017), "Accession of Croatia", INFCIRC/193Add. 30. The former trilateral Safeguards Agreement between Euratom, IAEA and the United Kingdom was terminated as of 23:00 GMT on 31 December 2020 following the UK's withdrawal from Euratom. See IAEA (2021), "Termination", IAEA Doc. INFCIRC/263 Mod. 1.

IV. Euratom secondary legislation

Today, the most prominent Euratom secondary legislation is the legislation adopted under Chapter 3 of the Euratom Treaty related to nuclear safety, radiological protection, emergency preparedness and response, radioactivity in drinking water, safe management of radioactive waste and spent fuel, transport of radioactive waste and spent fuel and decommissioning.[47]

A. Nuclear safety

To this day, about a quarter of the electricity and half of the low-carbon electricity in the EU is generated by nuclear energy. It is crucial that this type of energy is generated in a safe and secure way, which is why nuclear safety is an absolute priority for the Euratom Community.

While operators, under the supervision of independent national regulatory authorities, are primarily responsible for the safety of their nuclear installations, an EU-wide approach to nuclear safety is of key importance because a nuclear accident could have negative consequences for countries across Europe and beyond. Nuclear safety covers a wide range of activities such as ensuring proper operating conditions for nuclear installations, preventing accidents and mitigating the consequences if they happen.

The most significant legal act in this field is the NSD, originally adopted in 2009,[48] that comprises provisions relating to the establishment of a national legislative and regulatory framework for nuclear safety of nuclear installations, to the organisation, duties and responsibilities of the competent regulatory authorities, to the obligations of the licence holders, to the education and training of all parties' staff, and to the provision of information to the public.

In July 2014, an amendment to the 2009 NSD was adopted that had to be transposed into member states' legislation by 2017. The amending directive[49] took account of a review of the Euratom legal framework on nuclear safety in the light of the Fukushima Daiichi nuclear power plant accident in 2011 and the findings of the EU stress test exercises. Through the amended NSD, the Euratom Community significantly enhanced its leadership in nuclear safety worldwide.

The amended directive requires Euratom member states to give the highest priority to nuclear safety at all stages of the lifecycle of a nuclear power plant. This obligation includes carrying out safety assessments before the construction of new nuclear power plants and ensuring significant safety enhancements for existing reactors. Specifically, the directive:

- strengthens the role of national regulatory authorities by ensuring their independence from national governments. Euratom member states must provide the regulators with sufficient legal powers, staff, and financial resources;

47. The dedicated financial assistance programme for the decommissioning of nuclear facilities in Bulgaria and Slovakia (see Council Regulation (Euratom) 2021/100, *infra* note 63) is in fact based on the *sui generis* Article 203 of the Euratom Treaty but there is an undeniable strong link between these financial assistance programmes and the "Health and Safety" Chapter 3 of the Euratom Treaty. This is acknowledged *inter alia* in recitals (1) and (2) of this regulation according to which "[a]fter the shutdown of a nuclear facility, the main positive impact to be achieved is the *progressive reduction of radiological risk for the workers, the public and the environment* in the Member States concerned as well as in the Union as a whole" and financial assistance under such a financial programme "should be provided […] *with the aim of supporting the decommissioning of nuclear facilities and the safe management of radioactive waste.*" *Ibid*., p. 3 (emphasis added).

48. See Directive 2009/71/Euratom, *supra* note 14.

49. See Directive 2014/87/Euratom, *supra* note 17.

- creates a system of peer reviews. Euratom member states choose a common nuclear safety topic every six years and organise a national safety assessment on it. They then submit their assessments to other countries for review. The findings of these peer reviews are made public;
- requires a national system of safety re-evaluation for all nuclear power plants to be conducted at least once every ten years;
- increases transparency by requiring operators of nuclear power plants to release information to the public, both in times of normal operation and in the event of incidents.

B. Radiological protection

People may be exposed to ionising radiation from various sources, for example, naturally occurring radioactive material, medical applications, industrial practices, effluents from nuclear installations, fallout from nuclear weapons testing and the impact of nuclear accidents. Exposure to increased levels of ionising radiation can be harmful to human health. The Euratom Community therefore seeks to protect its citizens against the dangers of increased levels of exposure.

The Euratom Community adopted the first BSS Directive in 1959 to ensure the highest possible protection of workers and members of the public against the dangers arising from exposure to ionising radiation. The BSS Directive sets out standards for radiological protection in the member states. The overall objective of radiological protection is to protect workers and the general public against the dangers arising from ionising radiation, resulting from practices using radiation or radioactive substances, including the nuclear fuel cycle. The BSS Directive sets limits on the maximum radiation dose that anyone should receive under normal conditions. These limits are based on international studies on the effects of radiation and are set at levels to minimise harmful effects. In addition to keeping doses below these limits, nuclear facilities and radioactive waste sites must work to keep any radiation doses received by the public and its workers as low as reasonably achievable.

This directive has been amended regularly, taking into account the latest scientific findings and recommendations. The most recent BSS Directive[50] was adopted in 2014 and had to be transposed into national legislation by February 2018. This new BSS Directive modernises and consolidates the European radiological protection legislation into one instrument and also includes emergency procedures that were strengthened following the Fukushima Daiichi nuclear power plant accident.

The updated directive broadens the application to the whole range of radiation sources and categories of exposure: occupational, medical, public and environmental. It covers the protection of:

- workers, in particular medical staff and workers in workplaces with indoor radon and in activities processing naturally occurring radioactive material;
- the public, in particular from radon in dwellings;
- medical patients, in particular with regard to the avoidance of misadministration or other incidents in radiodiagnosis and radiotherapy.

The BSS are developed in consultation with a group of scientific experts in public health and particularly in radiological protection.

50. See Directive 2013/59/Euratom, *supra* note 13.

C. Safety and security of radioactive sources

The BSS Directive also covers the safety and security of radioactive sources in the Euratom Community. Radioactive sources are used in medicine, research and industrial activities. The radioactive material is sealed in small metal containers and, as long as it is handled and disposed of correctly, it does not pose any threat to human health or the environment.

However, these sources can be lost, abandoned or even stolen. Radioactive material can fall in the hands of people without licence or the knowledge as to how to handle it properly. Sources can also end up in scrap metal recycling plants, and accidental contamination can result from a breach of the source. These radioactive sources that are outside regulatory control are called orphan sources.

The Euratom Community has specific rules to prevent the exposure of workers and the public to radioactivity that could arise from inadequate control of radioactive sources, and to ensure that each radioactive source is kept under control. They are compiled in Chapter IX (sections 2 and 3) of the BSS Directive. The requirements are closely linked to the IAEA *Code of Conduct on the Safety and Security of Radioactive Sources*,[51] and its related guidance.[52]

D. Emergency preparedness and response

In the event of a nuclear accident, fast and accurate sharing of information can make a huge difference in ensuring people's safety. Under the Euratom Treaty, the European Commission is responsible for exchanging information quickly. It does this through the European Community Urgent Radiological Information Exchange (ECURIE),[53] which was set up to facilitate early notification and information exchange in the event of a radiological or nuclear emergency. All Euratom member states plus the Montenegro, the Republic of North Macedonia, Norway, Switzerland and the United Kingdom take part, and they must promptly notify the Commission if they decide to take measures in order to protect their population in the event of an emergency. The Commission must then make this notification available to all other ECURIE members.

The European Radiological Data Exchange Platform (EURDEP)[54] makes radiological monitoring data from 38 European countries available to each other. All Euratom member states plus Azerbaijan, Belarus, Iceland, North Macedonia, Norway, the Russian Federation, Serbia, Switzerland, Turkey, Ukraine and the United Kingdom, participate in EURDEP. EURDEP data is usually provided at least once a day. Data is delivered at least once every hour during an emergency. Public radiation monitoring data is made available at the public EURDEP site.

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51. IAEA (2000), *Code of Conduct on the Safety and Security of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/2001.

52. IAEA (2012), *Guidance on the Import and Export of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/IMO-EXP/2012, IAEA, Vienna.; IAEA (2018), *Guidance on the Management of Disused Radioactive Sources*, IAEA Doc. IAEA/CODEOC/MGT-DRS/2018, IAEA, Vienna.

53. The setting up of ECURIE was enabled by the Council Decision of 14 December 1987 on Community arrangements for the early exchange of information in the event of a radiological emergency, OJ L 371 (30 Dec. 1987), p. 76.

54. European Commission, Joint Research Centre (n.d.), "EURDEP", https://remon.jrc.ec.europa.eu/About/Rad-Data-Exchange (accessed 15 Nov. 2021).

E. Radioactivity in drinking water

The Euratom Drinking Water Directive[55] provides a framework for controlling radioactivity in drinking water and the radiation dose received from the consumption of different forms of drinking water.

The directive applies to tap water and to water in bottles or containers intended for human consumption. It does not apply to natural mineral waters and to small private supplies. The directive deals with natural as well as with artificial radionuclides. It lays down general principles for monitoring and gives technical details (frequencies of sampling, analysis methods, measuring methods, etc.).

This directive lays down values for radon, tritium, and the so-called "indicative dose", which covers many other radionuclides. The values have an indicative function, but they are not limits *per se*. Exceeding a value should not be regarded as a health risk without examining the situation more closely. A thorough investigation may – if warranted – lead to remedial action. In this situation, the public has to be informed.

F. Safe management of radioactive waste and spent fuel

Radioactive waste is mainly generated from the production of electricity in nuclear power plants or from the non-power-related use of radioactive materials for medical, research, industrial and agricultural purposes. All 27 Euratom member states generate radioactive waste, and 20 of them also manage spent fuel on their territory.

Radioactive waste is any radioactive material in gaseous, liquid or solid form that will not be used any longer in the country of origin or in the destination country. The material also must be controlled as radioactive waste by a regulatory body under the legislative and regulatory framework of the countries of origin and destination.

Spent fuel is the name given to nuclear fuel that has been removed from a nuclear power plant or research reactor following irradiation. It is a mixture of plutonium, uranium and other waste materials and is no longer usable as such as fuel. It is extremely radioactive and generates a large amount of heat and must be carefully managed. Individual member states take different approaches to the long-term management of spent fuel, but all involve a period of interim storage at the nuclear power plant or research reactor site following the removal of the fuel from the reactor.

The notion of spent fuel is different from that of radioactive waste as certain Euratom member states opt to directly dispose of it, thus turning it into waste, while other Euratom member states choose to reprocess it in order to separate the plutonium and/or uranium and to allow for its reuse in new nuclear fuel or for other purposes.

Owing to its radiological properties and the potential hazard it poses, it is important to ensure the safe management of radioactive waste at all stages. It requires containment and isolation from humans and the living environment over a long period of time.

Progress has been made in safely disposing of very low level and low level waste in the Euratom Community, and so far Finland, France and Sweden have selected sites for the deep geological disposal of intermediate and high level waste from civilian facilities. It is likely that they will open the first repositories for these kinds of waste between 2024 and 2035.

55. Council Directive 2013/51/Euratom of 22 October 2013 laying down requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption, OJ L 296 (7 Nov. 2013), p. 12.

The safe management of this type of waste is regulated in the Euratom Community by the Euratom Radioactive Waste and Spent Fuel Management Directive).[56] This directive requires *inter alia* that:

- Euratom member states have a national policy for spent fuel and radioactive waste management;
- Euratom member states draw up and implement national programmes for the management of these materials, including the disposal, of all spent nuclear fuel and radioactive waste generated on their territory;
- Euratom member states should have in place a comprehensive and robust framework and a competent and independent regulatory body, as well as financing mechanisms to ensure that adequate funds are available;
- Public information on the management of radioactive waste and spent fuel and opportunities for public participation are available;
- Euratom member states submit to the Commission every three years (starting August 2015) national reports on the implementation of the directive, on the basis of which the Commission will draft a report on the overall implementation of the directive and an inventory of radioactive waste and spent fuel present in the Euratom Community's territory and the future prospects;
- Euratom member states carry out self-assessments and invite international peer reviews of their national framework, competent authorities or national programme at least every ten years (the first by August 2023).

The export of radioactive waste for disposal in countries outside the Euratom Community is allowed only under very strict conditions and is in fact banned with respect to all third countries that do not yet have an operational radioactive waste disposal facility.

G. Transport of radioactive materials

The shipment of radioactive waste and spent fuel through import, export and transit is a common practice in the Euratom Community that occurs regularly and is regulated under the Euratom Directive on Shipments of Radioactive Waste and Spent Fuel.[57] This directive:

- establishes a system of prior authorisation for such shipments in the Euratom Community;
- requires operators to notify national authorities about shipments of radioactive materials which depart from, go through, or end up in the Euratom Community;
- allows Euratom member states to ship spent fuel to each other for reprocessing and organise the return of the resulting radioactive materials;
- allows Euratom member states to send shipments of radioactive materials that do not comply with the directive back to their country of origin;
- prohibits the export of radioactive waste to the African, Caribbean and Pacific Group of States, to Antarctica, or to any country that does not have the resources to safely manage it.

56. See Directive 2011/70/Euratom, *supra* note 15.

57. Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel, OJ L 337 (5 Dec. 2006), p. 21.

A separate regulation governing solely the intra-Community shipment of radioactive substances had been established in 1993 by Council Regulation (Euratom) No. 1493/93.[58]

H. Nuclear decommissioning programmes

Following the Chernobyl disaster in 1986, a discussion was held at the European[59] and international level[60] about the need to shut down the so-called high power channel type reactors (RBMK) and other first-generation Soviet-designed nuclear reactors. At the time of their accession to the EU and Euratom, Bulgaria, Lithuania and the Slovak Republic agreed to shut down reactors at the Kozloduy, Ignalina and Bohunice sites respectively.

Both the EU and the Euratom Community launched the nuclear decommissioning assistance programmes in order to fulfil the obligations undertaken under the accession agreements for these three member states.[61] In the initial years and until 2013, the EU and Euratom co-financed decommissioning activities related to the safe removal of radioactive materials as well as complementary actions, such as projects to mitigate the consequences of shutting down the reactors (e.g. replacement for lost electricity generation capacity) and to mitigate social consequences (such as lost employment). As of 2014 and gradually thereafter, the dedicated EU/Euratom co-financing has concentrated on safety challenges of the decommissioning, while other actions have been financed by other sources or instruments.

At present, both the EU and the Euratom Community have decided to continue supporting these programmes in the period 2021-2027 in order to:

- assist Lithuania[62] in decommissioning the Ignalina nuclear power plant, with specific emphasis on managing the radiological safety challenges.
- assist Bulgaria and the Slovak Republic[63] in implementing the Kozloduy decommissioning programme and the Bohunice decommissioning programme respectively, and to support the JRC decommissioning and waste management programme.

These new assistance programmes represent simpler and more flexible instruments to provide EU/Euratom funds for decommissioning and waste management. These programmes have a high potential for creating added value through broad dissemination to all EU/Euratom member states of knowledge generated on nuclear decommissioning.

58. Council Regulation (Euratom) No 1493/93 of 8 June 1993 on shipments of radioactive substances between Member States, OJ L 148 (19 June 1993), p. 1.

59. See the conclusions of the European summit of June 1994 held in Corfu, Greece, in European Commission (1994), "Resolving Ukraine's Nuclear Crisis - Finding a Global Strategy through the G7", MEMO/94/50, available at: https://ec.europa.eu/commission/presscorner/detail/en/MEMO_94_50 (accessed 15 Nov. 2021).

60. See the conclusions on nuclear safety at the G7 summit of July 1994 held in Naples, Italy, in the Summit Communiqué, available at: www.g7.utoronto.ca/summit/1994naples/communique/index.html (accessed 15 Nov. 2021).

61. Lithuania and Slovakia acceded to the EU and Euratom on 1 May 2004 and Bulgaria on 1 January 2007.

62. Council Regulation (EU) 2021/101 of 25 January 2021 establishing the nuclear decommissioning assistance programme of the Ignalina nuclear power plant in Lithuania and repealing Regulation (EU) No 1369/2013, OJ L 34 (1 Feb. 2021), p. 18.

63. Council Regulation (Euratom) 2021/100 of 25 January 2021 establishing a dedicated financial programme for the decommissioning of nuclear facilities and the management of radioactive waste, and repealing Regulation (Euratom) No 1368/2013, OJ L 34 (1 Feb. 2021), p. 3.

V. Conclusion

When the Euratom Treaty was signed in 1957, nuclear energy was seen as an energy resource for Europe's economic development and, over the past 60 years, the Euratom Treaty has provided considerable power to the Euratom Community to take decisions in the areas of nuclear safety and radiological protection of workers and citizens.

It is internationally recognised that the stringent framework provided by the Euratom Treaty and the rigorous application of strict safety standards at member state level have contributed to preventing major accidents and radioactive releases on Euratom Community soil over the last 60 years. Indeed, no major accident has happened on Euratom Community soil to date. The Euratom Treaty also provided the framework allowing Europe to develop first class civil nuclear applications in energy, research and healthcare, thereby creating jobs and growth through innovation. Nuclear energy has provided a major source of energy independence and diversification throughout multiple energy crises in the 1970s and 1980s, while at the same time reducing CO_2 emissions. The Euratom Treaty provided the legal basis for Europe to quickly respond to external events and major nuclear accidents in order to protect itself and has enabled the Euratom Community to speak with one voice externally, exercising strong leadership on nuclear safeguards, research, safety and certain aspects of non-proliferation issues.

It is true that the Euratom Treaty provides a comprehensive legal framework for the development and use of nuclear power, including far-reaching supranational powers at the Euratom Community level. In practice, however, the application of those powers throughout the years has been selective, and has evolved in response to the emerging challenges and public concerns over time.

Today, Euratom-based activities are focused on improving radiological protection, nuclear safety and the management of nuclear waste and spent fuel, and enhancing scientific research to underpin those activities. Also still relevant are efforts to foster security of supply of nuclear materials and services for power and non-power uses, promote international co-operation for the peaceful uses of nuclear energy and technologies, ensure full nuclear safeguards to counter nuclear proliferation by exercising the exclusive powers of the Commission, as well as to participate in the global research to produce large-scale and carbon-free energy from fusion through the ITER project.

Moreover, it should also be kept in mind that the use of nuclear energy and radioactive materials is not limited only to the energy sector. European citizens benefit practically from peaceful nuclear applications in medicine, industry, agriculture and many other areas of modern life. Medical uses of these technologies benefit patients across Europe, in particular in the fight against cancer, and the Euratom Community is the leading global supplier of medical radioisotopes and a world leader in developing radiological diagnostics and treatments.[64]

It is therefore clear that this legal framework remains of vital importance in Europe given the continued use of nuclear energy and technologies by a significant number of Euratom member states.[65] Consequently, the Euratom Treaty continues to provide a critical framework benefiting all EU citizens in its member states and beyond.

64. See the recently adopted "Action Plan for security of radioisotope supply, quality and safety, and technological development and innovation", in European Commission (2021), *SAMIRA: Strategic Agenda for Medical Ionising Radiation Applications*, Doc. SWD(2021) 14 final, the first comprehensive plan for action to support safe, high-quality and equitable use of radiological and nuclear technology in healthcare.

65. Under Article 194 of the TFEU, *supra* note 4, the EU/Euratom member states have the right to choose their own energy mix including the use of nuclear energy. Currently 13 EU member states out of 27 use nuclear energy for power generation.

The impact of the major nuclear power plant accidents on the international legal framework for nuclear power

by Stephen G. Burns[*]

Over time, numerous events and developments have shaped the utilisation of nuclear energy as well as the approach to its regulation. For example, the Three Mile Island (TMI) accident in 1979 was a significant event affecting the nuclear power industry in the United States (US) and the US Nuclear Regulatory Commission's (NRC) regulatory programme, yet other incidents or "near misses" at facilities, scientific and engineering assessments of reactor technology, and changes to enhance the NRC's organisational effectiveness have also shaped the framework for regulation.[1] Nonetheless, in public consciousness, three major nuclear power accidents have arguably dominated the debate over the safety and regulation of nuclear power operations: the TMI accident; the 1986 Chernobyl accident in Ukraine, then part of the Union of Soviet Socialist Republics (USSR); and the multi-plant Fukushima Daiichi accident in Japan in 2011. For each accident, there were certainly impacts that the events have had on national legislation pertaining to nuclear energy, whether in the country where the accident occurred or in others.[2] Moreover, each accident has also had an impact on the international legal framework for peaceful uses of nuclear energy. This article focuses on the international dimension by considering commentary and analysis contemporaneous with the events as well as reflections made some decades after the accidents occurred. And though each accident has had an impact, the Chernobyl accident has clearly been the most significant driver of change in the international legal regime.

I. Three Mile Island

The Three Mile Island Nuclear Station, located near Harrisburg, Pennsylvania, had two licensed units. Unit 2 had been licensed to operate since February 1978. At about 4:00 a.m. on Wednesday, 28 March 1979, unit 2 experienced equipment failure on the plant's secondary side, which prevented the main feed water pumps from sending water to the steam generators, which would

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1. See Fewell, J.B., D. Ferraro and D. Reddick (2017), "Accidents and Innovation Shaping the Nuclear Regulatory Landscape", *Infrastructure*, Vol. 56, No. 4, ABA Publishing, pp. 3-13. The World Nuclear Association (WNA) lists historical nuclear reactor accidents on its website and notes the more serious toll non-nuclear energy accidents have exacted on human life. WNA (2017), *Safety of Nuclear Power Reactors: Appendices*, Appendix 1, "The Hazards of Using Energy", www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/appendices/safety-of-nuclear-power-reactors-appendix.aspx (accessed 28 May 2021).

2. For example, the accidents prompted regulatory reform initiatives in the host countries. Sexton, K. (2015), "Crisis, criticism, change: Regulatory reform in the wake of nuclear accidents", *Nuclear Law Bulletin*, No. 96, OECD Publishing, Paris, pp. 35-62.

remove heat from the reactor core.[3] The turbine generator and then the reactor itself began to shut down and thereby increase the pressure in the reactor's primary system. Per design, the pilot-operated relief valve opened to help control pressure, but the valve failed to close and stuck open when pressure fell to an acceptable level. Moreover, the control room's instrumentation erroneously indicated that the valve had closed so that the operating crew was unaware that coolant in the form of steam was pouring out of the open valve. As a consequence, the crew did not understand that the plant was experiencing a severe loss-of-coolant accident. Other instrumentation readings also led the crew to incorrectly assume that the water level was adequate to cover the reactor core. The operators then took steps that exacerbated the situation and consequently led to a drop in water level in the reactor pressure vessel and overheating of the core.

Some 3 hours and 20 minutes after the accident began, the operators started the emergency core cooling system again. The core began to cool. By 8:00 a.m., the transient was over, but the sequence of events caused a partial meltdown of the reactor core and a small off-site release of radioactivity (equivalent to a dose of about 100 millirem or 1 millisievert (mSv) above background at the site boundary). However, for several days uncertainty about the possibility of a hydrogen explosion in the reactor vessel dominated the technical assessment of the plant's status. In the face of this uncertainty, Pennsylvania Governor Richard Thornburgh advised on Friday, 30 March 1979, that persons within a five-mile (eight kilometres (km)) radius of the plant should stay indoors and that pregnant women and preschool-age children should evacuate the area. On Sunday, 1 April 1979, President Jimmy Carter, First Lady Rosalynn Carter, and Governor Thornburgh visited the plant with NRC's lead official Harold Denton. At this point, the reactor's condition was considered to be relatively stable and to no longer pose a significant danger. The Governor's precautionary advisory to pregnant women and preschool-aged children was lifted within two weeks.

The Three Mile Island accident had a significant impact on the US nuclear industry and the NRC.[4] Official reports on the accident, one by a Presidential Commission and the other an inquiry sponsored by the NRC itself, contain blistering criticism of the NRC and the industry.[5] For example, the Presidential Commission's report concluded, "With its present organization, staff, and attitudes, the NRC is unable to fulfil its responsibility for providing an acceptable level of safety for nuclear power plants."[6] Both reports even called for the reconfiguration of the NRC (then barely into its fourth year of existence) into an agency headed by a single administrator, a step that President Carter ultimately rejected in favour of a reorganisation plan intended to enhance the role of the Chairman in an emergency and improve NRC's organisation.[7] The accident had also revealed significant weaknesses in emergency planning and response capabilities. President Carter consolidated federal responsibility for off-site emergency planning and response to radiological incidents in the Federal Emergency Management Agency, which had been established by his administration before the

3. The description of the event is taken from the factsheet posted on NRC (2018), "Backgrounder on the Three Mile Island Accident", www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html (accessed 28 May 2021).

4. For an overview of the impacts of the accident on nuclear regulation in the United States, see NRC, Office of Nuclear Regulatory Research (2016), *Three Mile Island Accident of 1979 Knowledge Management Digest – Overview*, NUREG/KM-0001, Rev. 1.

5. See Report of the President's Commission on the Accident at Three Mile Island (1979), *The Need for Change: The Legacy Of Three Mile Island*; NRC Special Inquiry Group (1980), *Three Mile Island: A Report to the Commissioners and to the Publ*ic, NUREG/CR1250, Vols. 1-3.

6. Report of the President's Commission (1979), *supra* note 5, p. 56.

7. Reorganization Plan No. 1 of 1980, 45 *Federal Register* (Fed. Reg.) 40561 (16 June 1980), codified in 5 United States Code (USC) Appendix. See Sexton, K., *supra* note 2, pp. 42-48.

Three Mile Island accident. The NRC required utilities to develop, maintain and exercise emergency response plans, including integration with off-site responders.[8]

Other regulatory actions included a vast array of initiatives aimed at improving the safety of design and operation of nuclear stations as well as mitigating the consequences of events when things went awry. The NRC staff issued to licensees and licence applicants in 1980 the consolidated recommendations from its "TMI Action Plan", which the Commission had approved for implementation.[9] The new requirements were reflected in the outcome of licensing reviews, orders to operating licensees and changes to the NRC's regulations. Within the nuclear industry itself, the Institute of Nuclear Power Operations (INPO) was established to improve the safety focus of power operations and the accountability of plant operating organisations.[10] Through INPO, the industry established standards of excellence against which it would hold its members accountable – a measure of self-policing through inspection and evaluation.

For the United States, historian J. Samuel Walker observes, "The dual legacy of the [Three Mile Island] crisis was, on the one hand, to galvanize regulatory and operational improvements that reduced the risks of another severe accident and, on the other hand, to increase opposition to the expansion of nuclear power".[11] That conclusion holds true outside the United States as well. For example, France, with currently the largest operating fleet in Europe, implemented improvements to plant design, operating procedures and emergency preparedness.[12] But the accident also proved to be a catalyst for anti-nuclear sentiment, as reflected in a 1980 referendum and resulting change to national law in Sweden that froze its nuclear energy programme and set a long-term phase-out of the existing Swedish reactor fleet.[13]

Given the broad attention to the accident, did Three Mile Island have a more global effect on international nuclear law and regulation? We know that no new international conventions or legal instruments resulted directly from the accident at Three Mile Island. Nonetheless, the accident did provide further impetus for sharing information on operational experience and laid the groundwork for bilateral and multilateral approaches to providing assistance during an emergency. Moreover, the accident helped prompt the initiation of the international safety inspections of nuclear power plants through the International Atomic Energy Agency's (IAEA) Operational Safety Review Team (OSART) programme that continues to this day.[14]

8. NRC's rules are reflected in Title 10 of the Code of Federal Regulations (CFR) 50.47 and in Appendix E to 10 CFR Part 50 and were adopted in 1980 after consideration of lessons learnt from the Three Mile Island accident. Emergency Planning, Final Rule, 45 Fed. Reg. 55402 (19 Aug. 1980).

9. NRC, Office of Nuclear Reactor Regulation (1980), *Clarification of TMI Action Plan Requirements*, NUREG-0737.

10. On INPO's development, see Rees, J.V. (1994), *Hostages of Each Other: The Transformation of Nuclear Safety since Three Mile Island*, University of Chicago Press, Chicago.

11. Walker, J. S. (2004), *Three Mile Island: A Nuclear Crisis in Historical Perspective*, University of California Press, Berkeley, California, p. 244.

12. See Institut de Radioprotection et de Sûreté Nucléaire (2015), *Nuclear Power Reactor Core Melt Accidents*, chap. 7.1.5, pp. 350-56; Tanguy, P. (1983), "The French Approach to Nuclear Safety", *Nuclear Safety*, Vol. 24, No. 5, US Department of Energy Technical Information Center, Oak Ridge, pp. 589, 594-95.

13. See NEA (1980), "Sweden, Nuclear Legislation, Bill concerning the future energy policy (1980)", *Nuclear Law Bulletin*, No. 26, OECD Publishing, Paris, p. 23; *ibid*., Sandstrom, S., "After the Referendum", pp. 53-57.

14. See Sacchetti, D. (2009), "The Peer View", *IAEA Bulletin*, Vol. 50, No. 2, p. 29; Hancher, L. and P. Cameron (1988), "After Chernobyl: Has Anything Really Changed?", in P. Cameron, L. Hancher and W. Kühn (eds.), *Nuclear Energy Law After Chernobyl*, Graham and Troutman, London, pp. 183-84.

The importance of systematic reporting and evaluation of operating experience was underscored by the realisation that two precursor events had occurred at other reactors but were unknown to the staff operating Three Mile Island. The Davis-Besse plant in Ohio and the Beznau plant in Switzerland had also experienced a stuck pilot-operated relief valve with misleading indications to operators that the reactor coolant system had sufficient water, but the operators at both plants were able to recognise and address the problem before serious damage occurred. Although the Davis-Besse event had been reported to the NRC, the Special Inquiry Group report found that the NRC's "preoccupation with hardware and design questions, and the lack of any clear-cut responsibility for identifying significant operating problems and warning operators about them combined to prevent the real message of Davis-Besse from getting to Three Mile Island."[15] The agency did not become aware of the Beznau experience until *after* the TMI accident.[16]

Initial steps to establish a system to share information on incidents at nuclear installations had begun under an NEA initiative in 1978, and Organisation for Economic Co-operation and Development (OECD) countries approved the institution of an Incident Reporting System in 1981.[17] The OECD Council adopted the system as a Council Recommendation in 1983; such recommendations, though not binding, are accorded "great moral force as representing the political will of the Adherents".[18] The IAEA extended the reporting system to its member states with nuclear power programmes in April 1983, and the IAEA and NEA now jointly run the system.[19]

In the realm of emergency response and assistance, the Three Mile Island accident prompted the IAEA to enhance its activities and to encourage states to consider arrangements to provide mutual assistance in the event of an accident. Although efforts to establish a legal framework for emergency assistance had borne some fruit in the 1960s with the conclusion of the Nordic Mutual Emergency Assistance Agreement, little enthusiasm had existed for a broader agreement.[20] After the Three Mile Island accident, discussions were initiated under IAEA auspices to consider further development of an assistance framework. The United States had initiated efforts to negotiate a convention to address arrangements for emergency assistance.[21] The efforts led in February 1982 to the establishment of a group of experts to study the means of responding to and facilitating requests for assistance prompted by a radiological emergency. The expert panel developed two documents: *Guidelines for Mutual Emergency Assistance Arrangements in Connection with a Nuclear Accident or Radiological Emergency* (IAEA Doc. INFCIRC/310, 1984) and *Guidelines on Reportable Events, Integrated Planning and Information Exchange in Transboundary Release of Radioactive Materials* (IAEA Doc. INFCIRC/321, 1985). These recommendations were useful to states as models if they wished to pursue bilateral or multilateral agreements, but they fell short of any binding international agreement on the subject.

15. NRC Special Inquiry Group, *supra* note 5, Vol. 1, p. 95; see also *ibid*., pp. 94-99 for further context.

16. *Ibid*., p. 94.

17. IAEA (2018), *Operating Experience Feedback for Nuclear Installations*, IAEA Safety Standards Series No. SSG-50, Annex, pp. 35-36; IAEA (2010), *IRS Guidelines – Joint IAEA/NEA International Reporting System for Operating Experience*, Services Series No. 19, p. 1.

18. OECD (1983), *Recommendation of the Council concerning the Operation of a Nuclear Power Plant Incident Reporting System*, OECD/LEGAL/0201, C(83)6/Final, adopted 22 Feb. 1983, https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0201 (accessed 28 May 2021).

19. See references in *supra* note 17.

20. IAEA (1963), *Nordic Mutual Emergency Assistance Agreement in Connection with Radiation Accidents*, INFCIRC/49; see Cameron, P. (1988), "The Vienna Conventions on Early Notification and Assistance", in *Nuclear Energy Law After Chernobyl*, *supra* note 14, p. 22.

21. Cameron, P. (1988), *supra* note 20, p. 21.

Although no new binding international legal instruments came into being as a result of the Three Mile Island accident, the response to the accident sowed seeds that would finally germinate in the wake of the Chernobyl accident. Indeed, the 1994 Diplomatic Conference on the Convention on Nuclear Safety acknowledged that:

> The accident at Three Mile Island and the disaster at Chernobyl had given further impetus to the establishment of international norms. While the Chernobyl accident was the only one to have transboundary radiological consequences, the impact of both accidents had gone far beyond the borders of the States where they had occurred.[22]

II. Chernobyl

On 26 April 1986, a sudden power surge during a reactor systems test destroyed unit 4 of the nuclear power station at Chernobyl, Ukraine, in the former Soviet Union. The operators had prepared a test to determine the length of time that the turbines could rotate and provide power to the main circulating pumps in the event of a loss of main electric supply.[23] Among other actions, the operators disabled the automatic shutdown mechanisms prior to the planned test. The reactor became extremely unstable, and when the operators began the shutdown procedure, the control rods caused a significant power surge as they were inserted into the reactor core. The reactor experienced substantial damage, the control rods jammed without having fully inserted, and intense steam generation eventually caused a steam explosion that spewed fission products into the atmosphere. Another explosion soon followed, throwing graphite and other fragments out of the fuel channels. The fuel melted and started fires that added to the radioactive release.

The accident resulted in the largest uncontrolled release of radioactive material ever experienced from any civilian installation. For some ten days, large quantities of radioactive material were released into the air. Most of the released material fell close to the plant in the form of dust and debris, but some material was carried by wind over Belarus, Russia, Ukraine and even into Scandinavia and other parts of Europe. Initial information that an accident had occurred came from detection of elevated radiation readings in Sweden, before the Soviet government had informed the international community that the accident had occurred.

Emergency responders poured sand and boron by helicopter on the reactor debris in order to extinguish the fires, mitigate radioactive releases and prevent the criticality of the nuclear material. A temporary concrete "sarcophagus" was constructed within a few weeks to retard

22. "Summary Record of the First Plenary Meeting of the Diplomatic Conference on a Nuclear Safety Convention", in IAEA (1994), *Convention on Nuclear Safety*, Legal Series No. 16, IAEA, Vienna, p. 64, para. 12.

23. The summary of the accident and its impacts is based on information posted online at: WNA (updated 2021), "Chernobyl Accident 1986", www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx (accessed 28 May 2021). Information on health effects was drawn from the World Health Organization (WHO) and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). See WHO/IAEA/UNDP, Press Release, "Chernobyl: the true scale of the accident" (5 Sept. 2005), www.who.int/mediacentre/news/releases/2005/pr38/en/ (accessed 28 May 2021); WHO (2016), "1986-2016: Chernobyl at 30", available at: www.who.int/ionizing_radiation/chernobyl/Chernobyl-update.pdf?ua=1 (accessed 28 May 2021); UNSCEAR (2011), *Sources and Effects of Ionizing Radiation*, Report to the General Assembly 2008, Vol. II, Annex D, "Health Effects due to radiation from the Chernobyl accident"; UNSCEAR, *Report of United Nations Scientific Committee on the Effects of Atomic Radiation*. The IAEA issued an official report on the accident through its International Nuclear Safety Advisory Group (INSAG) in IAEA (1986), *Summary Report on the Post-accident Review Meeting on the Chernobyl Accident*, INSAG-1, IAEA, Vienna, which was later updated in IAEA (1992), *The Chernobyl Accident: Updating of INSAG-1*, INSAG-7, IAEA, Vienna. The document includes as an annex a report commissioned by the USSR State Committee for the Supervision of Safety in Industry and Nuclear Power.

further release of radioactive material. The government closed the area within 30 km of the plant, except for those persons who were involved in the recovery from the accident or who were operating the undamaged reactors at the site (which were not finally closed until 1999). Some 115 000 people were evacuated from the most heavily contaminated areas in 1986 and another 220 000 people were evacuated in following years.

Two persons died as a result of the explosion. About 1 000 on-site staff and emergency workers received high radiation doses on the first day of the accident. By July 1986, 28 deaths, including 6 fire fighters, had resulted from radiation exposures – estimated to range up to 20 000 mSv – which were incurred by those responding to the accident on the first day. Some 200 000 people from across the Soviet Union were involved in the recovery and clean-up during 1986 and 1987. They also received high doses, on average 100 mSv. Experts estimated, based on statistical projections, that radiation exposure among the higher-exposed populations could cause up to 4 000 eventual deaths, i.e. among emergency workers in 1986-1987 as well as among the evacuees and residents of the most contaminated areas. As of 2005, about 6 000 cases of thyroid cancer appear to have resulted from the accident, and nine children died from thyroid cancer; some 20 000 cases have been reported as of 2015, though not all are considered directly caused by the accident.

As noted above, the occurrence of the accident was not immediately known outside the Soviet Union, and the initial response of the international community was to urge the Soviet government to provide information relevant to the accident. For example, a statement issued by the G7 during its Tokyo summit in early May 1986 urged the Soviet government "which did not do so in the case of Chernobyl, to provide urgently such information [on the emergency and accident], as our and other countries have requested".[24] The Soviet government invited IAEA Director General Hans Blix to visit the USSR and Chernobyl in early May. In a speech broadcast on 14 May 1986, Soviet General Secretary Mikhail Gorbachev, while accusing the Western powers of trying to make political capital out of the accident, nonetheless announced the openness of the Soviet Union to broad enhancements in the international regime for notification, assistance and plant safety, a message he reiterated in subsequent communications to the IAEA.[25] The IAEA through its Board of Governors soon put the wheels in motion that would lead to the broad consideration of new instruments to govern the international nuclear safety regime.

Even the novice at nuclear law gains an early appreciation of the impact of the Chernobyl accident on the international legal framework affecting emergency notification and assistance, the safety of nuclear installations, and liability for damage from nuclear incidents. The Early Notification Convention and the Assistance Convention were negotiated within months of the accident and entered into force before a year had passed.[26] The Convention on Nuclear Safety was adopted in 1994 and was followed by the Joint Convention on the Safety of Spent Fuel

24. IAEA (1986), "Statement Issued on 5 May 1986 by the Heads of Government of Seven Major Industrial Nations and the Representatives of the European Community", IAEA Doc. INFCIRC/333.

25. Letter dated 14 May 1986 from the Permanent Representative of the Union of Soviet Socialist Republics to the United Nations addressed to the Secretary-General, A/41/339 (1986), Annex, "Address given on Soviet Television on 14 May 1986 by the General Secretary of the Central Committee of the Communist Party of the Soviet Union (CPSU)", pp. 5-7; Letter from Mr M. Gorbachev, General Secretary of the Central Committee of the Communist Party of the Soviet Union, to Dr H. Blix, Director General of the Agency (20 June 1986), IAEA Doc. INFCIRC/334.

26. Convention on Early Notification of a Nuclear Accident (1986), IAEA Doc. INFCIRC/335, 1439 UNTS 276, entered into force 27 Oct. 1986 (Early Notification Convention); Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1986), IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987 (Assistance Convention).

Management and on the Safety of Radioactive Waste Management in 1997.[27] Although nuclear liability conventions had been adopted in the early 1960s, the transboundary effects of Chernobyl spurred efforts to improve the conventions and achieve greater harmonisation between the existing instruments. The Joint Protocol linking the Paris and Vienna Conventions on nuclear liability was negotiated in 1988,[28] and further negotiations led to proposed revisions to both the Vienna and Paris Conventions and to a new Convention on Supplementary Compensation (CSC).[29] Some suggest that the accident had an impact as well on other instruments relating to nuclear safety and environmental protection.[30]

For some, the reaction to the negotiation of new international legal instruments after Chernobyl could be said to be, "It's about time!". From this point of view, nuclear energy had lagged in the development of a robust system of international legal instruments and was dominated by national systems of law and regulation that guarded themselves against external scrutiny. But Dr Norbert Pelzer offers a more balanced assessment of the lessons from Chernobyl in an article he wrote within a year of the accident:

> [O]ne can state that – long before the Chernobyl accident in 1986 – there has been a comprehensive régime of national and international norms to assure the safe use of peaceful nuclear energy and to guarantee just compensation in case of an incident. So the stable door seemed to be locked without giving the horse a chance to bolt. It bolted nevertheless, Chernobyl happened, and the management of the incident proved that there are still gaps in the system.[31]

Despite the call to action prompted by the accident and the resulting negotiation of new legal instruments, the commentary on the development and text of the new instruments reflects a mixed reaction to the outcomes, both in views expressed contemporaneously with their negotiation as well as in retrospective reflection on what had been achieved. The cup was half full *and* half empty: the new instruments marked great progress in establishing international norms – but couldn't they have been much better?[32]

27. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996 (CNS); Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001 (Joint Convention).

28. Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (1988), IAEA Doc. INFCIRC/402, 1672 UNTS 293, entered into force 27 Apr. 1992 (Joint Protocol).

29. Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997), IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force 4 Oct. 2003 (1997 Vienna Protocol); Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 April 2015 (CSC); Protocol to Amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004), entered into force 1 Jan. 2022, available at: www.oecd-nea.org/law/paris_convention.pdf (2004 Paris Protocol).

30. See Sands, P. (1996), "Observations on International Nuclear Law Ten Years after Chernobyl", *Review of European, Comparative & International Environmental Law* (Reciel), Vol. 5, Issue 3, Wiley-Blackwell Publishing, Oxford, p. 199.

31. Pelzer, N. (1987), "The impact of the Chernobyl accident on international nuclear energy law", *Archiv des Völkerrechts*, Vol. 25, No. 3, Mohr Siebeck Verlag, Tübingen, p. 295. Compare Tanguy, P. (1988), "Three decades of nuclear safety", *IAEA Bulletin*, Vol. 30, No. 2, pp. 51-57. For perspectives that preceded the Chernobyl accident, see Pelzer, N. (1981), "The nature end scope of international co-operation in connection with the peaceful uses of nuclear energy, and its limits – an assessment", *Nuclear Law Bulletin*, No. 27, OECD Publishing, Paris, pp. 34-49; de la Fuente, A.H. (1982), "The legal force of international rules relating to nuclear risks", *Nuclear Law Bulletin*, No. 30, OECD Publishing, Paris, pp. 47-59.

32. See e.g. Sands, P. (1996), *supra* note 30, p. 200.

A. Early Notification and Assistance Conventions

Within a month of the accident, the IAEA Board of Governors had set out the path that would lead to the adoption of the Early Notification and the Assistance Conventions. In July 1986 the IAEA had invited experts to work towards developing a framework for notification and assistance in the event of a nuclear accident, and by the end of September 1986 the conventions had been adopted and opened for signature at a special session of the IAEA General Conference.[33]

Apart from the political will galvanised by the accident, several additional factors contributed to the conventions' swift negotiation. First, the focus was narrowed to the issues of notification of incidents posing a threat of radiological releases and of provision of mutual assistance to mitigate the consequences of incidents and recover from them. Thus, the more complex and potentially controversial question was pushed down the road as to whether international instruments should lay out standards for the safety of nuclear installations or establish a scheme for ensuring adherence to such standards. The narrower approach can be understood as allowing states to focus on the possibility of "easy wins" to help restore public credibility after the Chernobyl accident and to avoid a stalemate over further progress had debate over safety standards turned to a focus on the argued defects in the Soviet reactor designs.[34]

Second, the existence of the relatively fresh guidelines in INFCIRC/310 and INFCIRC/321 that arose out of post-Three Mile Island discussions, as well as earlier related efforts, helped speed negotiation of the new Early Notification and Assistance Conventions by providing a baseline for their substantive content.[35] Third, the language of the conventions is extraordinarily flexible, so much so that the text is criticised as allowing states to simply decide for themselves how they will comply without repercussions. As Carlton Stoiber colourfully puts it, the conventions are full of "weasel words" that allow a state "to make its own determination about what action to take or what information to provide to other parties", and they lack enforcement measures or strong dispute resolution procedures that would strengthen them.[36] For example, the Early Notification Convention essentially vests in the state where the incident occurs the discretion to determine the significance of the event for other states, thereby leading one to wonder whether the Soviet Union would have given notification of the Chernobyl accident had the convention been in force at that time.[37] Thus, some argue that the Early Notification Convention is weaker than other international instruments

33. The development of the texts of the conventions and other background material relating to their negotiation and conclusion can be found in IAEA (1987), *Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency*, IAEA Legal Series No. 14, IAEA, Vienna. A good overview of the conventions is found in Moser, B. (1989), "The IAEA Conventions on Early Notification of a Nuclear Accident and on Assistance in the Case of a Nuclear Accident or Radiological Emergency", *Nuclear Law Bulletin*, No. 44, OECD Publishing, Paris, pp. 10-23. See also Pelzer, N. (1987), *supra* note 31, p. 299; Rautenbach, J., W. Tonhauser and A. Wetherall (2006), "Overview of the International Legal Framework Governing the Safe and Peaceful Uses of Nuclear Energy – Some Practical Steps", in NEA and IAEA (eds.), *International Nuclear Law in the Post-Chernobyl Period*, OECD Publishing, Paris, p. 9.

34. See Cameron, P. (1988), *supra* note 20, p. 20; Stoiber, C. (2018), "Inside nuclear baseball: Reflections on the development of the safety conventions", *Nuclear Law Bulletin*, No. 100, OECD Publishing, Paris, p. 61.

35. Adede, A.O. (1987), *The IAEA Notification and Assistance Conventions in the Case of a Nuclear Accident*, Graham and Trotman – Martinus Nijhoff, London, pp. xxii, 1 (Mr Adede was a legal adviser at IAEA and secretary to the Group of Experts that negotiated the conventions); Cameron, P. (1988), *supra* note 20, pp. 21-22; Pelzer, N. (1987), *supra* note 31, pp. 304-305. Mr Adede's view of the progress achieved through the conventions was criticised as too sanguine in one review. Sands, P. (1991), "Book Review", *British Yearbook of International Law*, Vol. 61, Issue 1, Oxford University Press, pp. 363-364.

36. Stoiber, C. (2018), *supra* note 34, p. 62.

37. Pelzer, N. (1987), *supra* note 31, p. 303.

on reporting similar events or even customary law.[38] The Assistance Convention's provisions allowing a state to avoid dispute resolution by opting out of the provisions are similarly criticised.[39]

Nonetheless, the two conventions were praised for their swift negotiation and entry into force and are credited as making necessary progress, if only with modest effect, in the establishment of the international nuclear safety regime. Viewed from the perspective contemporaneous with their negotiation, the conventions are viewed as a "first step in the right direction" and of "considerable significance".[40]

B. The safety conventions

As noted earlier, consideration of a convention addressing the safety of nuclear power plants was deferred in the immediate aftermath of the Chernobyl accident. Finally, in 1990, member states of the European Community proposed the convening of a conference in 1991 to review the status of nuclear safety and to formulate recommendations at both a national and an international level.[41] The 1990 General Conference approved the proposal, and the special conference was held in early September 1991. Later that month, having received the report on the proceedings, the General Conference initiated the steps that would ultimately result in the development of a draft text of a convention. An open-ended "Group of Experts on a Nuclear Safety Convention" met seven times between May 1992 and February 1994 to shape the text that would be then submitted for consideration at a Diplomatic Conference convened in June 1994.

The preliminary work of the expert group is reflected in the final draft of the proposed convention and in the Convention on Nuclear Safety as it was adopted at the Diplomatic Conference. For example, the expert group agreed that the principles set out in a draft document on safety fundamentals would serve as the basis of the obligations of the parties to the Convention.[42] The incentive nature of the Convention's approach also stems from the deliberation of the expert group, as did the decision to focus the Convention on nuclear power plants and to

38. *Ibid*.; Sands, P. (1996), *supra* note 30, p. 200; Carroll, S. (1996), "Transboundary Impacts of Nuclear Accidents: Are the Interests of Non-Nuclear States Adequately Addressed by International Nuclear Safety Instruments?", *Reciel*, Vol. 5, Issue 3, p. 207; Politi, M. (1987), "The Vienna Conventions of September 26, 1986 on early notification and assistance in case of a nuclear accident or radiological emergency", in F. Vandenabeele (ed.), *Nuclear Inter Jura '87, Proceedings*, International Nuclear Law Association, Belgium, pp. C-93 to C-96.

39. Cameron, P. (1988), *supra* note 20, p. 29; Pelzer, N. (1987), *supra* note 31, p. 306; Politi, M. (1987), *supra* note 38, p. C-94.

40. Cameron, P. (1988), *supra* note 20, p. 32, quoting Pelzer, N. (1987), *supra* note 31, p. 306. See also Pelzer, N. (2006), "Learning the Hard Way: Did the Lessons Taught by the Chernobyl Accident Contribute to Improving Nuclear Law?" in *International Nuclear Law in the Post-Chernobyl Period*, *supra* note 33, pp. 78-79.

41. See Note by the Director General (1991), "Measures to Strengthen International Co-Operation in Matters relating to Nuclear Safety and Radiological Protection", IAEA Doc. GC(XXXV)/970, p. 1. Political developments such as the dissolution of the Soviet Union and the reunification of Germany provided renewed impetus for a nuclear safety convention. See Wellock, T. (2013), "The Children of Chernobyl: Engineers and the Campaign for Safety in Soviet-designed Reactors in Central and Eastern Europe", *History and Technology*, Vol. 29, No. 1, Routledge, London, pp. 3, 14-15; Stoiber, C. (2018), *supra* note 34, p. 63; Stoiber, C. (1999), "International Convention on Nuclear Safety: National Reporting as the Key to Effective Implementation", in N. Horbach (ed.), *Contemporary Developments in Nuclear Energy Law: Harmonising Legislation in CEEC/NIS*, Kluwer Law International, London, pp. 97, 98. The following two excellent synopses were drawn upon when describing the developments leading to the Convention on Nuclear Safety: Jankowitsch, O. (1994), "The Convention on Nuclear Safety", *Nuclear Law Bulletin*, No. 54, OECD Publishing, Paris, pp. 9-22, and Jankowitsch, O. and F. Flakus (1994), "International convention on nuclear safety: A legal milestone", *IAEA Bulletin*, Vol. 36, No. 3, pp. 36-40.

42. IAEA (1993), *Safety Fundamentals: The Safety of Nuclear Installations*, Safety Series No. 110, superseded by IAEA (2006), *Fundamental Safety Principles*, IAEA Safety Standards Series, No. SF-1, IAEA, Vienna.

defer consideration of an international agreement on safe waste management. The Convention on Nuclear Safety was opened for signature in September 1994 in conjunction with the 38th General Conference and came into force in October 1996.[43]

Following the commitment (see CNS, Preamble (ix)) to further develop a convention that would address the safety of radioactive waste management, the General Conference in 1994 invited the Director General and the Board of Governors to begin preparations for such a convention.[44] An expert group prepared a draft text in March 1997. The Joint Convention follows in many respects the general framework of the Convention on Nuclear Safety, including the "incentive" model. One issue that required more extensive negotiation included the issue of the treatment of spent fuel (which reprocessing states would not consider "waste"); ultimately, consensus was achieved by using safe management as a common focus for both radioactive waste and for spent fuel – thus, a "joint convention" covering both. Other issues included (1) ensuring proper integration with the Convention on Nuclear Safety in treating waste stored on an installation site and the treatment of an installation when it entered the decommissioning phase, (2) coverage of waste related to military or defence programmes, and (3) provisions on transboundary movement of waste and spent fuel. The Joint Convention was adopted on 5 September 1997 at the conclusion of the Diplomatic Conference convened to consider the draft. The Joint Convention entered into force in June 2001.

The reaction to the conventions was mixed, ranging from cautious optimism over their potential for enhancing nuclear safety to blunt criticism of them as creating a toothless regime that fails to solidify specific norms or obligations on their adherents.[45] Viewpoints differed over the embrace of general principles of safety *versus* specific norms, the emphasis on state responsibility *versus* a more international system, and the incentive *versus* a sanctions approach under the conventions. As noted above, the expert groups who developed the convention drafts relied on the safety fundamentals document that had been recently issued by the IAEA rather than more precise binding technical standards. These advisory norms were thus recognised within the conventions as a baseline of acceptable common standards for safety, but the conventions stop short of elevating them to more stringent, enforceable requirements.[46] While some might defend the efficacy of this approach in the face of the variance among widely differing national systems, others would compare the approach unfavourably to the international standards governing the aviation and maritime industries.[47]

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43. For the information on the negotiation and adoption of the CNS at the Diplomatic Conference, see IAEA (1994), *supra* note 22.

44. An overview of the negotiation of the Joint Convention is provided in Tonhauser, W. and O. Jankowitsch-Prevor (1997), "The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management", *Nuclear Law Bulletin*, No. 60, OECD Publishing, Paris, pp. 9, 12-21. The text and relevant official documents can be found in IAEA (2006), *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*, IAEA International Law Series No. 1, IAEA, Vienna.

45. Norbert Pelzer provides a good bibliography of commentary on the two conventions in his 2006 article "Learning the Hard Way: Did the Lessons Taught by the Chernobyl Accident Contribute to Improving Nuclear Law?", *supra* note 40, p. 88, nn. 77 and 78.

46. See Lamm, V. (2017), "Reflections on the development of international nuclear law", *Nuclear Law Bulletin*, No. 99, OECD Publishing, Paris, pp. 31, 36, 41-43. Nonetheless, Chernobyl fostered greater discussion about common safety criteria, progress that should not be discounted given the variability in national approaches, not only between the Soviet Union and other nations, but among other states as well. See Wellock, T. (2013), *supra* note 41, pp. 6-8.

47. Compare Handl, G. (1988), "Transboundary Nuclear Accidents: The Post-Chernobyl Multilateral Legislative Agenda", *Ecology Law Quarterly*, Vol. 15, Issue 2, University of California Berkeley School of Law, Oakland, pp. 203, 207, with Kamminga, M. (1995), "The IAEA Convention on Nuclear Safety", *International and Comparative Law Quarterly*, Vol. 44, Issue 4, Cambridge University Press, Cambridge, pp. 872, 873.

From the outset, tension was present between an approach resting upon state authority and responsibility as opposed to a more intrusive international inspection and sanctions regime.[48] Even in some of the earliest statements encouraging movement towards an international safety regime, IAEA Director General Hans Blix suggested:

> Whatever is done, however, it is important to retain the principle that responsibility for nuclear safety must remain with national governments. They alone can legislate. They alone exercise the power to enforce. They cannot be relieved of this duty by any international arrangements. But they might, of course, be required to comply with minimum standards.
>
> Whatever might be done as regards international safety standards, important steps could and should probably be taken in the sphere of international safety review of nuclear installations. I am not suggesting for your consideration a system of safety inspections in any way parallel to the safeguards. However, schemes falling short of such radical ideas and taking present programmes as a point of departure might have considerable value and be acceptable.[49]

The ultimate "incentive" approach of the conventions reflects a path that accommodates the tension between the competing considerations. In an oft-cited passage from her article on the Convention on Nuclear Safety, Odette Jankowitsch notes that the incentive character of the convention is intended to be synonymous with "encouragement" or "emulation", i.e. the peer reviews would be persuasive in encouraging states to achieve their obligations under the Convention and improve the safety of their facilities.[50] Notwithstanding the criticism of some commentators of the conventions as "disappointing" and failing to establish, or indeed evading, a "clearly binding international regime",[51] more recent assessments of the conventions' incentive approach have been more favourable, if still advising some caution.[52]

C. The nuclear liability conventions

At the time of the Chernobyl accident a nuclear liability regime of sorts existed in the international sphere in the form of two independent conventions: the 1960 Paris Convention established under OECD auspices (with the additional compensation scheme established under

48. See Reyners, P. (1996), "The Convention on Nuclear Safety of 1994", *Reciel*, Vol. 5, Issue 3, pp. 231, 232 and 234; Pelzer, N. (2006), *supra* note 40, p. 87.

49. Director General's Statement to Meeting of the Board of Governors, 21 May 1986, at 11; see also Blix, H. (1986), "The post-Chernobyl outlook for nuclear power", *IAEA Bulletin*, Vol. 28, No. 3, IAEA, Vienna, pp. 9, 11.

50. Jankowitsch, O., "The Convention on Nuclear Safety", *supra* note 41, p. 13. Ms Jankowitsch served as secretary to the Group of Experts and was an IAEA legal adviser.

51. See Kamminga, M. (1995), *supra* note 47, p. 880; Szasz, P. (1994), "Introductory Note, International Atomic Energy Agency: Convention on Nuclear Safety", *International Legal Materials*, Vol. 33, pp. 1514, 1515; Cameron, P. (1999), "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management", in N. Horbach (1999), *supra* note 41, pp. 117, 128. Boustany, K. (1998), "The Development of Nuclear Law Making or the Art of Legal 'Evasion'", *Nuclear Law Bulletin*, No. 61, OECD Publishing, Paris, pp. 39-53.

52. Handl, G. (2003), "The IAEA Nuclear Safety Conventions: An Example of Successful 'Treaty Management'?", *Nuclear Law Bulletin*, No. 72, OECD Publishing, Paris, pp. 7-27; Pelzer, N. (2006), *supra* note 40, pp. 93-95; de Wright, T. (2007), "The 'Incentive' Concept as Developed in the Nuclear Safety Conventions and its Possible Extension to Other Sectors", *Nuclear Law Bulletin*, No. 80, OECD Publishing, Paris, pp. 29-47; Montjoie, M. (2015), "Treaty implementation applied to conventions on nuclear safety", *Nuclear Law Bulletin*, No. 96, OECD Publishing, Paris, pp. 9-34.

the Brussels Supplementary Convention) and the 1963 Vienna Convention under IAEA auspices.[53] Although the two conventions shared common principles, such as strict liability, channelling of liability to the operator, the obligation to maintain financial security, and assignment of jurisdiction, there was no link between the conventions. Thus, a victim would be likely shut out of compensation for injuries suffered if the accident occurred in a neighbouring state that was party to a different convention than the one to which the victim's state adhered.

Attempts to link the two conventions stretched back to the time that the Vienna Convention had been adopted in 1963. A serious effort to negotiate a joint protocol linking the conventions gained some traction in 1974 but fell by the wayside. Work recommenced in 1984, but the Chernobyl accident – the first with significant transboundary effects – finally inspired an intentional focus on linking the existing conventions through the Joint Protocol adopted in 1988 as well as working further towards the improvement of the individual conventions.[54] That the Soviet Union did not adhere to an existing liability convention and the low likelihood of obtaining an enforceable judgment in Soviet courts added to the call for expanding and improving the existing liability regime.[55] Moreover, the conventions enjoyed relatively limited adherence. Although the Paris-Brussels regime in 1986 included 14 OECD states in Europe as members (including all countries that operated nuclear power plants), only 10 states had ratified the Vienna Convention. Only two of them – Argentina and Yugoslavia – operated nuclear power facilities, and none of the Soviet satellite states adhered to the Vienna Convention.[56]

The Joint Protocol was the initial task intended to improve the liability regime. The IAEA and NEA experts worked on a proposal in 1986 and 1987, and the IAEA Board of Governors' and the OECD Council's respective actions approved the holding of a Diplomatic Conference to consider the texts. The Diplomatic Conference adopted the draft text on 21 September 1988 and it entered into force in April 1992 upon the ratification or accession of five states party to the Paris and five states party to the Vienna liability conventions.[57]

The conclusion of the Joint Protocol was widely viewed as only a first, though necessary, step towards invigorating the international nuclear liability regime.[58] The Joint Protocol only linked those within the existing Paris and Vienna regimes that ratified the Joint Protocol; it did not

53. Convention on Third Party Liability in the Field of Nuclear Energy of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1960), 1519 UNTS 329 (Paris Convention or PC); Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1963), 1041 UNTS 358 (Brussels Supplementary Convention or BSC); Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977.

54. See IAEA (2013), *The 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention – Explanatory Text*, International Law Series No. 5, IAEA, Vienna, pp. 4-8; Busekist, O. (1989), "A Bridge Between Two Conventions on Civil Liability for Nuclear Damage: the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention", *Nuclear Law Bulletin*, No. 43, OECD Publishing, Paris, pp. 10, 11-14.

55. See e.g. Country report for Federal Republic of Germany (1986), "Compensation for Damage caused by the Chernobyl Accident under the Atomic Energy Act (1986)", *Nuclear Law Bulletin*, No. 38, OECD Publishing, Paris, pp. 21-22; Country report for Sweden (1986), in *ibid*., pp. 33-34 (addressing compensation to victims suffering damage from the Chernobyl accident).

56. See IAEA (1988), "Special Report, Highlights of the IAEA General Conference: 32nd regular session", *IAEA Bulletin*, Vol. 30, No. 4, IAEA, Vienna, p. 35.

57. See IAEA (2013), *supra* note 54, pp. 6-10.

58. See Boulanenkov, V. and B. Brands (1988), "Nuclear Liability: Status and prospects", *IAEA Bulletin*, Vol. 30, No. 4, pp. 5-9; Sands, P. (1996), *supra* note 30, p. 200; Carroll, S. (1996), *supra* note 38, pp. 208-209.

attempt to otherwise improve the compensation scheme under the conventions. Focusing on "modernising" the liability conventions was the next step. However, the journey towards an improved liability regime since Chernobyl has been a lengthy one, as evidenced by the time that it took after the accident occurred to negotiate revisions to the Vienna and Paris Conventions – 11 and 16 years respectively. Moreover, the CSC, an additional convention developed under IAEA auspices concurrent with the 1997 Vienna Protocol, only came into force in 2015, and the Paris-Brussels regime's revisions came into force in 2022.

Among other things, improvements to the liability regime focused on increasing the minimum liability amount, compensating a broader range of damages (including for the first time the environmental and economic costs of an accident), compensating more victims by widening the geographical scope of the regimes, and extending the prescription period within which victims may make their claims.[59] Work on revising the Vienna Convention began in 1989 and was ultimately shepherded by a Standing Committee on Liability for Nuclear Damage that held 17 sessions from 1990 to 1997. In its early stages, discussion focused not only on the liability of individuals or juridical entities under the law but also on the question of state liability in the event of an accident.[60] Ultimately, however, the work centred on revision to the Convention and on establishing an approach to supplemental funding.[61]

The Protocol to Amend the Vienna Convention was adopted at a Diplomatic Conference on 12 September 1997 and entered into force on 4 October 2003. The 1997 Vienna Protocol exists concurrently with the 1963 Vienna Convention. Thus, states may accede to the 1963 Vienna Convention only; the Vienna Convention *and* its 1997 Protocol; or the 1997 Vienna Protocol but not to the 1963 convention. The Diplomatic Conference also adopted the CSC, which is open to all states, including those already parties to the Paris-Brussels or Vienna regimes. Support for establishing a mechanism to provide supplementary funds to compensate nuclear damage arose during the discussion of the new Vienna Protocol, which would be over and above the amounts to be provided by the operator under the Paris and Vienna Conventions. The system of supplementary state funding in the CSC was modelled in part on the Brussels Supplementary Convention.

The CSC provides for a two-tier compensation system: the first tier is provided by the operator and, if necessary, the state where its installation is situated; the second tier is provided by the CSC states. The CSC allows a state to establish at its option a third tier of compensation. The CSC was also intended to provide the basis for a global liability regime to supplement and enhance the measures provided in the Paris and Vienna regimes. Importantly, the CSC allowed the United States to join an international nuclear liability convention without amending its national law, the Price-Anderson Act, 42 USC Section 2210, which provides for economic channelling of liability

59. "Progress towards a global nuclear liability regime" (2014), *Nuclear Law Bulletin*, No. 93, OECD Publishing, Paris, pp. 9, 21-22, Appendix 1 (outlines the enhancements under the revised conventions).

60. IAEA (2020), The *1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage – Explanatory Texts*, IAEA International Law Series No. 3 (Rev. 2), IAEA, Vienna, pp. 18-19; see Pelzer, N. (1987), *supra* note 31, p. 308; see also Lamm, V. (1998), "The Protocol amending the 1963 Vienna Convention", *Nuclear Law Bulletin*, No. 61, OECD Publishing, Paris, pp. 7-24.

61. A rich record of the viewpoints of experts on the changes to the liability system leading to the revised Vienna Convention and ultimately the revised Paris-Brussels regime can be found in a series of NEA publications on the subject. See NEA (2000), *Reform of Civil Nuclear Liability: Budapest Symposium 1999*, OECD Publishing, Paris; NEA (1994), *Liability and Compensation for Nuclear Damage: An International Overview*, OECD Publishing, Paris; NEA (1992), *Nuclear Accidents: Liabilities and Guarantees, Proceedings of the Helsinki Symposium Organised Jointly by the NEA and IAEA*, OECD Publishing, Paris. These publications are available at: NEA (2018), "Nuclear liability publications, workshops and symposia", www.oecd-nea.org/law/nuclear-liability-pubs-workshops-symposia.html (accessed 28 May 2021).

to the operator rather than the legal channelling approach provided in the conventions. The free-standing nature of the CSC and its structure gave support to the argument that the CSC lays the foundation for a more global liability regime.[62]

The parties to the Paris-Brussels regime participated in the discussions on the 1997 Protocol and soon moved to improve their own regime.[63] On 12 February 2004, the Protocol to Amend the Paris Convention and the Protocol to Amend the Brussels Supplementary Convention were signed. The protocols only entered into force on 1 January 2022, mainly because a decision of the Council of the European Union of 8 March 2004 requires that the contracting parties to the Paris Convention that are also European Union members "take the necessary steps to deposit simultaneously their instruments of ratification of the Protocol, or accession to it".[64] At the time, this requirement did not seem to be a constraint, but it ultimately became one. It was not until 2020 that Italy, the last of the European Union states adhering to the Paris Convention, finally concluded its national prerequisites for ratification of the 2004 Protocols.

Building on the common principles that underlie the original liability conventions, the efforts to improve the international liability regime did make progress in the years after Chernobyl. A broader range of compensable damages, longer time to make claims and a wider group of covered claimants are provided in the revised and new conventions. Moreover, a substantial increase in the minimum liability amounts was achieved: e.g. from operator liability of 15 million Special Drawing Rights (SDR, equivalent to about EUR 17.85 million or USD 21.5 million on 6 May 2021) maximum to EUR 700 million minimum under the revised Paris Convention and, under the 1997 Vienna Protocol, from USD 5 million in gold valued at USD 35 per troy ounce adjusted to reflect the current price of gold (about USD 259 million or EUR 214.8 million with gold at USD 1816 per troy ounce on 6 May 2021) to SDR 300 million (about EUR 357 million or USD 429.8 million on 6 May 2021). Despite these improvements, progress was slow in the 25 years that lapsed between the Chernobyl and Fukushima Daiichi accidents. By 2011 neither the CSC nor the 2004 Paris and Brussels protocols had taken force, and adherence to the 1997 Vienna Protocol was modest. Whatever momentum Chernobyl had prompted seemed to have lost its steam.[65]

62. McRae, B. (1998), "The Compensation Convention: Path to a Global Regime for Dealing with Legal Liability and Compensation for Nuclear Damage", *Nuclear Law Bulletin*, No. 61, OECD Publishing, Paris, pp. 25-38.

63. Dussart-Desart, R. (2005), "The Reform of the Paris Convention on Third Party Liability in the Field of Nuclear Energy and of the Brussels Supplementary Convention", *Nuclear Law Bulletin*, No. 75, OECD Publishing, Paris, pp. 7-33. Unofficial consolidated texts of the Revised Paris Convention and the Revised Brussels Supplementary Convention under the protocols were published respectively as NEA Doc. NEA/NLC/DOC(2017)5/FINAL and NEA Doc. NEA/NLC/DOC(2017)6/FINAL.

64. Council Decision 2004/294/EC of 8 March 2004 authorising the member states to ratify, in the interest of the European Community, the Protocol of 12 February 2004 amending the Paris Convention, *Official Journal of the European Union* (OJ) L 97 (1 Apr. 2004), p. 53. The Council had to authorise member states that are contracting parties to the Paris Convention to ratify the 2004 Protocol to amend the Convention because some of its provisions concern the judicial resolution of disputes, a subject that, according to European Union law, falls under the European Union's exclusive competence.

65. See Pelzer, N. (2010), "Main Features of the Revised International Regime Governing Nuclear Liability – Progress and Standstill", in NEA (ed.), *International Nuclear Law: History, Evolution and Outlook*, OECD Publishing, Paris, pp. 355, 382-386.

III. Fukushima Daiichi

The Great East Japan Earthquake struck north-eastern Japan on 11 March 2011, approximately 130 km east of the city of Sendai and approximately 370 km northeast of Tokyo.[66] The magnitude 9.0 earthquake and ensuing tsunami caused widespread devastation, including the loss of over 15 000 lives and disruption of local infrastructure. Eleven operating nuclear power plants along the north-eastern coast of Japan shut down automatically, including three plants operating at the six-unit Fukushima Daiichi station. At the time of the accident, units 1 through 3 were operating, unit 4 (located adjacent to unit 3) had no fuel in its reactor, and units 5 and 6, which are located separately from units 1-4 on the site, were shut down for routine maintenance and refuelling. The plants were boiling water reactors designed by the General Electric Company. The station lost power from the electrical grid, and flooding caused by the tsunami waves, including one as high as 15 metres, rendered all but one of the site's diesel generators incapable of supplying backup power. As a consequence, four of the units at the site entered a condition called "station blackout", meaning that the only electric power available came from station batteries, which are capable of providing power only in terms of hours, not days. Although units 1 through 3 had shut down automatically as designed in response to the earthquake itself, continued cooling of the reactor cores was necessary to remove residual heat and required the operability of equipment that relies in part on electric power.

Not only did workers at the plant have to deal with securing the operation of critical safety equipment, but they also faced significant damage to site infrastructure from the earthquake and tsunami. The damage complicated the workers' ability to access parts of the plant and conduct other recovery operations. Despite valiant efforts to cool the plants, adequate core cooling was lost within hours in the unit 1 reactor, within 36 hours in unit 3, and 71 hours in unit 2. As a consequence, the fuel in each of these reactors was damaged.

Explosions caused by the ignition of hydrogen gas released from the damaged fuel in the reactors impaired the functionality of equipment and the integrity of structures at the site, thereby further complicating site operations and recovery. Concerns also arose over the cooling capability for the spent fuel pools in each unit. At first, some debate occurred over whether the spent fuel pool in unit 4 had been substantially drained; loss of spent fuel cooling capability could lead to fuel damage and radioactive releases. This turned out not to be the case. Units 5 and 6, which are separated from the other Daiichi units and built on higher ground, were brought to a safe condition, in part relying on the single diesel generator that remained operable at unit 6.

The Japanese government initially ordered evacuation of residents within a 2-km zone, increased it to 10 km from the site and then expanded the evacuation to as far as 30 km from the site. In April 2011, the government established a restricted area within 20 km of the site to allow temporary access for members of the public but excluded the public within 3 km. Unlike Chernobyl, no early health effects much less deaths were observed due to radiation exposure of workers or nearby residents, and no discernible latent radiation health effects are expected. No significant radioactive releases were experienced outside of Japan. Japan did initiate communication with the IAEA within about an hour and a half after the earthquake, consistent with the Early Notification Convention, and member states began enquiring about plant status through the IAEA's contact points for the Early

66. The description of the accident is adapted from Burns, S. (2012), "The Fukushima Daiichi Accident: The International Community Responds", *Washington University Global Studies Law Review*, Vol. 11, No. 4, Washington University, St. Louis, pp. 739, 741-45, and the references cited therein. The IAEA has issued a multi-volume report addressing the accident and the lessons learnt therefrom. IAEA (2015), *The Fukushima Daiichi Accident: Report by the Director General*, GC(59)/14, Vols. 1-6, IAEA, Vienna. Volume 1 contains an executive summary.

Notification and Assistance Conventions about three hours after the earthquake. Japan did not formally seek aid under the Assistance Convention.[67]

The accident occurred a few weeks before the scheduled Fifth Review Meeting in early April 2011 of the contracting parties to the Convention on Nuclear Safety. At the conclusion of the Review Meeting, the contracting parties adopted a statement committing themselves to achieving high levels of nuclear safety through the enhancement of national measures and international co-operation, to preventing and mitigating accidents, and to carry out efforts to ensure the safety of existing and planned nuclear plants from the lessons learnt from the accident.[68] The parties also committed themselves to holding a dedicated meeting on the accident in 2012 at which the parties would consider lessons learnt from the accident and "if necessary, the continued suitability of the provisions of the Convention on Nuclear Safety". IAEA Director General Yukiya Amano announced the convening of a ministerial conference in June 2011 to make an initial assessment of the accident and its bearing on the international regime for emergency response and for safety.

In early June, the G8 and the NEA held an International Ministerial Seminar on Nuclear Safety in Paris followed by a meeting of nuclear regulators.[69] These meetings were followed shortly thereafter by the ministerial conference on nuclear safety at the IAEA in Vienna.[70] As a result of the June ministerial conference, the IAEA developed a draft "Action Plan" of items for member states, operators, the IAEA and other multinational organisations to carry out to strengthen nuclear safety. All 151 member states endorsed the plan at the General Conference on 22 September 2011.[71]

A. Impact on the emergency response and safety regime

The IAEA Action Plan encouraged the co-operation and involvement of member states in implementing 12 main actions:

- safety assessments of nuclear power plants in light of lessons learnt from the accident;
- strengthening peer reviews conducted by the IAEA;
- strengthening emergency preparedness and response capabilities;
- strengthening the effectiveness of national regulatory bodies;
- strengthening the effectiveness of operating organisations with respect to nuclear safety;
- reviewing and strengthening IAEA Safety Standards and improving their implementation;
- improving the effectiveness of the international legal framework;
- facilitating the development of the infrastructure necessary for member states embarking on a nuclear power programme;

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67. IAEA (2015), *supra* note 66, Vol. 1, pp. 94-96; *ibid*., Vol. 3, p. 131, Table 3.5 (timeline of events) and pp. 134-137.

68. IAEA, "Summary Report of the 5th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 4-14 April 2011", IAEA Doc CNS/RM/2011/6/Final, pp. 2-3.

69. The NEA produced a report on the forum. NEA (2011), "Proceedings of the Forum on the Fukushima Accident: Insights and Approaches", NEA Doc. NEA/CNRA/R(2012)12, OECD Publishing, Paris.

70. See IAEA (2011), "Declaration by the IAEA Ministerial Conference on Nuclear Safety in Vienna on 20 June 2011", IAEA Doc. INFCIRC/821; IAEA (2011), *Report by the Director General*, "IAEA Ministerial Conference on Nuclear Safety 20-24 June 2011", IAEA Doc. GOV/INF/2011/13-GC(55)/INF/10.

71. IAEA (2011), "Draft IAEA Action Plan on Nuclear Safety", *Report by the Director General*, IAEA Doc. GOV/2011/59-GC(55)/14, endorsed by the IAEA General Conference in Resolution, "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. No. GC(55)/RES/9 (22 Sept. 2011); IAEA (2011), "Initial Progress in Implementation of the IAEA Action Plan on Nuclear Safety", *Report by the Director General*, IAEA Doc. GOV/INF/2011/15, sec. A.2.

- strengthening and maintaining capacity building (i.e. ensuring available human resources necessary for safe nuclear power operation);
- protecting people and the environment from ionising radiation following an emergency;
- enhancing the transparency and effectiveness of communications and improving the dissemination of information; and
- effectively utilising research and development.

As to improving the effectiveness of the international legal framework, the Action Plan called on states, in the context of nuclear safety,

> to explore mechanisms to enhance the effective implementation of the Convention on Nuclear Safety, the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, the Convention on the Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, and to consider proposals made to amend the Convention on Nuclear Safety and the Convention on the Early Notification of a Nuclear Accident.[72]

The focus on the safety implications of the accident was not carried out solely through the international framework. National and regional responses to the accident led the way, whether in focusing on plant safety or re-assessing national policy on generating power from nuclear plants. For example, the European Union initiated "stress tests" (a term borrowed from the recent global financial crisis) to assess the safety of nuclear power plants and took other steps that eventually resulted in the adoption of a revised safety directive in 2014.[73] In the United States, the NRC constituted a task force to evaluate the implications of the accident for US plants and ultimately required measures to improve plant equipment, to enhance capability to cope with severe accidents, and to re-evaluate natural hazards such as seismic and flooding events that could adversely affect plants. Japan initiated a process to reassess the safety of its reactor fleet and changed its regulatory structure in the face of withering criticism of its institutions as having caused a "man-made disaster" at the Fukushima Daiichi station.[74] As to energy policy, Germany is notable for its swift decision – the *Energiewende* – to transition away from nuclear energy production.[75]

The Fukushima Daiichi accident has been a catalyst for a re-examination of the underlying assumptions of the framework for nuclear safety and a cause for reflection on the capacity and integrity of the responsible institutions. However, as for the international conventions related to nuclear safety, no changes have been made as a consequence of the Fukushima Daiichi accident. This should not be viewed as a failure of the international system but the result of the necessary and ultimately more productive focus on technical criteria, mitigation measures and public protection, and the resulting improvement of the "soft law" guidance and standards arising out of the lessons learnt from the accident.

72. "Draft IAEA Action Plan on Nuclear Safety", *supra* note 71, p. 4.

73. The updated European Union Directive was issued as 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, OJ L 219 (25 July 2014), p. 42 (2014 Amended Safety Directive).

74. See Burns, S. (2012), *supra* note 66, pp. 745-750, 758-759.

75. On the ups and downs of Germany's policy on nuclear power, see Winter, G. (2013), "The Rise and Fall of Nuclear Energy Use in Germany: Processes, Explanations and the Role of Law", *Journal of Environmental Law*, Vol. 25, Issue 1, Oxford University Press, Oxford, pp. 95-124.

Although the IAEA Action Plan identified, for example, potential changes to the Early Notification Convention as a task, the IAEA and its members worked on enhancing communication as well as assessment and dissemination of information in the context of the existing conventions as a means to productive improvement of the system of notification and assistance.[76] The Russian Federation had offered a proposal to amend the Early Notification Convention, but the required majority of contracting parties did not request the convening of a Diplomatic Conference to consider the proposal.[77]

Amendments to the Convention on Nuclear Safety were offered by Russia, Spain and Switzerland, but only a later Swiss amendment reached consideration at a Diplomatic Conference in 2015 where the contracting parties agreed to a non-binding declaration in lieu of the proffered amendment. Under Article 32 of the Convention on Nuclear Safety, proposed amendments to the Convention are considered at a review meeting or at an extraordinary meeting, and proposed amendments may be adopted by consensus or, in the absence thereof, submitted to a Diplomatic Conference if two-thirds of the parties present and voting at the meeting approve. Although Spain withdrew its proposal, Swiss and Russian proposals came before the 2012 extraordinary meeting that the contracting parties had agreed to hold after the Fifth Review Meeting.[78]

The Swiss proposal included amendments aimed at greater transparency, by requiring periodic reviews of national regulatory bodies (e.g. through an IAEA Integrated Regulatory Review Service mission) and public dissemination of the regulatory body's findings and by making country reports under the Convention publicly available and deleting the provision in the Convention providing for confidentiality of the debates at the review meetings on country reports. As to the safety of installations, the Swiss proposal would have required systematic safety assessments based on updated information from operating experience and state-of-the-art hazards assessments of the facility and its siting, design reviews by external experts to ensure compliance with IAEA standards, and external reviews of operational safety, i.e. through OSART missions conducted by the IAEA. Russia proposed including requirements for regular assessment of existing installations, noting IAEA safety standards as a basis for the regular assessment of a plant, and requiring that plant designs take into account an integrated assessment of unfavourable natural and "man-made" hazards affecting a site. The proposal also focused on institutional aspects, such as ensuring the requisite infrastructure and planning to support construction of new facilities, ensuring the effective co-ordination of national authorities and operating organisations

76. IAEA (2015), *supra* note 66, Vol. 1, pp. 96-99; see also IAEA (2015), *Assessment and Prognosis in Response to a Nuclear or Radiological Emergency*, International Experts Meeting 20-24 April 2015, IAEA/IEM/IX, IAEA, Vienna and IAEA (2013), *Preparedness and Response for a Nuclear or Radiological Emergency in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant*, IAEA/REP/EPR, IAEA, Vienna (the reports are the result of experts' meetings conducted under IAEA auspices).

77. Johnson, P.L. (2014), "Opening Address: Developments in Nuclear Law", in R.F. Manovil (ed.), *Nuclear Law in Progress, Proceedings of 21st International Nuclear Law Association Congress*, Legis, Buenos Aires, pp. 13, 18-19. The Russian proposal would have specified the contracting party's obligation to report within 24 hours of specified information on the incident (including a preliminary assessment of the accident on the International Nuclear and Radiological Event Scale) and its obligation to make accessible environmental monitoring information and to post that information on its competent authority's website. Letter from S.V. Kirienko, Director General of the State Atomic Energy Corporation, to Yukiya Amano, Director General, IAEA (20 June 2011), forwarding "Proposals of the Russian Federation for amendments to the Convention on Early Notification of a Nuclear Accident".

78. IAEA (2012), "Progress in the Implementation of the IAEA Action Plan on Nuclear Safety, Supplementary Information", IAEA Doc. GOV/INF/2012/11-GC(56)/INF/5, p. 22, para. 138; Johnson, P.L. (2013), "The post-Fukushima Daiichi response: The role of the Convention on Nuclear Safety in strengthening the legal framework for nuclear safety", *Nuclear Law Bulletin*, No. 91, OECD Publishing, Paris, pp. 7, 14-15.

for effective emergency management and accident mitigation, and providing the operator of the installation with adequate resources and authority to act in an emergency.[79]

At the extraordinary meeting held in August 2012 (only the second such meeting to have been held under the Convention), the contracting parties decided to establish a working group on "effectiveness and transparency" to consider actions to strengthen the Convention and to take into account potential amendments, including the Russian and Swiss proposals.[80] The working group's efforts resulted primarily in proposed revisions to various guidance documents and its report was considered at the Sixth Review Meeting of the Convention on Nuclear Safety held in March through April 2014.[81] The record of the Sixth Review Meeting reflects no further action on the original Russian and Swiss proposals, but Switzerland had submitted a new proposal in December 2013 to be considered at the Review Meeting.

Although Switzerland complimented the efforts of the working group to improve the review process of the Convention, it also suggested an amendment to Article 18 to emphasise "the critical importance" of maintaining containment integrity, a lesson of the Three Mile Island, Chernobyl and the Fukushima Daiichi accidents:

> Nuclear power plants shall be designed and constructed with the objectives of preventing accidents and, should an accident occur, mitigating its effects and avoiding releases of radionuclides causing long-term off site contamination. In order to identify and implement appropriate safety improvements, these objectives shall also be applied at existing plants.[82]

The Swiss amendment was comparable to the European Union's 2014 Amended Safety Directive, particularly Article 8's admonition that member states implement the "objective of preventing accidents" and mitigating their consequences so as to avoid radioactive releases that would hamper initial emergency response or "would require protective measures that could not be limited in area or time".

At the Sixth Review Meeting, the necessary two-thirds majority of the contracting parties (only Canada and the United States dissented) decided to refer the new Swiss proposal to a Diplomatic Conference, which was held on 9 February 2015.[83] An informal working group held several meetings in preparation for the conference. Ultimately, the contracting parties concluded that consensus was not possible on the amendment.[84] A number of major nuclear power states, such as Russia and the United States, did not support the amendment. Arguments against the amendment questioned whether it added any real value, i.e. that it was unnecessary in light of the existing text of Article 18 addressed to the design of nuclear facilities and of the changes to relevant guidance documents to address lessons from the Fukushima Daiichi accident. Moreover, the amendment could be counterproductive. A long time might be required to attain the needed assent of two-thirds

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79. The Swiss and Russian proposals are attached to the *Final Summary Report*, 2nd Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety, 27-31 Aug. 2012, IAEA Doc. CNS/ExM/2012/04/Rev.2.

80. *Ibid*., p. 9, para. 33.

81. Lacoste, A.-C. (2014), "Summary Report", 6th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 24 March–4 April 2014, IAEA Doc. CNS/6RM/2014/11_Final, p. 10, para. 41.

82. *Ibid*., Annex 1, "Proposal to amend the CNS by Switzerland".

83. *Ibid*., p. 10, para. 42; "Summary Report", Diplomatic Conference to consider a Proposal by Switzerland to amend the Convention on Nuclear Safety, 9 Feb. 2015, IAEA Doc. CNS/DC/2015/3/Rev.2.

84. "Summary Report", *supra* note 81, para. 11.

of the contracting parties; the outcome could also bifurcate the convention scheme into groups of states that either were party to the amendment or were not.[85]

The contracting parties instead agreed to adopt the "Vienna Declaration on Nuclear Safety" that reiterated principles of the Convention on Nuclear Safety to prevent accidents and mitigate their consequences.[86] The Vienna Declaration provides with respect to the safety of installations:

1. New nuclear power plants are to be designed, sited, and constructed, consistent with the objective of preventing accidents in the commissioning and operation and, should an accident occur, mitigating possible releases of radionuclides causing long-term off-site contamination and avoiding early radioactive releases or radioactive releases large enough to require long-term protective measures and actions.
2. Comprehensive and systematic safety assessments are to be carried out periodically and regularly for existing installations throughout their lifetime in order to identify safety improvements that are oriented to meet the above objective. Reasonably practicable or achievable safety improvements are to be implemented in a timely manner.

As a third principle, states' requirements for addressing the objectives are to take into consideration relevant IAEA safety standards and other "good practices" through the life of the plant, such as those identified at review meetings of the Convention on Nuclear Safety. The contracting parties also agreed to address these principles in their national reports for the Seventh Review Meeting scheduled for 2017.

The Vienna Declaration simply reaffirms the objectives of the Convention on Nuclear Safety; it neither replaces the Convention nor does the Declaration place any legal requirements upon the contracting parties. But, as one observer notes, the future treatment of the Vienna Declaration could lead to its consideration as customary international law depending on its application in

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85. See Stoiber, C. (2015), "Developments in the Law of Nuclear Safety: the Vienna Declaration", in C. Raetzke, U. Feldmann and A. Frank (eds.), *Aus der Werkstatt des Nucklearrechts*, Nomos Verlag, Baden-Baden, pp. 397, 405-406; Durand-Poudret, E. (2015), "Towards a new international framework for nuclear safety: Developments from Fukushima to Vienna", *Nuclear Law Bulletin*, No. 95, OECD Publishing, Paris, pp. 27, 32, 35.

86. "Summary Report", *supra* note 81, Annex I, "Vienna Declaration on Nuclear Safety", IAEA Doc. CNS/DC/2015/2/Rev.1. The text of the Vienna Declaration is also published as INFCIRC/872. The Swiss characterised the outcome of the conference a success even though their amendment did not gain consensus. Swiss Federal Nuclear Safety Inspectorate (ENSI) (9 Feb. 2015), News Post, "International community adopts Swiss idea for improving nuclear power plant safety" (comments of Dr Hans Wanner), www.ensi.ch/en/2015/02/09/international-community-adopts-swiss-idea-for-improving-nuclear-power-plant-safety/ (accessed 28 May 2021). However, others noted their disappointment with the outcome. For example, the Autorité de sûreté nucléaire [Nuclear Safety Authority] (ASN), the French nuclear regulator, issued a press release stating:

> The general objectives of nuclear safety of the Convention remain below the legally-binding dispositions of the European directive on Nuclear Safety revised in 2014. This situation might lead to a two-tier nuclear safety in the world, which would eventually be detrimental to all the countries. Anyway, the outcome of the negotiations does not live up to the issues at stake, recalled by the Fukushima Daiichi accident. ASN will keep on promoting the highest safety standards at the international level.

ASN, Press Release, "Diplomatic Conference of the Convention on Nuclear Safety: ASN considers the outcome does not live up to the safety issues at stake after the Fukushima Daiichi accident and will keep on promoting the highest safety standards" (10 Feb. 2015), www.french-nuclear-safety.fr/Information/News-releases/CSN-ASN-considers-the-outcome-does-not-live-up-to-the-safety-issues (accessed 21 May 2021).

future review meetings and treatment in IAEA standards and review missions.[87] The contracting parties at the Seventh Review Meeting in 2017 agreed to address the Declaration's principles in their country reports and the discussions and agreed to reference the declaration in the introductory section of the guidelines on preparation of national reports for the Convention review meetings.[88] The Declaration certainly is viewed as a vital instrument shaping the safety perspective by some states, particularly within Europe.[89] However, the extent to which the emphasis on the Vienna Declaration will continue more broadly is yet to be seen.

B. Nuclear liability

Although the Fukushima Daiichi accident did not have appreciable transboundary effects, the scope of damage and Japan's implementation of its scheme to provide for compensation drew the attention of the international community.[90] With respect to nuclear liability, the IAEA Action Plan on Nuclear Safety calls on:

> Member States to work towards establishing a global nuclear liability regime that addresses the concerns of all States that might be affected by a nuclear accident with a view to providing appropriate compensation for nuclear damage. The IAEA International Expert Group on Nuclear Liability (INLEX) to recommend actions to facilitate achievement of such a global regime. Member States to give due consideration to the possibility of joining the international nuclear liability instruments as a step toward achieving such a global regime.[91]

INLEX was established as an advisory group to the Director General in 2003. In response to the Action Plan, INLEX issued in 2012 a set of recommendations to facilitate progress towards a global nuclear liability regime and to encourage both nuclear and non-nuclear states to consider

87. Stoiber, C. (2015), *supra* note 85, p. 407.

88. "Summary Report", Seventh Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 27 March – 7 April 2017, IAEA Doc. CNS/7RM/2017/08/Final, pp. 2, 4, 6, 10, para. 2, 13, 22-24, 40-41. The change to the introduction to IAEA INFCIRC 572, Guidelines regarding National Reports under the Convention on Nuclear Safety is reflected in Rev. 6, p. 1, para. 3, issued 19 Jan. 2018. The Eighth Review Meeting was postponed in 2020 due to the global pandemic associated with the COVID-19 virus and it has been determined to hold a joint Eighth and Ninth Review Meeting in March 2023.

89. See Western European Nuclear Regulators Association (WENRA) (2016), *Position Paper: WENRA Input to IAEA Safety Strategy*, pp. 3, 5-6, available at: www.wenra.org/media/filer_public/2017/07/21/wenra_position_paper_iaea_strategy.pdf (accessed 6 May 2021). A news post by the Swiss regulatory authority contains criticism of non-European states (with the exception of Japan) in the context of the Vienna Declaration. ENSI, News Post, "The lessons from Fukushima must not be forgotten" (14 Sept. 2018), www.ensi.ch/en/2018/09/14/the-lessons-from-fukushima-must-not-be-forgotten/ (accessed 21 May 2021):

> The Vienna Declaration stands for a culture that is characterised by the concept of continuous improvement of nuclear safety," sums up Hans Wanner, Director General of [ENSI] and Chairman of [WENRA]. In particular, the declaration demands the periodic backfitting of existing nuclear power plants … The first conclusion two and a half years after the Vienna Declaration is sobering. While in Switzerland and in Europe such backfittings are already implemented as standard, concrete backfitting obligations or changes in the legislation have not occurred in any other countries outside Europe with the exception of Japan.

90. NEA Legal Affairs prepared in co-operation with the Japanese government a comprehensive compilation of commentary and texts related to the compensation carried out in Japan in response to the accident. NEA (2012), *Japan's Compensation System for Nuclear Damage*, OECD Publishing, Paris.

91. "Draft IAEA Action Plan on Nuclear Safety", *supra* note 71, p. 5.

joining one or more of the relevant international instruments.[92] INLEX urged states to reflect the international principles in their national legislation in order to establish a more universal system and to make progress in strengthening the modernised liability regimes. The recommendations included setting higher minimum liability amounts and ensuring coverage of latent injuries, as well as taking steps to secure financial remuneration or provide compensation where an accident might exceed the capacity of the required financial security. States are urged to ensure that claims arising from a nuclear accident are dealt with in a single forum, in a prompt, equitable and non-discriminatory manner with minimal litigation.

Although INLEX urges states – whether nuclear facilities exist in their territory or not – to establish treaty relations with as many states as practical, the INLEX recommendations do not express a preference for one of the existing nuclear liability regimes, noting that:

> [T]he CSC establishes treaty relations among States that belong to the Paris Convention, the Vienna Convention or neither, while leaving intact the Joint Protocol that establishes treaty relations among States that belong to the Paris Convention or the Vienna Convention. In addition to providing treaty relations, the CSC mandates the adoption of the enhancements developed under the auspices of the IAEA and contains features to promote appropriate compensation, including an international fund to supplement the amount of compensation available for nuclear damage.

Because INLEX is comprised of experts who are experienced in or advocate for one or more of the regimes, the dual approach reflected in the statement is understandable.[93] The recommendations did not foresee a change to the liability instruments but rather broader adherence to them as the path to be taken.

Notwithstanding the differing viewpoints as to which route provides the better path, a number of states affirmed their support for greater progress. For example, France and the United States – countries party to different international liability conventions – issued a "Joint Statement on Liability for Nuclear Damage" in August 2013 agreeing to "promote efforts to achieve a global nuclear liability regime based on treaty relations among France, the United States and other countries that might be affected by a nuclear accident", to "coordinate their actions in encouraging adherence to the enhanced international nuclear liability instruments" and to "urge countries to adopt national laws that incorporate the nuclear liability principles and recent enhancements to those principles", as well as certain best practices.[94] The G-20 issued a declaration in September

92. INLEX (June 2012), *Recommendations on How to Facilitate Achievement of a Global Nuclear Liability Regime*, As Requested by the IAEA Action Plan on Nuclear Safety, available at: www.iaea.org/sites/default/files/17/11/actionplan-nuclear-liability.pdf (accessed 28 May 2021). The author served as the NEA observer to INLEX in 2012 when these recommendations were adopted.

93. On the merits of the different instruments on liability, see views doubting the efficacy of the CSC as the basis of a unifying regime in Pelzer, N. (2006), *supra* note 40, p. 114; Chirpius, V. (2012), "Could the Convention on Supplementary Compensation (CSC) for Nuclear Damage Become the Fundament for a Unified EU Legal Regime of the Nuclear Third Party Liability?", in M. Beyens, D. Philippe and P. Reyners (eds.) (2012), *Prospects of a Civil Nuclear Liability Regime in the Framework of the European Union: Proceedings*, Bruylant, Brussels, pp. 78-81; for views supporting the CSC as the basis of a global regime, see Tonhauser, W. (2012), "Reactions to the EC Legal Study from a Legal and Policy Viewpoint", in *ibid*., pp. 24-25; Brown, O. (2012), "Convention on Supplementary Compensation for Nuclear Damage (CSC)", in *ibid*., pp. 169-170; McRae, B. (2007), "The Convention on Supplementary Compensation for Nuclear Damage: Catalyst for a Global Nuclear Liability Regime", *Nuclear Law Bulletin*, No. 79, OECD Publishing, Paris, pp. 17, 22-23.

94. The Joint Statement is available at: www.energy.gov/downloads/united-states-and-france-sign-joint-statement-civil-liability-nuclear-damage (accessed 28 May 2021).

2013 after its meeting in St. Petersburg that encouraged "multilateral cooperation towards achieving a global nuclear liability regime".[95]

Despite the slow path to progress, some accomplishments have been made. The CSC has finally come into force with the accession of Japan in 2015, followed by India in 2016 and Canada in 2017, all states with operating nuclear power plants. The United Arab Emirates, which recently began operation of its first nuclear power installation and other countries seeking to embark on a nuclear power plant programme, including Ghana, Jordan, Kazakhstan, Saudi Arabia, among others, have joined the CSC or the 1997 Vienna Protocol or both. And, finally, the entry into force of the 2004 Protocols to the Paris and Brussels Conventions is expected by 2022. But even if a well-integrated global regime is not within our immediate grasp, continued effort to harmonise the regimes and broaden the participation in them remains a worthy objective.[96]

IV. Conclusion

Three Mile Island was the wake-up call. Chernobyl was the spur to action. Fukushima Daiichi was a cause for reflection. Each of these accidents has influenced the development of nuclear law, though the regime within which the international community operates today is largely the product of the instruments developed after the Chernobyl accident. The safety regime has seen the push and pull of the debate over whether the pragmatism of the current incentive regime serves us well or whether the insistence on more exacting international standards would better promote nuclear safety. In the liability field, the question as to how or whether to broaden the reach of one or more of the existing conventions is the focus.

Our task is to keep the dialogue open and to continue the work of sustaining and improving robust national regimes and the international standards and rules that govern us. That task is ongoing – and not always easy. And it is one that should not await the next crisis to maintain or inspire our effort.[97] It requires vigilance, engagement, frankness in assessments, and continued movement towards greater transparency in national activities and assessments through the various review mechanisms. Ultimately, all states must show how they have acted to meaningfully strengthen their institutions, maintain and as needed improve plant safety, mitigate the potential impact of malfunctions and natural events, and protect the public.

95. The G-20 Leaders' Declaration, Saint Petersburg Summit (5-6 Sept. 2013), p. 24, para. 97, available at: www.g20.utoronto.ca/2013/Saint_Petersburg_Declaration_ENG.pdf (accessed 28 May 2021).

96. For an insurer's perspective on implementation of the revised conventions, see Quéré, A. (2014), "Challenges facing the insurance industry since the modernisation of the international nuclear third party liability regime", *Nuclear Law Bulletin*, No. 94, OECD Publishing, Paris, pp. 77-104.

97. See Rautenbach, J., W. Tonhauser and A. Wetherall (2006), *supra* note 33, p. 35.

Chapter 3

Radiological protection, nuclear safety and environmental protection

International system of radiological protection

by Edward Nicholas Lazo and Jacqueline Garnier-Laplace⁑*

The international system of radiological protection is made up of an intricate matrix of interacting elements, based on science, guiding principles and policy, that help to structure and develop international standards and national regulations that are ultimately implemented through operational actions and exchange of experience. These elements "communicate" and interact continually through both case-specific and general issues that stimulate policy interpretations, application of standards and regulations, scientific interpretations and operational adaptations. Many different circumstances, from specific situations to general concerns, can induce pressures within this structure that may result in modifications, additions, deletions or new applications. While this is a highly structured system, it retains some flexibility and has continuously adapted itself to the evolution of science and emerging circumstances.

The radiological protection system is supported and developed by a host of international and national organisations, each providing relevant input from the context of its particular mandate. While the underlying framework of the international system of radiological protection has been rather stable throughout its history, the interactions of its elements and of the organisations supporting those elements has evolved considerably since the last set of fundamental recommendations was published in 2007.[1] This article details how these elements and interactions currently operate, through the optic of the organisations involved.

A. Background, objective and definitions

Since the realisation, at the beginning of the 1900s, that exposure to ionising radiation could cause detrimental health effects, experts in the field have worked together to establish a scientific basis for describing radiation-related risks to human health and the environment, to recommend practical principles for protection against exposure to ionising radiation and to develop international standards and national regulations in this area. In broad terms, the primary aim of radiological protection is to contribute to an appropriate level of protection for people and the environment against the detrimental effects of radiation exposure without unduly limiting the desirable human actions that may be associated with such exposure.[2] The general principles of

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1. International Commission on Radiological Protection (2007), "The 2007 Recommendations of the International Commission on Radiological Protection: ICRP Publication 103", *Annals of the ICRP*, Vol. 37, Nos. 2-4, Elsevier Ltd., Amsterdam.

2. Lazo, E. (2007), "The International Systems of Radiological Protection: Key Structures and Current Challenges", *Nuclear Law Bulletin*, No. 80, OECD Publishing, Paris, pp. 49-63.

radiological protection are applicable to all nuclear-related activities and to all facilities at which exposure to ionising radiation may occur in a wide variety of circumstances; radiological protection norms have been characterised as a "chapeau" or envelope for all nuclear legislation.[3]

A brief glossary of legal and technical terms is provided to facilitate the understanding of the legal instruments.

- *Dose and dose limits:* dose is a measure of the energy deposited by radiation in a target, whereas dose limit is the value of the effective dose (i.e. the energy quantity defined as a summation of the tissue or organ equivalent doses, each multiplied by the appropriate tissue weighting factor; this metric reflects the amount of radiation detriment likely to result from the dose) or the equivalent dose (i.e. a measure of the dose to a tissue or organ designed to reflect the amount of harm caused) to individuals in planned exposure situations, which is not to be exceeded.[4]
- *Natural background radiation:* the doses, dose rates or activity concentrations associated with natural sources or any other sources in the environment that are not amenable to control.[5]
- *Principle of justification:* any decision that alters the radiation exposure situation should do more good than harm.[6]
- *Principle of optimisation of protection:* the likelihood of incurring exposures, the number of people exposed and the magnitude of their individual doses should all be kept as low as reasonably achievable, taking into account economic and societal factors.[7]
- *Principle of application of dose limits:* the total dose to any individual from regulated sources in planned exposure situations other than medical exposure of patients should not exceed the appropriate limits.[8]

B. Key institutions

Several international organisations contribute significantly to the establishment of a scientific and legal framework in the field of radiological protection. Although there is no "process" formally defined, the organisations work in the following fashion:

- The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) collects and assesses the scientific information on levels and effects of radiation exposure based on published scientific research.
- The International Commission on Radiological Protection (ICRP) uses the scientific data from UNSCEAR together with other considerations, such as ethics and social science, to formulate principles and a system and rationale for protection that can be used as a basis for the development of standards and regulations.

3. Stoiber, C., et al. (2003), *Handbook on Nuclear Law*, IAEA, Vienna, p. 47.
4. IAEA (2019), *IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection*, *2018 Edition*, IAEA, Vienna, pp. 64, 129.
5. *Ibid*., p. 30.
6. ICRP Publication 103, *supra* note 1, p. 88, para. 203.
7. *Ibid*., p. 89.
8. *Ibid*.

- The International Atomic Energy Agency (IAEA) develops international radiation safety standards in co-operation with other international agencies, which may be adopted by its member states and must be adopted by any state accepting the agency's assistance. These standards are based on the recommendations of the ICRP.
- The European Atomic Energy Community (Euratom) develops binding directives that must be transposed into national law by its member states. Under the Euratom Treaty, the European Commission (EC) plays a key role in setting standards for European countries, based on the recommendations of the ICRP.[9]
- The OECD Nuclear Energy Agency (NEA) explores new and emerging issues and challenges in the field of radiological protection in order to share experience and develop approaches to addressing these issues. The NEA's overarching goal in the area of radiological protection of human health and the environment is to assist member countries in the implementation and further development of the system of radiological protection and related science, regulation and operations. This goal is implemented by the NEA's Committee on Radiological Protection and Public Health (CRPPH). In particular, the NEA has worked in collaboration with the ICRP to "road-test" draft recommendations as to their implications for policy, regulation and application.

C. Key instruments in radiological protection

The following body of radiological protection *aquis* shall serve as a summary of the main legal elements (the list is not exhaustive):

- The 2007 Recommendations of the International Commission for Radiological Protection, ICRP Publication 103, *supra* note 1.
- The 2014 *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards*.[10]
- Council Directive 2013/59/Euratom of 5 December 2013 Laying Down Basic Safety Standards for Protection against the Dangers Arising from Exposure to Ionising Radiation, and Repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.[11]
- Council Decision 87/600/Euratom of 14 December 1987 on Community arrangements for the early exchange of information in the event of a radiological emergency.[12]

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9. Treaty Establishing the European Atomic Energy Community (1957), 298 UNTS 167, entered into force 1 Jan. 1958 (Euratom Treaty) (consolidated version published in *Official Journal of the European Union* (OJ) C 203 (7 June 2016)), Arts. 31-34.

10. EC, Food and Agriculture Organization of the United Nations, IAEA, International Labour Organization, NEA, Pan American Health Organization, United Nations Environment Programme, World Health Organization (2014), *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standard*s, IAEA Safety Standards Series, General Safety Requirements Part 3, No. GSR Part 3, IAEA, Vienna.

11. OJ L 13 (17 Jan. 2014), p. 1. This consolidates and repeals earlier directives related to the following subjects: (i) the earlier version of the Basic Safety Standards, Directive 96/29/Euratom; (ii) medical exposures, Directive 97/43/Euratom; (iii) public information, Directive 89/618/Euratom; (iv) outside workers, Directive 90/641/Euratom; (v) control of high-activity sealed radioactive sources and orphan sources, Directive 2003/122/Euratom; and (vi) provisions of Commission Recommendation 90/143/Euratom concerning radon.

12. OJ L 371 (30 Dec. 1987), p. 76.

- Council Regulation (Euratom) No. 2016/52 of 15 January 2016 laying down maximum permitted levels of radioactive contamination of food and feed following a nuclear accident or any other case of radiological emergency, and repealing Regulation (Euratom) No. 3954/87 and Commission Regulations (Euratom) No. 944/89 and (Euratom) No. 770/90.[13]

D. The international system of radiological protection

The international system of radiological protection was born of the need to protect medical researchers from the hazardous effects of ionising radiation. The current international system of radiological protection is developed and supported by the multiple organisations mentioned above. A brief history of each will help to fully understand the complexity of the current system and its framework.

1. ICRU and ICRP

The two earliest pillars of the system were created only a few decades after the discovery of radiation. At its first meeting in 1925, the International Congress of Radiology conceived the International X-Ray Unit Committee, which was created at its second meeting in 1928. This body, which was to become the International Committee on Radiological Units and Measurements (ICRU), was charged with proposing an internationally agreed upon unit for measurement of radiation as applied to medicine. In 1950, the ICRU expanded its role to wider aspects of radiation metrology.

In addition to the question of ionising radiation metrology, the 1928 meeting of the International Congress of Radiology recognised the need to actively address the health hazards of ionising radiation, and also created the International X-Ray and Radium Protection Committee to develop recommendations with regard to protection against the deleterious effects of ionising radiation. In 1950, this Committee was renamed as the International Commission on Radiological Protection and widened its focus beyond the medical profession and other radiation researchers and workers to address public protection issues. The ICRP has produced a series of general recommendations, providing the key elements and philosophy for the international system of radiological protection for the public and workers, always basing its work on the quantities and units developed and periodically updated by the ICRU. The first fundamental recommendations were issued in 1928, then followed by a series of six subsequent updates before being issued as numbered ICRP publications. The recommendations continued to evolve from Publication 1 (1959), Publication 6 (1964), Publication 9 (1966), Publication 26 (1987), Publication 60 (1990) to Publication 103 (2007). The ICRP foresees a future update of the general recommendations within 10 to 15 years from 2020.

These two bodies continue to provide concrete and scientifically based recommendations with regard to protection against ionising radiation, and now address these aspects for protection of the public, patients, workers and the environment. Their work and meetings were somewhat interrupted by the Second World War, but national efforts to develop atomic weapons lead to further research and thinking regarding radiological protection. In 1950, when the roles and mandates of both the ICRP and the ICRU were renewed, there was also a new focus on the hazardous effects of nuclear weapons and the beginnings of thinking with respect to protection in the context of civilian nuclear power.

13. OJ L 13 (20 Jan. 2016), p. 2.

2. UNSCEAR

In 1955, purportedly with the intention to deflect a proposal calling for an immediate end to all nuclear explosions, it was proposed to the General Assembly of the United Nations (UN) to establish a committee to collect and evaluate information on the levels and effects of ionising radiation. Subsequently, on 3 December 1955, the General Assembly unanimously approved a resolution[14] that established the United Nations Scientific Committee on the Effects of Atomic Radiation, which began with nominated experts from 15 countries. The UN General Assembly has since expanded membership to 21 countries. Since its creation, the UNSCEAR has issued authoritative reports presenting comprehensive evaluations of both the state of knowledge about the levels of ionising radiation to which human beings are exposed and of the possible effects of such exposures. The evaluation of exposure to non-human species has also been addressed in the most recent UNSCEAR reports. These evaluations form a substantial part of the scientific basis on which the international system of radiological protection rests.

3. IAEA

The IAEA was created in 1957 in response to fears and expectations resulting from the discovery of nuclear technology. In the context of the international system of radiological protection, the IAEA has been charged by the UN General Assembly to establish international standards in, *inter alia*, radiological protection. Since its inception, the IAEA has issued many standards; however, the International Basic Safety Standards (BSS) are among those with the most impact. The International BSS were initially published in 1962 and were subsequently updated and republished in 1967, 1982, 1996 and 2014. These updates were intended to implement the latest recommendations of the ICRP to assure that radiological protection standards were in line with radiological protection philosophy.

4. Euratom

In addition to the creation of UN bodies addressing radiological protection standards, the 1950s also saw the creation of bodies with more limited or regional membership with responsibilities for radiological protection. Euratom and the NEA are the two most prominent examples.

To tackle the general shortage of "conventional" energy in the 1950s, six states (Belgium, France, Germany, Italy, Luxembourg and the Netherlands) looked to nuclear energy as a means of achieving energy independence. Since the costs of investing in nuclear energy could not be met by individual states, these six founders joined together to form Euratom. The Euratom Treaty came into force in January 1958.[15] The treaty guarantees high safety standards for the public and prevents nuclear materials intended principally for civilian use from being diverted to military use. Detailed requirements for radiological protection are laid down in Title II, Chapter 3 "Health and Safety", Articles 30 to 39 of the Euratom Treaty. Pursuant to the treaty, a comprehensive set of directives, regulations, recommendations and decisions has been elaborated and adopted, as noted in section C above.

14. UN General Assembly (1955), "Effects of Atomic Radiation", UN Doc. A/RES/913/X, Resolution 913(X), adopted on 3 Dec. 1955 (the "founding resolution").

15. See *supra* note 9.

In particular, Euratom established its own Basic Safety Standards Directive for the protection of the health of workers and the general public against the dangers arising from ionising radiation, known as the European BSS Directive.[16] A directive is a legislative act addressed to Euratom member states that must be implemented in member states' national legislation. In order to take scientific and technical developments into account, the European BSS, which were originally established in 1959, were later revised on several occasions, i.e. in 1962, 1966, 1976, 1980, 1996 and 2013. The main scientific basis for the EU BSS are the ICRP recommendations, which can trigger revisions of the Directive to reflect the latest ICRP publication.

5. NEA

The Organisation for European Economic Co-operation (OEEC) was created in April 1948 to implement the Marshall Plan to reconstruct Europe. Nuclear energy was seen as an important aspect of this rebuilding. In February 1956, the OEEC Council established the Steering Committee for Nuclear Energy, which in 1958 became the European Nuclear Energy Agency and subsequently the NEA in 1972. In March 1957, the Working Party on Public Health and Safety was created to develop a programme of work in this area and to establish a mechanism to implement the proposed programme of work. Since 1973, this working party has been known as the CRPPH.[17] There are currently 34 member countries of the NEA who nominate radiological protection experts, generally from governmental regulatory or technical specialist organisations, to the CRPPH.

The NEA produced general radiological protection norms for its members in 1959, 1963 and 1968 as well as specific norms covering consumer products, tritium light sources, pacemakers and smoke detectors. However, this practice was stopped in the 1970s, leaving the development of such norms to the ICRP, the IAEA and the EC. Although the CRPPH no longer develops binding standards, it has continued to provide its members with a high-level, visible forum for exchange and discussion in order to seek common understanding of identified issues, to advance the state of the art in radiological protection theory, regulation and practice, to advance policies that bring the system of radiological protection more in line with modern societal needs and to promote international co-operative projects. With regard to the development of the system of radiological protection, the CRPPH has co-sponsored the International BSS, has actively interacted with the ICRP over the eight years of development of Publication 103 and has continued its forward-looking study of emerging scientific and decision-making issues in radiological protection.

6. Other significant organisations

While it is fair to say that the organisations most actively involved in the development and evolution of the system of radiological protection are UNSCEAR, the ICRP, the ICRU, the IAEA, the EC and the NEA, many other organisations have within their mandates significant aspects addressing radiological protection and the international system. These include several UN organisations, i.e. the World Health Organization (WHO), the International Labour Organization (ILO), the Pan American Health Organization (PAHO), the Food and Agriculture Organization (FAO) and the UN Environment Programme (UNEP). In addition, two significant technical standard-setting organisations address radiological protection issues: the International Electrotechnical Commission (IEC) and the International Standards Organisation (ISO).

16. Council Directive 2013/59/Euratom of 5 December 2013, *supra* note 11.

17. In February 1958, the working party became the Health and Safety Sub-committee, which in turn became the Radiation Protection Committee and finally in 1973 the CRPPH.

In 1990, the Inter-Agency Committee on Radiation Safety (IACRS) was constituted to create a forum for collaboration and co-ordination between international bodies with regards to radiation safety. It consists today of representatives of eight intergovernmental member organisations (EC, FAO, IAEA, ILO, NEA, PAHO, UNSCEAR and WHO) and five observer non-governmental organisations (ICRP, ICRU, IEC, International Radiation Protection Association and ISO). The main goal of IACRS is to provide a platform for interaction between these relevant international bodies to contribute to a common understanding of the scientific basis and legal framework for the application of the system of radiological protection, towards global harmonisation of radiation safety standards.[18]

In addition to these organisations, several others that continue to influence the evolution of the international system of radiological protection include the US National Council on Radiation Protection and Measurements, which has developed norms and standards for the United States for some time. The International Agency for Research on Cancer continues to perform fundamental scientific studies and broad epidemiological studies in support of the system's scientific basis.

E. Development and evolution of the system of radiological protection

The pathway of the system of radiological protection was, for much of its early existence, rather linear. This is to say, *radiation protection science* formed the basis of understanding in the field and was summarised by the UNSCEAR. Based on this understanding, the *philosophy and objectives* of radiological protection were developed and published as recommendations by the ICRP. Based on these recommendations, international *standards* were developed by the IAEA and as a binding instrument by Euratom. Finally, *national legislation and regulations* were developed on the basis of previously developed documents. This system was at least in part a result of the fact that those involved at each step had the legitimacy to discuss relevant issues within their relevant group and mandate, to take decisions and to pass them on to the next organisation in the development line. Decisions were generally not questioned, broadly because those who had made the decisions were seen as "the experts" in the field and their views were trusted. This process is shown schematically in the following figure.

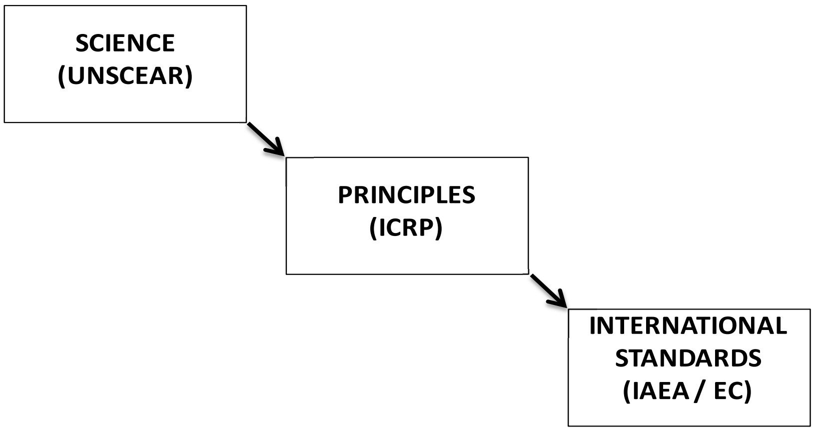

Figure 1. Development of international radiological protection standards (pre-1999)

18. For further information, see the website for the IACRS, available at: www.iacrs-rp.org/ (accessed 28 May 2021).

However, this process has evolved and changed in the context of the tarnishing or loss of social trust in "science" and in "technical bureaucrats", and there has been an increased recognition of the inherent complexity of radiation exposure situations.[19]

F. Stakeholder involvement in the evolution of radiological protection

Beginning with the social upheavals of the 1960s, the barriers that once surrounded risk assessment and management decisions and decision-making processes have been increasingly disappearing. The days when well-meaning public officials and technical experts could, to the best of their judgement, make public protection decisions in isolation are over. Today, many groups and individuals in different countries are interested in being involved, at various levels of participatory democracy, in discussions and decisions affecting public health and environmental protection issues. Individual members of the public subject to particular risks, local and national groups, associations, non-governmental organisations (NGOs) and even national, state and local level government offices that are not directly responsible for decisions often feel that their views should be taken into account during any decision-making process and that their concerns need to be addressed. These individuals and groups as well as the responsible regulatory authorities and, if applicable, the operators of facilities or users of material have come to be known collectively as stakeholders. Stakeholder involvement in decision framing and decision-making processes is increasingly common in today's world. Stakeholders question the role of science and authorities in decision making and demand accountability in decisions regarding the management of risks. As noted by the CRPPH in 1994:

> Moreover, the social dimension of radiation protection decisions, both in managing work force and in coping with the impact of large scale nuclear operations, including possible accidents, is now more fully recognised. It requires the development of better mechanisms for the involvement of social parties and the public in the decision processes and the search for a closer integration of the management of radiation risks with that of other hazardous substances or situations.[20]

The growing importance of stakeholder involvement in decision making has affected (i) the way that the principles of justification, optimisation and limitation are viewed; (ii) the way the role of the radiological protection profession in risk assessment and management is viewed; and (iii) the relative importance of case-specific circumstances in relation to harmonised, internationally accepted criteria. While the central importance of stakeholder involvement in addressing many risk situations is now widely accepted, the next step will be to optimise structures and processes to facilitate such participation.

The growing interest in decisions related to risk reflects many different aspects of social and scientific evolution. For example, the internet and the media have made information on risks much more available to everyone. At the same time, the technological promises of post-World War II have often not lived up to initial claims, breeding some scepticism of science and public institutions. With this has come the increasing realisation that science is only part of "the truth" with respect to judgemental decisions affecting such things as "safety", "security" and "the protection of health and the environment". Increasingly, social values emerge as being as influential as scientific facts with respect to decisions.

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19. These factors are expressed in NEA (2007), *Radiation Protection in Today's World: Towards Sustainability*, OECD Publishing, Paris.

20. *Ibid*., p. 24.

Along with these changes, which broadly reflect the individual's evolving place and role in society, the world has become much more of a "global entity", thus requiring global, social harmonisation in a broad sense. The notions of sustainability and intergenerational awareness have introduced a much longer view in any planning discussions.

Yet, as these global issues become more widely recognised, there is also a trend that local contexts are increasingly important to decisions regarding radiological risks, which has several implications. It is clear that there is no single "risk rationale" to dealing with risks, and there is no inherent social contradiction if the management of risk is not approached everywhere in a comparable or "equal" fashion, particularly in terms of stakeholder concerns and resource allocations. At the same time, aspects important at the international level can be subsidiary to those at the national level, which can in turn be subsidiary to local aspects. Thus, for example, local issues and concerns play a significant role in the siting of new installations or in discussion of emissions from existing facilities.

Further, environmentalism has continued to grow to the point where increasingly, and at many levels, there is a link between good public health and a healthy environment. Much of the public demand for a clean environment is thus formulated on the basis of "quality of life" and "well-being". These notions, both as social values and as scientific facts, are central to many of today's decisions and decision-making processes.

Finally, there is a growing view that radiological protection has for some time been somewhat independent, but should rather be viewed within the broader sphere of public health. In this context, the assessment and management of radiological risks are reformulated as being viewed together with many other risks and issues to be addressed to achieve good public health in a balanced fashion.

This roughly presented social evolution has to a great extent recast the approaches taken to any decisions affecting the evolution of the system of radiological protection. As the organisations described above were established in the 1950s, 1960s and 1970s, they fit broadly into the linear model of the times as previously mentioned. However, during the 1990s, stakeholders in the member countries of these organisations increasingly questioned governmental decisions and governmental decision makers themselves. Governmental expert body staffs also increasingly questioned the "how and why" with respect to new decisions. In particular, questions regarding the system in ICRP Publication 60[21] presented a number of issues with regard to the management of naturally occurring radioactive materials (NORM), the exemption and exclusion of radioactive materials and the implementation of protective actions, particularly following nuclear accidents. At least in part in response to pressures to discuss these issues and to find new solutions addressing the needs of various stakeholders, the ICRP Main Commission decided to open a broad discussion of where the system of radiological protection should go next and how the system should evolve to better address the needs and concerns of stakeholders.[22]

While previous ICRP recommendations had been developed in an "in-house" fashion, the current system of radiological protection, as recommended in ICRP Publication 103,[23] issued in December 2007, was the result of broad discussions among the radiological protection profession,

21 ICRP (1991). "1990 Recommendations of the International Commission on Radiological Protection", ICRP Publication 60, *Annals of the ICRP*, Vol. 21, Nos. 1-3, Pergamon Press, Oxford, UK.

22. This began in 1999 with an article by Roger Clarke, then the Chair of ICRP. Clarke, R. (1999) "Control of low-level radiation exposure: time for a change?", in *Journal of Radiological Protection*, Vol. 19, No. 2, IOP Publishing Ltd., Bristol, UK, pp. 107-115.

23. See *supra* note 1.

governments, regulatory organisations, industry, NGOs and any other relevant stakeholders.[24] Although still not entirely clear or fixed, this developmental process can be characterised as being one of broad stakeholder involvement. This is not to say that discussions have penetrated to the level of members of the public, but rather to suggest that many organisations and institutions not previously involved have had the opportunity to actively participate and to have their voices heard.

Regarding the next foreseen set of fundamental recommendations, ICRP will be engaging more people and organisations than ever before. Over the next ten years, the mechanism to involve many stakeholders in the revision process, notably (but not only) the Specific Liaison Organisations whose work is relevant to ICRP's mandate will certainly evolve to a more transparent and inclusive stakeholder involvement.

G. Non-linear decision making in radiological protection

The interrelated elements of this "new" approach to decision making can be broadly characterised as science, principles, standards and implementation:

- Radiological protection *science* will clearly influence the development of radiological protection principles; however, this philosophy will also influence the focus areas of scientific research. For example, the linear-non-threshold (LNT)[25] model that guides radiological protection principles has significantly influenced the focus of scientific research into low-dose effects of ionising radiation.
- Subsequently in the development process, *principles* will clearly guide the development of standards, and yet standards will reflect on the elements of developing principles that are needed and also on the focus areas of scientific research. For example, the ICRP considered eliminating the concept of justification from its fundamental recommendations as being broadly not a radiological protection decision, however this was strongly rejected because the concept of justification was seen as central to the standards and to national legislation and regulation.
- *Standards* will then clearly affect, generally through national regulations, how radiological protection is implemented through protective actions. Here again, however, *implementation* experience will reflect on standards, principles and science. For example, the existence of NORM, radium in pipe scale in the oil industry and uranium or thorium in phospho-gypsum in the phosphoric acid and fertiliser industries has driven the need for standards, principles and science to address these exposure situations for workers and the public. Expanded use of ionising radiation in medical imaging and significantly increasing patient doses have also provoked the need for the revisiting of protection standards, principles and science in this important area.

24. The NEA, through its CRPPH, participated very actively in these discussions, including the organisation of 7 international conferences to discuss the evolution of the system, 2 direct discussions between the CRPPH membership and the ICRP Chair, a series of expert groups and meetings resulting in 13 NEA publications, and 3 detailed and constructive assessments of various draft ICRP recommendations. This work by the NEA mobilised over 100 experts from 17 countries, coming from 25 national governmental organisations, national nuclear industries and international organisations. NEA (2009), *The NEA Contribution to the Evolution of the International System of Radiological Protection*, OECD Publishing, Paris, summarises the evolution that took place over this period, both within the ICRP and within the broader radiological protection community as compromise and agreement were slowly reached.

25. "Linear-non-threshold (LNT) model: A dose-response model which is based on the assumption that, in the low dose range, radiation doses greater than zero will increase the risk of excess cancer and/or heritable disease in a simple proportionate manner." ICRP Publication 103, *supra* note 1, p. 26.

Hence, these key elements of the system of radiological protection are all broadly linked together in a non-linear fashion and can be characterised as being part of a rather circular developmental process. At the same time, all these elements cannot exist alone, but are rather supported and fed by inputs and interactions with various organisations. Some organisations interact with one of these elements; others with more than one. Figure 2 is an attempt to illustrate the dynamic interdependence of the elements and organisations that make up and drive the evolution of the international system of radiological protection.

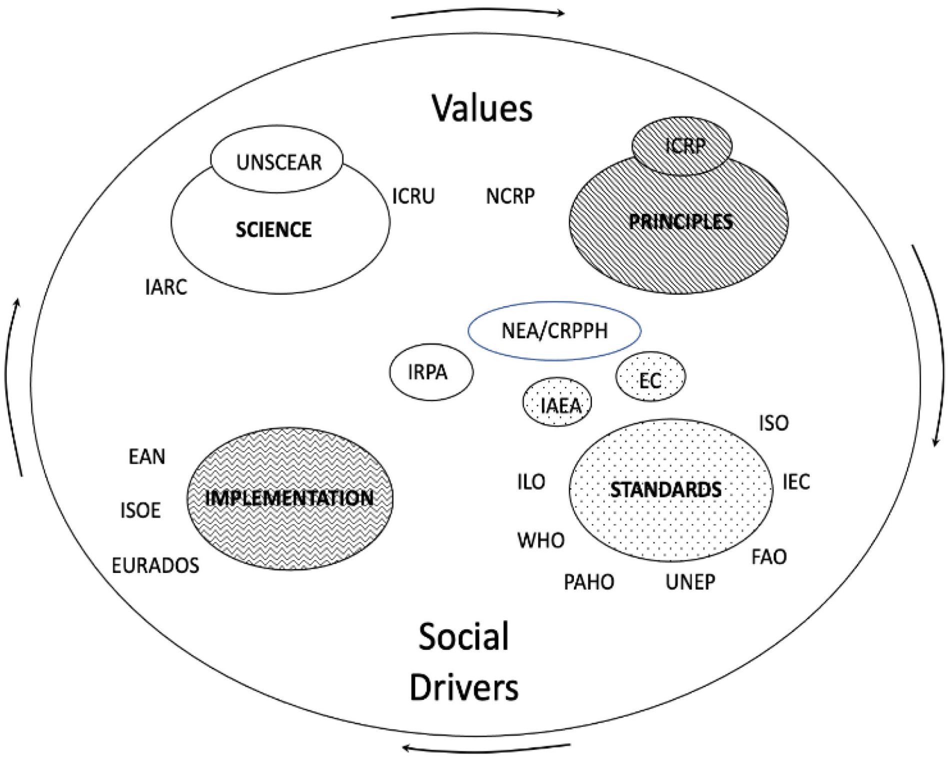

Figure 2. Development of international radiological protection standards (post-1999)

As a result of these shifts, there is a much broader interest in these various developmental steps and at the same time, a willingness to open discussions up to broader groups of stakeholders. In this context, the process of simplistic linear development has become far less linear and much more complex. However, the results are more likely to address stakeholder needs and concerns, more likely to be broadly understood, more likely to be accepted, and finally more likely to be sustainable.

Conclusions

The inputs and roles of the various organisations have led to a broad and rather complex international system of radiological protection (as perhaps imperfectly captured in Figure 2). The figure shows the dynamic and increasingly transparent structural elements that have evolved and continue to evolve.

It should be noted that the development of ICRP Publication 103, the latest set of recommendations describing the international system of radiological protection, is only one part of the overall evolution that is continually taking place. The International BSS of the IAEA translate the ICRP recommendations into regulatory language, and the Euratom Basic Safety Standards Directive provides a binding regulatory framework that all EU member states must implement in their national regulations. Both instruments have also been evolving in no small measure as a result of the new ICRP recommendations.

The "end-use" of the system, i.e. the implementation of radiological protection standards and regulations in practice, is extremely complex, broadly driven by the framework of the standards and strongly influenced by local circumstances. The experience from this process is also worthy of capturing and sharing to further enhance our understanding of the system of radiological protection, and how and why it does or does not reflect our needs, concerns and circumstances.

International legal framework on nuclear safety: Developments, challenges and opportunities

*by Wolfram Tonhauser, Anthony Wetherall and Lisa Thiele**

A. Introduction

Since 2010,[1] the international nuclear community has sought to strengthen the international legal framework for nuclear safety. Much impetus for this strengthening has stemmed from the accident at the Tokyo Electric Power Company's (TEPCO) Fukushima Daiichi nuclear power plant in Japan on 11 March 2011. Caused by a huge tsunami that followed a massive earthquake, it was the worst accident at a nuclear power plant since the Chernobyl disaster in the former Ukrainian Republic of the Union of Soviet Socialist Republics on 26 April 1986.[2]

The Fukushima Daiichi nuclear power plant accident brought nuclear safety to the forefront of global attention. The accident was a reminder that nuclear safety can never be taken for granted: nuclear safety must always be considered a work in progress, and complacency can be dangerous. Prior to the accident, the two other major accidents involving commercial nuclear power plants – Three Mile Island in 1979 in the United States and the 1986 Chernobyl accident – occurred in technically advanced countries with extensive managerial experience in operating complicated engineering systems. At the time of the Fukushima Daiichi nuclear power plant accident, much of the focus of the international nuclear community was on countries interested in nuclear power for the first time, so-called embarking or newcomer countries. Some 60 countries were expressing interest in, considering or actively planning for nuclear power.[3] That another major nuclear accident could occur in another technically advanced country with an existing and extensive

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The co-authors thank Ms Camille Scotto De Cesar and Mr Adeeb Jonathan Haddad, both from the IAEA Office of Legal Affairs, for their valuable expert research assistance and substantive comments.

1. This article is in many ways the next part of the story on nuclear safety that began with Tonhauser, W and A. Wetherall, "The International Legal Framework on Nuclear Safety: Developments, Challenges and Opportunities", in Nuclear Energy Agency (NEA) (2010), *International Nuclear Law: History, Evolution and Outlook*, Organisation for Economic Co-operation and Development (OECD) Publishing, Paris, pp. 157-169.

2. IAEA (2015), *The Fukushima Daiichi Accident: Report by the Director General*, IAEA Doc. GC(59)/14, IAEA, Vienna, "Foreword".

3. IAEA (2010), "Rising Expectations for New Nuclear Power Programmes", Attachment 6 to "Nuclear Technology Review 2010: Report by the Director General", IAEA Doc. GC(54)/INF/3/Att.6.

nuclear power programme was a stark reminder that nuclear safety is not achieved, but must be always cultivated, by any country.[4]

In the aftermath of the Fukushima Daiichi accident, questions were raised regarding the adequacy of the international legal framework for nuclear safety,[5] as well as associated IAEA Safety Standards and IAEA peer reviews and services. Unlike at the time of the 1986 Chernobyl accident when only fragments of the international legal framework for nuclear safety were available, by the time of the Fukushima Daiichi nuclear power plant accident, the framework was well in place. Four legally binding conventions and two non-binding codes of conduct had been adopted under the auspices of the IAEA. The instruments cover much of the nuclear fuel cycle, from the safety of nuclear power plants to spent fuel and radioactive waste management and emergency preparedness and response (EPR), as well as radioactive sources and research reactors. That this framework did not effectively contribute to preventing the accident was cause for global concern. Although following the Fukushima Daiichi nuclear power plant accident formal proposals were made to amend two of the safety conventions, they were not adopted. Rather, the focus of the international nuclear community has been on improving the effectiveness of the existing international legal framework for nuclear safety, as well as strengthening the associated IAEA Safety Standards and peer reviews and services.

Building on the original version of this article published a decade ago,[6] this current article considers developments, challenges and opportunities that have risen in the past ten years and contemplates emerging trends that may bear on the international framework for nuclear safety. More particularly, Part B of the article identifies some key developments aimed at adapting the international legal framework for nuclear safety to a post-Fukushima Daiichi nuclear power plant accident environment. In addition, Part B identifies some developments related to the two IAEA Codes of Conduct, which are now respectively recognised as primary guidance documents for the safety and security of radioactive sources and for the safe management of research reactors. An important corollary to nuclear safety is the need to have in place effective and coherent nuclear liability mechanisms to ensure prompt, adequate and non-discriminatory compensation for nuclear damage. Part B therefore also identifies the IAEA's post-Fukushima Daiichi nuclear power plant accident efforts to pursue the establishment of a global nuclear liability regime. Finally, Part B briefly highlights some of the efforts made by the IAEA Office of Legal Affairs to respond to increasing requests for legislative assistance by member states over the past decade.

Thereafter, Part C of this article identifies new challenges and opportunities to further strengthen and enhance the international nuclear safety framework, while also considering challenges and opportunities facing embarking countries.[7] In particular, it discusses developments and issues arising in the context of potential future deployment of small modular reactors (SMRs). Thereafter, the ongoing issue of the denial of shipments and the potential future opportunity to develop a new IAEA code of conduct addressing the facilitation of the safe and secure transport of radioactive material are highlighted. Part C also discusses the effort to establish a new IAEA

4. Although following the accident a few newcomer countries cancelled or revised their plans and others took a "wait and see" approach, most continued with their plans to introduce nuclear power.

5. Pelzer, N. (2011), "Does the Fukushima Nuclear Incident Require a Revision of the International Legal Regime on Nuclear Safety?", presentation at the IAEA Ministerial Conference on Nuclear Safety from 20 to 24 June 2011 in Vienna, Working Session 3: Possible Ways for Strengthening the Global Nuclear Safety Framework. See also Durand-Poudret, E. (2015), "Towards a new international framework for nuclear safety: Developments from Fukushima to Vienna", *Nuclear Law Bulletin*, No. 95, OECD Publishing, Paris, pp. 27-40.

6. Tonhauser, W. and A. Wetherall (2010), "The International Legal Framework on Nuclear Safety: Developments, Challenges and Opportunities", *supra* note 1.

7. See *ibid.*

code of conduct to address the control of transboundary movement of radioactive material inadvertently incorporated into scrap metal and semi-finished products of the metal recycling industries. Finally, Part C considers some of the challenges of decommissioning and disposal of high-level radioactive waste.

B. Developments following the accident at the Fukushima Daiichi nuclear power plant

1. Overview of the international legal framework

As was the case with the 1986 Chernobyl accident, the 2011 Fukushima Daiichi nuclear power plant accident was a wake-up call for the international nuclear community, leading to a further strengthening of the IAEA's role in nuclear safety. However, many of the international nuclear community's efforts have been different in the aftermath of the Fukushima Daiichi nuclear power plant accident. Prior to the 1986 Chernobyl accident, nuclear safety was considered a national, sovereign issue and had few legally binding international commitments. Following the 1986 Chernobyl accident, the cross-border implications of nuclear risks made it clear that the safety of nuclear installations and the safe management of radioactive waste and spent fuel could not be considered purely a matter of national responsibility and concern. The accident acted as a catalyst to a new era in international nuclear co-operation, leading to the birth of four nuclear safety conventions under the auspices of the IAEA. The global nuclear safety framework established since that accident reflects the post-Chernobyl consensus that underscored the need for a high level of international co-operation on issues such as EPR, the safety of nuclear power plants and the safe management of radioactive waste and spent fuel.[8]

The first and foremost international legal instrument addressing the safety of nuclear power plants is the Convention on Nuclear Safety (CNS) of 1994.[9] As for the CNS, it represents a commitment by contracting parties to achieve and maintain a high level of safety in these areas. Another cornerstone of the framework is the sister convention to the CNS, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the Joint Convention) of 1997.[10] It is the first and only international legally binding treaty in the

8. IAEA (2006), *Strengthening the Global Nuclear Safety Regime*, International Nuclear Safety Group (INSAG)-21, IAEA, Vienna. For a discussion of the post-Fukushima Daiichi response see Burns, S. (2012), "The Fukushima Daiichi Accident: The International Community Responds", *Washington University Global Studies Law Review*, Vol. 11, No. 4, Washington University, St. Louis, pp. 739-779.

9. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996. The CNS was adopted in Vienna on 17 June 1994, opened for signature on 20 September 1994 and entered into force on 24 October 1996. The CNS contains 35 articles subsumed under a Preamble and four chapters or sections: Chapter 1: Objectives, Definitions and Scope (Articles 1-3); Chapter 2: Obligations (Articles 4-19); Chapter 3: Meetings of the Contracting Parties (Articles 20-28); Chapter 4: Final Clauses and Other Provisions (Articles 29-35). There are no Annexes and no Protocols to the CNS.

10. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001. The Joint Convention was adopted in Vienna on 5 September 1997 and entered into force on 18 June 2001. The Joint Convention combines two distinct subject matters in a joint structure: (i) the safety of spent fuel management, and (ii) the safety of radioactive waste management. The Joint Convention contains 44 articles subsumed under a Preamble and seven chapters: Chapter 1: Objectives, Definitions and Scope of Application (Articles 1 to 3); Chapters 2-3: specific safety provisions (Articles 4 to 17) – Safety of Spent Fuel Management (Articles 4 to 10) and Safety of Radioactive Waste Management (Articles 11 to 17); Chapter 4: General Safety Provisions (Articles 18 to 26); Chapter 5: Miscellaneous Provisions (Articles 27 and 28); Chapter 6: Meetings of the Contracting Parties (i.e. peer review process) (Articles 29 to 37); and Chapter 7: Final Clauses and Other Provisions (Articles 38 to 44). As is the case with the CNS, there are no Annexes and no Protocols to the Joint Convention.

area of spent fuel and radioactive waste management. Further, there are the Convention on Early Notification of a Nuclear Accident (Early Notification Convention) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention), both adopted in September 1986 as a direct response to the Chernobyl accident.[11]

The four conventions, which establish high-level principles, objectives and requirements, are underpinned by a comprehensive suite of detailed, legally non-binding technical IAEA Safety Standards.[12] An important safety standard is the IAEA *Regulations for the Safe Transport of Radioactive Material* (the "IAEA Transport Regulations"), first published in 1961.[13] While alone they constitute merely non-binding recommendations, the IAEA Transport Regulations are adopted by the United Nations (UN) Model Regulations that were subsequently adopted in the globally implemented and mandatory modal regulatory documents issued by the International Maritime Organization (IMO) for transport by sea and International Civil Aviation Organization (ICAO) for transport by air.[14] In addition, the Early Notification and Assistance Conventions are supported by several operational arrangements that are the practical means by which the IAEA, its member states and other international organisations maintain emergency preparedness and effectively respond to any nuclear and radiological incident or emergency. These arrangements include the operations manual (EPR-IEComm (2019)),[15] the IAEA's assistance mechanism (EPR-RANET (2018))[16] and the joint plan of the international organisations (EPR-JPLAN (2017)).[17] In turn, the instruments and IAEA Safety Standards are supported by voluntary practical implementation mechanisms such as IAEA peer reviews and advisory services, as well as other IAEA assistance activities such as legislative assistance. Together, the instruments, standards and services form key elements of the Global Nuclear Safety Framework.

11. Convention on Early Notification of a Nuclear Accident (1986), IAEA Doc. INFCIRC/335, 1439 UNTS 276, entered into force 27 Oct. 1986; Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1986), IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987.

12. Relevant IAEA Safety Standards also formed the basis for the CNS and the Joint Convention. The Early Notification and Assistance Conventions were based on other IAEA guidance documents, namely IAEA (1985), *Guidelines on Reportable Events, Integrated Planning and Information Exchange In Transboundary Release of Radioactive Materials*, IAEA Doc. INFCIRC/321, and IAEA (1984), *Guidelines for Mutual Emergency Assistance Arrangements in Connection with a Nuclear Accident or Radiological Emergency*, IAEA Doc. INFCIRC/310.

13. IAEA (2018), *Regulations for the Safe Transport of Radioactive Material*, IAEA Safety Standards Series, Specific Safety Standards, No. SSR-6 (Rev.1), IAEA, Vienna.

14. In addition, the IAEA transport regulations serve as the basis for the model regulatory documents issued by the United Nations Economic Commission for Europe (UNECE) for transport by road, rail and inland waterway in Europe, and the Universal Postal Union for transport by post. Moreover, provisions compatible with (and often identical to) the IAEA transport regulations have been incorporated into national requirements by most member states. For example, in Canada the Packaging and Transport of Nuclear Substances Regulations, 2015 (SOR/2015-145) incorporate by reference certain definitions and requirements of the IAEA transport regulations on an ambulatory basis.

15. IAEA (2020), *Operations Manual for Incident and Emergency Communication*, IAEA Doc. EPR-IEComm (2019), IAEA, Vienna. IEComm facilitates the implementation of the articles of the Early Notification Convention and the Assistance Conventions that are operational in nature, such as the provisions for notification and information exchange and the communication protocols for Contact Points.

16. IAEA (2018), *IAEA Response and Assistance Network*, IAEA Doc. EPR-RANET 2018, IAEA, Vienna. The Response and Assistance Network (RANET) was established to facilitate the provision of international assistance upon request and in compliance with the Assistance Convention.

17. IAEA (2017), *Joint Radiation Emergency Management Plan of the International Organizations,* IAEA Doc. EPR-JPLAN (2017), IAEA, Vienna (JPLAN). The JPLAN describes a common understanding of how each organisation acts during a response and in making preparedness arrangements for a nuclear or radiological emergency.

2. *Adoption and implementation of the 2011 IAEA Action Plan on Nuclear Safety*

As a direct response to the Fukushima Daiichi nuclear power plant accident, the IAEA convened a Ministerial Conference on Nuclear Safety at the IAEA Headquarters from 20 to 24 June 2011. The objective of the conference was to learn lessons from the accident and strengthen nuclear safety throughout the world. At the conference, a Ministerial Declaration was adopted that, *inter alia*, requested the IAEA Director General to prepare a draft Action Plan on Nuclear Safety. In September 2011, the draft Action Plan on Nuclear Safety prepared by the Secretariat, was approved by the Board of Governors and unanimously endorsed by all member states at the 55th session of the General Conference that month (the 2011 Action Plan).

The 2011 Action Plan defined a programme of work to strengthen the global nuclear safety framework.[18] Twelve main actions were addressed, including the international legal framework, IAEA peer reviews, EPR, national regulatory bodies and IAEA Safety Standards.[19] The success of its implementation required the full co-operation and commitment of member states, the Secretariat and other relevant stakeholders. Since its adoption, significant progress has been made in several key areas.

After the Fukushima Daiichi accident and considering the 2011 Action Plan, several actions taken by the IAEA together with its member states and other stakeholders can be highlighted, focusing on those aimed at strengthening the international legal framework, IAEA peer reviews, EPR and IAEA Safety Standards. These actions have all contributed to the enhancement of the global nuclear safety regime. They include, for example, the strengthening of the IAEA legislative assistance programme with the aim of further promoting adherence to all the safety conventions by states and facilitating their effective implementation into national legislative and regulatory frameworks. In addition, efforts have focused on facilitating implementation of the obligations of the contracting parties to the CNS and the Joint Convention, including encouraging full participation in the review meetings through attendance and submission of national reports. Further, contracting parties to the CNS and the Joint Convention have strengthened the conventions' review processes. In addition, post-Fukushima efforts have focused on encouraging the voluntary attendance of the Meetings of the Competent Authorities identified under the Early Notification and Assistance Conventions. In this context, the international EPR framework and the IAEA Incident and Emergency System have been strengthened, including the operational arrangements under the Early Notification and Assistance Conventions, as well as the implementation of Convention Exercises (ConvEx) exercises to test these arrangements.[20] The ConvEx exercises have provided an opportunity for member states and international organisations to identify shortcomings in their

18. IAEA (2011), "Draft IAEA Action Plan on Nuclear Safety: Report by the Director General", IAEA Doc. GOV/2011/59-GC(55)/14 (IAEA Action Plan), endorsed in IAEA (2011), General Conference (GC) Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(55)/RES/9, adopted on 22 Sept. 2011, para. 4.

19. The Action Plan consisted of 12 main actions related to: safety assessments; IAEA peer reviews; emergency preparedness and response; national regulatory bodies; operating organisations; IAEA Safety Standards; the international legal framework; member states planning to embark on a nuclear power programme; capacity building; the protection of people and the environment from ionising radiation; communication and information dissemination; and research and development.

20. The ConvEx exercises are prepared at three levels of complexity: ConvEx-1 exercises are designed to test emergency communication links with contact points in member states and to test the response times of these contact points. ConvEx-2 exercises are designed to test specific parts of the international EPR framework; to practice procedures for international assistance; and to test the arrangements and tools used for assessment and prognosis. ConvEx-3 are full-scale exercises designed to evaluate international emergency response arrangements and capabilities for a severe nuclear or radiological emergency over several days, regardless of its cause.

national or international emergency response systems. As foreseen in the 2011 Action Plan,[21] the IAEA has also sought to fulfil its expanded role to perform assessment and prognosis during a nuclear emergency.[22]

Further, shortly after the accident a systematic review of the IAEA Safety Standards was undertaken by the Secretariat's Safety Standards Review Task Force. Since that time, the standards, which reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from the harmful effects of ionising radiation, were strengthened.[23] Member states continue to be encouraged to implement measures nationally, regionally and internationally to ensure nuclear, radiation, transport and waste safety, as well as EPR, considering the IAEA Safety Standards. The IAEA Safety Standards have also been explicitly recognised by contracting parties to the CNS and the Joint Convention as providing valuable guidance on how to meet the obligations of the conventions. The 2011 Action Plan included an action to review and strengthen IAEA Safety Standards and improve their implementation. The review of the standards "confirmed so far the adequacy of the current Safety Requirements. The review revealed no significant areas of weakness, and just a small set of amendments were proposed to strengthen the requirements and facilitate their implementation."[24]

Another major focus area post-Fukushima has been enhancing the effectiveness of IAEA safety peer reviews and advisory services and encouraging their voluntary utilisation on a regular basis by member states including follow-up reviews. In addition, promoting increased transparency through sharing the results of these reviews and services, as well as the reports of the review meetings of the CNS and Joint Convention, continues to be pursued. Further, emphasis continues to be placed on the importance of member states voluntarily performing self-assessments of their domestic nuclear, radiation, transport and waste safety, as well as their EPR measures. Finally, pursuant to the 2011 Action Plan, co-ordination and co-operation between the IAEA and the World Association of Nuclear Operators (WANO) have been strengthened, including to co-ordinate the timing of IAEA Operational Safety Review Team (OSART) missions and WANO peer reviews and to arrange periodic meetings of WANO and IAEA staff to discuss major safety-related activities.[25]

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21. As part of the efforts to enhance the transparency and effectiveness of communication and to improve the dissemination of information, the 2011 Action Plan, *supra* note 18, p. 6, called upon "the IAEA Secretariat to provide Member States, international organisations and the general public with timely, clear, factually correct, objective and easily understandable information during a nuclear emergency on its potential consequences". This was to include "an analysis of available information and a prognosis of possible scenarios based on the evidence, scientific knowledge and the capabilities of Member States". *Ibid*. The 57th General Conference in 2013 subsequently emphasised that this IAEA response role was to cover all nuclear and radiological emergencies. IAEA (2013), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(57)/RES/9, adopted on 19 Sept. 2013, para. 103.

22. See IAEA (2020), *Operations Manual for IAEA Assessment and Prognosis during a Nuclear or Radiological Emergency*, IAEA Doc. EPR-A&P (2019), IAEA, Vienna. EPR-A&P provides details of the IAEA assessment and prognosis process, including its technical basis, during a nuclear or radiological incident or emergency.

23. Article III A. 6. of the Statute of the IAEA (1956), 276 UNTS 3, entered into force 29 July 1957, provides that "[t]he Agency is authorized […] to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property." A number of IAEA Safety Requirements were revised to incorporate lessons-learnt from the Fukushima Daiichi nuclear power plant accident.

24. Letter from the Chair of the Commission on Safety Standards to the IAEA Director General (6 Jan. 2014), in IAEA (2016), *Safety of Nuclear Power Plants: Design*, IAEA Safety Standards, Specific Safety Standards, No. SSR-2/1 (Rev. 1), IAEA, Vienna, "Preface".

25. For example, on 17 September 2012 a new Memorandum of Understanding was concluded between IAEA and WANO to reflect increased post-Fukushima Daiichi co-operation.

On a final note, work to implement the 2011 Action Plan formed part of the Director General's report on the Fukushima Daiichi nuclear power plant accident including its five accompanying Technical Volumes released in 2015 (the "Fukushima Report").[26] The Fukushima Report addresses the accident's causes and consequences and aims to provide a comprehensive understanding of what happened during the accident and why. In 2015, work under the 2011 Action Plan concluded and many of its elements were included as routine IAEA work. During its operation, four comprehensive annual reports on its implementation were made by the Director General.[27] The focus on the lessons learnt from the Fukushima Daiichi nuclear power plant accident continues as the IAEA supports member states in addressing them. Since IAEA Director General Rafael Mariano Grossi assumed office on 3 December 2019, a priority continues to be promotion of adherence to the international legal instruments adopted under the organisation's auspices, not only on nuclear safety but also in other fields such as civil liability for nuclear damage.

3. Consideration of the formal proposals to amend the CNS and the Early Notification Convention

One of the 12 areas of the 2011 Action Plan on Nuclear Safety addressed the international legal framework for nuclear safety and the need to improve its effectiveness. In this context, the 2011 Action Plan foresaw member states considering formal proposals made to amend the CNS and the Early Notification Convention.

a. Proposals to amend the CNS

The Fifth Review Meeting of Contracting Parties to the CNS was the first major international nuclear safety meeting following the Fukushima Daiichi accident, and it was held from 4 to 14 April 2011 at the IAEA Headquarters.[28] The contracting parties to the CNS were faced with the reality that the CNS and its processes had not prevented the accident.[29] This called for some change. Two contracting parties to the CNS, the Russian Federation and Switzerland, proposed amendments to the CNS for consideration at the 2nd Extraordinary Meeting of the Contracting Parties to the CNS, which was held in August 2012.[30] The proposal submitted by Russia introduced, among other matters, a reference to IAEA Safety Standards and recommendations in the CNS. Switzerland's proposal focused on transparency, the international peer review process and periodic safety assessments.

26. *The Fukushima Daiichi Accident: Report by the Director General*, *supra* note 2, and Technical Vols 1-5, IAEA Doc. STI/PUB/1710.

27. IAEA (2015), "Progress in the Implementation of the IAEA Action Plan on Nuclear Safety: Report by the Director General", IAEA Doc. GOV/INF/2015/13-GC(59)/INF/5 and GOV/INF/2015/13-GC(59)/INF/5/Att.1 (Supplementary Information).

28. Summary Report of the 5th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 4-14 April 2011, Vienna, Austria, IAEA Doc. CNS/RM/2011/6/FINAL. For an overview of post-Fukushima developments in the context of the CNS, see Johnson, P.L. (2013), "The post-Fukushima Daiichi response: The role of the Convention on Nuclear Safety in strengthening the legal framework for nuclear safety", *Nuclear Law Bulletin*, No. 91, OECD Publishing, Paris, *p*p. 7-21.

29. Prior to the Fukushima Daiichi nuclear power plant accident, there had been four review meetings of the CNS contracting parties in April 1999, April 2002, April 2005 and April 2008.

30. Final Summary Report, 2nd Extraordinary Meeting of the Contracting Parties to the Convention of Nuclear Safety, 27-31 August 2012, Vienna, Austria, IAEA Doc. CNS/ExM/2012/04/Rev.2. In accordance with Article 32 of the CNS, Spain had also formally submitted a proposal but withdrew it before the 2012 2nd Extraordinary Meeting.

Pursuant to Article 32 of the CNS, proposed amendments are to be considered at a review meeting or an extraordinary meeting. The contracting parties could have either adopted such amendments by consensus or, in the absence of consensus, submitted the proposed amendment to a Diplomatic Conference, which required a two-thirds majority vote of the contracting parties present and voting, provided that at least one-half of the contracting parties were present at the time of voting.

On 9 February 2015, a Diplomatic Conference to consider a proposal to amend the CNS met at the IAEA Headquarters. It was attended by 71 contracting parties who considered the proposal made by Switzerland to amend Article 18, which addressed the design and construction of both new and existing nuclear power plants.[31] CNS contracting parties did not adopt the amendment of Article 18 but instead unanimously adopted the Vienna Declaration on Nuclear Safety (the Vienna Declaration). While there was a decision to not amend the CNS, and the adopted Vienna Declaration is not part of the CNS itself, the principles of the Vienna Declaration to which the CNS contracting parties agreed enhance the implementation of the objective of the CNS to prevent accidents with radiological consequences and mitigate such consequences should they occur.[32] Specifically, new nuclear power plants should be designed, sited and constructed consistently with the objective of avoiding early radioactive releases or radioactive releases large enough to require long-term protective measures and actions, and for existing nuclear power plants, comprehensive safety assessments are to be carried out to identify reasonably practicable or achievable safety improvements to meet the overall objective. Contracting parties voluntarily committed to ensure that the safety objectives set out in the Vienna Declaration would form an integral part of considerations during future CNS review meetings and would be used as a reference to help strengthen the peer review process of the CNS.

The adoption of the Vienna Declaration drove a change to national reporting under the CNS and to the peer review process. The Seventh Review Meeting of the Contracting Parties to the CNS, which was held in March-April 2017 at the IAEA Headquarters, included a peer review of the incorporation of appropriate technical criteria and standards used by contracting parties for addressing the principles of the Vienna Declaration in national requirements and regulations.[33] Discussions identified that the majority of contracting parties with nuclear power programmes did not face or expect issues in addressing the principles of the Vienna Declaration.[34] Further, CNS contracting parties reaffirmed that the principles contained in the Vienna Declaration should continue to be reflected in their actions to strengthen nuclear safety, in particular when preparing national reports on the implementation of the CNS, with special focus on Article 18 as well as other relevant articles, such as Articles 6, 14, 17 and 19. It was also recalled that the IAEA Commission on Safety Standards had confirmed that "the technical elements of the Vienna Declaration are already reflected in the relevant Safety Requirements of the IAEA".[35]

31. The proposal reflected the development at the European level of the amended Nuclear Safety Directive. See Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, *Official Journal of the European Union* (OJ) L 219 (25 July 2014), pp. 42-52.

32. "Vienna Declaration on Nuclear Safety: On principles for the implementation of the objective of the Convention on Nuclear Safety to prevent accidents and mitigate radiological consequences", adopted by the Contracting Parties meeting at the Diplomatic Conference of the Convention on Nuclear Safety, Vienna, Austria, 9 Feb. 2015, IAEA Doc. CNS/DC/2015/2/Rev.1. The text of the Vienna Declaration is also published as IAEA Doc. INFCIRC/872 (15 Feb. 2015).

33. Summary Report, 7th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 27 March – 7 April 2017, Vienna, Austria, IAEA Doc. CNS/7RM/2017/08/Final.

34. *Ibid*., para. 22.

35. *Ibid*., para. 24.

It is of note that all IAEA member states, not just the contracting parties to the CNS, continue to be encouraged to contribute to the realisation of the CNS objectives, including those enshrined in the Vienna Declaration.[36]

b. Proposal to amend the Early Notification Convention

Following the Fukushima Daiichi accident, a formal proposal to amend the Early Notification Convention was also submitted in 2011 by Russia. The proposal aims to strengthen the provisions in the Convention, for example, on prompt notification of the concerned parties and the IAEA, within a defined time period, by the state on whose territory the accident occurred. To succeed, the proposal required a majority of the parties to request the convening of a Diplomatic Conference as required in accordance with its Article 14. At present, only 14 states, namely, Argentina, Armenia, Belarus, Brazil, Colombia, Greece, Kazakhstan, Mongolia, Nicaragua, the Philippines, Russia, Singapore, Ukraine and Uruguay have expressed support for such a conference. The proposal has not been withdrawn and remains a proposal.

4. Strengthening the effectiveness of the nuclear safety conventions

The 2011 Action Plan on Nuclear Safety foresaw states parties exploring mechanisms to enhance the effective implementation of the CNS, the Joint Convention and the Early Notification and Assistance Conventions.

a. CNS and the Joint Convention

Post-Fukushima, the contracting parties to both the CNS and the Joint Convention have sought to enhance the effectiveness of the conventions through improvements to the review process itself and to the comprehensiveness of the national reports.

The CNS and the Joint Convention are "incentive conventions" designed to encourage consensus and participation, with obligations on contracting parties that are based on fundamental principles and that recognise state responsibility for nuclear safety. In this context, the mechanism for compliance with these conventions is the submission of national reports explaining how a contracting party complies with its obligations and participation in the peer review process. Participation in review meetings allows each contracting party to learn about how other contracting parties show their compliance and can both encourage and educate.

After the Fukushima Daiichi accident, the contracting parties to the CNS and the Joint Convention have worked to reflect a deeper understanding of how to make the peer review process more effective and to reflect efficiency, continuity over time and transparency. This has been done without amending the conventions themselves, but through evolving, by consensus, the guidance documents for the review processes and reports to facilitate comparison over time, consistency and ease of completion. An increased focus on transparency has also been emphasised in the reporting and review meeting process. Contracting parties have by consensus modified the guidance documents on the review process and on national reports established under the CNS[37]

36. IAEA (2020), GC Resolution: "Nuclear Radiation and Safety", IAEA Doc. GC(64)/RES/9, adopted on 25 Sept. 2020, para. 48.

37. There are three current CNS guidance documents that have been updated over the years: (1) "Rules of Procedure and Financial Rules", IAEA Doc. INFCIRC/573/Rev.6 (20 Jan. 2015); (2) "Guidelines regarding the Review Process under the Convention on Nuclear Safety", IAEA Doc. INFCIRC/571/Rev.7 (16 Jan. 2015); and (3) "Guidelines regarding National Reports under the Convention on Nuclear Safety", IAEA Doc. INFCIRC/572/Rev.6 (19 Jan. 2018).

and the Joint Convention.[38] Most recently, the effectiveness of the conventions was addressed at the 2017 Seventh CNS Review Meeting and the Sixth Review Meeting of the Contracting Parties to the Joint Convention held in May to June 2018.[39] Amending the guidance documents has been a preferred approach by the contracting parties.

In this regard, contracting parties have sought to enable a clearer and more efficient review process. They have addressed the submission and the content of national reports and proposals to be considered at review meetings, enabling new methods for forming country groups and enhancing the continuity of knowledge management and retention between review periods of the conventions. In addition, changes have been made to improve procedural mechanisms, to enable greater consistency in reporting, and to enhance international co-operation. National reports are more comprehensive, both in the summary section as well as in the article-by-article reporting sections.

Importantly, contracting parties have agreed to increased transparency in the review process. For example, the summary report of each CNS review meeting now identifies the contracting parties that submitted national reports prior to the meeting and those that presented their national reports during the meeting. Copies of national reports are made publicly available by the Secretariat 90 days after a review meeting, unless a contracting party notifies the Secretariat otherwise. This practice is also now applied to the Joint Convention's review process. These increased transparency measures are considered by contracting parties to be an enhancement of the peer review process. In addition, contracting parties have also sought to ensure coherence and benchmarking between the rules governing the review process of the Joint Convention and those of the CNS.

Finally, contracting parties have provided for the explicit use of IAEA Safety Standards in the framework of both conventions, notably when reporting on meeting obligations. For parties to the various international safety conventions, IAEA Safety Standards provide a consistent, reliable measure against which to both demonstrate and review the effective fulfilment of obligations under the conventions. While preambular paragraph (viii) of the CNS recognised "that there are 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", it was only in 2012 that the CNS contracting parties collectively and expressly recognised the IAEA Safety Standards as providing valuable guidance when reporting on meeting the obligations of the CNS.[40] This was followed by an identical recognition by the contracting parties to the Joint Convention in 2014.[41]

38. There are three current Joint Convention guidance documents that have been updated over the years: (1) "Rules of Procedure and Financial Rules", IAEA Doc. INFCIRC/602/Rev.5 (18 Dec. 2014); (2) "Guidelines regarding the Review Process", INFCIRC/603/Rev.7 (17 Sept. 2017); and (3) "Guidelines regarding the Form and Structure of National Reports", INFCIRC/604/Rev.3 (18 Dec. 2014).

39. Final Summary Report, Sixth Review Meeting of the Contracting Parties, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, 21 May – 1 June 2018, Vienna, Austria, IAEA Doc. JC/RM6/04/Rev.2.

40. IAEA (2013), "Guidelines regarding National Reports under the Convention on Nuclear Safety", IAEA Doc. INFCIRC/572/Rev.4, para. 19, provided that "IAEA Safety Standards, in particular 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 CNS. Reference to the IAEA Safety Fundamentals and Requirements, could be made when reporting on the obligations of the Convention". This paragraph is now paragraph 20 of the 2018 version of the Guidelines in INFCIRC/572/Rev.6, *supra* note 37.

41. IAEA Doc. INFCIRC/604/Rev.3, *supra* note 38.

b. Early Notification and Assistance Conventions

Further to the Fukushima Daiichi accident, some of these underlying practical arrangements and mechanisms, in particular, EPR-IEComm (which establishes the mechanisms and channels for communication among the Secretariat, states and relevant international organisations), RANET (which provides mechanisms for international assistance) and the JPLAN (which describes the practical arrangements of the organisations involved in a response) have been strengthened with a view to enhancing the effective implementation of the Conventions.

In the context of the adoption of the Action Plan, the IAEA's role in responding to a nuclear emergency was expanded to include providing member states, international organisations and the general public with timely, clear, factually correct, objective and easily understandable information during a nuclear emergency respecting its potential consequences. This includes analysis of available information and prognosis of possible scenarios based on evidence, scientific knowledge and the capabilities of member states. Further to 2013 General Conference resolution GC(57)/RES/9, the role was expanded to include a radiological emergency, not just a nuclear emergency.[42] In order to support the implementation of, and disseminate among member states, this assessment and prognosis response role, the Secretariat published the Operations Manual for IAEA Assessment and Prognosis during a Nuclear or Radiological Emergency (EPR-A&P 2019), *supra* note 22.

5. Promoting universal adherence to and effective implementation of the CNS and Joint Convention

The 20th anniversary marking the CNS and the Joint Convention occurred in 2014 and 2017 respectively. Both instruments continue to enjoy broad support, with 91 parties to the CNS and 84 parties to the Joint Convention as of 16 June 2021. This represents an increase of 19 and 27 since 2010. Following India's ratification of the CNS in March 2005, all IAEA member states operating nuclear power plants, with just one exception, are party to the CNS.

The IAEA has a central role in promoting adherence to the four nuclear safety conventions concluded under its auspices, namely, the CNS, the Joint Convention and the Early Notification and Assistance Conventions. Furthermore, the 2011 Action Plan on Nuclear Safety foresaw member states being encouraged to join and effectively implement these conventions. Since that time**,** the Secretariat has been working towards encouraging their universal adherence.

Activities continue to promote the importance of the conventions and to assist member states upon request with adherence, participation and implementation, as well as strengthening of their related technical and administrative procedures. As part of these efforts, in addition to the regular outreach, tailored promotional activities, such as bilateral meetings and regional and international workshops, were devised and implemented, focusing on the CNS and the Joint Convention. The Joint Convention covers spent fuel and radioactive waste management resulting from civilian nuclear reactors and applications, as well as transboundary movement of waste and disused sealed sources. Despite this being of direct relevance for a larger number of states than the CNS, for many years the Joint Convention had a comparatively low number of contracting parties, which also did not include some contracting parties to the CNS and several states that have issued expressions of support for the 2003 Radioactive Sources Code of Conduct. This situation was considered as an issue during the 2015 Fifth Review Meeting of the Contracting Parties of the

42. IAEA Doc. GC(57)/RES/9, *supra* note 21, para.103.

Joint Convention. By the time of the 2018 Sixth Joint Convention Review Meeting, the number of contracting parties had increased from 69 to 78. Nonetheless, contracting parties agreed to promote and facilitate accession to the Joint Convention. Further, the President of the Review Meeting also emphasised the need for contracting parties to collectively increase efforts to encourage those IAEA member states who are not yet contracting parties to the Joint Convention to become party to the Convention.[43]

A focus has been on countries not yet party to the conventions, including those that have signed the instruments but have not yet deposited their instrument of accession, as well as newcomer countries and non-nuclear power countries. All member states that have not yet done so, especially those planning on constructing, commissioning or operating nuclear power plants, or considering a nuclear power programme, continue to be urged to become contracting parties to the CNS.[44] Similarly, all member states that have not yet done so, particularly those managing radioactive waste or spent fuel, as well as states that have made a political commitment under the 2003 Radioactive Sources Code of Conduct, are urged to become contracting parties to the Joint Convention.[45]

6. Full and active participation in the global nuclear safety regime

a. Participation in the review processes of the CNS and Joint Convention

The review processes of the CNS and the Joint Convention, in which contracting parties submit and mutually assess their national reports, are the core of these incentive-based conventions. Being a contracting party to the CNS and Joint Convention imposes certain obligations, namely: preparation of a national report; review and submission of questions on the national reports of other contracting parties; provision of answers to the questions submitted by other contracting parties; and active participation in Organizational, Review and Extraordinary Meetings.

The review processes provide a singular opportunity for experience sharing and collective learning, enabling the identification of good practices, challenges, trends and issues. It is vital to the efficacy of the peer review processes that each contracting party takes an active part in an open and transparent review of its own national report and of the national reports of other contracting parties. The importance of contracting parties fulfilling their respective obligations and reflecting their actions to strengthen nuclear safety when preparing national reports, and actively participating in review meetings, has over the past decade become well recognised.[46] It is through this engagement in the peer review process and active participation that the benefits of the incentive safety conventions and progress in nuclear safety are realised.

Unfortunately, three years after the Fukushima Daiichi accident, the 2014 Sixth Review Meeting of the Contracting Parties to the CNS suffered from a lack of full attendance and a lack of submission of national reports, as well as late submission of other national reports, diminishing the viability of effective review by other contracting parties. Moreover, 7 contracting parties did not attend the Review Meeting and 34 posted no questions on the national reports of their peers.[47] Reflecting this

43. For a discussion, see Final Summary Report, Fifth Review Meeting of the Contracting Parties, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, 11 to 22 May 2015, Vienna, Austria, IAEA Doc. JC/RM5/04/Rev.2; IAEA Doc. JC/RM6/04/Rev.2, *supra* note 39.

44. IAEA Doc. GC(64)/RES/9, *supra* note 36, para. 14.

45. *Ibid*., para. 15.

46. *Ibid*., para. 16.

47. Summary Report, 6th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 24 March – 4 April 2014, Vienna, Austria, IAEA Doc. CNS/6RM/2014/11_Final, paras. 3 and 4.

disappointing level of implementation, the Summary Report of the Sixth CNS Review Meeting called on all contracting parties to commit themselves to the effective implementation of the review process, including the newly adopted improvements to the guidance documents.

By contrast the Seventh CNS Review Meeting held in 2017 had the highest level of participation by contracting parties to date. Seventy-seven of the 80 contracting parties participated in the Review Meeting. Such high attendance can in large part be attributed to the efforts of the President of the Review Meeting, together with the two Vice-Presidents. This included direct communication from the President of the Review Meeting to contracting parties, with reminders of reporting obligations, encouragement on the importance of active participation and facilitating resources, which bore results. Of course, it may be noted that even though all contracting parties apart from one submitted a national report, a number of these were submitted later than the deadline.[48] For the first time, states that had signed, but had not yet ratified, accepted or approved the CNS (signatory states) were invited to attend selected parts of the Seventh CNS Review Meeting. These sessions were also webcast for the first time. In another first, all national reports were made publicly available after the meeting on the IAEA website. These measures and their results bode well for a renewed commitment to the goals of the peer review process that the global community can expect to continue in future review meetings.

The rate of participation by contracting parties in the Review Meetings of the Joint Convention has held constant; however, the percent of contracting parties issuing national reports has increased and the number of questions has increased. This shows a small positive trend in adherence to the Joint Convention. However, around 10% of contracting parties are not attending the Review Meeting. Only 69 out of the 78 contracting parties attended the 2018 Sixth Joint Convention Review Meeting and 75 out of 78 contracting parties submitted national reports. Further, only 61 out of the 69 contracting parties participated in the 2015 Fifth Joint Convention Review Meeting.

b. Early Notification and Assistance Conventions

All member states that have not yet done so continue to be urged to become parties to the Early Notification Convention and the Assistance Convention. The importance of parties fulfilling the obligations stemming from these Conventions, and actively participating in regular meetings of the Representatives of Competent Authorities, is well recognised. The Secretariat continues to be requested to facilitate information exchange between interested member states and competent authorities.[49] Such facilitation is to improve national and international EPR arrangements and to promote the implementation of the Conventions and the IAEA Safety Standards dealing with EPR,

48. Summary Report, 7th Review Meeting, IAEA Doc. CNS/7RM/2017/08/F, *supra* note 33, para. 7. The plenary sessions of the Seventh CNS Review Meeting focused on: (i) challenges that were identified at the Sixth Review Meeting as a result of learnings following the Fukushima Daiichi nuclear power station accident; (ii) a "peer review of the incorporation of appropriate technical criteria and standards used by Contracting Parties for addressing the principles of the Vienna Declaration on Nuclear Safety in national requirements and regulations"; (iii) major common issues arising from the country group discussions, i.e. safety culture, international peer reviews, legal framework and independence of the regulatory body, financial and human resources, knowledge management, supply chain, managing the safety of ageing nuclear facilities and plant life extension, emergency preparedness, stakeholder consultation and communication; and (iv) challenges faced by non-nuclear power countries and embarking countries in complying with the obligations under the CNS. Several proposals to improve the peer review process under the CNS were also approved at the Review Meeting, relating, *inter alia*, to issuing a survey at each Review Meeting to evaluate the effectiveness of the changes to the review process, continuing to have topical sessions during future Review Meetings and organising regional CNS workshops for countries with no nuclear power reactors.

49. IAEA Doc. GC(64)/RES/9, *supra* note 36, para. 120.

such as GSR Part 7 (2015).[50] In June 2020, the Tenth Meeting of the Representatives of Competent Authorities identified under the Early Notification and Assistance Conventions was held.

States parties to the Early Notification Convention are obliged to make known their competent authorities and points of contact. In addition, the IAEA's Secretariat asks all states to designate their contact points in accordance with EPR-IEComm 2019, *supra* note 15. To date, 116 member states have designated contact points, but 17 are still not in accordance with definitions in EPR-IEComm 2019, and 7 member states have not provided their emergency contact points. Parties to the Assistance Convention are obliged to "within the limits of their capabilities, identify and notify the [IAEA] of experts, equipment and materials which could be made available for the provision of assistance to other States Parties in the event of a nuclear accident or radiological emergency" (Article 2(4)). This may be achieved by registering national assistance capabilities in the IAEA assistance mechanism (EPR-RANET (2018)). Today, a total of 35 states parties have registered their capabilities in RANET. This means that only 29% of the 122 parties to the Assistance Convention are in compliance with this obligation. States continue to be encouraged to register and update, on a regular basis in RANET, national capabilities that could be made available to states requesting international assistance.[51]

While many member states operate radiation monitoring networks, radiation monitoring information arising therefrom cannot be fully exchanged and utilised by other countries in a timely manner during radiation incidents and emergencies unless provisions are made to this end. This issue was once more demonstrated during the Fukushima Daiichi nuclear power plant accident, when radiation monitoring data was not always readily available in useful formats to countries. In 2016, the International Radiation Monitoring Information System (IRMIS) was established as an IAEA Incident and Emergency Centre web application that provides a mechanism for the reporting and visualisation of large quantities of environmental radiation monitoring data during nuclear or radiological emergencies.[52] IRMIS is not an early warning system but supports the implementation of the Early Notification Convention and complements the USIE. Finally, since 2010, the number of member states using the International Nuclear and Radiological Event Scale (INES) to communicate the safety significance of nuclear or radiological events has grown by 11 to a total of 80.

50. IAEA et al. (2015), *Preparedness and Response for a Nuclear or Radiological Emergency*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 7, IAEA, Vienna.

51. IAEA Doc. GC(64)/RES/9, *supra* note 36, para. 119.

52. IAEA (2020), *International Radiation Monitoring Information System*, *User Manual IRMIS Version 3.0.0*, IAEA, Vienna, issued as Attachment 2 to IAEA Doc. EPR–IEComm (2019), *supra* note 15. The manual supports and enhances some of the features of the Unified System for Information Exchange in Incidents and Emergencies (USIE). IRMIS is "primarily a data sharing platform that provides CAs [competent authorities] with 24/7 access to data collected and collated by routine monitoring in the participating states". *Ibid*., p. 4. However, IRMIS is not an early warning system. IRMIS analytical tools may be used to determine whether elevated levels of radiation observed in monitoring data are significant as far as radiological safety is concerned.

c. **IAEA safety peer** *reviews and advisory services and self-assessments*

The IAEA Safety Standards are effective only inasmuch as they are implemented in practice. Important mechanisms to support the application of IAEA Safety Standards include IAEA safety peer reviews and advisory services,[53] as well as other assistance activities such as legislative assistance. These voluntary practical mechanisms facilitate national implementation of the standards and instruments. The reviews and services are undertaken pursuant to the IAEA's statutory function of establishing standards and providing for their application (Statute of the IAEA, Article III.A.6). They are not compliance-monitoring mechanisms but rather are a means of assisting states through independent, objective and expert opinions and advice. In this context, they are an essential safety tool providing an assessment of, and an incentive for, the implementation of IAEA Safety Standards and the promotion of international best practices, as well as the implementation of the safety conventions.

Over the past decade, the focus has been on facilitating the normative expectation of member states' use of the IAEA safety peer reviews and advisory services. This expectation is reflected in the annual safety resolution of the General Conference. Moreover, member states, including those considering introducing nuclear power, are encouraged to regularly use them and associated follow-up missions at appropriate phases, and to implement recommended actions in a timely manner. In this regard, the 2011 Action Plan on Nuclear Safety provided for "[IAEA] Member States to be strongly encouraged to voluntarily host [such services], including follow-up reviews, on a regular basis". This outcome was also reflected in the post-accident amendments to the underlying guidance documents of the CNS in order to strengthen its effectiveness. Although IAEA safety peer reviews and advisory services are voluntary and remain outside the CNS, one of the focuses of the 2017 Seventh CNS Review Meeting was on the national reports' descriptions of the peer review missions conducted, their findings, the action plans created in response and how they are being implemented. In this way, the IAEA safety peer review process findings and follow-up can dovetail with the CNS peer review process and provide continuity and integration.

The IAEA continues to improve the effectiveness and efficiency of safety peer review and advisory services and self-assessment tools in the areas of the regulatory framework, operational safety, EPR, design safety and site evaluation. In this context, the IAEA continues to incorporate lessons learnt from their implementation and to share, as appropriate, the relevant information with member states. Further, the IAEA continues to assist states in applying its Safety Standards by providing education and training, promoting information exchange on best safety practices, and rendering a broad range of safety services.

53. IAEA safety peer review and advisory services include the Integrated Regulatory Review Service (IRRS), the Operational Safety Review Team (OSART), the Emergency Preparedness Review (EPREV) missions, the Site and External Events Design (SEED) review missions, the Technical Safety Review (TSR) services, the Occupational Radiation Protection Appraisal Service (ORPAS) missions, the Safety Aspects of Long Term Operation (SALTO) missions, the Peer Review of Operational Safety Performance Experience (PROSPER) mission, the Integrated Safety Assessment of Research Reactors (INSARR) missions, the Independent Safety Culture Assessment (ISCA) missions, the Advisory Missions on Regulatory Infrastructure for Radiation Safety (AMRAS), the Education and Training Appraisal (EduTA) missions. In 2014, the IAEA launched the Radioactive Waste Management Integrated Review Service (ARTEMIS) to cover disused sealed sources, spent fuel management, and decommissioning and remediation programmes. This peer review service is complementary to the aims of the Joint Convention and is targeted at operators as well as regulatory and policy making bodies. There is also the Advisory Mission on Regulatory Infrastructure for Radiation Safety and Security of Radioactive Material (RISS) focused on raising awareness and providing high-level advice to states on the need to establish or strengthen regulatory infrastructure for radiation safety and security of radioactive material. Five pilot missions were conducted in 2018 (Costa Rica, Gambia, Liberia, Paraguay, Uruguay) and one in 2019 (Central African Republic). In 2019 and 2020, three consultancy meetings were held to develop guidelines.

Currently, member states' requests for IAEA safety peer review and advisory services remain high across all safety areas. This status may be contrasted with the view held in 2013 that some member states were not employing the review services as extensively as would be desirable.[54] Although the 2011 Action Plan on Nuclear Safety anticipated that member states with nuclear power plants would host at least one OSART mission before September 2014, such missions were still not scheduled in 15 of the then 31 countries with nuclear power plants. Moreover, several member states had not hosted an OSART mission at any nuclear power plant for over ten years (although they benefitted from WANO missions). At that time, the participation in IRRS missions was also lagging. Some countries with nuclear power plants had never had the benefit of a mission and many countries that had received an initial IRRS mission had not scheduled a follow-up; others have not planned to host a second cycle whereas their first initial mission was conducted more than ten years ago. Further, of the 31 countries operating nuclear power plants, 21 have yet to host an EPREV mission.

Transparency of the evaluations performed by peers is a key element of the 2011 Action Plan on Nuclear Safety and is a powerful tool to create incentives to drive improvements. Over the past decade, the effectiveness of several peer reviews has been enhanced by sharing results, experiences and lessons learnt with member states. To improve the transparency, member states continue to be encouraged to make publicly available the findings and outcomes of reviews and services. In order to improve transparency, peer review reports and summaries (including those carried out in the past ten tears) are made available on the IAEA's website with the consent of member states. Further enhancements in the planning and implementation of the peer review services continue to be implemented.

d. Increased focus on self-assessments by IAEA member states

The concept of national self-assessment in all relevant safety areas prior to peer reviews has also been strengthened. The importance of member states voluntarily performing self-assessments of their domestic nuclear, radiation, transport and waste safety, as well as their EPR measures as effective tools for continued efforts to evaluate, maintain effective practices and further improve their respective nuclear safety, is well recognised.[55] Member states are encouraged to undertake regular self-assessments, taking into account the IAEA's self-assessment methodologies and tools, and are encouraged to make the outcomes publicly available. Self-assessment of the regulatory infrastructure for nuclear and radiological safety is key to establishing and developing a regulatory framework. Self-Assessment of Regulatory Infrastructure for Safety (SARIS), initially launched in 2013 and updated in 2017, enables countries to check (online) whether their regulatory infrastructure accords with IAEA Safety Standards. SARIS can be particularly useful for countries preparing to host IAEA review services such as the IRRS. Countries introducing nuclear power can use a SARIS component titled Integrated Review of Infrastructure for Safety (IRIS) to evaluate whether they are performing in line with recommendations in the IAEA Specific Safety Guide on *Establishing the Safety Infrastructure for a Nuclear Power Programme*.[56] In 2015, the IAEA launched a web-based platform (Emergency Preparedness and Response Management System, EPRIMS) specifically aimed at facilitating the conduct of self-assessment against EPR requirements (GSR Part 7, *supra* note 50) and sharing this self-assessment with the Secretariat and other countries.

54. Annual Letter of Assessment to Y. Amano, IAEA Director General, from Dr R. Meserve, INSAG Chairman (21 Aug. 2013).

55. IAEA Doc. GC(64)/RES/9, *supra* note 36, para. 42.

56. IAEA (2020), *Establishing the Safety Infrastructure for a Nuclear Power Programme*, IAEA Safety Standards Series, Specific Safety Guide, No. SSG-16 (Rev. 1), IAEA, Vienna.

Within the framework of the 2003 Radioactive Sources and 2004 Research Reactors Codes of Conduct, member states continue to be encouraged to carry out self-assessments and share the results at meetings. Such self-assessments are also a central part of the preparation of national reports for the CNS and the Joint Convention.

7. Strengthening civil liability for nuclear damage

Nuclear-related activities, such as the operation of nuclear power plants for electricity production, create a risk of a specific character. An important corollary to nuclear safety, therefore, is the establishment of effective and coherent nuclear liability mechanisms at the national and global levels to ensure prompt, adequate and non-discriminatory compensation for damage to, *inter alia*, people, property and the environment.

The Fukushima Daiichi nuclear power plant accident made evident the need for liability mechanisms to be in place prior to an accident. The accident did not cause bodily injury or casualties due to the release of radioactive substances within the population living around the nuclear power plant, but it affected the lives of tens of thousands of displaced citizens, resulted in very large economic loses and caused considerable environmental damage. It also fully demonstrated that a clear and comprehensive legal framework is necessary "to allow the operator of a nuclear installation – and its government, if necessary – to quickly react and adapt to the specific circumstances of events in order to ensure timely and financially adequate compensation to victims."[57]

As in the case of the past two severe accidents, Three Mile Island and Chernobyl, at the time of the Fukushima Daiichi nuclear power plant accident, the country concerned in this case, Japan, was not a party to any of the international nuclear liability instruments. Rather, it had national legislation conforming to the basic principles of nuclear liability as embodied in the international legal instruments on civil liability for nuclear damage.[58] Under this legislation, the nuclear operator, TEPCO, was exclusively liable for nuclear damage caused by the accident. Its liability was unlimited in amount.[59] The existing Japanese legislation, coupled with the innovative mechanisms adopted to supplement that legislation, fulfilled the purpose of allowing TEPCO to compensate victims of the accident in a timely and adequate manner given the circumstances.[60]

57. NEA (2016), *Five Years after the Fukushima Daiichi Accident: Nuclear Safety Improvements and Lessons Learnt*, OECD Publishing, Paris, p. 64.

58. Despite the multiplicity of international nuclear liability instruments that exist today, the substantive conventions are based on seven basic principles of nuclear liability that have developed over time and are generally accepted. These principles are: the exclusive liability of the operator; liability without fault; minimum liability amount of the operator; mandatory financial coverage of the operator's liability; limitation of the operator's liability in time; equal treatment of victims; and exclusive jurisdictional competence of the courts of one contracting party and recognition of judgments in all contracting parties.

59. Following the accident, TEPCO was not granted exemption from liability by the Japanese Government and Parliament based on the assumption that the exemption clause related to a grave natural disaster, as specified in the 1961 Act on Compensation for Nuclear Damage (Act No. 147 of 1961), as amended by Act No. 19 of 17 Apr. 2009, was inapplicable in this case.

60. Various means to allow TEPCO to meet its obligations towards the victims of the accident have been implemented, including provisional compensation payments as an emergency measure, the provision of financial support to TEPCO by the Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF) and NDF becoming the controlling shareholder of TEPCO. Moreover, the creation of the Dispute Reconciliation Committee for Nuclear Damage Compensation and the issuance of legally non-binding guidelines provided a mechanism for prompt out of court settlements of compensation for nuclear damage. For more information see IAEA (2015), *The Fukushima Daiichi Accident*, Technical Vol. 5, Post-accident Recovery, IAEA, Vienna, pp. 149-151.

Similar to the international legal framework for nuclear safety, the international legal frameworks on civil liability for nuclear damage – commonly referred to as the Paris regime and the Vienna regime – were already in place by the time of the Fukushima Daiichi nuclear power plant accident.[61] In fact, these frameworks or regimes, first established in the 1960s, were strengthened after the 1986 Chernobyl accident, which not only brought into sharp focus the inadequacies of existing safety measures but also the inadequacy of the international nuclear liability framework. Following the 1986 Chernobyl accident, new and modernised instruments were adopted under the auspices of the IAEA, in particular, the 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention,[62] the 1997 Protocol to the Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage (the 1997 CSC).[63]

By the time of the Fukushima Daiichi nuclear power plant accident, however, there continued to be an absence of treaty relations between states parties to different instruments and a comparatively low number of adherences to some of the instruments. The Fukushima Daiichi nuclear power plant accident gave renewed vigour to calls for a global nuclear liability regime. Since the accident, international efforts are focused on increasing participation in the regime based on the new and modernised instruments, thereby leading to the establishment of so-called global nuclear liability regime. The 2011 Action Plan on Nuclear Safety specifically called on IAEA member states to work towards establishing a global nuclear liability regime that addresses the concerns of all states that might be affected by a nuclear accident with a view to providing appropriate compensation for nuclear damage. Further, it called on them to give due consideration to the possibility of joining the instruments as a step towards achieving such a global regime.

The 2011 Action Plan on Nuclear Safety foresaw the IAEA International Expert Group on Nuclear Liability (INLEX) recommending actions to facilitate achievement of such a global regime. Pursuant to the Action Plan, INLEX, which was established in September 2003, adopted at its 12th regular meeting in 2012 a set of recommended actions to facilitate the achievement of a global nuclear liability regime.[64] The recommendations provide best practices on establishing a

61. The Paris regime consists of the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982, and by the Protocol of 12 February 2004, entered into force 1 Jan. 2022, unofficial consolidated text available at: NEA (2017), "Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004", NEA Doc. NEA/NLC/DOC(2017)5/FINAL (Revised Paris Convention). The Revised Paris Convention is concluded under the auspices of the OECD, open to OECD member states and to other states if all parties give their consent. The Revised Paris Convention is supplemented by the Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004, entered into force 1 Jan. 2022, unofficial consolidated text available at: NEA (2017), "Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004", NEA Doc. NEA/NLC/DOC(2017)6/FINAL (Revised Brussels Supplementary Convention).

62. Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (1988), IAEA Doc. INFCIRC/402, 1672 UNTS 293, entered into force 27 Apr. 1992; see also IAEA (2013), *The 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention – Explanatory Text*, IAEA International Law Series, No. 5, IAEA, Vienna.

63. Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997), IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force 4 Oct. 2003; Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473. See also IAEA (2020), *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage – Explanatory Texts*, IAEA International Law Series, No. 3 (Rev. 2), IAEA, Vienna.

64. IAEA (2012), "Recommendations on how to facilitate achievement of a global nuclear liability regime as requested by the IAEA Action Plan on Nuclear Safety, International Expert Group on Nuclear Liability (INLEX)".

global nuclear liability regime, including through the identification of actions to address gaps in and enhance the existing nuclear liability regimes.

An important milestone towards creating a global nuclear liability regime was the entry into force in April 2015 of the 1997 CSC.[65] The purpose of the 1997 CSC is to establish a worldwide liability regime with a view to increasing the amount of compensation for nuclear damage. It also aims to encourage regional and global co-operation and the promotion of a higher level of nuclear safety in accordance with the principles of international partnership and solidarity. In this context, the 1997 CSC specifies that a state having on its territory a nuclear installation as defined in the CNS will have to be a party to that Convention before joining the 1997 CSC (see Articles XVIII and XIX). With 1997 CSC's entry into force, the status of nuclear power plant coverage was significantly changed for the better. As of June 2021, the 1997 CSC now covers some 175 reactors in 11 states: that is nearly half of the 443 nuclear power reactors currently in operation.[66] Although it only has 11 parties, it currently is the treaty providing the most funds and covering the most nuclear power plants.

Today, IAEA member states continue to attach importance to effective and coherent nuclear liability mechanisms at the national and global level to ensure prompt, adequate and non-discriminatory compensation for damage to people, property and the environment resulting from a nuclear accident or incident. The IAEA continues to be requested to assist them in their efforts to adhere to the international nuclear liability instruments, considering the 2012 INLEX Recommendations. Since the Fukushima Daiichi accident, the IAEA has organised seven workshops on nuclear liability in all regions aimed at providing diplomats and experts from member states with an introduction to the international legal regime of civil liability for nuclear damage. Finally, more than 15 joint IAEA/INLEX missions have been conducted in specific target countries in order to raise awareness of the international nuclear liability regime and encourage wider adherence to the relevant international legal instruments.

However, the main challenge remains the comparatively low number of parties to the instruments. The nuclear liability instruments are largely adhered to by nuclear power generating countries, as well as some non-nuclear power plant countries. Further, as the Fukushima Daiichi nuclear power plant accident has shown, the costs of a major nuclear accident can run into the billions of US dollars. The compensation amounts available under the nuclear liability instruments, even the higher amounts now available under the modernised instruments such as the 1997 Vienna Convention and 1997 CSC, are unlikely to be able to address all valid claims for nuclear damage.

In June 2019, Canada hosted the First Meeting of the Parties and Signatories to the CSC. Participants discussed progress in implementing the convention and opportunities to expand CSC participation. In October 2020, following a request made by Canada on behalf of the contracting parties to the CSC, the Secretariat accepted to convene future meetings of the contracting parties and signatories to the CSC on a regular basis.

65. Deposit by Japan of its instrument of acceptance of the 1997 CSC on 15 January 2015 satisfied a key requirement of the entry into force provisions; i.e. adherence by at least 5 countries with at least 400 000 units of aggregate installed nuclear capacity. Pursuant to its terms, the 1997 CSC entered into force 90 days later, on 15 April 2015. For a discussion of the 1997 CSC with regard to entry into force, see McRae, B. (2015), "Entry into force of the Convention on Supplementary Compensation for Nuclear Damage: Opening the umbrella", *Nuclear Law Bulletin*, No. 95, OECD Publishing, Paris, pp. 7-25.

66. Based on the number of power reactors in the IAEA Power Reactor Information System (PRIS), available at https://pris.iaea.org/PRIS/home.aspx. Separately, in accordance with Article VIII.1 of the 1997 CSC "[e]ach Contracting State shall, at the time when it deposits its instrument of ratification, acceptance, approval or accession, communicate to the Depositary a complete listing of all nuclear installations referred to in Article IV.3. The listing shall contain the necessary particulars for the purpose of the calculation of contributions [to the international fund]."

8. Implementing the international legal framework at the national level

Interest in nuclear energy for peaceful purposes remains strong, with the result that, just as the international legal framework for nuclear safety has evolved, so too has the need for countries to implement this framework at the national level. In this regard, the IAEA has strengthened its programme of legislative assistance, which helps member states in their awareness of the international instruments and in establishing national legal frameworks. This programme applies a comprehensive approach to implementing legislation and has been applied by the IAEA since 2005. This "3S" approach emphasises the inter-relationships between safety, security and safeguards, and addresses not only the nuclear safety conventions but also the other legal instruments comprising the international legal frameworks for nuclear security and safeguards, as well as nuclear liability.

Since 2010, the IAEA Office of Legal Affairs has at the request of member states reviewed and provided comments on 162 draft national nuclear laws. Further, 11 regional workshops on nuclear law have been held in all regions. These workshops, addressing all aspects of nuclear law, provide an opportunity for the planning of future legislative activities in participating member states based on an assessment of their needs. In addition, at the request of member states, 28 awareness missions have been conducted in order to inform their policymakers about the importance of adhering to relevant legal instruments adopted under the IAEA's auspices. The IAEA has trained over 1 068 scientific visitors and fellows from a number of member states in various aspects of nuclear law. Further, the IAEA has developed new online training materials on nuclear law including an e-learning module. The first volume of the IAEA *Handbook on Nuclear Law* was published in 2003 as a resource for assessing the adequacy of national legal frameworks governing the peaceful uses of nuclear energy.[67] In 2011, the second volume of the *Handbook on Nuclear Law* was published as a practical aid to legislative drafting that brings together, for the first time, model texts of provisions covering all aspects of nuclear law in a consolidated form.[68]

Further, within the framework of the legislative assistance programme, the IAEA organised for the first time a "Meeting on the Role of the Legal Advisor in a Regulatory Body" in Vienna from 30 July to 2 August 2019. This meeting reflected the importance of legal expertise to the work of a national nuclear regulatory body.

In addition, the IAEA established in 2010 an annual training event, the Nuclear Law Institute (NLI). This comprehensive two-week course is designed to help meet the increasing demand by IAEA member states for legislative assistance and to enable participants to acquire a solid understanding of all aspects of nuclear law, as well as to draft, amend or review their national nuclear legislation. Over the course of 10 sessions, some 552 representatives from more than 126 IAEA member states have received training in drafting national nuclear legislation that will be in accord with the international nuclear law instruments.

The NLI and the legislative assistance programme are aimed at improving the effectiveness of the international legal framework, thus responding to the request in the 2011 Action Plan. In addition, since September 2011 an annual Treaty Event has been held on the margins of the regular session of the IAEA General Conference in order to promote universal adherence to the most important treaties deposited with the IAEA Director General, notably those related to nuclear safety and security, as well as to civil liability for nuclear damage. Member states are provided with a further opportunity to deposit their instruments of ratification, acceptance or approval of, or accession to, the treaties deposited with the Director General. A total of 46 instruments have been deposited during these events.

67. Stoiber, C. et al. (2003), *Handbook on Nuclear Law*, IAEA, Vienna.

68. Stoiber, C. et al. (2010), *Handbook on Nuclear Law: Implementing Legislation*, IAEA, Vienna.

Most recently, and within the constraints of the global pandemic, in October 2020 the IAEA Office of Legal Affairs launched a webinar series on nuclear law. Ending on 11 December 2020, the interactive webinar series covered the four main branches of international and national nuclear law: nuclear safety, security, safeguards and civil liability for nuclear damage. The series was divided into three parts and was comprised of nine webinars. It was devised as an online alternative to some of the Office of Legal Affairs' training activities and as an opportunity to engage with and address the ongoing needs of member states in nuclear law.

The series targeted countries that are not party to some or all of the relevant international legal instruments adopted by or under the auspices of the IAEA and/or are in the process of strengthening their existing national nuclear legislative framework. The webinar series amassed over 2 500 streams, with participation from officials with policy, legal, regulatory and technical backgrounds from over 100 countries. Given the success of the series and in response to expressed interest from industry, law firms, non-governmental organisations, civil society and academia, the IAEA Office of Legal Affairs hosted a webinar for the general public, "Nuclear Law in Practice: the IAEA Perspective", on 15 December 2020.

9. Other developments: Further strengthening the two IAEA Codes of Conduct

In addition to the above-mentioned post-Fukushima Daiichi accident actions and developments relating to the nuclear safety conventions, IAEA member states have adopted and progressively strengthened two non-legally binding IAEA Codes of Conduct. First, there is the Code of Conduct on the Safety and Security of Radioactive Sources of 2003 (the Radioactive Sources Code of Conduct),[69] which applies to all radioactive sources that could pose a significant risk to individuals, society and the environment. The Code of Conduct has been supplemented by two guidance documents. Second, the Code of Conduct on the Safety of Research Reactors of 2004 (the Research Reactors Code of Conduct),[70] applies to the safety of research reactors at all stages of their lives, from siting to decommissioning. These IAEA Codes of Conduct are legal instruments of a non-binding nature, prepared at the international level, to offer guidance to states for the development and harmonisation of policies, laws and regulations. With respect to both Codes of Conduct, states have agreed to hold voluntary periodic meetings to exchange information on national implementation. During the past decade, the two IAEA Codes of Conduct have continued to evolve and be supported by member states.

a. Radioactive Sources Code of Conduct

Over the past ten years, member states have continued to express support for the 2003 Radioactive Sources Code of Conduct. As a counterbalance to its legally non-binding nature, states have an opportunity to provide political support for its implementation.[71] As of 4 June 2021, 140 states had made a political commitment to implement the Code, an increase of 40 since 2010. A total of 145 states have nominated points of contact to facilitate the export and import radioactive sources.

69. IAEA (2004), *Code of Conduct on the Safety and Security of Radioactive Sour*ces, IAEA Doc. IAEA/CODEOC/2004, IAEA, Vienna.

70. IAEA (2006), *Code of Conduct on the Safety of Research Reactors*, IAEA Doc. IAEA/CODEOC/RR/2006, IAEA, Vienna.

71. See IAEA (2003), GC Resolution: "Measures to Strengthen International Co-operation in Nuclear, Radiation and Transport Safety and Waste Management", IAEA Doc. GC(47)/RES/7, adopted on 19 Sept. 2003, para. B.4; IAEA (2004), GC Resolution: "Measures to Strengthen International Cooperation in Nuclear, Radiation and Transport Safety and Waste Management", IAEA Doc. GC(48)/RES/10, adopted on 24 Sept. 2004, para. D.7.

In the past decade, ensuring continuous safe and secure management options for disused sealed radioactive sources became an important priority for member states. The increased use of sealed radioactive sources in medicine, industry, agriculture and research has resulted in a growing need for appropriate arrangements for the management of disused sealed radioactive sources, including reuse and recycling, storage and disposal. In the President's findings of the 2013 Abu Dhabi Conference, the development of additional guidance on this topic was recommended.[72] Further to the 2014 General Conference,[73] three Open-ended Meetings of Legal and Technical Experts were convened to develop guidance during 2014 to 2016. The Board's approval of the supplementary Guidance on the Management of Disused Radioactive *Sources* in September 2017 was welcomed by the General Conference that same month, which also endorsed the Guidance while recognising it is not legally binding.[74] The supplementary Guidance aims to consolidate and provide further detail on the management of disused sources, consistent with the provisions of the Radioactive Sources Code of Conduct.[75] The Guidance takes account of the Joint Convention, as well as the relevant IAEA Safety Standards. The Guidance also has a similar status as the supplementary Guidance on the Import and Export of Radioactive Sources, which was first adopted in 2004 and revised in 2011.[76] As of 4 June 2021, 42 states have made political commitments to the Guidance on the Management of Disused Radioactive Sources; 123 member states have made such commitments respecting the supplementary Guidance on the Import and Export of Radioactive Sources.

b. Safety of research reactors

Unlike the 2003 Radioactive Sources Code of Conduct and its supplementary guidance, there is no process foreseen by which states can make political commitments to apply the guidance in the 2004 Research Reactors Code of Conduct.[77] However, feedback from IAEA activities, including international meetings and safety review missions, shows that most member states with operating research reactors are applying the provisions of the 2004 Research Reactors Code of Conduct, including those on regulatory supervision, ageing management, periodic safety reviews and preparation for decommissioning.

72. IAEA (2015), *Safety and Security of Radioactive Sources: Maintaining Continuous Global Control of Sources throughout Their Life Cycle*, Proceedings of an International Conference, Abu Dhabi, United Arab Emirates, 27-31 October 2013, IAEA Doc. STI/PUB/1667, IAEA, Vienna, p. 716.

73. In 2014, the General Conference, in Resolution GC(58)/RES/10, encouraged the IAEA to "improve the long-term management of disused sealed radioactive sources." IAEA (2014), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(58)/RES/10, adopted on 25 Sept. 2014, para. 17. In addition, Resolution GC(58)/RES/11 "call[ed] upon all Member States to ensure that there is adequate provision for safe and secure storage and disposition pathways for disused radioactive sealed sources." IAEA (2014), GC Resolution: "Nuclear Security", IAEA Doc. GC(58)/RES/11, adopted on 26 Sept. 2014, para. 22.

74. IAEA (2017), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(61)/RES/8, adopted on 21 Sept. 2017, para. 26.

75. IAEA (2018), *Guidance on the Management of Disused Radioactive Sources*, IAEA Doc. IAEA/CODEOC/MGT-DRS/2018, IAEA, Vienna.

76. IAEA (2012), *Guidance on the Import and Export of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/IMO-EXP/2012, IAEA, Vienna. The main provisions of the 2004 Guidance were not altered and the biggest change in the 2012 Guidance was to Annex 1 that provides a questionnaire for helping assess a state's ability to safely and securely manage sources.

77. See the September 2004 GC Resolution, IAEA Doc. GC(48)/RES/10, *supra* note 71, paras. A.8.39 and A.8.40, which welcomed the adoption of the Code by the Board in March 2004 and encouraged states to apply the guidance in the Code to the management of research reactors.

The General Conference continues to encourage member states to apply the guidance in the Code at all stages in the life of research reactors, including planning, and encourages member states to freely exchange their regulatory and operating information and experience with regard to research reactors.[78] Further, the General Conference continues to request the Secretariat to provide ongoing support to member states, upon their request, in application of the Code. However, there remains a need for further improvements in several areas, including operational radiological protection, emergency planning and decommissioning planning, as well as regulatory effectiveness.

According to the IAEA Research Reactor Database, the number of research reactors constructed worldwide for civilian applications is about 846. Of the reactors constructed, 222 are currently in operation, 58 are permanently shut down for decommissioning, 13 are in an extended shutdown state and 446 have been decommissioned. More than two-thirds of all operating research reactors worldwide are over 30 years old. Over 20 IAEA member states are planning or implementing projects to establish their first or a new research reactor with the goal of building capacity for embarking on a nuclear power programme and/or to conduct research and development to support industry and national programmes such as those for medical radioisotope production. Developing the necessary safety, regulatory and technical infrastructures in a timely manner continues to be a challenge for member states embarking on new research reactor programmes. This includes the development of an adequate regulatory infrastructure in parallel with the implementation of a new research reactor project. This is primarily because the majority of these member states lack adequate qualified staff and adequate competencies in areas related to safety assessment, construction, commissioning, operation, safe utilisation, and decommissioning, and do not have a clear national strategy for human resource development or for building the necessary competencies. Weaknesses in the establishment of an effective regulatory body and in government support related to its establishment have also been identified during safety review missions.

c. Sharing experiences on implementation of the codes

Since the adoption of the two Codes of Conduct, IAEA member states have recognised that their effectiveness can be strengthened if supported by procedures and mechanisms to promote, review and enable the practical reporting of their effective, full and prompt implementation.

Already in 2006, a formalised process was established for a periodic exchange of information and lessons learnt and for the evaluation of progress made by states towards implementing the provisions of the 2003 Radioactive Sources Code of Conduct and its supplementary Guidance.[79] The formalised process governs the preparation and performance of the meetings organised by the IAEA to discuss the implementation of the 2003 Radioactive Sources Code of Conduct and its supplementary Guidance. The objective of the formalised process was to promote a wide exchange of information and lessons learnt on national implementation of the 2003 Radioactive Sources Code of Conduct and its supplementary Guidance and to facilitate a periodic evaluation of progress made by states towards implementing the provisions of the Code of Conduct.

78. IAEA Doc. GC(64)/RES/9, *supra* note 36, para. 21.

79. See IAEA (2006), “Measures to strengthen international cooperation in nuclear, radiation and transport safety and waste management: Report by the Director General”, IAEA Doc. GOV/2006/40-GC(50)/3, Annex 2, “Report of the Chairman, Meeting of technical and legal experts for Consultations with States with a view to establishing a formalized process for a periodic exchange of information and lessons learned and for the evaluation of progress made by States towards implementing the Code of Conduct on the Safety and Security of Radioactive Sources Vienna, 31 May to 2 June 2006”. This mechanism was called for in the findings of the 2005 International Conference on the Safety and Security of Radioactive Sources, held in Bordeaux, France. IAEA (2006), *Safety and Security of Radioactive Sources: Towards a Global System for the Continuous Control of Sources throughout Their Life Cycle, Proceedings of an International Conference, Bordeaux, 27 June – 1 July 2005*, IAEA Doc. STI/PUB/1262, IAEA, Vienna.

There are two elements to the formalised process. First, dedicated international meetings, organised by the Secretariat, are held every three years (ideally, in the year not currently used for the review processes under the CNS and the Joint Convention). Second, the formalised process enables the holding of regional meetings to share experiences. Since the adoption of the formalised process, four international meetings and one international conference have been held.[80] In addition, several topical meetings have been held. In 2019, the formalised process was revised to include the supplementary *Guidance on the Management of Disused Radioactive Sources* issued in 2018 and the inclusion of inter-regional meetings.[81] The revised process remains to be endorsed by the Board of Governors as was done for the 2006 process.

The formalised process shares some similarities with the review processes held under the CNS and Joint Convention, but also has some notable differences mainly stemming from the fact that the Code is a non-binding instrument. The instruments share a common objective of promoting a wide exchange of information and lessons learnt on national implementation. International meetings have opening and closing plenary sessions, as well as formation of country groups. The IAEA acts as the Secretariat for the international meetings as well as for the meetings under the conventions.

However, unlike the review processes of the CNS and Joint Convention, the formalised process is entirely voluntary. States choose the level of their participation. As a result, some states do not submit reports, but attend to listen to other states' reports and learn from the discussions. There is no obligation on states to make an oral or poster presentation, even if they have submitted a national paper. Some states submit reports, but are uncomfortable discussing security issues in a public forum and therefore do not report on that aspect of the Code.[82] Some states that have not made a national political commitment to the Code have nevertheless participated in the information exchange process.

The formalised process is clearly not as well developed as the conventions' review processes that operate on the basis of three supporting documents (rules of procedure and financial rules, guidelines regarding the review process, and guidelines regarding national reports).[83] Nonetheless, guidance for the preparation of voluntary national papers has been developed, as has a template that can be used on a voluntary basis. Further, unlike the reports under the conventions, the report on implementation of the Code is not on a provision-by-provision basis. Unlike the CNS and Joint Convention, there are no preparatory organisational meetings. Allocation of states to country groups for Code meetings is done initially alphabetically, with discretion for the Secretariat to adjust that allocation to ensure that there is an approximately even spread of experience across the groups. This is different from the allocation of contracting parties to the country groups under the CNS and the Joint Convention. The conventions' meetings result in a summary report addressing the issues discussed and the conclusions reached during the meeting and a president's report summarising observations, conclusions and decisions taken by the contracting parties. The meetings of the formalised process result in a report of the Chair that reflects broad outcomes of the discussions grouped under broad themes but does not identify any

80. The 2013 Abu Dhabi International Conference replaced the regular exchange of information meetings on the Code of Conduct and its supplementary guidance.

81. IAEA (2020), "Nuclear and Radiation Safety: Report by the Director General", IAEA Doc. GOV/2020/35-GC(64)/7, Annex 1, "Code of Conduct on the Safety and Security of Radioactive Sources, Revision of the Formalized Process".

82. McIntosh S. and K. Cutler (2015), "The Code of Conduct on the Safety and Security of Radioactive Sources; Past, Present and Future", in Proceedings of an International Conference, Abu Dhabi, United Arab Emirates, 27-31 October 2013, *supra* note 72, pp. 67, 75.

83. See guidance on the CNS and Joint Convention, *supra* notes 37 and 38.

participating state by name (as happens in the summary reports of the conventions' meetings). Both the formalised process of the 2003 Radioactive Sources Code of Conduct and the review process of the conventions show an increasing focus on the importance of transparency. After each international meeting, each state should indicate whether its national paper should be made publicly available by the Secretariat. With respect to the conventions, as noted above, the Secretariat now makes publicly available each national report within 90 days after the review meeting unless the contracting party concerned notifies the Secretariat otherwise.

Although no formalised process for information exchange has been established for the 2004 Research Reactors Code of Conduct, four international meetings to discuss its application have been held, in 2008, 2011, 2014 and 2017. The meetings enable participants to share and discuss the results of self-evaluations of their application of the 2004 Research Reactors Code of Conduct. The most recent meeting, originally planned for June 2020, was held virtually in June 2021, due to the global pandemic. In addition, regional meetings on application of the 2004 Research Reactors Code of Conduct are held between the international conferences. In these meetings, the focus is on application of specific areas of the 2004 Research Reactors Code of Conduct in which there is a common interest within the region. Finally, it is noted that those countries with operating research reactors that are contracting parties to the CNS are voluntarily reporting on research reactors in CNS review meetings.

C. Current and future challenges and opportunities

1. Potential future international deployment of SMRs

During the past two decades, advanced novel reactor technologies have emerged with the potential of meeting the common needs and concerns of many countries, including developing countries. *These advanced* technologies include a group of low power (electric power less than 300 MW per module)[84] reactors for commercial use frequently referred to as SMRs.

More than 70 SMR designs are currently in various stages of design and development, and a few concepts are close to deployment in more than 16 IAEA member states, representing both industrialised and developing countries.[85] SMRs can be used for a variety of purposes and applications including both baseload electricity generation in an interconnected electricity grid and non-electric applications such as district heating and sea-water desalination. SMRs comprise both evolutionary and innovative reactor technologies, in all major reactor lines and coolant types, the latter falling within the framework of Generation IV nuclear energy systems.[86] However,

84. Or less than 1000 MW(t) per module. IAEA (2005), *Innovative Small and Medium Sized Reactors: Design Features, Safety Approaches and R&D Trends, Final report of a technical meeting held in Vienna, 7-11 June 2004*, IAEA Doc. IAEA-TECDOC-1451, IAEA, Vienna. As categorised by the IAEA, small reactors are those with an equivalent electric power less than 300 MW; medium sized reactors are the reactors with an equivalent electric power between 300 and 700 MW.

85. IAEA (2020), *Advances in Small Modular Reactor Technology Developments, 2020 Edition, A Supplement to: IAEA Advanced Reactors Information System (ARIS)*, IAEA, Vienna.

86. There are six Generation IV designs: the 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 the People's Republic of China (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 website for more information, available at: www.gen-4.org.

SMRs closest to commercial operation are light water reactors (LWRs), the leading reactor type currently deployed worldwide.[87]

To date, there are no concrete examples of the international deployment of SMRs to technology recipient countries.[88] However, a broad scale future international deployment can be expected to lead to the location of more nuclear reactors in more countries than the 31 currently relying on nuclear power or the nearly 30 that are considering, have started planning or are well advanced in introducing nuclear power. For some, this may be a cause for concern, likely to be exacerbated with the entry into the existing community of 31 nuclear power plant countries by countries with limited or no experience in the unique requirements of complex nuclear technologies. Coupled with this is an increase in the international transport of nuclear material and possibly factory fuelled reactors. An overriding factor that affects the importance of addressing the issues raised by SMRs is the potential speed of deployment of such reactors, which is substantially less than that for existing large conventional nuclear reactors.

a. SMRs' novel characteristics

While all SMRs are not equal as compared to conventional stationary large nuclear power plants, many share common specific and often novel characteristics, that are interrelated, in terms of facility size, use of novel technologies, modular design and deployment models. The potential for SMR development poses both opportunities and challenges. On the one hand, there are many positive features associated with SMRs' potential. The common specific and often novel characteristics are the driving forces in their development and support the potential promise of their attainability by developing countries. These novel reactor technologies have the potential to enable developing countries to benefit from nuclear technology and serve as an appropriate option in addressing sustainable development goals.

On the other hand, realising a potential future SMR deployment to countries worldwide, including developing countries, presents several challenges. SMRs' specific characteristics raise policy, legal, regulatory and technical issues that are being discussed and will need to be adequately addressed. Here, the focus is on the legal issues with respect to SMRs' potential, which implicate the international legal framework for nuclear safety.

Proponents of SMR technologies are seeking licensing processes that are modified, adapted and simplified to address some of the unique features presented by SMRs, such as smaller size, difference in design and alternative approaches for construction including modularity. They

87. Dozens of LWR SMR designs are being prepared for near-term deployment, including the ACP-100 in China and NuScale in the United States.

88. Two industrial demonstration SMRs are in advanced stages of construction: in Argentina (CAREM, an integral pressurised water reactor (PWR)) and in China (HTR-PM, a high temperature gas-cooled reactor). They are scheduled to start operation between 2021 and 2023. The system-integrated modular advanced reactor (SMART) is an integral PWR (iPWR) with a rated electrical power of 107 MW(e) from 365 MW(t). In September 2015, a pre-project engineering agreement was signed between Korea and Saudi Arabia for deployment of SMART. See also note 88 *infra* regarding the first floating nuclear power plant or transportable marine-based nuclear power plant of the Russian Federation, the Akademik Lomonosov. In addition, in March 2017, the US Nuclear Regulatory Commission (NRC) accepted NuScale Power's SMR design certification application. In September 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 final design certification rule from the regulator by March 2022. Upon receiving full certification, utilities will be able to reference the design when applying for a combined licence to build and operate the new reactors in the United States. The Utah Associated Municipal Power Systems has a target commercial operation date of 2027 for the first NuScale plant, to be built in Idaho. NuScale has signed agreements with entities in Canada, the Czech Republic, Jordan and Romania to build future plants. The NRC is also reviewing the nation's first boiling water SMR design developed by GE-Hitachi.

highlight that current design and licensing rules are applicable to mostly large water reactors, and they indicate a need for internationally common rules for design, safety assessment and licensing for new innovative reactors

SMRs use many novel design features not widely analysed or licensed by regulatory bodies internationally. Some SMRs employ evolutionary (and others even innovative) design features presenting new design philosophies and safety systems. Many SMRs also present novel approaches to the life cycle, mainly associated with the construction, commissioning and decommissioning stages. For example, an important feature common to many SMR designs is that the plant largely can be built in a factory located in a vendor country to an identical design as serial engineered modules and then transported as modules (with or without fuel in the core) to a site for installation as demand arises. In this context, SMRs shift the balance of construction activity from the plant site to a factory, such as a manufacturing facility that may not be in the country where the SMR will be operated.

Finally, some SMRs also present novel approaches to deployment. Some may be deployed internationally as land-based fuelled reactors (with fuel already in the core) or operated as marine-based. Such SMRs would be factory manufactured, fuelled, tested (at its commercial power levels) and sealed in a facility or facilities in an SMR vendor country. The SMR could be transported, for example, by sea to another country for installation and operation. During this relocation, the reactor would stay in shutdown condition but some equipment such as its residual heat removal system or its instrumentation and control (I&C) systems (at least the 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 its operating cycle in the recipient country, the SMR would be returned loaded with irradiated fuel to the vendor state for refuelling and maintenance. It could then be returned to the SMR recipient, sent to another state or utilised in the vendor state. Such transport will be an integral part of SMRs' life cycle and essential for their development and utilisation worldwide. Some SMRs may be located on a barge or ship but the reactor would not provide a means of propulsion. One barge for a transportable nuclear power plant[89] – a subset of SMRs – has already been deployed in the country of origin.[90] Transportable nuclear power plants, transportable fuelled SMRs and those that SMRs that may be marine-based, pose challenges to the existing frameworks. They represent a special case, giving rise to specific issues and challenges, particularly in the context of international maritime transport.[91]

89. IAEA (2020), *Nuclear Safety Review 2020*, IAEA Doc. GC(64)/INF/3, IAEA, Vienna.

90. On 19 December 2019, the first floating nuclear power plant or transportable nuclear power plant of the Russian Federation, the Akademik Lomonosov, commenced operation in Pevek, in the Chukotka region of the Russian Federation. See IAEA PRIS, available at: https://pris.iaea.org/PRIS/CountryStatistics/CountryDetails.aspx?current=RU (accessed 14 June 2021). The KLT-40S is a 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 transportable nuclear power plants, 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 of 300 MW(e).

91. For a discussion of transportable nuclear power plants, see IAEA (2013), *Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study*, IAEA Nuclear Energy Series, No. NG-T-3.5, IAEA, Vienna; and International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO), "Case Study for the Deployment of a Factory Fuelled SMR" (in development), IAEA, Vienna.

b. An enabling environment for a potential future international SMR deployment

These specific SMR characteristics necessitate developing, internationally and nationally, 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. As considered here, this enabling environment concerns the following five elements:

Firstly, developments needed to demonstrate the availability of proven technology, such as to move from first-of-a-kind (FOAK) to Nth-of-a-kind (NOAK). The second element concerns reaching common positions on several technical and regulatory issues, including those related to the fundamental principles of defence in depth and the graded approach. The third element concerns the applicability of international legal frameworks, including on nuclear safety, to SMRs given their specific characteristics such as concerns potential deployment models. The fourth element concerns the fulfilment of technology recipient countries' obligations and normative expectations. In this context, the enabling environment concerns the development and implementation of a national nuclear infrastructure in SMR recipient countries that provides governmental, legal, regulatory, managerial, technological, human resource, industrial and stakeholder support. The required infrastructure 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. While this element is clearly relevant for embarking countries launching traditional nuclear power programmes, there are some aspects that can be highlighted in the context of a potential future SMR deployment, for example, the alignment of SMR programme and infrastructure development schedules. The final element concerns addressing the call for regulatory certainty in terms of the deployment of standardised modules in different countries.

b.1. Demonstrating the availability of proven technology

Readers will understand that a proven, safe, secure and economically competitive technology (not only vis-a-vis large nuclear power plants but also other energy sources) is essential to future SMR deployment as considered in this article.[92] Many, if not all recipients, will want to see successful on-schedule SMR projects in the country of origin that meet the design objectives of SMRs.[93] 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 FOAK demonstration plants. In moving to the next step of wide-scale deployment, some SMR developers and vendors can be expected to team with experienced engineering, procurement and construction contractors with strong track records.

92. The need for a proven, robust and efficient technology licensed in the technology holder's country expressed by developing countries in the case of nuclear power plants can be expected to be of equal if not of increased importance in the case of SMRs. The "proven technology" technical criterion is typically assigned a significant weighting factor in the process of reactor technology assessment. See IAEA (2013), *Nuclear Reactor Technology Assessment for Near Term Deployment*, IAEA Nuclear Energy Series, No. NP-T-1.10, IAEA, Vienna.

93. However, it is noted that Saudi Arabia agreed to collaborate on the commercialisation of the Korean-designed SMART reactor. Although the reactor received standard design approval from the Korean regulator, the Nuclear Safety and Security Commission, in mid-2012, there is no demonstration project in operation in Korea or elsewhere.

Modularisation in design and deployment is a key element of SMRs' purported scalability and affordability and a key driving force in their development. The economics of building SMR production facilities hinges upon the actual or potential number of SMR orders a vendor has, this in turn being particularly important for achieving SMR competitiveness.[94] A precursor for successful modularisation and a critical design philosophy is standardisation of design, which can enable serial mass production of standardised SMRs. Such serial production is dependent on regulatory certainty. This is why, as discussed here, it will be important to develop an enabling environment for SMR deployment that addresses not only the needs and limitations of many recipient countries, including developing countries, but also the need for regulatory certainty in different countries.

b.2. Reaching common positions on several technical and regulatory issues

There are several technical and regulatory issues stemming from SMRs' characteristics to be resolved. Some of the issues include those related to the fundamental principles of defence in depth and graded approach, as well as validation of enhanced passive safety systems, multi-modular deployment, staff requirements for operation and security, emergency planning zone requirements, and the interface between construction, commissioning, operation and other site-related issues.

Significantly, 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 IAEA continues to consider the legal, regulatory, technical, licensing, safety and security aspects of SMRs throughout their life cycle. Various IAEA activities are ongoing, including through the INPRO created in 2001 and the Technical Working Group on Small and Medium Sized or Modular Reactors (TWG-SMR) established in 2018 (albeit now disbanded), and the SMR Safety Working Group established in 2020 to review the applicability of the Safety Standards to SMRs and other novel advanced reactors. The IAEA also continues to support the Small Modular Reactor Regulators' Forum created in 2015, through which the regulatory bodies of member states work to identify and enhance understanding of key regulatory and licensing challenges and work together on technical issues and on issues of harmonisation of regulatory approaches. Further, the IAEA is organising a series of meetings on "Next Generation Reactors and EPR" in which discussions may be held among new reactor technology developers, regulators and EPR experts and grounds can be built for consensus on approaches to definition of necessary EPR arrangements for these new reactors.

b.3. Ensuring applicability and suitability of the international nuclear legal instruments and standards

Importantly, in the context of potential future international deployment of SMRs, it is prudent to consider whether the existing body of international legal instruments and the IAEA Safety Standards will provide an adequate backstop to cope with the potential challenges of SMR deployment worldwide.[95] Starting with the standards, a review is currently ongoing at the IAEA. This article

94. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, OECD Publishing, Paris; NEA (2016), *Small Modular Reactors: Nuclear Energy Market Potential for Near-term Deployment*, OECD Publishing, Paris.

95. In the context of traditional nuclear power plant new build, 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?" See *Pelzer*, *N.* (*2009*), "*Nuclear New Build – New Nuclear* Law?", *Nuclear Law Bulletin*, No. *84*, OECD Publishing, Paris, pp. *5, 6*.

offers some insights that may be confirmed or elaborated further as part of the ongoing IAEA work. It is expected that many of the safety standards are broadly applicable. However, there will be some areas about which further discussion is necessary, for example, the applicability of the design safety standards to innovative technologies. As addressed below, another important area may be the application of the IAEA Transport Regulations and Safety Standards to the international maritime transport of factory fuelled SMRs and marine-based SMRs.

Turning now 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 article. Addressing questions of treaty interpretation and application is a complex task and, in this article, 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 interpretative process and in which order they are to be applied.[96] We simply highlight here that authoritative treaty interpretation and application are matters for the parties to the relevant treaty.

As may be expected, most of the international legal instruments on safety do not expressly address SMRs. 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. A simple approach in determining the potential applicability of the nuclear safety conventions to SMRs can be based on a good faith based interpretation of the text, bearing in mind the purpose of the treaty and its remaining text. The approach is aimed at determining whether an SMR, its nuclear material or related activities such as transport or spent fuel and radioactive waste management, fall within the scope of application and existing legal definitions of the nuclear safety conventions. 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 radioactive material when being sent to or from this country.

In this regard, some instruments, like the Early Notification Convention, have been crafted to address a broad range of facilities and activities under which SMRs may fall.[97] They are of a generic and comprehensive nature, being technology neutral. They make no distinction between the type of material, facilities or activities that fall within their scope of application. Further, in some cases the drafters expressed themselves in language that was carefully chosen rather than in loose and general terms. For example, the drafters of the nuclear liability instruments purposely limited the scope of their application so as not to apply to questions of civil liability for nuclear

96. Vienna Convention on the Law of Treaties (1969), 1155 UNTS 331, entered into force 27 Jan. 1980. 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 (VCLT, Article 31). 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 (VCLT, Article 32). 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.

97. The main focus of the Early Notification Convention 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 Convention (i.e. Article 3).

damage arising from a nuclear incident during the operation of nuclear ships.[98] Likewise, the CNS was thoughtfully crafted to limit its scope of application to land-based nuclear power plants only (Article 2(i)). This would appear to rule out those SMRs that may be marine-based. However, it is noted that in the context of the peer review process, the contracting parties, having in mind the safety objectives of the CNS, expressly agreed that they could follow the guidelines regarding the national reports for reporting on a voluntary basis the safety of other types of civilian nuclear reactors.[99] Reporting by contracting parties therefore, albeit on a voluntary basis, could apply to marine-based SMRs, as some contracting parties currently do with regard to research reactors. The contracting parties to the CNS and the Joint Convention have made consensus-based decisions respecting the peer review process and national reporting in order to enhance their efficacy and respond to events, which shows that this can be done.

It is not possible to go through all the instruments in this concise article with a view to how SMRs would be treated specifically in each, as it seems clear that, within a single instrument, an SMR may be defined differently for the purposes of transport than when in a fixed position in a recipient country. For the most part, though, whether as a facility, as material or in relation to an activity like transport, SMRs appear to fall within the scope and definitions of the existing corpus of international instruments, standards and guidance, as well as other texts. Doubtless, over the coming years, further consideration will be given to whether the current international legal framework for nuclear safety adequately addresses SMRs. In this context, 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 multilateral efforts to be limited, with recourse being made to bilateral arrangements. Nonetheless, given the potential speed with which SMRs can be deployed in the future, it would be prudent to begin reviewing the current international legal framework, as any changes are likely to take some time to agree and implement.

b.3.i. International maritime transports of factory fuelled SMRs and marine-based SMRs

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, which applies to all modes of transport. The record of the worldwide transport of nuclear fuel cycle material, such as fresh and spent nuclear fuel, high-level waste and mixed oxide (MOX) fuel, is a successful and safe one, with tens of thousands of safe shipments over more than 50 years.[100]

98. Handrlica, J. (2019), "The Rijeka Draft of a Convention on the Liability of Operators of Nuclear Ships: Very Late Requiem", *Zbornik Pravnog fakulteta Sveučilišta u* Rijeci [Collected papers of the Law Faculty of the University of Rijeka], Vol. 40, Issue 3, Faculty of Law, University of Rijeka, Croatia, pp. 1153-1174.

99. IAEA (2015), "Guidelines regarding the National Reports under the Convention on Nuclear Safety", IAEA Doc. INFCIRC/572/Rev.5; a further revision was issued in January 2018 as INFCIRC/572/Rev.6.

100. 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. See IAEA (n.d.), "Transport security", available at: www.iaea.org/topics/transport-security (accessed 14 June 2021).

However, the international transport of a fuelled reactor is different from the worldwide transport of such nuclear fuel cycle material. This is also distinct from nuclear powered vessels; although the transport of a fuelled reactor or a transportable nuclear power plant may have similarities to nuclear powered vessels, they are distinct and may possibly represent a new category for which nuclear safety norms, standards or best practices will need to be developed.[101]

There is a need to ensure application of safety requirements for the safe international maritime transport of SMRs. In this context, two considerations with respect to the transport of certain types of nuclear material can be discussed. The first consideration is the transport package that 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 that are the 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 that meets prescribed requirements and performance testing criteria, while irradiated reactor fuel is required to be contained in a Type B Fissile package that meets other requirements and performance testing criteria. Since 2001, the IAEA Transport Regulations have been incorporated as Class 7 (Radioactive Material) into the UN Recommendations on the Transport of Dangerous Goods Model Regulations,[102] which in turn are incorporated into the IMO International Maritime Dangerous Goods (IMDG) Code,[103] which is made mandatory through Chapter VII (on the carriage of dangerous goods) of the 1974 SOLAS Convention (as amended).[104]

The second consideration with respect to the transport of certain nuclear material is the transport vessel that will convey the cargo. This matter is addressed by the IMO INF Code that in January 2001 was also made mandatory through Chapter VII, Part D, Regulation 15 of the 1974 SOLAS Convention (as amended).[105] The INF Code addresses the construction, equipment and

101. UNCLOS does not include a specific definition for "ship" or "vessel". Under the IMO's existing regulatory framework, there is no unified definition for "ship" and the status of a transportable nuclear power plant, i.e. as a ship or not, is undefined. Under the International Convention for the Safety of Life at Sea (1974), 1184 UNTS 2, entered into force 25 May 1980 (SOLAS Convention), there is no definition for "ship". However, a "nuclear ship" is defined as one provided with a nuclear power plant. *Ibid*., Annex, Chap. I, Part A., Regulation 2(j). Moreover, Chapter VIII (Nuclear ships) of the Annex to 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 Nov. 1981. The IMO Code was adopted as a guide on internationally accepted safety standards for the design, construction, operation, maintenance, inspection, salvage and disposal of nuclear merchant ship. The IMO Code superseded the Recommendations Applicable to Nuclear Ships annexed in Attachment 3 to the Final Act of the 1974 SOLAS Convention. Resolution A.491(XII), *supra*, para. A.1. Platforms or barges that have no propulsion system are not covered by the 1974 SOLAS Convention per the Annex, Chapter I (General Provisions), Part A (Application, Definitions, etc.), Regulation 3(a)(iii). Under the IAEA Transport Regulations, Specific Safety Standards, No. SSR-6 (Rev.1), *supra* note 13, a "vessel" is defined as "any sea-going vessel or inland waterway craft used for carrying cargo".

102. UNECE (2019), *UN Recommendations on the Transport of Dangerous Goods – Model Regulations*, 21st revised edition, UN, Geneva. The recommendations are developed by the UN Economic and Social Council's Sub-Committee of Experts on the Transport of Dangerous Goods.

103. IMDG Code (2018 edition), including Amend. 39-18, came into force on 1 Jan. 2020; IMDG Code (2020 edition), Amend. 40-20, comes into force on 1 June 2022 and may be applied voluntarily as from 1 Jan. 2021.

104. Chapter VII, Part A, Regulation 3. See IMO, International Convention for the Safety of Life at Sea (SOLAS), International Maritime Organization, 1974.

105. 1999 International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships, Resolution MSC.88(71), adopted by the IMO Maritime Safety Committee on 27 May 1999 (INF Code).

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 the UN Convention on the Law of the Sea (UNCLOS),[106] a ship carrying nuclear materials 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)[107] and applies the IMDG Code as concerns Class 7 (Radioactive Material) and the INF Code as concerns INF Cargo.[108]

In light of these two considerations, the issue with respect to the transport of a 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) so as to 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.

Another issue concerning a future international maritime transport of fuelled reactors is the potential to reignite the debate over fundamental principles of territorial sovereignty of a coastal state and the freedom of the seas by a flag state. SMR transports, as is the case for the international maritime transport of radioactive material, are likely to be of concern to the international community, thereby requiring an internationally co-ordinated 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 MOX fuel by foreign-flagged vessels from the early 1990s to the mid-2000s. Calls mainly stemmed from coastal states that lay along or close to the actual or potential transport routes, many of which were concerned about lack of information that 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.

Since that time, much has been done to allay concerns. Today, there exists enhanced voluntary dialogue between flag and coastal states, bilaterally and within the framework of the IAEA. In the early 2000s, the informal consultation Coastal State-Shipping State Dialogue mechanism was established on 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

106. UN Convention on the Law of the Sea (1982), 1833 UNTS 397, entered into force 16 Nov. 1994.

107. IMO (2014), *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)*, IMO Doc. LEG/MISC.8.

108. 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.

Level Radioactive Waste and, as appropriate, Irradiated Nuclear Fuel by Sea" have been in place.[109] Significantly, the practice of some shipping states has been to avoid the territorial seas and EEZs of some states.

Looking forward, it will clearly be essential that activities involving radiation exposure, such as the potential future international transport of SMRs, be subject to certain standards of safety. The current high level of safety 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 worldwide SMR deployment, including fuelled reactors, should not undermine the current level of confidence that agreed levels of safety are met when radioactive material is being transported around the world. In this context, it is reasonable to expect that any future effort to strengthen the international legal 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 will be limited, with recourse being made to bilateral arrangements.

b.4. Supporting fulfilment of technology recipient countries' obligations, standards and normative expectations

It is well understood that nuclear safety is a national responsibility that cannot be outsourced. In this light, the decision to embark on an SMR programme must be an informed one, including governmental commitment to the required national and international obligations for a technology recipient country to effectively move forward to other phases of SMR programme preparation and implementation processes. This commitment 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. This commitment also entails ensuring the existence of a strong national infrastructure that can guarantee continuing attention to safety.[110] In fulfilling their obligations and commitments, SMR recipients will need to be intelligent, competent and knowledgeable customers. These requirements are clearly applicable in the case of traditional nuclear power plants. Further, no different from the requirements in the case of a nuclear power plant programme, a sufficient level of technical, legal and commercial knowledge is required, and sole reliance on technical support from the SMR vendor or other bodies from outside the country is neither possible nor practicable.

However, as touched upon here, potential future SMR deployment may involve special considerations. For example, SMR deployment to recipient countries that are also developing countries can entail a need for significant bilateral and multilateral support, beyond that currently observed due to modularisation, licensing and regulatory oversight of a new technology and because some vendors may offer alternative approaches not widely applied in the context of traditional nuclear power plants.

A major challenge can be expected regarding the development and implementation of an appropriate national nuclear safety infrastructure and knowledge base to support the successful introduction of an SMR programme. In this context, SMR recipients will need to develop an effective and comprehensive legislative and regulatory framework, including a regulatory body

109. IAEA (2014), "Communication dated 15 April 2014 received from the then Resident Representative of Norway to the Agency regarding the Working Group on 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 Doc. INFCIRC/863.

110. Annual Letter of Assessment to Y. Amano, IAEA Director General, from Dr R. Meserve, Chairman of INSAG (26 July 2011).

as an effectively independent authority for regulatory control with sufficient financial and human resources and legal authority for preparing and issuing regulations and guides by which the SMR will be assessed, licensing, inspection and enforcement. Various international legal instruments and IAEA standards and guidance set out the core functions that the regulatory body should perform for effective regulatory control. The Fukushima Daiichi nuclear power plant accident highlighted the imperative of establishing an effective regulatory framework for nuclear power plants, including an independent (in law, practice and culture) and effective expert regulatory body that is credible, trusted, competent and adequately resourced. In the context of licensing the first traditional nuclear power plant, INSAG-22[111] identifies Phase 2 of the Milestones Approach as being critical for the establishment of a regulatory body. 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 framework and to undertake the initial activities including the development of regulations, guides and a licensing process.[112] The regulatory body should establish a comprehensive human resources programme to develop the specialised areas of competence to conduct its activities in Phases 2 and 3.

In the context of a potential future international SMR deployment, the need for significant bilateral and multilateral support can be expected. Strengthened bilateral co-operation will be essential to enabling successful international SMR deployment, in particular, in supporting the establishment of a fully competent and functional regulatory body (such as through training of selected staff, provision of experts, assistance and education in adapting safety evaluations) and developing national regulations, guides and licensing.[113] As highlighted above, many SMR recipients can be expected to rely heavily on the support of an SMR vendor country and its regulatory body, for example, stemming from modularisation and the specificities of SMR licensing. Some SMR vendors will offer, and some newcomers will likely be interested in, different or alternative ways of overcoming developmental challenges associated with a highly sophisticated technology, especially in terms of operational capability. The choice of an SMR vendor will not only affect the development and implementation (including schedule) of the SMR programme and projects but can also affect the design of the legislative and regulatory framework, including the licensing process.

The licensing of the first SMR in recipient countries will require early development of the regulatory body. Similar to traditional nuclear power plant newcomers, inexperienced regulators in SMR recipients will clearly be challenged in seeking to license their first SMRs.[114] For these countries, the development of a comprehensive set of national regulations and guides addressing nuclear safety will require significant efforts. 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 guides and standards). In the context of the first nuclear power plant, it is expected that the "reference plant" concept will be employed, by which the country's first nuclear power plant would have essentially the same design and safety features as a nuclear power

111. IAEA (2008), *Nuclear Safety Infrastructure for a National Nuclear Power Programme Supported by the IAEA Fundamental Safety Principles*, INSAG-22, IAEA, Vienna. See also IAEA (2015), *Milestones in the Development of a National Infrastructure for Nuclear Power*, IAEA Nuclear Energy Series, No. NG-G-3.1 (Rev. 1), IAEA, Vienna.

112. IAEA (2012), *Licensing the First Nuclear Power Plant*, INSAG-26, IAEA, Vienna.

113. For recent examples of how traditional nuclear power plant newcomers and expanding countries have addressed some of the issues see IAEA (2021), *Experiences of Member States in Building a Regulatory Framework for the Oversight of New Nuclear Power Plants: Country Case Studies*, IAEA Doc. IAEA-TECDOC-1948, IAEA, Vienna.

114. See the "Tallinn Declaration on the Future of SMR Licensing", signed by nine European companies in Tallinn, Estonia, on 9 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.

plant that is already licensed by an experienced regulator.[115] Consequently, an option is to start development of national regulations by adopting or adapting regulations from the vendor country (or an experienced country that has licensed the same type of technology, if one exists), although this would not necessarily lead to a set of technology neutral regulations. In any case national regulations should be developed to cover the localisation of the plant and the analysis of site-specific issues.

For nuclear power plant exports, in addition to the common practice of a recipient's regulator considering international good practice and IAEA Safety Standards, the assessments undertaken by a foreign regulatory body, including those of the vendor country, are also considered.[116] This 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 preliminary safety analysis report (PSAR), the regulatory body could learn considerably from the existing safety evaluation report 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.[117] 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. Significantly, a recipient's regulatory body will also need to develop the competencies to respond to programme development in a timely manner without compromising safety.

b.4.i. Alignment of SMR programme and infrastructure development schedules

In the coming years, efforts to seek greater regulatory convergence between SMR vendor countries and potential recipients can be expected. 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. In this context, it will also be important for both SMR vendor countries and potential newcomers to fully understand, plan and incorporate into their SMR programme and project plans the time required for the development of the necessary national nuclear infrastructure in newcomer countries.

A trend has been observed in traditional nuclear power plant programmes and projects, as well as research reactor projects, whereby project milestones, such as site licensing, bids and construction, are outpacing the development of the necessary legal, regulatory and technical safety infrastructure. As a result, undue pressure can arise on the relevant organisations, including the regulatory body, to make sure that staff are recruited in time and trained in the requisite components of nuclear safety.

While several years may be needed from the initial consideration of an SMR programme to its operation, long lead times that typically arise in conventional nuclear power plant programmes and projects may not occur in the case of some SMR deployment.[118] SMRs aim to significantly reduce

115. INSAG-26, *supra* note 112.

116. *Ibid*.

117. *Ibid*.

118. One of the main aspects of nuclear power development programmes and the implementation of nuclear power plant projects is the fact that long lead times are involved mainly due to preparatory actions and unanticipated construction delays. 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. IAEA (2015), *Milestones in the Development of a National Infrastructure for Nuclear Power*, *supra* note 111, p. 2. In the context of a research reactor programme, this period is about five to ten years. IAEA (2012), *Specific Considerations and Milestones for a Research Reactor Project*, IAEA Nuclear Energy Series, No. NP-T-5.1, IAEA, Vienna, p. 9. These periods may clearly vary depending on the resources devoted to the programme and projects.

the typically lengthy construction period for large nuclear power plants that span six to seven years to approximately three to five years.[119] At the same time, as shown by some nuclear power plant new build programmes, there is also the possibility for very aggressive schedules to be planned by SMR developers. Such planning needs to take into account the necessary early regulatory activities, such as establishing the regulatory framework and conducting the licensing process.

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) can be complex and takes time.[120] Experience from IAEA missions including IRRS, International Physical Protection Assessment Service and Integrated Nuclear Infrastructure Review (INIR) missions has identified a lack of competent staff, insufficient financial resources, insufficient independence, lack of an appropriate regulatory framework and inability to hire external experts as challenges for countries new to nuclear power programmes.

SMR recipients' regulators need competencies and capabilities to make safety-focused decisions. Even if the regulator has experience with research reactors, it is recognised for nuclear power plants 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 PSAR.[121] Challenges observed by the above-mentioned IAEA missions include the development and implementation of regulations and guides, a licensing process and an inspection programme on a timescale consistent with the nuclear power plant implementation schedule.[122] Given the potentially steep learning curve to develop the needed competencies to regulate in an SMR-recipient country, careful management of potential future SMRs deployment must account for the time this may require. Clearly, there is a need to avoid undue pressure on the regulatory body, which could affect its effectiveness and independence, including pressure related to the timing for licensing. SMR recipients should therefore ensure that the regulator is 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.

b.5. Toward harmonisation of regulatory requirements

The business model for SMRs contemplates multiple standardised units being deployed in many places. Regulatory certainty is essential for successful deployment of standardised modules in different countries. At the same time, regulating safety is a national responsibility, as embodied in the relevant international legal instruments. Each national regulator is bound by law to apply its national safety regulations and requirements and licensing process, which have a basis in each country's legislation. This results in the challenge to maintain national responsibility for regulating and national requirements in a way that states can realise the potential benefits that are offered by SMRs.

119. This may be attributed to a reduction in scale (smaller footprint), learning through experience, increased 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. See IAEA (2018), *Deployment Indicators for Small Modular Reactors*, IAEA Doc. IAEA-TECDOC-1854, IAEA, Vienna, pp. 8-10.

120. IAEA (2021), *Integrated Nuclear Infrastructure Review (INIR): Ten Years of Lessons Learned*, IAEA Doc. IAEA-TECDOC-1947, IAEA, Vienna.

121. INSAG-26, *supra* note 112.

122. *Ibid*.

The IAEA *INSAG*[123] considers that, if the contemplated benefits of advanced designs are to be realised, the licensing system should be modernised. In a similar vein, members of the IAEA SMR Regulators Forum agree that while efficiencies can be gained in existing processes, it is not necessary to develop new licensing processes for SMRs in many cases because existing processes are sufficient.

Some SMR proponents have advocated international licensing solutions, ranging from validating and accepting design approvals to international design certification. In this context, harmonisation of national safety requirements is a prerequisite for common reactor design acceptance to facilitate the deployment of standardised modules, this being fundamental to SMRs commercial viability.

Distinct from such proposed solutions, another view is that common reactor design acceptance can be achieved without harmonising all requirements through co-operation and the potential utilisation of the regulations and requirements of a vendor country and the sharing of design assessments, which for traditional nuclear power plants is at times the practice. Further, today, there is a degree of harmonisation of basic safety requirements in high-level regulatory documents and, at least partially, in legal provisions[124] that are based on the fundamental principles and address common elements. Regulations in each country are typically developed in light of the IAEA Safety Standards (and nuclear security guidance), as well as inputs from stakeholders such as industry, scientific bodies, government and the public. Regulatory co-operation and information sharing among national nuclear regulatory bodies can also contribute towards greater harmonisation and alignment through the sharing of lessons and regulatory reviews. Such co-operation on a bilateral and multilateral basis has long been an important aspect of nuclear safety, and with the novelty of the innovative SMR designs, such international collaboration with a common view to nuclear safety may be considered key. There is a need to ensure that the national obligations and responsibilities for licensing are maintained in the country where SMRs are intended to be operated while also providing a licensing system that facilitates deployment of fuelled SMR modules produced in another country. Currently, each country's regulator would remain responsible for a comprehensive licensing and oversight process. Moreover, national regulatory processes must not be subordinated or limited by foreign decisions.

In moving forward, enhanced utilisation of IAEA services can be expected, including utilisation of the Milestones Approach[125] and INIR missions, which is a holistic IAEA peer review (conducted by a team of IAEA staff and international experts who have experience in nuclear power programmes and infrastructure development). In parallel to the review of the technological aspects, a regulatory body may consider the use of the IAEA's safety review services to review the compliance of reactor designs against the IAEA Safety Standards and the management of the licensing framework. While such assistance is generic in nature and cannot replace the detailed review required to license a particular design, it can provide a regulatory body with a valuable starting point for its future activities.

123. 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. INSAG has the objective of providing authoritative advice and guidance on nuclear safety approaches, policies, and principles.

124. There is also a need to pursue internationally accepted codes and standards as many countries have developed their own, such as mechanical codes or I&C codes. There are common standards in defining overarching utility requirements for new reactor designs such as in the United States, Electric Power Research Institute's Utility Requirements Document, and in Europe, the European Utility Requirements.

125. The consideration of SMRs is being further explored subject to the work done by the SMR Regulators' Forum and the expected near-term deployment of FOAK SMR design. See IAEA (2020), "Strengthening the Agency's Activities related to Nuclear Science, Technology and Applications: Report by the Director General", IAEA Doc. GOV/2020/28-GC(64)/5.

Further, SMR recipients can be expected to participate in the various multiple international and regional networks, initiatives and technical co-operation fora of regulatory bodies and other co-operation activities, which contribute to increased information sharing among embarking countries and their regulators, as well as among future SMR operators. For example, there is the Global Nuclear Safety and Security Network, 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 programmes.[126] Supplementary to enhanced bilateral co-operation with an SMR vendor's regulatory body, a potential future international deployment of SMRs may provide a catalyst for increased multinational regulatory co-operation. An alignment of the national regulatory requirements of the participating states would clearly greatly facilitate such work, and the technology neutral IAEA standards on safety assessment and on reactor design would be a useful starting point.

Although there are various international co-operation mechanisms and though regulators often consider standards and requirements stemming from the nuclear power plant vendor's country, there is no mutual acceptance or endorsement of design approvals or licences. The principle of the independence of the regulatory body, as enshrined in international legal instruments and embedded in IAEA Safety Standards, applies to the regulatory body's decision making. To simply import a foreign licensing decision would not respect the fundamental principle of regulatory independence. The principle of national responsibility for independent regulatory decision making seems unlikely to change in the future. At the same time, steps to enhance co-operation among national regulators, along with the potential for greater harmonisation and alignment of regulatory requirements as informed by technology neutral safety standards, can perhaps help avoid duplication of regulatory effort without compromising independence. Such co-operation may be considered as providing a useful exercise for each SMR recipient's formal licensing process.

2. Denials of shipments and the international transport of radioactive material

Over the past decade, the volume of radioactive materials transported via rail, road, air and water worldwide has increased dramatically. The vast majority of transports – around 95% – are not fuel cycle-related. Rather, they are related to medicine, agriculture, research or industry. Most of this transport is the transport of medical and industrial radioactive sources. The great majority of shipments of radioactive material occurs routinely and without issue every day by all modes of transport.[127] Despite the establishment of a robust international regulatory framework, 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 is of particular concern in the medical sector where failure to deliver radioactive material on time can often result in a direct effect upon the lives of those patients who are dependent upon medical applications of radioisotopes.[128]

126. The RCF is open to all IAEA member states. As of January 2018, the RCF comprised: Bangladesh, Belarus, Canada, Chile, China, Egypt, Finland, France, Germany, Ghana, the Islamic Republic of Iran, Japan, Jordan, Kenya, Morocco, Nigeria, Pakistan, Poland, Korea, Russia, South Africa, Sudan, United Arab Emirates, the United Kingdom, the United States and Viet Nam, as well as the IAEA, the European Commission and the NEA.

127. Wright T. de, et al. (2016), "Delay and Denial of Shipment", *Proceedings of the International Conference on the Safe and Secure Transport of Radioactive Material: The Next Fifty Years – Creating a Safe, Secure and Sustainable Framework*, Vienna, Austria, 16-21 October 2011, IAEA Doc. IAEA-TECDOC-CD-1792, IAEA, Vienna.

128. IAEA (2015), *Nuclear Safety Review 2015*, IAEA Doc. GC(59)/INF/4, IAEA, Vienna.

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.[129] In resolution GC(49)/RES/9 of September 2005, the General Conference encouraged the IAEA to constitute an International Steering Committee to oversee the resolution of the issue of denials of shipments of radioactive material.[130] 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-DOS led to the creation of a comprehensive Action Plan, a network of national focal points (and Regional Coordinators), a database recording reports of denials, a set of training packages and a communication strategy.[131] 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 that must be addressed.[132] In 2013, the ISC-DOS was dissolved and in 2014 the Transport Facilitation Working Group (TFWG) was formed independently from the IAEA as a standing group of experts made up of former Chairs of ISC-DOS and representatives of interested member states and industry bodies.[133]

In September 2018, the General Conference in Resolution GC(62)/RES/6 recognised ongoing difficulties relating to the delay and denial of shipments, and in September 2019, the General Conference in Resolution GC(63)/RES/7 encouraged member states to continue to pursue efforts to avoid and address problems related to denials of and delays in the shipment of radioactive material, particularly shipment by air.[134] Moreover, at the 2020 General Conference, they were called upon to facilitate the transport of radioactive material and to identify, if they have not done so, a national focal point on denials of shipment of radioactive materials to achieve a satisfactory and timely resolution of this issue.[135] The Secretariat was also requested in the 2019 General Conference resolution to hold a technical meeting to share experience and with a view to establishing a working group, with full participation of interested member states 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 member states by June 2020.[136] Due to the global

129. IAEA (2004), *Safety of Transport of Radioactive Material, Proceedings of an International Conference, Vienna, 7–11 July 2003*, IAEA Doc. STI/PUB/1200, IAEA, Vienna.

130. IAEA (2005), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation and transport safety and waste management", IAEA Doc. GC(49)/RES/9, adopted on 30 Sept. 2005, para. B.12.

131. The objectives of the ISC-DOS were to serve as a mechanism to facilitate the co-ordination of a comprehensive international work plan of activities conducted by the organisations 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 organisations, transport trade organisations and manufacturers of sources of radioactive material.

132. IAEA Doc. IAEA-TECDOC-CD-1792, *supra* note 127, p. 12, "President's Findings".

133. The 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, composed of representatives of the IAEA, ICAO, and IMO Secretariats as well as UNECE.

134. IAEA (2018), GC Resolution: "Nuclear and Radiation Safety", IAEA Doc. GC(62)/RES/6, adopted on 20 Sept. 2018, para. 81; IAEA (2019), GC Resolution: "Nuclear and Radiation Safety", IAEA Doc. GC(63)/RES/7, adopted on 19 Sept. 2019, para. 80.

135. IAEA Doc. GC(64)/RES/9, *supra* note 36, para. 80.

136. IAEA Doc. GC(63)/RES/7, *supra* note 134, para. 81.

pandemic, the meeting was delayed, but took place virtually on 23-26 March 2021. An outcome of that meeting was agreement to create a working group to evaluate and address the issues of denial of shipment; its first (virtual) meeting was scheduled for summer 2021.

3. Control of transboundary movement of radioactive material inadvertently incorporated into scrap metal and semi-finished products of the metal recycling industries

Another example of an unsuccessful effort 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 semi-finished products of the metal recycling industries. For several decades, metal recycling has been 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 radioactive sources that may pose a significant risk to individuals, society and the environment, such sources may still inadvertently be incorporated into scrap metal. Radioactive sources in lower categories than those considered by the 2003 Radioactive Sources Code of Conduct 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 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.[137]

The 2009 International Tarragona Conference was organised as a response to increasing global concerns. The participants of the conference unanimously recognised "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".[138] In September 2009, in resolution GC(53)/RES/10, the IAEA General Conference noted "the outcomes from the [2009 Conference], and [requested] the Secretariat to take into account the recommendations of this conference".[139] 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".[140] In September 2010, the General Conference 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

137. 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.

138. IAEA (2011), *Control and Management of Radioactive Material Inadvertently Incorporated into Scrap Metal, Proceedings of an International Conference, Tarragona, Spain, 23-27 February 2009*, IAEA Doc. STI/PUB/1502, IAEA, Vienna, p. 354.

139. IAEA (2009), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(53)/RES/10, adopted on 18 Sept. 2009, para. 57.

140. IAEA (2014), *Control of Transboundary Movement of Radioactive Material Inadvertently Incorporated into Scrap Metal and Semi-finished Products of the Metal Recycling Industries, Results of the Meetings Conducted to Develop a Draft Code of Conduct*, IAEA Doc. IAEA/CODEOC/METRECYC, IAEA, Vienna, p. 1.

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 Code of Conduct. In September 2013, in resolution GC(57)/RES/9, the IAEA General Conference recorded that it "[a]ppreciate[d] the intensive efforts undertaken by the Secretariat to develop a code of conduct on the transboundary movement of scrap metal, or materials produced from scrap metal, that may inadvertently contain radioactive material, and, and encourage[d] the Secretariat to make the results of the discussion conducted on this issue available to Member States by issuing a relevant TECDOC[…]."[141] In accordance with that resolution, the draft text of the proposed draft 2013 Metal Recycling Code of Conduct was published in February 2014.[142]

The objective of the proposed draft 2013 Metal Recycling Code of Conduct was to protect people, property and the environment from ionising 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 Code of Conduct was without prejudice to the authorised movement of radioactive material. Implementation of the Code of Conduct was to be accomplished through the development, harmonisation and implementation of national policies, laws, regulations, guidance, and, as applicable, strategies, as well as through the fostering of international co-operation. In implementing the Code of Conduct, states were encouraged to make appropriate use of the IAEA's Safety Standards.

Similar to the 2004 Reactor Code of Conduct, the proposed draft 2013 Metal Recycling Code of Conduct not only addressed 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 harmonise the approaches of member states 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 Code of Conduct 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 Code of Conduct 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 radioactive sources, in particular the 2003 Radioactive Sources Code of Conduct and its supplementary guidance. Further, the proposed draft 2013 Metal Recycling Code of Conduct also took account of the provisions of the Joint Convention, the Early Notification and Assistance Conventions, as well

141. IAEA Doc. GC(57)/RES/9, *supra* note 21, para. 98.

142. IAEA Doc. IAEA/CODEOC/METRECYC, *supra* note 140, pp. 4 *et seq*.

as the arrangements given in the then existing concept of operations manual for communicating to the IAEA in emergencies (IEComm 2012).[143]

With regard to the inadvertent presence of radioactive materials in metal scrap and metal recycling industry products, the IAEA should continue to promote its existing publications on this topic and, considering the various available options, to increase awareness on this issue, encourage harmonised approaches to prevent and manage such presence and, from a safety and a security perspective, evaluate the benefits and drawbacks of these options to decide on the best way forward.[144]

The IAEA has developed and launched the Scrap Metal Tool Kit, a collaboration platform for information and experience exchange for the control of radioactive material inadvertently incorporated into scrap metal and semi-finished products of the metal recycling industries. The toolkit contains a database of radioactive sources with an illustrated catalogue of previously detected radioactive material in the metal recycling industries. The toolkit provides hands-on experience for users through case studies of previous incidents involving radioactive material unintentionally present in scrap metal with detailed descriptions of such incidents. It can help users to identify sources and radioactive material when encountered and to foster better communication among different stakeholders including border authorities.

A supporting e-learning course "Control of Radioactive Material Inadvertently Incorporated into Scrap Metal" was launched simultaneously with the toolkit, which has been reported to be used by more than 500 users at the beginning of 2021.

4. Decommissioning and disposal of spent fuel and high-level radioactive waste

With respect to the back end of the nuclear fuel cycle, namely, the decommissioning of nuclear installations and the disposal of spent fuel and high-level radioactive waste, one may identify some developments that have taken place in the past ten years, as well as some opportunities for future consideration. As with much of the international legal framework for nuclear safety, the framework in the area of the decommissioning of nuclear installations can and must reflect lessons from the Fukushima Daiichi nuclear power plant accident and from the particular challenges that

143. Additionally, the proposed draft Code of Conduct was developed in light of the then applicable General Safety Requirements (GSR Part 3, 2011), which contain recommendations for protection against exposure to ionising radiation and for the safety of radioactive sources, and the then applicable General Safety Requirements (GSR Part 1, 2010) containing recommendations regarding the necessary infrastructure for safety), as well as the then applicable IAEA Safety Requirements (SSR-6, 2012) for the transport of radioactive material. See IAEA et al. (2011), *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, Interim Edition*, IAEA General Safety Requirements Part 3, No. GSR Part 3 (Interim), IAEA, Vienna; IAEA (2010), *Governmental, Legal and Regulatory Framework for Safety*, IAEA Safety Standards Series, No. GSR Part 1, IAEA, Vienna; IAEA (2012), *Regulations for the Safe Transport of Radioactive Material*, IAEA Safety Standards Series, Specific Safety Requirements, No. SSR-6, IAEA, Vienna. Further, the proposed draft Code of Conduct took account of the guidance given in two Safety Guides: IAEA (2004), *Application of the Concepts of Exclusion, Exemption and Clearance*, IAEA Safety Standards Series, Safety Guide, No. RS-G-1.7, IAEA, Vienna, and IAEA (2012), *Control of Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries*, IAEA Safety Standards Series, Specific Safety Guide, No. SSG-17, IAEA, Vienna. In particular, the proposed draft Code of Conduct was envisaged as being complementary to the latter Safety Guide 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.

144. Report of the Chairman, "Open-ended Meeting of Technical and Legal Experts to Share Information on States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its Supplementary Guidance", Vienna, 27-31 May 2019, IAEA Doc. GOV/2020/35-GC(64)/7, Annex 1, Attachment 2.

arise in the context of the decommissioning of accident-damaged nuclear facilities. In this latter respect, the work that is being done in Fukushima towards decommissioning is the subject of global attention, and IAEA-led peer review has been an important part of the learning.[145] It is also the case that as many facilities come to the end of their life cycle, for various reasons, there will be a need to decommission safely and in an environmentally and socially aware manner, scores of nuclear facilities. While there are national dimensions, there are also more generic challenges that the international community collaborates on.

Over the past ten years, there has been much work done as well with respect to the policy, legal and societal questions related to spent fuel disposal facilities. The legal frameworks within which the decisions respecting such facilities are made, given their long timelines and future-looking considerations, ought to reflect on such questions.

The contracting parties to both the CNS and the Joint Convention have made consensus-based changes to the rules and the processes that govern the national reporting and the peer review that takes place under the conventions. This has been with a view to enhancing safety through the enhancement of the review processes and learning therefrom. These measures have been outlined above and have promise for the enhancement of nuclear safety, including as regards decommissioning and disposal. It may be noted that, given its scope, the Joint Convention should have a membership of all IAEA member states, and certainly all those states with operating nuclear installations should be contracting parties to both the CNS and the Joint Convention given that these two "sister" conventions together cover the framework for nuclear safety in a life-cycle manner.[146]

a. Decommissioning of nuclear facilities

Considerable experience continues to be gained in the decommissioning of nuclear facilities and will continue in light of projections regarding the decommissioning activity to be seen worldwide as decisions are made on facility end-of-life for various reasons.[147] International and regional co-operation in this regard has sought to gather knowledge and share experience in various technical areas that are important to the minimisation of radiological hazards and the optimisation of various dismantling processes. This is an area where novel approaches and innovation can advance the safe operation of such projects,[148] and one may anticipate developments in automation and robotics as aspects for future consideration. This is an important area associated with the deployment of SMRs and the potential candidate member states that do not currently have a mature nuclear power programme.

145. See IAEA (2019), *Mission Report IAEA International Peer Review Mission on Mid- and Long-Term Roadmap Towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station (Fourth Mission)*, available at: www.iaea.org/sites/default/files/19/01/missionreport-310119.pdf (accessed 14 June 2021).

146. It is of note that in the Summary Report of the Sixth Review Meeting of the Joint Convention, the President "emphasized the need for Contracting Parties to collectively increase efforts to encourage those IAEA Member States who are not yet Contracting Parties to the Joint Convention to become Party to the Convention." Specific note was made in the summary report that some contracting parties to the CNS were not parties to the Joint Convention. See IAEA Doc. JC/RM6/04/Rev.2, *supra* note 39, para. 86.

147. According to the IAEA, the coming decades will see increasing work in respect of decommissioning and decommissioning planning, with the phasing out of many of the world's current operating nuclear reactors, alongside the need for new facilities being commissioned to have adequate funding and planning in place for their eventual decommissioning. Donovan, J. (3 Nov. 2020), "IAEA Advances Project to Address Challenges Facing Global Nuclear Decommissioning Efforts", available at: www.iaea.org/newscenter/news/iaea-advances-project-to-address-challenges-facing-global-nuclear-decommissioning-efforts (accessed 14 June 2021).

148. See e.g. Chatzis, I. (3 Sept. 2020), "Robots, Drones and Artificial Intelligence for Advanced Decommissioning and Environmental Remediation: Winners of the IAEA 2020 Crowdsourcing Challenge", available at: www.iaea.org/newscenter/news/robots-drones-and-artificial-intelligence-for-advanced-decommissioning-and-environmental-remediation-winners-of-the-iaea-2020-crowdsourcing-challenge (accessed 14 June 2021).

b. Disposal of spent fuel and high-level radioactive waste

The Preamble to the Joint Convention recognises "the importance of informing the public on issues regarding the safety of spent fuel and radioactive waste management", and the Joint Convention's obligations on its contracting parties include making safety information available to the public as part of the processes for siting and managing related facilities. It may be noted, after six review meetings of the Joint Convention and the experiences of contracting parties in this regard, that the importance of the public's confidence – in regulatory processes respecting such projects as well as in their safety – is vital to the development of such facilities. From a technical and scientific perspective, it may be that geological disposal is widely accepted as the standard for spent fuel and high-level waste disposal. At the same time, we may recognise the importance of public acceptance respecting such projects, especially given their very long timelines and environmental considerations.

With respect to the siting of such disposal facilities, the matter of locating a technically feasible and safe geological formation is of vital importance, but ideally it should also include factoring in the views of local communities that would potentially host the facility. As the Summary Report, paragraph 28, of the Sixth Review Meeting of the Joint Convention noted:

> The need for effective public involvement and engagement on spent fuel and radioactive waste management was recognised by many contracting parties as crucial in gaining public confidence in the safety of management facilities and activities. There was also increasing recognition that regional and international treaties concerning impacts on the environment required openness, transparency and public engagement.

There are societal considerations with respect to disposal facilities that can impact decision making and the public acceptance of such projects. Part of this includes the independence of the regulatory function and the confidence of the public in the regulatory process. Engagement with the public on important issues regarding the safety of projects from an early stage and recognising the long timelines of such projects can assist with this.

Under the Joint Convention and its peer review process, one sees the evolution in the contracting parties' understanding of these issues, learning from the experiences shared. It will remain a challenge for states as more decommissioning and disposal activities are undertaken worldwide to ensure that adequate and responsive public information processes can be effective in ensuring communities' understanding and acceptance of safety-related decisions.

D. Conclusion

In conclusion, many lessons have been learnt in the past ten years. Such lessons cover not only technical and regulatory aspects, but also philosophical and cultural issues. The Fukushima Daiichi nuclear power plant accident played an important catalytic role in the further development of international nuclear law on safety, as well as on related areas. IAEA Safety Standards were reviewed to reflect lessons learnt and IAEA safety peer review services were strengthened, with transparency and utilisation increasing.

Although nuclear safety remains the responsibility of each individual country, the Fukushima Daiichi nuclear power plant accident reaffirmed nuclear safety as a global concern and underlined the vital importance of effective international co-operation. The IAEA, along with its member states, continues to build upon the Action Plan on Nuclear Safety, the experience of states in implementing the Plan, as well as on the observations and lessons contained in the 2015 IAEA Fukushima Daiichi Accident Report and the principles of the Vienna Declaration. The IAEA uses them in defining its nuclear safety strategy and its programme of work, including priorities, milestones, timelines and performance indicators. The contracting parties to the nuclear safety conventions continue to deploy consensus-based improvements to the ways in which the peer review process can advance global nuclear safety and increase international co-operation.

Notwithstanding the current high safety record for international transports of radioactive material, a potential future worldwide SMR deployment raises the potential for substantial public concern in many countries about nuclear safety around the globe. An absolute precondition for future deployment of SMRs is the need to ensure that there is no lowering of the high level of safety. In this respect, it is necessary to ensure that, with respect to SMRs, the existing status of international nuclear law on nuclear safety is not only maintained in full but is also adapted as needed, and that recipient countries join and fully implement the applicable nuclear safety conventions. There should be no ambiguities when it comes to the framework necessary to limit the risks of the use of nuclear energy. Looking forward, 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, with the international legal framework for safety and the capability of the IAEA to deliver assistance to its member states being a large part of the discussion.

Regulation, licensing and oversight of nuclear activities

by Stephen G. Burns, Kimberly Sexton Nick, Christian Raetzke and Lisa Thiele[*]

I. Introduction

The international regime for nuclear safety largely relies on national law to establish a system of regulation of the operators of nuclear installations and the users of radioactive material. Regulation includes the establishment of a system of licensing or permitting, oversight and inspection of nuclear activities and enforcement of the requirements established to govern permitted activities or prevent unauthorised uses.

The rationale for relying primarily on national law to set out the framework and substance is reflected in the comments of then-Director General of the International Atomic Energy Agency (IAEA) Hans Blix to the IAEA Board of Governors soon after the Chernobyl accident:

> Whatever is done, however, it is important to retain the principle that responsibility for nuclear safety must remain with national governments. They alone can legislate. They alone exercise the power to enforce. They cannot be relieved of this duty by any international arrangements. But they might, of course, be required to comply with minimum standards.[1]

Although this approach has garnered criticism over the years from the time of the establishment of the Convention on Nuclear Safety (CNS)[2] to the present day, the burden of establishing an effective framework for regulation rests on individual states. Nonetheless, despite the absence of binding internationally-established safety standards as such, guidance established through international co-operation, such as safety standards developed under the auspices of the IAEA, inform national regimes.[3]

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1. Director General's Statement to Meeting of the Board of Governors, 21 May 1986, at 11.
2. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996 (CNS).
3. For example, the CNS notes in its Preamble, para. (viii), that "there are 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".

At a national level, there are any number of key institutions and actors involved in the nuclear sector.[4] Apart from the regulatory body itself, government ministries or agencies responsible for energy policy, research and development, environmental protection, emergency response, occupational safety, among others, can have a role in establishing or carrying out policies that can have an impact on the operation of nuclear facilities and use of radioactive materials. In addition to those licensed to engage in regulated activities, vendors, suppliers, industry standards-setting organisations, academic institutions, non-governmental advocacy groups, the media and the general public may shape the safety regime.

Ultimately, the regulator and the operator play the key roles in the regulatory system. As prescribed in the CNS, the regulator is responsible for establishing and enforcing the governing standards for authorised operation of nuclear installations and use of licensed materials, and the operator or authorised user bears the primary responsibility for compliance and safety of licensed activities.[5]

This article will highlight the important aspects of the regulation of nuclear activities, beginning with the consideration of key aspects of the structure of regulatory bodies. The fundamental role of standards setting, licensing, and oversight and enforcement will be explored. The importance of public participation and stakeholder involvement, as well as matters of Indigenous rights and responsible business conduct will be considered. Finally, the limited role for industry self-regulation is explored.

II. The regulatory body

1. International norms call for establishment of a regulatory body

Under international law and practice, states are expected to establish and maintain a legislative and regulatory framework to govern the safe use of radioactive materials and nuclear installations:

> A properly established legal and governmental framework provides for the regulation of facilities and activities that give rise to radiation risks and for the clear assignment of responsibilities. The government is responsible for the adoption within its national legal system of such legislation, regulations, and other standards and measures as may be necessary to fulfil all its national responsibilities and international obligations effectively, and for the establishment of an independent regulatory body.[6]

These basic principles are reflected in the binding international instruments, particularly the CNS and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention),[7] as well as in non-binding codes of conduct applicable across the entire scope of activities involving research reactors and the use of

4. For a description of the institutional elements of the global nuclear safety regime, see the report of IAEA's International Safety Group (INSAG), in IAEA (2006), *Strengthening the Global Nuclear Safety Regime*, INSAG-21, IAEA, Vienna, pp. 5-6.

5. CNS, *supra* note 2, Arts. 7 and 9.

6. IAEA et al. (2006), *Fundamental Safety Principles: Safety Fundamentals*, IAEA Safety Standards Series, No. SF-1, IAEA, Vienna, p. 7. In addition to the IAEA, this document is sponsored by other international organisations, i.e. the European Atomic Energy Community, the Food and Agriculture Organization of the United Nations, the International Labour Organization, the International Maritime Organization, the OECD NEA, the Pan American Health Organization, the United Nations Environment Programme, and the World Health Organization.

7. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001.

radioactive material.[8] Establishment of competent institutions and effective regulation are primarily a national responsibility. There is no international regulatory authority over nuclear safety, though the international regime provides for and encourages peer review among states.[9]

Regulatory bodies have several core attributes and responsibilities. The CNS, for example, briefly describes the obligations of states in establishing their regulatory authority:

> Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework …, and provided with *adequate authority, competence and financial and human resources* to fulfil its assigned responsibilities.
>
> Each Contracting Party shall take the appropriate steps to *ensure 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.[10]

The organisational separation of the regulator from those involved with the promotion or utilisation of radioactive materials or nuclear installations is understood as the need to ensure the independence of the regulatory body, the term used, for example, in the Joint Convention.[11]

2. Organisational forms of the regulatory body

No particular form of organisation is prescribed beyond the general characteristics and functions of the regulatory body. In practice, two primary forms of structure have been used: a multi-member agency or commission, or a regulatory authority headed by a single director or administrator. Examples of the commission form of organisation include the regulatory bodies in Argentina, Canada, France, India, Japan, Korea, Spain and the United States.[12] Regulatory authorities headed by a single administrator include those in Australia, the People's Republic of China (China), the Czech Republic, Mexico, the Russian Federation (Russia), South Africa,

8. CNS, *supra* note 2, Art. 7; Joint Convention, *supra* note 7, Art. 19; IAEA (2004), *Code of Conduct on the Safety and Security of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/2004, p. 5; IAEA (2006), *Code of Conduct on the Safety of Research Reactors*, IAEA Doc. IAEA/CODEOC/RR/2006, p.5, para. 9.

9. See e.g. CNS, *supra* note 2, Art. 20 (periodic review meetings); IAEA (2013), *Integrated Regulatory Review Service (IRRS) Guidelines for the Preparation and Conduct of IRRS Missions*, IAEA Services Series, No. 23, IAEA, Vienna, pp. 1-4. The European Union (EU) establishes a regional framework for nuclear safety and regulation through Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations, as amended by Directive 2014/87/Euratom of 8 July 2014, *Official Journal of the European Union* (OJ) L 219 (25 July 2014), p. 42 (2014 Amended EU Safety Directive).

10. CNS, *supra* note 2, Art. 8 (emphasis added). Compare the Joint Convention, *supra* note 7, Art. 20; *Code of Conduct on the Safety and Security of Radioactive Sources*, *supra* note 8, pp. 8-12, paras. 20-22; *Code of Conduct on the Safety of Research Reactors*, *supra* note 8, p. 5, para. 9.

11. Joint Convention, *supra* note 7, Art. 20.

12. Argentina: Nuclear Regulatory Authority [Autoridad Regulatoria Nuclear (ARN)]; Canada: Canadian Nuclear Safety Commission, reports to Parliament through the Minister of Natural Resources; France: Authority for Nuclear Safety [L'Autorité de sûreté nucléaire (ASN)]; India: Atomic Energy Regulatory Board (AERB) under the Atomic Energy Commission; Japan: Nuclear Regulation Authority (NRA), an external organisation of the Ministry of Environment; Korea: Nuclear Safety and Security Commission (NSSC); Spain: Council on Nuclear Safety [Consejo de Seguridad Nuclear (CSN)]; United States: Nuclear Regulatory Commission (NRC).

Sweden and the United Kingdom.[13] Various structural approaches may be employed to enhance agency independence or to minimise political interference in decision making. For example, members of multi-member regulatory bodies may be appointed by different senior elected officials as in France or may be limited in terms of the number who may be registered with the same political party as in the United States.[14] The regulatory authority may report directly to the head of state or cabinet or may be organised within a ministry, ideally one that does not have responsibility for energy production or development.[15] One should also note that regulatory bodies may undergo structural reform or reorganisation or be given legislative authority to address new demands or expectations for their roles.[16] The perceived failings of the regulator in the wake of significant incidents such as the major nuclear accidents has resulted in regulatory reform.[17]

3. Characteristics of an effective regulator

Approaches to establishing an effective regulatory organisation are provided in a number of guidance documents issued by the IAEA and the NEA. For example, the IAEA has published as part of its general safety requirements *Governmental, Legal and Regulatory Framework for Safety*, which addresses such topics as the management and staffing of the regulatory body and the importance of establishing liaison with advisory bodies, support organisations and other authorities.[18] The NEA's Committee on Nuclear Regulatory Activities (CNRA), a group

13. Australia: Australian Radiation Protection and Nuclear Safety Agency (ARPANSA); China: National Nuclear Safety Administration (NNSA) within Ministry of Environmental Protection; Czech Republic: State Office for Nuclear Safety [Státní úřad pro jadernou bezpečnost (SÚJB)], reports to the Prime Minister; Mexico: National Nuclear Safety and Safeguards Commission [Comisión Nacional de Seguridad Nuclear y Salvaguardias (CNSNS)], a semi-autonomous body under the authority of the Ministry of Energy; Russian Federation: Federal Environmental, Industrial and Nuclear Supervision Service [Rostechnadzor] reporting to the government; Sweden: Radiation Safety Authority [Strålsäkerhetsmyndigheten (SSM)] within the Ministry of Environment; United Kingdom: Office for Nuclear Regulation (ONR), a statutory public corporation.

14. France's ASN has five commissioners, three who are designated by the President of the Republic and one each appointed by the President of the Senate and the President of the National Assembly. Article L. 592-2 of the French Environmental Code. The US NRC has five commissioners appointed by the President and confirmed by the Senate, but no more than three may be affiliated with the same political party. Energy Reorganization Act of 1974, as amended, sec. 201(a)(1), 42 *United States Code* (USC) 5841(a)(1).

15. For example, Canada established the CNSC as a "body corporate", which makes reports to Parliament through the Minister of Natural Resources but is not under the supervision of the Minister of Natural Resources and remains an independent body. Nuclear Safety and Control Act (S.C. 1997, c. 9), sec 8(1), sec. 72; see NEA (2009), "Nuclear Legislation in OECD and NEA Member Countries: Canada", available at: www.oecd-nea.org/law/legislation/canada.pdf, p. 21. Rostechnadzor's alignment changed a few times within the government of the Russian Federation. See Sexton, K. (2015), "Crisis, criticism, change: Regulatory reform in the wake of nuclear accidents", *Nuclear Law Bulletin*, No. 96, OECD Publishing, Paris, pp. 35, 40-41.

16. Within the last 20 years, for example, the regulatory bodies have been restructured in France, Japan, Korea and the United Kingdom. See Act No. 2006-686 of 13 June 2006 on Transparency and Security in the Nuclear Field (TSN Act), Title I, Art. 10 (creating France's ASN), the provisions of which have since been transposed in the French Environmental Code; Energy Act 2013, Part 3, "Nuclear Regulation", and Schedule 7, "The Office for Nuclear Regulation" (establishment of ONR as a statutory public corporation in the United Kingdom); Act on the Establishment and Management of Nuclear Safety and Security Commission (2011), amended in 2013 (creating Korea's NSSC); Act for Establishment of the Nuclear Regulation Authority, Act No. 47 of June 27, 2012, Extra Official Gazette of June 27, 2012 (creating Japan's NRA). For a report on the establishment of regulatory bodies on countries newly entering nuclear power generation, see IAEA (2021), *Experiences of Member States in Building a Regulatory Framework for the Oversight of New Nuclear Power Plants: Country Case Studies*, Doc. IAEA-TECDOC-1948, IAEA, Vienna.

17. See Sexton, K. (2015), *supra* note 15.

18. IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 1 (Rev. 1), IAEA, Vienna, pp. 21-24, Requirements 18-21.

composed of representatives of regulatory bodies from NEA member countries, has issued a series of regulatory guidance reports, referred to as "green booklets", which address various aspects of establishing a competent, well-functioning regulatory body.[19] The CNRA suggests that an effective regulator:

- is clear about its regulatory roles and responsibilities, its purpose, mandate and functions;
- has public safety as its primary focus;
- has independence in regulatory decision making from any undue influence on the part of the nuclear industry and those sectors of government that sponsor this industry;
- has technical competence at its core, with other competencies built upon this fundamental and essential requirement;
- is open and transparent in its regulations and decisions;
- has a regulatory framework and requirements that are clear and easily understood by all stakeholders;
- makes clear, balanced and unbiased decisions, and is accountable for those decisions;
- has a strong organisational capability in terms of adequate resources, strong leadership and robust management systems;
- performs its regulatory functions in a timely and efficient manner;
- has and encourages a continuous self-improvement and learning culture, including the willingness to subject itself to independent peer reviews.[20]

4. Critical duties of the regulator

Regardless of the structure of the regulatory authority, the CNS and Joint Convention make clear that the legislative and regulatory framework governing the safety of nuclear facilities must provide for certain basic regulatory functions.[21] For example, national safety requirements and regulations or directives must be established. Within the legal framework of the regulatory system, a licensing system shall be established for nuclear installations, which includes authorisations and prohibitions. Moreover, the regulator is to be empowered to verify compliance with such standards and regulations through inspections and assessments. Finally, the regulator must be able to enforce compliance with established standards and regulations using measures that include the suspension, modification or revocation of a licence. These essential powers and duties will be addressed through the remainder of this article

III. Standard setting

An essential task in creating an effective regulatory system is the specification of the criteria and standards against which proposed uses of radioactive material and installation of nuclear facilities are to be assessed. Uniform standards foster consistency and transparency in regulation and help ensure that the objectives for safety and security are met across the spectrum of authorised activities. Such standards also provide the basis for enforcement to ensure compliance or to deter unauthorised activities.

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19. A list of the booklets published to date can be found in NEA (2016), *The Safety Culture of an Effective Nuclear Regulatory Body*, OECD Publishing, Paris, p. 31, Appendix 1.

20. See e.g. NEA (2014), *The Characteristics of an Effective Nuclear Regulator*, OECD Publishing, Paris, pp. 7-8. 15, 18-19 (highlighting the importance of the regulator's technical competency and strong organisational capability).

21. CNS, *supra* note 2, Art. 7; Joint Convention, *supra* note 7, Art. 19.

1. International standards as guidance

There are no international binding safety standards as such. However, in practice the IAEA Safety Standards play a substantial role. The Safety Standards are comprised of three groups of publications, the Safety Fundamentals, the Safety Requirements and the Safety Guides, and are recommended for implementation as part of the national regulatory system in order to "establish a consistent and comprehensive basis for the proper protection of people and the environment against radiation risks."[22] The Safety Requirements address general requirements related to, for example, institutional framework and capacity, radiological protection, safety assessment, waste management, decommissioning, emergency preparedness and response. Specific requirements are laid out on siting of nuclear installations, the design, construction and operation of nuclear power plants, the safety of research reactors and fuel cycle facilities, waste disposal and safe transport of radioactive material.

The Codes of Conduct and related guidance on the safety of research reactors and on the safety and security of radioactive sources also supply model standards for implementation at a national level. The CNS notes that it "entails a commitment to the application of fundamental safety principles for nuclear installations", and fundamental safety requirements have been enshrined in soft law instruments, such as the Vienna Declaration of 2015.[23] Legislation in some states expressly references international standards and guidance as sources for developing implementing regulations.[24]

2. Standard setting under national law and regulations

Thus, the adoption of standards to be applied to licensed activities is largely a product of national law, reflected in both legislation as well as implementing regulations. Legislation is intended to establish the "safety principles for protecting people – individually and collectively – society and the environment from radiation risks, both at present and in the future".[25] Although legislation may at times prescribe more specific criteria or assign particular tasks or assessments to be undertaken, legislation typically sets out high-level safety or security requirements and objectives,[26] such as "adequate protection to the health and safety of the public"

22. IAEA (2006), *Fundamental Safety Principles: Safety Fundamentals*, *supra* note 6, p. 3. The process for developing the standards is described in a prefatory chapter "The IAEA Safety Standards" in *ibid*.

23. CNS, *supra* note 2, preambular para. (viii); IAEA (2015), "Vienna Declaration on Nuclear Safety: On principles for the implementation of the objective of the Convention on Nuclear Safety to prevent accidents and mitigate radiological consequences", IAEA Doc. INFCIRC/872, pp. 3-4 (2015 Vienna Declaration).

24. For example, Russia provides that the regulator's "regulations and rules must take into account the recommendations of international organisations in the field of the use of atomic energy in whose work the Russian Federation participates." See Federal Law No.170 of the Russian Federation on the Use of Atomic Energy, of 21 November 1995, as last amended by Federal Law No.159 of 2 July 2013, Art. 6, Russian Gazette No. 6121 of 5 July 2013, unofficial translation available at: www.oecd-nea.org/jcms/pl_23974/regulatory-and-institutional-framework-for-nuclear-activities-russia (accessed 27 May 2021). Similarly, the UAE provides that its regulatory authority "establish and develop the control and regulatory principles including the measures of Safety, Nuclear Safety and Nuclear Security and ensure its validity and adequacy in addition to its compliance with international measures and recommendations". Federal Law by Decree No. 6 of 2009, Article 11(g), unofficial translation available at: https://fanr.gov.ae/ar/Documents/20101024_nuclear-law-scan-eng.pdf (accessed 27 May 2021).

25. IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, *supra* note 18, p. 5.

26. See Raetzke, C. and M. Micklinghoff (2006), *Existing Nuclear Power Plants and New Safety Requirements – An International Survey*, Carl Heymanns Verlag, Berlin, pp. 194-196.

in the US Atomic Energy Act or "precaution against damage which is necessary in the light of the state of the art in science and technology" in the German Nuclear Energy Act.[27] In the European Union (EU), Article 8a of the 2014 Amended EU Safety Directive sets forth a "nuclear safety objective" that is binding on the EU member states.[28] A recurring principle for nuclear safety (and for health and safety in general) is the ALARP principle – the risk must be "as low as reasonably practicable".[29]

The high-level safety requirements are usually fleshed out with more detailed provisions in government ordinances (decrees) and regulations. Authority to promulgate regulations may rest in the regulatory authority itself or may involve formal approval of other governmental authorities.[30] The principal purpose of establishing a system of regulations is "to codify safety requirements of general applicability that require mandatory compliance by all authorized parties."[31]

Regulations will address the broad scope of activities permitted under national law and the subject matters pertinent to the regulatory body's determinations of safe and secure uses of radioactive materials and operation of nuclear installations. Thus, regulations can be expected to address such topics as radiological protection and monitoring, siting of installations, management and organisation of authorised activities, technical competencies, staffing, procedural controls, security, reporting requirements, training, quality assurance, and waste management, among other matters related to nuclear safety and security. In addition, regulations may include requirements related to environmental protection and reporting. The regulations may set out standard conditions for licences or require the licensee to develop procedures or programmes that are effectively binding legal requirements. The regulations themselves may be supplemented by guidance documents that provide advice or illustrations of satisfactory means of meeting the requirements in the regulations.[32] Although such guidance documents may not in themselves be binding, they may become so if a licensee or applicant chooses to incorporate the terms of the guidance document in, for example, its licensing basis, procedures and implementation plans or if the regulatory body includes them in the licence as a mandatory reference.

Besides international standards and specific prescriptions in national legislation, a number of other sources can provide the content of regulations and regulatory guidance. Results and experience of research and development efforts as well as lessons from operating experience can inform the approach to and content of regulatory standards. The regulator may engage advisory

27. US Atomic Energy Act of 1954, as amended, sec. 182a., 42 USC 2232(a); German Nuclear Energy Act, Art. 7, para. 2, no. 3 and Art. 6, para. 2, no. 2.

28. 2014 Amended EU Safety Directive, *supr*a note 9, p. 49.

29. A classic example for ALARP (in legislation that applies to nuclear activities but is not nuclear-specific) is the UK Health and Safety at Work etc. Act of 1974, 1974 c. 37, sec. 2.

30. For example, the US NRC is authorised to adopt regulations in accordance with applicable federal administrative procedures under the Atomic Energy Act of 1954, as amended, sec. 161b., 42 USC 2201(b). In Canada, the CNSC is empowered to promulgate regulations with the approval of the Governor in Council. Nuclear Safety and Control Act, S.C. 1997, c. 9, sec. 44. France's ASN is consulted on decrees and ministerial orders related to nuclear safety and may issue technical regulations to complement such decrees and ministerial orders, subject to the confirmation of ministers in charge of nuclear safety. Articles L. 592-25 and L. 592-20 of the French Environmental Code.

31. IAEA (2018), *Functions and Processes of the Regulatory Body for Safety*, General Safety Guide No. GSG-13, IAEA, Vienna, p. 12. For example, Canada's CNSC has developed a set of regulatory documents (REGDOCs) that lay out the requirements contained in statutes and regulations with guidance for implementation. See CNSC website, "Regulatory Documents", available at: www.nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/index.cfm (accessed 27 May 2021).

32. IAEA (2018), *Functions and Processes of the Regulatory Body for Safety*, *supra* note 31, p. 13.

bodies on issues bearing on the regulatory framework. Industry codes and consensus standards developed by national and international groups, such as the International Commission on Radiological Protection (ICRP) and the International Organization for Standardization (ISO), are often recognised in regulations or regulatory guidance as a means of addressing compliance.[33]

At bottom, the establishment of standards through law and regulation is important to provide a consistent, thorough, efficient and transparent regulatory framework for licensing, oversight and enforcement of nuclear activities.

IV. Licensing nuclear activities

1. General principles of licensing

a. Purpose and essence of a licensing process

In legal terms, a licence is a "formal authority to do something that would otherwise be unlawful".[34] This supposes that the applicable law provides for certain activities for which a licence is required, the reason generally being that the activity in question poses a potential harm – or, in other words, a risk – to legally protected interests.

For such potentially hazardous activities, legislation establishes the provisions fixing the conditions with which the person wanting to perform such an activity must comply. These provisions aim at eliminating, or at least reducing to an acceptable level, the potential hazard posed by the activity. If these provisions are complied with, the activity can be allowed.

Therefore, the essence of a licensing process – both in general administrative law and in nuclear law in particular – can be said to be the evaluation, by the competent authority, as to whether the expected activity complies with all applicable requirements. In the case of nuclear activities, these cover fields such as nuclear safety, nuclear security and protection of the environment. If compliance is sufficiently demonstrated by the applicant, the competent body will grant the licence, together with licence terms and conditions ensuring continuous compliance along the entire span of the activity. Therefore, licensing is the essential and decisive tool for ensuring safety, security, environmental protection, and other regulated aspects of an expected nuclear activity. Once the licence has been issued and the activity starts, the focus shifts to the oversight and supervision process, which ensures that the licence holder complies with the licence and the activity is actually performed as described by the applicant in the licensing process.

For the licensee, the licence is a valuable asset. It is a formal document stating the right to lawfully engage in the activity. Third parties, such as neighbours, must accept the legality of this activity (depending on national law, they may, of course, file an action against the licence before

33. For example, the US NRC lists on its website "Consensus Standards Used by NRC", available at: www.nrc.gov/about-nrc/regulatory/standards-dev/consensus.html (accessed 27 May 2021). The ICRP contributes to the development of the Basic Safety Standards related to radiological protection issued by IAEA and other organisations. IAEA et al. (2014), *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards*, GSR Part 3, IAEA, Vienna, p. 2. For discussion of use of codes developed by standards developments organisations in nuclear plants, see American Society of Mechanical Engineers (ASME) (2012), *Code Comparison Report for Class 1 Nuclear Power Plant Components*, ASME Doc. STP-NU-051-1, ASME Standards Technology LLC, New York and Multinational Design Evaluation Programme (2013), *Regulatory Frameworks for the Use of Nuclear Pressure Boundary Codes and Standards in MDEP Countries*, MDEP Technical Report TR-CSWG-01, available at: www.oecd-nea.org/mdep/documents/cswg-technical-report-tr-cswg-01.pdf (accessed 27 May 2021).

34. *Oxford Dictionary of Law* (2009), 7th edition, Oxford University Press.

a law court or other competent tribunal or administrative body, asserting that it has been wrongfully granted). Moreover, the licence may not be withdrawn by the competent authority arbitrarily, i.e. without cause. In national legislation, the power of the regulatory body to revoke a licence is normally restricted to certain well-defined criteria, such as a substantive disregard by the licensee of licence conditions or legal requirements. This means that the licence is a keystone of protection of the investment in a nuclear facility.

b. National and international level

Considering the fact that a nuclear licence embodies the formal authority to perform a nuclear activity, such as construction and operation of a nuclear power plant, it is hardly surprising that such licences are in the remit of national administrative bodies; there is no international institution entrusted with the authority to grant licences for nuclear installations. A licence being a formal legal document, the licensing process follows the relevant rules of administrative law. Thus, licensing is an administrative function that is regulated by the national law of each country. There is no instrument of international law prescribing the main elements of a licence or of a licensing process.

Although there is no "Convention on Nuclear Licensing", there is an obligation in international nuclear law that the safety of nuclear activities is assessed and verified by the competent authorities. As the licensing procedure is the essential legal tool for ensuring prior assessment and verification before the activity starts, the existence of a licensing process is required by international instruments. For example, the CNS, Article 7, para. 2(ii), requires "a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence". National governments are expected to promulgate legislation that establishes the "type of authorization that is required for the operation of facilities and for the conduct of activities, in accordance with a graded approach" and, accordingly, the "depth and scope of the review and assessment of the facility or activity by the regulatory body shall be commensurate with the radiation risks associated with the facility or activity".[35] The details, however, are left to the legislation of each state.

This also means that each state employs its own terminology for legal acts allowing a nuclear activity. Terms such as "licence", "authorisation", "permit" or "consent" may be used in the national legislation and regulations of English-speaking countries; in other languages, there will be a variety of terms as well. Within one given jurisdiction, different terms may be employed to denominate the different levels of authorisations in nuclear law, ranging from allowing construction and operation of a nuclear installation to stating that an individual person is permitted to be part of the control room staff. In this article, which focuses on the authorisation of major nuclear activities, the terms "licence" and "licensing" will be used throughout.

c. Licensing as an administrative function

The licensing process formally begins with an application submitted by the applicant, i.e. the potential future licensee. In the course of the process, the applicant will submit all documents necessary to demonstrate compliance with applicable licensing requirements. The process itself is more or less defined in national legislation; there may be mandatory steps such as official publication of the application, availability of information to the public, public participation, formal hearings, involvement of other authorities and notification to other states. Many elements

35. IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, *supra* note 18, p. 5, sec. 2.5(3) and p. 27, sec. 4.40.

of the process are today shaped by general environmental law, such as the preparation of an environmental impact assessment (EIA) with an opportunity for public participation.[36]

Once the regulatory body has satisfied itself that the expected activity complies with applicable requirements, the applicant will normally obtain the licence (there may be some discretionary power to grant or not to grant the licence according to national law). The licence will be issued by the regulatory body itself if it is empowered by national legislation to do so; in some jurisdictions, the licence is formally issued by government or a minister, obviously based on a positive statement by the regulatory body.[37]

The form and content of a nuclear licence depend very much on national law. Having said this, the main elements should be more or less comparable since they result from the function of the licence, i.e. allowing a specified nuclear activity after having assessed compliance with all requirements necessary for licensing.

The first and legally most relevant part of a licence is the formal legal statement conferring authority on the applicant – who thus becomes the licensee – to perform the nuclear activity, thus removing the legal barrier that would otherwise make the activity unlawful. This necessitates a clear definition of the authorised activity in the licence. The activity is described to a suitable extent in the licence itself; in addition, especially in the case of large nuclear installations, the licence can make reference to licensing documents such as design documents and the final safety assessment report (see below). With this reference, the characteristics of the plant (concerning design, siting and the licensee) as described in those processes are encompassed within the legal requirements of the licence and thus made mandatory; the licensee cannot deviate from this without informing the regulatory body and, if necessary, asking for a consent or a formal modification to the licence.

Another section of the licence consists of terms and conditions. Depending on the relevant national legislation, the licence may or may not be issued for a specified time period or term, meaning the licensee must apply for a licence extension or renewal if it wants to perform the activity beyond that term. If there is no term, the licence stays valid until it is revoked by the licensing authority or surrendered by the licensee, though the activity remains subject to oversight by the competent authority.

Licence conditions impose certain duties on the licensee. For example, the licensee may have to adhere to certain operational limitations (e.g. temperature, thermal output, fuel burnup), to take defined measures in certain events, to perform regular maintenance activities, to notify changes to procedures or to hardware, to report at certain intervals on operational occurrences, etc.[38] The objective of such licensing conditions is to ensure that there is ongoing compliance with safety, security and other requirements during the entire validity of the licence.

36. For more information about the role of environmental law, see Nick, K.S. and P. Bowden (2021), "Nuclear activities and environmental protection: The international legal framework", *infra*, pp. 211-276.

37. Concerning licences for nuclear power plants, the regulators in the United States (NRC) and in the United Kingdom (ONR) issue licences themselves. Finland, Spain and Sweden are countries in which the government (Finland, Sweden) or the competent ministry (Spain) issues the licence based on a statement by the regulatory body. In France, the government issues the basic licence (*autorisation de création*) whereas subsequent operating licences are within the competence of the regulator ASN.

38. In most countries, licence conditions are tailored to fit the specific licence. In the United Kingdom, there is a set of standard licence conditions attached to all nuclear site licences. Accordingly, these licence conditions are very generic and generally oblige the licensee to implement "adequate arrangements" to deal with specified matters. See ONR (Feb. 2017), *Licence condition handbook*, available at: www.onr.org.uk/documents/licence-condition-handbook.pdf (accessed 28 May 2021).

Depending on national administrative law, a licence may also contain an explanatory section or justification where the regulatory authority describes the process and the assessment it has performed and gives the reasons why it concludes that the mandatory requirements are met and the licence can be issued. If there has been public participation during the licensing process, the licence may give a summary of comments and objections and indicate how they have been dealt with by the regulatory body.

2. Licensing activities for the nuclear fuel cycle

The regulatory considerations applicable to the licensing of nuclear power plants are often the focus of any description of how the nuclear regulatory licensing process unfolds, perhaps understandably given their scale and significance. At the same time, a full view of the regulatory control over the nuclear industry begins at the front end of the nuclear fuel cycle, the extraction of uranium ore, and continues through the steps of uranium refinement, conversion, enrichment, fuel fabrication and waste management. A "cradle to grave" perspective on the appropriate regulatory oversight of nuclear-related activity thus starts with the licensing of uranium mine operations.

As with the steps of the development of a project for a nuclear power plant, a uranium mine project is regulated for construction, operation, decommissioning and safe return/release from regulatory control, a life-cycle approach. The early nuclear industry conducted uranium mining activities in a way that did not reflect current understanding of environmental protection, worker safety or remediation planning, and there is a legacy of sites requiring remediation in many parts of the world, where the remediation work continues today.[39] In contrast, today's industry operates within a regulatory structure that reflects worker protection and protection of the environment, with social acceptability of operations being an increasing consideration for decisions to authorise mining operations. As was noted in the most recent 28th edition of the "Red Book", *Uranium 2020: Resources, Production and Demand*:[40]

> [T]he environmental and social aspects of the uranium production cycle are gaining increasing importance […] With a need for increased uranium production to meet demand, the continued development of transparent, safe and well-regulated operations that minimise environmental impacts is crucial, particularly for those countries hosting uranium production for the first time.

National regulators apply the principles of nuclear law to uranium mine operations, recognising that the risks to workers, the public and the environment arising from mine operations are different in scale from nuclear power plant operation, so the regulatory oversight is risk-informed. International guidance and industry tools exist,[41] and it is a best practice to require the end-of-life remediation and decommissioning plans before mine operations are constructed.

39. For a useful survey of uranium mine remediation activities, see IAEA (2011), *The Uranium Mining Remediation Exchange Group (UMREG), Selected Papers 1995-2007*, IAEA, Vienna.

40. NEA and IAEA (2020), *Uranium 2020: Resources, Production and Demand*, OECD Publishing, Paris, p. 11.

41. NEA (2014), *Managing Environmental and Health Impacts of Uranium Mining*, OECD Publishing, Paris; IAEA (2014), *Lessons Learned from Environmental Remediation Programmes*, IAEA Nuclear Energy Series, No. NW-T-3.6, IAEA, Vienna; World Nuclear Association (WNA) (2010), *Sustaining Global Best Practices in Uranium Mining and Processing: Principles for Managing Radiation, Health and Safety, Waste and the Environment*, WNA Policy Document, WNA, London, available at: www.world-nuclear.org/uploadedFiles/org/WNA/Publications/WNA_Position_Statements/PD-UraniumMining.pdf (accessed 27 May 2021).

Going forward from mining of uranium, the nuclear fuel cycle basically comprises the following activities:

- conversion of uranium;
- enrichment of uranium;
- fabrication of fuel assemblies;
- use of fuel assemblies in a reactor, i.e. fission of uranium; and
- activities associated with management of spent fuel and nuclear waste, i.e. storage, treatment and packaging, reprocessing and final disposal.

All of these activities are linked to specified facilities (conversion facility, enrichment facility, nuclear reactor, etc.) and the expected transport of the uranium or the spent fuel and radioactive waste between those facilities. These facilities and transports are all nuclear activities normally requiring a licence. There will be different applicants/licensees (e.g. the operators of the various facilities) and there may be different competent authorities even within the same country.

Depending on their object, these licensing processes may vary greatly in their substance (content) and their procedure. An important principle in nuclear regulation is that account must be taken of the potential magnitude and nature of the hazard associated with the facility or activity; the scope and level of detail of safety assessment must be commensurate with the hazard (graded approach).[42] This means that a licence for a transport of natural uranium does not require the same depth of assessment and the same elaborate procedure as a licence for construction and operation of a nuclear power plant or the licence for a storage facility for spent fuel.

3. *Licensing during the life cycle of a nuclear facility*

a. Role of safety assessment in licensing

Licensing is mainly about assessing compliance with all applicable requirements before an expected nuclear activity goes ahead. Applicable requirements fall into various categories. Some requirements are specific to nuclear activities, such as nuclear safety, nuclear security and physical protection, radiological protection or provision of a financial security for nuclear liability; other requirements have a more general scope, such as environmental protection, construction safety, safe work environment, etc.

In the licensing process for a large nuclear facility such as a nuclear power plant, nuclear safety (including radiological protection) is the most prominent issue. Adequate nuclear safety, in licensing, is determined by assessing the project against national standards and regulations.

In the licensing process, the applicant (the potential future licensee) demonstrates compliance by submitting technical documents that are reviewed by the regulatory authority and, as the case may be, by external experts or expert organisations contracted by the authority (often called technical support organisations or TSOs). In doing this, the regulatory body keeps the full responsibility, and accountability to government, parliament and the public, for the assessment of safety, security and other relevant requirements. TSOs can support the regulator by doing work assigned to them, but the decision about the acceptability of an application rests with the

42. The graded approach is Requirement 1, thus underlining its importance, in IAEA (2016), *Safety Assessment for Facilities and Activities*, IAEA Safety Standards Series, No. GSR Part 4 (Rev. 1), IAEA, Vienna, p. 7. IAEA (2010), *Licensing Process for Nuclear Installations*, IAEA Safety Standards Series, No. SSG-12, IAEA, Vienna, pp. 17-18 gives more details on the graded approach.

regulator.[43] In the course of the licensing process, the nuclear regulatory body may have to consult, and sometimes obtain the consent of, other administrative bodies; this may particularly be the case if the nuclear licensing process encompasses other, non-nuclear issues.

The applicant, in turn, may also rely on external support for producing licensing documentation or for providing an independent assessment of existing documentation. In the case of a large nuclear facility, documentation of the plant design will be supplied by the plant vendor. In the contract between the applicant (the future operator) and the vendor, delivery not only of hardware and construction services but also of documentation is a pivotal point. It is important to note, however, that the vendor normally is not party, in terms of administrative law, to the process. The applicant must check and endorse the documentation delivered by the vendor (which supposes that the applicant has the necessary knowledge and staffing to do this, being an "intelligent customer")[44] and submit it to the regulatory authority on its own behalf. Of course, there may be interaction among the applicant, vendor, regulatory body and, as the case may be, a TSO employed by the latter, but a legally relevant relationship normally exists primarily between the applicant and the regulatory body.

In international practice, the main safety aspects are laid out by the applicant in a comprehensive document often called the safety analysis report (SAR).

There are three main topical areas of assessment of nuclear safety for a nuclear installation:

- The *plant design* must comply with requirements such as the basic principle of defence in depth, complemented by engineering principles such as redundancy, diversity or fail-safe. Relevant internal and external events must be identified and taken into account.
- The proposed *site* must be suitable in terms of nuclear safety. This means on the one hand that the site characteristics do not present an intolerable risk of external events, e.g. via problematic seismic or flooding aspects; on the other hand, the potential impact of incidents on people and environment at the site must be evaluated, which may result in ruling out some sites due to population density, vicinity to specific protected natural habitats, etc.
- The *applicant* must demonstrate its ability to ensure nuclear safety by demonstrating it has adequate financial means, a competent staff, an adequate organisation, including an effective safety culture, a system of quality assurance concerning contractors, etc.

The assessment of these safety aspects in the licensing process is performed in a logical sequence, following the chronology of a nuclear project, which will normally be structured along the following steps: siting and site evaluation (which may include the EIA), design, construction, commissioning, operation, decommissioning and release from regulatory control.[45] A similar evaluation process applies to the area of nuclear security and physical protection. The applicant submits documents demonstrating compliance with applicable requirements, e.g. through plant design or organisational measures, along the assessment steps mentioned above.

43. Depending on the structure of the regulatory body, what is described as the TSO may be located within the regulatory body itself, and be an integral part of the regulatory functions and oversight.

44. See IAEA (2011), *Workforce Planning for New Nuclear Power Programmes*, IAEA Nuclear Energy Series, No. NG-T-3.10, IAEA, Vienna, pp. 6, n.1, 54; Office for Nuclear Regulation (Apr. 2019), *Licensee Core Safety and Intelligent Customer Capabilities*, ONR Guide, Doc. NS-TAST-GD-049 Rev. 7, p. 3.

45. For these steps, see IAEA (2010), *Licensing Process for Nuclear Installations*, supra note 42, pp. 21-49.

b. Steps in the licensing process and pre-licensing

As set out in the previous section, the technical assessment of nuclear safety and security in the licensing process is largely determined, in its content and its sequencing, by an internationally harmonised practice. By contrast, there is great variance in how these assessment steps are correlated to formal licences in national law.

Looking at nuclear power plants, a classical approach employed by many states[46] is a two-step licensing process with a construction licence and an operating licence. First, the regulatory authority issues a construction licence, based on an evaluation of preliminary safety and design information. When construction is completed, it grants an operating licence based on an evaluation of the final design and other operational considerations. In some jurisdictions, the construction or operating licence may be issued in several sequential partial licences.[47] In other jurisdictions, there may be more than two licensing steps, reflecting in more detail the sequence of safety assessment explained above.[48]

By contrast, some jurisdictions provide for only one comprehensive licence covering all of the safety assessment steps.[49] Since such a licence must be granted at the outset, before construction starts, it cannot be based on a full assessment of all aspects; therefore, such licences contain regulatory hold-points, e.g. before commissioning, where the regulatory body performs further assessment of relevant aspects according to acceptance criteria defined in the licence and gives a green light for going forward.[50] In legal terms, such hold-points are not separate licences in themselves since the formal authorisation of the activity has already been fully laid down in the comprehensive licence.

In some jurisdictions, certain elements of the evaluation needed for licensing a nuclear installation can be performed in a separate process before actual licensing starts. Such pre-licensing can involve the reactor design or the site. Thus, some states provide for a process in which the vendor of a reactor design submits the design to the regulatory body for confirmation that the design in general complies with the valid safety requirements. In a subsequent licensing process for a particular nuclear power plant, such confirmation can be referenced by the applicant

46. Examples are the United States (construction permit and operating licence under the traditional system as contained in NRC regulations in 10 *Code of Federal Regulations* (CFR) Part 50) and Finland.

47. This was the case in Germany for its existing nuclear power plants.

48. According to the Bulgarian Act on the Use of Nuclear Energy of 2002, Art. 15, a separate “permit” is issued for siting, design of a nuclear facility, construction and commissioning, and a “licence” is issued for operation of a nuclear facility.

49. Important examples are the UK Nuclear Site Licence, issued by the ONR, and the US combined construction and operation licence (COL) issued by the NRC under its regulations in 10 CFR Part 52, originally issued in 1989. In the US system, applicants may choose between applying for a COL under Part 52 or for a construction permit and an operating licence under the traditional approach in Part 50. See Burns, S. (2008), “Looking Backward, Moving Forward: Licensing New Reactors in the United States”, *Nuclear Law Bulletin*, No. 81, OECD Publishing, Paris, pp. 13-27.

50. In the United States, this is exemplified by ITAAC (inspections, tests, analyses and acceptance criteria) defined in the COL and verified by the NRC before the plant commences operation. See *ibid.*, p. 25. In the UK Nuclear Site Licence, the regulator ONR defines “hold points” requiring its consent for going forward; see ONR (2019), *Licensing Nuclear Installations*, para. 138, available at: www.onr.org.uk/licensing-nuclear-installations.pdf (accessed 27 May 2021).

(i.e. the future operator), meaning that the regulatory body, in principle, will not reiterate the general design assessment but will focus on design issues that are affected by the chosen site.[51]

Similarly, some nuclear regulatory systems offer the possibility of a generic, project-independent review and approval of potential sites, including an EIA, upon application.[52] Since the reactor design is not yet determined at this stage, the assessment is based on a generic "plant parameter envelope" of criteria. In a subsequent licensing process for a nuclear reactor at that site, the applicant can reference the early site permit. To the extent the expected installation keeps within the envelope criteria used for the permit, the matters dealt with in the permit are deemed resolved, leaving no room for a new assessment.

Seen from a legal perspective, neither a design confirmation nor a site permit can be qualified as licences. A design confirmation does not confer authority on the plant vendor to perform any specific activity that would otherwise be unlawful; the same goes for the site permit, which does not remove the legal barrier for any specific activity at the site. However, these documents have an important function for resolving parts of the assessment before licensing starts and thus for "front-loading" a licensing process, potentially reducing complexity and giving more certainty to the applicant.

c. Licensing modifications to existing installations and impact of changing safety requirements

A licensing process is the prerequisite for a nuclear installation to be designed, sited, constructed and enter into operation. However, the story does not end there; there may be, and often will be, additional licensing actions for existing installations and activities.

A licensing process may be triggered by major changes to the plant, e.g. a substantial power uprate. In such cases, the licensee applies for a licence amendment that follows the same principles as licensing for a new activity – the main aim being to verify whether the change as such, or the facility in the shape it takes by the change, complies with relevant requirements.

The licence for a nuclear power plant confers authority on the licensee to lawfully construct and operate a nuclear power plant as defined in the licence; this is based on a judgement of the competent regulator that the design of the plant is compliant with applicable legislation and regulations and thereby meets standards for safe operation. However, requirements will evolve throughout the life of a reactor. Research or experience from events may yield new knowledge about accident sequences; industrial research and development can lead to development of new safety features; the decennial periodic safety review (PSR) for individual facilities practised in most nuclear power countries involves a design analysis that may result in new concepts and ideas for safety improvements; or simply, the expectations of government and society about the adequate level of safety may change.

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51. In the United States, the NRC issues, upon application, a Design Certification in the form of a rule, thus a binding legal document. A Design Certification is valid for 15 years from the date of issuance but can be renewed for an additional 10 to 15 years. In the United Kingdom, the ONR performs a Generic Design Assessment (GDA) resulting in a Design Acceptance Confirmation (DAC); similarly, in Canada the Vendor Design Review (VDR) is provided as an optional service by the Canadian regulator Canadian Nuclear Safety Commission (CNSC). In contrast to the US Design Certification, the confirmation statement by the ONR and CNSC are not legally binding on subsequent licensing processes and a VDR is not a part of the Canadian licence application process; nonetheless, in practice they do reflect the regulatory assessment of a design in a way that can facilitate subsequent licensing processes.

52. The major example for this is the US NRC early site permit. See Burns, S. (2008), *supra* note 49, pp. 19-20.

This raises the question whether the licensee of an existing nuclear power plant can be obligated to modify the installation to comply with new findings or new standards (backfitting or retrofitting). There is no general rule in the CNS that speaks to this issue. Article 6 of the CNS obligates states parties, when the CNS enters into force for them, to review the safety of their nuclear power plants and, if necessary, to undertake all reasonably practicable improvements in order to upgrade safety or else to eventually shut down the plant. However, this provision, which was aimed at pragmatically addressing the safety of installations deemed most "problematic" at the time the CNS was adopted, does not constitute a legal provision on how to deal with ageing plants in general over time.

In this aspect, the 2015 Vienna Declaration goes a step further by introducing the general principle of carrying out comprehensive and systematic safety assessments throughout the lifetime of a facility in order to identify safety improvements and to implement them if they are reasonably practicable or achievable.[53] Similarly, the 2014 Amended EU Safety Directive, in Article 6(c), obliges member states to ensure that licensees "regularly assess, verify, and continuously improve, as far as reasonably practicable, the nuclear safety of their nuclear installations in a systematic and verifiable manner".[54]

The authority of the legislator, or the regulatory body, to impose new conditions on the holder of a valid licence, and – *vice versa* – the legal obligation of the licensee to comply with new requirements, depends on national constitutional and administrative law and thus varies somewhat from country to country.[55] Generally speaking, there is no clear solution to this – neither "absolute" protection of the licence against new requirements nor an obligation of permanent backfitting. From a synthesis of national approaches and from the generic principle of the 2015 Vienna Declaration, a general tendency can – with all necessary caution – be sketched as follows:[56]

- If new findings stemming from research or from events reveal that there is a deficiency in the safety concept of a design, backfitting is generally mandatory.
- If new options for further improvement, enhancing safety beyond the original level, are developed through research or the progress of technology, they will be implemented if this is "reasonable" (which supposes a cost/benefit analysis). For example, filtered venting of the containment is a feature that has been backfitted in many reactors, whereas it would seem impossible to add a core catcher to an existing facility. The test of being "reasonable" or "practicable" is also reflected in the wording of the 2015 Vienna Declaration and the EU Directive, as quoted above.
- If existing plants cannot reasonably be backfitted to comply with new requirements that are deemed essential, licensees may be compelled to close down their plant within a certain term, based on a high-level political decision and/or legislation passed to this purpose; this may (or not) involve some kind of compensation for the operators.

53. 2015 Vienna Declaration, Principle No. 2, *supra* note 23.

54. 2014 Amended EU Safety Directive, *supra* note 9.

55. For a survey, see Raetzke, C. and M. Micklinghoff (2006), *supra* note 26, pp. 207-226.

56. *Ibid.*, pp. 251-252.

d. Licensing long-term operation

Another major occasion for licensing activities arises if the original licence has a specific time-limited authorisation term. If the operator of the facility wants to continue operation beyond that term, an application for a renewal or an extension of the operating licence, or a safety review leading to an authorisation or approval, may be required. Depending on national legislation, such an authorisation may be necessary every 10 years; or the term may coincide with the expected design life of the plant, which tends to be 30-40 years.[57] In the latter case, the licensing process focuses on the acceptability of such lifetime extension, often called "long-term operation" (LTO). Even if the operating licence has been issued for an indefinite (or open-ended) authorisation term, the regulatory authority after 30-40 years of operation will typically require a safety case from the licensee to justify LTO. Therefore, "specific" or "indefinite" licence terms, i.e. whether LTO requires formal licensing action, are largely legal and administrative concepts rather than safety ones.[58]

The PSR may be performed in a particularly extended and thorough fashion when the 30- or 40-year threshold is reached, putting a particular focus on ageing issues. Preparing for LTO (whether linked to a licensing process or not) is often a milestone when not only ageing plant components are replaced but also when safety improvements of the design may be identified in order to make the nuclear power plant suitable for one or more decades of extended operation.

With now more than 50 years of experience operating some of the current fleet of nuclear power plants, the world's nuclear operators and their regulators have more knowledge of reactor ageing and experience ensuring safe operation of nuclear power plants over a longer term.[59] With the increased operating and regulatory experience, and with countries sharing their knowledge and experience, the licensing considerations applicable to LTO have arguably become less about the numerical "age" of a reactor and more about the results of systematically assessing on a periodic basis the overall safety of the systems and components of an existing facility or activity.

National regulatory frameworks determine how the authorisation of LTO is accomplished and whether and what requirements there are for a specific licensing decision or authorisation from the regulatory body. A crucial consideration for LTO is the issue of new safety requirements and safety upgrades and improvements. These are implemented through regulatory oversight in different ways under different national structures, and the international framework for nuclear power plant safety under the CNS speaks to improvements to existing facilities to upgrade safety, in its incentive-based provisions. The post-Fukushima Daiichi nuclear power plant accident 2015 Vienna Declaration on Nuclear Safety also sets out the CNS contracting parties' agreement respecting the safety assessment of existing facilities throughout their lifetime, to identify safety improvements, in furtherance of the CNS objectives. Interest in LTO remains high, as countries increasingly consider operations past the 50-60 year mark.[60]

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57. "Among the [countries with] specific terms, some countries base the term on the design life of the types of reactors in operation in the country at issue, with light water reactors (LWRs) traditionally having a design life of 40 years and pressurised heavy water reactors (PHWRs) traditionally having a design life of 30 years. In contrast, other countries base the term on the periodic safety review (PSR) process, specifying that authorisations are only valid for ten-year terms." NEA (2019), *Legal Frameworks for Long-Term Operation of Nuclear Power Reactors*, OECD Publishing, Paris, p. 28.

58. Emmerechts, S., C. Raetzke and B. Okra (2011), "Legal and regulatory aspects of long-term operation of nuclear power plants in OECD member countries", *Nuclear Law Bulletin*, No. 87, OECD Publishing, Paris, pp. 48-71.

59. NEA (2019), *Legal Frameworks for Long-Term Operation of Nuclear Power Reactors*, *supra* note 57, p. 16.

60. The legal considerations applicable to the long-term operation of nuclear power reactors are the subject of a comprehensive 2019 report that compiled information gathered from 25 countries, to provide insight into the various laws, regulations and policies applicable to the issues of long term operation. See NEA (2019), *Legal Frameworks for Long-Term Operation of Nuclear Power Reactors*, *supra* note 57.

Finally, at the very end of the lifetime of a nuclear installation, decommissioning and dismantling of the facility will often require a new licence. This will be set forth in section VI.1.a. "Licensing of decommissioning and dismantling".

4. *Licensing considerations*

a. Role and elements of efficient licensing

The aim of a licensing process is to authorise an activity, based on the premise that such activity is established by the relevant legislation to be acceptable provided it has been verified that it fulfils all applicable requirements. It follows from this that implementation of an expected nuclear activity meeting the stringent safety and security conditions imposed by law should be enabled, and not prevented, by the licensing process. Large nuclear installations such as nuclear power plants are complex projects with high budgets, requiring adequate management and a sufficient level of predictability. Seen from the viewpoint of the project owner, a licensing process not fit for its purpose may pose a significant risk to the project. Such risk may be seen to materialise, for example, when the licensing processes last much longer than reasonably expected or when relevant requirements are unclear at the outset or change during the process ("shifting target"), thus causing costly and lengthy re-engineering.

Clearly, responsibility for effective and efficient licensing rests on both the applicant and the regulator. The applicant must: be fully knowledgeable, clearly define the relevant features of the project, and submit adequate documentation in a timely manner, among other obligations. On the other side, the licensing process must be designed by legislation, and handled by the regulator, in an efficient way that delivers its purpose.[61]

There are several factors supporting the efficiency of a licensing system. One factor is that a strong political decision is taken in a legally relevant form before the actual licensing process starts, thus giving a firm basis to the expectation that the project will be licensed if it fulfils the relevant requirements.[62] One-step licensing, as described above, may be suitable to give confidence to the project owner since requirements are fixed and full authorisation is granted even before the main project funding is released for construction. Similarly, the instruments of pre-licensing (design certification and site licence), also discussed above, reduce complexity by settling important safety issues in advance, thus effectively "front-loading" the process.[63] If the licensing process comprises several licences, these steps should follow in a predictable fashion from each other.

Obviously, the existence of a strong and well-equipped regulator is not only required but is key to licensing processes on this scale;[64] also important is the establishment of procedures supporting efficient co-operation of all parties and clear assignment of responsibilities, and the adherence, if possible, of all parties to a pre-agreed timescale.

61. An analysis, based on a survey of worldwide nuclear industry, was produced by the World Nuclear Association in WNA (2013), *Licensing and Project Development of New Nuclear Plants*, available at: www.world-nuclear.org/our-association/publications/online-reports.aspx (accessed 30 Apr. 2021).

62. In Finland, a Decision-in-Principle on a new nuclear power plant is adopted by government and parliament before actual licensing starts. In the United Kingdom, Parliament in 2011 adopted a National Policy Statement on new nuclear build that included a list of suitable sites.

63. In the United States, the system of COL, Design Certification and Early Site Permit was introduced for this purpose, namely to encourage early resolution of safety issues, and to improve the stability and predictability of the licensing process. See Burns, S. (2008), *supra* note 49, p. 7.

64. See NEA (2014), *The Characteristics of an Effective Nuclear Regulator*, *supra* note 20, for a discussion of the most relevant aspects.

b. New technologies and international regulatory co-operation

National licensing regimes, though firmly rooted in their overall legislative system, must evolve and adapt to fulfil their function with regard to new technologies. Whereas nuclear power has in the past decades been delivered by reactors based on a small number of proven technologies (the vast majority being light water reactors), today new technologies are poised to enter the market. Small modular reactors (SMRs), in particular, are at the forefront of the conversation. "SMRs are defined today as nuclear reactors with a power output between 10 megawatt electric (MWe) and 300 MWe."[65] A considerable number of designs are currently being developed, based on a great variety of technologies, with advanced engineered features. They are deployable either as a single or multi-module plant and in most cases they will consist of modules built in factories and assembled at the site. SMR technologies can be based either on light-water technology or advanced reactor designs, often referred to Generation IV designs, using coolants such as gas, fluoride salt or liquid metal. A number of advanced designs are being evaluated through the Generation IV International Forum (GIF).[66]

There are many reasons why SMRs are currently evaluated as a potentially attractive option in many countries. They can provide electricity to remote areas or to local grids, they can offer a flexible complement to intermittent renewable generation sources, they can (depending on their technology) deliver process heat instead of electricity (this could be vital for hydrogen production) and they may also be economically attractive. Questions exist, however, regarding the legal framework for SMRs and how SMRs should be licensed. Two main issues are highlighted here.[67]

First, existing requirements are often modelled on the light-water reactor technology and would have to be revised to accommodate new technologies. Generally speaking, it would seem reasonable if at least high-level requirements in national regulations are formulated in a technology-neutral way. Moreover, it may be necessary to adapt some topical issues and criteria to the specific characteristics of SMRs, such as their limited radioactive inventory, inherent safety features or modular system. Many SMR designs claim to offer an increased level of safety, for example by relying on exclusively passive safety features. If this can be demonstrated to be true in the licensing process, some existing regulatory requirements, e.g. the need for specified active safety systems or the extent of an emergency evacuation zone, may be adjustable. Such an approach does not entail a "safety discount" or a paradigm shift in regulation; it means applying the graded approach generally valid in safety evaluation and regulation.[68] Obviously, many issues will arise when it comes to practical implementation; these must be resolved in accordance with the given legal system.

A second issue raised by the possible ascent of SMRs is enhancement of international standardisation and harmonisation. Standardisation of reactor designs and harmonisation of national regulations to avoid having to re-engineer a given design for every country of destination are topics that are already relevant for existing designs.[69] Since SMRs mostly follow the concept of factory-built modules shipped to the site (wherever it may be) and assembled there, harmonisation of national requirements may be considered of crucial importance for their

65. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, OECD Publishing, Paris, p. 15.

66. For more on GIF, see the GIF website available at: www.gen-4.org/gif (accessed 27 May 2021).

67. For a more fulsome discussion of the various licensing, regulatory and policy aspects, as well as the legal framework for SMRs, see NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, *supra* note 65, pp. 29-42.

68. See *supra* note 42.

69. For an industry view on this topic, see WNA (2010), *International Standardization of Reactor Designs*, available at: www.world-nuclear.org/our-association/publications/online-reports/cordel-standardization-of-reactor-designs.aspx (accessed 27 May 2021).

deployment. Avoiding the need for substantial customisation in every deployment country through harmonisation of requirements would enable the concept of modular fabrication and may be considered a prerequisite for the success of SMR development.

Regulatory co-operation and information sharing among nuclear regulators is a long-standing feature of the international nuclear safety regime.[70] The Multinational Design Evaluation Programme (MDEP) is a forum for co-operation of regulators that are considering the licensing of new reactors.[71] The universal acceptance of IAEA Safety Standards, together with regional harmonisation efforts such as the Western European Nuclear Regulators' Association in Europe, has resulted in high-level safety requirements being more and more comparable in most states. This is accomplished within a context that recognises that each country has its own regulatory requirements, based on international standards and guidance, but are country-specific.

In the context of SMRs, there are new initiatives and new ideas for efficiently ensuring the safety of such reactors in a way that enables technological advances and the realisation of innovation.[72] In this context, one sees the potential for changes to the extent and detail of regulatory co-operation, and potential for greater harmonisation of regulatory requirements.[73] In this regard, the US and Canadian nuclear regulatory bodies signed a Memorandum of Cooperation in August 2019 to enhance their long-standing regulatory co-operation, specifically respecting new reactor technologies. The enhanced co-operation is to include the sharing of regulatory insights from the review of SMR designs, with a view to develop common guidance between the regulatory bodies for the review of eventual licence applications. This close collaboration has the stated goal of reducing duplication of effort and increasing effective regulation by each of the two mature regulators. The initiative, and its potential for greater harmonisation of regulatory efforts, has been described by the President of the Canadian Nuclear Safety Commission (CNSC), Rumina Velshi, as a potential "paradigm shift" in the regulatory space.[74]

It remains to be seen if, beyond those initiatives within existing regulatory frameworks, new international licensing formats will evolve.

V. Oversight of nuclear activities

Even if the regulatory body sets the highest safety standards and binds the licensee to a comprehensive licensing terms, continued regulatory oversight remains critical to ensuring nuclear safety. In this vein, the CNS explains that the legislative and regulatory framework shall

70. The Preamble to the CNS, *supra* note 2, flags the importance to safety of international cooperation and bilateral and multilateral information sharing.

71. For details on MDEP, see the dedicated website available at: www.oecd-nea.org/mdep (accessed 27 May 2021). The NEA facilitates MDEP activities by providing technical secretariat services for the programme.

72. See e.g. reports of the IAEA's Small Modular Reactor (SMR) Regulators' Forum, available at: www.iaea.org/topics/small-modular-reactors/smr-regulators-forum (accessed 27 May 2021).

73. As the global nuclear community considers SMRs and how to regulate such advanced technologies, it is considering potential lessons from other sectors. For example, a "Multi-Sector workshop on innovative regulation: Challenges and benefits of harmonizing the licensing process for emerging technologies" was hosted in December 2020 by the NEA and the CNSC and considered examples from aviation, medicine and international transport of nuclear material. See NEA's website on the workshop, available at: www.oecd-nea.org/jcms/pl_46728/multi-sector-workshop-on-innovative-regulation-challenges-and-benefits-of-harmonising-the-licensing-process-for-emerging-technologies (accessed 27 May 2021).

74. Velshi, Rumina (11 Feb. 2020), "Remarks at the Advanced Reactors Summit VII", available at: https://nuclearsafety.gc.ca/eng/resources/presentations/president-velshi-remarks-advanced-reactors-summit.cfm (accessed 27 May 2021).

provide for: a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences; and the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.[75] 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 non-compliance is the result of mere inadvertence, negligence, "malpractice or wrongdoing by those persons/organizations under regulatory oversight".[76] Therefore, although the licensee maintains the prime responsibility for safety,[77] 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 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."[78] 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 approach".[79] However, digging deeper into the General Safety Requirements (GSR), as well as the General Safety Guides (GSG), a great deal more can be learnt.

1. Inspection

The first aspect of nuclear regulatory oversight is inspection and assessment. The IAEA provides 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".[80]

Focusing solely on inspections, 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."[81] 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;

75. CNS, *supra* note 2, Art. 7(2)(iii) and (iv).

76. IAEA (2003), *Independence in Regulatory Decision Making*, INSAG-17, IAEA, Vienna, p. 1.

77. CNS, *supra* note 2, Art. 9.

78. IAEA (2006), *Fundamental Safety Principles: Safety Fundamentals*, *supra* note 6, p. 8.

79. IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, *supra* note 18, p. 5.

80. *Ibid.*, pp. 27-31.

81. *Ibid.*, p. 30.

- inspect documents (including possibly taking them off-site), interview personnel, observe activities, monitor practices, examine procedures and perform tests; and
- 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."[82] In the simplest terms possible, this means 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 to inspect the control room may seem like government overreach, 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.[83]

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 "resident inspectors". These inspectors have their offices at the facility, spending their day on-site. Resident inspectors typically have access to all areas of the facility and perform daily monitoring of the activities, serving 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 provide for at least one if not two to three on-site resident inspectors at each nuclear power plant, with some even stationed at plants under construction. Not all nuclear power countries, however, provide for this type of inspection programme in their oversight regime. Whether to utilise the resident inspector system is a policy choice, with some 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.[84]

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 structural 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. This is not so difficult to achieve for inspectors in their normal course of planned or reactive inspections; however, a question arises as to how resident inspectors 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

82. IAEA (2016), *Safety of Nuclear Power Plants: Commissioning and Operation*, IAEA Safety Standards Series, Specific Safety Requirements, No. SSR-2/2 (Rev. 1), p. 7.

83. IAEA (2018), *Functions and Processes of the Regulatory Body for Safety*, *supra* note 31, p. 80.

84. ASN (2020), *ASN Report on the state of nuclear safety and radiation protection in France in 2019*, ASN, Montrouge, France, p. 145.

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 on-site.

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. Maintaining flexibility, though, is critical, as issues inevitably arise requiring adaptation, and transparency in these matters is key for ensuring public trust in the resident inspectors and ultimately the regulatory body.

2. Enforcement

The second aspect of regulatory oversight is enforcement. In a perfect world, enforcement would not be necessary; however, in the real world, mistakes 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 non-compliance before it happens;
- encourage early identification of violations and prompt comprehensive corrective actions by the licensee;
- compel the licensee into compliance; or
- punish the licensee for non-compliance?

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 non-compliance.[85] This is consistent with the graded approach.

Echoing the requirements in the CNS, the IAEA states 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.[86] Consistent with the graded approach, depending on the nature of the violation, the IAEA provides guidance on the types of incremental enforcement actions that may be taken.[87] In general, regulatory bodies have discretionary authority within a defined system of graduated sanctions that look a lot like those specified by the IAEA. Looking at the systems that exist in countries around the world, 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, significant 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

85. See IAEA (2018), *Functions and Processes of the Regulatory Body for Safety*, *supra* note 31, p. 93.

86. IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, *supra* note 18, pp. 31-32.

87. *Ibid.*, p. 31.

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.

a. Evaluating state of mind or *mens rea* in 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 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".[88] 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.

For example, in the 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.[89] The US NRC's *Enforcement Manual*, states that "A willful 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."[90] There are two different types of wilful violations, which are entirely separate and distinct: (1) one that is intentional or deliberate and (2) one that is caused by reckless or careless disregard or indifference as to whether a requirement will be violated.[91]

Most of the elements of these types of violations are the same, but they differ in that knowledge must be proven for a deliberate violation, meaning that the person committing the violation: knew that a requirement existed, understood the requirement, and knew the requirement was applicable at the time; and knew their actions were contrary to the requirement.[92] This distinction is important because in the United States, action can be taken against not only licensed entities and licensed individuals, but also against any non-licensed individual engaged in licensed activities if they:

- deliberately caused or would have caused, if not detected, a licensee to be in violation of a legal requirement; or

88. IAEA (2018), *Functions and Processes of the Regulatory Body for Safety*, *supra* note 31, p. 95.

89. NRC Office of Enforcement (15 Jan. 2020), *NRC Enforcement Policy*, NRC ADAMS Doc. ML19352E921, NRC, Washington, DC, pp. 9-10.

90. NRC Office of Enforcement (1 Dec. 2020), *Nuclear Regulatory Commission Enforcement Manual*, Rev. 11, Change 7, NRC, Washington, DC, p. 246.

91. *Ibid*.

92. *Ibid*., pp. 246-47.

- deliberately submitted materially inaccurate or incomplete information to the NRC, a licensee, an applicant or a licensee's or applicant's contractor or subcontractor.[93]

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.[94]

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 and regulatory authorities 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."[95] In particular, Chapter 9 of the Nuclear Energy Act contains a number of articles that speak to wilful offences and Article 88 specifies three different types of sanctions depending on whether the offence was committed: wilfully, knowingly or negligently.

Under 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 14 factors to be taken into account is: "The existence of intent or negligence in the commission of the offence."

b. Challenging enforcement actions

The need for access to justice applies to administrative decisions and actions as well as civil and criminal governmental decisions and actions. The IAEA provides that the laws and statutes setting out the framework for safety shall include "[p]rovision for appeals against decisions of the regulatory body".[96] While this mainly relates to authorisation decisions in that document,[97] 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.[98] In some instances, states may provide a prior opportunity for a hearing to allow a challenge before the enforcement action is taken.[99] Appropriate legal procedures must

93. 10 CFR 50.5(a)(1)-(2).

94. See e.g. *In re David Geisen*, CLI-10-23, 72 NRC 210 (2010).

95. ENSI (July 2019), *Switzerland's Eight National Report on Compliance with the Obligations of the Convention on Nuclear Safety*, ENSI, Brugg, p. 37.

96. IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, *supra* note 18, p. 5.

97. *Ibid.*, p. 25.

98. IAEA (2018), *Functions and Processes of the Regulatory Body for Safety*, *supra* note 31, p. 20.

99. *Ibid*.

be set up that allow for these types of challenges to be raised.[100] 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 some countries, 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 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 other countries, 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. 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; what is the nature of the appeal process; which body is the appeal raised to; and are further appeals possible? As noted by IAEA's International Safety Advisory Group (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."[101] 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.

c. Oversight of nuclear safety culture

The term "nuclear safety culture" originated 30 years ago following the Chernobyl accident, where INSAG found that "[t]here is a need for a 'nuclear safety culture' in all operating nuclear power plants".[102] For the first five years, there was no commonly accepted definition until the IAEA, through INSAG, put out its definition in 1991.[103] The IAEA's current definition has changed slightly since then, 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."[104] The IAEA definition represents an international governmental consensus. But, the definition does not change

100. See e.g. IAEA (2003), *Independence in Regulatory Decision Making*, *supra* note 76, p. 6.

101. *Ibid.*

102. IAEA (1986), *Summary Report on the Post-accident Review Meeting on the Chernobyl Accident*, IAEA Safety Series, No. 75-INSAG-1, IAEA, Vienna, p. 76.

103. IAEA (1991), *Safety Culture*, IAEA Safety Series, No. 75, INSAG-4, IAEA, Vienna, p. 4.

104. IAEA (2019), *IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection*, *2018 Edition*, IAEA, Vienna, p. 207; see also IAEA (2019), *Human and Organizational Aspects of Assuring Nuclear Safety – Exploring 30 Years of Safety Culture*, Proceedings of an International Conference, Vienna, Austria, 22-26 February 2016, p. 68.

much when viewed by international nuclear operators[105] and the definition is virtually the same at a national operator level as well.[106]

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".[107] Events demonstrate that there is a pattern where weak safety culture leads to declining safety performance, which manifests itself in safety problems that 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.[108] Safety culture issues can happen anywhere, at any time and in any aspect of the nuclear fuel cycle. 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.

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 the CNS and Joint Convention and even then only in the preambles, with a passing reference to a "desir[e] to promote an effective nuclear safety culture". Neither of the conventions elaborate how the provisions advance this objective. Thus, there are 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.

There is no worldwide consensus that laws can be written to mandate, or that regulations can be drafted to oversee, a healthy safety culture. Despite this, there are efforts to address this in legislation and regulation. First, at a regional level, the preamble of the EU'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."[109] 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. 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.

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 regulatory body issued a regulation mandating "a good safety culture",[110]

105. World Association of Nuclear Operators (WANO) (2013), *Traits of a Healthy Nuclear Safety Culture*, WANO Principles PL 2013-1, p. 3.

106. INPO (2012), "Traits of a Healthy Safety Culture", INPO 12-012, p. iv.

107. IAEA (1991), *Safety Culture*, *supra* note 103, p. 1.

108. Examples include: United States, 2002, Davis-Besse reactor pressure vessel head incident; United States, 2004-2007, Peach Bottom and Turkey Point sleeping security officers; Sweden, 2006, Forsmark-1 voltage transient event; Japan, 2011, Fukushima Daiichi nuclear power plant accident; Korea, 2012, Kori nuclear power plant station blackout event; and France, 2016, Le Creusot Forge document falsification.

109. 2014 Amended EU Safety Directive, *supra* note 9.

110. Säteilyturvakeskus (STUK, Finnish Radiation and Nuclear Safety Authority), "Regulation on the Safety of a Nuclear Power Plant", STUK Y/1/2018, chap. 6, sec. 25(1), adopted 10 December 2018.

and binding requirements provide seven behavioural requirements that must be provided for by nuclear facility operators or constructors.[111] Regulatory oversight of safety culture is provided through specific inspections, analysing licensee self-assessments and independent safety culture assessments.

Similarly, Canada's regulator sets out "requirements and guidance for fostering and assessing safety culture" that require licensees to "document their commitment to fostering safety culture in their governing documentation."[112] The key to the CNSC's safety culture framework are the five characteristics of a healthy safety culture and the "observable and measurable indicators for each safety culture characteristic".[113] Licensees are required to "conduct comprehensive, systematic and rigorous safety culture assessments at least every five years."[114]

Looking at Finland's and Canada's approaches, 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 organisations, like the World Association of Nuclear Operators (WANO), have compiled traits or characteristics of a healthy safety culture.[115] Such traits 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.[116] These traits are fairly universally recognised, with national organisations like the Institute of Nuclear Power Operations (INPO) and the Nuclear Energy Institute (NEI) in the United States, national regulatory bodies like the US NRC, as well as international organisations like the OECD Nuclear Energy Agency and the IAEA all essentially agreeing with them either directly or indirectly.[117]

While all ten are important, one is of critical significance for lawyers: the 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."[118] There are laws in most countries that speak to these issues, often the national whistleblower protection laws or employee protection laws. Although not covering all aspects of safety culture, they do provide a legal basis to help promote and protect a safety-conscious work environment.

Until recently, only nine EU countries provided comprehensive legal protection for whistleblowers. In an effort to strengthen protections, the EU approved new standards to protect whistleblowers who reveal breaches of EU law in a wide range of areas, including radiological

111. STUK, "Leadership and Management for Safety", STUK Guide YVL A.3, sec. 3.2, adopted 15 Mar. 2019.

112. CNSC (2018), REGDOC-2.1.2, "Safety Culture", Section 1.1, "Introduction: Purpose" and Section 2, "Fostering Safety Culture".

113. *Ibid.*, Appendix A: Safety Culture Reference Framework.

114. *Ibid.*, sec. 3, "Safety Culture Assessments".

115. WANO (2013), *Traits of a Healthy Nuclear Safety Culture*, WANO Principles PL 2013-1.

116. NRC, "Final Safety Culture Policy Statement", 76 *Federal Register* (Fed. Reg.) 34773, 34777 (14 June 2011).

117. INPO (2012), "Traits of a Healthy Safety Culture", INPO 12-012; NEI (March 2014), "Fostering a Healthy Nuclear Safety Culture", NEI-09-07, Revision 1; NEA (2016), *The Safety Culture of an Effective Nuclear Regulatory Body*, *supra* note 19; and IAEA (2009), *The Management System for Nuclear Installations*, IAEA Safety Standards Series, Safety Guide No. GS-G-3.5, IAEA, Vienna.

118. WANO (2013), *Traits of a Healthy Nuclear Safety Culture*, *supra* note 115, p. 9. See also NRC), Final Safety Culture Policy Statement, 76 Fed. Reg. 34773, 34777-78 (14 June 2011); Bel V, Branch of the Belgian Federal Agency for Nuclear Control (2014), "Nuclear Safety", available at: www.belv.be/index.php/en/ct-menu-v-nuclear/ct-menu-v-nuclearsafety (accessed 27 May 2021); and Republic of Korea (2016), *Seventh National Report for the Convention on Nuclear Safety*, pp. 74-75.

protection and nuclear safety.[119] It also aims to "strengthen the enforcement" of the nuclear safety culture requirements in Article 8(b)(2) of the 2014 Amended EU Safety Directive.[120] The Directive explicitly prohibits retaliation, outlining 15 types of prohibited actions.[121]

Nuclear-specific whistleblower protection already exists in a number of countries. In the United States it is included in both legislation and regulation. The US Energy Reorganization Act of 1974, as amended, states that no employer may discharge or otherwise discriminate against any employee because the employee has engaged in a number of enumerated activities.[122] The NRC implemented additional agency-specific regulations providing that "Discrimination … against an employee for engaging in certain protected activities is prohibited."[123] Japan also has a nuclear-specific whistleblower protection law that stipulates 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.[124]

The intangible nature of nuclear safety culture creates challenges, but overseeing 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, at least one element of safety culture can be codified and enforced though whistleblower protection laws.

3. Oversight conclusions

Oversight is about ensuring compliance with the applicable requirements, and ultimately, nuclear safety. Both safety conventions require that member countries incorporate oversight – inspection, assessment and enforcement – into their legal and regulatory frameworks, but there are no binding international oversight requirements. Soft law, mainly in the form of the IAEA Safety Standards, provides general principles of oversight. National implementation varies, especially with enforcement, due to differences in national legal frameworks. Regulatory bodies must have the legal authority to take any action necessary to ensure nuclear safety. Oversight presents a number of important legal and policy issues and while those discussed are quite different, all have distinct legal elements that require careful consideration by subject matter experts.

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119. Directive (EU) 2019/1937 of the European Parliament and of the Council of 23 October 2019 on the protection of persons who report breaches of Union law, OJ L 305 (26 Nov. 2019), pp. 17, 19, 34, preambular paragraph (11) and Art. 2(1)(a)(vi).

120. *Ibid.*, preambular paragraph (11).

121. *Ibid.*, Art. 19.

122. 42 USC 5851.

123. The regulation contained in 10 CFR 50.7 is also reflected 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". NRC, James Luehman; Denial of Petition for Rulemaking, 76 Fed. Reg. 12295 (7 March 2011). In practice, it can at times be difficult to distinguish true safety-related whistleblowing and instances where an employee may attempt to classify certain activities as whistleblowing in order to frustrate lawful employment actions (i.e. to paint said action as "retaliation"). This is specifically addressed by the US NRC in 10 CFR 50.7(d), which states that "An employee's engagement in protected activities does not automatically render him or her immune from discharge or discipline for legitimate reasons or from adverse action dictated by nonprohibited considerations." Thus, one must also address the issue of causation in these determinations.

124. Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors, No. 166, 10 June 1957, as amended, Art. 66, "Allegation to the Nuclear Regulation Authority".

VI. Additional considerations

1. Decommissioning and radioactive waste management

a. Licensing of decommissioning and dismantling

The decommissioning of large nuclear facilities, particularly of nuclear power plants and reprocessing plants, is a complicated process requiring high regulatory attention. The term "decommissioning" in this context does not only designate the final shutdown, but encompasses all the administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility.[125] In essence, the technical side of this is denoted by the term "dismantling", meaning the taking apart, disassembling and tearing down of the structures, systems and components of a facility for the purposes of decommissioning.[126] Dismantling can start soon after cessation of operation or it can be deferred by decades while the plant is maintained and monitored in a condition that allows the radioactivity to decay.

To the extent that dismantling results in the accrual of debris and materials that emit radiation because they are activated or contaminated, these must be adequately managed. Most materials generated in dismantling, such as large quantities of the debris from demolishing buildings, can be released from regulatory control because they are not radioactive or activity is negligible. For materials that cannot be thus released, it must be ensured that they are either re-used for another nuclear activity or are designated as nuclear waste and are adequately managed.[127] The result of decommissioning may be full dismantling, leading to a "greenfield" or a reuse of structures that have been stripped of contamination and have been cleared for a new use.

While it is true that many hazards associated with a nuclear facility end with its final shutdown and the removal of nuclear fuel to storage outside the facility and the overall risk is greatly reduced, dismantling of such facilities poses its own issues for nuclear safety and radiological protection, for security and for environmental protection. The dismantling process may give rise to new hazardous scenarios, for example a conventional fire leading to a release of radioactive particles, which are still present as contamination of plant components and structures, into the environment. During dismantling, workers must deal with contaminated or activated structures, which requires specific radiological protection measures or the decision to perform work by remote-control equipment. Finally, it must be ensured that once the aim of the decommissioning is reached and the former facility is fully released from nuclear regulatory control, the site and remaining structures, if any, do not pose a radiological threat to the public and the environment.

Therefore, dismantling is a nuclear activity in its own right, with its own licensing requirement in most jurisdictions, often – in the case of major facilities – involving full public participation and an EIA.[128] In such licensing processes, the safety, security, radiological protection and other environmental aspects will be scrutinised, based on documentation submitted by the operator. Sometimes, the nuclear power plant is turned over for decommissioning to a new owner, a specialised company; this may involve a licence transfer.

125. *IAEA Safety Glossary*, *supra* note 104, p. 53.

126. *Ibid*., p. 54.

127. For more details, see NEA (2020), *Optimising Management of Low-level Radioactive Materials and Waste from Decommissioning*, OECD Publishing, Paris.

128. Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, OJ L 26 (28 Jan. 2012), p. 8, Annex I, 2.b), lists "Nuclear power stations and other nuclear reactors including the dismantling or decommissioning of such power stations or reactors" as requiring an EIA.

When the decommissioning has reached completion, there may be formal termination of the licence.

b. Regulation of radioactive waste management

Radioactive waste management refers to the safe treatment, storage and disposal of radioactive waste with the goal of protecting people and the environment. Radioactive waste comes from nuclear installations, from sites using radioactive materials such as hospitals, universities, research laboratories, and industrial facilities, and from national defence establishments. Concerning activities dealing with management of radioactive waste from nuclear facilities, regulatory and licensing aspects affect the range of these activities themselves. Whereas the Joint Convention establishes some high-level principles, each state has its own primary and secondary legislation on radioactive waste management.[129]

National legislation establishes general principles on how to deal with nuclear waste; this includes setting up a national programme for waste management, caring for an inventory of nuclear waste, defining who is responsible for managing waste and who bears the cost, and often implementing the principle that domestic waste should be disposed of domestically and that disposal of foreign waste is forbidden. In this section, the focus will be on the regulation of the safety of nuclear waste management activities.

Radioactive waste is generated both during operations and during the decommissioning of nuclear facilities. The IAEA[130] distinguishes six classes of radioactive waste, depending on the activity and on complementing factors such as the half-life of the leading isotopes and the degree of heat generation. The basic distinction is between three categories: high-level waste (HLW), intermediate-level waste (ILW) and low-level waste (LLW); in the latter category, very low-level waste (VLLW) may be distinguished for some purposes. These different kinds of waste involve varying requirements on safety and security of waste management and different degrees of regulatory attention.

In imposing adequate and graded requirements and procedures, national legislation typically introduces its own set of definitions, which in most cases is broadly similar to the IAEA categorisation. Some nuclear law systems rather rely on the distinction of radioactive waste containing a significant quantity of fissionable material, meaning spent nuclear fuel destined for disposal and HLW from fuel reprocessing, and “other” nuclear waste. Waste containing significant fissionable material is highly active and generates heat and may be broadly said to coincide with the category of HLW.[131] HLW requires specific considerations, mainly the issues of control of criticality (i.e. prevention of re-criticality of the fissionable content) and heat removal; the fissionable material contained in the waste also requires heightened attention in terms of security and non-proliferation. These issues necessitate certain requirements on activities and facilities for the management of HLW.

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129. For a comparative overview of OECD countries, see NEA (2004), *The Regulatory Control of Radioactive Waste Management*, OECD Publishing, Paris; updated country reports and country profiles are available at:www.oecd-nea.org/jcms/pl_33688/radioactive-waste-management-programmes-in-nea-member-countries (accessed 27 May 2021). See also NEA (2005), *The Regulatory Function and Radioactive Waste Management – International Overview*, OECD Publishing, Paris.

130. IAEA (2009), *Classification of Radioactive Waste*, IAEA Safety Standards Series, No. GSG-1, IAEA, Vienna.

131. See *ibid.*, p. 15, in which spent fuel and waste from reprocessing are mentioned as the main elements of HLW, together with “any other waste requiring a comparable degree of containment and isolation.”

Lower level waste, by contrast, poses less significant hazards to people and the environment; under the graded approach relevant for nuclear regulation in general, requirements and licensing processes tend to be less exacting. LLW and VLLW represent the vast majority of radioactive waste, although they are only a small fraction of the radiological inventory.[132]

Concerning materials stemming from nuclear facilities but displaying non-existent or negligible levels of activity, national legislation may allow for a process of removing such materials from nuclear regulatory control, mainly by way of clearance. "Clearance" is a notion from the law of radiological protection; it means the removal of radioactive materials or radioactive objects within authorised practices from any further regulatory control by the regulatory body.[133] Clearance supposes that the activity of the material in question is determined, by measurement and calculations, to be below the clearance levels set by national legislation or regulations.[134] Seen from a legal perspective, such clearance changes the status of the material concerned: it is no longer of regulatory concern as radioactive waste or a radioactive substance, but can in principle be managed like any other kind of "conventional" waste, unless the clearance issued by the nuclear regulatory body contains some conditions concerning the future disposal route. When it comes to dismantling nuclear power plants, by far most of the materials and debris can be classified, after clearance or according to a "zoning" model identifying parts of the plant that have not been in touch with radioactivity and cannot be contaminated, as "conventional" waste.

Radioactive waste that cannot be released from control must be managed (treated, packaged, stored) and disposed of in licensed facilities. HLW will have to be stored for decades since waste disposal facilities have yet to be put into operation worldwide.

Disposal may depend, again, on types of waste. Whereas (V)LLW may be disposed of in engineered near surface facilities (which may be landfill type for VLLW), the IAEA recommends disposal at greater depths for ILW and disposal in deep, stable geological formations for HLW.[135] HLW disposal facilities normally are the object of complex site characterisation and authorisation procedures that may last over decades; they cover identification of a suitable site for the national repository (which may include mandatory consent of the local municipality), exploration of a chosen site, construction of the facility, operation (meaning the emplacement of the HLW) and finally closure of the facility. Several steps may be subject to an EIA and to public participation and even to endorsement by government or parliament.[136]

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132. NEA (2020), *Optimising Management of Low-level Radioactive Materials and Waste from Decommissioning*, *supra* note 127, p. 9.

133. IAEA et al. (2014), *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards*, *supra* note 33, p. 383.

134. Clearance levels are established in Annex VII of Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, OJ L 13 (17 Jan. 2014), p. 45.

135. IAEA (2009), *Classification of Radioactive Waste*, *supra* note 130, pp. 5-6. An example for a country broadly following these recommendations is France, where two landfill-type repositories for VLLW and LLW/ILW with short-lived radionuclides (Centre Morvilliers and Centre de l'Aube, respectively) are in operation, whereas ILW with long-lived radionuclides and HLW will be disposed in a deep geological repository (DGR) (the Cigéo project). In Germany, by contrast, all nuclear waste is scheduled to be buried in deep geological formations. For LLW and ILW, this will be the repository Schacht Konrad, whereas the process for identification of a site for a HLW repository is ongoing.

136. For example, in France the closure of the HLW repository can only be authorised by an Act of Parliament; see Code de l'environnement, Art. L-542-10-1, para. 14. In Germany, the site selection for the HLW repository has to be confirmed by an Act passed by both chambers of parliament (Bundestag and Bundesrat). See Standortauswahlgesetz, Art. 20.

Requirements imposed by legislation or regulations aim at long-term safety of the HLW repository, meaning long-term exclusion of the waste and its activity from the biosphere. Demonstration of this safety necessitates complex calculations and evaluations not only in terms of nuclear safety and radiological protection, but also in terms of mining safety and protection of the groundwater and of the environment in general. At the same time, legislation may also impose requirements concerning retrievability of the waste at least for a specified term, in case future generations choose to re-use the fissionable content or to reduce the activity of the waste by active means such as transmutation.

2. *Informing and involving stakeholders*

The "transparency principle" of nuclear law is explained in part as follows:

> The transparency principle requires that bodies involved in the development, use and regulation of nuclear energy make available all relevant information concerning how nuclear energy is being used, particularly concerning incidents and abnormal occurrences that could have an impact on public health, safety and the environment.[137]

The licensing process largely provides an opportunity for transparent consideration of the issues important to nuclear safety. At its core, there are two primary parties, namely the regulatory body and the applicant; their interaction, as has been outlined above, consists in essence of demonstration by the applicant, and evaluation by the regulator, of compliance with all relevant requirements for obtaining a licence. As noted above, the public and other stakeholders may have participatory rights in the licensing process as well.

Beyond the engagement between the regulator and the applicant, the importance of public participation in the licensing process has grown over time, with increased interest and expressed concern from stakeholders respecting regulatory decision making, and increased demand for participatory rights in the decisions that affect them. Stakeholders encompass a range of actors, including individuals as well as institutions or groups across political, business, scientific and civil society.[138] Nuclear energy projects generate significant public interest, and the participation in the licensing process of members of the public, neighbours, non-governmental organisations (NGOs), local government authorities and other stakeholders, is an important part of demonstrating how those matters that are of interest, are being addressed. Well-informed decisions broadly reflect the input of stakeholder views, and this can be an important matter for maintaining public confidence in the regulatory decision making itself.

In most jurisdictions, at least neighbours directly affected by a nuclear facility will have the opportunity to give their view and to raise objections; this may also be extended to a larger public. Due to the ascent of environmental law in the last decades, the role of the general public, and of environmental NGOs, in being consulted about a project's effects on the environment has also been strengthened.

Public participation in the licensing of a large infrastructure project (such as a nuclear facility) does not mean the public decides whether the project will be licensed; rather, public participation can enhance the transparency of the regulatory process and can offer views on the determinations

137. Stoiber, C. et al, (2003), *Handbook on Nuclear Law*, IAEA, Vienna, p. 10.

138. NEA (2015), *Stakeholder Involvement in Decision Making: A Short Guide to Issues, Approaches and Resources*, OECD Publishing, Paris, pp. 20-22.

that are to be made by the safety authority. There may be prerequisites for local consent concerning specific types of facilities (e.g. repositories) or specific sites (e.g. on the lands or territories of Indigenous peoples – to be explained *infra*). Generally, however, licensing determinations are made by the regulator, which has the statutory authority to assess safety, not by popular vote. Generally, the competent administrative body will analyse the factual merits of comments and objections and evaluate whether they warrant a modification of the project, the addition of licence conditions or the solicitation of supplementary evidence by the applicant. The authority may be obliged by national law to explain in writing (in the explanatory section of the licence or in a separate document) how it has taken the objections into account.

Stakeholders may also be present outside the national territory. The CNS in Article 17 obliges contracting parties to "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." The Joint Convention features equivalent wording in Articles 6 and 13 concerning, respectively, spent fuel and nuclear waste management facilities. Again, consultation does not give the neighbouring contracting parties a veto right.

In comparison to these nuclear law instruments, the Espoo Convention goes one step further by also obliging its states parties to provide an opportunity to the public in the areas likely to be affected to participate in relevant EIA procedures. Both the installation state and the affected state must ensure that the public is informed of the project and is provided with possibilities for making comments or objections on the proposed activity.[139]

Different regulatory bodies in different jurisdictions consider and invite stakeholder involvement in different ways, with different levels of participatory rights. Typically, public participation during licensing is focused on discussion of the particular aspects of the project subject to a licensing decision.[140] For example, some countries provide for local information committees at various phases of the life cycle of a facility, such as authorisation of construction, operation or decommissioning.[141] A hearing process is provided in some countries such as Canada, Finland, France and the United States. For example, Canada provides for a hearing before the CNSC itself on licensing and other matters and provides a participant funding programme to enhance participation by the public, Indigenous groups and other stakeholders in the licensing process.[142] The US NRC is required under its organic statute to offer hearings on all licensing decisions and must hold a hearing on construction authorisation for certain nuclear installations; such hearings have typically been held using procedures akin to a civil trial before an administrative tribunal comprised of technical and legal judges and subject to final review by the Commission itself.[143]

139. Convention on Environmental Impact Assessment in a Transboundary Context (1991), 1989 UNTS 310, entered into force 10 Sept. 1997 (Espoo Convention), Art. 3, para. 8, and Art. 4, para. 2.

140. See Raetzke, C. (2013), "Nuclear Law and Environmental Law in the Licensing of Nuclear Installations", *Nuclear Law Bulletin*, No. 92, OECD Publishing, Paris, pp. 55, 79.

141. NEA (2011), *Commendable Practices on Transparency in Nuclear Regulatory Communication with the Public*, NEA Doc. NEA/CNRA/R(2011)3, OECD Publishing, Paris, p. 26. This report provides an overview of practices in 18 countries (see p. 56) jointly prepared by the NEA's CNRA Working Group on Public Communication of Nuclear Regulatory Organisations and by the Working Group on Transparency Activities of the European Nuclear Safety Regulators Expert Group.

142. See Canadian Nuclear Safety Commission Rules of Procedure (SOR/2000-211), implementing Nuclear Safety and Control Act, S.C. 1997, c. 9, sec. 40; CNS (2019), *Participant Funding Program Guide*, issued pursuant to Nuclear Safety and Control Act, S.C. 1997, c.9 sec. 21(1)(b.1).

143. US Atomic Energy Act, as amended, sec. 189a, 42 USC 2239(a); see 10 CFR Part 2 for applicable hearing procedures.

A number of techniques may be employed to inform and engage stakeholders in the broad scope of nuclear regulatory activities, and involvement of stakeholders is an important objective throughout the life cycle of nuclear activities.[144] The level of stakeholder involvement can range from information access to solicitation of viewpoints on regulatory matters and broader engagement in decision making.[145] As noted above, regulators may be required under national legislation or environmental conventions to provide opportunities for comment or participation with respect to licensing decisions and related environmental assessments. Other opportunities for formal comment or participation may be provided in connection with the adoption of proposed rules and standards to be applied as part of the regulatory framework.

Apart from public involvement in formal decision making, a number of practices may be employed to bring transparency to regulatory activities. Some are shaped by generally applicable administrative laws pertaining to information access and open meetings. Access to agency documents is commonly provided through freedom of information laws and sometimes specific provisions provided in legislation governing nuclear activities.[146]

Regulators may establish open meeting policies to further transparency of the agency's activities and engagement with the regulated community. In the United States, for example, the NRC adopted its original open meeting policy in 1978 and issued its most recent update to the policy in 2021.[147] The policy provides for public observation and levels of participation in meetings conducted by the NRC staff, most of which are not specifically required to be open to the public by laws such as the Government in the Sunshine Act, 5 USC 552b, or the Federal Advisory Committee Act, 5 USC App. In Japan, the NRA has focused on ensuring that its meetings are open to the public and media as part of its approach to restoring credibility of and public confidence in the regulatory system in the wake of the Fukushima Daiichi accident.[148] In Canada, the CNSC conducts its meetings in public and offers participant funding to facilitate the participation of members of the public in those proceedings, which participation includes the opportunity to intervene and make submissions and comments when the CNSC hears annual reports from its staff on the staff's ongoing regulatory oversight of sectors of the nuclear industry.[149]

The establishment of advisory committees can be used to enhance transparency, foster communication and seek stakeholders' viewpoints. In France, for example, the legislation that established ASN as the regulator also established the High Committee for Transparency and Information on Nuclear Safety (HCTINS).[150] The HCTINS is composed of 40 members appointed for 6-year terms, including 4 members of parliament and 6 members each from 6 other categories,

144. See IAEA (2011), *Stakeholder Involvement Throughout the Life Cycle of Nuclear Facilities*, IAEA Nuclear Energy Series, No. NG-T-1.4, IAEA, Vienna; IAEA (2006), *Stakeholder Involvement in Nuclear Issues*, INSAG-20, IAEA, Vienna.

145. NEA (2015), *Stakeholder Involvement in Decision Making*, *supra* note 138, pp. 22-25.

146. NEA (2011), *Commendable Practices on Transparency*, *supra* note 141, p. 17, noting that at the time of publication all OECD countries had freedom of information laws as of 2006.

147. NRC Policy Statements, *Enhancing Participation in Public Meetings*, 86 Fed. Reg. 14964 (19 Mar. 2021); *Open Meetings and NRC Staff Policy*, 43 Fed. Reg, 28058 (28 June 1978).

148. NEA (2017), *NEA Workshop on Stakeholder Involvement in Nuclear Decision Making*, OECD Publishing, Paris, p. 26.

149. See Canadian Nuclear Safety Commission Bylaws (SOR/2000-212); Nuclear Safety and Control Act, S.C. 1997, c.9 sec. 21(1)(b.1).

150. TSN Act, *supra* note 16, Arts. 23-27, now codified as Articles L. 125-34 to L. 125-40 of the French Environmental Code.

including governmental authorities (including ASN), industry representatives, trade unions, local information committees (LICs), scientific and other experts, and associations noted under the Public Health Code.[151] The HCTINS acts as a forum for information, discussion and consultation on nuclear activities and their impact on the public and the environment. It may provide opinions on these matters, engage consultant services and obtain information from ASN and other relevant government bodies.[152]

As noted earlier, the use of LICs is a practice used in a number of countries to enhance transparency and stakeholder awareness of nuclear installations. The committees may be established across the various phases of an installation's life, ranging from construction, operation and decommissioning.[153] Membership on the committees may include local or regional government representatives and non-governmental representatives from academic institutions, environmental organisations, trade unions and businesses.

Two examples illustrate the use of LICs. France established LICs for nuclear installations in 1981 and codified their institution in the TSN Act in 2006.[154] The LICs monitor performance at the sites, disseminate information, and act as a forum for discussion on matters concerning nuclear safety and radiological protection. In the United Kingdom, each major nuclear installation has a Local Liaison Committees/Site Stakeholder Group that is run by the licensee and includes local officials, trade unions, interested local organisations and members of the public in the groups. ONR issues quarterly reports about inspection and regulatory activities relating to nuclear sites that are provided to the committees and made available to the public. ONR's site inspectors routinely attend committee meetings to report on regulatory actions and respond to requests for information.[155]

While the foregoing discussion does not cover all methods of interacting with stakeholders, the examples do illustrate the importance of taking steps to inform and to engage stakeholders in regulatory activities. The objectives of promoting transparency and engagement in the regulatory system are important to improving the understanding of the regulator's role, enhancing the quality of communication and decision making, and nurturing trust in the regulatory system.[156]

151. *Ibid*., Art. 23; the number of representatives was increased from five to six in the categories other than parliamentarians by Decree No. 2008-1108 of 29 October 2008 on the composition of the High Committee for Transparency and Information on Nuclear Safety, now codified in Articles R 125-77 to R. 125-87 of the French Environmental Code.

152. Articles L. 125-34 and L. 125-35 of the French Environmental Code.

153. NEA (2011), *Commendable Practices on Transparency*, *supra* note 141, pp. 26, 53, Appendix 3. A brief description of the experience of LICs in Sweden, the Slovak Republic and France is reflected in NEA (2018), *A Comprehensive Report on Three Regional Stakeholder Workshops in Europe, North America and Asia*, Doc. NEA/CNRA/R(2017)7, OECD Publishing, Paris, pp. 16-22.

154. France's LICs are comprised of "representatives of general councils, of municipal councils or of the deliberating assemblies of groups of communes and of regional councils concerned; members of Parliament elected in the department; representatives of environmental protection associations, economic interests associations and of representative trade union organisations of employees and of medical professions; as well as qualified personalities." TSN Act, *supra* note 16, Art. 23, now codified in Article L. 125-20 of the French Environmental Code.

155. ONR (2021), "Quarterly Local Liaison Committee/Site Stakeholder group reports", available at: www.onr.org.uk/llc/index.htm (accessed 27 May 2021).

156. Further information about the role of public participation in nuclear decision making can be found in Nick, K.S. and P. Bowden (2021), "Nuclear activities and environmental protection: The international legal framework", *infra*, pp. 211-276.

3. *Indigenous rights and responsible business conduct*

While the regulation and oversight of the conduct of nuclear fuel cycle activities is firmly a matter of national law, national nuclear regulatory law is certainly influenced by and reflective of international nuclear law as it develops and changes. Broader international law developments also impact the regulation and oversight of nuclear activities, and a review of the governance considerations that today's globalised nuclear industry must take into account necessarily includes the evolving law in the areas of international human rights and responsible business conduct.

a. Indigenous rights

The *United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)*,[157] first adopted by the UN General Assembly in 2007, sets out the manner in which international human rights law should apply to the world's Indigenous peoples. It has altered the political and legal climate in which the rights of Indigenous peoples are addressed in international law, and is increasingly referred to and relied on by Indigenous communities seeking to have their rights recognised by and within states. Particularly in respect of uranium mining and radioactive waste management projects, the international framework for Indigenous rights recognition that has been established under the UNDRIP can be an important reference for nuclear regulatory decision making.

While the UNDRIP does not create binding legal obligations,[158] it does contain strong normative language that describes both individual and collective rights of Indigenous peoples around the world, and it recognises land rights, self-determination and autonomy as collective rights enjoyed by Indigenous groups. It sets out redress rights in relation to historic injustices resulting from colonisation and dispossession of lands and resources, and addresses such issues as Indigenous cultures, languages and identity, providing clear statements of rights and guidance on how states may have co-operative relationships with Indigenous peoples. The extent to which the rights enshrined in the UNDRIP may amount to customary international law is the subject of ongoing study and discussion.

An important specific right enshrined in the language of the UNDRIP provides to Indigenous groups the right to give or withhold consent to a project that may affect their rights to their land, territories or resources. Free, prior and informed consent, known as "FPIC", can be an important concept when considering many development proposals in the nuclear field, including uranium mining or radioactive waste storage or disposal. Articles 29 and 32 of the UNDRIP include the following provisions:

> Art. 29, 2. States shall take effective measures to ensure that no storage or disposal of hazardous materials shall take place in the lands or territories of indigenous peoples without their free, prior and informed consent.

157. UN General Assembly Resolution 61/295 (2007), "United Nations Declaration on the Rights of Indigenous Peoples", UN Doc. A/RES/61/295, adopted 13 Sept. 2007, by a recorded vote of 144 in favour to 4 against, with 11 abstentions (hereinafter, UNDRIP). The four countries that voted against the Declaration at that time (Australia, Canada, New Zealand and the United States) have since altered their vote to support it.

158. The United Nations Treaty Collection (n.d.), *Treaty Reference Guide*, Glossary, "Declarations", available at: https://treaties.un.org/Pages/Overview.aspx?path=overview/glossary/page1_en.xml (accessed 27 May 2021), explains that the form of a declaration is "often deliberately chosen to indicate that the parties do not intend to create binding obligations but merely want to declare certain aspirations". The final recital to the preambular text of the UNDRIP solemnly proclaims the Declaration "as a standard of achievement to be pursued in a spirit of partnership and mutual respect". UNDRIP, *supra* note 157, p. 3.

> Art. 32, 2. States shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free and informed consent prior to the approval of any project affecting their lands or territories and other resources, particularly in connection with the development, utilization or exploitation of mineral, water or other resources.

While it is not a treaty nor does it impose binding obligations upon those who voted in its favour, the UNDRIP can have legal impact and affect how projects are considered, particularly resource projects.[159] This includes legal challenges based on FPIC, and the question of whether and when the UNDRIP requires that Indigenous groups must give their consent to projects for them to be authorised, and when it simply requires good faith effort on the part of the state to seek such consent. In Canada, for example, Indigenous peoples have constitutional protections that include a duty on the Crown (the state) to consult meaningfully with Indigenous groups when contemplating decision making that has the potential to impact existing or asserted Indigenous rights, and to take steps, where appropriate, to accommodate those rights. The way that the existing constitutional jurisprudence on the consultation duty fits together with FPIC in the UNDRIP is a live issue for Canada's policymakers, courts and state entities that authorise resource projects.[160]

The UNDRIP and Indigenous rights can also give rise to considerations that are key for radioactive waste projects. A process for siting a radioactive waste facility in Australia illustrates how the UNDRIP can inform the legal arguments and policy decisions on the issue. A Parliamentary Joint Committee on Human Rights found that a bill that was tabled in parliament on the siting of a national radioactive waste management facility might not adequately protect the Indigenous rights of the Barngarla people, including their right to culture and self-determination; the report noted also that the effect of the bill could extinguish their native title.[161] Subsequent submissions by NGOs respecting the bill recommended that the bill should be assessed for its compatibility with the UNDRIP, "in particular the principle of free, prior and informed consent".[162] In Canada, a DGR proposal by Ontario Power Generation (OPG) for LLW and ILW was withdrawn by OPG in early 2020 after a vote held in the community of the Saugeen Ojibway

159. Mauro Barelli outlines three themes that are commonly used to assess the reasonable expectations of state compliance with soft law instruments – context, content and institutional setting – the UNDRIP is expected to be effective at generating behaviour by states that conforms to its precepts. Barelli, M. (2009), "The Role of Soft Law in the International Legal System: the case of the United Nations Declaration on the Rights of Indigenous Peoples", *International and Comparative Law Quarterly*, Vol. 58, Issue 4, Cambridge Univ. Press, Cambridge, UK, pp. 957-983.

160. See e.g. Newman, D. (2017), *Political Rhetoric Meets Legal Reality*, Macdonald-Laurier Institute, Ottawa, available at: https://macdonaldlaurier.ca/files/pdf/MLIAboriginalResources13-NewmanWeb_F.pdf (accessed 27 May 2021). For an explanation of how Canada's nuclear regulator consults with Indigenous peoples in the context of authorising uranium mine operations, see the case summary of Fond du Lac Denesuline First Nation et al v. Canada (Attorney General) 2012 FCA 73, in *Nuclear Law Bulletin*, No. 89, OECD Publishing, Paris, pp. 107-109. In late 2020, Bill C-15, *An Act respecting the United Nations Declaration on the Rights of Indigenous Peoples*, was introduced in Canada's Parliament; its stated purposes are to give the UNDRIP application in Canadian law and to provide a framework for Canada's implementation of the UNDRIP.

161. See National Radioactive Waste Management Amendment (Site Specification, Community Fund and Other Measures) Bill 2020, at: www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r6500 (accessed 27 May 2021); see also Fitzgerald, L. (17 Apr. 2020),"Committee finds bill to name Napandee as waste site potentially limits human and Indigenous rights", *Eyre Peninsula Tribune*, Cleve, Australia, available at: www.eyretribune.com.au/story/6725861/nuclear-waste-bill-may-limit-human-rights/ (accessed 27 May 2021).

162. "13 top Australian non government organisations say that the Kimba nuclear waste dump plan is illogical", *Nuclear Australia*, available at: https://nuclearnewsaustralia.wordpress.com/2020/05/13/13-top-australian-non-government-organisations-say-that-the-kimba-nuclear-waste-dump-plan-is-illogical/ (accessed 27 May 2021).

Nation (SON) resulted in lack of support for the project, which would be built on the traditional territory of the SON. OPG had committed in 2013 that it would not build the DGR without the support of the SON, in recognition of the SON's Indigenous rights.[163]

There are mechanisms in place to promote the UNDRIP, including the Special Rapporteur on the rights of Indigenous Peoples.[164] The work of the Special Rapporteur reflects the directive expressed in Article 42 of the UNDRIP, that the "United Nations, its bodies, including the Permanent Forum on Indigenous Issues, and specialized agencies, including at the country level, and states shall promote respect for and full appreciation of the provisions of this Declaration and follow up on the effectiveness of this Declaration."

b. Multinational enterprises and responsible business conduct

The responsibilities on transnational corporations and other businesses to protect human rights in the conduct of their global activities are moving from the realm of the notion of good corporate citizenship and "social licence" to that of firmer legal requirements – from ethical and reputational considerations to legal compliance and due diligence. The overseeing of their nuclear operations by multinational enterprises, in the context of uranium mining in particular, may have developed through international soft law guidelines, recommendations and industry initiatives, but increasingly involves managing potential litigation risk and compliance with reporting and other legal requirements that are imposed by states demonstrating a commitment to sustainability, human rights protections and governance rules.

The UN "Protect, Respect and Remedy" Framework was developed by John Ruggie, who served as Special Representative of the Secretary-General on the issue of human rights and transnational corporations and other business enterprises from 2005 to 2011. This framework has three principles:

- state duty to protect and respect human rights;
- corporate responsibility to comply with applicable laws and to respect human rights; and
- the need for appropriate, effective remedies where human rights have been breached.[165]

To operationalise this Framework, the Guiding Principles on Business and Human Rights were developed, and were endorsed by the Human Rights Council in its resolution 17/4 of 16 June 2011.[166] The Guiding Principles are meant to be universal, and are stated to "apply to all States and to all business enterprises, both transnational and others, regardless of their size, sector, location, ownership and structure". They do not themselves create any new legal obligations on

163. Ontario Power Generation (31 Jan. 2020), "OPG committed to lasting solutions for nuclear waste", Media Release, available at: www.opg.com/media_release/opg-committed-to-lasting-solutions-for-nuclear-waste/ (accessed 27 May 2021).

164. UN Human Rights Council (UNHRC) Resolution 42/20 (2019), "Human rights and indigenous peoples: mandate of the Special Rapporteur on the rights of indigenous peoples", UN Doc. A/HRC/RES/42/20, adopted 26 Sept. 2019, reflects the most recent renewal of the mandate of the Special Rapporteur on the rights of Indigenous peoples, which includes state visits and reporting on how states implement the UNDRIP.

165. United Nations Human Rights Council (UNHCR) (2011), "Report of the Special Representative of the Secretary General on the issue of human rights and transnational corporations and other business enterprises, John Ruggie; Guiding Principles on Business and Human Rights: Implementing the United Nations "Protect, Respect and Remedy" Framework", UN Doc. A/HRC/17/31, Annex, p. 6, 21 Mar. 2011.

166. UNHRC (2011), *Guiding Principles on Business and Human Rights: Implementing the United Nations "Protect, Respect and Remedy" Framework*, UN Doc. HR/PUB/11.04, UN, New York and Geneva, (UNHRC Guiding Principles), available at: www.ohchr.org/documents/publications/guidingprinciplesbusinesshr_en.pdf (accessed 27 May 2021).

the part of anyone. However, they provide context to the three principles that can result in legal obligations, with admonitions to states to enact and enforce laws that are "aimed at, or have the effect of, requiring business enterprises to respect human rights". The Guiding Principles include specificity on how business enterprises should demonstrate their discharge of the responsibility to respect human rights, with transparent policy commitments and operational policies and procedures that include tracking the effectiveness of remedial actions taken.

Also in 2011, after periodic review under its Declaration on International Investment and Multinational Enterprises, the OECD revised its *Guidelines for Multinational Enterprises*[167] to update the 2000 version with some new principles: that enterprises should engage with stakeholders and do risk-based due diligence to identify, prevent and mitigate adverse impacts on local communities. A new human rights chapter was added to the *Guidelines*, to be consistent with the UN Guiding Principles noted above. The *Guidelines* updated and expanded the role of National Contact Points for Responsible Business Conduct (NCPs) to "further the effectiveness of the Guidelines" and included a provision that adhering governments "shall make available human and financial resources" so that NCPs can effectively fulfil their responsibilities.[168]

The *Guidelines* are recommendations and do not carry the force of law; instead, they provide principles and standards for responsible business conduct and "aim to promote positive contributions by enterprises to economic, environmental and social progress worldwide".[169] At the same time, the countries adhering to the *Guidelines* make a binding commitment to implement them, with the result that some implementation comes through national law. NCPs established by adhering governments handle complaints respecting compliance with the *Guidelines* through a voluntary, "non-judicial grievance mechanism" that is meant to have transparency. Despite its voluntary nature, this process can be "enforced" by governments,[170] and enterprises make and implement human rights protection policies for their operations that seek to address the rising expectations of governments, civil society and investors reflected in the *Guidelines*.

Sector-specific due diligence guidance has been created within this structure, in order to implement the *Guidelines*. The OECD adopted in July 2016 its *Due Diligence Guidance for Meaningful Stakeholder Engagement in the Extractive Sector*.[171] The *Guidance* includes both recommendations to industry management on developing a clear policy framework for engagement and for considering stakeholder engagement and views when making business decisions, and recommendations to on-the-ground industry personnel on identifying stakeholders and designing appropriate processes for engaging them and ensuring follow-through. Multinational companies involved in uranium extraction, the "front end" of the nuclear fuel cycle, need to be aware of their responsibilities in this regard.

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167. OECD (2011), *OECD Guidelines for Multinational Enterprises*, OECD Publishing, Paris, pp. 21, 23, 26, 31-34, 39.

168. *Ibid*., pp. 68, 71.

169. *Ibid*., p. 3.

170. *Ibid*., p. 34. For example, see Canada's explanation of its NCPs. Global Affairs Canada (updated 14 Aug. 2020), "Canada's National Contact Point for the Organisation for Economic Co-operation and Development Guidelines for Multinational Enterprises", available at: www.international.gc.ca/trade-agreements-accords-commerciaux/ncp-pcn/index.aspx?lang=eng&menu_id=1&menu=R (accessed 27 May 2021), which provides:

> There are consequences if Canadian companies do not participate, or do not engage in good faith and constructively, in the NCP dispute resolution process. Consequences are withdrawal of Government of Canada trade advocacy support abroad. Further, non-participation or the lack of good faith participation will also be taken into account in the Corporate Social Responsibility-related evaluation and due diligence conducted by the Government of Canada's financing crown corporation, Export Development Canada, in its consideration of the availability of financing or other support.

171. OECD (2017), *OECD Due Diligence Guidance for Meaningful Stakeholder Engagement in the Extractive Sector*, OECD Publishing, Paris.

The principles, guidelines and goals related to human rights, sustainability and responsible business conduct have various mechanisms by which they can result in legal requirements, and these requirements take several forms. Domestic laws enacted by states can impose positive obligations, mandatory reporting and transparency, and criminal sanctions for corruption, for example; these may apply to companies wherever they do business. As well, the financing of multinational enterprises can be tied to principles that must be respected, which can bring the achievement of such goals into financing contracts and compel corporate conduct in that way.[172] Finally, there is an awareness that courts in some jurisdictions are being asked to hear claims against multinational corporations for alleged human rights abuses and tortious liability arising from actions abroad.[173] If policies developed for responsible business conduct can give rise to a duty of care, they can thereby transform corporate social responsibility practices to required due diligence that carries legal accountabilities if they are not adequately fulfilled and respected.

4. A role for industry "self-regulation"?

Much of the foregoing analysis has focused on the important role of government in establishing an effective regulatory framework over nuclear activities. Given the licence holder's primary responsibility for safety reflected, for example, in CNS Article 9, industry has an obligation to carry out effective management of activities under licence and encourage best practices. In this context the role of self-governance among operators or licensees merits consideration. As noted in INSAG-21, an effective global nuclear safety regime depends on the effective contribution of multiple participants in the national and international infrastructure.[174]

Operators, nuclear plant vendors and suppliers of equipment and services are among the important industry stakeholders, as are national or regional industry associations and private international organisations such as vendor owners' groups, WANO, the World Institute for Nuclear Security (WINS) and the World Nuclear Association.[175] In some respects, the insurance system provides "a form of 'surrogate regulation', embodying the link between the 'invisible hand' of private liability and the 'visible hand' of regulation" in the management and assessment of risks.[176]

The founding of INPO in the United States in 1979 after the Three Mile Island nuclear power plant accident illustrates an industry initiative to raise the performance and improve the safety of operations. Its establishment reflects the viewpoint that in many respects operators of nuclear installations are "hostages of each other"; that is, poor performance of an operator reflects upon others and can have a negative impact on their credibility and status.[177] INPO has acted in many

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172. The Equator Principles are a financial industry benchmark for determining, assessing and managing environmental and social risk in projects and are found through the website of the Equator Principles Association, available at: www.equator-principles.com (accessed 27 May 2021). The current version of the Equator Principles (EP4, July 2020) restates the ten principles, explains that application of the principles fulfils financial institutions' responsibility to respect human rights due diligence in line with the UNHRC Guiding Principles, *supra* note 166, and includes careful language about stakeholder engagement and FPIC.

173. See e.g. Vedanta Resources PLC v. Lungowe [2019] UKSC 20 (United Kingdom); Nevsun Resources Ltd. v. Araya, 2020 SCC 5 (Canada).

174. IAEA (2006), *Strengthening the Global Nuclear Safety Regime*, INSAG-21, IAEA, Vienna, *supra* note 4, pp. 5-8.

175. *Ibid*., p. 6; IAEA (2017), *Ensuring Robust National Nuclear Safety Systems — Institutional Strength In Depth*, INSAG-27, IAEA, Vienna, pp. 7-11.

176. Marsden, E. (2014), "Risk regulation, liability and insurance : literature review of their influence on safety management", *Industrial Safety Cahiers*, No. 2014-08, Foundation for an Industrial Safety Culture, Toulouse, France, p. 30.

177. See generally Rees, J.V. (1994), *Hostages of Each Other: The Transformation of Nuclear Safety Since Three Mile Island*, University of Chicago Press, Chicago.

respects as an industry self-regulatory body. INPO conducts periodic evaluations of plant performance and corporate management, accredits training programmes, and evaluates events and operating experience. INPO and NRC have established a memorandum of agreement with respect to communication of safety information, and INPO has contributed to recent US national reports for the CNS.[178]

WANO was established in 1989 after the Chernobyl accident and, building on the experience of INPO in the United States, set out to establish an international system linking operators in order to "maximise the safety and reliability of nuclear power plants worldwide by working together to assess, benchmark and improve performance through mutual support, exchange of information, and emulation of best practices."[179] WANO maintains a central office in London and regional centres in Atlanta, Moscow, Paris and Tokyo. WANO has established a memorandum of co-operation with the IAEA to co-ordinate on peer reviews and such other matters as safety culture and facilitating communication of best practices. Like INPO, the results of WANO's assessments are provided to plant operators within the organisation but not generally made public.

WINS was founded in 2008 with headquarters in Vienna. Its objectives include promoting best security practices and eliminating weaknesses in global security to counter theft of nuclear materials and terrorism using such materials.[180] WINS facilitates worldwide co-operation between organisations responsible for security at nuclear facilities, which include private as well as government-owned entities. WINS maintains close consultation with the IAEA.

Neither INPO, WANO nor WINS pretend to assume the role of the national regulator. Although other industry organisations may also make important contributions to developing standards, establishing uniform practices and improving performance, care must be taken to ensure that such efforts do not result in a passive regulatory regime or one in which the regulator is considered "captured" by the industry it regulates. That undesirable consequence has been revealed in the institutional failings identified in the critiques of major nuclear events as well as other regulatory failings.[181]

VII. Conclusion

The foregoing analysis has provided a comprehensive overview of the functions and responsibilities of regulatory bodies and their role in setting standards, licensing and oversight of regulated nuclear activities. The main challenges in establishing an effective regulatory regime can be summed up in the following questions:

- Are the institutional authorities and responsibilities of government clear and appropriate?
- Have key international instruments been adopted and integrated into the legal regime?

178. See e.g. NRC (2019), *The United States of America Eighth National Report for the Convention on Nuclear Safety*, NUREG-1650 Rev. 7, pp. 203 *et seq*.

179. WANO (2017), *Compass 2018-2022: Guiding the World's Nuclear Operators on Their Path to Excellence*, WANO, London, p. 2, "WANO Mission".

180. See WINS website, available at: https://wins.org/ (accessed 27 May 2021).

181. See Sexton, K. (2015), *supra* note 15. In a recent example from the aviation industry, the investigation of system failures in the Boeing 737 MAX aircraft resulting in fatal crashes in 2019 identified failings both on the part of Boeing and the Federal Aviation Administration, the US authority responsible for certification of the aircraft. Herkert, J., J. Borenstein and K. Miller (2020), "The Boeing 737 MAX: Lessons for Engineering Ethics", *Science and Engineering Ethics*, Vol. 26, Springer Science+Business Media, Berlin, pp. 2957-2594; US House Committee on Transportation and Infrastructure (Sept. 2020), *Final Committee Report: The Design, Development and Certification of the Boeing 737 MAX*, US Gov't Printing Office, Washington, DC.

- Does the regulatory framework comprehensively address the primary objectives of safety and security?
- Is the scheme of regulation transparent, adaptable and coherent?
- Is the responsibility of the licensee for safety and security clear?

From the standpoint of effective integration within the international system, both regulators and operators should give attention to participating in the peer review system through, for example, IAEA's IRRS and Operational Safety Review Team (OSART) missions. Operators also can receive insights through industry peer reviews through WANO. Finally, through the NEA, regulators can share insights and experience, pool expertise and promote international co-operation in further developing the safe use of nuclear energy.

Although the system of regulation is essentially a national prerogative, the CNS and Joint Convention provide for addressing regulatory effectiveness through the regular review meetings of the contracting parties. In this regard, increased transparency of national reports and reviews is an important objective. Progress has been made along these lines as evidenced by all national reports being made publicly available after the 7th CNS Review Meeting in 2017. This transparency aligns with the efforts of national regulators to build, maintain and enhance the trust of stakeholders and the public in their regulatory processes, in recognition that effective nuclear regulation requires that trust.

Regulators should focus on their own organisations and practices to enhance the effectiveness of the regulatory system. Such measures include fostering a strong organisational culture that encourages good communication and the airing of differing views and integrating the organisational sub-units within the agency. Regulators need to maintain and improve the capacity and competency of their organisations as technologies evolve. Regulators must be vigilant in avoiding regulatory capture, but they must also avoid isolation from those they regulate and other stakeholders. Accountability within the governmental system is important without bowing to pure political expediency.

Effectiveness in regulation also requires combatting bureaucratic rigidity and risk aversion. Regulators are entrusted with holding licensees accountable for compliance with regulatory requirements and objectives, but regulators must also ensure that findings and reported observations are evaluated for their root causes and broader potential impact on management of risk. A focus on risk-informing the regulatory approach is important, as is being open to innovation in regulation while maintaining the regulatory core.

There is no singularly "correct" approach to the regulation, licensing and oversight of nuclear activities. As outlined in this article, there are many aspects to these issues and each country must determine within its own national legal structure how best to carry out the duties of ensuring that nuclear activities, insofar as they are generally permissible under national legislation, carry no harm to people or the environment. Although the obligations are many and the responsibility great, there is no issue of higher import than ensuring an adequate level of nuclear safety and security and compliance with all other requirements.

Nuclear activities and environmental protection: The international legal framework

by Kimberly Sexton Nick[*] and Paul Bowden[⁑]

It is an oft-repeated mantra of those working in the field of nuclear energy that nuclear is "special" and cannot be easily compared to other industries. While this is a general refrain when discussing project development, the same holds true for environmental protection. Like other industrial activities and infrastructure development projects, nuclear activities can have a number of non-radiological impacts on the environment – such as land use, water resources and animal life – but nuclear activities also present unique hazards related to radiological impacts. This duality – non-radiological environmental impacts versus radiological environmental impacts – has long influenced the development of environmental protection for nuclear activities.

The linkage between environmental law and nuclear law is not new. In fact, at an international level, this connection has existed for over 60 years. While some may still question whether nuclear activities are protective enough of the environment,[1] it is clear that the overall international legal framework of environmental protection for nuclear activities is not only as protective of the environment as any other major industrial activity, but that in certain circumstances it provides greater protections. Indeed, in some instances, aspects of nuclear law have provided a model or standard in fields of non-nuclear activity.[2]

Much of the literature addressing environmental protection for nuclear activities views the subject through the lens of the environmental lawyer. This article, however, views it through the lens of the nuclear lawyer and details its development, current status and future from this perspective. This article begins, in Part 1, with a description of the relevant "streams" and "sources" of law and presents an overarching legal framework. This part also sets the stage for the second part by highlighting three key practical doctrines that emerge. Part 2 addresses the historical development of environmental protection for nuclear activities and specifically the

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1. See e.g. Emmerechts, S. (2008), "Environmental Law and Nuclear Law: A Growing Symbiosis", *Nuclear Law Bulletin*, No. 82, OECD Publishing, Paris, pp. 91-110; Emmerechts, S. (2010), "Environmental Protection under Nuclear Law: Still a Long Way to Go", in NEA, *International Nuclear Law: History, Evolution and Outlook*, OECD Publishing, Paris, pp. 121-156.

2. See e.g. the development of the International Law Commission's (ILC) Principles on the Allocation of Loss in the Case of Transboundary Harm Arising Out of Hazardous Activities, which were influenced by international nuclear liability conventions. ILC, "Report of the International Law Commission on its fifty-eighth session (1 May-9 June and 3 July-11 August 2006)", Doc. A/61/10, ch. V, in ILC (2013), *Yearbook of the International Law Commission*, UN Doc. A/CN.4/SER.A/2006/Add.1 (Part 2), UN, New York/Geneva.

treaties and conventions. This part starts with the early focus on protection against radiological environmental impacts and then elaborates upon the transition to a focus on environmental law and nuclear law, which has a strong procedural focus. Particular attention is drawn to the regime under the auspices of the United Nations Economic Commission for Europe (UNECE), with the expansion into protection for and beyond radiological environmental impacts. Before concluding this part, environmental protection through human rights is addressed. The article concludes with, in Part 3, a very brief review and look to the future.

Part 1. Foundations of environmental protection for nuclear activities

A. Streams and sources making up the international legal framework

1. The three streams

The international legal framework of environmental protection for nuclear activities comprises three "streams" of law: environmental law of general application, which applies to both radiological and non-radiological impacts; nuclear law,[3] which applies primarily to radiological impacts; and a third, very important stream that represents the convergence of environmental law and nuclear law. This third stream is the law of wide environmental application but which makes express provision for nuclear activities. It applies to both the radiological as well as the non-radiological impacts and presents the most sophisticated take on environmental protection for nuclear activities. In so doing, it highlights nuclear energy's unique position at the forefront of conversations related to environmental protection.

Within each of these "streams", the substance of the law comes from one or more "sources". Although there are several sources of international law,[4] three primary sources compose the international legal framework of environmental protection for nuclear activities: international case law, international instruments, and treaties and conventions. These three sources are not independent of one another; instead, each informs, and is informed by, the other.

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3. "The body of special legal norms created to regulate the conduct of legal or natural persons engaged in activities related to fissionable materials, ionizing radiation and exposure to natural sources of radiation." Stoiber, C. et al. (2003), *Handbook on Nuclear Law*, IAEA, Vienna, p. 4.

4. Most discussions about the sources of international law begin with Article 38.1 of the Statute of the International Court of Justice (ICJ), which provides that the ICJ will decide cases according to the following sources of international law:

    a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states;
    b. international custom, as evidence of a general practice accepted as law;
    c. the general principles of law recognized by civilized nations;
    d. subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law.

    Charter of the United Nations with the Statute of the International Court of Justice annexed thereto (1945), 59 Stat. 1031, 1187, USTS 993, entered into force 24 Oct. 1945 (ICJ Statute). The ICJ list, however, is neither definitive nor exhaustive: "The above is not an exhaustive statement of the foundations on which the Court can construct its decision. Some are listed, but not all. For instance, the paragraph does not mention unilateral acts of States, nor does it make reference to the decisions and resolutions of international organs, which very often contribute to the development of international law and may also be sources of rights and obligations." ICJ (2019), *Handbook*, Triangle Bleu, Maubeuge, France, p. 96.

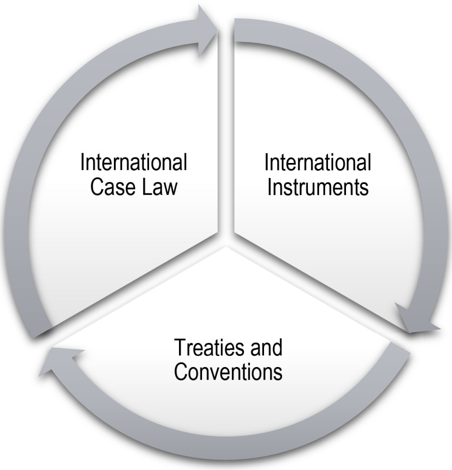

Figure 1. Sources of law of environmental protection for nuclear activities.

The fact that the framework comprises various streams and sources of law is not a failing, nor does it signify any underlying lack of coherence. Rather, it reflects the developing nature of environmental law, across the range of industrial and other human activities. It must be understood that these do not exist separately as a loosely related patchwork of laws, but rather, come together to create a coherent legal framework. That framework is shown in the following schematic.

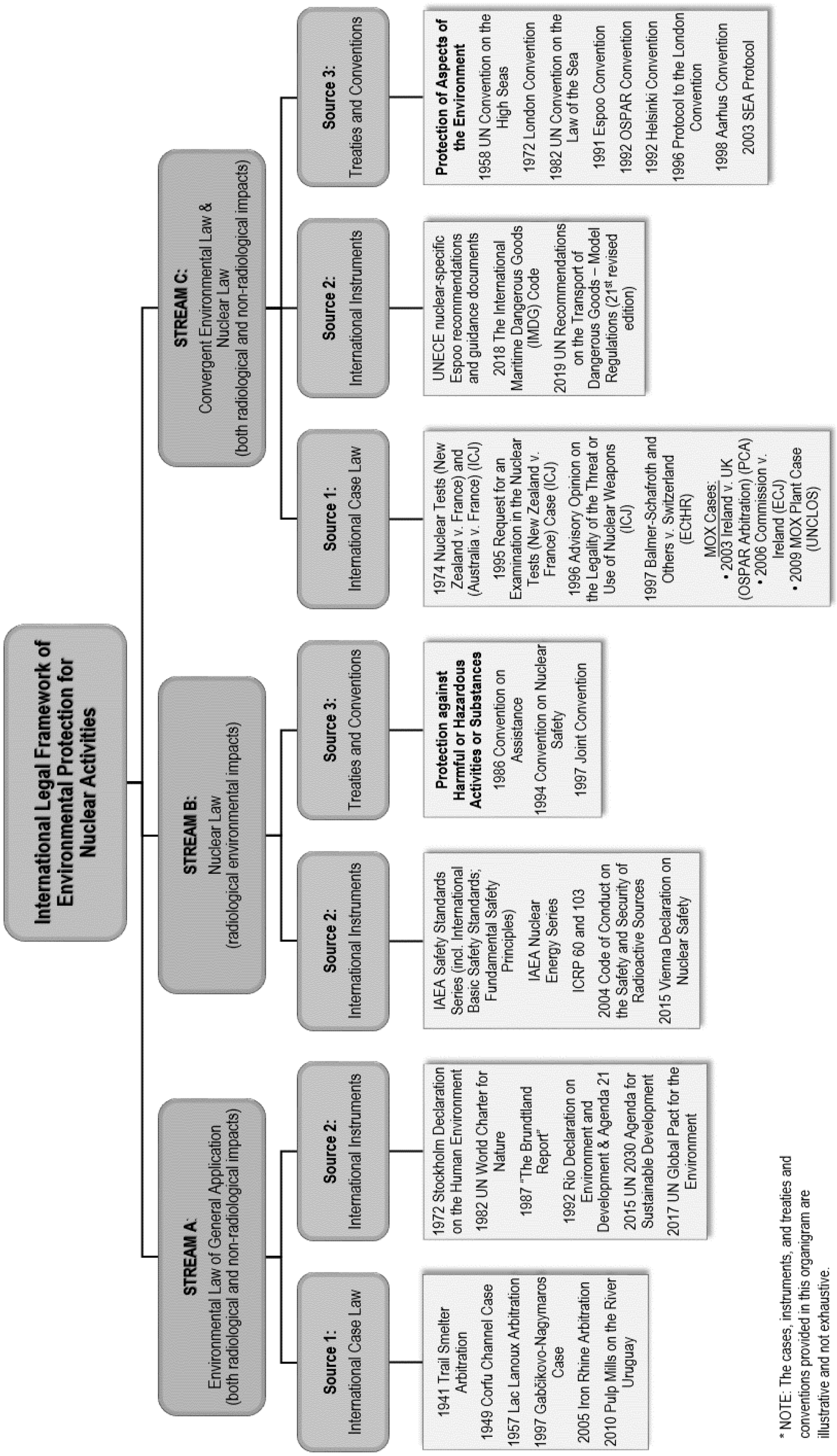

Figure 2. International legal framework of environmental protection for nuclear activities.

In order to see how the sources apply across, and shape the content of, the three higher level legal streams, one must first understand the nature of each of these sources, as well as the types of cases, instruments, and treaties and conventions included within.

2. Source 1: International case law

Although the international cases discussed herein often involved the interpretation of a treaty or an agreement between states as related to a specific activity at issue, these judgments of international tribunals, and in particular of the ICJ, play a role in the development of important principles of environmental law, some of which are of such significance that they are considered customary international law.[5] Not only do the cases contribute to the general principles of environmental law, but even where the subject matter concerns non-nuclear activities, the cases can be equally applicable to nuclear activities – whether it is cross-border industrial pollution or the abstraction impacts on transboundary water resources from the construction or operation of nuclear energy generation activities, among other issues – and to radiological as well as non-radiological impacts.

The prime source of international case law is that emanating from the ICJ, which is the principle judicial organ of the United Nations (UN).[6] Set up in 1945 and beginning its activities a year later, "[t]he ICJ is the highest court in the world and the only one with both general and universal jurisdiction: it is open to all Member States of the United Nations and, subject to the provisions of its Statute, may entertain any question of international law."[7] Although judicial decisions of the ICJ are meant to have "no binding force except between the parties and in respect of that particular case",[8] the International Law Commission (ILC) proposed in 1989 that "binding decisions of international organisations, and judgments of international courts or tribunals" should also be considered as "hard law" sources of international law.[9] Over the past 70 years, ICJ judgments – both those related to radiological and non-radiological environmental impacts – have been shaping the development of international environmental law.

In 1946, British warships were damaged, and some crew members died, as a result of mine explosions in the Corfu Channel (in Albanian waters) and the United Kingdom accused Albania of being responsible for the mines. In its decision finding Albania responsible, the ICJ acknowledged that there is a "general and well-recognized principle[]" that every state has an

5. This article adopts the ICJ's criteria for the determination of customary international law, which as outlined in the 1969 North Sea Continental Shelf Cases, states that "two conditions must be fulfilled. Not only must the acts concerned amount to a settled practice, but they must also be such, or be carried out in such a way, as to be evidence of a belief that this practice is rendered obligatory by the existence of a rule of law requiring it." North Sea Continental Shelf, Judgment, ICJ Reports 1969, p. 44 para. 77. According to the ICJ, a party must demonstrate that the "custom has become so established as to be legally binding on the other party." ICJ (2019), *Handbook*, *supra* note 4, p. 97. Some general examples of customary international law are obligations not to use force against another State, not to intervene in another State's affairs, not to violate another State's sovereignty and not to interrupt peaceful maritime commerce. Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America), Merits, Judgment of 27 June 1986, ICJ Reports 1986, p. 146 para. 292.

6. ICJ Statute, *supra* note 4, Article 1.

7. ICJ (2019), *Handbook*, *supra* note 4, p. 5.

8. ICJ Statute, *supra* note 4, Article 59.

9. Sands, P. and J. Peel (2018), *Principles of International Environmental Law*, Fourth Edition, Cambridge University Press, Cambridge, UK, p. 102; International Law Commission (1989), Draft Articles on State Responsibility, Part 2, Article 5(2)(b)-(c), "Report of the ILC to the United Nations General Assembly", UN Doc. A/44/10, p. 219.

"obligation not to allow knowingly its territory to be used for acts contrary to the rights of other States."[10] In its seminal 1996 Advisory Opinion on the "Legality of the Threat or Use of Nuclear Weapons", the ICJ:

> recognize[d] that the environment is not an abstraction but represents the living space, the quality of life and the very health of human beings, including generations unborn. The existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control is now part of the corpus of international law relating to the environment.[11]

This "general obligation" is considered customary international law. And from this foundation the ICJ has developed further principles.

One year after the ICJ's Advisory Opinion, in a case involving a hydroelectric dam project on the Danube River, the ICJ noted "that, in the field of environmental protection, vigilance and prevention are required on account of the often irreversible character of damage to the environment and of the limitations inherent in the very mechanism of reparation of this type of damage."[12] More recently, in the 2010 Pulp Mills on the River Uruguay case involving transboundary waterway issues, the ICJ found that states are "obliged to use all the means at its disposal in order to avoid activities which take place in its territory, or in any area under its jurisdiction, causing significant damage to the environment of another State."[13] The ICJ went on to note "that it may now be considered a requirement under general international law to undertake an environmental impact assessment [(EIA)] where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context, in particular, on a shared resource".[14] Just as with the general obligation above, the requirement to undertake an EIA in certain situations is also now generally considered part of customary international law.

In addition to judgments of the ICJ, cases before international arbitral tribunals, the Permanent Court of Arbitration (PCA), the European Court of Human Rights (ECtHR) and the International Tribunal for the Law of the Sea (ITLOS) have also provided important insights and contributed to the development of customary international law in this area. Eighty years ago, an international arbitral tribunal was called upon to resolve a dispute between the United States and Canada, where the United States claimed that sulphur fumes discharged from a zinc and lead smelter located at Trail, British Columbia, Canada (about 11 kilometres from the US border), caused damage in the US state of Washington. In finding Canada responsible, the tribunal, prefiguring the ICJ in its 1996 Advisory Opinion, stated that "no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence."[15] In a dispute between France and Spain related to a shared waterway, a different international arbitral tribunal expounded on the imperative of good neighbourliness, stating

10. Corfu Channel Case (United Kingdom of Great Britain and Northern Ireland v. Albania), Judgment of 9 Apr. 1949, ICJ Reports 1949, pp. 4, 22.

11. Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, ICJ Reports 1996, pp. 241-242. See also Trail Smelter Arbitration Case (US v. Canada), 3 UN Rep. Int'l Arb. Awards (RIAA) 1905 (1941), discussed *infra*.

12. Gabčikovo-Nagymaros Project (Hungary/Slovakia), Judgment, ICJ Reports 1997, p. 78.

13. Pulp Mills on the River Uruguay (Argentina v. Uruguay), Judgment, ICJ Reports 2010, p. 56 para. 101.

14. *Ibid.*, p. 83 para. 204.

15. Trail Smelter Arbitration Case, *supra* note 11, p. 1965.

that "France is entitled to exercise its rights; it cannot ignore Spanish interests. Spain can demand that its rights be respected and that its interests be taken into consideration."[16]

In the 2005 case regarding Belgium's "reactivation" of the Iron Rhine railway line linking Belgium to Germany through the Netherlands, the PCA provided a lasting definition of "environment", stating that it "is broadly referred to as including air, water, land, flora and fauna, natural ecosystems and sites, human health and safety, and climate."[17] In addition, it noted that "[t]he emerging [environmental] principles, whatever their current status, make reference to conservation, management notions of prevention and of sustainable development, and protection for future generations."[18]

In one of a series of linked cases at the intersection of environmental law and nuclear law, Ireland brought the United Kingdom before the PCA over low-level radioactive discharges into the Irish Sea from the Sellafield mixed oxide fuel (MOX) plant and related movements of radioactive material through the Irish Sea. In an earlier proceeding on the same matter, the ITLOS found that "the duty to cooperate is a fundamental principle in the prevention of pollution of the marine environment under Part XII of the Convention and general international law",[19] a principle that was affirmed by the PCA in 2003.[20]

Another case linking environmental law and nuclear law, Balmer-Schafroth and Others v. Switzerland, was heard by the ECtHR. In this case, local residents objected to the licence extension and power uprate for the Mühleberg nuclear power plant in Switzerland, demanding its immediate and permanent closure and claiming that the nuclear power plant did not meet current safety standards. After the Swiss Government dismissed their objections, the applicants claimed violations of Articles 6 and 13 of the European Convention for the Protection of Human Rights and Fundamental Freedoms (ECHR)[21] regarding access to fair hearings and national remedies. Although the ECtHR did not find in favour of the plaintiffs, seven judges signed onto a dissenting opinion that stated, in part:

> The majority appear to have ignored the whole trend of international institutions and public international law towards protecting persons and heritage, as evident in European Union and Council of Europe instruments on the environment, the Rio agreements, UNESCO instruments, the development of the precautionary principle and the principle of conservation of the common heritage. … Where the protection of persons in the context of the environment and installations posing a threat to human safety is concerned, all States must adhere to those principles.[22]

16. Lac Lanoux Arbitration Case (France v. Spain), 24 Int'l L. Rep. 101, 12 RIAA 281, p. 316 para. 23 (1957) ["*La France peut user de ses droits, elle ne peut ignorer les intérêts espagnols. L'Espagne peut exiger le respect de ses droits et la prise en considération de ses intérêts.*"].

17. Arbitration regarding the Iron Rhine ("Ijzeren Rijn") Railway between the Kingdom of Belgium and the Kingdom of the Netherlands, 27 RIAA 35, p. 66 para. 58 (2005).

18. *Ibid*.

19. MOX Plant (Ireland v. United Kingdom), Provisional Measures, Order of 3 Dec. 2001, ITLOS Reports 2001, p. 110 para. 82.

20. MOX Plant Case (Ireland v. United Kingdom), PCA Case No. 2002-01, Order No. 3, p. 20 (24 June 2003).

21. Convention for the Protection of Human Rights and Fundamental Freedoms (1950), 213 UNTS 222, entered into force 3 Sept. 1953.

22. Balmer-Schafroth and Others v. Switzerland, App. No. 22110/93 (ECtHR Grand Chamber Judgment of 26 Aug. 1997), 25 EHRR 598, Reports of Judgments and Decisions, ECtHR 1997-IV, p. 1346, Dissenting Opinion of Judge Pettiti, joined by Judges Gölcüklü, Walsh, Russo, Valticos, Lopes Rocha and Jambrek.

The cases discussed above are representative of those that relate to environmental protection for nuclear activities. Additional cases, both at the intersection of environmental law and nuclear activities[23] and environmental law of general application, could have been referenced but would only have reinforced the principles described *infra* and propositions provided above.

3. Source 2: International instruments

The second source of law is international instruments. These can sometimes be referred to as "soft law", which is a characterisation that comes with a bit of debate in the field of public international law. Although there is no universal definition of "soft law", the term is "[g]enerally … used to describe international instruments that their makers recognise are *not* treaties, but have as their purpose the promotion of 'norms' which are believed to be good and therefore should have general or universal application."[24] Among the three sources of law under discussion, international instruments can often have as much of an influence on the activities of states as what is sometimes seen in the "hard law" of international case law and treaties and conventions. Moreover, "soft law" often "sets" to become "hard law", for example because of the practice and states' attitude of obligation towards it,[25] or because the relevant instrument informs the content of a subsequent treaty, or at the level of national law, it is translated into a law or regulation of an individual state.[26]

Two important international instruments in Stream A (environmental law of general application) are UN Declarations. Although the international community began to address environmental protection well before 1972, the 20-year period that started with the 1972 UN Conference on the Human Environment in Stockholm and concluded with the 1992 UN Conference on Environment and Development in Rio de Janeiro represents the beginning of the "modern era" of international environmental law.[27] The 1972 Stockholm Conference was the UN's first major international conference on international environmental issues, while the 1992 Rio Conference was at the time the largest UN conference ever organised.[28] Together, the participants in these events adopted declarations – the Stockholm Declaration on the Human

23. See e.g. Nuclear Tests (Australia v. France), Judgment, ICJ Reports 1974, p. 253; Nuclear Tests (New Zealand v. France), Judgment, ICJ Reports 1974, p. 45; Request for an Examination of the Situation in Accordance with Paragraph 63 of the Court's Judgment of 20 Dec. 1974 in the Nuclear Tests (New Zealand v. France) Case, ICJ Reports 1995, p. 288; Athanassoglou and Others v. Switzerland, Application No. 27644/95, Judgment of 6 Apr. 2000, Reports of Judgments and Decisions, ECtHR 2000-IV, p. 173.

24. Aust, A. (2010), *Handbook of International Law*, 2nd edition, Cambridge University Press, Cambridge, UK, p. 11.

25. See *supra* note 5.

26. For example, the UK Ionising Radiations Regulations 2017, No. 1075, entered into force 1 Jan. 2018, which implements the worker safety aspects of the Euratom Basic Safety Standards Directive (Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom, *Official Journal of the European Union* (OJ) L 13 (17 Jan. 2014)), which in turn derives from ICRP (2007), "The 2007 Recommendations of the International Commission on Radiological Protection: ICRP Publication 103", *Annals of the ICRP*, Vol. 37, Nos. 2-4, Elsevier Ltd., Amsterdam, p. 25 (ICRP 103) and the IAEA International Basic Safety Standards (IAEA (2014), *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 3, IAEA, Vienna).

27. Sand, P.H., "Introduction", in Sand, P.H. (ed.) (2015), *The History and Origin of International Environmental Law*, Edward Elgar Publishing Limited, Cheltenham, UK, p. xv.

28. Sand, P.H. (1993), "International Environmental Law After Rio", *European Journal of International Law*, Volume 4, Oxford University Press, p. 377.

Environment[29] and the Rio Declaration on Environment and Development[30] – that contained numerous "common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human environment".[31] While not formally binding, the declarations "include provisions which at the time of their adoption were either understood to already reflect customary international law or expected to shape future normative expectations."[32] Many of the key principles of environmental protection law that emerged from these conferences concern nuclear activities as much as any other type of activity with potential environmental effects.

These two declarations, complemented and reinforced by international case law (discussed *supra*) as well as additional, subsequent instruments like the 2015 UN 2030 Agenda for Sustainable Development[33] and the more recent UN Global Pact for the Environment,[34] can be regarded as embodying and articulating certain key principles of international environmental law, of which the most relevant to nuclear activities are set out below.

Figure 3. Key principles of international environmental law.

29. Declaration of the United Nations Conference on the Human Environment, in Report of the United Nations Conference on the Human Environment, UN Doc. A/CONF.48/14/Rev.1 (1973) and Corr.1 (1973), 11 ILM 1416 (1972) (Stockholm Declaration).

30. Rio Declaration on Environment and Development, in Report of the United Nations Conference on Environment and Development, UN Doc. A/CONF.151/26/Rev.1 (Vol. I), 12 Aug. 1992, Annex I, 31 ILM 874 (1992).

31. Stockholm Declaration, *supra* note 29.

32. Handl, G. (2012), "Declaration of the United Nations Conference on the Human Environment (Stockholm Declaration), 1972 and the Rio Declaration on Environment and Development, 1992", p. 3, available at: UN Audiovisual Library of International Law, https://legal.un.org/avl/pdf/ha/dunche/dunche_e.pdf (accessed 6 June 2021).

33. UN General Assembly (UNGA) (2015), "Transforming our world: the 2030 Agenda for Sustainable Development", UN Doc. A/RES/70/1, adopted on 25 Sept. 2015 (21 Oct.).

34. UNGA (2018), "Towards a Global Pact for the Environment", UN Doc. A/RES/72/277, adopted on 10 May 2018 (14 May).

Streams B and C likewise include a number of critically important international instruments. Within the nuclear-specific law in Stream B are categories of international instruments like the International Atomic Energy Agency (IAEA) Safety Standards Series and Nuclear Energy Series as well as the publications of the International Commission on Radiological Protection (ICRP), among others. The Stream C international instruments are those at the intersection of environmental law and nuclear law. They include, for example, a number of recommendations and guidance documents related to the application of the Convention on Environmental Impact Assessment in a Transboundary Context[35] to nuclear activities, and instruments related to the transport of nuclear and radiological materials.

The role of these instruments in the development of the international legal framework will be described further *infra*.

4. Source 3: Treaties and conventions

The greater part of environmental protection for nuclear activities comes from Source 3, the treaties and conventions. These are to be found in Stream B, nuclear law (focusing on radiological environmental impacts), and Stream C, converging environmental law and nuclear law (relating to both radiological and non-radiological impacts). The structure of nuclear law in this area mirrors that of wider environmental law, in which "environmental priorities [are] essentially divided into two categories: those relating to the protection of various environmental media, and those relating to the regulation of particular activities or products",[36] or, more simply: what is to be protected and what is it to be protected against.

As explained, the nuclear law treaties and conventions (in Stream B) focus primarily on the control of sources of harm, notably ionising radiation, that are to be protected against. The treaties and conventions that go to the "hybrid" or "convergent" Stream C are also concerned with radiological impacts. The difference, however, between these two streams, as related to treaties and conventions, is that the nuclear law treaties and conventions emphasise the protection against harmful or hazardous activities or substances (ionising radiation), whereas the convergent environmental law and nuclear law treaties and conventions emphasise protection of aspects of the environment. Stream B treaties and conventions include the "traditional" nuclear safety conventions like the Convention on Nuclear Safety,[37] the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management[38] as well as the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.[39]

35. Convention on Environmental Impact Assessment in a Transboundary Context (1991), 1989 UNTS 310, entered into force 10 Sept. 1997 (Espoo Convention).

36. Sands, P. and J. Peel (2018), *supra* note 9, p. 4. See also Raetzke, C. (2013), "Nuclear law and environmental law in the licensing of nuclear installations", *Nuclear Law Bulletin*, No. 92, OECD Publishing, Paris, p. 56 ("One set of environmental laws protects particular aspects of the environment, such as environmental media (water, air or the soil) or certain species or habitats, against harm, whatever the cause of that harm may be. The other group of laws protects the environment in general against specific harmful or hazardous activities or substances, such as pollution from industry, release of gases causing climate change or risks emanating from genetically modified organisms.").

37. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996 (CNS).

38. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001 (Joint Convention).

39. Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1986), IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987 (Assistance Convention).

Stream C treaties and conventions include a number of marine pollution conventions such as the 1972 London Dumping Convention[40] (and its 1996 Protocol[41]), the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic[42] as well as the 1982 UN Convention on the Law of the Sea.[43] This stream, notably, also includes three key conventions under the auspices of the UNECE: the Espoo Convention and its Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context[44] and the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.[45] While these are not what this article treats as "nuclear" conventions, they do specifically provide for nuclear activities.

General environmental law (Stream A), by contrast, is more focused on the protection of environmental media and receptors rather than specific activities that may create impacts on those things. The substantive consequences of this are discussed more fully *infra*.

B. Three "core doctrines" of environmental protection for nuclear activities

In many ways, the international legal framework of environmental protection for nuclear activities is as broad and as complex as any other subject area in the nuclear law field. As just discussed, the number of binding and non-binding instruments and relevant international judgments is extensive and understanding the interconnections and applications requires careful reading. The five key principles of international environmental law outlined above are a helpful synthesis of the underlying themes as well as the relevant law to be considered. The manifestations of these principles can be identified in the substance of the law itself, and across all three streams, in what could be called three "core doctrines" of environmental protection for nuclear activities: justification of nuclear activities, assessments of the environmental impacts of certain nuclear activities and public participation in nuclear decision making.

40. London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972), 1046 UNTS 120, entered into force 30 Aug. 1975 (London Dumping Convention).

41. Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (1996), entered into force 24 Mar. 2006 (London Protocol).

42. Convention on the Protection of the Marine Environment of the North-East Atlantic (1992), 32 ILM 1068, entered into force 25 Mar. 1998 (OSPAR Convention). The shorthand "OSPAR Convention" gets its name from "two conventions [that] were unified, up-dated and extended by the 1992 OSPAR Convention" – the Oslo Convention, *infra* note 131, and the Convention on the Prevention of Marine Pollution from Land-Based Sources (1974), 13 ILM 352, entered into force 6 May 1978 (Paris Convention) – Oslo and Paris. OSPAR (n.d.), "About OSPAR", www.ospar.org/about (accessed 6 June 2021).

43. United Nations Convention on the Law of the Sea (1982), 1833 UNTS 397, entered into force 16 Nov. 1994 (UNCLOS).

44. Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (2003), 2685 UNTS 140, entered into force 11 July 2010 (in this article, the short form "SEA Protocol" will be used, though in common usage it is also referred to as the "Kyiv Protocol").

45. Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (1998), 2161 UNTS 450, entered into force 30 Oct. 2001 (Aarhus Convention).

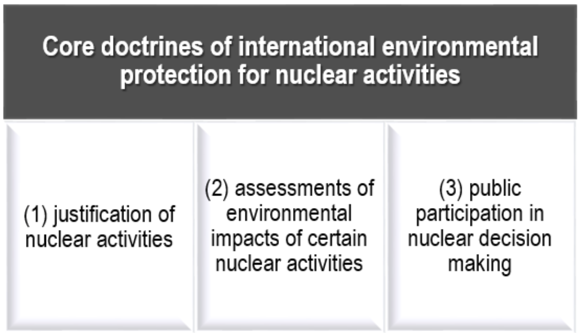

Figure 4. Core doctrines of environmental protection for nuclear activities.

1. Justification of nuclear activities

a. *International Commission on Radiological Protection (ICRP) Recommendations*

The first of these "core doctrines" is justification of nuclear activities (or simply, "Justification"). It is consonant with the international environmental law principle of sustainable development and in its earliest, and simplest, formulation it requires that "no practice [involving exposure to ionising radiation] shall be adopted unless its introduction produces a positive net benefit".[46] Justification is also one of the three general principles, or "pillars",[47] of the international radiological protection system[48] and was first systematically addressed in the Recommendations of the ICRP.[49] In its origins, Justification, as a source of law, can be viewed as "soft law" based on an international instrument (in this case the published and universally-accepted ICRP Recommendations); and in the taxonomy of this article, a "Source". It is also a strong example of "soft law" that has, over time, become "hard law", including at the level of national legislation as will be explained below.

Following the publication of ICRP 26, the concept of Justification was amplified in subsequent ICRP Recommendations. The ICRP maintained the radiological protection trilogy of Justification, Optimisation and Quantitative Dose Limitation in its 1991 ICRP 60, explaining Justification as: "No practice involving exposures to ionising radiation shall be adopted unless it produces sufficient benefit to the exposed individuals or to society to offset the radiation detriment it causes. (The justification of a practice)."[50] The ICRP's third, and still current, iteration of

46. ICRP (1977), "Recommendations of the International Commission on Radiological Protection: Publication 26", *Annals of the ICRP*, Vol. 2, No. 3, Pergamon Press, Oxford, p. 3 para. 12 (ICRP 26).

47. The three pillars of the radiological protection system should not be confused with the "Three Pillars" of the Aarhus Convention, to be discussed *infra*.

48. The two other principles of this system (also first articulated in 1977 in ICRP 26, *supra* note 46, are: "Optimisation" ("… all exposures shall be kept as low as reasonably achievable, economic and social factors being taken into account"), and "Quantitative Dose Limitation" ("… the dose equivalent to individuals shall not exceed the limits recommended for the appropriate circumstances by the [ICRP]").

49. The ICRP is a UK-based, independent non-governmental organisation (NGO), founded in Stockholm in 1928, on whose several specialist committees sit leading scientists and policymakers working in the field of radiological protection. Since the 1960s, its remit has expanded beyond the medical uses of ionising radiation to radiological protection issues from most sources. With the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the ICRP has been responsible for the creation and development of the current international system of radiological protection.

50. ICRP (1991), "1990 Recommendations of the International Commission on Radiological Protection: ICRP Publication 60", *Annals of the ICRP*, Vol. 21, Nos. 1-3, Pergamon Press, Oxford, p. 28, sec. 4.2(112) (ICRP 60).

Justification came in 2007, in ICRP 103. The glossary of key radiological protection terms defines Justification as:

> The process of determining whether either (1) a planned activity involving radiation is, overall, beneficial, i.e. whether the benefits to individuals and to society from introducing or continuing the activity outweigh the harm (including radiation detriment) resulting from the activity; or (2) a proposed remedial action in an emergency or existing exposure situation is likely, overall, to be beneficial, i.e., whether the benefits to individuals and to society (including the reduction in radiation detriment) from introducing or continuing the remedial action outweigh its cost and any harm or damage it causes.[51]

ICRP 103 further speaks of the Justification principle as: "Any decision that alters the radiation exposure situation should do more good than harm. This means that, by introducing a new radiation source, by reducing existing exposure, or by reducing risk of potential exposure, one should achieve sufficient individual or societal benefit to offset the detriment it causes".[52] The essence of Justification is that it is an exercise, and balancing judgement, that is to be performed before any decision is made to create or continue a situation that will or may cause exposure to ionising radiation. For that reason, it is closely linked to the process of licensing or permitting nuclear activities – and to notions of nuclear safety.

Justification has a wide application: to the design and operation of nuclear power plants and other nuclear facilities, the transport of radioactive materials, the marketing of sealed sources for industrial and commercial purposes, and the diagnostic and therapeutic uses of radioactive sources in medical settings, as some examples. Wide too are the categories of people, the harm or benefits for whom may be the focus of the Justification process. They include individual medical patients (for whom the equation may be the binary one of weighing one risk to personal health against another) and those working with, or potentially exposed to, radiation in the workplace, such as radiographers and industrial radiation workers. But, most importantly in the context of this article, they include whole communities and even societies where there are risks of population-level exposures as a result of releases of ionising radiation to the environment, even if these would only occur in unplanned and extreme circumstances. In this latter case, the relevant harm, risk and potential detriment to be taken account of may be very difficult to evaluate – even before starting to consider, on the other side of the scales, the potential positives or benefits of the relevant nuclear activity. Justification cases with an environmental or public radiation exposure aspect can be expected to have, by far, the most factors and uncertainties in play and the greatest level of complexity.

b. *European approach to Justification*

To understand how Justification has worked so far in practice and its impact on the undertaking of new nuclear activities, one must look at the way Justification has moved from being a science-policy based ("soft law") international norm to an IAEA safety principle and to "hard" judge-made law, as well as specific regional and national regulation. It was in Europe that an early, although not exclusive, lead was taken in bringing the ICRP Recommendations on Justification into practical effect. Article 2(b) of the 1957 Euratom Treaty provides that the European Atomic Energy Community (Euratom) should "establish uniform safety standards to protect the health of

51. ICRP 103, *supra* note 26, p. 25.

52. *Ibid*., p. 88, sec. 5.6(203).

workers and of the general public and ensure that they are applied".[53] Article 30 of the Euratom Treaty goes on to require "Basic standards [to] be laid down within the [European Atomic Energy] Community for the protection of the health of workers and the general public against the dangers arising from ionizing radiations".

Such basic standards have been established and developed over the decades under a series of Euratom Directives, applicable across member states of the Community. In 1980, Article 6 of the Euratom Basic Safety Standards Directive for the first time introduced to the Community the concept of Justification (and also Optimisation), providing: "The limitation of individual and collective doses resulting from controllable exposures shall be based on the following general principles: (a) every activity resulting in an exposure to ionizing radiation shall be justified by the advantages which it produces."[54] This was an explicit adoption of the Recommendations in ICRP 26.[55] Successive amending and revising Directives have extended the provisions of the Euratom Basic Safety Standards regarding Justification.[56] Article 5 in Chapter III ("System of Radiation Protection") of the current, 2013 Basic Safety Standards reads:

> General principles of radiation protection. Member States shall establish legal requirements and an appropriate regime of regulatory control … based on the principles of justification, optimisation and dose limitation: (a) Justification: Decisions introducing a practice shall be justified in the sense that such decisions shall be taken with the intent to ensure that the individual or societal benefit resulting from the practice outweighs the health detriment that it may cause. Decisions introducing or altering an exposure pathway for existing and emergency exposure situations shall be justified in the sense that they should do more good than harm.[57]

Article 19, "Justification of practices" of the 2013 Directive also provides that: "Member States shall ensure that new classes or types of practices resulting in exposure to ionising radiation are justified before being adopted."

There are three points of particular note in these provisions. First, they reinforce the point that the relevant principle is not one of Justification alone, but of "Justification in advance". Thus, Justification is an exercise that must be concluded before undertaking any specific projects falling within the category of the relevant practice that is being introduced or changed (e.g. a new class of diagnostics in the field of nuclear medicine or a new technology for treating and storing medium-level radioactive waste arising from nuclear energy generation). It is in practice undertaken before any final licences and permits allowing the first of those specific projects to proceed have been granted. Second, whereas Article 6 of the 1980 Euratom Basic Safety Standards appeared to limit Justification to the justifying of radiation doses from "controllable

53. Treaty Establishing the European Atomic Energy Community (1957), 298 UNTS 167, entered into force 1 Jan. 1958 (Euratom Treaty) (consolidated version in OJ C 203 (7 June 2016)).

54. Council Directive 80/836/Euratom of 15 July 1980 amending the Directives laying down the basic safety standards for the health protection of the general public and workers against the dangers of ionizing radiation, OJ L 246 (17 Sept. 1980), p. 1.

55. See Opinion of Advocate General Jacobs of 30 June 1992, Commission v. Kingdom of Belgium (Re Ionising Radiation Protection), C-376/90, EU:C:1992:283, paras. 16 and 21 in which Advocate General Jacobs stated in his Opinion to the European Court of Justice that the principles of radiological protection set out in ICRP 60 (as successor to ICRP 26) "are reflected in Article 6 [of the 1980 Basic Safety Standards Directive"].

56. See Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation, OJ L 159 (29 June 1996), p. 1, reflecting ICRP 60.

57. Council Directive 2013/59/Euratom, *supra* note 26.

exposures", Article 5 of the 2013 Directive is more expansive and in alignment with the ICRP's latest recommendations in ICRP 103. It refers to "exposure situations" and "pathways", rather than to doses; and it touches on the risks from unplanned exposures as well anticipated doses from controlled exposures.[58] Finally, it requires member states to "establish *legal requirements*" based on the principle of Justification.[59]

The obligation to establish legal requirements goes to the practical implementation of Justification at a national level – in Europe and elsewhere – over the past 40 years. From its first appearance in the 1980 Euratom Basic Safety Standards Directive, the Justification principle has been implemented in European Union (EU) member states in different ways.[60] There is, however, a general tendency for Justification to be legislated for as an overarching principle – a "guideline" or a "consideration" – to be applied by governmental bodies in the exercise of specific regulatory and decision-making processes, rather than as a separate legal and administrative process in its own right.[61] But, Justification was developed as a more formal legal requirement in some EU countries. For example, in Spain, Justification forms a mandatory element of the nuclear site licensing process,[62] and more recently in Ireland, the 2013 Euratom Basic Safety Standards Directive was transposed into its national laws (providing for an express Justification regime controlled by different government agencies for particular types of nuclear activity).[63]

The former position of the United Kingdom was, even within this mixed economy of national approaches to the adoption of Justification, something of an outlier. The 1980 Euratom Basic Safety Standards Directive had been partly implemented through the Ionising Radiation Regulations 1985, but not as regards Justification. Justification – and Optimisation – were addressed in the government's own "Guide to the Administration of the Radioactive Substances Act 1960", which was considered to represent approved practice but was not legally binding.[64] This position of the UK government met concerted legal challenge from several NGOs, all centred around the government's licensing of the THORP (Thermal Oxide Reprocessing Plant) and MOX facilities at British Nuclear Fuels plc's Sellafield nuclear site.[65] The end result of these cases was

58. "The Commission recommends that, when activities involving an increased or decreased level of radiation exposure, or a risk of potential exposure, are being considered, the expected change in radiation detriment should be explicitly included in the decision-making process. The consequences to be considered are not confined to those associated with the radiation – they include other risks and the costs and benefits of the activity. Sometimes, the radiation detriment will be a small part of the total. Justification thus goes far beyond the scope of radiological protection." ICRP 103, *supra* note 26, p. 89, section 5.7(205).

59. Council Directive 2013/59/Euratom, *supra* note 26, Article 5 (emphasis added).

60. See NEA (2011), *Evolution of ICRP Recommendations 1977, 1990 and 2007: Changes in Underlying Science and Protection Policy and Case Study of Their Impact on European and UK Domestic Regulation*, OECD Publishing, Paris.

61. E.g. Finland: Radiation Act (859/2018), Sections 5, 23, 24, etc.; Germany: Radiation Protection Ordinance of 29 November 2018 (*Federal Law Gazette* I, p. 2034, 2036), last amended by Article 1 of the Ordinance of 20 November 2020 (*Federal Law Gazette* I, p. 2502), sections 2-4; France: Public Health Code, Articles L.1333-1 and L. 1333-2; see also Nuclear Safety Authority (ASN) (2020), *ASN Report on the state of nuclear safety and radiation protection in France in 2019*, ASN, Montrouge, France, p. 240.

62. See Act 15/1980 of 22 April, Creating the Nuclear Safety Council, amended by Act 33/2007 of 7 November and Royal Decree 783/2001, of 6 July, approving the Regulation on the Protection of Health against Ionising Radiations (RPHIR).

63. Radiological Protection Act 1991 (Ionising Radiation) Regulations 2019 (S.I. No. 30 of 2019).

64. Tromans, S. and J. Fitzgerald (1997), *The Law of Nuclear Installations and Radioactive Substances*, 1st Edition, Sweet & Maxwell, London, p. 242.

65. R v Inspectorate of Pollution, ex parte Greenpeace [1994] 4 All ER 321; R v Inspectorate of Pollution, ex parte Greenpeace (No. 2) [1994] 4 All ER 329; R v Secretary of State for Environment, Food and Rural Affairs, ex parte Friends of the Earth Ltd and Greenpeace Ltd [2001] EWCA Civ 1847 and [2002] Env LR 24.

that the Court determined that, even in the absence of express national implementing legislation, Article 6 (and other provisions) of the 1980 Euratom Basic Safety Standards Directive did impose a legal requirement under UK law for a Justification exercise to be undertaken before granting authorisations for these sorts of nuclear activity.

In 2004, the United Kingdom re-addressed the process of Justification in the Justification of Practices Involving Ionising Radiation Regulations 2004.[66] These regulations prohibited the establishment of new classes or types of practice involving ionising radiation unless there had been a specific governmental "justification decision".[67] A senior minister of state was appointed the "Justifying Authority", with a formal application and decision-making process, involving external consultation, and the issuance of Justification decisions in the form of Parliamentary regulation. Thus, a new regime was created that stood separate and apart from any individual licensing or authorisation process. The UK government also issued detailed guidance on the application and administration of this new process.[68] The UK Justification process represents the most detailed of all national Justification regimes. It has proved valuable in the UK's consideration of the nuclear power plant new build programme that has ensued – and particularly with regard to the evaluation of potential environmental detriments and benefits that have formed part of this (see *infra*).

c. *IAEA approach to Justification*

While these developments in Europe may have been of interest to the wider international community, the position of the IAEA on Justification, and its reception of the Recommendations of the ICRP, have been of paramount importance internationally. The IAEA Safety Standards set out a broad international consensus as to Justification, with publications in its Safety Series being key international instruments.

Internationally, there is this focus on IAEA instruments (Stream B, Source 2) as there was (and remains) an absence of nuclear law treaties and conventions in relation to Justification. While the Convention on Nuclear Safety, adopted in 1994, and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, adopted in 1997, both incorporate the radiological protection principles of Optimisation and Quantitative Dose Limitation,[69] Justification is omitted from both Conventions.

The IAEA's first major statement on Justification following the publication of ICRP 60 was in its 1996 *International Basic Safety Standards*.[70] These Standards listed as the first of their "Radiation Protection Requirements", "Justification of practices".[71]

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66. The Justification of Practices Involving Ionising Radiation Regulations 2004 (S.I. No. 1796 of 2004).

67. *Ibid.*, Regulations 4(5), "Justification of new classes or types of practice" and 7 "Transitional Arrangements-new classes or types of practice".

68. The 2008 *The Justification of Practices Involving Ionising Radiation Regulations 2004: Guidance on their application and administration* was updated in May 2019 by the UK Department for Business, Energy and Industrial Strategy following the 2018 amendment to the Justification of Practices Involving Ionising Radiation Regulations 2004 and are available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/804958/Justification-of-practices-involving-ionising-radiation-regulations-2004.pdf.

69. CNS, *supra* note 37, Article 15; Joint Convention, *supra* note 38, Article 24.

70. IAEA (1996), *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources*, IAEA Safety Standards, Safety Series No. 115, IAEA, Vienna.

71. *Ibid*. paras. 2.20-2.22, with paragraph 2.20 reading: "No practice or source within a practice should be authorized unless the practice produces sufficient benefit to the exposed individuals or to society to offset the radiation harm that it might cause; that is: unless the practice is justified, taking into account social, economic and other relevant factors." Paragraph 2.21 explains that Appendix II contains detailed requirements for the justification of practices involving medical exposures.

In 2006, the IAEA published a new and unified set of principles representing the philosophy across all areas of the Agency's Safety Standards: the *Fundamental Safety Principles*.[72] These principles addressed Justification in a way that reflected the 1996 *International Basic Safety Standards* ten years before but also foreshadowed the developing view of the nature of Justification that emerged in ICRP 103, which was published the following year. Justification was accorded the status of a Fundamental Safety Principle (Principle 4) under the rubric that "Facilities and activities that give rise to radiation risks must yield overall benefits".[73] As with the 1996 *International Basic Safety Standards*, justification of medical radiation exposures was given special consideration (para. 3.20). Otherwise, Justification was considered in the following light:

> 3.18. For facilities and activities to be considered to be justified, the benefits that they yield must outweigh the radiation risks to which they give rise. For the purpose of assessing benefit and risk, *all significant consequences* of the operation of facilities and the conduct of activities have to be taken into account.
>
> 3.19. In many cases, decisions relating to benefit and risk are taken at the highest levels of government, such as decisions by a State to embark on a nuclear power programme. In other cases, the regulatory body may determine whether proposed facilities and activities are justified.[74]

Following the 2007 publication of ICRP 103, the IAEA published a major revision of the *International Basic Safety Standards* in 2014 (this happening broadly in parallel with the revision of the Euratom Basic Safety Standards).[75] These new standards stated that they were based on the 2006 *Fundamental Safety Principles*, including Principle 4, Justification. Introductory paragraph 1.13 is noteworthy:

> The operation of facilities or the conduct of activities that introduce a new source of radiation, that change exposures or that change *the likelihood of exposures* has to be justified in the sense that the detriments that may be caused are outweighed by the individual and societal benefits that are expected. The comparison of detriments and benefits often goes *beyond the consideration of protection and safety*, and involves the consideration of economic, societal and *environmental* factors also.[76]

The 2014 *International Basic Safety Standards* go on to place Justification among the standards' 52 "Requirements", addressing the justification of practices, the justification of medical exposures and the justification for protective actions.[77]

72. IAEA (2006), *Fundamental Safety Principles: Safety Fundamentals*, IAEA Safety Standards Series, Safety Fundamentals, No. SF-1, IAEA, Vienna.

73. *Ibid*., p. 10.

74. *Ibid.* (emphasis added).

75. IAEA (2014), No. GSR Part 3, *supra* note 26.

76. *Ibid*., p. 6 para. 1.13 (emphasis added).

77. See "Requirement 10: Justification of practices", "The government or the regulatory body, as appropriate, shall ensure that provision is made for the justification of any type of practice and for review of the justification, as necessary, and shall ensure that only justifies practices are authorized." *Ibid*., p. 35 para. 3.16.

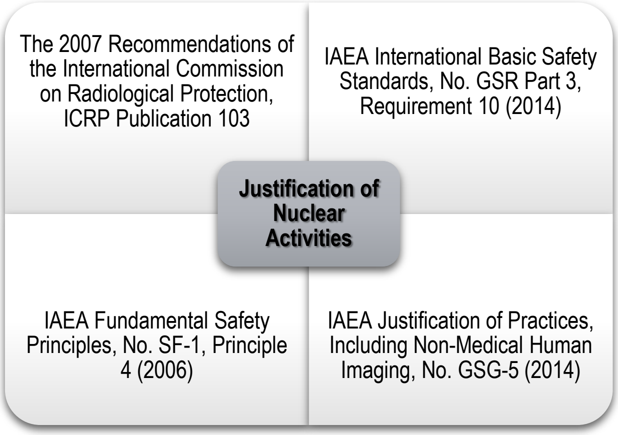

Figure 5. Non-exhaustive view of the international foundations of justification of nuclear activities.

Three observations can be made on the IAEA's present position on Justification, as set out in the 2006 *Fundamental Safety Principles* and the 2014 *International Basic Safety Standards*. First, the "likelihood of exposures" from unplanned, as well as planned, scenarios are to be taken into account in justifying nuclear practices and activities.[78] Second, Justification is not procedurally proscriptive; different countries may take varying approaches to the process and level of relevant decision making.[79] Third, the factors to be weighed in the Justification "balance" are very wide; they are not a "closed category". They do include economic, societal and (significantly in the context of this article) environmental factors.[80] The experience of Justification in the United States illustrates each of these points.

d. *US approach to Justification*

The radiological protection principles of Justification, Optimisation and Quantitative Dose Limitation are recognised by the US Nuclear Regulatory Commission (NRC).[81] The US radiation control regulatory regime is based on generally applicable national standards made by the Environmental Protection Agency (EPA) based on assessments and recommendations promulgated by the ICRP and the National Council on Radiation Protection and Measurements (NCRP) for use by federal agencies, including the NRC.[82] The focus, however, of the EPA's standards have not substantively addressed Justification (by contrast with Optimisation and Quantitative Dose Limitation), other than to acknowledge it as a relevant principle.[83] At the level of regulatory policy and practice, however, it appears that the NRC, in its licensing of nuclear activities, will "reject an application to use or produce radioactive materials if it determines that the application is frivolous (i.e. that the overall benefit to society is outweighed by the risk of radiation exposure associated

78. *Ibid.*, p. 6, para 1.13.

79. IAEA (2006), No. SF-1, *supra* note 72, Principle 4, para 3.19.

80. IAEA (2014), No. GSR Part 3, *supra* note 26, p. 6, para 1.13.

81. The NRC having, however, noted that the ICRP principles of radiological protection have in practice proven "difficult to implement". NRC (2007), *The United States of America Fourth National Report for the Convention in Nuclear Safety*, NUREG-1650, Rev. 2, NRC, Washington, DC, p. 105.

82. *Ibid.*

83. NCRP (1994), *Dose Control at Nuclear Power Plants*, NCRP Report No. 120, NCRP Publications, Bethesda, Maryland, pp. 2 and 20-21.

with the activity)."[84] This regulatory-based case-specific and policy-based approach to Justification must be viewed in a wider context, in which:

> For some large applications, such as the generation of electricity from nuclear power, *national policy* establishes the justification. Since the National Energy Policy favors nuclear power (i.e., the net benefit for the United States is deemed to be positive), the licensing process … does not specifically address the justification for licensing a nuclear power plant.[85]

This is, however, just one strand – of regulation and policy – and only part of the picture. On a broader administrative law front, the United States took a very early lead on Justification (without use of that term); i.e. one that predates even ICRP 26 and foreshadowed current approaches to the process of Justification, especially with regard to the importance of environmental factors.

For the past 50 years the US National Environmental Policy Act of 1969 (NEPA)[86] has required the US federal government to "use all practicable means and measures" "to protect environmental values", and it "makes environmental protection a part of the mandate of every federal agency and department."[87] Under NEPA, all agencies of the federal government must, among other requirements, ensure that environmental costs and benefits are considered in decision making along with economic and technical considerations, and for every major federal action that significantly affects the quality of the human environment, agencies must include a detailed statement on, among others: (1) the environmental impact of the proposed action, (2) unavoidable adverse environmental effects and (3) alternatives to the proposed action.[88] Thus, NEPA is about Justification.

Justification of activities, practices and facilities, and nuclear energy-related ones at that, is a long-standing approach in the United States under NEPA.[89] In one of the first cases interpreting NEPA, and one involving the US Atomic Energy Commission (AEC), the predecessor agency to today's US NRC, the DC Circuit Court of Appeals found that the AEC's newly-promulgated rule implementing NEPA did not go far enough in considering environmental impacts "to the fullest extent possible".[90] In explaining the basic purpose of the Act, the Court stated that:

> NEPA mandates a case-by-case balancing judgment on the part of federal agencies. In each individual case, the particular economic and technical benefits of planned action must be assessed and then weighed against the environmental costs; alternatives must be considered which would affect the balance of values. ... In some cases, the benefits will be great enough to justify a certain quantum of environmental costs; in other cases, they will not be so great and the proposed action may have to be abandoned or significantly altered so as to bring the benefits and costs into a

84. NRC (2007), NUREG-1650, *supra* note 81, p. 106.

85. *Ibid.* (emphasis added).

86. National Environmental Policy Act of 1969, as amended (NEPA), Pub. L. 91-190, 42 USC §§ 4321-4347.

87. *Ibid.*, at § 4331; Calvert Cliffs' Coordinating Committee, Inc. v. Atomic Energy Commission, 449 F.2d 1109, 1112 (DC Cir. 1971), cert. denied, 404 US 942 (1972).

88. NEPA, *supra* note 86, at § 4332.

89. "NEPA establishes environmental protection as an integral part of the Atomic Energy Commission's basic mandate. The primary responsibility for fulfilling that mandate lies with the Commission. … it must itself take the initiative of considering environmental values at every distinctive and comprehensive stage of the process beyond the staff's evaluation and recommendation." Calvert Cliffs' Coordinating Committee, *supra* note 87, at 1119.

90. *Ibid.*, at 1129.

> proper balance. The point of the individualized balancing analysis is to ensure that, with possible alterations, the optimally beneficial action is finally taken.[91]

Thus, the project should be justified before it begins. In the context of nuclear energy, Justification is "implemented during the licensing processes under 10 CFR Part 50 and 10 CFR Part 52 and during the operations phase through oversight."[92] Although it is not directly addressed in regulation, "when a nuclear power plant is licensed, the environmental costs and benefits are evaluated in an environmental impact statement."[93] Thus, it is not simply about radiological environmental impacts, but all environmental impacts.

e. *Justification in practice*

The role that Justification has to play in the protection of the environment for nuclear activities and the significance of environmental factors in the exercise of Justification (at whatever level and in whatever context, nationally, this is undertaken) have become critical themes. The environment will always appear on both sides of the "Justification balance sheet". On the one side, it relates to detriments – the detriment of augmental doses to individuals or communities from releases (planned or unplanned) of radiation into the environment and the detriment of potential contamination of the environment, and its impacts on public and private property and to flora and fauna. Nor is that to ignore the other, non-radiological impacts on the environment that can arise from the infrastructure development and resource uses that come with major nuclear-related projects, particularly in the nuclear energy sector. On the other side, Justification must take into account the benefits to the environment of certain nuclear activities, including the very low carbon profile of nuclear power generation and its potential contribution to relief from fossil fuel energy dependence as well as their applications in improved agronomy and potable water management and provision.

How, practically, environmental factors may be weighed in the decision making that governments undertake to reach a "net" Justification decision (essentially a subjective balancing – but one that must be evidence-based – between radiological, economic, societal and environmental concerns) is illustrated by the Justification decision of the UK Secretary of State for Energy and Climate Change made in 2010, under the Justification of Practices Involving Ionising Radiation Regulations (2004), in relation to the Justification application made by the UK Nuclear Industry Association (NIA) on behalf of the vendors of different nuclear reactor designs potentially forming part of the UK's revived nuclear new build programme.[94] What was originally sought to be justified, embracing all relevant reactor design types, was: "The generation of electricity from nuclear energy using oxide fuel of low enrichment in fissile content in light water cooled, water moderated thermal reactors using evolutionary designs."[95]

91. *Ibid.*, p. 1123.

92. NRC (2019), *The United States of America Eighth National Report for the Convention on Nuclear Safety*, NUREG-1650, Rev. 7, p. 153.

93. NRC (2016), *The United States of America Seventh National Report for the Convention on Nuclear Safety*, NUREG-1650, Rev. 6, p. 178.

94. The Justification of Practices Involving Ionising Radiation Regulations 2004, *supra* note 66.

95. NIA (2008), *Justification Application: New Nuclear Power Stations*, NIA, London, p. 6 para. 1.3, available at: https://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file49231.pdf.

In 2010, having conducted extensive consultation and having received evidence, the Secretary of State issued the Justification decisions.[96] In this Justification process and decision making, environmental factors proved to be the dominant considerations. On the detriments side, the Secretary of State, as "Justifying Authority", acknowledged that:

- there could be radiation doses to the public through off-site environmental exposures arising from routine operations of the relevant nuclear plant (but concluded that these would be very low);
- there was a risk of environmental exposures as a result of accident scenarios (which, though, would be addressed through site-specific licensing procedures were the reactor type to be commercially adopted once justified);
- long-term radioactive waste management raised issues (for which the Secretary of State considered there were technical and environmentally sustainable solutions); and
- there could be non-radiological environmental detriments from the construction, operation and decommissioning of any plant that might be built (the Secretary of State taking the view that the national system of environmental and nuclear-specific regulation was adequate to address these concerns on a site-by-site permitting basis).

The environmental factors figured equally, if not to an even greater extent, in considering the benefits of the new practice that was sought to be justified. Security of electricity supply and the UK's future energy mix favoured the introduction of new energy generation sources. But, the UK's commitment to reducing carbon emissions, particularly from energy generation, and meeting long-term challenges to the environment required a focus on introducing new technologies and practices to assist in achieving carbon reduction targets. The Secretary of State concluded that the practice and reactor types under consideration met these needs. The decision was that the practice was, overall, found to be justified. This example, from the United Kingdom, of the Justification process in practice may signify the wider and increasing importance of environmental considerations in the development of nuclear activities and of the "doctrine" of Justification in that development.

2. Assessments of the environmental impacts of certain activities

Assessments of environmental impacts include, at a basic level, governments investigating, evaluating and then "showing and telling" the potential effects on the environment (and human health) of proposed nuclear activities. With this invariably comes an obligation to enter into genuine dialogue on the assessments with designated third parties, including other governments and/or members of the public. The international recognition of assessments for environmental impacts emanates from all three primary sources of law, which provides the foundation for further discussion.

96. See e.g. UK Department of Energy and Climate Change (DECC) (2010), *The Justification of Practices Involving Ionising Radiation Regulations 2004; The reasons for the Secretary of State's Decision as Justifying Authority on the Regulatory Justification of the Class or Type of Practice being: "The generation of electricity from nuclear energy using oxide fuel of low enrichment in fissile content in a light water cooled, light water moderated thermal reactor currently known as the EPR designed by AREVA NP."*, Doc. URN 10D/831, DECC, London, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47936/666-decision-EPR-nuclear-reactor.pdf.

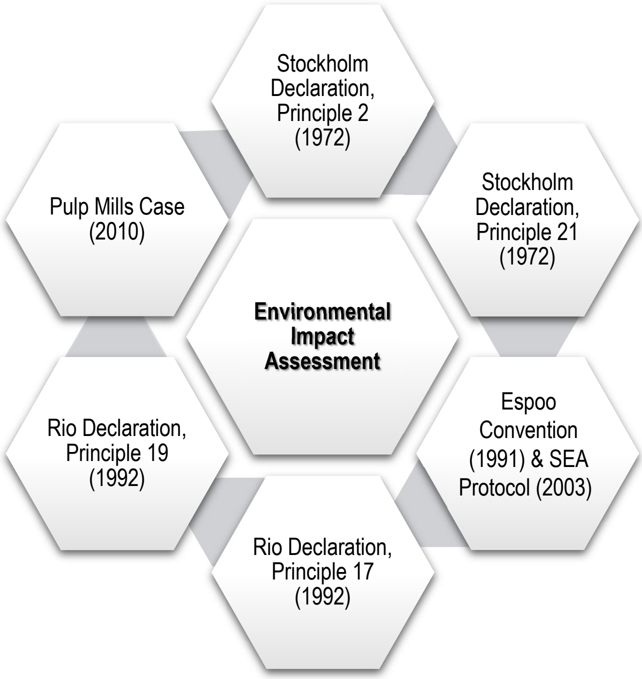

Figure 6. International foundations of transboundary environmental impact assessment obligation.

The roots of this doctrine can be traced back to the Stockholm Conference and its Declaration, which asserted in Principle 21 that while states have the "sovereign right to exploit their own resources pursuant to their own environmental policies", they 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."[97] It may not be immediately apparent that this Principle directly relates to environmental assessments. However, it should be read as the negotiators intended the language – the second clause limits the first: if states choose to exploit their resources, they must ensure that no (significant) transboundary damage occurs.[98] As explained in Principle 2, "The natural resources of the earth … must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate."[99] This presents an affirmative duty for governments to take action to effectuate environmental protection.

There is general agreement that three procedural duties stem from Principle 21: "Before undertaking an activity with a risk of (significant) transboundary harm, the state with jurisdiction over the activity should *assess* its potential transboundary effects, *notify* any potentially affected states, and *consult* with them over what to do."[100] Thus, the transboundary EIA imperative can trace its roots to the Stockholm Declaration.

97. Stockholm Declaration, *supra* note 29, Principle 21.

98. Knox, J.H. (2002), "The Myth and Reality of Transboundary Environmental Impact Assessment", *American Journal of International Law*, Vol. 96, No. 2, p. 293.

99. Stockholm Declaration, *supra* note 29, Principle 2.

100. Knox, J.H. (2002), *supra* note 98, p. 295 (emphasis in original).

What was read into Principle 21 was made explicit and unequivocal in Principle 17 of the Rio Declaration: "Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority."[101] This imperative was accepted as customary international law in the Pulp Mills case, in which the ICJ stated that:

> In this sense, the obligation to protect and preserve, under Article 41 (a) of the Statute, has to be interpreted in accordance with a practice, which in recent years has gained so much acceptance among States that it may now be considered a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context, in particular, on a shared resource. Moreover, due diligence, and the duty of vigilance and prevention which it implies, would not be considered to have been exercised, if a party planning works liable to affect the régime of the river or the quality of its waters did not undertake an environmental impact assessment on the potential effects of such works.[102]

Principle 19 of the Rio Declaration provided more details, requiring "prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith."[103] As will be explained further in this article, these principles found their way into the Espoo Convention, as well as the SEA Protocol.[104]

3. Public participation in nuclear decision making

The third emerging doctrine is that of public participation in decision making relating to nuclear activities that may have an impact on the environment. This involves participation by citizens, their representative bodies, international and non-governmental organisations and other interested third parties. The doctrine's status in customary international law is still unsettled (see *infra*), but where states assume public participation obligations, for example through treaties and conventions, these obligations may be characterised as "procedural", rather than substantive. As observed, however, by the ICJ in the Pulp Mills judgment, specific procedural obligations (in that case, intergovernmental information sharing and inter-state consultation on environmental impacts on a shared natural resource) may be important in facilitating the purposes of substantive state obligations to protect the environment.[105]

101. Rio Declaration, *supra* note 30, Principle 17.

102. Pulp Mills on the River Uruguay, *supra* note 13, p. 83 para. 204.

103. Rio Declaration, *supra* note 30, Principle 19.

104. As will be addressed in further detail *infra*, distinction should be made between the project-level environmental assessment obligations of the Espoo Convention and the plans and programmes-level environmental assessment obligations under the SEA Protocol.

105. Pulp Mills on the River Uruguay *supra* note 13, pp. 47-49, paras. 71-79 ("the two categories of obligations mentioned above complement one another perfectly, enabling the parties to achieve the object of the Statute", namely "the optimum and rational utilization of the River Uruguay", i.e. the use of the shared resource in accordance with international law). See also Sands, P. and J. Peel (2018), *supra* note 9, pp. 50-51; decision of the African Commission on Human and Peoples' Rights, Social and Economic Rights Action Center and the Center for Economic and Social Rights v. Nigeria, Comm. No. 155/96 (2001) (The Ogoniland Case).

The treatment of public participation in nuclear decision making is found in all three primary sources of law. Although there are numerous cases, treaties and conventions, and instruments that may be mentioned, six main sources are presented in Figure 7 and are addressed in the text below.

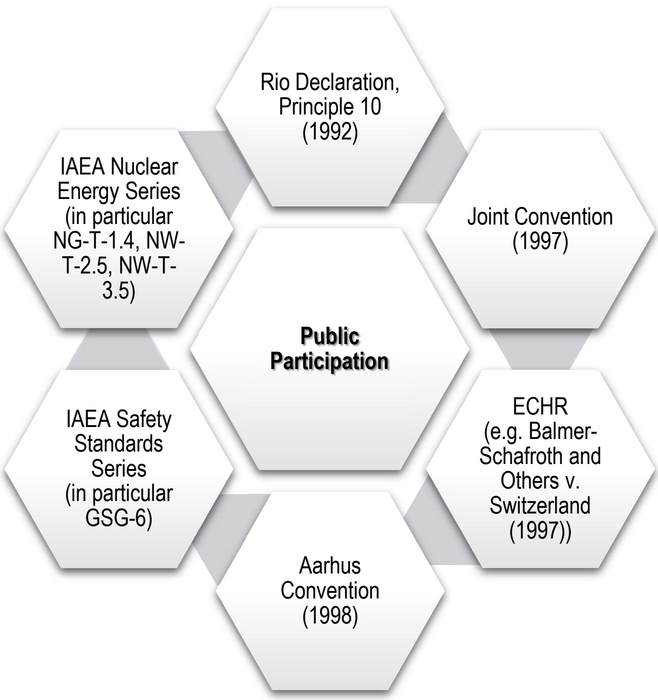

Figure 7. International foundations of public participation obligation.

The starting point for any discussion of public participation is Principle 10 of the Rio Declaration, which provides:

> Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.[106]

As Hey explains:

> The thinking behind Principle 10 might be captured as follows: individuals ultimately undergo the negative consequences of unsustainable activities and environmental degradation, therefore if individuals have access to these three procedural rights they will be able to voice their interests, and as a consequence uphold their substantive rights and the environment will be better protected.[107]

106. Rio Declaration, *supra* note 30, Principle 10.

107. Hey, E. (2016), *Advanced Introduction to International Environmental Law*, Edward Elgar Publishing Limited, Cheltenham, United Kingdom, p. 83.

Principle 10 was reconfirmed at the UN Conference on Sustainable Development (Rio+20) in 2012.[108]

The public participation obligations delineated in Principle 10, however, have not yet achieved the status of customary international law in the environmental sphere (i.e. as a Source 1 within Stream A), and, indeed, aspects of the ICJ's Pulp Mills judgment underscored this fact. While the Pulp Mills case is primarily cited for its conclusions regarding the prevention of transboundary harm and the requirement to undertake an EIA in certain circumstances, the case is notable also in its conclusion that neither the Espoo Convention, nor the 2001 ILC draft Articles on Prevention of Transboundary Harm from Hazardous Activities,[109] nor the 1987 UNEP "Goals and Principles of Environmental Impact Assessment",[110] provide a "legal obligation to consult [] affected populations".[111] This conclusion came despite both states parties agreeing that, in principle, the populations on both sides of the national borders likely to be affected by the proposed development should be consulted or invited to participate in the EIA process.[112]

The ICJ's approach to the legal basis for public participation in environmental matters should, however, be viewed within the wider international jurisprudence and case law, some of which relates specifically to nuclear activities. Over the past 70 years, the development of international environmental law has proceeded in parallel with that of the international law of human rights; the two, with increasing frequency, intersecting, informing and mutually supporting each other.[113] This intersection is specifically referenced in the first Preamble to the Stockholm Declaration, which states: "Both aspects of man's environment, the natural and the man-made, are essential to his well-being and to the *enjoyment of basic human rights* – even the right to life itself".[114]

108. See UNGA (2012), "The future we want", UN Doc. A/RES/66/288, adopted on 27 July 2012 (11 Sept.), paras C.42-53, which endorsed "The future we want", the outcome document of the United Nations Conference on Sustainable Development held in Rio de Janeiro from 20-22 June 2012. This conference followed the 11th Special Session of the United Nations Environment Programme (UNEP) Governing Council, Global Ministerial Environmental Forum in Bali in 2010 at which proposals for the international implementation of Principle 10 had been formulated. UNEP (2011), "Guidelines for the Development of National Legislation on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters", adopted by the Governing Council of the United Nations Environment Programme in decision SS.XI/5, part A of 26 Feb. 2010 ("Bali Guidelines"). In 2015, UNEP published an Implementation Guide on Principle 10. UNEP (2015), *Putting Rio Principle 10 into Action: An Implementation Guide for the UNEP Bali Guidelines for the Development of National Legislation on Access to Information, Public Participation and Access to Justice in Environmental Matters*, UNEP Publishing, Nairobi, Kenya.

109. 2001 Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, UN Doc. A/RES/56/82 (2001), 56 UN GAOR Supp. (No. 49) at 498, Supp. (No. 10) A/56/10 (V.E.1).

110. UNEP (1987), "Goals and Principles of Environmental Impact Assessment", Decision 14/25 of the Governing Council of UNEP, "Environmental impact assessment", of 17 June 1987.

111. Pulp Mills on the River Uruguay, *supra* note 13, p. 87 para. 216.

112. *Ibid.*, para. 215.

113. Boyle, A. (2008), "Relationship between International Environmental Law and other Branches of International Law", in Bodansky, D., J. Brunnée and E. Hey (eds.), *The Oxford Handbook of International Environmental Law*, Oxford University Press, pp. 125-146.

114. Stockholm Declaration, *supra* note 29 (emphasis added). Principle 1 of the Stockholm Declaration goes on to declare 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, and he bears a solemn responsibility to protect and improve the environment for present and future generations." *Ibid.*

Of the several major regional human rights treaties that have come into being since the Universal Declaration of Human Rights[115] was adopted by the UN General Assembly in 1948, the Additional Protocol to the American Convention on Human Rights, the African Charter of Human and People's Rights, and the Arab Charter on Human Rights expressly acknowledge what might be described as a human right to an "adequate", "satisfactory" or "healthy" environment".[116] Broader agreement, however, as to the scope or content of a specific "human right to the environment" has so far evaded the international community.[117] Nevertheless, the case law of the tribunals and other bodies that determine issues and claims under the regional human rights treaties referred to above shows how certain economic, social and cultural rights enshrined in those instruments, which are not explicitly "environmental" in character, have become vectors for the protection of the environment where the facts of the case connect the human rights under consideration with impacts on the environment.[118]

This case law-based development of environmental protection through the assertion of individual human rights has been most pronounced in the context of the ECHR and the judgments of the ECtHR. The ECtHR has variously found that: a local authority's inactivity in addressing community and health impacts from a waste-treatment facility, the closure of which was being sought, was a violation of ECHR, Article 8;[119] delays in providing environmental information that would have allowed people to assess the severity of risk of environmental harm by continuing to live in the vicinity of industrial and extractive sites were likewise violations of ECHR, Article 8;[120] but, on the other hand, the right to peaceful enjoyment of property (1952 ECHR Protocol,

115. UNGA (1948), "Universal Declaration of Human Rights", UN Doc. A/RES/217 (III) A.

116. See Sands, P. and J. Peel (2018), *supra* note 9, pp. 814 and 817, and generally pages 814-827. Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social and Cultural Rights (1988), entered into force on 16 Nov. 1999, Article 11, "Right to a Healthy Environment" ("1. Everyone shall have the right to live in a healthy environment and to have access to basic public services. 2. The States Parties shall promote the protection, preservation, and improvement of the environment"); African Charter of Human and People's Rights (1981), 21 ILM 59, entered into force 21 Oct. 1986 (Banjul Charter), Article 24 ("All peoples shall have the right to a general satisfactory environment favourable to their development"); Arab Charter on Human Rights (2004), 12 IHRR 893, entered into force 15 Mar. 2008 (2005), Article 38 ("Every person has the right to an adequate standard of living for himself and his family, which ensures their well-being and a decent life, including food, clothing, housing, services and the right to a healthy environment. The States parties shall take the necessary measures commensurate with their resources to guarantee these rights."). These treaties and international agreements are binding as between states and generally also provide for private individuals, groups and organisations the standing to make communications and to file complaints.

117. Hey, E. (2016), *supra* note 107, p. 125.

118. For example, in the 2001 Ogoniland case, the African Commission on Human and Peoples' Rights considered complaints brought on behalf of the Ogoni people relating to the operations of the state oil company, including evidence of serious adverse environmental and health impacts alleged to have arisen from those operators. The complaints were framed around Article 2 (non-discriminatory enjoyment of rights), Article 4 (right to life), Article 14 (right to property), Article 16 (right to health), Article 18 (family rights) and Article 21 (free disposal of wealth and natural resources) of the Banjul Charter, all in addition to Article 24 and the specific right to a "satisfactory environment". The Commission found that there had been violations of all these rights by the national government. The Social and Economic Rights Action Center and the Center for Economic and Social Rights v. Nigeria, African Commission on Human and Peoples' Rights, Comm. No. 155/96 (2001).

119. Article 8, "Right to respect for private and family life", para. 1, "Everyone has the right to respect for his private and family life, his home and his correspondence." López Ostra v. Spain, App. No. 16798/90, 303 Eur. Ct. H.R. 41 (ECtHR Judgment of 9 Dec. 1994).

120. Guerra and Others v. Italy, App. No. 116/1996/735/932 (ECtHR Grand Chamber Judgment of 19 Feb. 1998); Fadeyeva v Russia, App. No. 55723/00 (ECtHR First Section Judgment of 9 June 2005); Tătar v. Romania, App. No. 67021/01 (ECtHR Judgment of 27 Jan. 2009).

Article 1) would, on occasions, need to cede to public schemes for environmental protection and resource management.[121]

The ECHR has been specifically invoked, and its application considered by the ECtHR, in a number of cases relating to the carrying on of nuclear activities. In the case of Spire v. France, Articles 1 and 8 of the 1952 ECHR Protocol were raised in relation to a claim for compensation for loss of property value arising from the operations of a nuclear power station.[122] In addition, three cases concerning the licensing of two nuclear power plants (Mühleberg and Beznau) in Switzerland had their roots in ECHR, Articles 2 and 8, and Article 1 of the 1952 ECHR Protocol.[123] These arose from fears of serious off-site radiological impacts, but the complaints to the ECtHR were framed as violations by the Swiss Government (to which and through whose courts recourse and remedy had already been sought, unsuccessfully) of ECHR, Article 6(1). In each of the three cases, the ECtHR found Article 6(1) to be inapplicable on the basis that there had been a prior national process of adjudication, and in these circumstances, the Article 6 claims-base was too remote from the underlying substantive grievances of health and environment, which the national courts had already determined.

Despite their outcomes, these human rights cases all point to the relevance and potential importance of key provisions of the ECHR (and the corresponding provisions of the other regional human rights treaties) to the way in which governments and private sector companies undertake nuclear activities, showing how human rights arguments are capable of being deployed in challenging the perceived environmental impacts of such activities.[124] In general, recourse to international human rights tribunals such as the ECtHR must follow the exhaustion of national law processes and procedures. In practice therefore, and except where there has been egregious misdirection by a domestic tribunal on a substantive question of human rights (such as the rights to life, bodily integrity or peaceful enjoyment of property), challenges to the environmental risks and impacts of nuclear activities are most likely to be based on "procedural" human rights, and particularly those agreed by, and between, states in relation to participation in the decisions that may affect the environment and, through that, individual lives. This was clearly appreciated by the applicants in the ECtHR claims against Switzerland outlined above, hence particular reliance on "procedural" rights in the ECHR.

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121. 1952 Protocol to the Convention for the Protection of Human Rights and Fundamental Freedoms, Article 1, "Protection of property", "Every natural or legal person is entitled to the peaceful enjoyment of his possessions. No one shall be deprived of his possessions except in the public interest and subject to the conditions provided for by law and by the general principles of international law. The preceding provisions shall not, however, in any way impair the right of a State to enforce such laws as it deems necessary to control the use of property in accordance with the general interest or to secure the payment of taxes or other contributions or penalties." See Fredin v. Sweden, App. No. 12033/86 (ECtHR Judgment of 18 Feb. 1991).

122. Spire v. France, App. No. 13728/88 (Commission Decision of 17 May 1990), reprinted in 3 *Revue Universelle des Droits de l'Homme* 236 (1991) (regarding ECHR, Article 8: right to respect and home and family life autonomy infringed by nuclear power plant operations).

123. Balmer-Schafroth and Others v. Switzerland, App. No. 22110/93, *supra* note 22 (regarding ECHR, Article 6: right to fair public hearing in relation to the extension of the operating for the Mühleberg nuclear power plant); Athanassoglou and Others v. Switzerland, App. No. 27644/95 (ECtHR Grand Chamber Judgment of 6 Apr. 2000) (regarding ECHR, Article 6: right to fair public hearing in relation to the extension of the operating for the Beznau II nuclear power plant); Balmer-Schafroth and Others v. Switzerland, App. No. 50495/99 (ECtHR Second Section decision as to admissibility of 13 Sept. 2001).

124. See Tromans, S. (2010), *Nuclear Law: The Law Applying to Nuclear Installations and Radioactive Substances in its Historic Context*, 2nd Edition, Hart Publishing, UK, pp. 140-145.

The immediate discussion of public participation in decision making affecting the environment has focused on sources of international case law within Streams A and C and international instruments within Stream A. But, the reach of public participation as a "doctrine" across the international legal framework of environmental protection for nuclear activities is wider and deeper than this. By 1997, the doctrine had gained a place in the mainstream of nuclear law (Stream B) through the Joint Convention, adopted in that year. Preambular paragraph xv of the Joint Convention referenced the Rio Declaration and obliged contracting parties to "take the appropriate steps to ensure that procedures are established and implemented for a proposed [spent fuel management facility and radioactive waste management facility] … to make information on the safety of such a facility available to members of the public" (Articles 6(1)(iii) and 13(1)(iii)). This was a new and significant acknowledgement within the central corpus of nuclear law that public participation (even of a minimal sort) had become both an international norm and a legal obligation that states with nuclear energy programmes were to meet.

There was also more, and more detailed, work then being done within the IAEA on the development of public participation in decision making for a range of nuclear activities. This work led to the production of a number of relevant international instruments (within Stream B) under the Agency's auspices. In the IAEA Safety Standards Series, these instruments include *Communication and Consultation with Interested Parties by the Regulatory Body*,[125] a Guide that builds on Principle 2 of the IAEA *Fundamental Safety Principles* and specifically quotes from it in paragraph 1.3 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.

The document contained detailed practical guidance to regulators on recommended methodologies for engaging and collaborating with the public to achieve these objectives, including through legal changes that might be required to national regulatory frameworks. This Safety Standards Series guidance is mirrored in the Nuclear Energy Series, specifically in three technical reports: *Stakeholder Involvement Throughout the Life Cycle of Nuclear Facilities* (2011);[126] *An Overview of Stakeholder Involvement in Decommissioning* (2009);[127] and *Communication and Stakeholder Involvement in Environmental Remediation Projects* (2014).[128]

These IAEA documents effectively represent current international practice and standards on the implementation of Principle 10 of the Rio Declaration in key segments of the nuclear energy sector. Although not "hard law", they sit high in the hierarchy of authoritative international instruments relating to environmental protection and its relationship with public participation in the nuclear field.

125. IAEA (2017), *Communication and Consultation with Interested Parties by the Regulatory Body*, IAEA Safety Standards Series, No. GSG-6, IAEA, Vienna.

126. IAEA (2011), *Stakeholder Involvement Throughout the Life Cycle of Nuclear Facilities*, IAEA Nuclear Energy Series, No. NG-T-1.4, IAEA, Vienna.

127. IAEA (2009), *An Overview of Stakeholder Involvement in Decommissioning*, IAEA Nuclear Energy Series, No. NW-T-2.5, IAEA, Vienna.

128. IAEA (2014), *Communication and Stakeholder Involvement in Environmental Remediation Projects*, IAEA Nuclear Energy Series, No. NW-T-3.5, IAEA, Vienna.

There is, however, so-called "hard law" of critical importance in this subject area. Although there are public participation obligations in the Espoo Convention and SEA Protocol, unquestionably at the top of the hierarchy, another international convention, while not universal in nature, is still widely adopted: the Aarhus Convention. The Aarhus Convention seeks, through the obligations it imposes on its contracting parties, to do exactly what its long title indicates. It is about the participation of the public in decisions that have potential impacts on the environment. The Aarhus Convention and its two UNECE companion conventions, are part of the Stream C treaties and conventions, "convergent instruments" expressly covering both broad environmental and nuclear-specific situations.

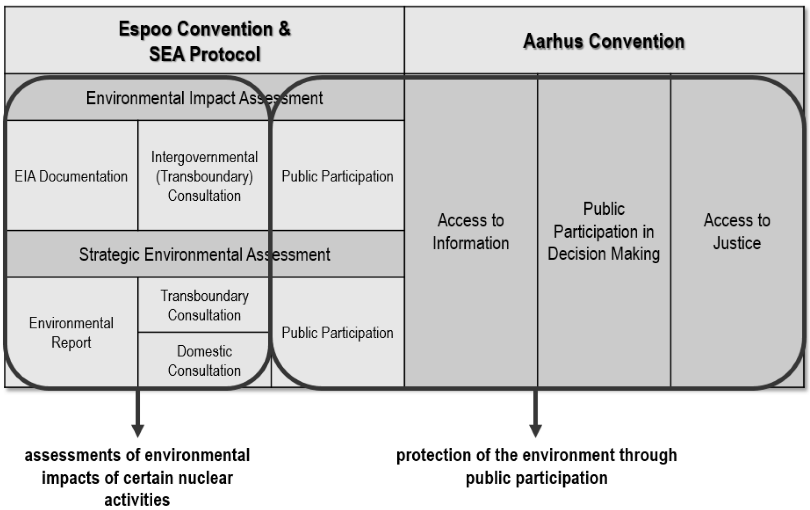

Figure 8. Overlap of public participation elements in the three UNECE conventions.

Their scope, detailed content and implementation are explained in Part 2.C. *infra*.

C. Conclusion

The three "doctrines" that have been discussed above are practical out-workings in the nuclear field of some of the key principles of international law identified in Figure 3 (*supra*). They emerge in almost all of the sources of law, and across each of the three streams of law set out in the international framework illustrated in Figure 2 (*supra*). Most importantly, perhaps, they are also the main compass bearings in charting the direction of travel of the law of environmental protection in the field of nuclear activities.

Part 2. Development of environmental protection for nuclear activities

A. The early focus on radiological environmental impacts and marine pollution

At the outset, environmental protection laws related to nuclear activities concentrated mainly on protection against radiation releases and specifically these related to the protection of the marine environment. Nuclear activities have been explicitly included in measures to protect the seas and waters since 1958 with the UN Convention on the High Seas, which provides that "Every State shall take measures to prevent pollution of the seas from the dumping of radio-active waste".[129] The follow-up IAEA Safety Series document clarified that the prohibition should apply

129. Convention on the High Seas (1958), 450 UNTS 11, entered into force 30 Sept. 1962, Article 25.

only to high-level waste, with low- and intermediate-level waste being able to be "safely disposed of into the sea under controlled and specified conditions."[130] This was enshrined in the 1972 London Dumping Convention, which obliges contracting parties to prohibit the dumping of "radioactive wastes or other radioactive matter".[131] High-level radioactive waste was categorised in the Annex I "black list", whereas low- and intermediate-level waste was categorised in the Annex II "grey list", which, while not banned, requires special care.[132] A Protocol to the London Dumping Convention was adopted in 1996 that takes "a more restrictive approach … by generally prohibiting all forms of dumping, except for some listed substances".[133] Even for those substances that may be considered for dumping, special mention is made that "radioactivity greater than *de minimis* (exempt) concentrations as defined by the IAEA and adopted by Contracting Parties, shall not be considered eligible for dumping".[134] Although the 1982 UN Convention on the Law of the Sea does not specifically mention radioactivity or radioactive waste, it does require the "adopt[ion of] appropriate rules, regulations and procedures for *inter alia*: the prevention, reduction and control of pollution and other hazards to the marine environment …".[135]

Between 1992 and 1995, four European regional maritime conventions were opened for signature, each of which addressed marine pollution and specifically related to radioactive waste management. Three of them, the OSPAR Convention, the Helsinki Convention[136] and the Barcelona Convention[137] similarly list radioactivity as one criterion to be considered and that particular attention should be paid to "radioactive substances, including wastes".[138] The OSPAR Convention, however, goes a step farther, stating in Annex II that "The dumping of low and intermediate level radioactive substances, including wastes, is prohibited."[139] The Bucharest

130. IAEA (1961), *Radioactive Waste Disposal into the Sea*, IAEA Safety Series, No. 5, IAEA, Vienna, p. 75.

131. London Dumping Convention, *supra* note 40, Article IV(1)(a) and Annex I(6). "[T]he protection of the marine environment against pollution caused by … radioactive materials" was provided for a few months later with the adoption of the regional 1972 Oslo Convention. Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft (1972), 932 UNTS 3, entered into force 7 Apr. 1974 (Oslo Convention). See Sands, P. and J. Peel (2018), *supra* note 9, pp. 28, 461.

132. Sjoblom, K.-L. and G. Linsley (1994), "Sea disposal of radioactive wastes: The London Convention 1972", *IAEA Bulletin*, 2/1994, IAEA, Vienna, p. 12.

133. Sands, P. and J. Peel (2018), *supra* note 9, p. 482.

134. London Protocol, *supra* note 41, Annex I(3).

135. UNCLOS, *supra* note 43, Article 145(a). But, in its rules related to innocent passage of ships, "nuclear-powered ships and ships carrying nuclear or other inherently dangerous or noxious substances or materials" are addressed. *Ibid.*, Article 22-23. In addition, UNCLOS, Article 207, "Pollution from land-based sources", "was a cause of action for Ireland's claim against the United Kingdom in respect of the MOX plant." Sands, P. and J. Peel (2018), *supra* note 9, p. 477. ("States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from land-based sources, including rivers, estuaries, pipelines and outfall structures.")

136. Convention on the Protection of the Marine Environment of the Baltic Sea Area (1992), entered into force 17 Jan. 2000 (Helsinki Convention).

137. Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (1995), entered into force 9 July 2004 (Barcelona Convention).

138. OSPAR Convention, *supra* note 42, Appendix 2, "Criteria Mentioned in Paragraph 2 of Article 1 of Annex I and in Paragraph 2 of Article 2 of Annex III", paras. 1(d) and 3(g); Helsinki Convention, *supra* note 136, Article 5, "Harmful Substances" and Annex I, "Harmful substances", paras. 1.1 and 1.2.

139. OSPAR Convention, *supra* note 42, Annex II, Article 3(3)(a). Radioactive waste is not included in the Helsinki Convention's list of banned substances, but the disposal of "Radioactive substances, including their wastes, if their discharges do not comply with the principles of radiation protection as defined by the competent international organizations, taking into account the protection of the marine environment" is prohibited by a Protocol to the Barcelona Convention. Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil (1994), entered into force 24 Mar. 2011, Annex I, A(9).

Convention addresses the topic slightly differently, where contracting parties "shall prevent pollution of the marine environment of the Black Sea from any [listed] source", which includes "Radioactive substances and wastes, including used radioactive fuel".[140] In addition, a protocol to the Bucharest Convention addresses land-based sources of marine pollution and calls upon contracting parties to "take into consideration" that "[t]he discharge of cooling water from nuclear power plants or other industrial enterprises using large amounts of water should be made in such a way as to prevent pollution of the marine environment of the Black Sea."[141]

In addition to the Conventions and Protocols discussed above, the 1992 Rio Conference addressed pollution too. Specifically, its Agenda 21 aims to "ensure that radioactive wastes are safely managed, transported, stored and disposed of, with a view to protecting human health and the environment, within a wider framework of an interactive and integrated approach to radioactive waste management and safety."[142]

B. Radiological environmental impacts under nuclear law

Protection of the environment is built into the foundations of the international nuclear safety conventions in addition to the panoply of soft law measures that not only form the fabric of those conventions but also enhance and supplement the obligations contained therein. The vast majority of the obligations and guidance associated with those instruments, however, relate largely to the protection of the environment from radiological, rather than non-radiological, environmental effects. Most of these instruments are adopted under IAEA auspices, and a review of the IAEA Statute reveals no mandate for the Agency to work towards the protection of the environment against non-radiological risks. Article III(A)(6) of the IAEA Statute authorises the Agency "To establish or adopt … standards of safety for protection of health and minimization of danger to life and property". This is reflected in the IAEA's 1960 *Health and Safety Measures*, which defined "safety standards" as "norms, regulations or recommendations established to protect health and minimize danger to life and property."[143]

The IAEA's programme on nuclear safety and environmental protection began to expand in the 1970s, and in 1976 a revision to *Health and Safety Measures* was published – *Safety Standards and Measures* – that broadened the definition of safety standards to include radiation-related environmental risks: "standards, regulations, rules or codes of practice established to protect man and the environment against ionizing radiation and to minimize danger to life and property".[144] As

140. Convention on the Protection of the Black Sea Against Pollution (1992), 32 ILM 1101, entered into force 15 Jan. 1994 (Bucharest Convention), Article VI and Annex I.

141. Protocol on Protection of the Black Sea Marine Environment against Pollution from Land Based Sources (1992), 32 ILM 1101, entered into force 15 Jan. 1994, Article 6(c).

142. Agenda 21, in Report of the United Nations Conference on Environment and Development, UN Doc. A/CONF.151/26/Rev.1 (Vol. I), 12 Aug. 1992, Annex II, Chapter 22 "Safe and Environmentally Sound Management of Radioactive Waste", p. 370 para. 22.3. But see also, *ibid*., pp. 371-372 para. 22.5(c), "States, in cooperation with relevant international organizations, where appropriate, should: … Not promote or allow the storage or disposal of high-level, intermediate-level and low-level radioactive wastes near the marine environment unless … such storage or disposal poses no unacceptable risk to people and the marine environment … making, in the process of consideration, appropriate use of the concept of the precautionary approach." See also Sands, P. (1996), "Observations on International Nuclear Law Ten Years after Chernobyl", *Review of European, Comparative & International Environmental Law* (RECIEL), Vol. 5, Issue 3, p. 201.

143. IAEA (1960), *The Agency's Health and Safety Measures* (approved by the Board of Governors on 31 Mar. 1960), IAEA Doc. INFCIRC/18, p. 3.

144. IAEA (1976), *The Agency's Safety Standards and Measures*, IAEA Doc. INFCIRC/18/Rev.1, p. 5. This definition still applies today and is the basis upon which the safety standards series is issued.

explained by Rainer and Szasz, this expansion in the programme and definition is due in large part to the aftermath of the Stockholm Conference.[145] To this day, the Agency's work is still principally directed according to this definition of safety standards[146] and therefore what followed was an emphasis not on general protection of the environment but rather a focus on the protection of the environment from radiation risks and/or hazards.

This focus is evident following the 1986 Chernobyl accident in the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, which in Article 1(1), "General Provisions", proclaims that "The States Parties shall cooperate between themselves and with the International Atomic Energy Agency … to facilitate prompt assistance in the event of a nuclear accident or radiological emergency to minimize its consequences and to protect life, property and the environment from the effects of radioactive releases."[147] Additionally, the International Nuclear Safety Advisory Group (INSAG) released the *Basic Safety Principles for Nuclear Power Plants* in 1988, which were developed due to the need for "commonly shared principles for ensuring a very high level of safety" especially following the Chernobyl accident.[148] Three safety objectives were defined, with the general nuclear safety objective being "To protect individuals, society and the environment by establishing and maintaining in nuclear power plants an effective defence against radiological hazard."[149] The focus is clearly on radiological effects and is emphasised by INSAG where it:

> recognize[s] that although the interests of society require protection against the harmful effects of radiation, they are not solely concerned with the radiological safety of people and the avoidance of contamination of the environment. The protection of the resources invested in the plant is of high societal importance and demands attention to all the safely issues with which this report is concerned. However, the main focus of this document is the safety of people. What follows is therefore expressed in these terms solely, but this is not to imply that INSAG has no regard for other factors.[150]

In 1993, the IAEA published its original Safety Fundamentals document in the IAEA Safety Series, which states that the "General Nuclear Safety Objective" is: "To protect individuals, society and the environment from harm by establishing and maintaining in nuclear installations effective defences against radiological hazards".[151] This dichotomy between radiological environmental impacts and non-radiological environmental impacts was carried forward into the negotiations on the Convention on Nuclear Safety, where one of the instrument's objectives is "to

145. Rainer, R.H. and P.C. Szasz (1993), *The Law and Practices of the International Atomic Energy Agency 1970-1980: Supplement 1 to the 1970 edition of Legal Series No. 7*, IAEA Legal Series, No. 7-S1, IAEA, Vienna, pp. 411, 426.

146. The current definition is only modified slightly: "Requirements, regulations, standards, rules, codes of practice or recommendations established to protect people and the environment against ionizing radiation and to minimize danger to life and property." IAEA (2019), *IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection*, 2018 Edition, IAEA, Vienna, p. 210.

147. Assistance Convention, *supra* note 39.

148. IAEA (1988), *Basic Safety Principles for Nuclear Power Plants: A Report by the International Nuclear Safety Advisory Group*, IAEA Safety Series No. 75-INSAG-3, IAEA, Vienna, p. 1. A revision, IAEA Doc. 75-INSAG-3 Rev. 1 (INSAG 12), was issued in 1999.

149. *Ibid.*, p. 6.

150. *Ibid.*, pp. 6-7.

151. IAEA (1993), *The Safety of Nuclear Installations*, IAEA Safety Series, No. 110, IAEA, Vienna (superseded), p. 2.

establish and maintain effective defences in nuclear installations against potential radiological hazards in order to protect individuals, society and the environment from harmful effects of ionizing radiation from such installations".[152] Also, any mention of impact evaluation and provision of information is focused on the "safety impact of a proposed nuclear installation on individuals, society and the environment".[153] In the same article "safety impact" is also used as a qualifier in the discussion on the provision of information to the public.[154]

Aligning the CNS objectives with the then nuclear safety objective, it is clear that the "safety impact" of the proposed nuclear installation was referring to radiological environmental risks rather than non-radiological environmental risks. Thus, while the Preamble, at the very outset, states that the contracting parties are "Aware of the importance to the international community of ensuring that the use of nuclear energy is safe, well regulated and environmentally sound" and even acknowledges that "accidents at nuclear installations have the potential for transboundary impacts", the CNS is focused specifically on radiological environmental protection.

The word "environment" is mentioned far more often in the later-in-time Joint Convention, but it is largely bounded in the same manner as the CNS. For example, while the second objective of the Joint Convention echoes Principle 3 of the Rio Declaration with talk of protecting "individuals, society and the environment" "now and in the future, in such a way that the needs and aspirations of the present generation are met without compromising the ability of future generations to meet their needs and aspirations", this is focused solely on the "harmful effects of ionizing radiation".[155] Similarly, the environmental protection measures in Articles 4 and 11 ("General Safety Requirements") are focused on adequate protection "against radiological hazards", while the environmental measures in Articles 7 and 14 ("Design and Construction") address "limit[ing] possible radiological impacts". And the siting requirements in Articles 6 and 13 use the same "safety impact" language as found in the CNS: "to evaluate the likely safety impact of such a facility on individuals, society and the environment".

Articles 8 and 15 (both entitled "Assessment of Safety of Facilities") of the Joint Convention are not as clear on their face. These articles require "a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility".[156] But, this does not mean an EIA. Instead, as explained in the "Guidelines regarding the Form and Structure of National Reports", both articles really address "the steps taken to protect individuals, society and the environment against radiological hazards".[157]

Two distinctions, however, can be made to the focus on radiological hazards. The first can be found in the Joint Convention's Preamble, which recalls Chapter 22 of Agenda 21 of the 1992 Rio Conference "which reaffirms the paramount importance of the safe and environmentally sound management of radioactive waste".[158] The second distinction can be found in the two articles on "Siting of Proposed Facilities", which contain explicit requirements for transboundary

152. CNS, *supra* note 37, Article 1(ii).

153. *Ibid.*, Article 17(ii).

154. *Ibid.*, Article 17(iv).

155. Joint Convention, *supra* note 38, Article 1(ii).

156. *Ibid.*, Articles 8 and 15.

157. IAEA (2014), *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management: Guidelines regarding the Form and Structure of National Reports*, IAEA Doc. INFCIRC/604/Rev.3, p. 5.

158. Joint Convention, *supra* note 38, Preambular para. xv.

consultations and the provision of safety-related information upon request.[159] Although this differs from the Aarhus Convention's requirement to provide "environmental information", the requirement is "in line with Agenda 21".[160] As explained by Tonhauser and Jankowitsch-Prevor, "the Joint Convention covers a much broader range of subjects and therefore has the potential to attract the attention of different national authorities and groups in society, notably those concerned with the environment."[161]

Thus, while there may be high-level statements about the importance of protecting the environment, such as when the IAEA states that "Safety measures and security measures have in common the aim of protecting human life and health and the environment",[162] any convention-related obligation or soft law requirement under IAEA auspices is only related to radiation risks and hazards. As enunciated in the IAEA's *Fundamental Safety Principles*, "The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation."[163] According to the IAEA, safety is synonymous with protection of the environment: "'safety' means the protection of people and the environment against radiation risks, and the safety of facilities and activities that give rise to radiation risks."[164] And while one can see the ideas of Stockholm and Rio in aspects of the *Fundamental Safety Principles*, such as Principle 7, "Protection of present and future generations", the breadth is limited by specifying "People and the environment, present and future, must be protected against radiation risks."[165] The IAEA acknowledges that "Radiological impacts in a particular environment constitute only one type of impact and, in most cases, may not be the dominant impacts of a particular facility or activity".[166] This is made clear in its Specific Safety Requirements on *Site Evaluation for Nuclear Installations*: while "there are other important factors in site evaluation, such as technology, economics, non-radiological environmental impacts and socioeconomic impacts, as well as the opinion of interested parties, including the public[, s]uch aspects of site evaluation are not covered in this publication."[167]

The conclusion of this section, however, is not that the nuclear safety instruments are not actually protective of the environment. Instead, it should be understood that the nuclear safety instruments actually do offer necessary protection against harmful or hazardous substances or activities, which is one of the two categories of international environmental laws. Further, because environmental protection is not within the mandate of all national nuclear safety organisations, it could be difficult to place such a responsibility there. To say that the nuclear safety conventions and soft law requirements do not go farther is not a criticism, but an acknowledgement of national roles and responsibilities, with the other piece of the equation provided elsewhere.

159. *Ibid.*, Articles 6(iv) and 13(iv).

160. Tonhauser, W. and O. Jankowitsch-Prevor (2006), "The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management", in *International Nuclear Law in the Post-Chernobyl Period*, OECD Publishing, Paris, p. 212.

161. *Ibid.*, p. 211.

162. IAEA (2006), No. SF-1, *supra* note 72, p. 4 para. 1.10.

163. *Ibid.*, p. 4.

164. *Ibid.*, p. 5.

165. *Ibid.*, p. 12. This flows down into the General Safety Requirements: "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: (1) The safety principles for protecting people — individually and collectively — society and the environment from radiation risks, both at present and in the future". IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 1 (Rev. 1), IAEA, Vienna, p. 5 para. 2.5(1).

166. IAEA (2014), No. GSR Part 3, *supra* note 26, p. 13.

167. IAEA (2019), *Site Evaluation for Nuclear Installations*, IAEA Safety Standards Series, Specific Safety Requirements, No. SSR-1, IAEA, Vienna, p. 4.

C. *Protection for and beyond radiological environmental impacts: The United Nations Economic Commission for Europe regime*

As environmental protection from non-radiological impacts is not covered by the nuclear safety conventions and soft law instruments, one must look to the regime provided by the UNECE. The UNECE was established in 1947 under Article 68 of the UN Charter as one of the many post-World War II institutions set up to aid in the European economic recovery. The UNECE is one of five Regional Economic Commissions that are subsidiary bodies to the UN Economic and Social Council and it has 56 member states throughout Europe, North America and Central and Western Asia.[168] There are 16 international legally binding instruments related to the environment (5 conventions and 11 protocols) adopted under UNECE auspices,[169] 3 of which expressly cover nuclear activities: the Convention on Environmental Impact Assessment in a Transboundary Context; the Protocol on Strategic Environmental Assessment to the Espoo Convention; and the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. Each of these will be addressed in turn.

1. Convention on Environmental Impact Assessment in a Transboundary Context

a. Introduction

The Espoo Convention is an outgrowth of the 1972 Stockholm Conference and in particular Principle 21 of the Declaration, as mentioned earlier. Following along from this was the 1975 Final Act of the Helsinki Conference on Security and Co-Operation in Europe (the predecessor to today's Organization for Security and Co-operation in Europe), which stated that the parties aimed to co-operate in the "Legal and administrative measures for the protection of the environment including procedures for establishing environmental impact assessments." This topic was referred to the UNECE for follow-up and after a series of meetings in the 1980s, the Espoo Convention was adopted in 1991 and entered into force in 1997.[170]

There are today 45 parties to the Espoo Convention, including the EU. The Convention is primarily a European convention, with the addition of Canada and certain Western and Central Asian countries. The United States and Russia, among other UNECE member countries, are signatories, but not parties. An amendment to the Convention was adopted in 2001 to allow all UN member states – not just UNECE member states – to accede to the Convention upon approval by the Meeting of the Parties (MOP) to the Convention.[171] Although technically in force since 2014, the First Amendment is not yet operational.[172]

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168. UNECE (n.d.), "Geographical scope", https://unece.org/geographical-scope (accessed 6 June 2021).

169, UNECE (2020), "Environment", https://unece.org/environment-4 (accessed 6 June 2021).

170. UNECE (n.d.), "History of the Convention and its Protocol), https://unece.org/history-convention-and-its-protocol (accessed 25 May 2021).

171. UNECE (2001), "Report of the Second Meeting", Doc. ECE/MP.EIA/4, Annex XIV, "Decision II/14: Amendment to the Espoo Convention", Sofia, Bulgaria, 26-27 Feb. 2001.

172. According to Article 14 of the Espoo Convention, amendments enter into force for parties having ratified, approved or accepted them on the 90th day after the receipt by the Depositary of notification of their ratification, approval or acceptance by at least three-quarters of the parties. But, the First Amendment will not enter into force until all the states and organisations that were parties to the Convention at the time the amendment was adopted on 27 February 2001, i.e. 31 parties, have ratified, approved or accepted the Amendment. As of 25 May 2021, five ratifications are needed to complete this process: Armenia, Belgium, North Macedonia, Ukraine and the United Kingdom.

b. Purpose and procedure

The Espoo Convention is a highly proceduralised instrument with two main components. The first is the obligation to give consideration to environmental factors of certain activities at an early stage in the project planning process (before a final decision is made to undertake the activity in question) by undertaking an environmental impact assessment. The second is the requirement for notification and consultation of states likely to be affected by significant adverse transboundary environmental impacts of the proposed project, as well as participation by members of the public.

The obligation to undertake an EIA falls on the "Party of Origin" (meaning the contracting party or parties where the proposed activity is planned to take place) (Article 1(ii)). In order to determine whether the Convention applies to a certain proposed activity, and thus whether an EIA is necessary, a first step "screening" must take place. States parties must automatically apply the provisions of the Convention when two requirements are met:

- the proposed activity is listed in the Convention (Appendix I); and
- the proposed activity is likely to cause a significant adverse transboundary impact (Article 2(2)).

Two nuclear energy-related activities are specifically listed in Appendix I: "nuclear power stations and other nuclear reactors"[173] and "[i]nstallations solely designed for the production or enrichment of nuclear fuels, for the reprocessing of irradiated nuclear fuels or for the storage, disposal and processing of radioactive waste".[174] An amendment to the Convention adopted in 2004 and that entered into force in 2017 widened the scope of the listed activities, but only for those member states that have ratified, approved or accepted this Amendment.[175] Under the Amendment, the scope expanded to also include the dismantling or decommissioning of nuclear power stations or reactors, as well as installations designed for the storage and/or final disposal of irradiated nuclear fuel.[176]

It is important to note that the Convention not only applies to the activities listed, but also to any major changes to these activities that may have a significant adverse impact across borders (Article 1(v)). If an activity is not specifically listed in Appendix I, but the parties agree that it is or is likely to cause a significant transboundary impact,[177] then the activity will be so treated and the provisions of the Convention will apply. The phrase "significant adverse transboundary impact" is critical, being mentioned 16 times in the Convention, and each component of the phrase must be defined and understood to grasp its full scope.

173. The Espoo Convention, however, explicitly excludes "research installations for the production and conversion of fissionable and fertile materials, whose maximum power does not exceed 1 kilowatt continuous thermal load". Espoo Convention, *supra* note 35, Appendix I(2).

174. *Ibid.*, Appendix I(3).

175. UNECE (2004), "Report of the Third Meeting", ECE/MP.EIA/6, Annex VII, "Decision III/7: Second Amendment to the Espoo Convention", Cavtat, Croatia, 1-4 June 2004. There are still nine ratifications outstanding as of 25 May 2021: Armenia, Belarus, Bosnia and Herzegovina, Ireland, Kazakhstan, Kyrgyzstan, North Macedonia, Ukraine and the United Kingdom.

176. *Ibid.*, Annex VII, Appendix "List of Activities".

177. Appendix III to the Espoo Convention, *supra* note 35, contains "General Criteria to Assist in the Determination of the Environmental Significance of Activities Not Listed in Appendix I".

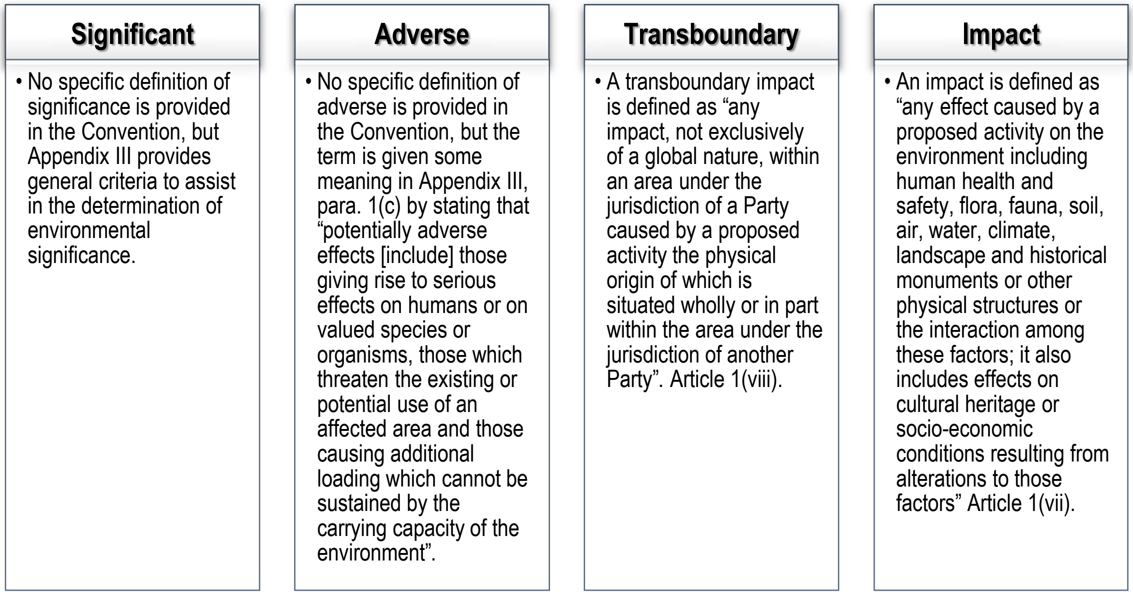

Figure 9. Definition of significant adverse transboundary impact under the Espoo Convention.

In determining whether this second requirement is met, the following considerations should be evaluated:

- What are the possible "adverse impacts" of the activity in question?
- Is the activity "likely" to cause adverse environmental impacts?
- Are the likely adverse environmental impacts "significant"?
- Are the likely significant environmental impacts "transboundary" and which parties would be effected?[178]

Another key word here is "likely", which is especially important in the nuclear context where there is the possibility, though very low likelihood, of high consequence events. Thus, questions arise as to whether the assessment should be made considering the likelihood "of transboundary radiological impact arising from normal operation, incidents and design-bas[is] accidents, but not less probable events, or whether it should include severe accidents beyond the design bas[is]."[179] Appendix III does not address the issue of accident risk, but in contrast, the EU EIA Directive does.[180] Espoo Convention guidance states that it "may be advisable" to include consideration of low likelihood impacts,[181] but in practice, parties are of mixed minds on the issue, with some

178. This list is adapted from that provided in UNECE (2020), "Guidance on the applicability of the Convention to the lifetime extension of nuclear power plants", ECE/MP.EIA/2020/9, p. 9 para. 54, as endorsed by the MOP in "Report of the Meeting of the Parties to the Convention on its eighth session and of the Meeting of the Parties to the Convention serving as the Meeting of the Parties to the Protocol on its fourth session", ECE/MP.EIA/30/Add.2−ECE/MP.EIA/SEA/13/Add.2, Addendum, "Decisions by the Meetings of the Parties to the Convention", "Decision VIII/6: Applicability of the Convention to the lifetime extension of nuclear power plants", Vilnius, Lithuania, 8-11 Dec. 2020).

179. UNECE (2011), "Background note on the application of the Convention to nuclear energy-related activities", ECE/MP.EIA/2011/5, Geneva, 20-23 June 2011, p. 5 para. 12.

180. *Ibid.*, p. 5 para. 13.

181. Ministry of the Environment, Finland; Ministry of the Environment, Sweden and Ministry of Housing, Spatial Planning and the Environment, the Netherlands (2003), *Guidance on the Practical Application of the Espoo Convention*, Finnish Environment Institute (SYKE), Finland, p. 15.

parties only analysing the normal operation of a nuclear installation, others analysing normal operation and design basis accidents, and still others looking at beyond design basis accidents.[182] In a case before the Espoo Implementation Committee related to the proposed Hinkley Point C nuclear power plant in the United Kingdom, the Committee stated that it favoured an inclusive approach, "however uncertain", whereby even worst-case scenarios would be considered.[183] In an earlier decision, the Committee found that "notification is necessary unless a significant adverse transboundary impact can be excluded".[184]

Once it is determined that an EIA is necessary, there are multiple mandatory steps to the EIA procedure. The first step is notification, which is the formal start of the procedure. All "affected parties" that have been identified as being potentially affected by the transboundary impact of the proposed activity should receive a notification (Article 3(1)). The affected party must then timely respond to the notification, acknowledging receipt of the notification and indicating whether it intends to participate in the EIA procedure (Article 3(3)). If a potentially affected party decides not to participate and indicates this in its reply to the notification, the application procedure ends (Article 3(4)). On the other hand, if the affected party wants either to be informed or to participate, the application procedure continues with further exchange of information on the proposed activity and its possible significant adverse transboundary impact (Article 3(5)).

The EIA documentation must include all relevant items mentioned in Appendix II of the Convention. According to Appendix II, an EIA contains descriptions of, *inter alia*, the proposed activity and its purpose; reasonable alternatives, as well as the no-action alternative; the environment likely to be significantly affected and its alternatives; the potential environmental impact of the proposed activity and its alternatives, and an estimation of its significance; and mitigation measures to keep adverse environmental impact to a minimum.[185] "The concerned Parties shall then arrange for distribution of the documentation to the authorities and the public of the affected Party in the areas likely to be affected and for the submission of comments to the competent authority of the Party of origin" (Article 4(2)).

Throughout these steps, "the Convention requires that the public of the affected Party is given the opportunity to participate in the environmental impact assessment process. Participation is specified in the Convention as a right to be informed and a right to express views."[186] This opportunity to participate must be "equivalent to that provided to the public of the Party of origin" (Article 2(6)). Apart from the broad public and the officially designated individuals in the country of origin and affected country, bodies worth consulting include different national, regional and local authorities, specialists, and NGOs on all sides of the border.[187] Then, all of the gathered

182. UNECE (2017), *Good Practice Recommendations on the Application of the Convention to Nuclear Energy-related Activities*, UN Publication, Geneva, p. 13 para. 22.

183. UNECE (2018), "Findings and recommendations of the Implementation Committee on compliance by the United Kingdom of Great Britain and Northern Ireland with its obligations under the Convention in respect of the Hinkley Point C nuclear power plant", ECE/MP.EIA/2019/14, Geneva, 5-7 Feb. 2019, p. 16 para. 94.

184. UNECE (2014), "Report of the Meeting of the Parties to the Convention on its sixth session and of the Meeting of the Parties to the Convention serving as the Meeting of the Parties to the Protocol on its second session", ECE/MP.EIA/20/Add.1−ECE/MP.EIA/SEA/4/Add.1, Addendum, "Decisions adopted by the Meeting of the Parties to the Convention", "Decision VI/2: Review of Compliance with the Convention", Geneva, 2-5 June 2014, p. 4 para. 7.

185. Espoo Convention, *supra* note 35, Article 4 and Appendix II.

186. Ministry of the Environment, Finland; Ministry of the Environment, Sweden and Ministry of Housing, Spatial Planning and the Environment, the Netherlands (2003), *supra* note 181, p. 21.

187. See *Ibid*.

information must be examined and a final decision made and transmitted, which includes the reasons why as well as the considerations to the affected party as well as the impacts on the affected party (Article 6). In addition, there is a voluntary post-project analysis step (Article 7).

c. Implementation

Just as mentioned earlier that distinction must be made between the consideration of radiological vs. non-radiological environmental impacts, distinction must also be made between the purpose and obligations of a domestic EIA and transboundary EIA. When the Espoo Convention was adopted, most of the parties to the Convention already had national legislation providing for domestic EIAs.[188] The Espoo Convention does not take the place of those requirements but rather adds on to them. Different national laws and regulations, as well as international instruments (if any) apply based on which type of EIA is being conducted and for which type of environmental impact:

	Domestic EIA	**Transboundary EIA**
Radiological Environmental Impacts	National Nuclear Safety Laws and Regulations	International Nuclear Safety Conventions and International Soft Law Nuclear Instruments (examples: CNS; Joint Convention; IAEA SSR-1; IAEA GSG-10)
Non-radiological Environmental Impacts	National Environmental Laws	International Environmental Conventions, Regional Environmental Directives, and Customary International Law (examples: Espoo Convention and EU EIA Directive)

Figure 10. Differentiating the laws applicable to domestic and transboundary EIA.

Domestic EIAs generally do not contain a Stockholm Declaration Principle 21-type prohibition against significant or substantial environmental harm.[189] Domestic "EIA systems virtually never require states to adopt mitigative measures, much less to disapprove projects because of their environmental effects. EIA is designed to provide a decision maker and the public with information about the environmental consequences of a proposal, not to force an environmentally correct decision."[190] As an example, NEPA, which is widely considered the blueprint for other domestic EIA legislation, does "not require agencies to elevate environmental concerns over other appropriate considerations. … Rather, it required only that the agency take a 'hard look' at the environmental consequences before taking a major action."[191]

The Espoo Convention, on the other hand, goes further, obligating parties to "either individually or jointly, take all appropriate and effective measures to prevent, reduce and control significant adverse transboundary environmental impact from proposed activities" (Article 2(1)),

188. *Ibid.*, p. 9.

189. Knox, J.H. (2002), *supra* note 98, p. 298.

190. *Ibid*.

191. Baltimore Gas and Electric Co. v. Natural Resources Defense Council, 462 US 87, 97 (1983).

but it is not necessarily explicit that a project may not move forward if there will be such impacts.[192] Instead, the requirement is for all "Parties [to] ensure that, in the final decision on the proposed activity, due account is taken of the outcome of the environmental impact assessment, including the environmental impact assessment documentation, as well as the comments thereon received … and the outcome of the consultations." (Article 6(1)) The Espoo Convention Implementation Committee, however, has stated that "the Convention is based on the principle of prevention, which is well embedded into international environmental law."[193] The Implementation Committee cited both the ICJ's Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons as well as the ICJ judgment in the Gabčíkovo-Nagymaros case for the justification that prevention is a basic principle of the Convention. In its findings and recommendations regarding the Danube-Black Sea Deep-Water Navigation Canal in the Ukrainian sector of the Danube Delta, the Implementation Committee found that the party of origin (Ukraine) "should have taken all appropriate and effective measures to, first of all, prevent a significant adverse transboundary environmental impact from the project."[194]

The Implementation Committee is one of several options available to member states in the event of a disagreement over the interpretation or implementation of the Convention. The Convention itself provides for two options: dispute settlement and an Inquiry Commission. There are two steps under dispute settlement, where the first step is negotiation and the second step involves either the ICJ or arbitration (Article 15). The Inquiry Commission can be invoked in a very specific circumstance. A question can be submitted to the Inquiry Commission if parties cannot agree whether there is likely to be a significant adverse transboundary impact and a party believes it should have been notified of the proposed activity (Article 3(7)). To date, the Inquiry Commission procedure has only been invoked once (in 2004, regarding the Danube-Black Sea Deep-Water Navigation Canal case already mentioned).

The most important dispute resolution method under the Convention, however, is the previously mentioned Implementation Committee. The Implementation Committee was established in 2001 with the objective of "assist[ing] Parties to comply fully with their obligations under the Convention."[195] The Implementation Committee consists of eight parties to the Convention who each appoint a permanent member of the Committee (with the possibility to also appoint an alternate member).[196] It should be noted that the Committee does not consider itself a court or a tribunal because its mandate is for "a non-adversarial and assistance-oriented [compliance] procedure" (Article 14bis(1)).

The Committee fulfils its obligation by considering submissions of non-compliance; periodically reviewing parties' compliance; preparing advisory reports; preparing reports on compliance; and gathering information on compliance.[197] The Committee reviews parties' compliance on the basis

192. For further discussion on these issues, see Knox, J.H. (2002), *supra* note 98, pp. 291-319.

193. UNECE (2008), "Report of the Meeting of the Parties to the Convention on Environmental Impact Assessment in a Transboundary Context on its Fourth Meeting, Held in Bucharest, Romania, from 19 to 21 May 2008", ECE/MP.EIA/10, "Decision IV/2: Review of Compliance", "Annex I: Implementation Committee's findings and recommendations further to a submission by Romania regarding Ukraine", p. 91 para. 53.

194. *Ibid*.

195. UNECE (2004), ECE/MP.EIA/6, *supra* note 175, Annex II, "Decision III/2: Review of Compliance", Appendix, "Structure and Functions of the Implementation Committee and Procedures for Review of Compliance", para. 4 (as amended by UNECE (2014), ECE/MP.EIA/20/Add.1−ECE/MP.EIA/SEA/4/Add.1, *supra* note 184, "Decision VI/2: Review of Compliance with the Convention").

196. *Ibid*., para. 1(a).

197. UNECE (2014), "Structure and Functions of the Implementation Committee and Procedures for Review of Compliance", *supra* note 195, paras. 5-7.

of: party-to-party submissions; self-referrals; or Committee initiatives. Committee initiatives are launched in two ways, either based on information obtained from other sources (most often from NGOs), followed by correspondence with the party concerned to gather further information, or as a result of specific compliance issues arising from the periodic reviews of the implementation of the Espoo Convention. Each of these is then followed by correspondence with the party concerned and other stakeholders to define whether the Implementation Committee should further examine the matter.

If the Committee decides to consider the matter further, it will hold formal discussions with the parties involved and at the conclusion the Committee, in closed session, drafts findings and recommendations, drawing appropriate conclusions as to the compliance with the Convention, which are then shared with the involved parties.[198] The findings and recommendations are then formally adopted by the Implementation Committee, taking into account comments received, and then forwarded to the MOP for adoption.[199] Over the course of its life, the Implementation Committee has considered 20 cases related to nuclear activities: 2 submissions by parties (S/3 Metsamor, Armenia and S/4 Ostrovets, Belarus, both now closed), 2 Committee initiatives (CI/4 Rivne, Ukraine and CI/5 Hinkley Point C, United Kingdom, both now closed), and 16 information gathering cases.[200] Of these 16 cases, 8 are still open and 7 relate to lifetime extensions in Belgium, Bulgaria, Czech Republic, France, Netherlands, Spain and Ukraine.[201]

d. *Environmental impact assessments and long-term operation / lifetime extensions of nuclear power reactors*

As mentioned earlier, pursuant to Article 1 of the Espoo Convention, any major change to an activity listed under Appendix I of the Convention also falls within its scope of application. Identical provisions are found in Annex I to the SEA Protocol, which lists projects for which each party to the SEA Protocol shall ensure that an SEA is carried out at the plan or programme level. It is a "long-standing and widely agreed" upon requirement for there to be an assessment of the

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198. UNECE (2008), "Report of the Meeting of the Parties to the Convention on Environmental Impact Assessment in a Transboundary Context on its Fourth Meeting, Held in Bucharest from 19 to 21 May 2008", ECE/MP.EIA/10, "Decision IV/2: Review of Compliance", "Annex IV: Operating rules of the Implementation Committee", Rules 11-13 (as amended by UNECE (2011), ECE/MP.EIA/15, "Decision V/4: Review of Compliance", "Annex: Amendment of the operating rules of the Implementation Committee" and UNECE (2014), ECE/MP.EIA/20/Add.1−ECE/MP.EIA/SEA/4/Add.1, *supra* note 184, "Decision VI/2: Review of Compliance with the Convention", "Annex I: Amendments to the structure and functions of the Implementation Committee and procedures for review of compliance").

199. *Ibid.*, Rule 13.

200. Note: none of these case number totals include specific compliance issues, of which there are many.

201. One was raised by the NGO Greenpeace Netherlands concerning the extension of the lifetime of the Borssele nuclear power plant in the Netherlands (EIA/IC/INFO/15). Another concerns three facilities in Belgium (Doel 1 & 2, Tihange 1) raised by the German federal states of North Rhine-Westfalia and Rhineland-Palatinate (EIA/IC/INFO/18). One concerns the extension of the lifetime of several reactors at the Dukovany nuclear power plant in the Czech Republic, raised by four NGOs in the Czech Republic and Germany (EIA/IC/INFO/19). Another concerns the lifetime extensions of three reactors at the Rivne nuclear power plant, three reactors at the South Ukrainian nuclear power plant, five reactors at the Zaporizhzhya nuclear power plant and two reactors at the Khmelnitsky nuclear power plant in Ukraine (EIA/IC/INFO/20). One concerns the extension by Bulgaria of the lifetime of units 5 and 6 of the Kozloduy nuclear power plant, close to the border with Romania, which was submitted by a Romanian NGO (EIA/IC/INFO/28). One was raised by Greenpeace France regarding 32 units of 8 nuclear power plants in France (EIA/IC/INFO/32). And finally, one related to two units of the Almaraz nuclear power plant in Spain (EIA/IC/INFO/34).

environmental impacts of the construction and operation of new nuclear power reactors,[202] but this was not always the case. Most of the nuclear power reactors now operating in UNECE member countries were built before the Espoo Convention entered into force in 1997 and their construction was often not subject to an EIA process.[203]

In some countries, like the United States, there is a clear requirement for an environmental review as part of the licence renewal process. However, in most countries, a licence extension does not systematically necessitate an EIA. "There are several explanations for this, many having to do with the form of [the long-term operation (LTO)] authorisation. Where licences are open-ended, no changes are made to the licence, and no major works are foreseen to continue operation, there is not necessarily a trigger to perform such an environmental review under the existing laws."[204]

In 2011, a Ukrainian NGO brought information to the Espoo Implementation Committee regarding potential non-compliance with the Espoo Convention by Ukraine for the planned extension of the Rivne nuclear power plant in Ukraine, which is close to the border with Belarus and Poland. In its 2014 decision, the Implementation Committee found that Ukraine, whose legislation did not require the carrying out of either a domestic or a transboundary EIA procedure for the lifetime extension of the Rivne nuclear power plant, was in non-compliance with the Convention.[205] It stated:

> that the decision to authorize a proposed activity subject to the Convention, according to the national procedure, only for a limited period of time meant that any subsequent decision to extend that limited period of time, whether in the form of a new licence or amendment or renewal of the existing one, would, under the Convention, be another decision of a competent authority to authorize or undertake a proposed activity. In that context it becomes less relevant whether it is a new activity or a major change to an activity.[206]

The MOP "endorse[d] the findings of the Implementation Committee that the extension of the lifetime of the [subject] nuclear power plant, … after the initial licence had expired, should be considered as a proposed activity under [Article 1(v)] of the Convention, and is consequently subject to the provisions of the Convention".[207] However, this decision was limited to the situation in Ukraine with the Rivne nuclear power plant.[208]

202. NEA (2019), *The Legal Frameworks for Long-Term Operation of Nuclear Power Reactors*, OECD Publishing, Paris, p. 32.

203. UNECE (2011), "Background note on the application of the Convention to nuclear energy-related activities", *supra* note 179, p. 3 para. 2.

204. Nick, K.S. (2018), "Today is yesterday's pupil: Reactor licence renewal in the United States", *Nuclear Law Bulletin*, No. 101, OECD Publishing, Paris, p. 49.

205. UNECE (2014), "Report of the Implementation Committee on its thirtieth session", ECE/MP.EIA/IC/2014/2, Geneva, 25-27 Feb. 2014, para. 65(b) and (c). Findings adopted by the Meeting of the Parties in UNECE (2014), ECE/MP.EIA/20/Add.1−ECE/MP.EIA/SEA/4/Add.1, *supra* note 184, "Decision VI/2: Review of Compliance with the Convention", paras. 68-71.

206. UNECE (2014), "Report of the Implementation Committee on its thirtieth session", *supra* note 205, para. 45.

207. UNECE (2014), ECE/MP.EIA/20/Add.1−ECE/MP.EIA/SEA/4/Add.1, *supra* note 184, "Decision VI/2: Review of Compliance with the Convention", para. 68.

208. *Ibid.*, paras. 68-71.

As just explained, there are currently 16 open information gathering cases with the Implementation Committee, 7 of which relate to lifetime extensions, with more expected in the future. Because of the "considerable legal uncertainty as to whether and in what circumstances lifetime extensions of nuclear power plants require a transboundary environmental impact assessment under the Espoo Convention", an *ad hoc* group on the applicability of the Espoo Convention to the lifetime extension of nuclear power plants was established.[209] Over the course of three-and-a-half years, the *ad hoc* group addressed many different issues, including: does the lifetime extension represent an activity or a major change to an activity; is the lifetime extension likely to cause significant adverse transboundary impact; and is the lifetime extension subject to a decision of a competent authority in accordance with an applicable national procedure.[210] Due to the many different lifetime extension scenarios, the ultimately adopted "Guidance on the applicability of the Convention to the lifetime extension of nuclear power plants" did not provide a "one-size-fits-all approach", but rather provides a number of "principles and factors" to consider in determining the applicability.[211]

One of the main issues for the *ad hoc* group was whether the guidance should be applicable to the activity itself – the "lifetime extension of nuclear power plants" or whether it applies to the "decisions" on the "lifetime extension of nuclear power plants".[212] If the guidance is limited to LTO decisions, most parties to the Convention would not have to undertake an EIA process.[213] This question raised another, more global question for the members of the Espoo Convention, which is whether there is actually an obligation under Article 2 of the Espoo Convention to establish a national decision-making procedure for "any activity or any major change to an activity" which is "likely to cause significant adverse transboundary impact".[214] The scope of this question reaches far beyond the LTO scenario and could possibly affect any proposed activity, not just a nuclear energy-related activity, under the Convention. And, it raises a far more wide-reaching question: for any covered activity, should we assess or reassess the impact of such already authorised activity over time? Here again, nuclear energy activities are at the forefront of the discussion.

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209. UNECE (2018), "Draft terms of reference for possible guidance on the applicability of the Convention to the lifetime extension of nuclear power plants: Proposal by the *ad hoc* working group", ECE/MP.EIA/WG.2/2018/4, Geneva, 28-30 May 2018, p. 3.

210. See UNECE (2020), "Draft guidance on the applicability of the Espoo Convention to the lifetime extension of nuclear power plants: Note prepared by the Co-Chairs of an *ad hoc* working group based on inputs from members of this group", ECE/MP.EIA/WG.2/2020/INF.12, Geneva, 24-26 August 2020.

211. *Ibid.*, p. 3 para. 9. For a complete analysis of the Guidance, please see Emmerechts, S. and P. Bourdon (2020), "Environmental impact assessments and long-term operation of nuclear power reactors: Increasing importance of environmental protection in the European Union?", *Nuclear Law Bulletin*, No. 105, OECD Publishing, Paris, pp. 7-29.

212. Letter from L. Tanner and C. Sangenstedt to the Meeting of the Parties to the Espoo Convention, 8th Session and Meeting of the Parties to the Protocol on SEA, 4th Session, Vilnius, Lithuania, 8-11 December 2020, "Letter of the Co-Chairs of the *ad hoc* working group on the applicability of the Espoo Convention to the lifetime extension of nuclear power plants", p.2.

213. More detailed information on the types of licensing processes for LTO in NEA member countries can be found in: NEA (2019), *The Legal Frameworks for Long-Term Operation of Nuclear Power Reactors*, *supra* note 202.

214. Letter from L. Tanner and C. Sangenstedt (2020), *supra* note 212.

Emerging issue: Are small modular reactors (SMRs) included within the scope of the Espoo Convention?

SMRs are defined generally as nuclear reactors with a power output between 10 MWe and 300 MWe. Designs with power outputs smaller than 10 MWe have been referred to as micro modular reactors.

The Espoo Convention applies when two requirements are met:

- the proposed activity is listed in the Convention (Appendix I); and
- the proposed activity is likely to cause a significant adverse transboundary impact.

If one assumes, *arguendo*, that the scope of Appendix I (either the original text or the text as modified under the Second Amendment) is broad and covers SMRs, the next question is whether the construction and operation of an SMR is likely to cause a significant adverse transboundary impact. Given the numerous different types of SMRs and the multitude of locations where they could be built, as with the LTO issue, a one-size-fits-all approach may not be possible. Thus, one must analyse each of the four considerations mentioned earlier:

- What are the possible "adverse impacts" of the construction and operation of the SMR?
- Is the activity "likely" to cause adverse environmental impacts?
- Are the likely adverse environmental impacts "significant"?
- Are the likely significant environmental impacts "transboundary" and which parties would be effected?

While it may not be possible to exclude SMRs as a class, it may be possible for countries of origin to try to exclude certain types of SMR designs (regardless of their geographic proximity to a border). Arguments can be made that the inherent, passive safety features of SMR designs preclude or at least drastically reduce the possibility of the type of significant adverse transboundary impacts of traditional reactors – under normal operating conditions as well as in the event of a design basis or beyond design basis accident. And, if such an event were to occur, there are additional safety features that allow for actions to be taken to either mitigate or preclude any off-site release of radioactivity.

This could still be challenging, however, due to the inclusive approach favoured by the Implementation Committee and the finding that notification should be made "unless a significant adverse transboundary impact can be excluded". Potentially affected countries can always challenge the country of origin's determination on this matter and the Inquiry Commission procedure invoked under Appendix IV.

2. Protocol on Strategic Environmental Assessment to the Espoo Convention

a. Introduction

The Espoo Convention applies at the project level (Article 2(7)). But, the Convention itself states that there is a need to widen its scope and declares that "the Parties shall endeavour to apply the principles of environmental impact assessment to policies, plans and programmes" (Article 2(7)). Even before the adoption of the Espoo Convention, governments realised that decisions made far earlier in the process – even at the policy and planning stage – can lead to adverse environmental impacts, some that have irreversible consequences.[215] A number of countries, as well as the European Commission,[216] had already incorporated strategic environmental

215. See e.g. UNECE (2016), *Protocol on Strategic Environmental Assessment: Facts and Benefits*, UNECE, Geneva, p. 7.

216. Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment, OJ L 197 (21 July 2001), p. 30.

assessments into their national legislation.[217] Some legislation even went as far back as 1969, with the US National Environmental Policy Act, which applies "in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment".[218]

The Protocol on Strategic Environmental Assessment to the Espoo Convention is an outgrowth of national legislation as well as a number of important international instruments, including Principle 4 of the Rio Declaration, which states that "In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it."[219] At the same 1998 conference where the Aarhus Convention (discussed *infra*) was adopted, the final report noted that strategic environmental assessments of proposed energy policies, plans and programmes in the UNECE region, among other sectors, "should be undertaken as a matter of priority".[220]

At the third Ministerial Conference on Environment and Health held in London in 1999, ministers and representatives of European member states of the World Health Organization (WHO) agreed, among other "commitments to action", to "carry out environmental impact assessments fully covering impacts on human health and safety. We invite countries to introduce and/or carry out strategic assessments of the environment and health impacts of proposed policies, plans, programmes and general rules."[221] Two years later, the 2001 road map for implementing the commitments within the UN's Millennium Declaration,[222] the predecessor to today's Sustainable Development Goals, had as its seventh goal "Ensure environmental sustainability", which incorporated the ninth "target", "Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources".[223] Finally, the outcome of the World Summit on Sustainable Development held in South Africa a year later "stresse[d] the importance of strategic frameworks and balanced decision making as fundamental requirements for advancing the sustainable development agenda."[224]

In the midst of these events, in 2001, the parties to the Espoo Convention "decided to start negotiations on a protocol to the Convention addressing SEA" and those negotiations lasted two years, concluding in 2003.[225] Based in part on the EU SEA Directive, the SEA Protocol was adopted in Kyiv, Ukraine in May 2003 and it entered into force in July 2010. The Protocol has 33 parties,

217. See e.g. UNECE (2016), *Protocol on Strategic Environmental Assessment: Facts and Benefits*, *supra* note 215.

218. NEPA, *supra* note 86, at Sec. 102 [§ 4332] (2)(C); see also UNECE (2012), *Resource Manual to Support Application of the UNECE Protocol on Strategic Environmental Assessment*, UNECE, Geneva, ECE/MP.EIA/17, p. 160.

219. Rio Declaration, *supra* note 30, Principle 4.

220. ECE Secretariat (1998), Report on the Fourth Ministerial Conference "Environment For Europe", ECE/CEP/41, Arhus, Denmark, 23-25 June 1998, pg. 45, Annex II, para 20.

221. "London Declaration on Action in Partnership", EUR/ICP/EHCO 02 02 05/18 Rev.5, Third Ministerial Conference on Environment and Health, London, 16-18 June 1999, WHO Regional Office for Europe, Copenhagen, pg. 4 para. 7.

222. UNGA (2000), "United Nations Millennium Declaration", UN Doc. A/RES/55/2, adopted on 8 Sept. 2000 (18 Sept.).

223. UNGA (2001), Report of the Secretary-General, "Road map towards the implementation of the United Nations Millennium Declaration", UN Doc. A/56/326, "Annex: Millennium development goals" (6 Sept.).

224. UNECE (2016), *Protocol on Strategic Environmental Assessment: Facts and Benefits*, *supra* note 215, p. 4.

225. UNECE (n.d.), "History of the Convention and its Protocol", https://unece.org/history-convention-and-its-protocol (accessed 25 May 2021).

all from Europe, plus Armenia and Cyprus. The Protocol is open to all UN member states and a country can be a party to the Protocol while not being a party to the Espoo Convention.[226]

b. Purpose and procedure

It is critical to first understand what a strategic environmental assessment is. The Protocol defines an SEA as 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.[227]

The goal of the SEA Protocol is to "provide[] early and effective inputs … to ensure that environmental considerations are thoroughly taken into account in the development of plans and programmes".[228] SEAs must be integrated at the earliest stages, irrespective of whether these plans or programmes are likely to have a transboundary impact. In fact, unlike the Espoo Convention, the Protocol "applies mainly to domestic plans and programmes".[229]

Obligatory at the plans and programmes level of decision making, SEAs are strongly recommended at an even earlier stage of decision making, "in the preparation of its proposals for policies and legislation that are likely to have significant effects on the environment, including health" (Article 13). As explained in the SEA *Resource Manual*, "The Protocol does not offer a definition of 'policies and legislation', though policies are generally considered to be strategic proposals at a higher or more general level than plans and programmes."[230]

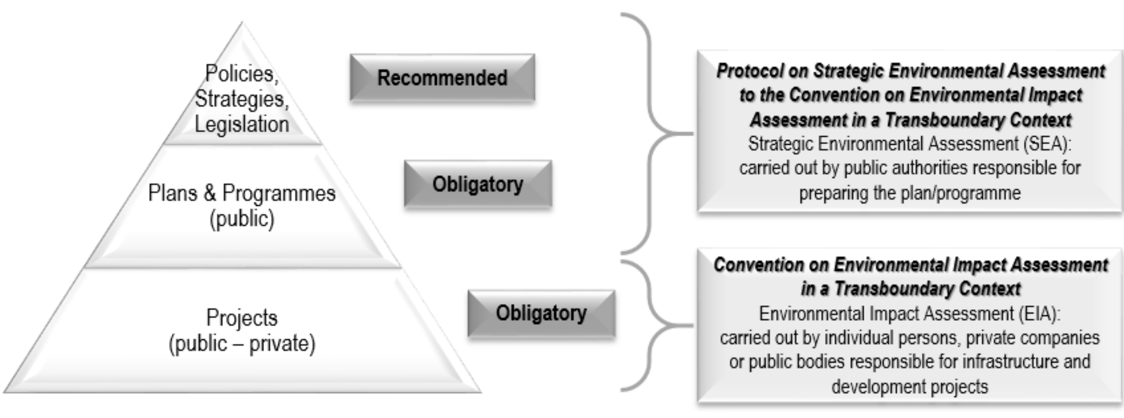

Figure 11. Application of SEA and EIA in the environmental decision-making process[231]

226. UNECE (2012), *Resource Manual*, *supra* note 218.

227. SEA Protocol, *supra* note 44, Article 2(6).

228. UNECE (2012), *Resource Manual*, *supra* note 218, p. 34 para. 21.

229. UNECE (2016), *Protocol on Strategic Environmental Assessment: Facts and Benefits*, *supra* note 215, p. 4.

230. UNECE (2012), *Resource Manual*, *supra* note 218, p. 108.

231. UNECE (2016), *Protocol on Strategic Environmental Assessment: Facts and Benefits*, *supra* note 215, pp. 6, 20.

Under the SEA Protocol, an SEA must be undertaken for certain defined plans or programmes "likely to have significant environmental, including health, effects".[232] First, one must look at the definition of "plans and programmes" in Article 2 to determine if the plan or programme, including any modifications to them, meets the Protocol's definition (Article 2(5)). If the plan or programme meets the high-level definition, it must next be determined if that plan or programme is within the field of application under the Protocol as laid out in Article 4 and Annexes I and II. As with the Espoo Convention, the SEA Protocol specifically applies to certain nuclear activities.

There is a mandatory application of the Protocol under two circumstances related to nuclear energy:

- first, if the plan or programme sets the framework for future development consent for projects listed in Annex I; and
- second, if the plan or programme sets the framework for future development consent for any other project listed in Annex II and the relevant Annex II project requires an EIA under national legislation (Article 4(2)).

The projects described in Annexes I and II are almost mirror images of those listed under the original Espoo Convention Appendix 1 and as amended in the Second Amendment to the Espoo Convention. SEA Protocol Annex I(2) and (3) copies the original Espoo Convention Appendix 1(2) and (3). While there are minor distinctions between Annex II and Appendix 1 to the Second Amendment, they are largely distinctions without differences. Ultimately, the Protocol will apply, in general, to plans and programmes related to nuclear power reactors as well as installations related to spent fuel and radioactive waste management if they "are likely to have significant environmental, including health, effects" (Article 4(1)).

Once the requirement to perform an SEA is confirmed, there are three main components: an environmental report, public participation and transboundary consultations. As explained in Article 7(2), the environmental report shall "identify, describe and evaluate the likely significant environmental, including health, effects of implementing the plan or programme and its reasonable alternatives." Article 8(1) on public participation provides that "Each Party shall ensure early, timely and effective opportunities for public participation". In practice, that process should serve the purposes of providing information, gathering comments and engaging the public concerned in collaborative problem solving.

Article 10 on transboundary consultations provides that notification is required when a proposed plan or programme in one country (the party of origin) is likely to have significant environmental effects on the territory of another country (the affected party). This notification must include the draft plan or programme, the environmental report, including information on transboundary effects, and information on the decision-making procedure, including information on a time schedule for comments (Article 10(2)). This transboundary consultation does not provide any sort of "right of veto" to the consulted parties.[233]

232. SEA Protocol, *supra* note 44, Article 4. The Protocol defines this as "any effect on the environment, including human health, flora, fauna, biodiversity, soil, climate, air, water, landscape, natural sites, material assets, cultural heritage and the interaction among these factors." *Ibid.*, Article 2(7).

233. UNECE (2016), *Protocol on Strategic Environmental Assessment: Facts and Benefits*, *supra* note 215, p. 22.

c. *Strategic environmental assessments for nuclear activities in practice*

As noted by the IAEA, "only a small number of SEAs have been performed for nuclear power programmes".[234] In part, because of this fact, the IAEA published guidance in 2018 for the conduct of SEAs for nuclear power programmes. In this document, the IAEA outlined the stepwise approach to SEAs in three different contexts: the why, the what, and the how and where of policies, plans and programmes related to nuclear energy.

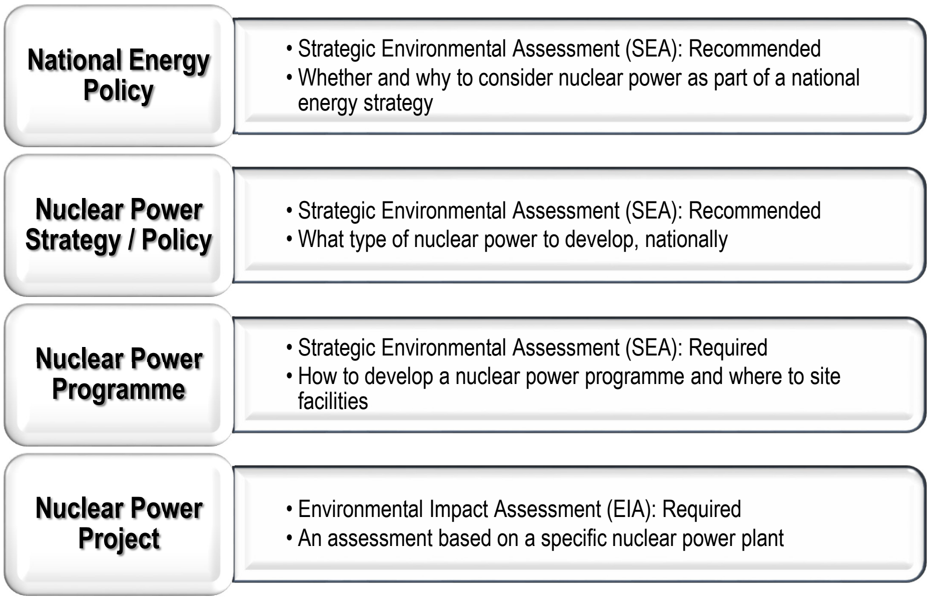

Figure 12. Stepwise approach to SEA and EIA in the development and implementation of nuclear energy[235]

Some examples of how SEAs are carried out in the development phase is the SEA for the Energy Policy of Poland until 2040, the objective of which "is to ensure energy security while ensuring the competitiveness of the economy, energy efficiency and reduction of the environmental impact of the energy sector, and with optimum use of Poland's own energy resources", where the SEA analysed a number of components for meeting this, including the introduction of nuclear energy in 2033.[236] The environmental impacts of developing a nuclear power programme were already analysed in a 2014 "Strategic Environmental Assessment Report for the Polish Nuclear Programme".[237] In the United Arab Emirates, a 2010 SEA analysed two different locations for potentially siting new nuclear power plants, which ultimately resulted in the selection of the Barakah site.[238] In addition, an SEA could be carried out again later in the

234. IAEA (2018), *Strategic Environmental Assessment for Nuclear Power Programmes: Guidelines*, IAEA Nuclear Energy Series, No. NG-T-3.17, IAEA, Vienna, p. 3.

235. *Ibid.*, pp. 4, 5, 12, and 25.

236. Ministry of Climate and Energy of Poland (2021), "Report on the Strategic Impact Assessment of the Draft of Polish Energy Policy Until 2040 – Summary and Conclusions", Appendix 3.3, available at: https://bip.mos.gov.pl/fileadmin/user_upload/bip/strategie_plany_programy/Polityka_energetyczna_Polski/zal.__3_.3_do_SOOS_-_Streszczenie_SOOS_z_wnioskami__ANG__2021-02-02.pdf.

237. Szkudlarek, L., D. Lewicka-Szczebak and M. Kasprzak (2014), "Strategic Environmental Assessment Report for the Polish Nuclear Programme", Ministry of Economy, Warsaw.

238. Paul C. Rizzo Associates (2010), Strategic Environmental Assessment (SEA) – Proposed Nuclear Power Plant Complex, Western Region, Abu Dhabi Emirate, UAE, Project No. 08-4075, Paul C. Rizzo Associates, Abu Dhabi, Vol. 1.

lifetime of a nuclear power plant, if the national government is taking another look at their national energy strategy to determine whether nuclear power should continue to be a part of the energy mix or perhaps re-thinking the nuclear power strategy or policy to determine whether to look at building new nuclear power plants or extending the lifetime of existing operating reactors.

d. Implementation

Implementation of the SEA Protocol is largely governed by the Espoo Convention. In the event of a dispute regarding the interpretation or application of the Protocol, Article 20 of the Protocol states that Article 15 of the Espoo Convention applies. Further, from the beginning of the creation of the Espoo Implementation Committee in 2001, it was determined that it would be available to review compliance with any future protocols to the Convention.[239] The Committee was encouraged to include reviews of the SEA Protocol in a 2004 MOP decision.[240] The application of the Implementation Committee to the SEA Protocol was made formal in 2011, in the 5th session of the MOP and the 1st session of the Meeting of the Parties to the Convention serving as the Meeting of the Parties to the Protocol in Decision V/6-I/6 "Application of the compliance procedure of the Convention to the Protocol".[241] This was made explicitly clear in the 2004 Second Amendment to the Convention, which added Article 14bis on "Review of Compliance", which codified the Implementation Committee's "non-adversarial and assistance-oriented procedure" as well as the fact that "The compliance procedure shall be available for application to any protocol adopted under this Convention."

As of February 2021, of the 11 total SEA cases brought before the Implementation Committee, 4 relate to energy in general[242] and 1 specifically relates to nuclear energy (information gathering case SEA/IC/INFO/2, regarding whether the decision by the Armenian government to adopt a "new energy programme, which among other projects, envisaged the construction of" the Metsamor Nuclear Power Plant).

3. Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters

a. Introduction

Of the three UNECE instruments considered in this article, the 1998 Aarhus Convention has had the widest and most visible impacts across their respective contracting parties in relation to environmental protection in the nuclear field.[243] These are seen not only in new substantive law and

239. UNECE (2001), ECE/MP.EIA/4, *supra* note 171, Annex IV, "Decision II/4: Review of Compliance".

240. UNECE (2004), ECE/MP.EIA/6, *supra* note 175, Annex II, "Decision III/2: Review of Compliance".

241. UNECE (2011), "Report of the Meeting of the Parties to the Convention serving as the Meeting of the Parties to the Protocol on its first session", ECE/MP.EIA/SEA/2, "Decision I/6-V/6: Application of the compliance procedure of the Convention on Environmental Impact Assessment in a Transboundary Context to the Protocol on Strategic Environmental Assessment", Geneva, 20-23 June 2011, pp. 13-14.

242. Two are Committee initiatives (SEA/IC/CI/1 regarding the "Energy Sector Development Strategy of the Republic of Serbia for the Period up to 2025 with projections up to 2030" and SEA/IC/CI/2 regarding Serbian Energy Sector Development Strategy and its implementation programme) and two are information gathering cases (SEA/IC/INFO/1, which was closed in December 2019 and led to SEA/IC/CI/2, and the still open SEA/IC/INFO/4 related to the draft Energy Policy of Poland until 2040).

243. The parties to Aarhus, of which there are currently 47, are a smaller number than those who are parties to the Espoo Convention. They comprise most states in Europe, the EU and several Central Asian states. Although it is a regionally-based international agreement, any state that is a member of the UN can accede to the Aarhus Convention if approved by the Meeting of the Parties.

regulation at regional and national levels, which were brought about by the Aarhus Convention, but also in changes to rules of court and tribunal procedure, public administration, litigation funding and costs recovery, and in the structures of decision making in relation to national environment, energy and industrial policies.[244]

As noted in Part 1(B), a core element of the Aarhus Convention is public participation in environmental decision making.[245] This is, however, just one of three sets of rights that form the "Three Pillars" of the Aarhus regime, the others being public access to environmental information from public authorities (Article 4) and access to justice for the public where rights granted under the other two Pillars are said to have been infringed or inadequately met (Article 9).

The Convention also requires arrangements to be put in place for public authorities in contracting party states to proactively collect, manage and disseminate information on activities that have, or may have, significant environmental effects and on their own strategies, plans and operations regarding anything that falls within the scope of the Convention (Article 5). And it requires contracting party states to encourage operators, whether in the public or private sector, to make publicly available information on their environmental performance on a voluntary basis (Article 5). The Aarhus Convention also calls on the contracting parties to issue public guidance on the rights and workings of the Convention itself, to promote environmental education and awareness, and to recognise and support non-governmental environmental organisations that have environmental protection aims (Article 3(2)-(4)). At the time of its entry into force in 2001, UN Secretary-General Kofi Annan described the Aarhus Convention as "the most ambitious venture in environmental democracy undertaken under the auspices of the United Nations. Its adoption was a remarkable step forward in the development of international law".[246]

In its Preamble, the Convention refers to Principle 10 of the Rio Declaration. The concordance between the text of this Principle and the substance of the Three Pillars of the Aarhus Convention is noteworthy and illustrates the progression of Principle 10 as a Source 2, non-binding international instrument, into Source 3, "hard" treaty/convention law.[247] The Convention Preamble also states that "every person has the right to live in an environment adequate to his or her health and well-being". This appears to assert a substantive human right with regard to the environment.[248] This is reinforced in Article 1 ("Objective") of the Convention:

In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well-being, each Party shall guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters in accordance with the provisions of this Convention.

The text of the Aarhus Convention thus assumes a substantive human right (and treats its contribution to securing that right as its purpose), but its operative provisions are entirely "procedural". They require the contracting parties to act in ways that grant non-state third parties specific and practical rights and legal entitlements. These Convention rights stand on their own and

244. For an illustration of the nature and breadth of these impacts, see the case relating to the United Kingdom communicated to the Aarhus Convention Compliance Committee (ACCC or Compliance Committee) by Client Earth, the Marine Conservation Society and an individual claimant, ACCC/C/2008/33 (UK).

245. See Aarhus Convention, *supra* note 45, Articles 6-8.

246. UNECE, Press Release, "Environmental Rights Not a Luxury", Ref. No. ECE/ENV/01/15 (29 Oct. 2001).

247. See UNECE Aarhus Convention Secretariat (2012), "The Role of the Aarhus Convention in Promoting Good Governance and Human Rights", provided as input to the report prepared by the Office of the High Commissioner for Human Rights pursuant to resolution 19/20, para I.4; Hey, E. (2016), *supra* note 107, p. 127.

248. See discussion of environmental protection and the law on human rights at Part 1(B)(3), *supra*.

are operable without any party to the Convention being required to accept the, still, controversial proposition that there is an underlying human right for individuals to enjoy some particular standard of environmental well-being.[249]

The Aarhus Convention, like its companion UNECE instruments, the Espoo Convention and the SEA Protocol, falls within Stream C of the international legal framework of environmental protection for nuclear activities (see Figure 2, *supra*). Its scope of application is broad, covering both radiological and non-radiological effects on the environment of nuclear activities, as discussed further below in relation to each of the Convention's "Three Pillars". In common with the SEA Protocol, the Aarhus Convention is concerned with "significant environmental effects" on the environment, wherever these occur, whether within or beyond the national borders of any relevant contracting party.[250] This contrasts with the Espoo Convention, its field of application being different from the Aarhus Convention in so far as the former is focused on activities that are "likely" to cause significant "adverse", "transboundary" impacts.[251]

These nuanced differences in the scope and application of these three UNECE instruments may present issues for those states that have ratified the Aarhus Convention and one or more of the other instruments in their aligning of national laws and processes to implement both or all three in a coherent way. This exercise may have particular challenges with regard to the nuclear power sector where, for example, the science and opinions about the likelihood and materiality of routine off-site radioactive discharges and their environmental/human health effects and the potential for transboundary movement of radionuclides in non-emergency scenarios are often subjects for debate.

The Aarhus Convention Compliance Committee[252] (see *infra*) has, in several cases, considered the interplay between the Aarhus Convention and the Espoo Convention and the SEA Protocol. The general import has been that the two Conventions and the Protocol establish separate regimes and separate sets of rights (the fulfilment of which under one instrument does not necessarily satisfy similar or related rights under any of the others) but that there is correspondence in certain aspects between each regime and they are intended to be mutually supportive.[253]

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249. See the Declaration of the United Kingdom made upon signature of the Aarhus Convention and confirmed upon ratification:

> The United Kingdom understands the references in article 1 and the seventh preambular paragraph of this Convention to the "right" of every person "to live in an environment adequate to his or her health and well-being" to express an *aspiration* which motivated the negotiation of this Convention and which is shared fully by the United Kingdom. The *legal rights* which each Party undertakes to guarantee under article 1 *are limited* to the rights of access to information, public participation in decision-making and access to justice in environmental matters in accordance with the provisions of this Convention.

UNECE (2014), *The Aarhus Convention: An Implementation Guide*, 2nd Edition, ECE/CEP/72/Rev.1, UNECE, Geneva, p. 250 (emphasis added).

250. Aarhus Convention, *supra* note 45, Articles 2(3), 4(1), 5(1) and 6(1)(b); SEA Protocol, *supra* note 44, Article 2(6)-(7) and 4(1), noting that the Aarhus Convention does differ from the SEA Protocol in so far as Aarhus is more expansive, being based around significant effects that "*may*" occur. The SEA Protocol speaks of such effects that are "*likely*" to occur.

251. Espoo Convention, *supra* note 35, Article 1(vii)-(viii) and Article 2(1)-(2).

252. Established in 2002 under Article 15 of the Aarhus Convention at the First Meeting of the Parties. UNECE (2004), "Report of the First Meeting of the Parties", ECE/MP.PP/2/Add.8, Addendum, "Decision I/7: Review of Compliance", Lucca, 21-23 Oct. 2002.

253. See generally UNECE (2014), *The Aarhus Convention: An Implementation Guide*, *supra* note 249, pp. 122-125, and in relation to nuclear activities specifically the communications to the ACCC in cases ACCC/C/2009/41 (Slovakia), ACCC/C/2010/51 (Romania) and ACCC/C/2013/91 (United Kingdom).

b. *The "Three Pillars" of Aarhus*

As discussed above, the Aarhus Convention requires its contracting parties to provide, within their national legal regimes and systems of public administration, three sets of procedural rights for individuals and groups or collectives representing private parties.

i. *Pillar 1: Access to environmental information*

The first of these Aarhus rights is the right of "the public", within the framework of relevant national law, to request of public authorities, and to be given, "environmental information" within specified time limits, without any interest in the information needing to be stated by the person requesting it (Article 4(1)). The definition of "environmental information" is broad. It includes: "any information in written, visual, aural, electronic or any other material form" (Article 2(3)), which relates to a list of matters concerning aspects of the environment and human health and to certain "factors", "such as substances, energy, noise and *radiation* and activities or measures, including administrative measures, environmental agreements, policies, legislation, plans and programmes, affecting or likely to affect the elements of the environment [otherwise listed]" (Article 2(3)(b) (emphasis added)).

There are 11 potential grounds on which a public authority may refuse to provide such information. These include confidentiality of public authority proceedings, legally protected confidentiality of commercial and industrial information, personal data protection and national defence and security (Article 4(3) and (4)). These exemptions are, however, to be interpreted restrictively and taking into account the wider public interest in information being disclosed rather than withheld (Article 4(4)).

The public authority is required to tell the requesting party, as soon as possible, if it does not hold the relevant information and to direct it to any other relevant authority where applicable (Article 4(5)). Refusals of a request must be in writing, if it was a written request, and must be made promptly (Article 4(7)).

These provisions of Article 4 are closely tied with the extensive, proactive, duties imposed on the contracting parties under Article 5, which include taking steps to ensure that their public authorities "possess and update environmental information ... relevant to their functions" (Article 5(1)(a)); to ensure they have systems "so that there is an adequate flow of information to public authorities … [on] activities which may significantly affect the environment" (Article 5(1)(b)), to make reports on the national state of the environment and to disseminate publicly other information relevant to the environment.[254]

A purposive joint effect of Articles 4 and 5 is for contracting parties to develop schemes of national public administration in which public authorities that have responsibility for environmental questions become curators of national environmental data and information and are in a position to respond substantively to a wide range of environmental information requests from the public. This requirement does not, of course, entirely meet the issue that important records and information may not always be in the possession of governmental agencies. There is no right under the Aarhus Convention to require disclosure of information from private parties, such as privately-owned utilities or environmental consultancies, and this has been an area for criticism of the Convention.[255] Article 5(6) of the Convention addresses this challenge albeit in an indirect and perhaps minimalist way as follows: "Each Party shall encourage operators whose activities

254. Aarhus Convention, *supra* note 45, Articles 5(3), (4), (5) and (7).

255. Mason, M. (2010), "Information Disclosure and Environmental Rights: The Aarhus Convention", *Global Environmental Politics*, Vol. 10, Issue 3, Massachusetts Institute of Technology Press, Boston, pp. 10-31.

have a significant impact on the environment to inform the public regularly of the environmental impact of their activities and products, where appropriate within the framework of voluntary eco-labelling or eco-auditing schemes or by other means". The public authorities in the nuclear field who are likely to fall within the ambit and requirements of Articles 4 and 5 include environment, climate change, foreign affairs, energy and public health ministries; national environmental regulators and agencies; nuclear regulatory bodies; state-run hospitals; radiological research facilities and higher education bodies conducting relevant research activities – all of whom may hold "environmental information" as defined in the Convention.

The types of environmental information connected with nuclear activities that may fall under Article 5 or have to be disclosed under Article 4 are also broad: among them would be radiation discharge records and off-site environmental monitoring data related to individual nuclear facilities; epidemiological and other studies on radiological health effects associated with particular sites or activities; nuclear facility safety assessments and safety cases; data, research and reports prepared for EIAs on projects in the nuclear field (domestic and transboundary); similar material relating to SEA plans and programmes; communications between ministries and agencies and with international counter-parties on the environmental aspects of policies and programmes in the nuclear sector; radioactive waste management and transport records and evaluation, and incident reports and "whistleblower" communications on radiological situations with potential or actual environmental consequences. What constitutes "environmental information" for the purposes of Articles 4 and 5 of the Aarhus Convention, however, always has marginal uncertainties and the application of these provisions in particular cases may involve detailed evaluation of individual documents and data sets.[256]

Although the implementation of the Aarhus Convention is territorial and jurisdictional in nature, "the public" that is entitled to request and receive information is not limited to citizens or nationally based entities of the contracting party. It is "an international public".[257]

Case Study

Article 4: Access to environmental information

ACCC/C/2009/44 (Belarus), ECE/MP.PP/C.1/2011/6/Add.1

In this case, the communicant was European ECO Forum and the public authorities were the Ministries of Energy and Environment of Belarus. This case concerned a failure to comply with Article 4(1) in relation to information requested regarding a proposal to develop a new build nuclear power plant, as well as alleged failures in relation to Articles 3(1) and (8); 6(2), (4), (6) and (7); and Articles 8 and 9. In its evaluation and main findings, the ACCC found that not all information provided by the public authorities was accurate and complete. Nevertheless, the information provided reflected the current knowledge of the public authorities: "the authorities provided the information that was held by them at that time and there is no evidence that they knowingly provided inaccurate or incomplete information" (para. 67). However, by restricting access to a full version of a relevant EIA Report relating to the proposed plant and by not allowing copies to be made, there was a failure to comply with Article 4(1)(b).

256. See UNECE (2011), "Report of the Compliance Committee on its thirty-third meeting", ECE./MP.PP/C.1/2011/6/Add.1, Addendum, "Findings and recommendations of the Compliance Committee with regard to communication ACCC/C/2009/44 concerning compliance by Belarus", Chisinau, Moldova, 27-28 June 2011.

257. Aarhus Convention, *supra* note 45, Article 2(4) and Article 3(9), the latter providing:

> Within the scope of the relevant provisions of this Convention, the public shall have access to information, have the possibility to participate in decision-making and have access to justice in environmental matters without discrimination as to citizenship, nationality or domicile and, in the case of a legal person, without discrimination as to where it has its registered seat or an effective centre of its activities.

While important as sets of free-standing procedural rights, those provided for in Article 4 and Article 5 are closely connected with, and play a facilitative role in, the advancement of the further rights of public participation in environmental decision making provided for in Article 6 ("Pillar 2") of the Aarhus Convention.

ii. *Pillar 2: Public participation in environmental decision making*

The foundation of the second pillar of the Aarhus Convention is Article 6 ("public participation in decisions on specific activities"), but the Convention is more extensive than that. It also includes "public participation concerning plans, programmes and policies relating to the environment" (Article 7) and "public participation during the preparation of executive regulations and/or generally applicable legally binding normative instruments" (Article 8).

Article 6 applies to decisions (to be made by competent entities in the contracting party) on whether or not to permit "proposed activities" of certain types (Article 6(1)). "Proposed activities" is not a defined term in the Aarhus Convention, although "proposed activity" is a term used in the Espoo Convention where it is defined as "any activity or any major change to an activity subject to a decision of a competent authority in accordance with an applicable national procedure" (Espoo Convention, Article 1(v)), which is instructive in the Aarhus context.

The starting point of Article 6 is that it applies to all of the activities that are listed in Annex I to the Convention (Article 6(1)(a)). These activities track closely, but are not identical to, the similar list of activities contained in Appendix I of the Espoo Convention (following its Second Amendment).[258] It is Article 6(1)(a) and Annex I that make the Aarhus Convention a source of law, like the Espoo Convention and SEA Protocol, within the stream of converging environmental and nuclear law (Stream C). Annex I contains a list of specific nuclear activities falling under Article 6(1) and the Convention regime. In summary these are: nuclear power plants; other nuclear reactors (except small research reactors); the decommissioning of these plants and reactors; nuclear fuel reprocessing plants; nuclear enrichment plants; nuclear fuel and high-level radioactive waste facilities; radioactive waste repositories; and nuclear fuel and radioactive waste storage sites (Annex I(1)).

Annex I specifies other "activities", a number of which could be ancillary to the nuclear energy sector activities summarised above, including sites for the treatment or disposal of non-radioactive waste, major road improvement schemes, piers for loading and unloading large vessels, quarrying and the construction of electric power lines. Significantly, this longer list also includes: "Any activity not [otherwise listed] where public participation is provided for under an environmental impact assessment procedure in accordance with national legislation" (Annex I(20)). Accordingly, the right to public participation in decisions to undertake any of these activities encompasses both their potential radiological and non-radiological effects.

To the extent that there are any nuclear-related activities that do not fall under Annex I, Article 6(1)(b) is also relevant. It provides, secondarily, that the provisions of Article 6 should apply, in accordance with national laws, to "decisions on proposed activities *not listed in annex I*

258. See also the comparable list of "projects" in Annex I to the SEA Protocol, *supra* note 44. Note that Article 6(1)(a) applies the provisions of Article 6 to Annex I listed activities, without more; by contrast with the Espoo Convention, *supra* note 35, which, in its corresponding provision, Article 2(2) appears to set out a "double test" requiring the activity both to be one appearing in its Appendix I list and also to be one that is likely to cause "significant adverse transboundary impact". The activities listed in Annex I to the Aarhus Convention may be deemed to have significant environmental effects but no inquiry into that is required by Article 6(1)(a).

which may have a significant effect on the environment. To this end, Parties shall determine whether such a proposed activity is subject to these provisions" (emphasis added).[259]

The Annex I activities largely relate to fixed installations or activities at particular locations. They cover many, but not the entire range of, nuclear activities that are undertaken within some contracting parties for which state permitting may be required: for example, the transport of radioactive materials or the production and use of these materials for medical purposes. In cases where such activities do not require EIAs under national law (see the discussion of Annex I(20), *supra*), it is for individual governments to decide whether they may have a significant effect on the environment and whether the provisions of Article 6 should apply to them.[260]

Those who are entitled to participate in the relevant Article 6 decision making are "the public concerned".[261] This is a potentially narrower group than "the public" for the purpose of access to information under Article 4 and Article 5. The public concerned: "means the public affected or likely to be affected by, or having an interest in, the environmental decision making; for the purposes of this definition, non-governmental organizations promoting environmental protection and meeting any requirements under national law shall be deemed to have an interest" (Article 2(5)). The non-discrimination provision in Article 3(9) supplements this definition and allows for the public in countries outside the relevant contracting party who can show that they are likely to be affected by, or have an interest in, the permitting decision to participate in it.[262]

Procedural rights and processes for public participation are detailed in the other provisions of Article 6. They include:

- The public concerned being informed of the environmental decision-making procedure early and in a timely and effective manner (Article 6(2)).
- Notices to the public concerned with the decision making containing, at least, substantial information of the nature, substance, possible outcomes, procedural steps and timetable of that procedure; the availability of relevant environmental information and whether or not there is an EIA exercise also required (Article 6(2)(a)-(e)).
- Reasonable time frames within the procedure for the public to prepare and participate effectively (Article 6(3)).
- Public participation to take place early, "while all options are open" (Article 6(4)).
- Permit applicants encouraged to identify and to communicate with the public concerned (Article 6(5)).
- The public authorities responsible for the decision to provide access, as soon as available, to "all information relevant to the decision-making" (subject to the grounds for refusal provided for in Article 4). This information must include certain mandatory information,

259. The phrase "Parties shall determine" in Article 6(1)(b) is ambiguous, but the favoured interpretation is that it allows for each individual contracting party to make the relevant decision under this provision. See UNECE (2014), *The Aarhus Convention: An Implementation Guide*, *supra* note 249, p. 131.

260. What is environmentally "significant" is not defined in the Aarhus Convention. But see Espoo Convention, *supra* note 35, Appendix III(1).

261. Aarhus Convention, *supra* note 45, Articles 6(2), (5) and (6).

262. See Communication ACCC/C/2004/03 (Ukraine) "generally speaking, there are no provisions or guidance in or under Article 6, paragraph 2, on how to involve the public in another country in relevant decision-making, and that such guidance, seems to be needed". UNECE (2005), "Report of the Seventh Meeting", ECE/MP.PP/C.1/2005/2/Add.3, "Findings and Recommendations with regard to compliance by Ukraine with the obligations under the Aarhus Convention in the case of Bystre deep-water navigation canal construction (submission ACCC/S/2004/01 by Romania and communication ACCC/C/2004/03 by Ecopravo-Lviv (Ukraine))", Geneva, 16-18 Feb. 2005, para. 28.

such as a description of the significant effects on the environment from the proposed activity and any measures envisaged to prevent or reduce them (Article 6(6)).

- Rights for the public to submit, in writing or at a public hearing, information, analysis and comments (Article 6(7)).
- Due account taken of the public participation process in the eventual decision (Article 6(8)).
- The public to be informed promptly of that decision, along with the reasons for the decision (Article 6(9)).

Significantly, Article 6(10) provides that whenever the public authority has to *reconsider or update the activity's "operating conditions"* (emphasis added) (for example when there is an application for an existing permit extension or renewal) all the Article 6 steps and procedures described above, with necessary changes to suit the circumstances, have to be followed. The "where appropriate" proviso does not give the contracting party or its public authorities complete discretion to proceed with a reconsideration decision without regard to Article 6. It imports an objective test; for example, requiring consideration by the contracting party as to whether there is a proposed change in operations that itself may have different environmental effects from those current, whether there is new scientific information or environmental monitoring data that may alter understandings of the impacts of the continued activity or whether there are new groups and communities who could be affected, and possibly in different ways, by the activities under new or revised permitting conditions. Any of these factors may be reasons for undertaking a new exercise in public participation, even if not all issues considered in the original decision-making process are revisited.[263]

Case Study

Article 6: Public participation in environmental decision making

ACCC/C/2009/41 (Slovakia), ECE/MP.PP/2011/11/Add. 3

In this case, the communicant was the Austrian NGO "Global 2000/Friends of the Earth Austria". The public authority was the Slovak Republic Nuclear Regulatory Authority ((Úrad Jadrového Dozoru, UJD). The case dealt with a failure to provide for public participation as required by Article 6(10) in three (linked) decision-making processes for permits effecting changes (construction conditions, equipment changes, preliminary safety report modifications) to an existing construction permit granted prior to the Slovak Republic's ratification of the Convention for the development of units 3 and 4 at the Mochovce nuclear site (also alleged failures regarding Articles 9(2) and (3)). The ACCC found that:

- The changes were of a type and magnitude that amounted to a "reconsideration and update of the original operating conditions" of an Article 6(1)(a) activity (para. 55). Therefore Article 6(10) applied and public participation in the permitting change decisions was required.
- Article 6(10) applied even though the original permit pre-dated the adoption of, and the Slovak Republic's ratification of, the Convention.
- The "where appropriate" provision in Article 6(1) did not give the public authority complete discretion; objective factors were required to justify not applying Article 6.
- Public participation in a subsequent Espoo EIA procedure did not remedy the situation; the EIA process was a separate undertaking under a different regime. In the Slovak Republic, an EIA is not a permitting process and public participation after the change permits had been granted was not "early" as required by Article 6(4), which was invoked through Article 6(10).

263. In Communication ACCC/C/2009/41 (Slovakia, Mochovce Nuclear Power Plant), the ACCC found that "the clause 'mutatis mutandis, and where appropriate' does not imply complete discretion for the Party concerned to determine whether or not it was appropriate to provide for public participation." UNECE (2011), "Report of the Compliance Committee", ECE/MP.PP/2011/11/Add.3, Addendum, "Findings and recommendations with regard to communication ACCC/C/2009/41 concerning compliance by Slovakia (adopted by the Compliance Committee on 17 December 2010)", Chisinau, Moldova, 29 June - 1 July 2011, para. 55.

Attention is often focused on Article 6 and public participation in decision making about particular activities and the permitting processes around them. As explained earlier, however, the public participation rights created by the Aarhus Convention run wider. Article 7 is a "softer" provision than Article 6. It requires contracting parties to:

> make appropriate practical and/or other provisions for the public to participate during the preparation of *plans and programmes* that relate to the environment, within a transparent and fair framework, having provided the necessary information to the public. Within this framework, [Articles 6(3) (4) and (8) (*supra*)] shall be applied. […] To the extent appropriate, each Party shall endeavour to provide opportunities for public participation in the preparation of policies relating to the environment.[264]

There are two cross-cutting aspects to these rights under Article 7 that have implications for its application in practice, particularly in the nuclear energy field where the development of any nuclear facility typically involves a complex series, over time, of governmental and regulatory decision-making processes. The first issue is the distinction between what constitutes the preparation of a "plan" or "programme" under Article 7 and what amounts to a "decision to permit a proposed activity" to which Article 6, in full, applies. This question was confronted by the Compliance Committee in the 2006 Lithuania case concerning a major waste landfill development, where a detailed local waste management plan, despite its description and the fact that it was of a category that had been held out as a "plan" subject to Article 7 by the Lithuanian government in an Aarhus national implementation report, did in fact generate a permit decision that fell under Article 6(1) rather than Article 7.[265] As such, it was, of course, subject to a different process under the Convention than that which had been supposed. As the Compliance Committee observed, for "the Committee … when it determines how to categorize the relevant decisions under the Convention, their labels in the domestic law of the Party concerned are not decisive".[266]

The misclassification of a particular type of decision for the purposes of the Convention (i.e. whether it is within Article 6 or Article 7), be it by the contracting party, a public authority or the public, at the time of the relevant decision making, could have practical and legal consequences for the process itself and the resultant decision. There is a fine line between a "plan" to consider a future type of activity and a decision to undertake a specific activity. Tromans comments that "a decision which paves the way for a later decision on a specific activity can contain an Article 6-type decision as well as Article 7-type decisions; thus a plan or programme may contain elements which are capable of bringing it within the ambit of Article 6", going on to point out particular problems that might, in these circumstances, arise under the UK nuclear development and permitting regimes.[267]

264. Aarhus Convention, *supra* note 45, Article 7 (emphasis added). "The public" for the purpose of Article 7 is that identified by the relevant public authority". This is not thought to be as restrictive as "the public concerned" under Article 6 and is thereby a potentially wider group. See UNECE (2014), *The Aarhus Convention: An Implementation Guide*, *supra* note 249, p. 175.

265. Communication ACCC/C/2006/16 (Lithuania), UNECE (2008), "Report by the Compliance Committee", ECE/MP.PP/2008/5/Add.6, Addendum, "Compliance by Lithuania with its Obligations under the Convention", Riga, 11-13 June 2008.

266. *Ibid.*, para. 57.

267. Tromans, S. (2010), *supra* note 124, pp. 154-155.

The second issue concerns the interrelationship between Article 7 and strategic environmental assessment (particularly under the SEA Protocol), both being concerned with "plans and programmes". The SEA Protocol recites the Aarhus Convention and the Lucca Declaration[268] and, in Article 8, contains its own public participation provisions. These provisions of the Protocol are not identical to the public participation regime under Article 7 (read with Article 6(3) and (4)) of the Aarhus Convention. Accordingly, compliance with Article 8 of the SEA Protocol, in relevant cases, cannot be assumed to automatically fulfil the requirements of Article 7 of Aarhus and the two together should, for practical purposes, be treated as a combined "check sheet".

The plans and programmes within the field of application of Aarhus Article 7 are also significantly wider than under the SEA Protocol. They are not plans and programmes restricted to those "which are likely to have significant environmental, including health, effects" as in SEA Protocol, Article 4(1), but those simply "relating to the environment". The type of plans and programmes in which Article 7 may require the public to participate could go well beyond those contemplated in the SEA Protocol. These might include, for example, the budgeting plans of an environmental agency with responsibilities for aspects of regulating the nuclear energy sector, plans for the provision of new radiological monitoring services by a government health department or proposed public education campaigns on the health risks of radiation in the environment.

The other, wider aspect of the Aarhus Convention's Pillar 2 is public participation in the preparation of executive regulations and legally binding instruments. This is addressed in Article 8. Its purpose is closely connected with "the desirability of transparency *in all branches of government*" (Preambular para. 11 (emphasis added)).

In common with Article 6, and unlike Article 7, Article 8 concerns matters (i.e. the preparation of regulations and legal instruments) that "may have a significant effect on the environment", not merely those "relating to the environment". Like Article 7, but unlike Article 6, Article 8 refers to "the public" rather than "the public concerned". In other respects, it differs materially from the rest of the public participation regime in both Articles 6 and 7, in so far as: the obligation placed on contracting parties is a "best efforts" obligation and not an obligation of complete performance[269] and such express procedural entitlements as are granted to the public are non-specific and relatively weak.[270]

Article 8 is also relatively narrowly-focused: on situations where public authorities in a contracting party are themselves competent to make executive regulations or other legally binding rules of general application (e.g. directions, codes and standards) or where, as a matter of public administration, they play an expert or advisory role in the preparation of draft laws and regulations before transmission to legislative bodies. Article 8 stops short of providing for any Pillar 2 public participation in the legislative process itself. In many countries this would raise fundamental constitutional and political questions.

268. A Statement on the implementation, strengthening and future work under the Aarhus Convention made at the First meeting of the Aarhus Convention Parties in October 2002. UNECE (2004), "Report of the First Meeting of the Parties", ECE/MP.PP/2/Add.1, Addendum, "Lucca Declaration", Lucca, 21-23 Oct. 2002.

269. "Each Party shall strive to promote effective public participation …" Aarhus Convention, *supra* note 45, Article 8.

270. Aarhus Convention, *supra* note 45, Article 8 contemplates the promotion of effective public participation "at an appropriate stage, and while options are still open" during the preparation stage of relevant rulemaking, but expressly stipulates only three steps: (a) the fixing of timeframes for participation, (b) the publication of the draft rules in question and (c) giving the public, "directly or through representative consultative bodies", the opportunity to comment.

While, at least in theory, enforceable by members of the public and representative organisations under Article 9 of Pillar 3 of the Aarhus Convention (*infra*), Article 8 as a whole might be seen as more aspirational than proscriptive. Where, however, contracting parties do introduce measures intended to open the preparation of environmental legislation to public participation[271] the range of draft regulations and other instruments that are within their scope is potentially wide. In the nuclear field, this could for example extend to the setting of intervention levels for indoor concentrations of naturally occurring radon gas; proposed modifications to standard licence conditions for nuclear sites; new regulations for off-site radiological monitoring and reporting and the Justification decision regarding the introduction of a new nuclear technology (*supra*).

iii. *Pillar 3: Access to justice*

Pillar 3 of the Aarhus Convention is concerned with access to environmental justice within the national legal and administrative systems of the contracting parties. Specifically, it requires contracting parties to ensure that there are procedures and remedies available for those whose Convention rights under Pillars 1 and 2 have not been met (Articles 9(1) and (2)). It goes further than this. Pillar 3 obliges the parties to give members of the public (subject to certain qualifications) access to administrative or judicial procedures to challenge all acts and omissions of private, as well as public, bodies that contravene any aspect of national environmental laws (Article 9(3)). This third pillar not only creates a secondary set of obligations that underwrite the Convention's primary obligations with regard to public participation, but also a dynamic for the development of "environmental justice" generally among the contracting parties.

It is not the complete absence of rights to challenge, review and remedy in national systems so much as the quality of due process, the costs, the delays and rights of legal standing for certain groups in the exercise of those rights that inform the provisions of Pillar 3.[272] These access to justice rights are meant to be available to all, in national courts and tribunals, on a non-discriminatory basis and without reference to citizenship, nationality and domicile (Article 3(9)). Under Article 9(1) "any person" who considers that his or her rights to information under Article 4 have been unfulfilled should not only have access to a review procedure "before a court of law or another independent and impartial body established by law" but also an "expeditious procedure" that is "free of charge or inexpensive" under which the relevant public authority reconsiders the decision under challenge or there is a review by "an independent and impartial body other than a court of law."

Article 9(2) applies to challenges to the substantive or procedural legality of decisions made by, or relevant acts or omissions of, public authorities in meeting their public participation in decision-making obligations under Article 6 (and by reference and extension, Article 7). Reflecting the concept in Article 6, the Article 9(2) rights are for the "public concerned" with the additional condition of such persons either "having a sufficient interest" or "an impairment of a

271. E.g. Slovenia's Environmental Protection Act, ZVO-1, *Official Gazette of the Republic of Slovenia*, No. 39/06, official consolidated text No. 49/06. See generally UNECE (2014), *The Aarhus Convention: An Implementation Guide*, *supra* note 249, pp. 181-185.

272. See Mason, M. (2006), "Citizenship Entitlements Beyond Borders? Identifying Mechanisms of Access and Redress for Affected Publics in International Environmental Law", *Global Governance: A Review of Multilateralism and International Organizations*, Brill | Nijhoff, Vol. 12(3), pp. 283-303. See also UNECE (2005), "Report on the Seventh Meeting", ECE/MP.PP/C.1/2005/2/Add.1, Addendum, "Findings and Recommendations with regard to compliance by Kazakhstan with the obligations under the Aarhus Convention in the case of information requested from Kazatomprom (Communication ACCC/C/2004/01 by Green Salvation (Kazakhstan))", Geneva, 16-18 Feb. 2005.

right" (where this is required by the national law).[273] These particular rights are, similar to Article 9(1), the rights to access to a review procedure before a court of law "*and/or*" an independent body established by law, while not precluding other preliminary administrative reviews where these exist under national law.

The "catch all" access to justice provision is Article 9(3). It has potential application in cases where a challenge may not otherwise fall within Articles 9(1) or 9(2) (e.g. a claim of non-compliance with Article 8 (public participation during the preparation of executive regulators or legislative instruments) or where a person or organisation may not be able to meet the "sufficient interest" requirements of Article 9(2)). If members of the public meet any relevant national criteria, under Article 9(3), they are to "have access to administrative or judicial procedures to challenge acts and omissions by *private persons* and public authorities which contravene provisions of its national law relating to the environment" (emphasis added). These access rights thus extend beyond public authority decision making and administrative law to cases of liability and civil responsibility in private law.[274] In the nuclear context they would cover failures by regulatory bodies to carry out transboundary EIAs for new nuclear build where required under domestic laws implementing the Espoo Convention or to civil claims against a nuclear operator for alleged damage to property failing within the country's third party nuclear liability regime.

Echoing the earlier observation that Article 9 of the Aarhus Convention is as much about the modalities and practicalities of access to justice as the availability of justice itself, and giving Article 9(3) a potentially radical complexion, Article 9(4) goes on to lay down that all of the access to justice rights in Article 9(1), 9(2) and 9(3): "shall provide adequate and effective remedies, including injunctive relief as appropriate, and be fair, equitable, timely and not prohibitively expensive."[275]

273. In Article 9(2), what amounts to a "sufficient interest" and "impairment of right" is addressed. Although it is to be determined under the relevant national law, crucially, that determination is to be made "consistently with the objective of giving the public concerned wide access to justice within the scope of [the] Convention" and NGOs satisfying the requirements of Article 2(5) are deemed to have sufficient interest or, where necessary, an impairment of right. The relevant part of Article 2(5) refers to NGOs "promoting environmental protection and meeting any requirements under national law". See UNECE (2006), "Report of the Meeting", ECE/MP.PP/C.1/2006/4/Add.2, Addendum, "Findings and Recommendations with regard to compliance by Belgium with its obligations under the Aarhus Convention in relation to the rights of environmental organizations to have access to justice (Communication ACCC/C/2005/11 by Bond Beter Leefmilieu Vlaanderen VZW (Belgium))", Geneva, 14-16 June 2006; Judgment of the Court (Fourth Chamber) of 12 May 2011, Bund für Umwelt und Naturschutz Deutschland, Landesverband Nordrhein-Westfalen eV v Bezirksregierung Arnsberg, C-115/09, EU:C:2011:289.

274. Communication ACCC/C/2006/18 (Denmark), UNECE (2008), "Report by the Compliance Committee", ECE/MP.PP/2008/5/Add.4, Addendum, "Compliance by Denmark with its Obligations under the Convention", Riga, 11-13 June 2008.

275. See general discussion in UNECE (2014), *The Aarhus Convention: An Implementation Guide*, *supra* note 249, pp. 195-197.

Case Study
Article 9: Access to justice
North East Pylon Pressure Campaign Ltd & Sheehy v An Bord Pleanála & Ors
Court of Justice of the European Union (First Chamber), C-470/16, Judgment 15 March 2018, EU:C:2018:185

This case arose from a request for preliminary ruling from the High Court of Ireland under Article 267 of the Treaty on the Functioning of the European Union in relation to a costs order made by the Irish courts against the applicants in their unsuccessful application for judicial review of a decision by the Irish planning appeals board giving development consent for the erection of pylons carrying high-voltage transmission cables connecting the electricity grids of the Republic of Ireland and Northern Ireland. The grounds of challenge included, but were not limited to, infringement of rules in relation to public decision making in environmental matters. The fundamental question was whether the requirement of Article 9(4) of the Aarhus Convention that the costs of procedures to enforce public participation rights derived from the Convention should not be "prohibitively expensive" applied to the entire costs of the proceedings to seek judicial review or just to that part of the costs that could be related to those particular rights (which would apparently be the case under national law and the EU implementing legislation on which it was based). The Court's findings included:

- A case such as the one brought by the applicants in the main proceedings in Ireland came with Article 9, and specifically Article 9(4).
- Article 9(4) did not lay down precise rules that directly answered the question and the Convention as a whole did not have direct effect in national law.
- But, whatever rules the Irish courts decided to apply, they had to interpret their national procedural law, "to the fullest extent possible [] consistent with the objectives laid down in Article 9(3) and (4) of the Aarhus Convention, so that judicial procedures are not prohibitively expensive" for the applicants (para. 57).
- The "not prohibitively expensive" requirement of the Aarhus Convention applied to the whole of the An Bord Pleanála's costs of the unsuccessful application for leave that the Irish court had awarded against the applicants. Viewed in the round, the entirety of the applicants' legal challenge should be regarded as seeking to ensure that national environmental law was being complied with.

c. *Application of the Aarhus Convention in national law*

The Aarhus Convention is, first and foremost, concerned with the contracting parties guaranteeing within their own laws the third party legal rights contemplated by the Convention. In Convention countries, many of these rights were already provided in existing laws and procedural and administrative rules. In virtually all countries, however, some changes have been needed to achieve compliance. There have been national implementing laws with a dominant and explicitly Aarhus character, such as Poland's Act on Providing Information on the Environment and Environmental Protection, Public Participation in Environmental Protection and on Environmental Impact Assessment 2008 (as amended in 2010); Norway's Act of 9 May 2003 No. 31 Relating to the Right to Environmental Information and Public Participation in Decision-making Processes Relating to the Environment (Environmental Information Act); and Iceland's Act No. 23/2006, on Access to Information on Environmental Matters (with Act No. 140/2012, on Access to Information). The larger number of legislative changes, however, have been through modifications to existing sectoral-specific laws, such as planning and development, waste management licensing, local government, product labelling and integrated pollution control. In Ireland, for example, there have been over 60 pieces of legislation to implement the Convention.[276] The national implementation of the Convention has also taken the form of changes to court rules of procedure[277] and public information

276. Government of Ireland; Department of the Environment, Climate Change and Communications (2021), "Aarhus Convention", www.gov.ie/en/publication/b3b1a-aarhus-convention (accessed 6 June 2021).

277. E.g. in the United Kingdom under the Civil Procedure Amendment Rules 2013, S.1 2013 No. 26 (L.1).

initiatives such as Portal U, a central online information portal of the environmental administration in Germany, which was set up in response to Article 5 of the Convention and served as a central access point to publicly held environmental information and data.

The national courts play a key role through the judgments and case law that have developed around national implementation of the Convention. In the United Kingdom, for example, the English Court of Appeal, determined in the case of Morgan & Another v Hinton Organics (Wessex) Ltd,[278] that while the Aarhus Convention was not directly incorporated into English law, it might "be taken into account [by the courts] in resolving ambiguities in [national] legislation intended to" implement it.[279] In the case of judicial review proceedings brought by Greenpeace Ltd challenging the UK government's process of reviewing the future of nuclear new build, the court held that the government's "in principle" decision to support new build should have been supported by the "fullest consultation" with the public for it to have been consistent with the public participation obligations accepted by the UK government when acceding to the Aarhus Convention.[280] These Convention obligations were a highly material consideration that should have informed the government's decision on how to proceed.[281] As the judge in the Morgan case commented, the ratification of the Aarhus Convention by (the then) European Community "gives the European Commission the right to ensure that Member States [of the EU] comply with the Aarhus [Convention] obligations in areas within [the EU's] competence".[282]

The EU has a particularly important role in the implementation of the Convention, not least with more than half the current signatories to the Convention also being EU member states. The EU has international law obligations as a party to the Convention to use all its co-ordination, legislative and jurisdictional competences to implement the Convention's requirements, not only within its own institutions and operations, but also in ways that have effect on the laws and procedures of individual EU member states. For this reason, the rulings of the Court of Justice of the European Union have been influential in the development of both EU and national laws relating to the Convention, particularly in respect of Pillar 3 and NGOs' rights of standing and protections against prohibitively expensive costs (*supra*).[283]

The key EU-wide legal instruments introducing Aarhus principles into EU law, and through that into national laws of EU member states, are the EU Directive on public access to environmental information and the EU Directive relating to the environment and public participation.[284] This corpus of implementing law that has grown within the EU applies to the nuclear and radiological sectors, and to nuclear activities, as much as any other area of industrial or human activity within the EU.

278. Morgan & Another v Hinton Organics (Wessex) Ltd [2009] EWCA Civ 107.
279. *Ibid.*, para. 22.
280. R (Greenpeace Ltd) v Secretary of State for Trade and Industry [2007] EWHC 311 (Admin), para. 51.
281. *Ibid.*, para. 53.
282. Morgan, *supra* note 278, para. 22.
283. See Judgment of the Court (Second Chamber) of 7 October 2004, Commission v France (Étang de Berre), C-239/03, ECR I-09325, EU:C:2004:598.
284. Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC, OJ L 41 (14 Feb. 2003), p. 26; Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC, OJ L 156 (25 June 2003), p. 17. For instruments relating to the workings of the EU itself see Regulation (EC) No 1367/2006 of the European Parliament and of the Council of 6 September 2006 on the application of the provisions of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters to Community institutions and bodies, OJ L 264 (25 Sept. 2006), p. 13; Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents, OJ L 145 (31 May 2001), p. 43.

d. *Aarhus Convention institutions and compliance mechanisms*

The Convention provides for its own framework of bodies and systems to keep the implementation and future development of the Convention under review. These include the Meeting of the Parties, to be held at least once every two years (Article 10)[285] and at which the IAEA is specifically accorded observer status (Article 16(4)). In keeping with the objective under Article 1, the Convention also gives environmental NGOs access to the MOP, as observers, at which they are entitled to seek to address the meeting,[286] without voting rights. There is a Secretariat to the Convention, the role being met by the Executive Secretary of the UNECE (Article 12).

There are conventional mechanisms for disputes between the contracting parties concerning the interpretation or application of the Convention (including submission to arbitration or the ICJ).[287] Of particular importance, however, is the Aarhus Convention Compliance Committee that was established at the First Meeting of the Parties.[288] The Compliance Committee has a broad mandate, including preparing reports on compliance and implementation at the request of a MOP and considering submissions and communications, including on individual compliance situations at national level, from contracting parties, intergovernmental and non-governmental organisations and private individuals.[289]

In these cases, the Compliance Committee has no power to give legally binding decisions, but it makes evaluations and findings and can give recommendations to the MOP, which are publicly available (and which may lead to further measures under the Convention at the contracting party level).[290] The Compliance Committee has, over several years, examined and made findings on a number of individual cases relating to the energy sector and nuclear activities. As well as those cases highlighted in the case studies, the Compliance Committee has considered, among others:[291]

- Hungary (ACCC/C/2014/105): the extension of the Paks nuclear power plant in relation to timely access to information (Articles 4(2) and (3)) and availability of information concerning environment policy proposals (Article 5(7)).

285. In practice, however, the meetings have occurred every three years, starting in 2002, with the Seventh MOP postponed from 2020 until 2021.

286. Aarhus Convention, *supra* note 45, Article 10(5) and Rule 27, Convention Rules of Procedure under Aarhus Convention, Article 10(2)(h). UNECE (2004), "Report of the First Meeting of the Parties", ECE/MP.PP/2/Add.2, Addendum, "Decision I/1: Rules of Procedure", Annex, "Rules of Procedure of the Meeting of the Parties to the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters", Lucca, Italy, 21-23 Oct. 2002.

287. Aarhus Convention, *supra* note 45, Article 16 and Annex II.

288. UNECE (2004), ECE/MP.PP/2/Add.8, *supra* note 252.

289. See generally UNECE (2019), *Guide to the Aarhus Convention Compliance Committee*, UNECE, Geneva; UNECE (2014), *The Aarhus Convention: An Implementation Guide*, *supra* note 249, pp. 222-224.

290. See the UK Supreme Court judgment in Walton v the Scottish Ministries (Scotland) [2013] PTSR51 in which the court observed that "…the decisions of the [Aarhus Convention Compliance] Committee deserve respect on issues relating to standards of public participation", para. 100.

291. The ACCC has issued findings in other nuclear-energy related cases as well, including: Czech Republic (ACCC/C/2012/71), ECE/MP.PP/C.1/2017/3; United Kingdom (ACCC/C/2012/77), ECE/MP.PP/C.1/2015/3; Slovakia(ACCC/C/2013/89), ECE/MP.PP/C.1/2017/13; Germany (ACCC/C/2013/92), ECE/MP.PP/C.1/2017/15; and Czech Republic (ACCC/C/2013/106), ECE/MP.PP/C.1/2020/3. Slovakia (ACCC/C/2009/41), ECE/MP.PP/2011/11/Add.3 and Belarus (ACCC/C/2009/44), ECE/MP.PP/C.1/2011/6/Add.1 were addressed in the case studies. A compilation of ACCC findings from 18 February 2005 until 5 February 2021 is available at: https://unece.org/sites/default/files/2021-02/Compilation_of_CC_findings_05.02.2021_eng.pdf (accessed 25 May 2021).

- Romania (ACCC/C/2010/51): concerning the construction of a new nuclear power plant where NGOs alleged failures to respond to information requests (Article 4(1)), inadequate responses to requests (Articles 4(3), (4) and (7)) and failure to provide adequate time for consideration of information (Article 4(3)).
- United Kingdom (ACCC/C/2013/91): concerning the rights of an individual German communicant to participate in any EIA process concerning the proposed Hinkley Point C nuclear power plant and the application of Articles 6(2), (5) and (7) to the decision-making process and the interpretation of "the public" and "the public concerned" under Articles 2(4) and (5).
- The Netherlands (ACCC/C/2014/104): concerning a proposed amendment/extension to the Borssele nuclear power plant operating licence where an NGO contended that the decision making was subject to Article 6(1)(a) or 6(10) and that, in these circumstances, there had been inadequate opportunity for public participation pursuant to Article 6(4) and inadequate information provided by the public authority contrary to Article 6(6).

Whether it is by direct accession or through the Convention's role as a model for similar intergovernmental agreements,[292] or through the ongoing nuclear sector cases before the Compliance Committee, the Aarhus Convention is likely to influence the future direction of Stream C of the international legal framework under discussion.

Part 3. Conclusion: A review and look to the future

The body of international nuclear law that has developed over the past seven decades is unique in a number of respects. First, there is its intense focus on the safety of nuclear activities and the security of the radioactive materials that are used in those activities. There is also its special regimes of safeguards and third party nuclear liability. All these aspects relate, in one way or another, to the particular hazards of ionising radiation. Second, it has special, if not unique, qualities in the sheer volume of laws, "hard" and "soft", which it comprises – from the Recommendations of the ICRP to the Convention on Nuclear Safety – and in the wide breadth of international adherence to many of its elements.[293]

While this may be the case, international nuclear law is not a wholly self-contained body of law; it is neither remote nor partitioned off from other areas and disciplines of international law. It has grown alongside and has informed, and been informed by, broad international law developments, especially, as the analysis and discussion in this article seeks to show, those in the field of international environmental law.

292. Although the Aarhus Convention is open to any member of the UN if approved by the MOP, there was still a recent initiative of the 33 countries of Latin America and the Caribbean to draft a regional environmental agreement. The Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean, or the "Escazú Agreement", was adopted on 4 March 2018, and was modelled entirely off of the three pillars of the Aarhus Convention. Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean (2018), C.N.195.2018.TREATIES-XXVII.18, entered into force 22 Apr. 2021 (Escazú Agreement).

293. For example, as of 27 May 2021, the CNS, *supra* note 37, counts 91 contracting parties; the Joint Convention, *supra* note 38, counts 84 contracting parties; the 1980 Convention on the Physical Protection of Nuclear Material, IAEA Doc. INFCIRC/274 Rev. 1, 1456 UNTS 125, entered into force 8 Feb. 1987, counts 162 contracting parties; and the 1968 Treaty on the Non-Proliferation of Nuclear Weapons, IAEA Doc. INFCIRC/140, 729 UNTS 169, entered into force 5 Mar. 1970, counts 191 states parties.

It is true that some international treaties and conventions devoted to environmental protection, such as the 1989 Basel Convention, cede the field to nuclear law where it contains its own international controls applying specifically to radiological materials.[294] There is, however, no "general ionising radiation exclusion" in international environmental law. The priority accorded to safety under nuclear law has an intimate relationship with wider laws on environmental protection. Much of the case law of the ICJ and other international tribunals on environmental questions and major international environmental instruments, such as the Stockholm and Rio Declarations, apply as much to nuclear activities and their radiological impacts on the environment as they do to the activities of other industrial and commercial sectors. The key principles of international environmental law that have been extrapolated from these sources of law do so as well.

Nuclear law has itself developed environmental protection norms and standards through nuclear-specific international instruments and treaties and conventions, which have met, and in some instances gone beyond, general trends and expectations, as for example in relation to Justification. Nuclear law's focus on controlling the effects of ionising radiation on the environment, as well as on people, has become progressively intensive.[295] Since the UN Convention on the High Seas in 1958, there have been numerous treaties and conventions that have general environmental application and at the same time make express provision for environmental protection for nuclear activities and in which nuclear law and environmental law effectively "converge" in a single instrument. Notable in this context are the three UNECE instruments discussed above: the Espoo Convention, the SEA Protocol and the Aarhus Convention. The "case law" that has emerged following their implementation is derived to an appreciable extent from their application to situations involving nuclear activities.

Protection of the environment has emerged as a philosophy and policy of nuclear law, from which it has developed processes and procedures that are incorporated into many facets of decision making in the nuclear sector. Transparency, the sharing of intentions and information and openness to the scrutiny of, and participation by others, in decision making are now hallmarks of modern international environmental law. They are also singular features of the international framework of environmental protection for nuclear activities, which this article delineates and describes. It is a framework comprised of sources drawn both from mainstream environmental law and international nuclear law, but which can be seen as integrated and coherent and which allows for its own further development.

What those future developments will be may depend not only on future trends and ambitions within the sphere of international environmental law but also on the part nuclear activities may play, and the new technologies these might entail, in meeting the current challenge of global climate change. Technological innovations in the nuclear sector, such as the commercial operation of SMR fleets, the introduction of Generation IV reactor types and the deployment of nuclear power plants in cogeneration schemes as well as for conventional generation of baseload electricity,[296] may raise new questions as to whether, and in what ways, the law is needed to protect the environment from any impacts of these new types of activity. It may prove to be the case that the protection of the environment against radiological impacts will become primarily an issue for older nuclear

294. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989), 1673 UNTS 57, entered into force 5 May 1992, Article 1(3).

295. See ICRP 103, *supra* note 26, Chapter 8, and ICRP (2014), "Protection of the Environment under Different Exposure Situations: ICRP Publication 124", *Annals of the ICRP*, Vol. 43, No. 1, SAGE, London.

296. See The Royal Society (2020), *Nuclear cogeneration: civil nuclear energy in a low-carbon future*, Policy Briefing, The Royal Society, London.

technologies entering a "sunset" phase, with the long-term management of radioactive waste the foremost concern. Nuclear's "sunrise" technologies may demand as much attention be given to the non-radiological aspects as to their, potentially less significant, radiological effects on the environment. Under that scenario, the ever greater coalescence of international nuclear law and international environmental law may be the leitmotif of the future development of the international legal framework of environmental protection for nuclear activities.

Chapter 4

Nuclear transport, nuclear security and safeguards

Experience in the application of the IAEA *Code of Conduct on the Safety and Security of Radioactive Sources*

*by Hilaire Mansoux and Anthony Wetherall**

A. Introduction

In the 1990s, international concerns regarding the safety of sealed radioactive sources eventually led the International Atomic Energy Agency (IAEA) to adopt a legally non-binding code of conduct in 2000, the *Code of Conduct on the Safety and Security of Radioactive Sources*.[1] After the terrorist attacks of 11 September 2001 (9/11), sealed radioactive sources that were primarily considered a safety concern in the past were now considered to also present a security risk. The impact of the tragic events of 9/11 and the rise in security concerns brought about an extensive revision of the earlier Code of Conduct, resulting in the adoption in 2003 of a revised *Code of Conduct on the Safety and Security of Radioactive Sources* (2003 Code of Conduct).[2]

The 2003 Code of Conduct was first drafted in open-ended technical and legal meetings of representatives of IAEA member states. It was then adopted by the IAEA Board of Governors (Board) and subsequently endorsed by the IAEA GC in 2003. Once approved and endorsed, the Code of Conduct is considered a legal instrument of a non-binding nature, prepared at the

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The co-authors thank Mr. Stephen Evans, lecturer at the International School of Nuclear Law and former IAEA staff member, for his very useful critique and insights. The authors also thank Mr Adeeb Jonathan Haddad from the IAEA Office of Legal Affairs for his valuable expert research assistance.

1. IAEA (2000), *Code of Conduct on the Safety and Security of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/2001. In 2004, another Code of Conduct was adopted by the IAEA: IAEA (2006), *The Code of Conduct on the Safety of Research Reactors*, IAEA Doc. IAEA/CODEOC/RR/2006. In 1990, an IAEA Code of Practice was adopted. IAEA (1990), "Code of Practice on the International Transboundary Movement of Radioactive Waste", IAEA Doc. INFCIRC/386. The terms "Code of Conduct" or "Code of Practice" are used with no substantial difference in meaning. In contrast with the two IAEA Codes of Conduct, this Code of Practice was not "adopted" by the Board and subsequently "endorsed" by the General Conference (GC). Rather, the Board decided to take the action as suggested in paragraph 7 of document GOV/2445 and requested the Director General to transmit the Code of Practice to the GC, with a recommendation to adopt the Code, ensure its wide dissemination and monitor its implementation. See IAEA Board of Governors, Record of GOV/OR Meeting 730, 14 June 1990, paras. 84-86. Thereafter, the General Conference on 21 September 1990, by resolution GC(XXXIV)/RES/530, adopted the Code of Practice. See IAEA (1990), GC Resolution: "Measures to Strengthen International Co-operation in Matters relating to Nuclear Safety and Radiological Protection, Code of Practice on the International Transboundary Movement of Radioactive Waste", IAEA Doc. GC(XXXIV)/RES/530, adopted on 21 Sept. 1990, para. 1.

2. IAEA (2004), *Code of Conduct on the Safety and Security of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/2004, endorsed in IAEA (2003), GC Resolution: "Measures to Strengthen International Cooperation in Nuclear, Radiation and Transport Safety and Waste Management," IAEA Doc. GC(47)/RES/7, adopted on 19 Sept. 2003, para. B.2.

international level, to offer guidance and principles to states for the development and harmonisation of national policies, laws, and regulations and sets forth desirable attributes to strengthen the control of radioactive sources.

Since its adoption, the 2003 Code of Conduct has received international recognition and endorsement and forms the basis of many national and international regulations on the use of radioactive sources. It is now recognised as the principal international instrument for both the safety and the security of radioactive sources. It has also been strengthened through the development of two supplementary guidance documents. In 2003-2004, the IAEA began efforts to improve the security of sources transferred across borders. The first document, the supplementary *Guidance on the Import and Export of Radioactive Sources*, first adopted in 2004 and then revised in 2011, aims to provide for an adequate transfer of responsibility when a source is being transferred from one state to another.[3] The second document, the supplementary *Guidance on the Management of Disused Radioactive Sources* was adopted in 2017.[4] This supplementary document 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.

As a counterbalance to the legally non-binding nature of the 2003 Code of Conduct and its supplementary guidance documents, states have an opportunity, pursuant to the relevant resolutions of the GC, to provide political support for their implementation through unilateral political commitments. In addition, the 2003 Code of Conduct and its supplementary guidance documents are not static instruments. For example, they are reviewed on a regular basis and may be amended if required following consensus on proposed amendments. Since 2006, a formal review mechanism has been implemented that includes triennial IAEA international information exchange meetings that provide a unique opportunity to share experiences and lessons learnt on implementation and for collective learning by experience.

Support for the 2003 Code of Conduct and fulfilment of its objectives are expressly and implicitly reflected in the IAEA's work and integrated into appropriate IAEA safety and security review services, technical co-operation projects and extra-budgetary programmes. Moreover, they are reflected in the IAEA's biennial regular programme of activities[5] and the IAEA Technical Cooperation Programme[6] as financed from the Technical Cooperation Fund and extra-budgetary contributions.

This paper discusses experience in the application of the 2003 Code of Conduct. Part B of this paper identifies some features and uses of radioactive sources. Part C then describes the development of the Code of Conduct leading to the 2000 version and the revised version in 2003 and identifies the scope, objectives and main elements of the document. Thereafter, Part D discusses the supplementary *Guidance on the Import and Export of Radioactive Sources*,

3. IAEA (2005), *Guidance on the Import and Export of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/IMP-EXP/2005, IAEA, Vienna (2004 Import-Export Guidance); IAEA (2012), *Guidance on the Import and Export of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/IMO-EXP/2012, IAEA, Vienna (2011 Import-Export Guidance).

4. IAEA (2018), *Guidance on the Management of Disused Radioactive Sources*, IAEA Doc. IAEA/CODEOC/MGT-DRS/2018, IAEA, Vienna.

5. IAEA (2019), *The Agency's Programme and Budget 2020–2021*, IAEA Doc. GC(63)/2, IAEA, Vienna. In respect of the 2003 Code of Conduct and its supplementary guidance, see *ibid*., Major Programme 3, Programme 3.3 Radiation and Transport Safety and Programme 3.5 Nuclear Security, pp. 111-114, 117-122.

6. Information on the programme can be obtained through the IAEA's webpage, "Technical cooperation programme", available at: www.iaea.org/services/technical-cooperation-programme (accessed 6 June 2021).

including its development, revision, objectives, scope and elements. Part E describes the supplementary *Guidance on the Management of Disused Radioactive Sources*, including its development, objectives, scope and elements. Part F considers the political commitments that have been given by member states to the 2003 Code of Conduct and its supplementary guidance. Finally, aspects of the implementation of the 2003 Code of Conduct and its supplementary guidance are considered in Part G**,** including the formalised process of information exchange. Annex I provides a more comprehensive history of the development of the 2003 Code of Conduct. Annex II provides additional details on the formalised process.

B. Radioactive sources

Radioactive material, including radioactive sources, is used throughout the world for a variety of purposes in medicine, industry, agriculture, research and education. Sealed radioactive sources are radioactive material permanently sealed in a capsule or closely bonded in a solid form. Sealed radioactive sources are typically small, ranging in size from a few millimetres to several centimetres. However, some specialised designs may be almost 50 centimetres in length. Their small size, coupled with the wide variety of designs and radiation output, have significant implications for their safe use and the security of such sources.

Devices containing radioactive sources are used by most nations in wide-ranging medical and industrial applications These radioactive sources are routinely transported worldwide on public roads, railways and ships. Radioactive sources utilise a wide range of radionuclides and amounts of radioactive material. Since the 1950s, radionuclides produced artificially in nuclear facilities and accelerators, including cobalt-60, strontium-90, caesium-137 and iridium-192, have become widely used.

Radioactive sources are commonly used in a variety of medical applications for both diagnosis and therapy. They are also used for medical equipment sterilisation and similar non-clinical functions. Radioactive sources used in medical applications can be very powerful and therefore have the potential to cause serious and life-threatening injuries if they are used improperly or maliciously, become lost or are stolen. Radiation therapy (teletherapy) devices commonly use cobalt-60 or caesium-137 as the source of radiation. Another common medical use of radioactive sources is brachytherapy, during which the source is placed in direct internal contact with the patient’s affected organs. In more recent years, radioactive sources have also been used to perform stereotactic radiosurgery using a device called a gamma knife to perform non-invasive treatment of tumours and other abnormalities in the brain.

One of the most common industrial uses of radioactive sources is gamma radiography for non-destructive testing by using the penetrating characteristics of gamma radiation to inspect welds, such as those in gas and water pipelines, and to look inside solid materials for flaws that cannot be seen with the naked eye. Radioactive sources are also widely used in agricultural applications, for food sterilisation and even for the eradication of insect pests.

Given their small dimensions and very wide application globally, it is not uncommon for radioactive sources to be inadvertently incorporated into scrap metal and encountered in the normal course of business in the metal recycling industry. In recent years, advances have been made to reliably identify and safely manage inadvertent contamination of metals destined for recycling into new commercial products, but this remains a significant safety issue at the global level.

C. IAEA *Code of Conduct on the Safety and Security of Radioactive Sources*

1. Development and revision of the Code of Conduct

When used in accordance with their design and as recommended by manufacturers and suppliers, radioactive sources have many benefits for mankind and the environment. Although the vast majority of radioactive sources located all over the world are used in a safe and secure manner, accidents involving radioactive sources have occurred, some with serious, even fatal, consequences. When these sources are lost, stolen, or make their way into untrained or malicious hands, the consequences can be severe, even deadly in some cases. The risks posed by these sources vary widely depending on such factors as the radionuclides used, their physical and chemical form and their activity (see below).

In the 1990s, there was growing concern about radioactive sources that (for one reason or another) were not subject to regulatory control or over which regulatory control had been lost. Since then, a series of international conferences in Dijon (1998), Buenos Aires (2000), Vienna (2003) and Bordeaux (2005) helped to shape the international legal framework applicable to the safety and security of radioactive sources.

The origins of the Code of Conduct can be traced back to the International Conference in Dijon in 1998, which led to the development of an international Action Plan approved in September 1999. Pursuant to the Action Plan, meetings of legal and technical experts were held in March and July 2000, and lead to the development of the *Code of Conduct on the Safety and Security of Radioactive Sources*. This Code of Conduct was adopted on 22 September 2000. Part A. of Annex I provides an overview of the background to the development of this IAEA Code of Conduct in September 2000.

The 1998 Dijon International Conference (and the 2000 Buenos Aires International Conference) took place primarily in response to the growing realisation that inadequate controls over radioactive sources had led to significant radiological accidents, some of which had caused serious injuries, even death, and/or severe economic disruption.[7] These accidents had their origins mainly in a breakdown or absence of proper regulatory control and were not the result of malicious intent.

A number of provisions of the IAEA *Code of Conduct on the Safety and Security of Radioactive Sources* that were adopted in 2000 were relevant to maintaining control over sources. Some of those provisions explicitly referred to the need for "security". However, the focus of those provisions was on incidents such as persons stealing shiny objects for scrap metal resale, unaware of the risks to health and the environment. No consideration was given at that time to the deliberately criminal use of sources in radiological dispersal devices or other malicious devices.[8]

7. Although the 2003 Code of Conduct's provisions addressed security, the focus at that time was very much on incidents such as radioactive sources in scrap metal. No consideration was given to the possible use of sources for malicious purposes, such as radiological dispersal devices. At that time, agreement was not reached on several issues, notably those relating to the creation of comprehensive national registries for radioactive sources, obligations of states exporting radioactive sources, and the possibility of unilateral declarations of support.

8. McIntosh, S. and K. Cutler (2015), "The Code of Conduct on the Safety and Security of Radioactive Sources; Past, Present and Future", in IAEA (2015), *Safety and Security of Radioactive Sources: Maintaining Continuous Global Control of Sources throughout Their Life Cycle*, *Proceedings of an International Conference on the Safety and Security of Radioactive Sources: Maintaining Continuous Global Control of Sources throughout Their Life Cycle*, *Abu Dhabi, United Arab Emirates, 27-31 October 2013*, IAEA Doc. STI/PUB/1667, IAEA, Vienna.

The tragic events of 9/11, and subsequent concerns regarding the possible use of radioactive sources 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 radioactive sources. An outcome at that time was the development of a draft revised Code of Conduct, first prepared in 2002 and subsequently modified in 2003. The 2003 March Vienna (Hofburg) International Conference also highlighted the need to strengthen controls over the security of radioactive sources. The revised Code of Conduct was adopted in September 2003.

Revisions to the 2000 Code of Conduct elaborated on and added provisions relevant to physical protection and security and to further strengthen safety, including access controls, national registries, training, notification requirements, orphan source recovery, import/export guidelines, emergency planning, inspections and enforcement. One vitally important addition to the revised 2003 Code of Conduct is the categorisation of radioactive sources contained in Annex 1 of the document.[9] Part B of Annex I of this article provides an overview of the background to the development of the revised 2003 Code of Conduct.

2. *2003* Code of Conduct on the Safety and Security of Radioactive Sources

a. Objectives

The 2003 Code of Conduct is aimed primarily at governments with the objective of achieving and maintaining a high level of safety and security of radioactive sources through the development, harmonisation and enforcement of national policies, laws and regulations, and through the fostering of international co-operation. Although the 2003 Code of Conduct is directed at governments, it clearly states that the prime responsibility for radioactive sources should be with the persons who are granted the relevant authorisations.[10]

The 2003 Code of Conduct relies on existing international standards relating to nuclear, radiation, radioactive waste and transport safety and to the control of radioactive sources. It is intended to complement existing international standards in these areas.[11] However, the document is not part of the IAEA Safety Standards Series or the Nuclear Security Series of publications.

As expressed in paragraph 5(a), the objectives of the 2003 Code of Conduct are, through development, harmonisation 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 radioactive sources;

(ii) prevent unauthorised access or damage to, and loss, theft or unauthorised transfer of, radioactive sources, 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

9. Wheatley, J.S. (2004), "Revised IAEA Code of Conduct on the Safety and Security of Radioactive Sources", in International Radiation Protection Association (IRPA), *Proceedings of the 11th International Congress of the International Radiation Protection Association*, IRPA, Madrid, Spain.

10. For a critical discussion of the 2000 Code of Conduct, see Boustany, K. (2000), "A Code of Conduct on the Safety of Radiation Sources and the Security of Radioactive Materials: A New Approach to the Normative Control of a Nuclear Risk?", *Nuclear Law Bulletin*, No. 65, OECD Publishing, Paris, p. 7, and Boustany, K. (2001), "The IAEA Code of Conduct on the Safety of Radiation Sources and the Security of Radioactive Materials. A Step Forwards or Backwards?", *Nuclear Law Bulletin*, No. 67, OECD Publishing, Paris, p. 9.

11. Reyners, P. (2010), "Three International Atomic Energy Agency Codes", *International Nuclear Law: History, Evolution and Outlook*, OECD Publishing, Paris, p. 171.

(iii) mitigate or minimise the radiological consequences of any accident or malicious act involving a radioactive source.

These objectives should be achieved through the establishment of an adequate system of regulatory control of radioactive sources, applicable from the stage of initial production to final disposal, and a system for the restoration of such control if it has been lost. The 2003 Code of Conduct aims to foster international co-operation in order to achieve these objectives. *Ibid*.

b. Scope of the 2003 Code of Conduct

The 2003 Code of Conduct applies to all sealed radioactive sources[12] that may pose a significant risk to individuals, society and the environment as referenced in Annex I of the Code.[13] "Significant risk" as used in the 2003 Code of Conduct (see paragraph 5), refers to severe deterministic health effects, including permanent injury and death. Table I of the 2003 Code of Conduct "provides a categorisation by activity levels for radionuclides that are commonly used. These are based on D-values which define a dangerous source, i.e. a source that could, if not under control, give rise to exposure sufficient to cause severe deterministic effects."[14] The sealed radioactive sources covered by the 2003 Code of Conduct include, with some modification, sources in Categories 1 to 3 of the categorisation developed in IAEA-TECDOC-1344, which includes five categories.[15] With regard to unsealed sources, a preambular paragraph in the 2003 Code of Conduct notes that, although the contents of the Code of Conduct should not be applied precisely to unsealed radioactive sources, states are encouraged to regulate them under similar principles in some circumstances.

12. Under the 2003 Code of Conduct, *supra* note 2, p. 3, sec. I.1, "Definitions", "'radioactive source' means radioactive material that is permanently sealed in a capsule or closely bonded, in a solid form and which is not exempt from regulatory control. It also means any radioactive material released if the radioactive source is leaking or broken, but does not mean material encapsulated for disposal, or nuclear material within the nuclear fuel cycles of research and power reactors."

13. Annex 1 to the 2003 Code of Conduct, *supra* note 2, p. 15, lists the sources covered by the code:

> Category 1 sources, if not safely managed or securely protected would be likely to cause permanent injury to a person who handled them, or were otherwise in contact with them, for more than a few minutes. It would probably be fatal to be close to this amount of unshielded material for a period of a few minutes to an hour. These sources are typically used in practices such as radiothermal generators, irradiators and radiation teletherapy. Category 2 sources, if not safely managed or securely protected, could cause permanent injury to a person who handled them, or were otherwise in contact with them, for a short time (minutes to hours). It could possibly be fatal to be close to this amount of unshielded radioactive material for a period of hours to days. These sources are typically used in practices such as industrial gamma radiography, high dose rate brachytherapy and medium dose rate brachytherapy. Category 3 sources, if not safely managed or securely protected, could cause permanent injury to a person who handled them, or were otherwise in contact with them, for some hours. It could possibly - although it is unlikely - be fatal to be close to this amount of unshielded radioactive material for a period of days to weeks. These sources are typically used in practices such as fixed industrial gauges involving high activity sources (for example, level gauges, dredger gauges, conveyor gauges and spinning pipe gauges) and well logging.

14. *Ibid*.

15. IAEA (2003), *Categorization of radioactive sources*, *Revision of IAEA-TECDOC-1191, Categorization of radiation sources*, IAEA Doc. IAEA-TECDOC-1344. This "modification" relates to radioactive sources that contain radionuclides that, though included in IAEA-TECDOC-1344, do not meet the definition of "radioactive source" in the Code; for example, sources that are not in a solid form, or are unsealed sources are outside the scope of the 2003 Code of Conduct, and are therefore excluded from Table I in Annex I of the Code.

Although the 2003 Code of Conduct generally applies to sources in Categories 1, 2 and 3, those recommendations that relate to national registers and export and import controls are limited to sources in Categories 1 and 2. Category 1 sources are considered the most dangerous, while Category 2 sources present less a danger. Category 3 sources are less dangerous than Category 2 sources.

In addition to the three categories, states should also devote appropriate attention to the regulation of other potentially harmful radioactive sources. Further, states should give appropriate attention to radioactive sources considered by them to have the potential to cause unacceptable consequences if employed for malicious purposes and to aggregations of lower activity sources (as defined by IAEA-TECDOC-1344) that require management under the principles of the Code of Conduct. Finally, the 2003 Code of Conduct does not apply to nuclear material as defined in the Convention on the Physical Protection of Nuclear Material,[16] except for sources incorporating plutonium-239. It also does not apply to radioactive sources within military or defence programmes.

3. Substantive elements of the 2003 Code of Conduct

The 2003 Code of Conduct includes "Basic Principles" that provide general recommendations that states should follow to protect individuals, society and the environment. The "Basic Principles" are divided into 11 general provisions (paragraphs 7-17), 2 provisions on legislation and regulations (paragraphs 18-19), 3 provisions which apply to the regulatory body (paragraphs 20-22), and 6 provisions for the import and export of radioactive sources (paragraphs 23-29):

- General recommendations (paragraphs 7-17). For example, every state should, in order to protect individuals, society and the environment, take the appropriate measures necessary to ensure: that the radioactive sources within its territory, or under its jurisdiction or control, are safely managed and securely protected during their useful lives and at the end of their useful lives; and the promotion of safety culture and of security culture with respect to radioactive sources. Further, every state should have in place an effective national legislative and regulatory system of control over the management and protection of radioactive sources. Also, every state should establish a national register of radioactive sources.
- Legislation and regulations (paragraphs 18-19). The text recommends that every state should have in place legislation and regulations that, *inter alia*, prescribe and assign governmental responsibilities to ensure the safety and security of radioactive sources and provide for the effective control of radioactive sources. Such legislation or regulations should provide for, in particular, the establishment of a regulatory body whose regulatory functions are effectively independent of other functions with respect to radioactive sources, such as the management of radioactive sources or the promotion of the use of radioactive sources.
- General roles and responsibilities of the regulatory body (paragraphs 20-22). These include, for example, the authority to establish regulations and guidance; to enforce regulatory requirements, including the inspection of premises; and to require that persons managing sources be authorised and submit safety and security assessments. In addition to describing the powers of the regulatory body, the Code of Conduct recommends that states should ensure that this body is provided with adequate resources – both financial support and

16. Convention on the Physical Protection of Nuclear Material (1980), IAEA Doc. INFCIRC/274 Rev. 1, 1456 UNTS 125, entered into force 8 Feb. 1987.

qualified personnel. Importantly, paragraph 20(e)(7) indicates that "every State should ensure that the regulatory body established by its legislation has the authority to attach clear and unambiguous conditions to the authorizations issued by it, including conditions relating to the safe and secure management of disused sources, including, where applicable, agreements regarding the return of disused sources to a supplier."

- Guidance on the import and export of radioactive sources (paragraphs 23-29). These provisions include specifically the need for: prior notification by the exporting state and, as appropriate, consent by the importing state; checks as to whether the recipient is authorised to receive and possess the source; and an evaluation of whether the importing state has the appropriate technical and administrative capability, resources and regulatory structure to manage the source in a manner consistent with the provisions of the Code of Conduct. An "exceptional circumstances" clause (paragraph 26) is also included for situations in which the recipient does not have an authorisation or when the importing state does not fully meet the provisions of the Code of Conduct.
- Nuclear security. Several recommendations specifically relate to the security of radioactive sources, including the need for: an assessment of domestic threats (paragraph 16); measures to reduce the likelihood of malicious acts, including sabotage; the mitigation or minimisation of radiological consequences arising from accidents or malicious acts; an assessment of the trustworthiness of individuals (paragraph 20(viii)); and protecting the confidentially of security information (paragraph 17).[17]
- Orphan sources. Several provisions directly relate to orphan radioactive sources, including paragraphs 9(a), 13(a), 22(o). For example, paragraph 22(o) indicates that each state "should ensure that its regulatory body […] is prepared to recover and restore appropriate control over orphan sources […]". Paragraphs 8(c) and (d)) also address national strategies for gaining or regaining control over orphan sources.
- Management of disused sources. Several provisions, in particular paragraphs 14, 15, 20, 22 and 27, are directly relevant to the management of disused radioactive sources.
- Role of the IAEA and dissemination of the Code. Paragraphs 30 and 31 respectively address the role of the IAEA in collecting and disseminating information and developing and providing for the application of relevant technical standards and the dissemination of the Code of Conduct.

4. Categorisation of radioactive sources

Prior to the adoption of the *Code of Conduct on the Safety and Security of Radioactive Sources* in 2000, the wide variety of uses of radioactive materials necessitated the development of some form of categorisation so that the controls to be applied would be commensurate with the radiological risks associated with the sources and materials. The action on categorisation of radioactive sources in the 1999 Action Plan was given high priority because it was a prerequisite for other actions. As part of its activities to implement the 1999 Action Plan, the IAEA developed a simple, generally applicable system for categorising radioactive sources. The sources were ranked according to the harm they could cause, such that controls to be applied would be commensurate with the risk they posed.

17. Wheatley, J.S. (2004), *supra* note 9.

The ranking is as follows:

- Category 1 (higher risk): industrial radiography sources, teletherapy sources, irradiators;
- Category 2 (medium risk): brachytherapy sources (with both high and low dose rates), fixed industrial gauges with high activity sources, well logging sources; and
- Category 3 (lower risk): fixed industrial gauges with lower activity sources.

The Board and GC endorsed the categorisation system, and a technical document describing the ranking system was published in 2000 as IAEA-TECDOC-1191, *Categorization of Radioactive Sources*.[18]

Under the 2001 Revised Action Plan, the IAEA Secretariat reviewed how the categorisation system was being used. It found that the system was useful for categorising radioactive sources according to radiological and other risks but was limited in its scope of application.[19]

A revised categorisation system was developed, providing a numerical relative ranking of radioactive sources and practices and assigning them into one of five categories.[20] The categorisation system is based on the potential for radioactive sources to cause deterministic health effects. The revised categorisation was published in 2003 as IAEA-TECDOC-1344.[21] The categorisation was a foundation for the revised 2003 Code of Conduct, playing a central role in the Code of Conduct's harmonised implementation. IAEA Safety Guide, Doc. RS-G-1.9.,[22] provides further guidance on categorising sealed radioactive sources and on how categorisation can be used to meet the requirements for regulatory control set out in IAEA Safety Standards Series No. GSR Part 1 (Rev.1).[23] This Safety Guide is intended to provide support for international harmonisation of measures for control of radioactive sources and their security, in particular for the implementation of the 2003 Code of Conduct.

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18. IAEA (2000), *Categorization of Radioactive Sources*, IAEA Doc. IAEA-TECDOC-1191 (corrected version Mar. 2001), IAEA, Vienna. The publication describes the development of the 1999 Action Plan and its approval at p. 1.

19. IAEA (2001), "Measures to Strengthen International Co-Operation in Nuclear, Radiation, Transport and Waste Safety; Radiation Safety (Secretariat responses to radiation safety issues of Member States)", IAEA Doc. GOV/2001/29-GC(45)/12), Attachment, "Revised Action Plan for the Safety and Security of Radiation Sources".

20. In addition to the three categories, two more categories were included. Category 4 individual sources are considered as being "[u]nlikely to be dangerous": i.e. "[i]t is very unlikely that anyone would be permanently injured by this amount of radioactive material. However, this amount of unshielded radioactive material, if not safely managed or securely protected, could possibly – although it is unlikely – temporarily injure someone who handled it or were otherwise in contact with it, or who were close to it for a period of many weeks." This category also includes dispersed radioactive material in an amount, "if dispersed by a fire or explosion, could not permanently injure persons." Category 5 includes individual sources that are considered as being "[n]ot dangerous", i.e. "[n]o one could be permanently injured by this amount of radioactive material", and dispersed radioactive material, the amount of which, "if dispersed by a fire or explosion, could not permanently injure persons." IAEA Doc. IAEA-TECDOC-1344, *supra* note 15, p. 29.

21. *Ibid*.

22. IAEA (2005), *Categorization of Radioactive Sources*, IAEA Safety Standards Series, Safety Guide, No. RS-G-1.9, IAEA, Vienna. The categorisation is not relevant to radiation generating devices such as X-ray machines and particle accelerators, although it may be applied to radioactive sources produced by, or used as target material in, such devices.

23. IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 1 (Rev. 1), IAEA, Vienna.

D. Supplementary 2004 and 2011 *Guidance on the Import and Export of Radioactive Sources*

1. Development of the supplementary Import-Export Guidance

a. February and July 2004 technical meetings

When the text of the 2003 Code of Conduct was approved by the Board prior to the September 2003 GC, the Board's chairperson stated that "there were still concerns regarding the import and export of radioactive sources. That matter needed to be further explored and some guidance developed."[24] Accordingly, in February 2004, the Secretariat convened a meeting to develop such guidance in accordance with the 2000 Code of Conduct. In July 2004, the experts at their second meeting, reached consensus on the text of the draft Guidance on the Import and Export of Radioactive Sources.

b. September 2004 Board and GC meetings: 2004 supplementary *Guidance on the Import and Export of Radioactive Sources*[25]

On 14 September 2004, the draft text of the Guidance on the Import and Export of Radioactive Sources was approved by the Board. On 24 September 2004, the GC, in resolution GC(48)/RES/10.D, welcomed the approval by the Board and endorsed the Guidance while recognising that it was legally non-binding. Further, the GC highlighted that at its September 2004 meeting, the Board had stressed the importance that exporting states, in applying the supplementary 2004 Import-Export Guidance, in particular paragraphs 8(c) and 11(c), carry out the information exchange and consultations set out in paragraph 21 of the Guidance. In March 2005, the 2004 Import-Export Guidance was published by the IAEA as IAEA/CODEOC/IMP-EXP/2005.

The development of the supplementary 2004 Import-Export Guidance was another important move towards a global system for continuous control of radioactive sources throughout their life cycle. The supplementary 2004 Import-Export Guidance represents the first international framework for export control of radioactive sources and an important step forward in preventing theft and diversion of materials being transferred across borders. It also evidences a shared commitment by exporting and importing states to the safety and security of radioactive sources.[26]

2. Revised 2011 supplementary Import-Export Guidance[27]

Paragraph 20 of the supplementary 2004 Import-Export Guidance provides for a review and, if appropriate, a revision of the text approximately five years after publication. In May 2010, the Secretariat convened a technical meeting for information sharing on implementation of the 2003

24. See IAEA Doc. IAEA/CODEOC/IMP-EXP/2005, *supra* note 3, "Foreword".

25. IAEA Doc. IAEA/CODEOC/IMP-EXP/2005, *supra* note 3, endorsed in IAEA (2004), GC Resolution: "Measures to Strengthen International Cooperation in Nuclear, Radiation and Transport Safety and Waste Management", IAEA Doc. GC(48)/RES/10, approved 24 Sept. 2004, para. D.8.

26. Wheatley, J.S. (2004), *supra* note 9.

27. IAEA Doc. IAEA/CODEOC/IMO-EXP/2012, supra note 3, endorsed in IAEA (2011), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(55)/RES/9, approved on 21 Sept. 2011, para. 76.

Code of Conduct and 2004 Import-Export Guidance.[28] The technical meeting was attended by 155 experts from 82 states.

The technical meeting reached consensus that the main provisions of the 2004 Import-Export Guidance were effective and should not be altered, in part to avoid ambiguity about the status of states' political commitments to follow the Guidance. However, participants did support revisions to update and clarify the text in order to improve harmonised implementation. The meeting recommended initiating a process for the review and revision of the 2004 Import-Export Guidance.

The biggest change recommended by the technical meeting was to Annex 1 of the document, which provides a questionnaire to help assess a state's ability to safely and securely manage imported sources. Consensus was reached on the draft revised text of the supplementary Import-Export Guidance that was approved by the Board on 12 September 2011 and endorsed by the GC in resolution GC(55)/RES/9 on 21 September 2011. In May 2012, the supplementary Import-Export Guidance was published by the IAEA as IAEA/CODEOC/IMO-EXP/2012.

3. Objective and scope of the supplementary 2011 Import-Export Guidance

The supplementary 2011 Import-Export Guidance provides a common framework for the import and export of Category 1 and 2 sources within the scope of paragraphs 23-29 of the 2003 Code of Conduct. Exporting and importing states should aim to follow the Guidance when deciding whether or not to authorise exports and imports of such sources. States may also apply the framework to other radioactive sources or may apply conditions in addition to the provisions of the 2011 Import-Export Guidance. The supplementary 2011 Import-Export Guidance does not apply to sources or programmes not covered by the 2003 Code of Conduct, such as nuclear material or radioactive sources within military or defence programmes.

The objective of the supplementary Guidance is to improve the safety and security of imports and exports of such radioactive sources in accordance with the provisions laid down in paragraphs 23-29 of the 2003 Code of Conduct. With this objective in mind, the supplementary Guidance is not intended to impede international co-operation or commerce, as long as these do not contribute to the use of such sources for purposes that threaten radiation safety and source security. States should consider the 2011 Import-Export Guidance in a manner consistent with their national legislation and relevant international commitments.

The supplementary 2011 Import-Export Guidance specifically refers to paragraph 3.5 of *RS-G-1.9*, the IAEA Safety Guide *Categorization of Radioactive Sources*, *supra* note 22, for additional information on aggregation of sources.

a. Exports of Category 1 and 2 radioactive sources

Prior to granting an authorisation for the export of a Category 1 or 2 source, the exporting state should "satisfy itself, insofar as practicable, that the importing State has the appropriate technical and administrative capabilities, resources and regulatory structure needed for the management of the source in a manner consistent with the guidance in the Code…." (paragraphs 8(b) and 11(b) of the 2011 Import-Export Guidance). As noted in the 2007 information exchange meeting, there is currently no common approach among exporting states as to how they so satisfy themselves. In the 2018 information exchange meeting, it was stated that a single national model for exporting states to satisfy themselves would not be practicable due to national specificities.

28. IAEA (2010), Report of the Chairman, "Open-ended Meeting of Technical and Legal Experts for Sharing of Information on States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources", Vienna, 17-21 May 2010.

b. Imports of Category 1 and 2 radioactive sources

More and more states have introduced provisions for applying the Import-Export Guidance in their importing licensing process. They will reply to a request of consent from exporting states, and make sure that the end-user facility is properly licensed before the source is actually imported in the country. Co-operation with customs and border control forces have been significantly strengthened.

c. Exceptional circumstances

As discussed in the 2007 and 2018 information exchange meetings, provisions on exceptional circumstances are extremely rare and are used solely for Category 1 cobalt-60 radioactive sources for medical purposes. Before export is granted based on exceptional circumstances, an in-depth and demanding assessment of the risks and benefits is performed, involving numerous contacts with the importing state officials, recipient hospital and the IAEA.

d. Transit and trans-shipment

Although the transport of radioactive sources through the territory of a transit or trans-shipment state is not subject to the authorisation procedures outlined in paragraphs 24 and 25 of the 2003 Code of Conduct and therefore not subject to the provisions of the 2011 Import-Export Guidance, states should consider paragraph 29 of the Code of Conduct, which states that the transport of radioactive sources through the territory of a transit or trans-shipment state should be conducted in a manner consistent with existing relevant international standards relating to the transport of radioactive materials, in particular paying careful attention to maintaining continuity of control during international transport.

4. National points of contact

The import and export of radioactive sources subject to the supplementary 2011 Import-Export Guidance requires the exchange of information between importing and exporting states. Pursuant to paragraph 4 of the Guidance, each state should nominate a point of contact (a person or a position) for the purpose of facilitating the export or import of radioactive sources in accordance with the 2003 Code of Conduct and supplementary 2011 Import-Export Guidance. States should provide the IAEA with details of these points of contact. To facilitate this bilateral exchange of information, the Secretariat collects and publishes the national contact points *via* the internet.[29]

The ongoing need to keep the details of national contact points updated and, where possible, to designate alternate contact points to ensure continuity in case of absence of the primary contact point, continues to be emphasised, as well as having points of contact familiar with their expected roles and responsibilities. As of 30 April 2021, 145 states have designated a point of contact.

5. "Importing and Exporting States Questionnaire"

To facilitate the timely review of export requests and further harmonise the application of the Import-Export Guidance, each state is urged to make its responses to the "Importing and Exporting States Questionnaire" (Annex I) available to the IAEA and, as soon as practicable, any update of those responses if they change. Responses should, with the consent of the state

29. The List of Points of Contact (dated 6 Nov. 2020) is available at: https://nucleus.iaea.org/sites/ns/code-of-conduct-radioactive-sources/Documents/Import%20export%20contact%20points%20Web%20version%206%20November%202020.pdf (accessed 30 May 2021).

concerned, be made available to the points of contacts of other states. As of 30 April 2021, 105 states have completed the questionnaire.

6. *Forms to facilitate implementation*

As a result of the agreement reached at the 2005 meeting, forms for "Request for Consent" and "Notification of Shipment" have been prepared, translated into the six official UN languages and placed on the internet *via* a password-protected website to assist states in importing and exporting Category 1 and 2 sources:

- Request to the importing state for consent to import Category 1 radioactive sources or to import Category 1 and 2 sources under exceptional circumstances;
- Request to the importing state for confirmation that the recipient is authorised to receive and possess Category 2 radioactive sources; and
- Notification to the importing state prior to shipment of Category 1 or 2 radioactive sources.

E. Supplementary 2017 *Guidance on the Management of Disused Radioactive Sources*

1. *Development of the supplementary 2017 Guidance*

The 2013 Abu Dhabi International Conference replaced the regular exchange of information meetings on the 2003 Code of Conduct and its supplementary Import-Export Guidance (see Part D above). The President of the Abu Dhabi Conference recommended that "[a]dditional guidance at the international level for the long-term management of disused radioactive sources should be developed."[30] In September 2014, the GC, in resolution GC(58)/RES/10, encouraged the IAEA to "improve the long-term management of disused sealed radioactive sources" and "call[ed] upon all Member States to ensure that there is adequate provision for safe and secure storage and disposition pathways for disused radioactive sealed sources."[31]. In October 2014, the Secretariat in response convened a meeting. One of the conclusions of the Chairman was that "[t]he meeting agreed that the development of the guidance should continue to be pursued as supplementary guidance under the [2003] Code of Conduct, at a similar level to the [2004] Import/Export Guidance."[32] In September 2015, the GC, in resolution GC(59)/RES/10, noted "the discussion on the ongoing development of supplementary guidance to the [2003] Code of Conduct […] regarding the management of disused sealed sources."[33]

The Chairman of the second meeting held in December 2015 concluded that "[t]he meeting agreed that the development of the guidance should continue to be pursued as supplementary guidance under the Code of Conduct, while IAEA should consider the additional development of

30. IAEA (2015), *Safety and Security of Radioactive Sources: Maintaining Continuous Global Control of Sources throughout Their Life Cycle*, *supra* note 8, p. 716.
31. IAEA (2014), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(58)/RES/10, adopted on 25 Sept. 2014, paras. 17 and 96.
32. IAEA (2014), Report of the Chairman, "Open-ended Meeting of Technical and Legal Experts to develop internationally harmonised guidance for implementing the recommendations of the Code of Conduct on the Safety and Security of Radioactive Sources in relation to the long-term management of disused radioactive sources", Vienna, 20-23 Oct. 2014, para. 18.b.
33. IAEA (2015), GC Resolution: "Nuclear Security", IAEA Doc. GC(59)/RES/10, adopted on 18 Sept. 2015, para. 26.

more detailed technical guidance on the management of disused sources."[34] On 23 February 2016, following the second technical meeting, the revised draft guidance was sent to all member states for a 120-day comment period. The relevant Safety Standards Committees and the Nuclear Security Guidance Committee were also invited to submit comments to the Secretariat. The Report of the Chairman of the third technical meeting held in July 2016 recorded that "[a] large number of States agreed that the text does not need further revision and supported the approach that the document should be sent to the Board for approval as supplementary guidance under the Code." [35] The report also recorded that consensus was not reached on this matter. In September 2016, the GC, in resolution GC(60)/RES/9, requested that "the Secretariat take note of and consider, as appropriate, the report of the Chairman from the 2016 Open-ended Meeting of Technical and Legal Experts … containing draft supplementary Guidance on the Management of Disused Radioactive Sources".[36]

At the March 2017 session of the Board, the issue was considered and the Chairman indicated that, in light of the discussion, more time would be required for further deliberation through informal consultations with a view to finalising the issue at the September 2017 session of the Board at the latest. Further to the conclusion of the informal consultations, the revised text submitted to the Board in document GOV/2017/4/Rev.1 was approved on 11 September 2017. On 21 September 2017, the GC, in resolution GC(61)/RES/8, endorsed the *Guidance on the Management of Disused Radioactive Sources* (2017 Disused Radioactive Sources Guidance) contained in document GC(61)/23, "while recognizing it is not legally binding," and called on all member states "to make a political commitment to implement the [2003] Code of Conduct [..] and its supplementary Guidance on the Import and Export of Radioactive Sources and its supplementary Guidance on the Management of Disused Radioactive Sources."[37] In 2018, the supplementary 2017 Disused Radioactive Sources Guidance was published by the IAEA as IAEA/CODEOC/MGT-DRS/2018 as guidance supplementary to the 2003 Code of Conduct.[38] The supplementary 2017 Disused Radioactive Sources Guidance is intended to consolidate and provide further details on the management of disused radioactive sources consistent with the 2003 Code of Conduct in response to requests from member states.

34. IAEA (2015), Report of the Chairman, "Open-ended Meeting of Legal and Technical Experts to Develop Internationally Harmonized Guidance for Implementing the Recommendations of the Code of Conduct on the Safety and Security of Radioactive Sources in Relation to the Management of Disused Radioactive Sources", Vienna, 14-17 Dec. 2015, para. 16.c.

35. IAEA (2016), Report of the Chairman, "Open-ended Meeting of Legal and Technical Experts to Develop Internationally Harmonized Guidance for Implementing the Recommendations of the Code of Conduct on the Safety and Security of Radioactive Sources in Relation to the Management of Disused Sources", Vienna, 27 June – 1 July 2016, para. 11.b.

36. IAEA (2016), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(60)/RES/9, adopted on 29 Sept. 2016, para. 121.

37. IAEA (2017), GC Resolution: "Nuclear Security", IAEA Doc. GC(61)/RES/8, adopted on 21 Sept. 2017, paras. 26 and 27; IAEA (2017), "Code of Conduct on the Safety and Security of Radioactive Sources: Guidance on the Management of Disused Radioactive Sources: Report by the Director General", IAEA Doc. GC(61)/23.

38. IAEA (2018), *Guidance on the Management of Disused Radioactive Sources*, *supra* note 4.

2. Objectives and scope of the supplementary 2017 Disused Radioactive Sources Guidance

The supplementary 2017 Disused Radioactive Sources Guidance applies to all radioactive sources within the scope of the 2003 Code of Conduct, including orphan sources once regulatory control has been regained. The supplementary Guidance addresses the management of a radioactive source once it becomes disused but does not address the circumstances in which a radioactive source may become disused. The supplementary 2017 Disused Radioactive Sources Guidance is focused on the safe and secure management of disused radioactive sources. While recognising that such management should be compatible with the state's overall programme for radioactive waste management, the supplementary Guidance does not address such a programme, which is dealt with in other IAEA publications. The terms used in the supplementary 2017 Disused Radioactive Sources Guidance have the same meanings as those terms defined in the 2003 Code of Conduct and the supplementary 2011 Import-Export Guidance.

Within the context of the overall life cycle management of radioactive sources, the objective of the 2017 Disused Radioactive Sources Guidance is to encourage states to improve the safety and security of disused sources in line with the provisions of the Code of Conduct. The Guidance is intended to advise states on the available management options for disused sources.

The 2017 Disused Radioactive Sources Guidance stands as supplementary guidance under the Code of Conduct at a similar level as the Import-Export Guidance. This non-legally binding Guidance provides a general framework for the management of disused sources. Detailed requirements and guidance relevant to implementation of this Guidance are found in the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention),[39] as well as the relevant IAEA Safety Standards, Nuclear Security Series publications and the Nuclear Energy Series. It is intended to be used by states when establishing or strengthening their national policy, strategy, legislation and regulations consistent with their relevant international commitments.

F. Political commitments to the 2003 Code of Conduct and its two supplementary guidance documents

As a counterbalance to its legally non-binding nature, states have an opportunity to provide political support for the implementation of the 2003 Code of Conduct pursuant to the relevant resolutions of the GC. The GC has also encouraged states to make so-called "political commitments" of support to the IAEA Director General (DG) when endorsing the 2004 Import-Export Guidance, the 2011 Import-Export Guidance and the 2017 Disused Radioactive Sources Guidance.

1. 2003 Code of Conduct

The text of the 2003 Code of Conduct was finalised in July 2003 and presented to the Board in September 2003, which approved it and decided to transmit it to the GC. On 19 September 2003, the GC, in resolution GC(47)/RES/7, welcomed the Board's approval and endorsed the objectives and principles set out in the revised 2003 Code of Conduct while recognising that the Code of Conduct is not a legally binding instrument. Furthermore, the GC urged each state to write to the DG stating that it fully supports and endorses the IAEA's efforts

39. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001, Art. 28.

to enhance the safety and security of radioactive sources; and that it is working towards following the guidance contained in the revised Code of Conduct and encourages other countries to do the same. In addition, the GC requested the DG, subject to the availability of resources, to compile, maintain and publish a list of states that make a political commitment by writing to him as urged by the GC.[40] As of 4 June April 2021, 140 states have made a political commitment to the 2003 Code of Conduct.

2. Supplementary 2004 and 2011 Import-Export Guidance

In September 2004, the GC, in endorsing the 2004 Import-Export Guidance, in resolution GC(48)/RES/10.D, noted that more than 30 countries had made clear their intention to work towards effective import and export controls by 31 December 2005, and encouraged states to act in accordance with the 2004 Import-Export Guidance on a harmonised basis and to notify the DG of their intention to do so as supplementary information to the 2003 Code of Conduct, recalling operative paragraph B.6 of resolution GC(47)/RES/7.B. [41]

In September 2011, the Board approved the revised 2011 Import-Export Guidance, which was endorsed that month by the GC in resolution GC(55)/RES/9. No substantive changes were made to the main provisions of the Import-Export Guidance and, thus, the Board and GC considered that states' political commitments to the DG remained intact unless the IAEA was notified otherwise by a state.[42] As of 4 June 2021, 123 states have made a political commitment to the Import-Export-Guidance.

40. In endorsing the 2003 Code of Conduct, the GC "[u]rge[d] each State to write to the Director General that it fully supports and endorses the IAEA's efforts to enhance the safety and security of radioactive sources, is working toward following the guidance contained in the IAEA Code of Conduct on the Safety and Security of Radioactive Sources, and encourages other countries to do the same". IAEA Doc. GC(47)/RES/7, *supra* note 2, para. B.4. The GC in operative paragraphs B.5 and B.6 of the resolution also "[r]equest[ed] that the Director General, subject to the availability of resources, compile, maintain and publish a list of States that have made a political commitment […]" and also "[r]ecognize[d] 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." *Ibid*. The following year, the GC "[c]ontinue[d] to endorse the principles and objectives of the Code of Conduct on the Safety and Security of Radioactive Sources, 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". IAEA Doc. GC(48)/RES/10, *supra* note 25, para. D.7.

41. In 2004 the GC "[f]urther welcome[d] the approval by the Board of Governors of the [2004 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 Director General of their intention to do so as supplementary information to the [2003 Code of Conduct], recalling operative paragraph 6 of resolution GC(47)/RES/7.B". IAEA Doc. GC(48)/RES/10, *supra* note 25, para. D.8.

42. In 2011, the GC "Underline[d] the important role of the Guidance on the Import and Export of Radioactive Sources for the establishment of continuous control of radioactive sources, note[d] that, as at 5 September 2011, 66 States had notified the Director General 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". IAEA (2011), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste", IAEA Doc. GC(55)/RES/9, adopted on 22 Sept. 2011, para.74.

3. Supplementary 2017 Disused Radioactive Sources Guidance[43]

At the September 2017 GC, 50 states actively expressed support for the supplementary 2017 Disused Radioactive Sources Guidance to have the same status as the 2011 Import-Export Guidance, recognising the need for guidance at this level. Further, member states noted that management of disused sources poses significant challenges and this level of document would help states establish necessary policy frameworks to safely and securely manage disused sources. As of 4 June 2021, 42 states have made a political commitment to the 2017 Disused Radioactive Sources Guidance.

4. Other support

Over the years, there have been various and encouraging expressions of support for the Code of Conduct and its supplementary guidance. Even before the revisions to the Code of Conduct were finalised, its importance was recognised by the G8, which, at its Évian-les-Bains summit in June 2003, provided political support for the Code in a statement on "Non-Proliferation of Weapons of Mass Destruction – Securing Radioactive Sources", issued on 2 June 2003.

Also, at the July 2006 summit of the G8 in St. Petersburg, Russian Federation, the G8 nations noted progress made to improve controls on radioactive sources and to prevent their unauthorised use. The G8 reaffirmed the commitment to fulfil the 2003 Code of Conduct provisions, working to put into place the controls over the import and export of radioactive sources at the earliest possible date and urged all other states to adopt the Code of Conduct. The G8 nations undertook to continue to support international efforts to enhance regulatory controls on radioactive sources, in particular the IAEA's Regional Model Projects on Upgrading Radiation Protection Infrastructure.[44]

Further, development of the 2004 Import-Export Guidance received considerable political backing in a manner similar to revision of the Code of Conduct. Leaders at the 30th G8 Summit held in Sea Island, Georgia, United States in 2004 and the 2004 US – European Union (EU) Shannon Summits endorsed the Guidance and announced their intention to put the Guidance in place by the end of 2005.[45]

In the Communiqué for the 2012 Nuclear Security Summit in Seoul, leaders urged states to "reflect into national practices relevant IAEA Nuclear Security Series documents, the [2003 Code of Conduct] and its supplementary [2011 Import-Export Guidance]; and establish national registers of high-activity radioactive sources where required."[46] Another example of support is the Ministerial Declaration of the July 2013 International Conference on Nuclear Security, which "[i]nvite[d] States that have not yet done so to make a political commitment to implement the non-

43. In 2017 the GC "[c]all[ed] on all Member States to make a political commitment to implement the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources Radioactive sources 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 of Conduct and the Guidance, and request[ed] the Secretariat to continue supporting Member States in this regard". IAEA (2017), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(61)/RES/8.2, adopted on 21 Sept. 2017, para. 27.

44. G8, "Report of the Nuclear Safety and Security Group: Report to the Leaders", St. Petersburg, 17 July 2006.

45. G8 Action Plan on Nonproliferation, Sea Island, 9 June 2004, sec. 7, "Implementation of the Evian Initiative on Radioactive Source Security"; see MacLachlan, A. (2005), "Guidance on the Import and Export of Radioactive Sources", *Nuclear Law Bulletin*, No. 75, OECD Publishing, Paris, pp. 131, 133.

46. "Seoul Communiqué 2012 Seoul Nuclear Security Summit", issued 28 March 2012, para. 1.

legally-binding [2003 Code of Conduct] and supplementary [2011 Import-Export Guidance], and encourage[d] all States to implement these instruments and to maintain effective security of radioactive sources throughout their life cycle".[47] Further, in the Ministerial Declaration of the December 2016 and February 2020 International Conferences on Nuclear Security, Ministers "commit[ted] to maintain effective security of radioactive sources throughout their life cycle, consistent with the [Code of Conduct] and its supplementary guidance documents."[48]

G. Implementation of the 2003 Code of Conduct and its two supplementary guidance documents

1. Formalised process of the 2003 Code of Conduct and its two supplementary guidance documents

a. Development of the 2006 formalised process

i. 2005 Bordeaux International Conference:[49] Voluntary national papers and presentations

An advance towards a global system for continuous control of sources throughout their life cycle was made at the 2005 Bordeaux International Conference. The 2005 Bordeaux International Conference "[r]ecognized the value of the presentations and discussion of 24 national working papers from Member States; and encouraged IAEA to undertake consultations with Member States to establish a formalized process for periodic exchange of information and lessons learned and evaluation of progress made towards implementing the provisions of the Code."[50] Following a request of the GC in resolution GC(49)/RES/9 (2005), work was initiated on the development of a formalised process.[51]

47. Ministerial Declaration adopted by the International Conference on Nuclear Security: Enhancing Global Efforts, Vienna, 1 July 2013, in IAEA (2014), *International Conference on Nuclear Security: Enhancing Global Efforts*, IAEA, Vienna, pp. 13-16.

48. Ministerial Declaration adopted by the International Conference on Nuclear Security: Commitments and Actions, Vienna, 5 December 2016, in IAEA (2017), *International Conference on Nuclear Security: Commitments and Actions*, *Summary of an International Conference Organized by the International Atomic Energy Agency and Held in Vienna, 5-9 December 2016*, IAEA, Vienna, pp. 14-16; and "Ministerial Declaration", International Conference on Nuclear Security: Sustaining and Strengthening Efforts, 10-14 Feb. 2020, available at: www.iaea.org/sites/default/files/20/02/cn-278-ministerial-declaration.pdf (accessed 30 May 2021).

49. IAEA (2006), *Safety and Security of Radioactive Sources: Towards a Global System for the Continuous Control of Sources throughout Their Life Cycle, Proceedings of an International Conference, Bordeaux, 27 June – 1 July 2005*, IAEA Doc. STI/PUB/1262, IAEA, Vienna. The 2005 Bordeaux International Conference was hosted by the Government of France and organised by the IAEA in co-operation with the European Commission, the European Police Office, the International Criminal Police Organization, the International Commission on Radiological Protection, the International Labour Organization, the International Radiation Protection Association (IRPA), the World Customs Organization, and the World Health Organization and under the auspices of the G8. It was attended by about 300 participants from 64 IAEA member states.

50. *Ibid*., p. 560.

51. IAEA (2005), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation and transport safety and waste management", IAEA Doc. GC(49)/RES/9, adopted on 30 Sept. 2005, para. 59.

ii. June 2006 Technical Meeting:[52] *Development of a formalised information exchange process*

Further to the 2005 GC resolution GC(49)/RES/9 (paragraph 59), the Secretariat organised a May – June 2006 meeting to establish a formalised process for periodic exchange of information and lessons learnt, together with evaluation of progress made by states towards implementing the provisions of the 2003 Code of Conduct. The meeting was attended by experts from 66 member states, five non-member states and an observer from the European Commission (EC). The group of experts reached consensus on a formal mechanism for a voluntary, periodic exchange of information for all states to share experiences and lessons learnt in implementing the 2003 Code of Conduct and its supplementary Import-Export Guidance. As suggested by the group of experts, the Chair's report and the proposed formalised process were included as Annex 2 to GOV/2006/40-GC(50)/3.[53] The mechanism recommended by the meeting was consistent with the non-binding nature of the 2003 Code of Conduct and was based primarily on a single international meeting open to all states held every three years. It was foreseen that regional meetings, which included issues related to the 2003 Code of Conduct and relevant international conferences, would provide an input to the international meeting. It was also foreseen that all meetings would be subject to the availability of funding. It was also foreseen that the information exchange process should encourage the broadest possible participation by all member states and non-member states, whether or not they have made a political commitment to the 2003 Code of Conduct and its supplementary Import-Export Guidance. Intergovernmental organisations may also be invited to attend as observers.

iii. September 2006 Board and GC meetings: Establishment of the 2006 formalised process

In September 2006, the mechanism recommended by the June 2006 technical meeting was endorsed by the Board and noted by the GC. The GC in resolution GC(50)/RES/10 recognised the value of information exchange on national approaches to controlling radioactive sources and took note of the Board's endorsement of the process.[54]

The objective of the formalised process was to promote a wide exchange of information and lessons learnt on national implementation of the 2003 Code of Conduct and its supplementary Import-Export Guidance and to facilitate periodic evaluation of progress made by states towards implementing the provisions of the Code of Conduct and Guidance.

52. IAEA (2006), Report of the Chairman, "Meeting of technical and legal experts for Consultations with States with a view to establishing a formalised process for a periodic exchange of information and lessons learned and for the evaluation of progress made by States towards implementing the Code of Conduct on the Safety and Security of Radioactive Sources (TM-28817)", Vienna, 31 May – 2 June 2006.

53. IAEA (2006), "Measures to strengthen international cooperation in nuclear, radiation and transport safety and waste management: Report by the Director General", IAEA Doc. GOV/2006/40-GC(50)/3, Annex 2, Attachment to Chair Report, "Process for the Sharing of Information as to States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its associated Guidance on the Import and Export of Radioactive Sources", pp. 3-6.

54. IAEA (2006), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation and transport safety and waste management ", IAEA Doc. GC(50)/RES/10, adopted on 22 Sept. 2006, para. 66.

iv. 2020 Board and GC meetings: Revised formalised process

In the 2019 information exchange meeting of legal and technical experts, a revised formalised process was agreed upon and finalised. It also addressed the supplementary 2017 Disused Radioactive Sources Guidance and the inclusion of inter-regional meetings. In September 2020, the GC, in resolution GC(64)/RES/9, requested the Secretariat "to continue to foster information exchange on implementation of the [2003] Code of Conduct […] and its [2011 Import-Export Guidance] and its [2017 Disused Radioactive Sources Guidance]".[55] The revised process remains to be endorsed by the Board of Governors; and thus the 2006 process continues to apply.

b. Elements of the formalised process: International, inter-regional and regional meetings

The formalised process governs the preparation and performance of meetings organised by the IAEA to discuss implementation of the 2003 Code of Conduct and its supplementary guidance. There are two main elements to such an information exchange: a dedicated international meeting and regional meetings. In addition, the following elements can be highlighted:[56]

- National paper/report: "States wishing to submit voluntary national papers in English sharing their experience on implementation of the Code and the Guidance are encouraged to provide these to the IAEA Secretariat four weeks in advance of the meeting to facilitate timely transmission to other states participating in the meeting. The Secretariat would then make the papers available to other participants in advance of the meeting via a password-protected website. Countries may choose to discuss any relevant issues in their papers."
- National presentation: States wishing to make an oral or poster presentation can do so, but there is no obligation to do so, even if a state has submitted a national paper.
- Country groups: An opening plenary would be followed by meetings of country groups. "Allocation of States to Country Groups would initially be done alphabetically, with discretion for the Secretariat to adjust that allocation to ensure that there is an approximately even spread of experience across the Groups." The country groups would each have their own Chair appointed by the opening plenary.
- Closing plenary: After the conclusion of the country group sessions, all participating states would again meet in plenary. That plenary would hear reports from the Chairs of the Country Groups on the discussions within those groups and may further discuss topics of interest identified by those reports.
- Report of the meeting: "The Chairman should prepare a report of the meeting of approximately 5-6 pages. That report would not identify any participating state by name but would be grouped under broad themes. The report might also identify areas where the process might be improved for future meetings."

55. IAEA (2020), GC Resolution: "Nuclear and Radiation Safety", IAEA Doc. GC(64)/RES/9, adopted on 25 Sept. 2020, para. 108.

56. IAEA (2006), "A Process for the Sharing of Information as to States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its associated Guidance on the Import and Export of Radioactive Sources", available at: https://nucleus.iaea.org/sites/ns/code-of-conduct-radioactive-sources/Documents/formalized-process-english.pdf. See particularly paras. 4, 7, 9 and 10.

i. International information sharing meetings

The formalised process foresees an international meeting organised by the Secretariat and held every three years (ideally, in those years not assigned to review processes under the Convention on Nuclear Safety[57] and the Joint Convention). The first such meeting was held in 2007. Such meetings provide a forum for exchange of information on national implementation of the 2003 Code of Conduct and its supplementary guidance. Each meeting would have a duration of five days. States participating in the meeting would be urged to submit national papers and presentations, but such submissions would not be mandatory.

Noting the non-binding nature of the 2003 Code of Conduct and its supplementary Guidance, it is recognised that such an exchange of information through a formalised process would:

> a) Assist states in their national implementation of the Code and its Guidance by enabling them to learn from the experiences of others and to evaluate their own progress on implementation of the Code and Guidance;
>
> b) Increase the knowledge of States concerning the capability of other States to manage Category 1 and 2 sources in a manner consistent with the provisions of the Code in order to facilitate the application of the import and export provisions of the Code and Guidance;
>
> c) Increase the awareness of the Secretariat about the implementation of the Code and Guidance to assist them in the planning of their regular and technical co-operation programs; and
>
> d) Invite and encourage more States to implement (and politically commit to) the Code and Guidance.[58]

As outlined in Annex II *infra*, several international meetings and one international conference were held in the context of the formalised process.

ii. Regional and inter-regional meetings

The formalised process foresees additional sharing of information at the regional level (preferably prior to the international meeting) on experience with implementation of the 2003 Code and its supplementary guidance, as appropriate on an as-needed basis. Reports from such meetings would be presented to the opening plenary of an international meeting. In order to reduce costs, regional meetings are foreseen to be held in conjunction with other relevant regional meetings. The organisation of regional meetings would be left to the participants in each meeting. The formalised process foresees the Secretariat attending these regional meetings, if invited. The Chairs of these regional meetings may also wish to provide meeting summaries to the Secretariat for transmission to other states prior to the international meeting.[59]

57. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996.

58. IAEA (2006), “A Process for the Sharing of Information as to States’ Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its associated Guidance on the Import and Export of Radioactive Sources”, *supra* note 56, para. 1.

59. *Ibid*., para. 3(b).

iii. Topical meetings

Several topical meetings have been held, in particular:

- 2008, Guidance on the Import and Export of Radioactive Sources:[60] This meeting was suggested by the first information exchange meeting held in 2007. During the meeting, delegates shared their implementation of the newly published supplementary Import-Export Guidance. The meeting was attended by 167 experts from 87 member states and by observers from the EC, the Organization for Security and Co-operation in Europe (OSCE) and the International Source Suppliers and Producers Association (ISSPA).
- 2009, Long Term Strategies for the Management of Sealed Sources:[61] During the meeting, delegates discussed the important and potentially weakest part of "cradle to grave" management of radioactive sources, which relates to the safe and secure handling of disused radioactive sources. The meeting emphasised the need to pay more attention to this issue at the national and international levels and made proposals for its further consideration in the near future. The meeting was attended by 75 experts from 51 member states and by observers from the EC and ISSPA. The meeting was held following the 2009 Tarragona International Conference, which focused on the management and control of radioactive materials in scrap metal.[62] Participants of the conference unanimously recognised "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".[63]
- 2011, Review and Revision of the Guidance on the Import and Export of Radioactive Sources:[64] During the meeting, as agreed in the 2010 2nd Information Exchange Meeting, a proposed draft revision of the supplementary Import-Export Guidance was discussed and agreed. No major changes were made, but some updates and clarifications were provided based on feedback from countries on the implementation of the Guidance since 2005. The meeting was attended by 155 experts from 82 member states and by observers from the EU, OSCE and ISSPA.

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60. IAEA (2008), Report of the Chairman, "Open-ended Meeting of Technical and Legal Experts on the Code of Conduct on the Safety and Security of Radioactive Sources: Lessons Learned from Implementing the Supplementary Guidance on Import and Export Controls", Vienna, 26-28 May 2008.

61. IAEA (2009), Report of the Chairman, "Technical Meeting on Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources with Regard to Long Term Strategies for the Management of Sealed Sources", Vienna, 29 June to 1 July 2009.

62. IAEA (2011), *Control and Management of Radioactive Material Inadvertently Incorporated into Scrap Metal, Proceedings of an International Conference, Tarragona, Spain, 23-27 February 2009*, IAEA Doc. STI/PUB/1502, IAEA, Vienna.

63. *Ibid*., p. 354. From 2011 to 2013, three open-ended technical meetings were held to develop a text resulting in a proposed draft 2013 Metal Recycling Code of Conduct. In accordance with resolution GC(57)/RES/9 of the September 2013 GC, the draft text of the proposed draft 2013 Metal Recycling Code of Conduct was published in February 2014. IAEA (2014), *Control of Transboundary Movement of Radioactive Material Inadvertently Incorporated into Scrap Metal and Semi-finished Products of the Metal Recycling Industries, Results of the Meetings Conducted to Develop a Draft Code of Conduct*, IAEA Doc. IAEA/CODEOC/METRECYC, IAEA, Vienna, "Foreword". However, this Code of Conduct was never adopted by the IAEA Policy-Making Organs.

64. IAEA (2011), "Open-ended Meeting of Technical and Legal Experts on the Code of Conduct on the Safety and Security of Radioactive Sources: Review and Revision of the Guidance on the Import and Export of Radioactive Sources", Vienna, 30 May – 1 June 2011.

- 2012, Long Term Strategies for Management of Disused Sealed Radioactive Sources:[65] The purpose of the meeting was to promote the safe and secure management of disused sources, with an emphasis on sustainable and comprehensive long-term management strategies. A total of 21 presentations were given at the meeting by member states, the IAEA and ISSPA, and 4 working group sessions were organised under themes related to strategies for the safe and secure long-term management of disused sources. The meeting was attended by 148 experts from 62 member states and by observers from the EC, the Food and Agriculture Organization (FAO) and ISSPA.

iv. Meetings for countries having not yet expressed political support to implementing the 2003 Code of Conduct

Some countries that had not yet made a political commitment to the Code have, however, implemented the key provisions of the Code, but had not been able to raise awareness of the importance of the document within their governments. Some other countries, mainly new IAEA member states, have not yet had a chance to be fully informed about the Code of Conduct and the associated political support mechanism. Over the years, several meetings have been held to identify concerns and challenges to implementing the Code in those states. One of the aims is to promote political support and implementation of the provisions. The most recent meeting was held in November 2015 in Vienna.

H. Conclusion

Since, 2003 the *Code of Conduct on the Safety and Security of Radioactive Sources* has been widely endorsed internationally. Many states (140 as of 30 April 2021) have committed to following the 2003 Code of Conduct, which also continues to receive strong collective support from IAEA member states through resolutions of the annual IAEA GC.

Implementation of the 2003 Code of Conduct has resulted in an improvement in the control over radioactive sources “from cradle to grave”. Expression of commitment to the 2003 Code of Conduct and the guidance is linked to a positive impact on development of radiological safety and nuclear security infrastructures, as monitored by the IAEA. The national papers submitted prior to the meetings and the presentations made during the meetings show continuous progress in implementing the provisions of the 2003 Code of Conduct and its supplementary guidance. In fact, over the last two decades, the number of incidents or accidents involving radioactive sources has been significantly reduced.

Finally, the IAEA organises many activities aimed at improving the promotion and implementation of the 2003 Code of Conduct and its guidance, but continued support and peer encouragement from member states is necessary for these efforts to continue and for the safety and security of radioactive sources to be sustainable.

65. IAEA (2012), Report of the Chairman, “Technical Meeting on Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources with Regard to Long Term Strategies for the Management of Disused Sealed Radioactive Sources”, Vienna, 27 Feb. – 1 Mar. 2012.

ANNEX I

Background to the development and revision of the Code of Conduct on the Safety and Security of Radioactive Sources

A. Development of the *Code of Conduct on the Safety and Security of Radioactive Sources*

1. 1998 Dijon Conference[1]

The earliest international fostering of information exchange on safety and security of radioactive sources took place one year after the publication of the IAEA Basic Safety Standards. The specific issue of the safety of radioactive sources, including the security of radioactive materials, first attracted international attention at the 1998 Dijon International Conference. The conference was the first of its kind devoted to this subject and brought together radiation safety experts, regulators, and customs and police officers to foster information exchange through review and open discussion.

An important outcome of the Dijon Conference was the recommendation that radioactive sources should not fall out of regulatory control. This meant that national regulatory bodies would undertake to maintain records of all aspects of the use of radioactive sources within their borders until the sources are exported or permanently disposed of in a proper manner. To do this would require each nation to establish a national inventory of those responsible for each source, monitor the applications and transfers of the sources and track their fate at the end of their useful lives. A process would also be required and efforts made to find 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 authorisation i.e. an "orphan source". Such sources represent the greatest risk in the case of either an accident or potential malicious use.

Given the large numbers of orphan sources known to be distributed throughout the world in the late 1990s, another conclusion of the Dijon Conference was to encourage efforts to improve and intensify the detection of radioactive materials crossing national borders and moving within countries. This would involve at the very least, radiation measurements at strategic locations and international, co-operative intelligence gathering.

Ultimately, the 1998 Dijon International Conference recommended investigation of the feasibility of formulating international undertakings that would encourage broad, global adherence to effective operation of national systems for the safety of radioactive sources and the security of radioactive materials.

1. IAEA (1999), *Safety of Radiation Sources and Security of Radioactive Material, Proceedings of a Conference, Dijon, France, 14-18 September 1998*, IAEA Doc. STI/PUB/1042, IAEA, Vienna.

2. 1999 Action Plan: development and adoption

September 1998 GC resolution GC(42)/RES/12: A report of the 1998 Dijon International Conference was considered at the September 1998 meeting of the IAEA's GC.[2] The concern expressed about orphan sources led to the adoption of GC resolution GC(42)/RES/12 that encouraged all governments "to take steps to ensure the existence within their territories of effective national systems of control for ensuring the safety of radiation sources and the security of radioactive materials."[3] In addition, the GC, among other matters, requested the IAEA Secretariat to prepare for the consideration of the Board of Governors a report on (i) how national systems for ensuring the safety of radioactive sources and the security of radioactive materials can be operated at a high level of effectiveness; and (ii) whether international undertakings concerned with the effective operation of such systems and attracting broad adherence could be formulated. The IAEA DG was requested to report to the GC at its 1999 regular session on the implementation of the resolution. A further resolution of the GC, GC(42)/RES/18, at its September 1998 meeting dealt with the related matter of illicit trafficking in nuclear materials and other radioactive sources.[4] In this resolution, among other matters, the DG was requested to submit a report to the GC at its 1999 regular session on the activities undertaken by the Secretariat in the intervening period.

Report of senior experts, international undertaking: In response to the GC request, a group of senior experts met in Buenos Aires from 7 to 10 December 1998 and in Washington, DC from 27 to 30 January 1999. The report prepared by the experts contained a brief review of the safety and security of radioactive sources with specific emphasis on the problems posed by orphan sources, together with measures currently in place to deal with them. It also related the identified deficiencies in this regard and made proposals for improvement. The senior experts' report also addressed the matter of whether international undertakings should be formulated to strengthen the international response to these identified issues. In this context, the report concluded there may be a need for effective international undertakings in the area of the safety and security of radioactive sources. It was suggested that such an international undertaking might take the form of a convention or similar type of international instrument. Whatever its form, the instrument should provide for clear determination by nation states and attract their broad adherence. The IAEA was strongly encouraged to initiate exploratory discussions for achieving such an international undertaking. The report did not deal in any detail with the related topic of illicit trafficking.[5]

Proposed Action Plan and its adoption: In March 1999, the IAEA Secretariat presented the requested report to the Board of Governors, which noted the report's conclusions and recommendations and requested the Secretariat to prepare an Action Plan to take into account these conclusions and recommendations, in line with the Board's discussion of the report.[6] A proposed draft "Action Plan for the Safety of Radiation Sources and the Security of Radioactive Materials"

2. IAEA (1999), "The Safety of Radiation Sources and the Security of Radioactive Materials", IAEA Doc. GOV/1999/46-GC(43)/10, Attachment 2, Appendix 1.

3. IAEA (1998), GC Resolution: "The Safety of Radiation Sources and the Security of Radioactive Materials", IAEA Doc. GC(42)/RES/12, adopted 25 Sept. 1998, para. 2.

4. IAEA (1998), GC Resolution: "Measures against Illicit Trafficking in Nuclear Materials and Other Radioactive Sources", IAEA Doc. GC(42)/RES/18, adopted on 25 Sept. 1998.

5. IAEA Doc. GOV/1999/46-GC(43)/10, *supra* note 67, Attachment 1, "Report prepared by the Secretariat on the advice of the experts that met in 1998 and 1999", pp. 3-4.

6. The Report of the Chairman stated that "[...]there had been general support for the conclusions and recommendations in the ... report prepared on the basis of advice from a group of experts [...] and noted that the action plan would come before the Board before being transmitted to the General Conference". *Ibid.*, p. 3, para. 6.

was subsequently prepared by the Secretariat. [7] From 25 to 28 May 1999, the Secretariat convened a group of consultants in Prague to begin drafting the Action Plan. The draft was further developed in the course of a technical committee meeting held in Vienna from 12 to 14 July 1999. On 20 September 1999, the Board approved the Action Plan and requested the Secretariat to implement it. In October 1999, the GC in resolution GC(43)/RES/10 endorsed the Action Plan and urged the Secretariat to implement it. The primary purpose of the 1999 Action Plan was to enable the IAEA to develop and implement activities that would assist member states in maintaining and, where necessary, improving the safety of radiation sources and the security of radioactive materials over their life cycle. The 1999 Action Plan covered seven areas: (i) regulatory infrastructure; (ii) management of disused sources; (iii) categorisation of sources; (iv) response to abnormal events; (v) information exchange; (vi) education; and (vii) training and international undertakings.

1999 Action Plan and an international undertaking: The 1999 Action Plan envisaged a body of international technical and legal experts, nominated by governments to undertake exploratory discussions relating to an international undertaking in the area of the safety of radiation sources and the security of radioactive materials. These exploratory discussions would focus on the form and content of such an international undertaking. This undertaking would address, *inter alia*, the establishment of national legislation, regulations and regulatory authorities; 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 response to the detection of orphan sources. Account was to be taken of the provisions of the Joint Convention which, among other things, places obligations on contracting parties regarding the transboundary movement of spent fuel and radioactive waste and regarding the possession, remanufacturing or disposal of disused sealed sources, e.g. radioactive sources that are no longer used, and are not intended to be used, for the practice for which an authorisation has been granted. Statements made at the Board at that time suggested that the development of a code of conduct would be the most generally acceptable way to proceed. Further to the 1999 Action Plan and responding to GC resolution GC(43)/RES/10,[8] the Secretariat called for a group of senior consultants to prepare a report[9] addressing whether international undertakings should be formulated to strengthen the safety of radiation sources and the security of radioactive materials. Such an international undertaking could be formulated and might take the form of a convention or some other type of instrument. Whatever its form, it should provide for a clear determination by and attract the broad adherence of states. The IAEA was strongly encouraged to initiate exploratory discussions for achieving such an international undertaking.

3. *September 2000 Board and GC meetings: establishment of the* **Code of Conduct on the Safety and Security of Radioactive Sources**

Early in 2000, the Secretariat convened an open-ended meeting of technical and legal experts to undertake exploratory discussions on a possible Code of Conduct on the Safety of Radiation Sources and the Security of Radioactive Materials. The group met in March and July 2000 and

7. *Ibid*., Attachment 2, "Proposed Action Plan for the Safety of Radiation Sources and the Security of Radioactive Materials".

8. IAEA (1999), GC Resolution: "Measures to Strengthen International Co-Operation in Nuclear, Radiation and Waste Safety: The Safety of Radiation Sources and the Security of Radioactive Materials", IAEA Doc. GC(43)/RES/10, adopted on 1 Oct. 1999.

9. IAEA Doc. GOV/1999/46-GC(43)/10, *supra* note 67, Attachment 2, "Proposed Action Plan for the Safety of Radiation Sources and the Security of Radioactive Materials".

developed a draft Code of Conduct on the Safety and Security of Radioactive Sources.[10] On 11 September 2000, the Board took note of the draft Code of Conduct as prepared within the framework of the 1999 Action Plan. In doing so, it requested the DG to organise consultations on decisions that the IAEA's Policy-Making Organs might wish to take in the light of the report of the chairman of the open-ended meeting, specifically the final draft text of the Code of Conduct regarding, *inter alia*, its application and implementation and to make recommendations thereon to the Board.[11] On 22 September 2000, in resolution GC(44)/RES/11, the GC endorsed the actions taken by the Board of Governors on 11 September 2000 in respect of document GC(44)/7 on the implementation of the 1999 Action Plan and invited member states to take note of the Code of Conduct and to consider, as appropriate, means of ensuring its wide application.[12] The 2000 *Code of Conduct on the Safety and Security of Radioactive Sources* was published by the IAEA in March 2001 with the reference IAEA/CODEOC/2001.

4. 2000 (December) Buenos Aires International Conference[13]

An activity related to the implementation of the 1999 Action Plan was the convening of the 2000 Buenos Aires International Conference where international support for the Code of Conduct was clearly expressed.[14] The Conference produced 16 "major findings", including a set of 8 "immediate future actions" that states should take with a view to ensuring the safety of radiation sources and the security of radioactive materials. Many of the findings reinforced the activities already listed in the 1999 Action Plan.

Following the 1998 Dijon International Conference, the associated regulatory problems of safety and security of radioactive sources were recognised by national competent authorities in their first encounter with the issue at the 2000 Buenos Aires International Conference. Two of the actions identified in the findings can be highlighted. First, preventing criminal misuse of radioactive sources should be seen as complementary to measures to increase safety and security. Thus, a distinction would be made between criminal activities involving an intent to expose people to radiation and breaches of safety and security in which there is no malicious intent. This distinction has implications for border monitoring in particular. Second, states should develop proactive national strategies for locating orphan sources, including actions to bring orphan sources or vulnerable sources (e.g. those in inadequate storage) under proper control.

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10. IAEA (2000), "Measures to Strengthen International Co-Operation in Nuclear, Radiation and Waste Safety: The Action Plan for the Safety of Radiation Sources and the Security of Radioactive Materials", IAEA Doc. GOV/2000/34-GC(44)/7, Attachment 7, Annex.

11. *Ibid*., Attachment 7, p. 7.

12. IAEA (2000), GC Resolution: "Measures to Strengthen International Co-Operation in Nuclear, Radiation and Waste Safety", IAEA Doc. GC(44)/RES/11, adopted on 22 Sept. 2000, para. 4.

13. IAEA (2001), *National Regulatory Authorities with Competence in the Safety of Radiation Sources and the Security of Radioactive Materials, Proceedings, International Conference held in Buenos Aires, Argentina, 11-15 December 2000*, IAEA Doc. IAEA-CSP-9/P, IAEA, Vienna.

14. The Conference called upon states to provide for the Code's application and implementation. High-level officials, senior experts from national authorities and senior policy and decision makers exchanged views and experience on the administrative, technical and managerial aspects of ensuring the regulatory control of safety of radiation sources and the security of radioactive materials by national authorities. The problems of establishing an effective regulatory authority, supported by several government agencies in each state, and on the procedures for the effective control of "radiation" sources and radioactive materials were emphasised. In particular, the steps involved in generating a regulatory control system where it does not exist, preventing sources from escaping from the control system and locating and regaining control over orphan sources, were discussed. See *ibid*., pp. 481-85.

B. Revision of the 2000 *Code of Conduct on the Safety and Security of Radioactive Sources*

The International Conferences in Dijon in 1998 and Buenos Aires in 2000 took place primarily in response to the growing realisation that inadequate controls over radioactive sources have led to significant radiological accidents, some of which had caused serious injuries, even death, and/or severe economic disruption.[15] These accidents had their origins mainly in a breakdown or absence of proper regulatory control and were not a result of malicious intent.

Several provisions of the 2000 Code of Conduct were relevant to maintaining control over sources. Some of those provisions explicitly referred to the needs of "security". However, the focus of those provisions was on incidents such as persons stealing shiny objects for scrap metal resale, unaware of the risks to health and the environment. No consideration was given at that time to the deliberately criminal use of sources in radiological dispersal devices or other malicious devices.[16]

The tragic events of 9/11 and subsequent concerns regarding the possible use of radioactive sources 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 radioactive sources. Revisions to the 2000 Code of Conduct elaborated on and added provisions relevant to physical protection and security and to further strengthen safety, including access controls, national registries, training, notification requirements, orphan source recovery, import and export guidelines, emergency planning, inspections and enforcement. One vitally important addition to the 2003 Code of Conduct is the categorisation of radioactive sources contained in Annex 1 of the Code.[17]

2001 Revised Action Plan:[18] In 2001, the Secretariat, taking into account, *inter alia*, the major findings of the 2000 Buenos Aires International Conference and the "Common Position",[19] produced a "Revised Action Plan for the Safety and Security of Radiation Sources" that was issued as an attachment to document GOV/2001/29-GC(45)/12, *supra* note 19. In approving the revised Action Plan on 10 September 2001, the Board requested the Secretariat to implement it subject to the availability of resources and, as appropriate, to inform the Board of progress made in its implementation. Significantly, the 2001 Action Plan called for the Secretariat to consult member states on their experience in implementing the 2000 Code of Conduct.

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15. Although the 2003 Code of Conduct's provisions addressed security, the focus at that time was very much on incidents such as radioactive sources in scrap metal. No consideration was given to the possible use of sources for malicious purposes, such as radiological dispersal devices. At that time, agreement was not reached on several issues, notably those relating to the creation of comprehensive national registries for radioactive sources, obligations of states exporting radioactive sources, and the possibility of unilateral declarations of support.

16. McIntosh S. and K. Cutler (2015), *supra* note 8.

17. See text from the Annex to the 2003 Code of Conduct, *supra* note 13.

18. "Revised Action Plan on the Safety and Security of Radiation Sources", *supra* note 19.

19. In April 2001, the Secretariat organised the First Africa Workshop on the Establishment of a Legal Framework governing Radiation Protection, the Safety of Radiation Sources and the Safe Management of Radioactive Waste that was held in Addis Ababa, Ethiopia. The workshop adopted a "Common Position on the Establishment of a Legal Framework governing Radiation Protection, the Safety of Radiation Sources and the Safe Management of Radioactive Waste" (the "Common Position"). In the Common Position, the participants called upon the IAEA to "create a forum for African countries to consider the Code of Conduct on the Safety and Security of Radioactive Sources [publication IAEA/CODEOC/2001] and give it a legally binding effect so that the safe and peaceful use of nuclear technology is not compromised". IAEA (2002), *IAEA Annual Report 2001*, IAEA Doc. GC(46)/2, IAEA, Vienna, p. 80.

May 2002 questionnaire on the effectiveness of the 2000 Code of Conduct: In May 2002, member states were requested by the Secretariat to provide information on how they were implementing the 2000 Code of Conduct and on how best to strengthen it to address emerging radiological security concerns ("Review of the Effectiveness of the Code Questionnaire"). Taking the results of this survey into consideration, the IAEA convened three open-ended meetings in August 2002, March 2003 and July 2003 to revise the 2000 Code of Conduct to more adequately address security concerns.

August 2002 technical meeting:[20] In August 2002, the Secretariat convened an open-ended meeting to consider the effectiveness of the 2000 Code of Conduct. The meeting was mindful of the desirability of a strengthened 2000 Code of Conduct in response to questions arising from responses to the Secretariat's May 2002 request for information and to address security concerns in light of the events of 9/11 regarding possible deliberate and malicious use of radioactive sources to cause damage to individuals, society and the environment.

At the August 2002 meeting, the provisions of the 2000 Code of Conduct relating to the security of radioactive sources were strengthened in the light of 9/11 and consensus was reached on several previously unresolved issues. Several changes addressing security issues were made, including the addition of a specific objective relating to security and a reference to the need to protect the facilities in which sources are managed as well as the sources themselves. In addition, the meeting agreed that exports of sources that may pose a significant risk to individuals, society or the environment should be subject to a special authorisation. Further, the 2000 Code of Conduct was amended to provide for the establishment of national registers of those radioactive sources that pose the most significant risks. In addition, the meeting reached consensus on the importance of entire life-cycle management of sealed radioactive sources that pose a significant risk. However, it was recognised that further work was needed, especially in relation to the scope of the 2000 Code of Conduct. Those issues included, among others, ways of encouraging broad adherence to the 2000 Code of Conduct. Another issue requiring further consideration was that of recycling or reuse of sources. Also, while the meeting agreed on the need for export controls, it concluded that further details may need to be discussed.

The meeting recommended that the draft revised Code of Conduct be provided to the Board and GC for information, together with the Chairman's report. The group recommended that the DG consider convening an open-ended meeting once the revision of IAEA-TECDOC-1191, *Categorization of Radiation Sources*, *supra* note 18, was finalised, to consider the revision of the scope of the Code of Conduct, resolution of outstanding issues and whether, and how, principles set out in the 2000 Code of Conduct might be made subject to commitment by member states.

September 2002 Board and GC meetings: In September 2002, the draft text from the August 2002 meeting was provided for information to the GC in GOV/2002/35/Add.1-GC(46)/11/Add.1, *supra* note 84, including the Report of the Chairman, to which a draft revised Code of Conduct was annexed. The GC, in resolution GC(46)/RES/9, welcomed the work done to strengthen the 2000 Code of Conduct and noted that a draft revised Code of Conduct was expected to be put to the Board during 2003.[21]

20. IAEA (2002), "Measures to Strengthen International Co-Operation in Nuclear, Radiation, Transport and Waste Safety Implementation of the Revised Action Plan for the Safety and Security of Radiation Sources Draft Revised Code of Conduct on the Safety and Security Of Radioactive Sources", IAEA Doc. GOV/2002/35/Add.1-GC(46)/11/Add.1, Annex, "Report of the Chairman, Technical Meeting to consider the effectiveness of the Code of Conduct on the Safety and Security of Radioactive Sources, Vienna, 19-23 August 2002".

21. IAEA (2002), GC Resolution: "Measures to Strengthen International Co-Operation in Nuclear, Radiation, Transport and Waste Safety", IAEA Doc. GC(46)/RES/9, adopted on 20 Sept. 2002, para. 15.

2003 2nd technical meeting (March) and 3rd technical meeting (July): At a second meeting held in March 2003, changes were made to some of the definitions in the draft revised Code of Conduct and language encouraging harmonisation of the formats of national source registers was added. In addition, progress was made towards defining the scope of the draft revised Code of Conduct and regarding inclusion of provisions relating to import and export controls. A final consensus was not reached; however, the experts agreed that the resulting text should be circulated to all member states for comment. At the third meeting held in July 2003, consensus was reached on the scope and text of the revised Code of Conduct.[22]

March 2003 Vienna (Hofburg) International Conference,[23] focus on nuclear security: The events of 9/11 triggered a new dimension of information exchange, which was highlighted at the March 2003 Vienna (Hofburg) International Conference. After the conference, there was international consensus on ensuring source security control (i.e. that source control should be retained) from "cradle to grave", i.e. from initial manufacture to final disposal. Besides being circulated to all member states, the draft revised Code of Conduct was also made available to the 2003 March Vienna (Hofburg) International Conference. The "Findings of the President of the Conference" included a recommendation that states make a concerted effort to follow the principles contained in the Code of Conduct then being revised.[24]

September 2003 Board and GC meetings: Approval and endorsement of the 2003 Code of Conduct: On 8 September 2003, the revised Code of Conduct was approved by the Board. On 19 September 2003, in resolution GC(47)/RES/7.B, the GC welcomed the Board's approval and endorsed its objectives and principles.[25] The revised 2003 Code of Conduct was published in January 2004 as IAEA/CODEOC/2004[26] and replaced the version published as IAEA/CODEOC/2001 in March 2001. It reflects the important findings produced by the March 2003 Vienna (Hofburg) Conference.

22. IAEA (2003), "Measures to Strengthen International Cooperation in Nuclear, Radiation and Transport Safety and Waste Management Revision of the Code of Conduct on the Safety and Security of Radioactive Sources: Report by the Director General", IAEA Doc. GOV/INF/2003/49-GC(47)/9, Annex 2, "Report of the Chairman".

23. IAEA (2003), *Security of Radioactive Sources, Proceedings of an International Conference held in Vienna, Austria, 10-13 March 2003*, IAEA Doc. STI/PUB/1165, IAEA, Vienna.

24. *Ibid*., p. 443.

25. IAEA Doc. GC(47)/RES/7, *supra* note 2, paras. B.1 and B.2, which endorsed IAEA Doc. GOV/INF/2003/49-GC(47)/9, *supra* note 87, Annex 1, "Draft revised Code of Conduct on the Safety and Security of Radioactive Sources".

26. 2003 Code of Conduct, *supra* note 2.

ANNEX II

The "formalised process": international meetings and international conference

2019 5th information exchange meeting:[1] The most recent information exchange meeting was held in 2019. A total of 47 national papers and 42 papers on implementation practices were submitted by 28 member states in advance of the meeting. Eighty-seven oral presentations took place. The meeting identified that the initiative of presenting implementation practices papers was valuable, that states should be encouraged to submit papers and that the IAEA should establish a process to analyse and disseminate the corresponding information. During the meeting, participants reviewed the revised formalised process[2] and agreed to proposed changes related to the inclusion in the process, of the new 2017 Disused Radioactive Sources Guidance and addition of inter-regional meetings as part of the process. The Report of the Chairman records that "As called for in the current version of the 'formalized process', it is suggested that the Secretariat submits th[e] report, including the attached revised version of the 'formalized process', to the IAEA's policymaking organs for their information." The information exchange was attended by 191 experts from 102 member states and observers from ISSPA, the International Irradiation Association and the Nuclear Threat Initiative. The papers and presentations were made available to participants on a secured shared webpage.

2016 4th information exchange meeting:[3] The 2016 information exchange served as a forum for the exchange of information on national implementation of the 2003 Code of Conduct and its supplementary Import-Export Guidance. The meeting included plenary sessions devoted to, *inter alia*, the international and regional initiatives related to safety and security of radioactive sources, synergies between the 2003 Code of Conduct and the Joint Convention, and ongoing and new initiatives to assist states in the implementation of the safety and security principles of the Code. The meeting was attended by 190 experts from 102 states.

2013 3rd information exchange meeting:[4] The 2013 Abu Dhabi International Conference replaced the regular exchange of information meetings on the 2003 Code of Conduct and its supplementary Import-Export Guidance. The conference served as a forum for the exchange of information on national implementation. It was the first international conference on safety and security of radioactive sources to be held since the 2005 Bordeaux International Conference. Sixty-

1. IAEA (2019), Report of the Chairman, "Open-ended Meeting of Technical and Legal Experts to Share Information on States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its Supplementary Guidance", Vienna, 27-31 May 2019.

2. Following a request of the IAEA GC, a formalised 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 was elaborated upon in June 2006 and subsequently noted by the IAEA Board of Governors (the "Formalised Process"). In particular, it governs the preparation and performance of the meetings organised by the IAEA to discuss the implementation of the Code and associated Guidance. See *supra* notes 52 and 53.

3. IAEA (2016), Report of the Chairman, "Open-ended Meeting of Technical and Legal Experts for Sharing of Information on States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources", Vienna, 30 May – 3 June 2016.

4. IAEA (2015), *Safety and Security of Radioactive Sources: Maintaining Continuous Global Control of Sources throughout Their Life Cycle*, *supra* note 8.

seven member states prepared national reports on their implementation of the Code. The conference consisted of nine plenary and two poster sessions. Participants reviewed current successes and challenges in ensuring the safety and security of radioactive sources and identified means of maintaining the highest possible levels of safety and security from manufacture to disposal. Among the topics discussed were ways of better controlling the movement of radioactive sources throughout the world, including import and export controls, and the return and repatriation of disused sources, as well as global industry practices and trends with regard to the design, use, recycling and disposal of radioactive sources. The conference was attended by approximately 320 participants from 87 member states, 1 non-member state and 6 international organisations. The timing of the conference coincided with the tenth anniversary of the endorsement of the 2003 Code of Conduct.

2010 2nd information exchange meeting:[5] The 2010 information exchange served as another forum for the exchange of information on national implementation of the 2003 Code of Conduct and its supplementary Import-Export Guidance. The 2010 information exchange meeting was attended by 160 experts from 91 member states. In September 2010, the 54th session of the GC, in noting the recommendations of the technical meeting, requested the Secretariat to implement them, in particular, the recommendation calling for the organisation of an international conference on the safety and security of radioactive sources, which was planned for 2013.[6]

2007 1st information exchange meeting:[7] At the first information exchange meeting held in June 2007, information was exchanged and a variety of topics were discussed, including: infrastructure for regulatory control; facilities and services available to the persons authorised to manage radioactive sources; training of staff in the regulatory body, law enforcement agencies and emergency service organisations; experience in establishing a national register of radioactive sources; and national strategies for gaining or regaining control over orphan sources. The meeting confirmed that there was widespread international support for the 2003 Code of Conduct and its Import-Export Guidance. Moreover, the 2007 meeting indicated significant but uneven progress among member states in implementing the provisions of the Code. The availability of sufficient resources and expertise was highlighted as an ongoing challenge in many states. In addition, several issues that relate to the harmonised implementation of the Import-Export Guidance were raised, and it was suggested that these issues should be further discussed at a dedicated international meeting. The 2007 information exchange meeting was attended by 122 experts from 70 member states, 2 non-member states, and observers from the EC, OSCE and FAO. Experts from 53 states took the opportunity to present papers on their experiences in implementing the Code and the Guidance. In line with the non-legally binding nature of the Code and supplementary Import-Export Guidance, participation and presentation of papers was on a voluntary basis. Participants appreciated the open nature of the discussions and encouraged the IAEA to hold similar meetings in the future, perhaps on a triennial basis and subject to availability of funds. Several conclusions were reached and summarised in the Chairman's report.

5. IAEA (2010), Report of the Chairman, *supra* note 28.

6. IAEA (2010), GC Resolution: "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. GC(54)/RES/7, adopted on 24 Sept. 2010, para. 65.

7. IAEA (2007), Report of the Chairman, "Open-ended Meeting of Technical and Legal Experts for Sharing of Information as to States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources", Vienna, 25 – 29 June 2007.

The international regulatory framework governing the safe and secure transport of nuclear and radioactive materials

by Khalil Bukhari[*]

The law applicable to the international transport of radioactive materials (RAM), which includes nuclear materials, does not change very often, but the manner in which it is implemented continues to develop as those that are involved in the industry seek to improve practices to enhance the safety, security and efficiency of nuclear transports. This article is based on the author's experience as a nuclear transport lawyer involved in transports of the most sensitive type within the nuclear fuel cycle. These form a small part of the much larger radioactive material transport industry, but the focus here will be on the author's experiences in the interpretation and the application of the regulations pertaining to transport of radioactive materials as relevant to the transport of nuclear materials.

Approximately 20 million consignments of RAM take place around the world each year.[1] Road and air are generally the predominant transport modes and, while most are from use in medicine, agriculture, research, manufacturing, non-destructive testing and mineral exploration, about 5% of these consignments are nuclear fuel cycle-related. This is the area of the industry with which the author is most familiar, and it has involved about 7 000 transports of used fuel (over 80 000 tonnes) on land and sea since 1971, with a major fraction of those in Europe being transboundary transports.

Despite so many such transports there has never been an incident causing a container of highly radioactive material to be breached. This is, at least in part, a testament to the regulatory framework that is in place and the stringent controls and procedures it requires to be implemented for such transports.

As transport is a very broad international activity it will not be possible here to discuss all local and national laws and regulations that may be applicable to any particular transport; hence, the focus will be on a high-level review in two parts. First, an overview will be presented of the background, law and regulations applicable to international RAM transports. Second, consideration will be given to some of the practical aspects and challenges of RAM transports as affected by such regulations.

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1. World Nuclear Association (2021), "Transport of Radioactive Materials", https://world-nuclear.org/information-library/nuclear-fuel-cycle/transport-of-nuclear-materials/transport-of-radioactive-materials.aspx#Sources (accessed 23 Oct. 2021).

I. Transport: An overview

A. Importance of transport

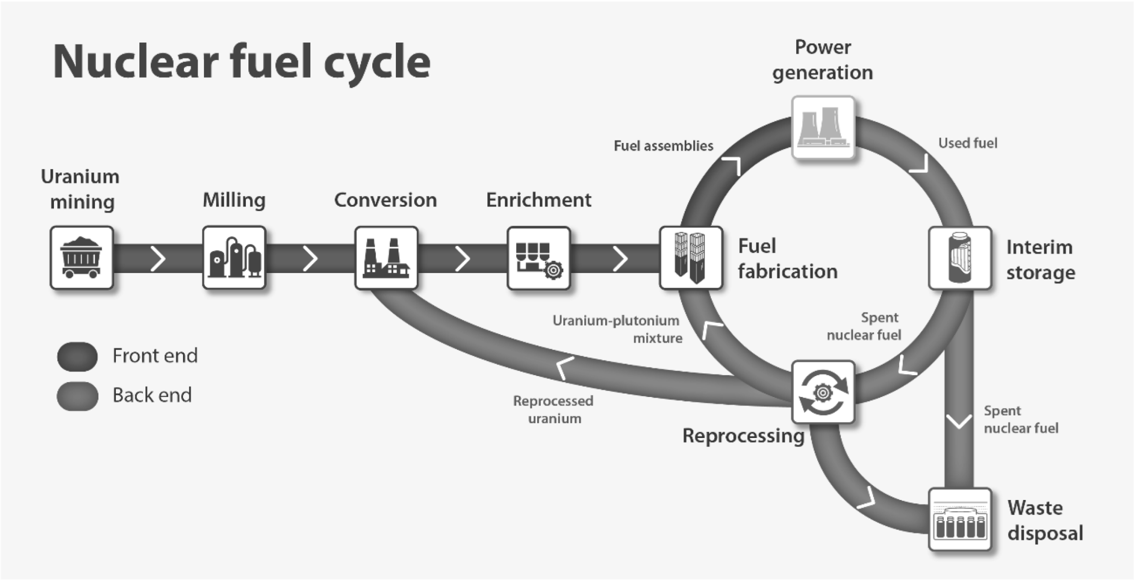

Figure 1. Nuclear fuel cycle

Source: OECD Nuclear Energy Agency (NEA).

Figure 1 is a representation of the various stages of the nuclear fuel cycle. The front end consists of mining, milling, conversion, enrichment and fuel fabrication, while the back end consists of reprocessing spent fuel, recovery of plutonium and uranium, and storage and disposal of waste. The locations at which these activities occur are spread throughout the world. Uranium mines are mainly found in Australia, Canada, the People's Republic of China (China), Kazakhstan, Namibia, Niger, the Russian Federation (Russia), South Africa, Uzbekistan and the United States, among others. But enrichment facilities are mainly found in Europe, China, Russia and the United States. To connect all these activities, a safe, secure and reliable transport industry is crucial to allow the global nuclear industry to operate and supply essential energy needs throughout the world. Without transport, much of this vital global industry would cease to function effectively or at all. It is clear that transport is a vital component of the nuclear industry.

B. Importance of regulations

Figure 2 shows a typical scene at the unloading of a container of nuclear material from a ship at the Barrow Marine Terminal in the United Kingdom (UK) operated by Nuclear Transport Solutions, the transport division of the UK Nuclear Decommissioning Authority. Every aspect of this activity, including all equipment, assets, processes and individuals involved, are required to be maintained and functional to the highest degree to ensure such activities are performed with the utmost safety and security each time and meet the three technical requirements that are vital in the nuclear industry: safety, security and safeguards (these will be discussed in more detail below). The regulations set out what is required to meet such requirements and are therefore critical to the transport industry.

Figure 2. Aerial view of Barrow Marine Terminal

Source: Pacific Nuclear Transport Limited.

C. Stakeholder co-ordination

RAM transport is a highly coordinated process and involves multiple governmental and non-governmental stakeholders such as:

- regulators and competent authorities;
- consignors;
- consignees;
- carriers;
- site operators;
- packaging manufacturers;
- customs and border control agencies;
- road, rail, airport, and seaport authorities;
- trade agencies;
- security agencies;
- emergency response organisations;
- police forces.

RAM transports can also involve multiple modes of transport (road, rail, air, sea, inland waterways, postal services) depending on the category of radioactive material and requirements of different nations involved and their nuclear programmes or lack thereof. With such a diverse range of stakeholders and activities, the highly organised and efficient co-operation of all stakeholders involved is essential to maintain safe and secure transport. This can require significant preparation in advance of any transport, especially for the highest category and most sensitive nuclear materials for which compliant licence approval processes for packages and exports can take many years. Therefore, an initial regulatory review of any transport can be an important asset to ensure a transport plan is as efficient as possible without unnecessary or unforeseen delays.

D. RAM transport: Regulatory overview

An extensive body of laws and regulations apply to RAM transports and in particular nuclear transports, because they occur within and across national borders. It is therefore not surprising that many who are not familiar with nuclear transport find this area of law confusing.

To bring some clarity, it will help to start with some background and overview of the regulatory framework and then discuss the following:

- IAEA Transport Regulations;
- packaging requirements;
- transport by road;
- transport by rail;
- transport by sea and inland waterways;
- transport by air;
- transport by post;
- physical protection requirements in transport;
- European Union (EU) RAM transport regulations;
- international treaties, conventions and codes; and
- nuclear liability.

1. Legal and regulatory framework

As already mentioned, the transport of nuclear material is a major component of nuclear activities worldwide and of constant concern for all states involved. Consequently, the law relating to RAM transports and therefore nuclear transports is complex and cuts across a variety of jurisdictions and regulatory bodies, as well as covering different aspects such as:

- national law;
- regional law (e.g. the EU);
- international nuclear law;
- modal law (specific mode of transport);
- general international law (law of the sea, law of the air).

The common aim of most legal and regulatory frameworks is to at least cover the three essential technical aspects of safety, security and safeguards. Safety in RAM transports is concerned with maintaining control over nuclear materials and avoiding incidents and accidents. Security is focused on the prevention, detection of, response to theft of and use of RAM for malicious acts. Lastly, safeguards activities are how the IAEA confirms that states are not using civilian nuclear programmes for illicit military purposes. This approach is frequently referred to as the "3S concept" and emphasises the interrelationship among the three areas.

As there is no single international legal instrument to address all three technical aspects, a range of international legal instruments and recognised safety, security and safeguards principles, practices and procedures are required to ensure RAM transports are completed in a safe and secure manner.

a. Transport definitions (IAEA)

Before discussing the regulatory framework in any detail, it is worth reviewing the IAEA's definition of the term "transport":

> all operations and conditions associated with, and involved in, the movement of *radioactive material*; these include the *design*, manufacture, maintenance and repair of *packaging*, and the preparation, consigning, loading, carriage including in-transit storage, *shipment* after storage, unloading and receipt at the final destination of loads of *radioactive material* and *packages*.[2]

The definition is clearly very broad, covering many different activities, each requiring different types of laws and regulations. Other more limited definitions also exist and are used in various legal instruments, thereby making the area of transport regulation a highly complex subject. It is further complicated by the relatively broad definitions of the terms "package" and "packaging":

- package: "complete product of the packing operation, consisting of the packaging and its contents prepared for transport";[3]
- packaging: "one or more receptacles and any other components or materials necessary for the receptacles to perform containment and other safety functions."[4]

b. Requirement for a legal and regulatory framework

RAM transport in the public domain is considered an activity that is vulnerable to criminal activities (e.g. theft and sabotage) and, as RAM come in a variety of forms, they present a range of potential hazards during transport, including radiological and contamination hazards affecting human health, the environment and other socio-economic issues. Certain types of RAM, such as plutonium, are crucial for the development of nuclear weapons, which can give rise to safeguards and nuclear proliferation concerns. All these potential issues need be appropriately managed and, therefore, an appropriate legal and regulatory framework relating to the transport of RAM is essential.

c. Implementation of the legal and regulatory framework

The essential legal and regulatory framework is implemented by various international agencies (e.g. the United Nations (UN), IAEA, Organisation for Economic Co-operation and Development Nuclear Energy Agency, the EU, Association of Southeast Asian Nations) working together to produce a harmonised framework that ensures compliance with all applicable regulations, protection of people and the environment, allows for transport of goods and services, and minimises the regulatory burden on businesses involved in transport to ensure the commercial viability of the transport industry.

2. IAEA (2018), *Regulations for the Safe Transport of Radioactive Material*, IAEA Safety Standards Series, Specific Safety Requirements, No. SSR-6 (Rev.1), IAEA, Vienna, p. 3, para. 106 (emphasis in original).

3. *Ibid*., p. 10, para. 231.

4. *Ibid*., p. 10, para. 232.

2. The transport regulations

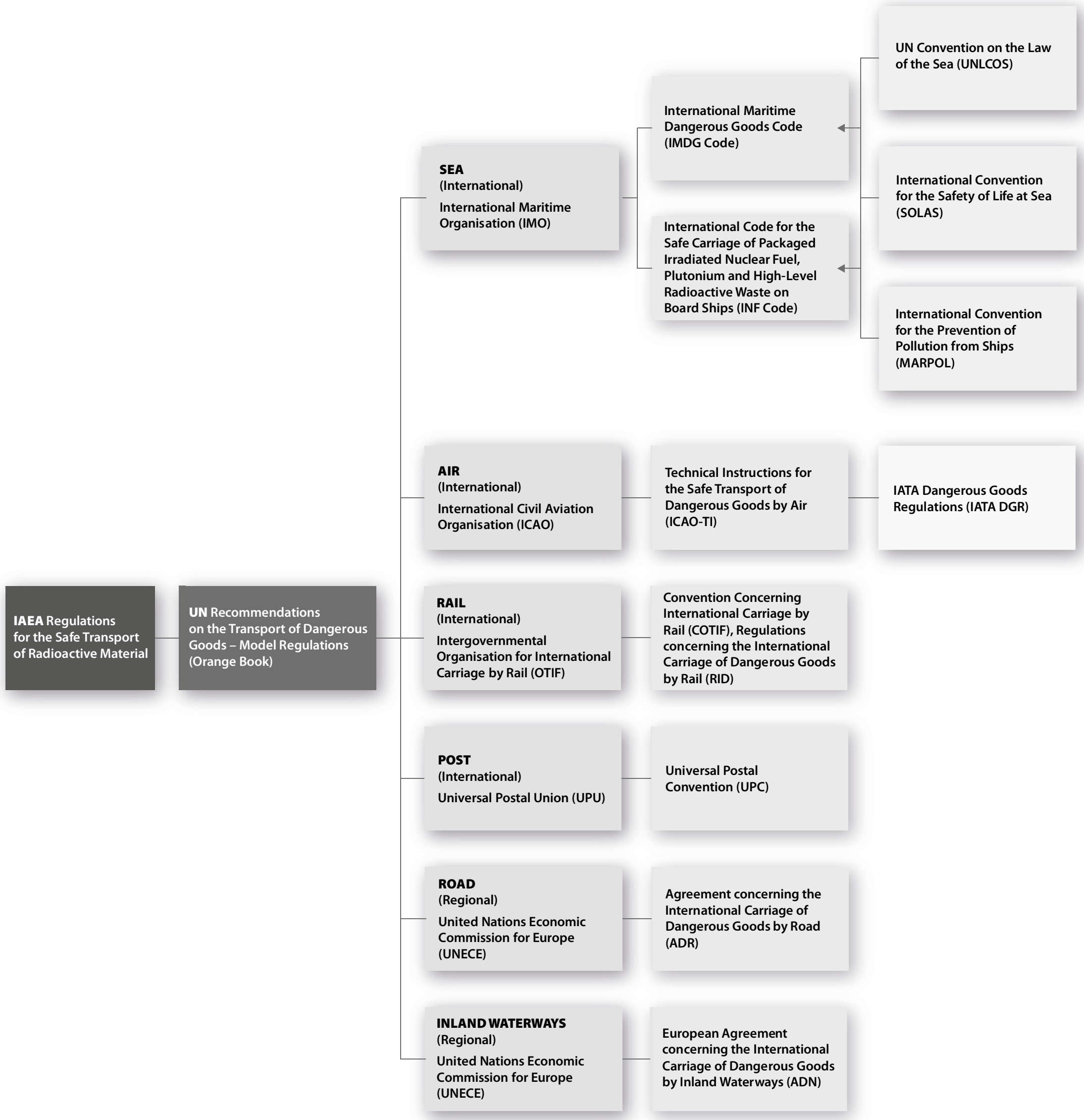

Figure 3. Legal framework for RAM transport

Source: NEA.

Figure 3 illustrates an overview of the basic regulations governing transports of RAM and show multiple levels of binding and non-binding standards, regulations and recommendations:

- IAEA *Regulations for the Safe Transport of Radioactive Material* (IAEA Transport Regulations) appear in the latest edition of the IAEA Safety Standards Series, No.SSR-6 (Rev. 1),[5] and these regulations apply to the transport of radioactive material by all modes on land, water or air, including all incidental activities to such transport as per the broad IAEA definition of "transport". The IAEA encourages member states and international organisations to adopt these regulations in the formulation and implementation of their national and international regulatory requirements for the transport of radioactive material.

5. *Ibid*.

- The UN *Recommendations on the Transport of Dangerous Goods*[6] are widely known as the "Orange Book", have been developed by a UN Committee of Experts and are based on the IAEA Safety Standards. The Orange Book is presented in the form of "Model Regulations" providing a universal system of recommendations and a legal and technical regulatory framework for the transport of all categories of dangerous goods and transport modes. The Orange Book covers a range of activities – from the design, manufacture, maintenance and repair of packaging to the preparation, consigning, loading, carriage, unloading and receipt of loads of radioactive material and packages. It therefore plays an important role in ensuring harmonisation and consistency in the basic safety and security requirements for transport. It is regularly reviewed and updated. The latest issue is the 21st edition, which was published in 2019.

- The major international and regional modal regulations for worldwide or regional application are based on the Orange Book. These include:

  - The Agreement concerning the International Carriage of Dangerous Goods by Road (ADR);[7]
  - The Regulations concerning the International Carriage of Dangerous Goods by Rail (RID);[8]
  - International Maritime Dangerous Goods Code (IMDG Code), issued by the International Maritime Organisation (IMO) for transport by sea;[9]
  - International Civil Aviation Organisation (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO-TI);[10]
  - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN);[11]
  - Universal Postal Convention (UPC).[12]

  The provisions of these modal regulations apply to the international transport of dangerous goods and are legally binding only for states that are party to the relevant regulations. It is up to each state to apply the modal regulations to domestic dangerous goods transports.

Also relevant is regional legislation such as EU regulations, as well as international treaties and conventions relating to nuclear liability that will be discussed in more detail later in this article.

6. UN (2019), *Recommendations on the Transport of Dangerous Goods – Model Regulations (Rev. 21)*, ST/SG/AC.10/1/Rev.21, UN, New York and Geneva, Vols. I and II.

7. UN Economic Commission for Europe (UNECE) (2020), *ADR applicable as from 1 January 2021 – Agreement Concerning the International Carriage of Dangerous Goods by Road*, ECE/TRANS/300, UNECE, Geneva, Vols. I and II (ADR 2021).

8. RID, with effect from 1 January 2021, Appendix C to the Convention concerning International Carriage by Rail, available at: https://otif.org/fileadmin/new/3-Reference-Text/3B-RID/RID_2021_e_01_July_2021.pdf (accessed 23 Oct. 2021).

9. IMO (2020), *IMDG Code, 2020 Edition*, IMO Publishing, London (voluntary implementation as of 1 Jan. 2021; mandatory application as of 1 June 2022).

10. ICAO (n.d.), "Technical Instructions For The Safe Transport of Dangerous Goods by Air (Doc 9284)", www.icao.int/safety/dangerousgoods/pages/technical-instructions.aspx (accessed 23 Oct. 2021).

11. ADN (2000), 2497 UNTS 3, entered into force 29 Jan. 2008. The text of the ADN and its Annexed Regulations are published in UNECE (2020), *European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN) including the Annexed Regulations, applicable as from 1 January 2021*, ECE TRANS/301 (Vol. I), UNECE, Geneva (ADN 2021).

12. Universal Postal Union (UPU) (2018), *Convention Manual*, UPU, Berne.

The IAEA Transport Regulations set controls and requirements to ensure the protection and safety of people, property and the environment from the harmful effects of RAM and ionising radiation during any transport. This is achieved by requiring that any transport and associated package meets certain requirements for containment, shielding, confinement and heat management. Containment prevents the uncontrolled spread of RAM while shielding prevents excessive radiation levels. Confinement prevents criticality of fissile material, and heat management prevents thermal damage. To meet these objectives, the IAEA Regulations set requirements around characterisation, classification, preparation and the packaging of RAM based on the principle that the higher the potential hazard from the RAM, the more stringent the requirements for the packaging.

a. Transport regulations: Functional requirements within member states

The IAEA Transport Regulations set requirements and activities for individual bodies within member states; for example, governments are required to establish a suitable and adequate legal framework and a competent authority. The competent authority's responsibilities include regulatory activities such as licensing, monitoring of compliance through inspection and enforcement, and provision of guidance and public information. Consignor responsibilities cover characterisation, classification, and packaging of RAM, whereas carrier and consignee responsibilities are to follow consignor instructions in respect of the handling, carriage and receipt of the package based on its characteristics and how it has been classified and packed.

b. UN Recommendations on Transport of Dangerous Goods (the "Orange Book")

The UN Recommendations prescribe detailed minimum technical, organisational and administrative requirements for the transport of dangerous goods and specify in particular:

- the dangerous goods prohibited from transport;
- the dangerous goods permitted for transport;
- the transport conditions to be met, particularly packaging and labelling requirements;
- the classification of material;
- the principal dangerous goods;
- the packing and stowing requirements of different classes of goods;
- testing procedures; and
- marking, labelling, placarding, and documentation requirements.

The UN Recommendations classify nine categories of dangerous goods and RAM (including nuclear material) forms Class 7 of the nine categories. The other classes are:

- Class 1: explosives;
- Class 2: gases;
- Class 3: flammable liquids;
- Class 4: flammable solids;
- Class 5: oxidising substances;
- Class 6: toxic substances;
- Class 8: corrosive substances;
- Class 9: miscellaneous dangerous substances and articles.

3. Packaging requirements for transport of radioactive materials

In respect of packaging, the IAEA Transport Regulations adopt a risk-based approach. As the radioactive hazard of the content increases, the packaging requirements become more demanding. While there are general design requirements that apply to all packages to ensure that they can be handled safely and securely, the applicable performance standards and approval process for the design and operation of packaging varies according to the activity and physical form of the radioactive contents being transported. Fundamentally, the radioactive material being transported needs to remain safe under both normal and accident conditions of transport.

There are five different types of packages:

- excepted: for very low radioactive content where potential hazards are insignificant, e.g. radiopharmaceuticals.
- industrial: for material having low radioactive content and non-radioactive objects having low levels of surface contamination where the potential hazards are low. There are three categories of industrial packages (Type IP-1, IP-2, IP-3) that differ depending on the nature of the applicable transport conditions.
- Type A: for significant but not large quantities of radioactive material with limits on the radionuclide content to ensure risks posed by any release are low.
- Type B: for highly radioactive material with no activity limits, e.g. high-level waste and mixed oxide fuel. These packages can withstand highly challenging test criteria regarding impact, fire and immersion. Examples of such tests (as required by the IAEA Transport Regulations) are:
  - a penetration test to ensure the package can withstand impact from sharp objects during transport. This involves a metal bar of minimum specifications to be dropped onto the package from a specific height;
  - a water spray test to simulate rainfall over a prolonged period to ensure water cannot penetrate the packaging;
  - a thermal test to expose the package for 30 minutes to an average temperature of at least 800 degrees centigrade;
  - a stacking test to simulate effects of loads on a package over an extended period of time to ensure that the integrity of the package is maintained when subject to normal loading pressures during transport;
  - an immersion test to demonstrate the integrity of the package when submersed under water by exposing the package to a pressure of a head of water of 15 metres for at least 8 hours;
  - drop tests to demonstrate integrity of the package when subjected to impacts that can occur during a transport or accident: drop of 1.2 metres onto a flat horizontal surface, drop of 1 metre onto the end of a rigid steel bar of minimum specification, and a drop of 9 metres onto an unyielding surface.

  These packages require their designs to be approved, licensed and registered with a local competent authority with regulatory testing conducted before first use. They also require regular periodic testing, and they are inspected before each transport. Figure 4 shows an example of a Type B package called a TN28 package that is used for the carriage of high-level waste.

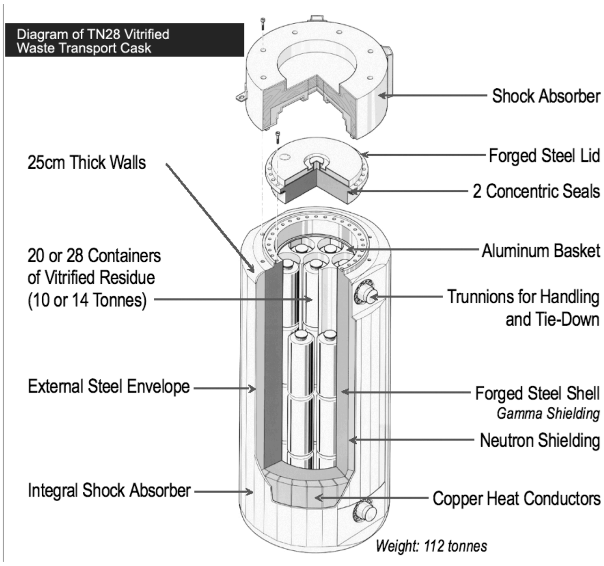

Figure 4. Diagram of Type B package TN28

Source: Pacific Nuclear Transport Limited.

- Type C: like Type B packages, these are very robust packages that are accident resistant and used for transporting large quantities of highly radioactive material with no activity limits by any mode of transport, including air transport. Type C packages are tested to ensure that they can withstand a fall from a height of 450 metres by impact onto a target at a speed of 90 metres per second. The world's first Type C package was designed under the US-Russian Research Reactor Fuel Return programme to enhance safety of air transport of research reactor spent nuclear fuel.

4. Transport of radioactive materials by road

The ADR is published by UNECE and first entered into force on 29 January 1968. It is an agreement among states but has no overall enforcing authority. In practice, checks are the responsibility of the states, with non-compliance leading to legal action by national authorities. Presently, the ADR contracting states are mainly in Europe, Central Asia and North Africa.[13] The ADR applies to transport operations performed on the territory of at least two of the contracting states.

The ADR allows for most dangerous goods to be transported in road vehicles subject to various conditions set out in Annexes A and B. Annex A regulates the goods transported and their packaging and labelling requirements (including exemptions), specifically:

- dangerous goods that are prohibited from international transport; and

13. Currently the contracting parties are: Albania, Andorra, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kazakhstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Montenegro, Morocco, Netherlands, Nigeria, Republic of North Macedonia, Norway, Poland, Portugal, Republic of Moldova, Romania, Russia, San Marino, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Tunisia, Turkey, Ukraine, United Kingdom and Uzbekistan.

- dangerous goods authorised for international transport and the associated requirements in respect of:
  - classification of goods, including classification criteria and relevant test methods;
  - use of packaging (including mixed packaging);
  - use of tanks (including filling);
  - consignment procedures (including marking and labelling of packages and placarding and marking of means of transport as well as documentation and information required);
  - provisions concerning the construction, testing and approval of packaging and tanks; and
  - use of means of transport (including loading, mixed loading and unloading).[14]

Annex B regulates the construction, equipment and operation of vehicles used in the transport of dangerous goods, specifically:

- requirements for vehicle crews, equipment, operation and documentation; and
- requirements concerning the construction and approval of vehicles.[15]

The annexes are regularly amended and updated. The latest amendments came into force on 1 January 2021, and a revised version has been published (ADR 2021, *supra* note 7). The structure is consistent with that of the IMDG Code, ICAO-TI and RID.

5. Transport of radioactive materials by rail

The carriage of dangerous goods by rail within Europe, the Middle East and Africa is governed by the RID, which forms Appendix C to the Convention Concerning International Carriage by Rail (COTIF).[16] COTIF governs the running of the Intergovernmental Organisation for International Carriage by Rail (OTIF), an intergovernmental organisation dedicated to international rail transport based in Berne, Switzerland. OTIF is a legal entity recognised under international law and in the national laws of its member states.[17] OTIF promotes and facilitates international carriage by rail and provides legal and technical interoperability for international carriage by rail via COTIF. As well as the RID, COTIF contains six other appendices covering technical functional requirements and model contracts for the carriage of passengers and goods, which together establish uniform railway law.[18] The RID regulates dangerous goods that can and cannot be transported and their packaging and labelling requirements in the same manner as the ADR[19] and is fully harmonised and consistent with the ADR, ADN, IMDG Code and ICAO-TI. Directive 2008/68/EC[20] (see section I.11 below) also harmonises the RID into EU law.

14. ADR 2021, *supra* note 7, Vol. 1, Chap. 1.1 Sec. 1.1.2.1.
15. *Ibid*., Vol. 1, Chap. 1.1, Sec. 1.1.2.3.
16. RID (2021), *supra* note 8.
17. OTIF (2019), *COTIF 1999 – Convention concerning International Carriage by Rail, Unofficial consolidated version*, OTIF, Berne. Current OTIF members are: Afghanistan, Albania, Algeria, Armenia, Austria, Azerbaijan, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iran, Iraq, Ireland, Italy, Jordan, Latvia, Lebanon, Liechtenstein, Lithuania, Luxembourg, Monaco, Montenegro, Morocco, Netherlands, North Macedonia, Norway, Pakistan, Poland, Portugal, Romania, Russia, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Syria, Tunisia, Turkey, Ukraine, the United Kingdom and the European Union.
18. The appendices and other reference texts may be obtained through the OTIF website at: https://otif.org/en/.
19. RID (2021), *supra* note 8, Chap. 1.1, Sec. 1.1.2.1.
20. Directive 2008/68/EC of the European Parliament and of the Council of 24 September 2008 on the inland transport of dangerous goods, *Official Journal of the European Union* (OJ) L 260 (30 Sept. 2008), p. 13.

6. Other regulations governing transport of dangerous goods by road and rail

The 1994 MERCOSUR/MERCOSUL Agreement of Partial Reach to Facilitate the Transport of Dangerous Goods regulates the road, rail, air and sea transport of dangerous goods between Argentina, Brazil, Paraguay and Uruguay. The transport of RAM between the member states is governed by this Agreement and specific regulations of the competent authorities of each member state that are consistent with the 1985 edition of the IAEA Transport Regulations, as amended in 1990. The Agreement also requires that transports of dangerous goods by air and sea must comply with ICAO and IMO requirements. Other South American countries may become parties to the Agreement in the future but are also considering an International Dangerous Goods Code that is under development for transport between North American Free Trade Agreement countries (Canada, Mexico and the United States).[21]

Several Southeast Asian countries are also considering a regional convention for inland transport that would be based on the Orange Book and the regulations relating to Class 7 material which are consistent with the IAEA Transport Regulations.[22]

7. Transport by sea and inland waterways

The transport of RAM by sea is subject to a wide range of international conventions, codes and agreements, as well as specific domestic legislation. It is beyond the scope of this article to examine each detail so a general overview will be provided here.

a. UN Convention on the Law of the Sea (UNCLOS)[23]

From a general perspective, UNCLOS covers the right of innocent passage for all ships and the obligation for ships carrying nuclear and other dangerous substances to observe special precautionary measures and protection of the marine environment. In addition, landlocked states are given rights of access through transit states. UNCLOS also sets various geographical limits:

- internal waters: “landward side of the baseline”;
- territorial waters: “baseline to 12 nautical miles”;
- contiguous zone: “12 to 24 nautical miles”; and
- exclusive economic zone: “baseline to 200 nautical miles”.

b. International Maritime Dangerous Goods Code[24]

The IMDG Code is based on the IAEA Safety Standards and is consistent with the format of the UN Recommendations on the Transport of Dangerous Goods. It specifies requirements in respect of container stowage and the segregation of incompatible substances and establishes standards of safety and levels of control of radiation, criticality and thermal hazards to persons, property and the environment linked to the transport of dangerous goods, including radioactive materials.

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21. IAEA (2017), *Legally Binding and Non-Binding International Instruments and Regulations Concerning the Safe Transport of Radioactive Materials and Their Implementation*, IAEA, Vienna, p.26, Sec. 3.10.
22. *Ibid*.
23. 1833 UNTS 397, entered into force 16 Nov. 1994.
24. See *supra* note 9.

c. *The International Convention for the Safety of Life at Sea (SOLAS) 1974*[25]

SOLAS refers to the IMDG Code and sets minimum safety standards for the construction, equipment and operation of ships. It adopts the IAEA Transport Regulations for dangerous goods related to safety and is considered the most important of all international treaties regarding the safety of ships. The first version was adopted in 1914, though it never entered into force, in response to the Titanic disaster; successive versions appeared in 1929, 1948, 1960 and 1974. Under the 1974 version, any amendment will enter into force on a specified date unless an agreed number of parties lodge their objections. Consequently, updates or amendments to the 1974 Convention have been made on a number of times and the Convention today can be referenced as SOLAS 1974, as amended.

The flag states of all ships are responsible for ensuring that they comply with the requirements of SOLAS, and contracting governments are allowed to inspect ships of other contracting states if it is believed that a ship does not comply with SOLAS requirements; this procedure is characterised as port state control.

d. *The International Convention for the Prevention of Pollution from Ships (MARPOL)*[26]

MARPOL is the primary international convention regulating the prevention of pollution of the marine environment by ships and was adopted on 2 November 1973 at the IMO. It was incorporated into the Protocol of 1978 that was adopted in response to a number of tanker accidents in the 1970s. The combined Convention and Protocol came into force on 2 October 1983. The Convention was further amended in 1997 by the adoption of a new Protocol and a new Annex VI, which entered into force on 19 May 2005. The Convention currently includes six Annexes as follows:

- Annex I: Regulations for the Prevention of Pollution by Oil (in force 2 October 1983);
- Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (in force 2 October 1983);
- Annex III: Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (in force 1 July 1992);
- Annex IV: Prevention of Pollution by Sewage from Ships (in force 27 September 2003);
- Annex V: Prevention of Pollution by Garbage from Ships (in force 31 December 1988);
- Annex VI: Prevention of Air Pollution from Ships (in force 19 May 2005).

While none of the annexes directly apply to RAM, MARPOL is nevertheless an important aspect of the considerations for any transport of RAM by sea.

e. *European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways*

The ADN applies to transports on inland waterways and has the same status as the ADR, being aligned with the IAEA Transport Regulations in respect of the transport of RAM. Currently there are 18 contracting parties[27] to the ADN. Other member states of UNECE with territory

25. 1184 UNTS 2, entered into force 25 May 1980.

26. Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships (1978), 1340 UNTS 61, entered into force 2 Oct. 1983.

27. Austria, Belgium, Bulgaria, Croatia, Czech Republic, France, Germany, Hungary, Luxembourg, Netherlands, Poland, Moldova, Romania, Russia, Serbia, Slovak Republic, Switzerland and Ukraine.

incorporating inland waterways may also become contracting parties, provided that the inland waterways are defined within the European Agreement on Main Inland Waterways of International Importance (AGN).[28]

The ADN does not apply to the carriage of dangerous goods including RAM by ships on maritime waterways forming part of the inland waterways[29] nor does it apply to the carriage of dangerous goods including RAM by warships or other ships belonging to or operated by a state, provided such ships are used by the state exclusively for governmental and non-commercial purposes. However, each contracting party is required to ensure that such ships are operated in compliance with the ADN where it is reasonable to do so.[30]

The regulations annexed to the ADN address the transport of dangerous goods on inland waterways and the construction and operation of ships. Moreover, they also refer to "requirements and procedures for inspections, the issue of certificates of approval, recognition of classification societies, derogations, special authorisations, monitoring, training and examination of experts."[31]

f. International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Waste on Board Ships (INF Code)[32]

For ships carrying radioactive material, additional stringent regulations are imposed through the INF Code, which were initially introduced as recommendations in 1993 by the IMO and then made mandatory in 2001.The INF Code applies to all ships transporting INF cargo (packaged irradiated nuclear fuel, plutonium and high-level radioactive wastes carried as cargo in accordance with Class 7 of the IMDG Code), but does not apply to warships, naval or other ships owned or operated by a government and used only on government non-commercial service. However, each contracting member state must ensure that such ships carrying INF cargo are essentially compliant, so far as reasonable and practicable, with SOLAS and the INF Code. The INF Code defines three classes of ships (Class INF 1, 2 and 3 ships) based on the aggregate level of radioactivity and INF cargo that a ship is permitted to transport.

INF 1 and INF 2 ships are certified to carry INF cargo within specific limits of activity as follows:

- INF 1 ship: "INF cargo with an aggregate activity less than 4,000 [TeraBecquerel (TBq)]";
- INF 2 ship: "irradiated nuclear fuel or high-level radioactive wastes with an aggregate activity less than $2x10^6$ TBq and … plutonium with an aggregate activity less than $2x10^5$ TBq".[33]

INF 3 ships "are certified to carry irradiated nuclear fuel or high-level radioactive wastes and … plutonium with no restriction of the maximum aggregate activity of the materials."[34] A diagram of an INF 3 ship can be seen in Figure 5 below.

28. AGN (1996), 2072 UNTS 313, entered into force 26 July 1999.

29. ADN, Chap. I, Art. 1, in ADN 2021, *supra* note 11, p. xiii.

30. *Ibid*.

31. *Ibid*., p. iii; see ADN, Chap. 1, Art. 2, in *ibid*., p. xiv.

32. IMO (n.d.), "International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (INF Code)", www.imo.org/en/OurWork/Safety/Pages/INF-Code.aspx (accessed 23 Oct. 2021).

33. IMO (n.d.), "INF Code", www.imo.org/fr/OurWork/Safety/Pages/Containers-Default.aspx (accessed 23 Oct. 2021).

34. *Ibid.*

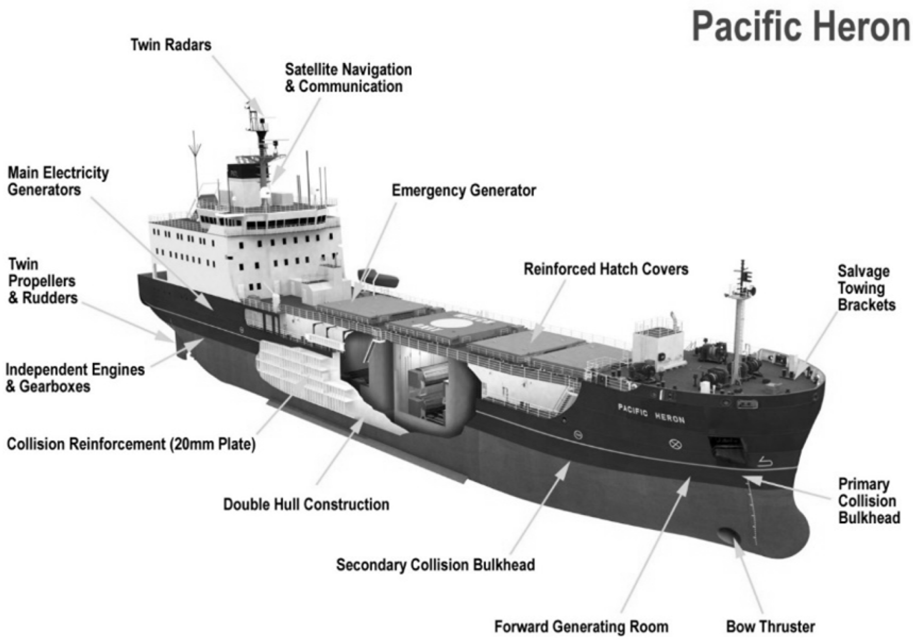

Figure 5. Diagram of an INF 3 ship

Source: Pacific Nuclear Transport Limited.

Such ships must also comply with the International Safety Management Code (ISM Code)[35] and the International Ship and Port Facility Security Code (ISPS Code).[36]

The ISM Code provides an international standard for the safe management and operation of ships and is based on general principles that are expressed in broad terms to have widespread application. The ISPS Code is a comprehensive security regime that was conceived following the 11 September 2001 attacks in the United States. It aims to establish an international framework for co-operation between contracting governments, governmental agencies, local administration and the shipping and port industry with the ultimate purpose to enhance maritime security. The ISPS Code provides for a standardised and consistent framework for evaluating risks, thereby enabling governments to offset changes in the security threat through determination of appropriate security levels and corresponding security measures.

The maritime security management measures include designation of appropriate personnel (security officers) on each ship, in each port facility and in each ship-owning company to make assessments and put into effect security plans that will be approved for each ship and port facility. States that are contracting parties to SOLAS have a legal obligation to comply with the requirements of the ISPS Code and to submit information to the IMO.

35. IMO (n.d.), "The International Safety Management (ISM) Code", www.imo.org/en/OurWork/HumanElement/Pages/ISMCode.aspx (accessed 23 Oct. 2021).

36. IMO (2003), *International Ship & Port Facility Security Code and SOLAS Amendments 2002*, IMO, London.

8. Transport of radioactive materials by air

The operation of commercial aircraft is governed by the Convention on International Civil Aviation that was signed on 7 December 1944 in Chicago and entered into force in 1947 (known as the Chicago Convention).[37] It established the main principles allowing air transport and led to the creation of the ICAO, a specialised agency of the UN, which oversees the Chicago Convention.

Annex 18 of the Chicago Convention establishes the international standards and recommended practices for the safe transport of dangerous goods by air. To align with the regulations covering the transport of dangerous goods by other modes of transport, the provisions of Annex 18 are based on the ADR and the IAEA Transport Regulations.

Annex 18 contains definitions, including of "dangerous goods", and requires each contracting state to ensure compliance with the ICAO-TI.[38] The ICAO-TI contain detailed instructions on the following aspects of transport of dangerous goods by air: substance and article classification, packing, package labelling and marking acceptance, procedures for loading aircraft, and training of personnel.

The ICAO-TI are intended to ensure such transports meet a level of safety without placing an aircraft or its occupants at risk. The ICAO-TI are updated every two years, the most recent edition being the 2021-2022 edition. Before the development of the ICAO-TI, the carriage of dangerous goods by air was subject to the Restricted Articles Regulations of the International Air Transport Association (IATA). While the ICAO-TI are now the minimum legal requirement, airlines continue to require compliance with IATA Dangerous Goods Regulations (IATA DGR)[39] that succeeded the Restricted Articles Regulations. The IATA DGR are based on the ICAO-TI and are consistent with the IAEA Transport Regulations and the ADR.

9. Transport of radioactive materials by post

The UPU regulates the international postal services of UN member states via the UPC[40]. The UPU originally was formed by treaty in 1874 as the General Postal Union and is the second oldest international organisation in the world. The UPU helps to ensure a universal network of postal products and services. It sets rules for international mail exchanges and makes recommendations to improve customer service.

While the UPC generally prohibits the sending of goods by post that may be explosive, flammable or dangerous, it allows the forwarding of radioactive material by post by authorised consignors subject to compliance with conditions within the Regulations of the UPC. This should normally be done by the quickest route, usually by air, between member states that have agreed to such carriage between them subject to prior consent from the competent authorities of the state of origin. Member states that do not fall into this category cannot allow such items to transit through their territory. The UPC also lays down specific requirements for the labelling of radioactive material sent by post that identify the consignor and that the contents are radioactive materials.

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37. 15 UNTS 295, entered into force 4 Apr. 1947. The most recent version is found in ICAO (2006), *Convention on International Civil Aviation*, Doc. 7300/9, 9th edition, ICAO, Montréal.

38. See *supra* note 10.

39. IATA (2021), *Dangerous Goods Regulations*, 63rd edition, IATA, Montréal (effective 1 Jan. to 31 Dec. 2022).

40. UPU *Convention Manual*, *supra* note 12.

10. Physical protection requirements in transport

The main international legal instrument governing the physical protection of nuclear material during international transport for peaceful purposes is the Convention on the Physical Protection of Nuclear Material (CPPNM).[41]

The CPPNM entered into force in February 1987 and was strengthened in 2005 by an Amendment[42] extending the scope of the original convention to cover physical protection of nuclear sites and nuclear material in storage and transport for peaceful purposes and providing for further criminal offences for breaching such protection. The CPPNM specifies the level of physical protection (Category I, II, and III) that civil nuclear material requires during transport and allows for the prosecution and punishment of offences of theft and sabotage of such material. A range of measures is provided, including physical barriers graded depending on the threat level and the adverse consequences of a security incident.

The IAEA has also published the Recommendations on Physical Protection of Nuclear Material [43] that are intended to guide member states and their competent authorities in developing and implementing a physical protection regime for nuclear material and nuclear facilities. The responsibility for implementing physical protection systems rests with the member states that are shipping and receiving the radioactive material. For example, a UK ship carrying nuclear material would need to comply with the UK Nuclear Industries Security Regulations (NISR) 2003,[44] which incorporate into UK law the UK's obligations under the IAEA Recommendations and the CPPNM. Practically, this responsibility for providing adequate physical protection will lie with the consignor and carrier of the nuclear material.

11. EU RAM transport legislation

The EU can restrict or prohibit transports of dangerous goods, including RAM, that are of particular concern to the EU. For example, European Council Regulation (Euratom) No. 1493/93[45] regulates transports of radioactive substances between EU member states. It provides for a double declaration system (by the holder and the consignee) for intra-EU transports. The regulation established a system of controls and duties in respect of such transports. Certain procedures are required to be followed when radioactive substances exceeding certain quantities are transported between EU member states. These require the consignor to obtain a prior written declaration from the consignee confirming that the consignee has complied with its national requirements for safe storage, use and disposal of the radioactive materials being received. Such declarations must be endorsed by the competent authority of the member state of the consignee. Consignors must also provide quarterly summaries of all transports made to a member state to the competent authority of that member state that specify the consignee, type of substance or source, total activity, number of deliveries and the highest single quantity of each radionuclide delivered.

41. IAEA Doc. INFCIRC/274 Rev. 1, 1456 UNTS 125, entered into force 8 Feb. 1987.

42. Amendment to the Convention on the Physical Protection of Nuclear Material (2005), IAEA Doc. INFCIRC/274/Rev.1/Mod.1, entered into force 8 May 2016.

43. IAEA (2011), *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5),* IAEA Nuclear Security Series No. 13, IAEA, Vienna.

44. Nuclear Industries Security Regulations 2003 (S.I. No. 403 of 2003), as amended.

45. Council Regulation (Euratom) No. 1493/93 of 8 June 1993 on shipments of radioactive substances between Member States, OJ L 148 (19 June 1993), p. 1.

Directive 2008/68/EC[46] on the inland transport of dangerous goods is the main legal instrument that establishes a common regime regulating all inland transport of dangerous goods, including RAM, within the EU. It extends the application of the ADR, RID and ADN to national as well as international transport of dangerous goods in order to harmonise the conditions under which dangerous goods are transported across the EU. However, it does not apply to transports of dangerous goods directly under the control of armed forces and each member state has the right to prohibit the transport of dangerous goods within its territory for reasons other than safety (for example, national security). Each member state can also set more stringent requirements to transport operations performed within their territory using a conveyance registered within its territory and may also authorise transports in exceptional situations within its territory that may otherwise be prohibited by the Directive.

12. International treaties, conventions and codes

a. The Convention on Early Notification of a Nuclear Accident

The Convention on Early Notification of a Nuclear Accident[47] entered into force on 27 October 1986 following the Chernobyl nuclear power plant accident and establishes a notification system for nuclear accidents involving release, or likely release, of radioactive material that results or may result in a transboundary impact on another state. States are required to report details of the accident including location, time and type of accident. Notification can be made directly to affected states or via the IAEA.

b. The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency[48]

This Convention was also adopted in 1986 following the nuclear accident at Chernobyl and came into force on 26 February 1987. It sets out a framework for co-operation among states and with the IAEA to facilitate assistance and support in the event of nuclear accidents or radiological emergencies in order to minimise their impact and maximise the protection of life, property and the environment. States can request assistance from the IAEA or other states. In case a request is made, states can decide whether they can provide the requested assistance and are required to promptly decide and notify the requesting state party, directly or through the IAEA, whether it can to render the assistance requested from its available resources (experts, equipment and materials). The Convention does not define "nuclear accident or radiological emergency", but it is not restricted to any particular type of activity or facility and applies to national and international events.

c. Code of Conduct on the Safety and Security of Radioactive Sources[49]

This Code is non-legally binding and intended to ensure that radioactive sources, disused sources and orphan sources[50] are used appropriately within a suitable safety and security framework. It is based on technical criteria providing recommendations on safety and security

46. See *supra* note 20.

47. IAEA Doc. INFCIRC/335, 1439 UNTS 276, entered into force 27 Oct. 1986.

48. IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987.

49. IAEA (2004), *Code of Conduct on the Safety and Security of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/2004.

50. *Ibid*., Sec. I.1.

procedures and a national register of radioactive sources. It has two supporting documents: the Guidance on the Import and Export of Radioactive Sources[51] and the Guidance on the Management of Disused Radioactive Sources.[52] The former provides for transfer of responsibility when a source is transferred between states; the latter provides guidance on national policy and strategy for management of disused sources, their storage and return to suppliers.

d. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management[53]

The Joint Convention applies to the safety of spent fuel and radioactive waste management. It covers spent fuel from civilian nuclear reactors and radioactive waste resulting from civilian applications. If such materials are permanently transferred from military or defence programmes to civilian programmes, these materials are also covered. The Joint Convention also covers liquid or gaseous radioactive materials released into the environment in a controlled manner from nuclear facilities.

Article 27 of the Joint Convention provides certain requirements for the transboundary movement of such material, such as ensuring movements are authorised with prior notification and consent of the receiving state, provided it has the necessary administrative and technical capacity and regulatory structure to receive and manage the material in a compliant manner to the satisfaction of the state of origin, ensuring that such movements are in compliance with modal transport obligations, and ensuring the state of origin allows the return of the material if the transboundary movement cannot be completed.

e. The Code of Practice on the International Transboundary Movement of Radioactive Waste[54]

This Code serves as IAEA guidelines for the development and harmonisation of policies and laws on the international transboundary movement of radioactive wastes. One of its objectives is to prevent illicit transports involving disposal of radioactive waste. The Code "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."[55] The Code is not legally binding, but adoption of the Code underpins the commitment of states to take appropriate measures to prevent unauthorised transport of radioactive waste across borders. The Code also confirms the right of states to prohibit foreign radioactive waste movements within their territory.

51. IAEA (2012), *Guidance on the Import and Export of Radioactive Sources*, Doc. IAEA/CODEOC/IMO-EXP/2012, IAEA, Vienna.

52. IAEA (2018), *Guidance on the Management of Disused Radioactive Sources*, IAEA/CODEOC/MGT-DRS/2018, IAEA, Vienna.

53. IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001.

54. IAEA Doc. INFCIRC/386 (1990).

55. *Ibid*., Art. I, p.3.

13. Nuclear liability in transport of RAM

For all nuclear transports, a variety of regimes can govern nuclear liability:

- Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982, and by the Protocol of 12 February 2004;[56]
- Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004;[57]
- Vienna Convention on Civil Liability for Nuclear Damage (1963) (Vienna Convention) and the 1997 Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (Vienna Convention);[58]
- Convention on Supplementary Compensation for Nuclear Damage (1997) (CSC);[59]
- Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (1988) (Joint Protocol).[60]

These instruments can overlap with each other during a transport and thereby cause some confusion when it comes to negotiating transport contracts. On paper, such negotiations may appear to be straightforward and consist of a simple statement of which party has nuclear liability under the relevant convention with an indemnity for the transporter for claims that do not fall within any of the applicable conventions.

In practice, however, negotiating transport contracts can be a tedious and lengthy process, especially regarding liability for claims that do not fall within the scope of a particular convention and the parties attempting to satisfactorily answering questions about what may happen in the event of an incident, what claims may arise, and against whom. Combined with sometimes differing perspectives from insurers on each side with subtly different interpretations of relevant legislation and their applicability, negotiations can become very frustrating. In such circumstances there is no substitute for careful consideration of the applicable nuclear liability regimes to a transport with full engagement of each party's legal advisors and nuclear insurers. Such circumstances also potentially reinforce the need for a global liability regime that would help to minimise conflict between different liability regimes, their scope and liability limits.

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56. The Revised Paris Convention as amended by the 2004 Protocol entered into force on 1 January 2022. An unofficial consolidated text is available at: NEA (2017), "Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004", NEA Doc. NEA/NLC/DOC(2017)5/FINAL.

57. The Revised Brussels Supplementary Convention as amended by the 2004 Protocol entered into force on 1 January 2022. An unofficial consolidated text is available at: NEA (2017), "Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004", NEA Doc. NEA/NLC/DOC(2017)6/FINAL.

58. Vienna Convention (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977; 1997 Protocol to Amend the Vienna Convention, IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force 4 Oct. 2003.

59. CSC (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 Apr. 2015.

60. IAEA Doc. INFCIRC/402, 1672 UNTS 293, entered into force 27 Apr. 1992.

a. Channelling of liability during transport

While it is beyond the scope of this chapter to examine in detail the different global nuclear liability regimes, it is pertinent to summarise the principles of the main international nuclear liability regimes that apply to a simple nuclear transport.

With regard to the Paris Convention and the Vienna Convention, the principles are similar:

- For a transport between two states that are parties to the same convention, the transfer of nuclear liability between the consignor and consignee can occur at any point as agreed in writing between the consignor and consignee.
- In absence of any written agreement, the standard position is that nuclear liability will transfer from the consignor to the consignee at the gates of the facility of the consignee.
- For a transport from a convention state to a state that is not a party to the same convention, the transfer of nuclear liability from consignor to consignee will occur when the nuclear material is unloaded from the means of transport in the territory of the location of the consignee's facility.
- For a transport from a non-convention state to a convention state, nuclear liability will transfer from consignor to consignee when the nuclear material is loaded onto the means of transport in the territory of the location of the consignor's facility.
- When a transport occurs between the territory of a Paris Convention signatory and a Vienna Convention territory, there will be two different nuclear liability regimes applicable to the same transport. It is this perceived "overlap" of geographical scope that can cause confusion and much debate between parties involved in an international transport of nuclear material, especially if the parties involved are not familiar with the details of the scope and limits of different nuclear liability regimes. It is therefore essential that appropriate legal counsel is obtained in such circumstances.
- Further issues arise related to determining the liable operator and which courts have jurisdiction in such cases.

Such issues have led to much discussion over the merits of a single global nuclear liability regime. Some commentators take the view that a global nuclear liability regime is the best way to protect the public by ensuring promptly available funds with minimal litigation, certainty of allocation of nuclear liability, permitting the insurance markets to marshal their resources and to address the international and transboundary nature of the nuclear industry, transports and potential damage.[61]

It is pertinent at this point to also mention the CSC and the Joint Protocol. The CSC establishes treaty relations between countries that might be affected by a nuclear incident and creates an international fund to ensure minimum available funds to compensate nuclear damage. By linking countries together, including those that are parties to the Paris or Vienna Conventions or that have national laws consistent with the nuclear liability principles set out within the CSC, the CSC could provide a basis for a global nuclear liability regime but, to fulfil this aim practically, a more significant number of countries would need to join. The intent behind the Joint Protocol was to establish a link between the Paris and Vienna Conventions and to address conflicts such as those discussed above. However, only states that are parties to either the Vienna Convention or Paris Convention may join the Joint Protocol, and while it has led to treaty relations between some Paris

61. McRae, B. (2015), "Entry into force of the Convention on Supplementary Compensation for Nuclear Damage: Opening the umbrella", *Nuclear Law Bulletin*, No. 95, OECD Publishing, Paris, p. 15.

and Vienna Convention countries, it cannot be said to be the answer to the issues arising due to a lack of a global liability regime.[62] Thus, while progress has been made with regard to a potential global liability regime, it remains to be seen whether a more significant number of countries that might be affected by a nuclear accident will join the CSC or will look at alternative means to address the issues that a lack of a global liability regime produces, especially for the agreement on nuclear liability during nuclear material transports.

II. RAM transports in practice: Key considerations

Some of the key practical considerations and steps in connection with a prospective RAM transport as impacted by the regulations already discussed can be summarised as follows:

- material to be transported;
- security and physical protection;
- location and destination;
- mode of transport and transporter;
- consignor and consignee liability, risk, and insurance;
- origin, export, and ownership.

Of course no one size fits all and much will depend on the individual transport, locations and type of material involved, but the following considerations can provide a useful starting point when considering a potential RAM transport.

A. Material to be transported

The type, quantity and activity level of the material is one of the most important considerations. These characteristics will confirm whether the material is "nuclear matter" or "excepted matter". If the material falls within the definition of "nuclear matter" under the applicable national legislation, it can be understood which of the various nuclear liability regimes will apply, the type of packaging that will be required, the level and type of security and physical protection that will be required, as well as the options for potential routes.

B. Security and physical protection

As already explained, the CPPNM prescribes the level of physical protection (Category I, II, and III) at which nuclear material used for peaceful purposes is to be protected against theft and sabotage while in national and international transport and provides for the prosecution and punishment of such offences. Thus, for example, the high security vehicle shown in Figure 5 that is used to carry nuclear material will comply with the relevant local legislation (e.g., UK NISR 2003, as amended) that implements the CPPNM and the IAEA recommendations. The vehicle will incorporate a variety of special measures in its construction, from the type of locks used to the material used and the electronic surveillance equipment installed inside the vehicle. In accordance with the NISR 2003, as amended, such a vehicle would also be protected during the highest category transports by specially trained armed officers from the UK Civil Nuclear Constabulary (CNC), a specialised armed security force established by UK legislation. The choice of transport route itself would also be an important measure ensuring physical protection. For example, transport routes will avoid areas of potential civil disorder and war zones.

62. *Ibid*., p. 16.

Figure 5, *supra*, provided another example of how security and physical protection requirements play out in practice. It detailed some key features of a ship purpose-built to carry nuclear material. In accordance with the INF Code, the ship is classified as an INF 3 ship, the highest class that can carry all types of nuclear material, including the most sensitive such as high-level radioactive waste or plutonium. To comply with physical protection and security requirements, such ships are armed and also protected during the highest category transports by specially trained officers from organisations such as the UK CNC. Such ships also have a range of specialised features, including double reinforced hulls, enhanced buoyancy, dual navigation, cargo monitoring and cooling systems, twin engines and propellers, and spare generators. In line with IAEA recommendations,[63] they also have a fully trained team of nuclear experts available at all times, including experts in salvage, security and emergency response, engineers, technicians, divers and even helicopter pilots.

C. Location and destination

The next set of considerations flow from an understanding of the location and destination of the material. These will highlight what type of local input and advice will be required and which subcontractors will need to be engaged, from port operatives to local emergency services. A review of possible transport routes between the two locations and the applicable liability regimes will be important to identify which territories the transport may need to pass through, the required permissions from local authorities, and the insurance and contractual liabilities that will need to be addressed. This will help decide the possible realistic options for the transport route, especially if going through different national territories. For example, some countries may not be interested in allowing radioactive material destined for a neighbour to go through their territory; others may take a more relaxed approach depending on the parties involved. Availability of insurance or contractual cover may also influence the route taken.

Some organisations, such as Nuclear Transport Solutions in the United Kingdom, maintain ongoing links with the governments of the countries near or along the routes that they use on a regular basis in order to familiarise the authorities of those countries with the type of transports that they perform and the safety and security measures that they implement to ensure they are comfortable with how those transports are completed.

At this point a transport plan will start to be formed with details of the route, parties to be involved, timings, security requirements, protections, dates and type of material. The transport plan, especially for the highest category of material, would be strictly controlled with access limited on a need-to-know basis to the parties concerned with the transport and the respective governments of the countries involved.

D. Mode of transport and transporter

The mode of transport and the transporter comprise an important consideration that is affected by many different factors, including political and public views of such transports in the sending and receiving countries as well as in neighbouring countries (for road and rail transit), availability of funds for transport costs, time available, and the type and quantity of material. Generally, sea transport is the slowest and most expensive, air transport is the quickest for overseas transports, and the cost of road and rail transport can vary depending on the route. National opinion in third

63. Including INFCIRC/225 (Rev. 5), *supra* note 43 and IAEA (2002), *Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material*, IAEA Safety Standards Series No. TS-G-1.2 (ST-3), IAEA, Vienna.

party countries will heavily influence whether air, road and rail transports are viable. Especially with the most sensitive transports, sea transport can be the preferred method despite the extra cost and time required because transit through third party countries can be unavailable due to national, political or public sensitivities.

The identity of the transporter will be a vital consideration. The transporter will need to be suitably experienced and competent in the type of transport and in handling the type of material involved. The transporter will take control of the material in between the two facilities and will therefore need the trust of whichever party remains ultimately responsible for all liabilities originating from the transport, be that the consignor, consignee or the owner of the material being transported.

Regardless of mode of transport, it will be up to the consignor as part of its obligations under the relevant carriage of dangerous goods regulations to satisfy itself that the transporter is competent to perform the transport before agreeing to release the material into the possession of the transporter. In practice, the choice of transporter is usually agreed upon by all parties concerned and, for the most sensitive transports, the transporter is engaged in all aspects of the preparation for transport rather than simply being a third party contractor that picks up and drops off the material at agreed dates and locations.

E. Consignor and consignee liability, risk and insurance

Identification of the consignor and consignee should in most cases be straightforward, but in practice it sometimes is not. While it may be clear between which facilities the material is to be transported, sometimes the exact identity and formal name of the consignor or consignee can be mistaken, especially if one is dealing through a third party arranging the transport. Even minor spelling mistakes misidentifying the relevant consignor or consignee on the relevant documentation related to licences or other approvals can lead to last-minute delays affecting schedules, costs, and insurance policies and, in some instances, can result in postponement of the transport. Hence, identifying the correct parties involved is of paramount importance.

Another important consideration is liability transfer between the consignor and consignee; the two main issues for them will be liability under national carriage of dangerous goods legislation implementing the ADR (CDG liability) and nuclear liability. CDG liability will transfer at the point when the material is clearly accepted by the consignee in writing, which will be dependent on the relevant agreement between the parties. As already discussed, transfer of nuclear liability will depend on the nuclear liability regimes of the two countries involved. If both countries subscribe to the same regime, it can be straightforward to agree to liability transfer. Otherwise, it can become a tedious and difficult discussion, especially when the two parties have a differing view of how the relevant legislation applies. This is where nuclear liability insurers can be helpful in clarifying their understanding of the application of the liability regime. However, if insurers disagree on interpretation of the relevant liability regimes and there is either overlapping of insurance or a gap in insurance cover for the transport it becomes a cause of concern to transporters that would not want to be left responsible for nuclear liability for the transport at any point unless the relevant legislation allows and nuclear liability insurance is available to the transporter.

Finally, physical risk usually transfers on loading and unloading of the material but can transfer several times depending on the agreement between the parties. It is important that this point of transfer is accurately identified because many different interpretations can exist around point of transfer during any given transport.

F. Origin, export, and ownership

Origin of the material is an important consideration, regardless of where the material is currently located, because the obligation codes allocated to that material by Euratom signifying origin will dictate to which destinations the material can and cannot go. Much will depend on any agreements between the government of the originating country and of the destination countries. Export licence applications for nuclear material are made to a local regulator and can take as little as a few weeks to well over a year to obtain the licence, so it is imperative that these applications are made in good time. Understanding ownership of the material is another key consideration as in many cases the title owner can be a different party than the party currently in possession or the party that will receive the material, and consent of the title owner is required to move the material.

G. Practical challenges: Protestors[64]

Given the nature of their operations, transporters of nuclear material have many responsibilities to discharge, including the safety and security measures required to protect their assets and cargo. However, these measures extend beyond the transport itself to the safety and security of any protestors. Transporters must recognise that individuals and organisations have a right to peaceful protest, and when those protests potentially impact directly transport operations, transporters have a duty of care to ensure that protestors are not harmed.

Transporters often have little warning of protests and so are unable to take planned actions to limit the risks posed by protestors, as such action would lead to publicity around transport dates, which should be minimised in accordance with INFCIRC/225 (Rev. 5), *supra* note 43, which requires transport dates to be kept confidential. Consequently, transporters have been forced to apply for emergency injunctions to prevent protestors from encountering their ships and risking injury to themselves and endangering the transport or cargo. It is important to clarify that transporters should not try to stop lawful protests. The intention should always be to manage transports safely and securely and to ensure any protests are conducted safely without serious risk to the safety of protestors legitimately voicing their views.

While transporters should always support rights to democratic protest, they should also be entitled to exercise their rights to carry out legal authorised and safe transport operations without interference. The law can help in these situations to protect a transporter's business and reputation and ultimately the lives of protestors and of the transporter's employees, but it requires a spirit of tolerance on all sides as per the words of Dr Albert Einstein: "But laws alone cannot secure freedom of expression; in order that every man may present his views without penalty there must be a spirit of tolerance in the entire population."[65]

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64. See also Bukhari, K. (2016), "From Chaos to Calm In One Injunction", Paper No. 4032, Proceedings of the 18th International Symposium on the Packaging and Transportation of Radioactive Materials, PATRAM 2016, Kobe, Japan, 18-23 September, available at: https://resources.inmm.org/system/files/patram_proceedings/2016/F4032.pdf (accessed 23 Oct. 2021).

65. Einstein, A. (1950), *Out of My Later Years*, Kensington Publishing Corp., New York, "On Freedom (1940)", p. 13.

III. Conclusion

RAM transport is a highly regulated activity governed by a complex but comprehensive international regulatory framework that applies to all categories of RAM and modes of transport. This framework is supplemented by national standards and requirements that are regularly reviewed and updated. It is not perfect, but it has been effective in minimising RAM transport incidents, and all those entities involved in RAM transport, whether transporters or regulators, will need to remain focused on the ongoing and ever-changing legal, safety and security challenges in the domain of national and international RAM transport.

Nuclear security: Physical protection, illicit trafficking and nuclear terrorism

by Sonia Drobysz[*]

1. The importance of nuclear security law

Concerns about the possibility and consequences of the theft of nuclear or other radioactive material and the sabotage of nuclear facilities or shipments arose in the early 1970s. Under the International Atomic Energy Agency (IAEA) research and development programme, expert consultations were held in 1971 and 1972 to prepare recommendations for the physical protection of nuclear material in use, transit and storage.[1] The recommendations were updated and published in 1975,[2] while the IAEA Secretariat had already begun "legal studies with a view to preparing an international convention, or other appropriate legal instrument, dealing with the problems of ensuring physical protection of nuclear materials while they are being transported."[3] Those efforts led to the adoption in 1979 of the Convention on the Physical Protection of Nuclear Material (CPPNM), the preamble of which expresses states' desire to "avert the potential dangers posed by the unlawful taking and use of nuclear material".[4]

The subsequent expansion of peaceful activities using nuclear and other radioactive material, combined with the evolution of transnational organised criminality and terrorism, kept the threat of criminal or other unauthorised acts involving such materials growing.[5] As a consequence, measures to address those threats and risks continuously developed. Nowadays, the prevention of, detection of, and response to, criminal or intentional unauthorised acts involving or directed at nuclear material, other radioactive material, associated facilities, or associated activities is encompassed

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1. See IAEA (1972), *Annual Report 1 July 1971 – 30 June 1972*, IAEA Doc. GC(XVI)/480, para. 129(c); IAEA (1975), *The Physical Protection of Nuclear Material*, IAEA Doc. INFCIRC/225, cover note. See also Jankowitsch-Prevor, O. (2010), "The International Law of Transport of Nuclear and Other Radioactive Material", in Nuclear Energy Agency (NEA) (ed.), *International Nuclear Law: History, Evolution and Outlook*, OECD Publishing, Paris, p. 201.

2. IAEA (1975), *supra* note 1; see also IAEA (1975), "The Agency's budget for 1976. The physical protection of nuclear material", IAEA DOC. GC(XIX)/RES/328, adopted on 26 Sept. 1975, para. 2.

3. IAEA (1975), *Annual Report 1 July 1974 – 30 June 1975*, IAEA Doc. GC(XIX)/544, para. 149.

4. Convention on the Physical Protection of Nuclear Material, (1980), IAEA Doc. INFCIRC/274 Rev. 1, 1456 UNTS 125, entered into force 8 Feb. 1987 (CPPNM).

5. For a more detailed description of the threat, see e.g. IAEA et al. (2007), *Combatting Illicit Trafficking in Nuclear and other Radioactive Material*, IAEA Nuclear Security Series, No.6, IAEA, Vienna, pp. 3-9.

under the concept of nuclear security.[6] Physical protection used in a broad sense is a synonym for nuclear security.[7] In a narrower sense, however, it refers to "those aspects of nuclear security related to measures against the unauthorized removal of nuclear material or the sabotage of nuclear material or nuclear facilities."[8] In other words, physical protection designates a "set of legal, administrative and technical measures, including physical barriers, to 'physically protect' such material."[9]

Nuclear security aims to address the threat of illicit trafficking. Although sometimes understood as the illegal movement of nuclear and other radioactive materials across borders,[10] in IAEA publications it has been defined as "a situation which relates to the unauthorized receipt, provision, use, transfer or disposal of nuclear materials, whether intentional or unintentional and with or without crossing international borders."[11] The IAEA Incident and Trafficking Database broadly gathers information on incidents involving illicit trafficking and other unauthorised activities involving nuclear and other radioactive materials.[12]

Nuclear security also aims to address the threat of nuclear terrorism. While the latter has not been defined as such, nuclear terrorist acts are encompassed in the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT). Those acts include the unlawful and intentional possession and use of radioactive material, a nuclear explosive device, a radioactive material dispersal or radiation-emitting device with the intent to cause death, serious bodily injury, substantial damage to property or to the environment, or to compel a natural or legal person, an international organisation or a state to do or refrain from doing an act; the unlawful and intentional demand for radioactive material, a device or a nuclear facility by threat, under circumstances which indicate the credibility of the threat, or by use of force; and various forms of participation in those acts.[13]

Nuclear security shares with nuclear safety and safeguards the common aim of protecting people, property, society and the environment from the risks associated with the peaceful uses of nuclear energy.[14] As such, it forms part of the "3S" concept, which emphasises that measures taken to address one of these areas can contribute to addressing the others as well.

In his article on nuclear security included in the International School of Nuclear Law (ISNL) 10th anniversary publication, Mr Carlton Stoiber noted that nuclear security as a field of nuclear

6. IAEA (2013), *Objectives and Essential Elements of a State's Nuclear Security Regime*, IAEA Nuclear Security Series, No. 20, IAEA, Vienna, p. 1.

7. IAEA (2015), *Nuclear Security Series Glossary,* Version 1.3, IAEA, Vienna, p. 18.

8. IAEA (2018), *Physical Protection of Nuclear Material and Nuclear Facilities (Implementation of INFCIRC/225/Revision 5)*, IAEA Nuclear Security Series, No. 27-G, IAEA, Vienna, p. 4 n.1. See also IAEA (2012), *Identification of Vital Areas at Nuclear Facilities*, IAEA Nuclear Security Series, No. 16, IAEA, Vienna, p. 34.

9. Vez Carmona, M. (2005), "The International Regime on the Physical Protection of Nuclear Material and the Amendment to the Convention on the Physical Protection of Nuclear Material", *Nuclear Law Bulletin*, No. 76, OECD Publishing, Paris, p. 30.

10. VERTIC (2012), *Illicit trafficking of nuclear and other radioactive material - The legislative response*, VERTIC, London, p. 5.

11. Stoiber, C. et al. (2003), *Handbook on Nuclear Law*, IAEA, Vienna, p. 154.

12. See IAEA Incident and Trafficking Database, available at: www.iaea.org/resources/databases/itdb (accessed 21 May 2021).

13. International Convention for the Suppression of Acts of Nuclear Terrorism (2005), 2445 UNTS 137, entered into force 7 July 2007, Art. 2.

14. See IAEA (2018), *Developing Regulations and Associated Administrative Measures for Nuclear Security*, IAEA Nuclear Security Series, No. 29-G, IAEA, Vienna, para. 1.10, p. 3.

law had seen significant recent developments.[15] These included the strong commitment by heads of state gathered during the 2010 Washington Nuclear Security Summit to the objectives of international nuclear security instruments and progress towards universal adherence to the CPPNM, as well as recognising the importance of robust national legislative and regulatory frameworks for nuclear security. Ten years later, even though the Nuclear Security Summit process ended with the last summit in 2016, nuclear security continues to be high on the global security agenda due to the ongoing threat it aims to address. The IAEA 2020 report on nuclear security, relying on information collected through the IAEA Incident and Trafficking Database, notes that illicit trafficking, thefts, losses and other unauthorised activities and events involving nuclear and other radioactive material continue to occur.[16]

It is therefore worth looking at developments that have marked the international legal framework for nuclear security over the past ten years, as well as persisting challenges and proposals to strengthen the framework. Given that international commitments need to be implemented at the national level through the development of nuclear security legislation, this article will also review the main elements of such legislation.

2. The international legal framework for nuclear security

While it is largely recognised that the "responsibility for nuclear security within a State rests entirely with the State",[17] a number of international instruments have been adopted to address the threats posed by illicit trafficking and nuclear terrorism and to develop physical protection systems. Due precisely to the transnational nature and possible effects of the threat, those instruments are relevant for all states, not only those with significant nuclear activities.[18] This section provides an overview of the international legal framework for nuclear security and looks at a few challenges and proposals to strengthen this framework.

a. Overview of the international legal framework for nuclear security

One of the "key points about nuclear security law" as highlighted by many, including Mr Stoiber, is that:

> no single international instrument addresses nuclear security in a comprehensive manner. Instead, a broad range of international legal and guidance instruments (many developed under IAEA auspices) must be considered in determining what measures should be adopted to ensure that nuclear material and other radioactive materials and related facilities are adequately protected.[19]

There are multiple instruments related to nuclear security, adopted under the auspices of different organisations, and of various legal nature and scope. While this is also the case in other

15. Stoiber, C. (2010), "Nuclear Security: Legal Aspects of Physical Protection, Combating Illicit Trafficking and Nuclear Terrorism", in NEA (ed.), *International Nuclear Law: History, Evolution and Outlook, supra* note 1, p. 219.

16. IAEA (2020), *Nuclear Security Report 2020: Report by the Director General*, IAEA Doc. GOV/2020/31-GC(64)/6, para. 27.

17. See e.g. IAEA (2013), *supra* note 6, para. 1.4.

18. Johnson, P.L. (2014), "Facilitating the entry into force and implementation of the Amendment to the Convention on the Physical Protection of Nuclear Material: Observations, challenges and benefits", *Nuclear Law Bulletin,* No. 94, OECD Publishing, Paris, p. 11.

19. Stoiber, C. (2010), *supra* note 15, p. 220.

areas of nuclear law to some extent,[20] this makes the task of presenting this framework challenging. This article provides an overview focusing on the main instruments and combining historical, sectoral, legal and institutional criteria.[21]

i. IAEA instruments

Although not explicitly foreseen in its Statute,[22] the mandate of the IAEA in the area of nuclear security has expanded considerably over the years. The Agency has played an increasingly central role in the development and implementation of the international legal framework on physical protection, but also in combatting illicit trafficking or other unauthorised acts with nuclear and other radioactive material and nuclear terrorism.

The CPPNM is the "first of its kind:"[23] a legally binding instrument addressing the physical protection of nuclear material used for peaceful purposes. It was adopted under the auspices of the IAEA in 1979 and entered into force on 8 February 1987. One significant development in nuclear security law over the past ten years has been the entry into force on 8 May 2016 of the Amendment to the CPPNM, 11 years after its adoption in July 2005.[24]

The Amended CPPNM, or "Convention on the Physical Protection of Nuclear Material *and Nuclear Facilities*",[25] applies to nuclear material (e.g. plutonium, uranium 233 and 235) and

20. Nuclear safety is an example, although most instruments have been adopted under the auspices of the IAEA. As Anthony Wetherall pointed out,

    > Some commentators differentiate the international legal frameworks on nuclear security and nuclear safety by stating that there is not a single comprehensive international legal instrument on nuclear security, unlike in the area of nuclear safety. However, it should be clarified though that there is *per se* no single international legal instrument that comprehensively addresses nuclear safety.

    Wetherall, A. (2016), "Strengthening the international legal framework for nuclear security: Better sooner rather than later", *Nuclear Law Bulletin,* No. 98, OECD Publishing, Paris, p. 25. Instruments for nuclear safety include: the Convention on Nuclear Safety, (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996; the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001; the Convention concerning the Protection of Workers against Ionizing Radiations, (1960), ILO Convention No. 115, 431 UNTS 41, entered into force 17 June 1962; and non-binding instruments such as the IAEA (2006*) Code of Conduct on the Safety of Research Reactors*, IAEA Doc. IAEA/CODEOC/RR/2006.

21. For a more comprehensive presentation, see IAEA (2011), *The International Legal Framework for Nuclear Security*, IAEA International Law Series, No. 4, IAEA, Vienna. See also Stoiber, C. (2010), *supra* note 15, pp. 219-242.

22. Statute of the International Atomic Energy Agency (1956), 276 UNTS 3, entered into force 29 July 1957, (IAEA Statute).

23. IAEA (1980), *The Annual Report for 1979*, IAEA Doc. GC(XXIV)/627, para. 21.

24. Amendment to the Convention on the Physical Protection of Nuclear Material (2005), IAEA Doc. INFCIRC/274/Rev.1/Mod.1, entered into force 8 May 2016 (ACPPNM). On the process leading to the adoption of the Amendment, see Vez Carmona, M. (2005), *supra* note 9, pp. 34-46.

25. In an update on its website on 12 December 2018, the IAEA noted:

    > Despite the recent entry into force of the Amendment, the IAEA Secretariat, in line with established depositary practice, will continue to refer to the "CPPNM" and to the "Amendment to the CPPNM" until *all* States Parties to the CPPNM have consented to be bound by the Amendment. Until this happens, the use of the new title of the Convention as amended, i.e. "Convention on the Physical Protection of Nuclear Material and Nuclear Facilities" would be misleading, because it could give the impression that, alongside the original convention, there is now a new convention and that States could now join either one or the other.

    IAEA (12 Dec. 2018), "UPDATE: Eight Questions and Answers on the Amendment to the Convention on the Physical Protection of Nuclear Material", available at: www.iaea.org/newscenter/news/update-eight-questions-and-answers-on-the-amendment-to-the-convention-on-the-physical-protection-of-nuclear-material (accessed 21 May 2021).

facilities used for peaceful purposes. Its threefold scope[26] covers the physical protection of nuclear facilities and material in domestic activities and during international transport; offences with and against nuclear material and facilities and related criminal provisions; and international co-operation, assistance and information exchange.

The 2005 Amendment significantly strengthens the CPPNM given that the unamended version only covers the physical protection of nuclear material while in international transport. The Amendment extends the CPPNM's scope with "a new 'core' undertaking"[27] to establish, implement and maintain an appropriate physical protection regime applicable to nuclear material and nuclear facilities under its jurisdiction, with the aim of protecting against theft and other unlawful taking of nuclear material in use, storage and transport; ensuring the implementation of rapid and comprehensive measures to locate and, where appropriate, recover missing or stolen nuclear material; protecting nuclear material and nuclear facilities against sabotage; and mitigating or minimising the radiological consequences of sabotage.[28]

In establishing a physical protection regime, states parties to the Amended CPPNM shall establish and maintain a legislative and regulatory framework to govern physical protection; establish or designate a competent authority or authorities responsible for the implementation of that framework; and take other appropriate measures necessary for the physical protection of nuclear material and nuclear facilities.[29] The amended convention goes further in detailing the physical protection framework by listing 12 fundamental principles of physical protection of nuclear material and nuclear facilities including:

- the responsibility of the state for the establishment, implementation and maintenance of a physical protection regime;
- the responsibility of the state during the international transport of nuclear material;
- a legislative and regulatory framework to govern physical protection including measures for licensing, inspections and enforcement;
- a competent authority responsible for the implementation of the legislative and regulatory framework;
- the prime responsibility of licence holders for the implementation of the physical protection of nuclear material or facilities;
- prioritisation of the development and maintenance of security culture in all organisations involved in implementing physical protection;
- the state's current evaluation of the threat as a basis for the state's physical protection;
- a graded approach as a basis for physical protection requirements;
- defence in depth, a concept of several layers and methods of protection (structural or other technical, personnel and organisational), to be reflected in physical protection requirements;
- a quality assurance policy and quality assurance programmes to provide confidence that specified requirements for all activities important to physical protection are satisfied;
- preparation and implementation of contingency plans to respond to unauthorised removal of nuclear material or nuclear sabotage; and
- protection of the confidentiality of relevant information.[30]

26. The "threefold" characterisation is mentioned in several articles on the CPPNM. See e.g. Vez Carmona, M. (2005), *supra* note 9, p. 34.
27. Johnson, P.L. (2014), *supra* note 18, p. 19.
28. ACPPNM, Art. 2A.1.
29. ACPPNM, Art. 2A.2.
30. ACPPNM, Art.2A.3.

The Amended CPPNM provides that its states parties shall apply those principles "as is reasonable and practicable," which recognises that "a national physical protection regime could be different in each State."[31] In addition, each state has discretion to "reasonably decide" that nuclear material does not need to be subject to the physical protection regime, taking into account the nature of the material, its quantity and relative attractiveness and the potential radiological and other consequences associated with any unauthorised act directed against it and the current evaluation of the threat against it.[32] Such nuclear material should nevertheless be protected in accordance with prudent management practice.

Further to strengthening the physical protection of nuclear material and nuclear facilities used for peaceful purposes, the Amended CPPNM seeks to ensure the prevention, detection and punishment of offences with such material and facilities.[33] The 2005 Amendment expands on the criminal provisions of the 1979 Convention. The amended text requires states to make the following acts punishable under national law:

- unauthorised receipt, possession, use, transfer, alteration, disposal or dispersal of nuclear material and which causes or is likely to cause death or serious injury to any person or substantial damage to property *or to the environment* (amendment additions italicised);
- theft or robbery of nuclear material;
- embezzlement or fraudulent obtaining of nuclear material;
- a threat to use nuclear material to cause death or serious injury to any person or substantial damage to property *or to the environment* (amendment additions italicised);
- a demand for nuclear material by threat or use of force or by any other form of intimidation;
- *carrying, sending, or moving of nuclear material into or out of a state without lawful authority (smuggling)* (amendment additions italicised);
- *an act directed against a nuclear facility or interfering its operation (sabotage)* (amendment additions italicised).[34]

States shall also make punishable the ancillary offences of threat, attempt and participation (CPPNM), as well as organising or directing the commission of an offence or contributing to its commission (Amended CPPNM). A number of additional criminal measures provide for obligations related to the establishment of jurisdiction,[35] detention,[36] prosecution,[37] extradition,[38] fair treatment[39] and mutual legal assistance.[40]

31. Johnson, P.L. (2014), *supra* note 18, p. 18.
32. ACPPNM, Art. 2A.4.
33. See language in the ACPPNM Preamble.
34. ACPPNM, Art. 7.
35. ACPPNM, Art. 8.
36. ACPPNM, Art. 9.
37. ACPPNM, Art. 10.
38. ACPPNM, Arts. 10, 11, 11A, 11B.
39. ACPPNM, Art. 12.
40. ACPPNM, Art. 13.

The last set of measures in the CPPNM focuses on international co-operation, assistance and information exchange. They were also expanded by the Amendment to be consistent with the new physical protection and criminal measures and, therefore, apply not only to the recovery and protection of nuclear material in case of theft, robbery or any other unlawful taking of nuclear material, but also to the case of sabotage of nuclear material and facilities. The Amended CPPNM also facilitates the sharing among states parties of guidance on the design, maintenance and improvement of national systems of physical protection of nuclear material in international transport as well as in domestic use, storage and transport, and of nuclear facilities.[41] Regarding information exchange and mutual assistance in case of nuclear security-related events, the provisions of the so-called Early Notification and Assistance Conventions,[42] adopted in 1986 under the IAEA auspices, are also relevant. They were initially "conceived and adopted as safety instruments"[43] but apply in the event of nuclear accidents and radiological emergencies whatever their origin, including malicious acts.[44]

In addition to the legally binding CPPNM and its Amendment, the IAEA has been developing a number of non-legally binding instruments that can be included in nuclear co-operation agreements or incorporated into national legal frameworks. They vary in denomination, scope and content and provide specific and evolving guidance on how to implement nuclear security obligations, thus complementing the legally binding framework. The IAEA Code of Conduct on the Safety and Security of Radioactive Sources,[45] for example, covers all radioactive sources that may pose a significant risk to individuals, society and the environment. Its objectives include achieving and maintaining a high level security of radioactive sources; preventing unauthorised access or damage to, and loss, theft or unauthorised transfer of, radioactive sources, so as to reduce the malicious use of such sources to cause harm to individuals, society or the environment; and mitigating or minimising the radiological consequences of any malicious act involving a radioactive source. The Code is supplemented by the *Guidance on the Import and Export of Radioactive Sources*[46] and the *Guidance on the Management of Disused Radioactive Sources*.[47] As of 9 February 2021, 140 states had made a political commitment to implement the Code, while 123 states had notified the IAEA Director General of their intention to act in a harmonised manner in accordance with the import and export Guidance and 41 states with the management of disused sources Guidance.[48]

41. See ACPPNM Art. 5.5.

42. Convention on Early Notification of a Nuclear Accident (1986), IAEA Doc. INFCIRC/335, 1439 UNTS 276, entered into force 27 Oct. 1986 (Early Notification Convention), and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1986), IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987 (Assistance Convention).

43. IAEA (2011), *supra* note 21, p. 5.

44. *Ibid*. See also Tonhauser, W. and A. Wetherall (2010), "The International Legal Framework on Nuclear Safety: Developments, Challenges and Opportunities", in NEA (ed.), *International Nuclear Law: History, Evolution and Outlook*, *supra* note 1, p. 160.

45. IAEA (2004), *Code of Conduct on the Safety and Security of Radioactive Sources*, IAEA Doc. IAEA/CODEOC/2004.

46. IAEA (2012), *Guidance on the Import and Export of Radioactive Sources*, IAEA/CODEOC/IMO-EXP/2012, IAEA, Vienna (revision of 2004 guidance approved by the IAEA General Conference in resolution GC(55)/RES/9, 21 Sept. 2011).

47. IAEA (2018), *Guidance on the Management of Disused Radioactive Sources*, IAEA/CODEOC/MGT-DRS/2018, IAEA, Vienna (approved by the IAEA General Conference in resolution GC(61)/RES/8, 21 Sept. 2017).

48. IAEA (2021), "List of States", https://nucleus.iaea.org/sites/ns/code-of-conduct-radioactive-sources/Documents/Status_list%2030%20April%202021.pdf (accessed 28 May 2021).

Other IAEA documents form part of the IAEA "Nuclear Security Series", currently structured as follows:

- Nuclear Security Fundamentals establishing the fundamental objective and essential elements of a state's national nuclear security regime;
- Recommendations setting out measures that states should take in order to achieve and maintain an effective regime;
- Implementing Guides providing guidance on how states can implement the Recommendations;
- Technical Guidance providing more detailed guidance on specific methodologies and techniques for implementing security measures.[49]

A key text is the *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities* also known as "INFCIRC/225". The first version predates the CPPNM and it is understood as the Convention's "companion" document.[50] The current version notes that it:

> will assist [IAEA] Member States to implement a comprehensive physical protection regime, including any obligations and commitments they might have as parties to international instruments related to the physical protection of nuclear material and nuclear facilities, especially the Amendment to the Convention on the Physical Protection of Nuclear Material, of July 2005.[51]

Other issues of the Nuclear Security Series cover a wide range of topics including nuclear security culture and education, nuclear security systems and measures for major public events, computer security at nuclear facilities, insider threats, transport of radioactive material, nuclear forensics and crime scene management.[52]

ii. United Nations and other instruments

The United Nations and other organisations, which would not traditionally deal with nuclear-related threats and activities, have adopted a number of instruments that are relevant to nuclear security. Nuclear security, however, is not usually their main or only focus and they separately address part of the physical protection, illicit trafficking and/or nuclear terrorism aspects.

Within the United Nations, the UN Security Council noted in its Resolution 1373 adopted in 2001 the close connection between international terrorism and illegal movement of nuclear material, and emphasised the need to enhance co-ordination of efforts on national, subregional, regional and international levels in order to strengthen a global response to this threat to international security.[53] In 2004, it adopted Resolution 1540 on the non-proliferation of weapons of mass destruction,

49. See IAEA Nuclear Security Series webpage, www.iaea.org/resources/nuclear-security-series (accessed 21 May 2021). On the efforts to strengthen and structure the nuclear security guidance and the comparison with nuclear safety standards, see Wetherall, A. (2016), *supra* note 20, pp. 30-32.

50. Jankowitsch-Prevor, O. (2010), *supra* note 1, p. 201. See also preamble of the Amended CPPNM: "The States Parties to this Convention […] recognizing that there are 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.[…]"

51. The current version is IAEA (2011), *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)*, IAEA Nuclear Security Series, No. 13, IAEA, Vienna, para. 1.8, p.2.

52. See list on the IAEA's website at: www.iaea.org/publications/search/type/nuclear-security-series (accessed 21 May 2021).

53. United Nations Security Council Resolution (UNSCR) 1373 (2001), "Threats to international peace and security caused by terrorist acts", UN Doc. S/RES/1373, adopted 28 Sept. 2001, operative paragraph 4.

which specifically addresses threats caused by non-state actors and terrorist acts and covers biological, chemical but also nuclear weapons and related materials.[54] The resolution includes a number of legally binding decisions for UN member states, which have been reiterated by the Security Council in subsequent resolutions.[55] The first set of obligations aims to refrain states from supporting non-state actors, as well as prohibit any non-state actors, to develop, acquire, manufacture, possess, transport, transfer or use biological, chemical and nuclear weapons.[56] In contrast with other UN instruments, the resolution then significantly covers the protection of related materials, including nuclear material. Adopted prior to the entry into force of the CPPNM Amendment, it was the first legally binding universal instrument requiring states to establish domestic controls over such material.[57] Those controls include effective measures to account for and secure nuclear material in production, use, storage or transport; physical protection measures; appropriate effective border controls and law enforcement efforts to detect, deter, prevent and combat, including through international co-operation when necessary, the illicit trafficking and brokering in nuclear material; and export, transit, trans-shipment and re-export controls as well as related financing measures.[58] The resolution's preamble recognises that most states "have taken effective measures to account for, secure and physically protect sensitive materials, such as those required by the Convention on the Physical Protection of Nuclear Materials and those recommended by the IAEA Code of Conduct on the Safety and Security of Radioactive Sources".

Other instruments adopted under the auspices of the United Nations and forming part of the universal and conventional framework against terrorism address the threat of nuclear terrorism, often in association with other broader issues such as terrorist bombings, the financing of terrorism, and the safety of civil aviation or maritime navigation.[59] The ICSANT,[60] however, specifically requires its 117 states parties[61] to prevent, make punishable, prosecute or extradite and co-operate regarding unlawful acts with nuclear and other radioactive material, devices and nuclear facilities committed with the intent to cause death or serious bodily injury, substantial damage to property or to the environment, or to compel a natural or legal person, an international organisation or a state to do or refrain from doing an act; as well as the unlawful and intentional demand for radioactive material, a device or a nuclear facility by threat, under circumstances that indicate the credibility of the threat, or by use of force; and various forms of participation in those acts.[62]

54. UNSCR 1540 (2004), "Non-proliferation of weapons of mass destruction", UN Doc. S/RES/1540, adopted on 28 Apr. 2004.

55. UN Security Council decisions are binding on UN member states per Article 25 of the UN Charter. According to article 39 of Chapter VII of the Charter, under which UNSCR 1540 is adopted, the UN Security Council may take such decisions on measures to maintain or restore international peace and security. See UNSCR 1673 (2006), "Non-proliferation of weapons of mass destruction", UN Doc. S/RES/1673, adopted on 27 Apr. 2006; UNSCR 1810 (2008), "Non-proliferation of weapons of mass destruction", UN Doc. S/RES/1810, adopted on 25 Apr. 2008; UNSCR 1977 (2011), "Non-proliferation of weapons of mass destruction", UN Doc. S/RES/1977, adopted on 20 Apr. 2011; and UNSCR 2325 (2016), "Non-proliferation of weapons of mass destruction", UN Doc. S/RES/2325, adopted on 15 Dec. 2016.

56. UNSCR 1540, operative paragraphs 1 and 2.

57. Wetherall, A. (2016), *supra* note 20, p. 19.

58. UNSCR 1540, operative paragraph 3.

59. For an overview from the perspective of the fight against nuclear and radiological but also biological and chemical terrorism, see United Nations Office on Drugs and Crime (UNODC) (2016), *The International Legal Framework against Chemical, Biological, Radiological and Nuclear (CBRN) Terrorism*, Counter-Terrorism Legal Training Curriculum, Module 6, United Nations, New York. See also Gehr, W. (2007), "The Universal Legal Framework Against Nuclear Terrorism," *Nuclear Law Bulletin*, No. 79, OECD Publishing, Paris, pp. 5-16.

60. ICSANT, *supra* note 13.

61. Status as of 28 May 2021.

62. ICSANT, Art. 2.

The 2005 ICSANT entered into force on 7 July 2007 and is considered one of the international universal anti-terrorism instruments.[63] It is broader in scope than the Amended CPPNM as it covers acts involving nuclear but also other radioactive material including in military uses, and nuclear facilities used for both peaceful and military purposes. While it focuses on criminal and international co-operation measures, it calls on states parties to make every effort to adopt appropriate measures to ensure the protection of radioactive material (including nuclear material as covered by the CPPNM), taking into account relevant recommendations and functions of the IAEA, for the purposes of preventing offences under the Convention.[64] States parties shall also have regard to the IAEA's physical protection recommendations when seizing or otherwise taking control of radioactive material, devices or nuclear facilities, following the commission of an offence.[65]

The prevention, criminalisation and international co-operation regarding unlawful acts with nuclear (but also biological and chemical) weapons and nuclear and radioactive material are also covered in instruments adopted in the specific contexts of terrorist bombings,[66] maritime navigation,[67] the safety of fixed platforms[68] and civil aviation.[69] Measures to prevent, prosecute and punish the financing of acts covered in those instruments as well as in the CPPNM and ICSANT are provided for in the International Convention for the Suppression of Financing of Terrorism.[70]

b. Challenges and proposals to strengthen the international legal framework for nuclear security

In 2010, Mr Stoiber identified a number of "key points" about nuclear security law that remain relevant.[71] The first point has already been mentioned and concerns the complexity of the international legal framework for nuclear security, which is characterised by the multiplicity of instruments, their varying legal nature and scope; and consequently the multiplicity of

63. For a summary of the Convention's negotiating history, see Jankowitsch-Prevor, O. (2005), "International Convention for the Suppression of Acts of Nuclear Terrorism", *Nuclear Law Bulletin*, No. 76, OECD Publishing, Paris, pp. 7-27.

64. ICSANT, Art. 8. The IAEA publication *Combatting Illicit Trafficking in Nuclear and Other Radioactive Material*, *supra* note 5, p. 27, notes that "this provision has the interesting legal ramification of drawing so-called soft law instruments developed by the IAEA as voluntary guidance into the framework of hard law. Accordingly, it could be argued that contracting parties to this Convention have the obligation to apply relevant IAEA requirement". The article, however, only requires states to "*make every effort* to adopt appropriate measures to ensure the protection of radioactive material" (emphasis added).

65. ICSANT, Art. 18.

66. International Convention for the Suppression of Terrorist Bombings (1997), 2149 UNTS 284, entered into force 23 May 2001 (Terrorist Bombings Convention).

67. Protocol to the Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation (2005), IMO Doc. LEG/CONF.15/21, entered into force 28 July 2010 (2005 Protocol to the SUA Convention).

68. Protocol of 2005 to the Protocol for the Suppression of Unlawful Acts Against the Safety of Fixed Platforms Located on the Continental Shelf (2005), IMO Doc. LEG/CONF.15/22, entered into force 28 July 2010 (Protocol of 2005 to the Fixed Platforms Protocol).

69. Convention on the Suppression of Unlawful Acts Relating to International Civil Aviation (2010), ICAO Doc. 9960, entered into force on 1 July 2018.

70. International Convention for the Suppression of the Financing of Terrorism (1999), 2178 UNTS 229, entered into force 10 Apr. 2002 (Terrorist Financing Convention).

71. Stoiber, C. (2010), *supra* note 15, pp. 220-221. Subsequent comment on this framework, with reference to other relevant literature, include Wetherall, A. (2016), *supra* note 20, pp. 22-40; Drobysz, S. (2016), "A framework for the secure development of nuclear energy: obligations, challenges and possible solutions", in Black-Branch, J. and D. Fleck, *Nuclear non-proliferation in international law, Vol. III, Legal aspects of the use of nuclear energy for peaceful purposes*, T.M.C Asser Press, The Hague, p. 272.

organisations involved. This situation is not specific to nuclear security, however. The framework for nuclear safety comprises a number of conventions, codes and standards. The framework for nuclear non-proliferation also includes treaties and guidelines, with different layers of international, regional and bilateral obligations. In the area of nuclear security, the complexity presents both risks and benefits.[72] On the one hand, the various instruments may overlap and include contradictory provisions. In addition, the non-binding character of codes, standards and recommendations, as well as the lack of mechanisms to enforce the provisions of legally binding instruments, leave certain aspects of nuclear security subject to states' discretion. On the other hand, the multiple obligations and recommendations are also complementary in scope and of reinforcing nature. The combination of "soft" and "hard" law leaves flexibility in an area that is said to remain the prime responsibility of states,[73] but also in which technological developments constantly call for the quick adaptation of the framework. Proposals to strengthen the existing framework thus include a combination of suggestions to adopt new instruments, such as a comprehensive convention on nuclear security,[74] the consolidation of existing instruments, strengthened reporting and information sharing.[75]

Regarding the existing conventions and treaties, the emphasis has been placed on their entry into force, then their universalisation and implementation. The entry into force of the Amendment to the CPPNM, a significant achievement of the past few years, took 11 years. This was partly due to the "apparent paradox"[76] created by the Amendment provisions, which required ratification of two-thirds of the states parties to the CPPNM for the Amendment to enter into force. The total number of states parties required was therefore a "moving figure": as the number of states parties to the Convention grew, so did the required number of adhesions to the Amendment.[77] Another and related reason delaying entry into force was the process for states to individually join the Convention and the Amendment.

To date, universalisation of the international legal framework for nuclear security generally remains a challenge. As Mr Stoiber noted in 2010,

> a significant number of States have either not adhered to the relevant international instruments or have failed to implement them effectively through their national legal and regulatory frameworks. This situation leaves gaps in the global system that can be exploited by terrorism or criminal elements. Therefore, broader adherence to the relevant instruments and more effective and co-ordinated implementation must be a high priority.[78]

Obstacles to universalisation that have been identified include: a low political prioritisation of nuclear security-related issues; the perception that the treaties, conventions and recommendations are not relevant for states with no nuclear activities; a lack of awareness or

72. For a detailed analysis, see Wetherall, A. (2016), *supra* note 20, pp. 22-40.

73. Stoiber, C. (2010), *supra* note 15, p. 220; see also, e.g. IAEA (2020), General Conference Resolution: "Nuclear Security", IAEA Doc. GC(64)/RES/10, adopted on 25 Sept. 2020, preambular paras. d) and g).

74. Nuclear Security Governance Experts Group (2015), *International Convention on Nuclear Security*, available at: www.nsgeg.org/ICNSReport315.pdf (accessed 21 May 2021).

75. For a summary of the different proposals, see Wetherall, A. (2016), *supra* note 20, p. 37-40. See also Drobysz, S. (2016), *supra* note 71, pp. 267 et seq.

76. Jankowitsch-Prevor, O. (2010), *supra* note 1, p. 201.

77. Johnson, P.L. (2014), *supra* note 18, p. 17.

78. Stoiber, C. (2010), *supra* note 15, pp. 220-221.

misperception of the existing legal framework and its benefits; a lack of legal and technical capacity and/or expertise at the national level to move the adherence process forward and ministerial and parliamentarian hurdles.[79]

As of 28 May 2021, the CPPNM had 162 parties including Euratom,[80] while the amended convention counted 125 parties including Euratom.[81] Thirty-seven states parties to the CPPNM thus have yet to join the amendment, along with states that are neither party to the CPPNM nor its Amendment. The IAEA's Director General, as the depositary for the Convention, has therefore sustained the efforts to promote further adherence to the Amended CPPNM.[82] The Conference of the Parties to the Amendment to the CPPNM will also provide an opportunity to address the

79. Regarding the CPPNM, see Johnson, P.L. (2014), *supra* note 18, pp. 28-38; regarding all instruments, see Wetherall, A. (2016), *supra* note 20, p. 26.

80. According to Article 18, section 4.(a) and (b) of the CPPNM, the Convention is open for signature or accession by international organisations and regional organisations. In matters within their competence, such organisations shall, on their own behalf, exercise the rights and fulfil the responsibilities that the Convention attributes to states parties. The role of the European Atomic Energy Community with respect to physical protection has been clarified by the Court of Justice of the European Communities when it examined the need for the Community to accede to the CPPNM in its Ruling 1/78 of 14 Nov. 1978, "Delivered pursuant to the third paragraph of Article 103 of the EAEC Treaty - Draft Convention of the International Atomic Energy Agency on the Physical Protection of Nuclear Materials, Facilities and Transports", European Court Reports 1978 -02151, ECLI:EU:C:1978:202. The Court confirmed:

> it may be noted that in the preamble to the EAEC Treaty the parties showed themselves anxious "to create the conditions of safety necessary to eliminate hazards to the life and health of the public", that Article 2 (e) gives the Community the task of making certain, by appropriate supervision, that nuclear materials "are not diverted to purposes other than those for which they are intended", without making any distinction with regard to the nature of such diversions and the circumstances in which they might take place and finally that the very expression "safeguards" which the Treaty uses to characterize the provisions of Chapter VII has a wider scope than the mere substitution of a different destination for the one declared by a user of nuclear materials. The Treaty here envisages all diversions of nuclear materials entailing a security risk that is to say the danger of interference with the vital interests of the public and the States. Consequently, there can be no doubt that the concept of "safeguards" within the meaning of the Treaty is sufficiently comprehensive to include also measures of physical protection.

Ibid., para. 21. The Court also clarified the division of powers between the Community and its member states regarding the implementation of the Convention. The Court states:

> Once the convention has entered into force, its application will entail close co-operation between the institutions of the Community and the Member States. The tasks to be carried out by the Community will relate in essence to the supply arrangements and the management of the nuclear common market, the implementation of security provisions which cover the whole of the Community and finally the management of the right of property ownership. The relevant provisions of the Treaty, together with the provisions of the convention itself, which, once it has been concluded by the Community, will form an integral part of Community law, will provide an appropriate legal basis for the necessary implementing measures […] For the rest it will be for the Member States to adopt the appropriate implementing provisions, each in its own territory, especially in the field of the intervention of the public authorities, criminal prosecutions and extradition.

Ibid., para. 36.

81. In its decision approving the accession of the European Atomic Energy Community to the Amended CPPNM, the European Council referred to the Ruling 1/78 of 14 Nov. 1978 of the Court of Justice of the European Communities mentioned in European Union Council Decision 2007/513/Euratom of 10 July 2007, approving the accession of the European Atomic Energy Community to the amended Convention on the Physical Protection of Nuclear Material and Nuclear Facilities, *Official Journal of the European Union* L190/12, para. 4 (21 July 2007).

82. See IAEA (2020), *supra* note 16, sec. B.10., p. 3.

Convention's universalisation and implementation. According to Article 16.1 of the Amended Convention, such a conference shall be convened five years after the entry into force of the amendment. A conference was therefore set to take place in 2021 but at the time of publication, it was postponed to 2022 due to the COVID-19 pandemic.[83] The convening of further conferences with the same objective of "review[ing] the implementation of [the] Convention and its adequacy as concerns the preamble, the whole of the operative part and the annexes in the light of the then prevailing situation"[84] may subsequently be agreed.[85]

Although both convened by the IAEA, the CPPNM review conferences are not to be confused with the International Conferences on Nuclear Security (ICONS). First held in 2013 and convened every three to four years at the request of the IAEA General Conference,[86] ICONS provide a unique – since the end of the Nuclear Security Summit process in 2016 – avenue for ministerial and expert discussions on all aspects of nuclear security open to all IAEA member states. In contrast, the CPPNM Review Conference will only convene states parties to the Amended CPPNM and focus on matters within the scope of the conference.[87] Other international organisations have also developed dedicated assistance programmes, within the scope of their respective mandate, to support universalisation for other instruments. For example, the UN Office of Counter Terrorism and the UN Office on Drugs and Crime have focused their efforts on the universalisation and implementation of ICSANT.[88]

Another important consideration is the need to implement obligations in international instruments through appropriate national legislative and regulatory frameworks, which in some countries is required prior to accession or ratification of such international obligations and may therefore also delay the adherence process.[89] In other countries, national implementing legislation is adopted once international obligations have been accepted and must therefore be carried out.

83. As of 1 March 2021, meetings of the Preparatory Committee took place virtually during the week of 7-11 December 2020 and on 1 February 2021. During the Preparatory Committee meetings, the parties agreed to convene the Conference at the end of March 2022. See "IAEA Director General's Introductory Statement to the Board of Governors", 1 March 2021, available at: www.iaea.org/iaea-director-generals-introductory-statement-to-the-board-of-governors-1-march-2021 (accessed 21 May 2021).

84. ACPPNM, Art. 16.1.

85. ACPPNM, Art. 16.2. On recommendations for the CPPNM review conference, see Neakrase, S. (2019), "Strengthening Nuclear Security with a Sustainable CPPNM Regime", *Arms Control Today*, Vol. 49, available at: www.armscontrol.org/act/2019-06/features/strengthening-nuclear-security-sustainable-cppnm-regime (accessed 21 May 2021).

86. See e.g. IAEA (2020), *supra* note 73, para. 6.

87. For a more detailed comparison between CPPNM Review Conferences and ICONS, see Neakrase, S. (2019), *supra* note 85.

88. For a description of the IAEA's activities, see Johnson, P.L. (2014), *supra* note 18, pp. 22-28. On support to ICSANT's universalisation, see e.g. UN Office of Counter Terrorism, UN Counter Terrorism Centre (UNCCT) (2019), *UNCCT Annual Report 2019*, pp. 99, 153, available at: www.un.org/counterterrorism/sites/www.un.org.counterterrorism/files/uncct_annual_report_2019.pdf (accessed 21 May 2021).

89. It took ten years for the United States to ratify the CPPNM, ICSANT and other related conventions due to internal difficulties in adopting implementing legislation; see Reif, K. (2015), "Congress Finally Passes Legislation to Prevent and Counter Nuclear Terrorism," *Arms Control Now* blog, available at: www.armscontrol.org/blog/2015-06-02/congress-finally-passes-legislation-prevent-counter-nuclear-terrorism (accessed 21 May 2021). See also Burnard, L. (2019), "Former US congressional candidate attempts to buy radioactive substance on the dark web", *Trust and Verify*, Issue No. 163, VERTIC, London, p. 9.

3. National legislative and regulatory frameworks for nuclear security

Establishing and implementing an effective legislative and regulatory framework, comprised of both primary (laws) and secondary (regulations such as decrees and rules) legislation as well as complementary manuals, standard operating procedures and guidelines,[90] is required by international instruments, and it is an essential element of a state's nuclear security regime. After identifying the main elements of this framework, it is worth raising a few observations on its development.

a. Key elements of national legal frameworks for nuclear security

Under the CPPNM as amended, each state party shall establish and maintain a legislative and regulatory framework to govern physical protection.[91] In addition, each state party shall inform the IAEA Director General of its laws and regulations, which give effect to the Convention.[92] UNSCR 1540,[93] ICSANT[94] and other conventions also require the adoption of specific legal measures to give effect to the provisions as identified in the first part of this article.

In an effort to synthesise the various requirements, Mr Stoiber identified "a number of common elements for addressing nuclear security [that] have achieved a high level of consensus among states engaged in the peaceful uses of nuclear energy" and which "represent an emerging legal framework for nuclear security."[95] This framework has been consolidated through recent developments and guidance[96] and can be summarised as including:

- **definition** of key terms such as "nuclear material", "nuclear facilities", "radioactive material" and "device" to help clarify the scope of legislation, identifying which acts and materials are covered;[97]
- **offences, penalties and related criminal measures** to prohibit and punish illegal acts with nuclear and other radioactive material and facilities, facilitate their investigation, provide for comprehensive jurisdiction of national courts to prosecute them, and enable extradition;
- **regulatory activities for nuclear security** including: the establishment of an independent national authority(ies) responsible for regulatory oversight; a system that licenses nuclear activities, including transfers, only when such activities comply with nuclear security requirements; a system of inspection of nuclear activities to verify compliance with nuclear security requirements;

90. See "Overview of regulations, agreements and associated administrative measures to govern the nuclear security regime" in IAEA (2018), *Developing Regulations and Associated Administrative Measures for Nuclear Security*, *supra* note 14, pp. 9-12.

91. CPPNM as amended, Art. 2A.2. (a).

92. CPPNM, Art. 14.1.

93. UNSCR 1540, operative paras. 2 and 3(d).

94. ICSANT, Art. 5.

95. Stoiber, C. (2010), *supra* note 15, pp. 237-240.

96. See e.g. Republic of Indonesia and VERTIC (2014), *National Legislation Implementation Kit on Nuclear Security,* Presented by the Republic of Indonesia to the Nuclear Security Summit, The Hague, the Netherlands, 24-25 March 2014, available at: www.vertic.org/media/assets/nim_docs/NIM%20Tools%20(Guides%20Handbooks)/Nuclear%20Security/NLIK-Nuclear%20Security_EN_3mar2014.pdf (accessed 21 May 2021); Johnson, P.L. (2014), *supra* note 18, pp. 31-33; Drobysz, S., (2016), *supra* note 71, pp. 255-258; IAEA (2018), *supra* note 14.

97. The IAEA Nuclear Security Glossary usefully compiles such definitions which can be found in international binding and non-binding instruments. See IAEA (2015), *supra* note 7. For relevant international provisions, see e.g. Article 1 of the Amended CPPNM and Article 1 of ICSANT.

- **physical protection and security requirements to protect and secure nuclear and other radioactive material and facilities in domestic use and international transport,** placing the prime responsibility for the implementation of such requirements on the licensee and requiring the licensee to adopt nuclear security plans, incidents notification systems, and contingency plans to respond to such incidents;
- **international co-operation and assistance measures**, protecting sensitive information as appropriate to facilitate the international response to nuclear security incidents, including the rapid recovery of stolen material; exchange of information of potential threats; exchange of information and best practices on nuclear security systems.

The COVID-19 pandemic has also shown the importance of having business continuity plans in place to provide for the maintenance of adequate levels of physical protection and other nuclear security-related measures under extraordinary circumstances. This includes possibly reduced, but nevertheless appropriate, levels of regulatory oversight and regulatory relief.[98]

b. Observations on the development of national legal frameworks for nuclear security

Nuclear security legislation is important in all states, not only those with significant nuclear activities.[99] As noted in other publications on nuclear security legislation,[100] however, there are various approaches to incorporating the elements of the legal framework at the national level, depending on a number of country variables ranging from the status regarding adherence to international instruments and membership in international institutions, the national legal system, the existing national legal framework, current and planned activities with nuclear and other radioactive material, to security concerns. Such national (and sometimes regional) circumstances justify tailored legal drafting, with the possibility of:

- The adoption of new laws and/or the amendment of existing ones.
- Sectoral implementation through a number of laws and regulations separately covering criminal aspects, physical protection, export controls, etc.
- Comprehensive nuclear laws including a dedicated nuclear security section and/or separate nuclear security regulations.
- Detailed nuclear security legislation applicable to all nuclear and other radioactive materials and facilities or focusing on certain aspects. In fact, while some aspects of nuclear security law may not need to be expanded upon in certain countries – for example, detailed licensing or physical protection measures for nuclear material and facilities if there are no such materials and facilities – others will still need to be adopted, such as criminal measures ensuring that no country will be a safe haven for individuals or legal persons sabotaging or trafficking facilities and materials in other countries.

98. See e.g. Canada's experience: http://nuclearsafety.gc.ca/eng/resources/emergency-management-and-safety/pandemic-preparedness.cfm (accessed 21 May 2021) and US experience: www.nrc.gov/about-nrc/covid-19/security-ep/training-qualification-req.html (accessed 21 May 2021).

99. See Johnson, P.L. (2014), *supra* note 18, p. 11.

100. See e.g. *ibid*., p. 33; Republic of Indonesia and VERTIC (2014), *supra* note 96, sec. IV, p. 37 et seq.; IAEA (2018), *supra* note 14.

The status of implementation itself varies from one country to the other, and not all states have adopted a comprehensive nuclear security legal regime.[101] A number of reasons of different nature may explain this situation.[102] Some are similar to what has been observed regarding universalisation of the international legal framework and relate to a lack of prioritisation, absence of or limited awareness of the framework, and capacity issues both in terms of expertise and resources. There are also obstacles that are more specific to the nuclear security framework and the legislative drafting process. For example, given the complexity of the international legal framework for nuclear security, including both binding and non-binding texts, it may be difficult to identify all the relevant commitments made by the state and assess to what extent they are already incorporated in the national legal framework. Further, when drafting legislation, harmonising the international requirements and their implementing provisions requires a set of both legal and technical skills. While the international instruments are prescriptive about what should be done, they provide fewer details as to how it should be done.

As referenced throughout this article, tools and assistance programmes have therefore been developed by intergovernmental organisations to help states overcome those challenges and develop adequate legislation. Each focuses on aspects that fall within those organisations' mandates in line with the international instruments comprising the nuclear security framework. IAEA guidance therefore addresses matters within the scope of the CPPNM, the Code of Conduct on the Safety and Security of Radioactive Sources and the Nuclear Security Series, while the UN and UN Office on Drugs and Crime guidance focus on criminal measures and nuclear terrorism.[103] Non-governmental institutions can also assist; for example, VERTIC developed nuclear security legislative tools and can provide assistance to implement instruments across the chemical, biological, radiological and nuclear security international framework.[104]

4. Conclusion

Since the creation of the ISNL 20 years ago, illegal acts including illicit trafficking, thefts, and losses of nuclear and other radioactive material have continued to occur. Recent extraordinary events such as the COVID-19 pandemic have not put the nuclear security threat on hold and opportunities for vulnerabilities have continued to be identified, including the ongoing threat of nuclear terrorism and the risks of cyber-attacks, which remote working and the increased use of technology may have increased.[105]

Nuclear security must therefore continue to be a priority, which involves sustained efforts to strengthen the relevant international legal framework through universalisation of existing instruments, including the CPPNM as amended and ICSANT. The implementation of such legally

101. See e.g. findings and recommendations of the Nuclear Threat Initiative (NTI) Nuclear Security Index on nuclear security regulatory regimes on NTI's webpage "Strengthen Nuclear Security Regulatory Regimes and Strive for Continuous Improvement", available at: www.ntiindex.org/recommendation/recommendation-2-2/ (accessed 21 May 2021).

102. For further developments, see e.g. Johnson, P.L. (2014), *supra* note 18, pp. 28 et seq.; Drobysz, S. (2016), *supra* note 71, pp. 264 et seq.

103. See e.g. UNODC (2016), *supra* note 59; UNODC (2008), *Legislative Guide to the Universal Legal Regime Against Terrorism*, United Nations, New York.

104. See e.g. Republic of Indonesia and VERTIC (2014), *supra* note 96.

105. See Roth, N. (2020), "Securing nuclear facilities in a time of COVID-19", Stimson Center, Washington, DC, available at: www.stimson.org/2020/securing-nuclear-facilities-in-a-time-of-covid-19/ (accessed 21 May 2021).

binding conventions but also non-legally binding guidance at the national level is then key to building strong nuclear security regimes worldwide.

Given the challenges that states face in doing so, Mr Stoiber's prediction in the ISNL 10th anniversary publication holds true: "Nuclear lawyers […] will have continuing opportunities and responsibilities to contribute to the development and enhancement of the legal framework for ensuring the protection of nuclear and other radioactive materials and preventing sabotage of nuclear facilities."[106]

106. Stoiber, C. (2010), *supra* note 15, pp. 241-42.

The IAEA safeguards system

*by Laura Rockwood**

The nuclear non-proliferation regime is a complex of varied and evolving instruments and measures intended to deter and detect the proliferation of nuclear weapons. It includes, *inter alia*, global and regional treaties on non-proliferation, export controls, physical protection, measures designed to track and deter illicit trafficking in nuclear and other radioactive materials, and international verification. Taken together, these instruments and measures, if effectively implemented, create a finely woven fabric that reduces the risk of the proliferation of nuclear weapons through state and non-state actions. The cornerstone of this regime is the safeguards system of the International Atomic Energy Agency (hereinafter the "Agency" or IAEA). This article describes the legal framework of IAEA safeguards and how the system has developed.

A. Legal framework

I. IAEA Statute

The IAEA's safeguards system is grounded in the provisions of the Agency's Statute, which entered into force on 29 July 1957.[1] As originally contemplated, the IAEA was to be a sort of broker of controlled nuclear assistance and trade. It was anticipated that the majority of the safeguards arrangements would be a function of the Agency's responsibility under Article II of the Statute to "ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose." However, the Statute was drafted in such a way as to permit growth and flexibility in the system.

Article III.A.5 of the Statute authorises the Agency to establish and administer safeguards designed to ensure that projects in the field of nuclear energy carried out or fostered by the Agency are not used in such a way as to further any military purpose (a requirement with respect to which Article XI.F.4 sets out in more detail: the assistance provided shall not be used in such a way as to further any military purpose, and the project shall be subject to the safeguards provided for in Article XII to the extent the agreement specifies particular controls to be relevant). In addition, Article III.A.5 authorises the IAEA to apply safeguards to any bilateral or multilateral arrangement, at the request of the parties, and to any of the nuclear activities of a state, at that state's request.

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1. Statute of the International Atomic Energy Agency (1956), 276 UNTS 3, entered into force 29 July 1957, Art. II (IAEA Statute).

Article XII of the Statute sets out the fundamental features of Agency safeguards in three paragraphs:

1. the rights and responsibilities that the Agency has when carrying out safeguards, to the extent relevant to the specific situation:
   - "[t]o examine the design of specialised equipment and facilities";
   - "[t]o require the maintenance and production of operating records to assist in ensuring accountability for and control of source and special fissionable materials";
   - to require the submission of reports;
   - to send into the state "inspectors, designated by the Agency after consultation with the State or States concerned, who shall have access at all times to all places and data and to any person who by reason of his occupation deals with materials, equipment or facilities which are required by this Statute to be safeguarded, as necessary to account for [nuclear] materials … and to determine whether there is compliance with the undertaking against use in furtherance of any military purpose" and with any other conditions prescribed in the agreement; and
   - impose certain sanctions.
2. the requirement that the Agency establish a staff of inspectors, whose general functions are specified in the Statute (including right of access).
3. the steps available to inspectors, by the Director General and by the Board of Governors in the event a state is found to be in violation of its safeguards agreement, including calling upon the state to remedy the non-compliance, reporting such non-compliance to the member states of the Agency, to the Security Council and the General Assembly of the United Nations (UN) and imposing certain sanctions.

II. Treaty and supply agreement obligations

1. Assistance provided by the Agency

Article III.A.5 of the Statute contemplates the application of Agency safeguards to assistance provided by the IAEA. As indicated in Article XI.F of the Statute, assistance may be provided to Agency member states by the IAEA in connection with any project for research on, or development or practical application of, atomic energy for peaceful purposes. Assistance provided under such projects can take the form of special fissionable or other material, services, equipment and/or facilities. These projects, which are administered by the IAEA's Department of Technical Cooperation, normally entail the conclusion of two documents: first, a supply agreement between a supplier state, the recipient state and the Agency, and secondly, a project agreement between the Agency and the recipient state which, among other provisions, requires the application of Agency safeguards where relevant. That is so, for example, where the project involves the supply of nuclear material or facilities.

2. Multilateral and bilateral treaties

Article III.A.5 of the Statute also authorises the IAEA to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement.

a. The Treaty on the Non-Proliferation of Nuclear Weapons

The first global treaty calling for IAEA safeguards was the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), which entered into force on 5 March 1970.[2] Article III.1 of the NPT requires each non-nuclear weapon state[3] (NNWS) to accept safeguards, as set forth in an agreement to be concluded with the IAEA in accordance with its Statute, on all source or special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices. The safeguards agreements required under Article III.1 are referred to as "full scope agreements" or, more commonly, "comprehensive safeguards agreements" (CSAs).

In addition, Article III.2 of the NPT requires each state party to the NPT not to provide source or special fissionable material, or equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to a NNWS for peaceful purposes unless the source or special fissionable material is subject to Agency safeguards. There is no corresponding requirement with respect to exports to NWSs.

Negotiation of the NPT resulted in accommodation of a number of states' interest in retaining the right to use nuclear energy for non-explosive military purposes, specifically, nuclear naval propulsion. In addition, the treaty contemplates availability to NNWSs of the potential benefits of peaceful applications of nuclear explosives, although not necessarily access to the nuclear explosive devices themselves or to the relevant technology.

b. The Tlatelolco Treaty

The first regional treaty on non-proliferation and a nuclear-weapon-free zone (NWFZ) was the Treaty for the Prohibition of Nuclear Weapons in Latin America (the Tlatelolco Treaty), which was opened for signature in Tlatelolco, Mexico on 14 February 1967, and has entered into force for the states in the zone of application.[4] Article 1 of the treaty requires all parties

> to use exclusively for peaceful purposes the nuclear material and facilities which are under their jurisdiction, and to prohibit and prevent in their respective territories: (1) The testing, use, manufacture, production or acquisition by any means whatsoever of any nuclear weapons, by the Parties themselves, directly or indirectly, on behalf of anyone else or in any other way; and (2) The receipt, storage, installation, deployment and any form of possession of any nuclear weapons, directly or indirectly, by the Parties themselves, by anyone on their behalf or in any other way.

Articles 12-18 of the Tlatelolco Treaty establish a control system for the purpose of verifying compliance with the obligation under the treaty to use nuclear energy exclusively for peaceful purposes. Under that system, a party to the Tlatelolco Treaty is required to conclude multilateral or bilateral agreements with the IAEA for the application of its safeguards to its nuclear activities. Similar to the NPT, the Tlatelolco Treaty also contemplates the possibility of peaceful

2. Treaty on the Non-Proliferation of Nuclear Weapons (1968), IAEA Doc. INFCIRC/140, 729 UNTS 169, entered into force 5 Mar. 1970.

3. Article IX.3 of the NPT defines a nuclear-weapon state (NWS) as "one which had manufactured and exploded a nuclear weapon or other nuclear explosive device prior to 1 January 1967", of which there are five: China, France, the Soviet Union (now the Russian Federation), the United Kingdom and the United States.

4. Treaty for the Prohibition of Nuclear Weapons in Latin America (1967), 634 UNTS 326, entered into force 22 Apr. 1968.

applications of nuclear explosions conducted by a NWS. However, unlike the NPT, the Tlatelolco Treaty does not contain a requirement of safeguards as condition of nuclear supply.

There are two additional protocols to the Tlatelolco Treaty. Additional Protocol I of the treaty is open to any state which has territories in the zone of application of the treaty for which it is, *de jure* or *de facto*, internationally responsible (France, the Netherlands, the United Kingdom and the United States) and requires the state to conclude a safeguards agreement with respect to such territories. Additional Protocol II is open to the five NWSs and contains an undertaking not to use or threaten to use nuclear weapons against the parties to the Tlatelolco Treaty (referred to as "negative security assurances").

c. The Rarotonga Treaty

The South Pacific Nuclear Free Zone Treaty (the Rarotonga Treaty) was opened for signature in 1985 and entered into force on 11 December 1986.[5] Article 8 of the treaty, which establishes the control system under the treaty, requires the application to peaceful nuclear activities of safeguards by the IAEA pursuant to an agreement required in connection with the NPT or equivalent in scope. Unlike the NPT and the Tlatelolco Treaty, no nuclear explosives or nuclear explosive devices are permitted within the zone of application of the treaty. With regard to exports, Article 4 of the Rarotonga Treaty requires each party not to provide source or special fissionable material, or equipment or material especially designed or prepared for the processing, use or production of special fissionable material for peaceful purpose to any NNWS unless subject to IAEA safeguards, or to any NWS unless subject to applicable safeguards agreements with the IAEA. Under that same article, each state party also expressly undertakes to support the continued effectiveness of the international non-proliferation system based on the NPT and the IAEA safeguards system.

The Rarotonga Treaty includes three protocols: Protocol 1 is similar to Additional Protocol I of the Tlatelolco Treaty and is open to states with territories for which they are internationally responsible which are situated within the South Pacific nuclear-free zone (France, the United Kingdom and the United States). Protocols 2 and 3 are open to the five NWSs. Protocol 2 contains an undertaking not to use or threaten to use nuclear explosive devices against any party to the treaty or any territory within the zone for which it is internationally responsible. Protocol 3 contains an undertaking not to test any nuclear explosive device within the zone.

d. The Bangkok Treaty

The Southeast Asia Nuclear Weapon-Free Zone Treaty (the Bangkok Treaty) was opened for signature by "all states in Southeast Asia, namely, Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam", on 15 December 1995, in Bangkok, and entered into force on 27 March 1997.[6] Under this treaty, each state party undertakes to use exclusively for peaceful purposes nuclear material and facilities which are within its territory and areas under its jurisdiction (Article 4(2)(a)) and control and to conclude an agreement with the IAEA for the application of full scope safeguards to its peaceful nuclear activities (Article 5). The treaty also prohibits the export of source or special fissionable material, or especially designed or prepared equipment or material, to any NNWS except under a CSA, and to NWSs, in conformity with applicable safeguards agreements with the IAEA (Article 4(3)(a)-(b)). The control system set up under the Bangkok Treaty also has a mechanism permitting a state party to request that a "fact-

5. South Pacific Nuclear Free Zone Treaty (1985), 1445 UNTS 177, entered into force 11 Dec. 1986.

6. Treaty on the Southeast Asia Nuclear Weapon-Free Zone (1995), 1981 UNTS 129, entered into force 27 Mar. 1997.

finding mission [be sent] to another State Party in order to clarify and resolve a situation which may be considered ambiguous or which may give rise to doubts about compliance with the provisions of this Treaty" (Article 13). The Bangkok Treaty includes a Protocol on negative security assurances open to signature by the NWSs.

e. The Pelindaba Treaty

The African Nuclear Weapon-Free Zone Treaty (the Pelindaba Treaty) was opened for signature in Cairo, Egypt, on 11 April 1996, and came into force on 15 July 2009.[7] Pursuant to this treaty, "Each Party undertakes: (a) Not to conduct research on, develop, manufacture, stockpile or otherwise acquire, possess or have control over any nuclear explosive device by any means anywhere; (b) Not to seek or receive any assistance in the research on, development, manufacture, stockpiling or acquisition, or possession of, any nuclear explosive device; [and] (c) Not to take any action to assist or encourage the research on, development, manufacture, stockpiling or acquisition, or possession of any nuclear explosive device" (Article 3). The parties also undertake to prohibit the stationing of nuclear weapons on their territory (Article 4(1)) and to prohibit the testing of any nuclear explosive devices on their territory (Article 5(b)). As regards safeguards, each state party undertakes to conduct all activities for the peaceful use of nuclear energy under strict non-proliferation measures to provide assurance of exclusively peaceful uses, to conclude a comprehensive safeguards agreement with the IAEA and not to export source or special fissionable material, especially designed or prepared equipment or material to NNWSs except subject to a CSA (Article 9). Associated with the treaty are three protocols: Protocol I, which is open to signature by the five NWSs, binds those states not to use or threaten to use a nuclear explosive device against a party to the treaty or in the African nuclear-weapon-free zone; Protocol II, also open to signature by the five NWSs, commits the parties to it not to test or assist or encourage the testing of a nuclear explosive device within the zone; and Protocol III, which is open to all states with territories with respect to which it has *de jure* or *de facto* international responsibility situated in the zone, requires, *inter alia*, the application of safeguards to such territories.

f. The Semipalatinsk Treaty

The Central Asian Nuclear-Weapon-Free Zone Treaty was signed on 8 September 2006 by Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, in Semipalatinsk, Kazakhstan.[8] The treaty, which entered into force on 21 March 2009, created the first denuclearised zone in the northern hemisphere and the first bordered by two NWSs. Similar to the other NWFZ treaties, the parties "undertake[:] (a) Not to conduct research on, develop, manufacture, stockpile or otherwise acquire, possess or have control over any nuclear weapon or other nuclear explosive device by any means anywhere; (b) Not to seek or receive any assistance in the research on, development, manufacture, stockpiling, acquisition, possession or obtaining control over any nuclear weapon or other nuclear explosive device; [and] (c) Not to take any action to assist or encourage the research on, development, manufacture, stockpiling, acquisition or possession of, any nuclear weapon or other nuclear explosive device" (Article 3(1)(a)-(c)). The parties also undertake to prohibit the stationing of nuclear weapons on their territory (Article 3(1)(d)(i)) and to prohibit the testing of any nuclear explosive devices on their territory (Article 5(b)). As regards safeguards, each state party undertakes to use nuclear material and facilities for

7. African Nuclear-Weapon-Free Zone Treaty (1996), 35 I.L.M. 698, entered into force 15 July 2009.

8. Treaty on a Nuclear-Weapon-Free Zone in Central Asia (2006), No. 51633, entered into force 21 Mar. 2009 (Semipalatinsk Treaty).

exclusively peaceful uses and to conclude with the IAEA, if it has not already done so, a CSA (Article 8(a)-(b)). Significantly, the Semipalatinsk Treaty also requires each state party to conclude an additional protocol (AP) as well as a CSA (see discussion *infra*) and not to export source, or special fissionable material, especially designed or prepared equipment or material, to a NNWS unless that state has concluded with the IAEA a CSA and an AP (Article 8(b)-(c)). Associated with the treaty is a protocol, open to signature by the five NWSs, containing negative security assurances and an undertaking not to contribute to any act that constitutes a violation of the treaty or the protocol.

g. The Argentina/Brazil Agreement

The Governments of Argentina and Brazil entered into an agreement in 1991 calling for the establishment of a bilateral inspectorate (ABACC – the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials) and for the conclusion of a comprehensive agreement with the IAEA for the application of safeguards to all nuclear material in nuclear activities in Argentina and Brazil.

3. At the request of a state

Finally, Article III.A.5 of the Statute authorises the IAEA to implement safeguards, "at the request of a State, to any of that State's activities in the field of atomic energy". This serves as the basis for agreements concluded by a state, generally because of supply arrangements with other states who insist on safeguards as a condition of supply to provide assurance that nuclear-related trade is not used for military purposes. This provision also serves as the basis for the conclusion and implementation of the so-called voluntary offer agreements (VOAs) concluded with the five NWSs.

III. Basic safeguards documents

1. Item-specific safeguards agreements: INFCIRC/66/Rev.2

The Agency's first safeguards document was drafted by interested governments and the Secretariat in 1959 and 1960 and approved by the Board of Governors on 31 January 1961.[9] It contained the principles and procedures for the application of safeguards to small reactors.[10] This document was extended to larger reactors by decision of the Board of Governors on 26 February 1964.[11] In 1964 and 1965, a completely revised safeguards document was negotiated by a group of government experts and approved by the Board of Governors after unanimous concurrence by the General Conference in September 1965.[12] Annex I to INFCIRC/66, which contains provisions for reprocessing plants, was approved by the Board in 1966, and Annex II, which contains provisions for safeguarded nuclear material in conversion and fuel fabrication plants, was adopted by the Board in 1968. With its two annexes, the safeguards document is now referred to as INFCIRC/66/Rev.2.[13] Its provisions are incorporated by reference in each item-specific safeguards agreement.

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9. IAEA (1961), "The Agency's Safeguards", IAEA Doc. INFCIRC/26.
10. And more specifically, to "research, test and power reactors with less than 100 megawatts thermal output, to the source and special fissionable material used and produced in these reactors and to small research and development facilities". *Ibid.*, Article I(4).
11. IAEA (1964), "The Agency's Safeguards: Extension of the system to large reactor facilities", IAEA Doc. INFCIRC/26/Add.1.
12. IAEA (1965), "The Agency's Safeguards System (1965)", IAEA Doc. INFCIRC/66.
13. IAEA (1968), "The Agency's Safeguards System (1965, as Provisionally Extended in 1966 and 1968)", IAEA Doc. INFCIRC/66/Rev.2.

In June 1961, the Board of Governors adopted a document referred to as the "Inspectors Document",[14] developed with the help of government experts, which covers four different areas of inspection activities, including designation of Agency inspectors, notification of inspections, the conduct of inspection and rights of access and the privileges and immunities of inspectors. This document is also incorporated by reference in INFCIRC/66-type agreements (the comparable provisions in CSAs are included in the text of the agreements themselves). Hence, the Inspectors Document is of relevance only to agreements concluded pursuant to INFCIRC/66/Rev.2.

INFCIRC/66-type safeguards agreements originally included a basic undertaking on the part of the state or states party to the agreement not to use any safeguarded item for any military purpose. As will be discussed below, after 1974, that undertaking was expanded to limit the use of any item safeguarded thereunder to peaceful purposes and to prohibit the use of such items for the manufacture of any nuclear weapon, or to further any other military purpose or for the manufacture of any other nuclear explosive device.

2. Comprehensive safeguards agreements: INFCIRC/153 (Corr.)

In 1970, the Board of Governors established the Safeguards Committee (also called "Committee 22", as it was the 22nd committee established by the Board of Governors[15]) to advise it on the contents of safeguards agreements to be concluded between the NNWSs party to the NPT and the IAEA.[16] Participation in the Committee was open to all member states of the Agency and included, in addition to many states party to the NPT, states that were not party, such as France,[17] India and Pakistan. The Safeguards Committee developed a 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", which the Board approved in 1972, and requested the Director General to use as the basis for negotiating safeguards agreements under the NPT.[18] The document was published by the Agency as INFCIRC/153 (Corr.).

INFCIRC/153 has also served as a basis for the structure and content of CSAs concluded pursuant to the Tlatelolco Treaty and is considered the standard for safeguards agreements under the Rarotonga Treaty, the Pelindaba Treaty and the Bangkok Treaty. In addition, it provided a basis for the negotiation of the first unilateral CSA with Albania, a non-NPT comprehensive agreement with Ukraine,[19] and the quadripartite safeguards agreement concluded with Argentina and Brazil.[20]

The basic undertaking of the state under a CSA tracks the language of the NPT. In such agreements, the state undertakes to accept safeguards on all source or special fissionable material in all peaceful nuclear activities carried out on its territory or subject to its jurisdiction or control

14. IAEA (1961), "The Agency's Inspectorate: Memorandum by the Director General", IAEA Doc. GC(V)/INF/39, Annex.

15. Rockwood, L. (2018), "Naval Nuclear Propulsion: Seeking Verification Processes", in George Washington University Institute for International Science and Technology Policy (ed.), *Institute for International Science & Technology Policy Occasional Papers Series: Reducing Risks from Naval Nuclear Fuel*, Washington, DC, p. 29.

16. IAEA (1971), *Annual Report l July 1970 -3 0 June 1971*, IAEA Doc. GC(XV)/455, pp. 7, 45. See also Fischer, D. (1997), *History of the International Atomic Energy Agency: The First Forty Years*, IAEA, Vienna, pp. 254-257.

17. France, however, later acceded to the NPT in August 1992.

18. IAEA (1972), *The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, IAEA Doc. INFCIRC/153 (Corrected), IAEA, Vienna.

19. Ukraine has since concluded an NPT CSA.

20. IAEA (1994), "Agreement of 13 December 1991 between the Republic of Argentina, the Federative Republic of Brazil, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials and the International Atomic Energy Agency for the Application of Safeguards", IAEA Doc. INFCIRC/435.

anywhere for the exclusive purpose of verifying that such material is not used for nuclear weapons or any other nuclear explosive device.[21] For its part, the IAEA has the right and obligation to ensure that all such material is safeguarded in accordance with the agreement, that is to say, to verify that there is no diversion of declared nuclear material to proscribed purposes and that there is no undeclared nuclear material or activity in the state.[22]

Following the end of the Cold War, a series of events resulted in a dramatic change in the IAEA's safeguards system. The discovery of a clandestine nuclear weapons programme in Iraq, the continuing difficulty in verifying the initial report of the Democratic People's Republic of Korea (DPRK) upon entry into force of its NPT CSA and the decision of the South African Government to give up its nuclear weapons programme and join the NPT, all played a role in an ambitious effort by IAEA member states and the Secretariat to strengthen the safeguards system.

Motivated by these events, between 1991 and 1993, the Board confirmed the IAEA's authority under CSAs to verify not just the correctness, but the completeness of states' declarations concerning nuclear material and facilities, with a view to ensuring that there is no diversion to proscribed purposes of any nuclear material in the state, whether declared or undeclared.[23] The Board also confirmed the IAEA's right to have early access to design information about nuclear facilities and its continuing right to verify such information.[24] In addition, the Board confirmed the IAEA's authority to use: environmental monitoring, a novel tool developed by the IAEA during its Security Council mandated verification in Iraq for detecting undeclared enrichment and reprocessing activities;[25] satellite imagery and any other information available to it, whether from open sources or national technical means (intelligence information).[26]

In June 1993, the Board of Governors requested the Director General to submit to it concrete proposals for the assessment, development and testing of measures for strengthening safeguards and improving its cost-effectiveness.[27] In response to that request, the Secretariat of the IAEA, in

21. It is worth noting that, as under the NPT, while all explosive uses of nuclear material are prohibited under CSAs, not all military uses of nuclear material are prohibited. However, should a CSA state wish to withdraw nuclear material for use in a non-proscribed military activity, such as nuclear propulsion for submarines, the state must first agree with the IAEA on arrangements to ensure that the material is not removed from safeguards only for so long as it is in that use.

22. See INFCIRC/153 (Corr), *supra* note 18, para. 7.

23. See, for example, experience with South Africa (IAEA (1991), "South Africa's Nuclear Capabilities", IAEA Doc. GC(XXXV)/RES/567. The draft resolution, submitted by Zaire on behalf of the African Group, was adopted without a vote.), Romania (IAEA (1992), "Record of GOV/OR Meeting 783", IAEA Doc. GOV/OR.783, paras. 90-93) and with special inspections (IAEA (1992), "Record of GOV/OR Meeting 776", IAEA Doc. GOV/OR.776, paras, 48, 83, and 84).

24. See IAEA (1992), "Strengthening of the Safeguards System: Report by the Director General", IAEA Doc. GC(XXXVI)/1017, p. 2, para. 5, incorporated into IAEA (1992), "Strengthening of Agency Safeguards: The Provision and Use of Design Information", IAEA Doc. GOV/2554/Att.2/Rev.2.

25. The use of environmental monitoring was one of the measures identified by the Standing Advisory Group on Safeguards Implementation (SAGSI) in its April 1993 Report that would enhance the Agency's ability to detect undeclared facilities and activities and recommended that these measures be further developed. IAEA (1993), "Report to the Director General on the 36th Series of SAGSI Meetings", IAEA Doc. SAR-15, Task 3. Following a legal analysis, the Director General found that it was "reasonable to conclude that environmental monitoring may be used to verify design information at any location to which the Agency has access to carry out design information verification", IAEA (1995), GOV/2784, pp. 20-21.

26. See IAEA (1995), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System: Report by the Director General to the General Conference", IAEA Doc. GC(40)/17.

27. IAEA (1993), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System: Report by the Director General", IAEA Doc. GC(XXXVII)/1073, para. 18.

December 1993, initiated its "Development Programme for a Strengthened and More Cost-effective Safeguards System", also known as "Programme 93+2".[28]

Over the course of the following two years, the Secretariat identified a comprehensive set of strengthening and efficiency measures for greater access to information, more extensive physical access to locations and maximisation of the efficiency and cost-effectiveness of the existing system of safeguards under INFCIRC/153[29] and tabled it for the Board's consideration in June 1995.

The measures were divided into two parts: Part 1, consisting of measures that could, in the Secretariat's view, be implemented under existing legal authority; and Part 2, consisting of measures that were believed to require complementary legal authority. The Board took note of the Director General's plan to implement at an early date those measures that fell within existing authority, thus indicating the Board's concurrence with the Secretariat's legal interpretation of the Agency's existing rights of access to information and locations, and urged states party to comprehensive safeguards agreements to co-operate with the Secretariat to facilitate such implementation.[30] The Board also tasked the Secretariat with developing a legal instrument for the implementation of the Part 2 measures.[31]

3. Model Additional Protocol: INFCIRC/540 (Corr.)

Between June 1995 and June 1996, the Secretariat of the IAEA, in close consultation with member states of the Agency, developed for the Board's consideration a draft model of a protocol additional to safeguards agreements for that complementary authority.[32] That draft served as the basis for the deliberations of "Committee 24", the Committee established by the Board of Governors to negotiate and present to it a model protocol.[33] On 15 May 1997, the Board of Governors, in a special session, approved the model for a new legal instrument designed to strengthen the effectiveness and improve the efficiency of the IAEA safeguards system: the "Model Protocol Additional to Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards" (INFCIRC/540 (Corr.)).

The text of the Model Additional Protocol consists of a preamble, 18 articles and 2 annexes. The language of the preamble reflects the backbone of the negotiations: the need for a balance to

28. IAEA (1993), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System: Report by the Director General on the Secretariat's Programme for Assessment, Development and Testing SAGSI's Recommendations on the Implementation of Safeguards", Board of Governor's Paper, IAEA Doc. GOV/2698. The Secretariat's programme was called "93+2" in the expectation that the process of developing the recommendations would be completed prior to the 1995 NPT Review and Extension Conference.

29. IAEA (1995), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System – Proposals for a Strengthened and More Efficient Safeguards System: A Report by the Director General", IAEA Doc. GOV/2807, included as Annex 4 to IAEA (1995), "Strengthening the Effectiveness and Improving the Efficiency of Agency Safeguards: Report by the Director General to the General Conference," IAEA Doc. GC(39)/17.

30. IAEA (1995), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System", IAEA Doc. GC(39)/RES/17, para. 5.

31. *Ibid.*, para. 6.

32. IAEA (1996), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System – Proposals for Implementation under Complementary Legal Authority: A Report by the Director General", Annex 3, "Working Draft of Model Additional Protocol for Committee 24", IAEA Doc. GOV/2863. This document was included as Annex 1 to IAEA (1996), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System: Report by the Director General to the General Conference", IAEA Doc. GC(40)/17.

33. Although informally known as Committee 24, its formal name was the "Committee on Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System, established by the Board of Governors on 14 June 1996". IAEA (1996), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System: Report by the Director General to the General Conference", IAEA Doc. GC(40)/17, p. 4, paras. 15 and 17.

be struck between, on the one hand, the desire to strengthen the effectiveness and improve the efficiency of the Agency's safeguards system and, on the other hand, the obligation to keep "the frequency and intensity of activities … to the minimum consistent with [this] objective". The measures provided for in the Model Additional Protocol include:

- information about, and inspector access to, all aspects of a state's nuclear fuel cycle, from uranium mines to nuclear waste and any other location where nuclear material intended for non-nuclear uses is present;
- information on, and short-notice inspector access to, all buildings on a nuclear site;
- information about, and inspection mechanisms for, fuel cycle-related research and development;
- information on the manufacture and export of sensitive nuclear-related technologies and inspection mechanisms for manufacturing and import locations;
- the collection of environmental samples beyond declared locations when deemed necessary by the IAEA; and
- administrative arrangements that improve the process of designating inspectors, the issuance of multi-entry visas (necessary for unannounced inspections) and IAEA access to modern means of communications.

Article 1 of the Model Additional Protocol establishes the relationship between an AP and the relevant safeguards agreement. It provides that the agreement and the AP are to be read as a single document with, in cases of conflict, the provisions of the AP prevailing.

An AP, in combination with a state's CSA, provides as complete a picture as practicable of that state's production and holdings of nuclear source material, the activities for further processing of nuclear material (for both nuclear and non-nuclear application), and specified elements of the infrastructure that directly support the state's current or planned nuclear fuel cycle. The increased "complementary access" not only strengthens the IAEA's ability to verify declared nuclear material and activities but helps it provide assurances that undeclared nuclear activities are not concealed within declared nuclear sites or at other locations in the state.

4. Privileges and Immunities Agreement: INFCIRC/9/Rev.2

Agency safeguards inspectors are entitled to certain privileges and immunities while carrying out their responsibilities. These are grounded in Article XV.A of the Agency Statute, which provides that the staff of the Agency shall enjoy such privileges and immunities as are necessary in the independent exercise of their functions in connection with the Agency, and are spelled out in the Agreement on the Privileges and Immunities of the Agency.[34] The relevant provisions of this agreement are incorporated by reference into the safeguards agreements. They include immunity from legal process in respect of words spoken or written and all acts performed by an inspector in his or her official capacity, immunity from personal arrest or detention for non-official capacity, immunity from personal arrest or detention for non-official as well as official acts occurring during a mission, inviolability of papers and documents and freedom from seizure of personal baggage.

These privileges and immunities are extended to inspectors not only by the country in which an inspection takes place, but also by those member states through which inspectors are transiting on their way to and from that country. It bears noting that the IAEA has consistently taken the position that the Statute creates an obligation for member states to grant immunities as specifically defined in INFCIRC/9/Rev.2 and that non-acceptance of that agreement does not reduce the

34. IAEA (1967), "Agreement on the Privileges and Immunities of the Agency", IAEA Doc. INFCIRC/9/Rev.2.

obligation of a member state to accord inspectors immunities adequate to enable them to efficiently complete their missions.

IV. Decisions and practices of the IAEA's Board of Governors

The legal framework of IAEA safeguards is formed not only by legal instruments, such as the documents referred to above, but also by the decisions and practices of the IAEA's Board of Governors. Some of the more significant decisions are referred to above. A number of other significant actions taken by the Board in the context of interpretation of the Agency safeguards agreements are described below.

1. Duration and termination of INFCIRC/66 agreements (GOV/1621)[35]

Paragraph 16 of the INFCIRC/66/Rev.2 makes reference to the "desirability" of providing for the continuation of safeguards with respect to produced special fissionable material and to any materials substituted therefor. In 1973, the Board expressed concern about the need for safeguarding such material after the expiry of a safeguards agreement.[36] As a consequence, since 1974, the duration of INFCIRC/66-type agreements has been tied to the actual use in the recipient state of supplied material or items, rather than to fixed periods of time. Under these agreements, safeguards are required to continue on all safeguarded items, including subsequent generations of produced nuclear material derived from safeguarded material or facilities, until safeguards are terminated in accordance with the revisions of INFCIRC/66/Rev.2.[37]

2. Nature of the "no military" use undertaking

As indicated above, the early safeguards agreements concluded in accordance with INFCIRC/66/Rev.2 contained an undertaking by the state not to use safeguarded items for "any military purposes". Following the Indian testing of a so-called "peaceful" nuclear explosive device in 1974, the Director General proposed, and the Board accepted, an interpretation of that undertaking precluding the use of safeguarded items for any nuclear explosive device, whether intended for peaceful or non-peaceful ends, owing to the technical impossibility of distinguishing between a nuclear explosive device for peaceful uses and one for military uses.[38] Although a small

35. IAEA (1973), "Safeguards: The Formulation of Certain Provisions in Agreements under the Agency's Safeguards System (1965, as provisionally extended in 1966 and 1968)", IAEA Doc. GOV/1621.

36. Scheinman, L. (1987), *The International Atomic Energy Agency and World Nuclear Order*, Routledge, London, p. 138.

37. *Ibid.*, pp. 138-139.

38. *Ibid.* As explained in Rainer, R.H. and P.C. Szasz (1993), *The Law and Practices of the International Atomic Energy Agency 1970-1980: Supplement 1 to the 1970 edition of Legal Series No. 7*, IAEA Legal Series No. 7-S1, IAEA, Vienna, p. 318:

> It was not until February 1975 that the Board was formally seized with an interpretation of the 'peaceful use' undertaking. In connection with a Safeguards Agreement with Spain which contained the standard undertaking, Spain announced that it would transmit an interpretative letter of that undertaking to the Director General, confirming that the undertaking "... included the obligation, in particular, not to divert [the nuclear material] to nuclear weapons or other nuclear explosive devices". The Director General placed on record "that an invariable and cardinal obligation involved in that undertaking was also that the nuclear materials should not be used for the development, manufacture or testing of nuclear explosive devices of any kind"; that Agency safeguards had from the outset been intended to ensure compliance with that obligation; and that, in future, the agreements themselves would contain such a clause. The USSR, as the supplier of the enriched uranium to Spain, subsequently confirmed that the exchange of letters should be "regarded as part of the agreement". All subsequent non-NPT Safeguards Agreements contain explicit undertakings against any explosive use of safeguarded items.

number of states expressed reservations about this interpretation, all INFCIRC/66/Rev.2 safeguards agreements since 1975 have incorporated a basic undertaking that expressly precludes the use of safeguarded items for the manufacture of any nuclear weapon or to further any other military purpose or for the manufacture of any other nuclear explosive device.[39]

3. Coverage of transfers of technology, non-nuclear material

Although originally limited in applicability to nuclear material and certain types of nuclear facilities, the scope of INFCIRC/66-type agreements over the years has been expanded with the approval of the Board. These agreements have since included provisions for the safeguarding of such items as non-nuclear materials (e.g. heavy water, zircaloy), non-nuclear facilities (such as heavy water production plants) and transferred technology.

4. Containment and surveillance

The Board of Governors has approved specific provisions for the application of containment and surveillance measures which were originally not expressly included in INFCIRC/66-type safeguards agreements but have recently been routinely included.

5. Policy in implementation of financial clauses in safeguards agreements

While all Agency safeguards agreements reflect the basic principle that the expenses of safeguards are to be shared between the Agency and the state concerned, with each party bearing the expenses of carrying out its own responsibilities under the agreement, questions have arisen over the years as to the responsibility for particular expenses associated with certain safeguards activities. In 1990, the Director General presented to the Board a uniform policy with respect to the allocation of such expenses under INFCIRC/66/Rev.2-type agreements and INFCIRC/153-type agreements.[40] The Secretariat has, since that time, included in the subsidiary arrangements to all safeguards agreements the provisions presented to the Board.[41]

6. Interpretation of provisions related to the early provision of design information

On 26 February 1992, the Board of Governors adopted a recommendation of the Director General related to the early provision of design information.[42] In so doing, the Board interpreted paragraph 42 of INFCIRC/153, which stipulates that such information shall be provided by a state "as early as possible before nuclear material is introduced into a new facility", as requiring the provision of design information as soon as the decision to construct, to authorise construction or to modify a facility has been taken and, on an iterative basis, as the design is developed. The implementation of this interpretation required the modification of, *inter alia*, the standardised Code 3.1 of the General Part of Subsidiary Arrangements, which previously had provided for the submission of information on new facilities only 180 days before the introduction of nuclear

39. See, for example, IAEA (1978), "The Text of the Agreement of 17 November 1977 Between the Agency and India for the Application of Safeguards in Connection with the Supply of Heavy Water from the Soviet Union", IAEA Doc. INFCIRC/260.

40. IAEA (1990), "Policy in Implementation of Financial Clauses in Safeguards Agreements", IAEA Doc. GOV/INF/577.

41. IAEA (1974), Model Text of Subsidiary Arrangements to Comprehensive Safeguards Agreements, current version (2017), IAEA Doc. SG-FM-1170.

42. IAEA (1992), GOV/2554/Att.2/Rev.2, *supra* note 24.

material into a new facility.[43] At the direction of the Board, the Secretariat negotiated with states with subsidiary arrangements in force the modification of Code 3.1. As of 2021, all such states have agreed to the modified Code 3.1.[44]

B. Contents, comparison and implementation of safeguards agreements

The safeguards agreements concluded by the IAEA may be categorised generally as:

- the item-specific agreements concluded in accordance with INFCIRC/66/Rev.2;
- CSAs concluded in accordance with or along the lines of INFCIRC/153 (Corr.); and
- safeguards agreements applicable to all or part of the civil nuclear fuel cycles of NWSs (the VOAs).

The basic goals of all safeguards agreements are similar: to verify compliance with the undertakings of the states parties not to use safeguarded items for proscribed purposes. Moreover, the basic technical aspects of the implementation of safeguards are applied in all states subject to safeguards. Each agreement provides for Agency review of design information; reporting and record keeping by the state; inspection activities to be carried out by the IAEA, including rights of access and notification of inspections; and provisions related to the exemption and termination of safeguards. To the extent practical and legally permissible, efforts are made to standardise the Agency's safeguards approaches, taking into account technical variations among the states' nuclear programmes.

While INFCIRC/66/Rev.2 identifies the safeguards procedures that are to be implemented under item-specific agreements, its provisions are simply incorporated by reference into the agreements and, while there is some consistency in the format and content of such agreements, there is no "model" INFCIRC/66-type agreement. INFCIRC/153, however, is much more comprehensive, and was intended to serve as guidance to the Secretariat on the content and format of CSAs.[45] Hence, agreements concluded pursuant to INFCIRC/66/Rev.2 reflect a greater degree of variation than do agreements concluded pursuant to INFCIRC/153. The agreements concluded with the NWSs (all of which are party to the NPT) more closely resemble the latter in format, with substantive variations reflecting the more limited scope of the VOAs. This latter category of agreements is often referred to as "voluntary offer agreements", owing to the fact that the NPT does not impose on NWSs a requirement similar to that assumed by NNWSs party to the NPT to conclude safeguards agreements with the IAEA.

Some of the differences between the three types of agreements are outlined below, the most significant of which relate to the scope of the agreements and the basic undertakings of the states thereunder.

43. IAEA (1974), Model Text, *supra* note 41.

44. However, the Islamic Republic of Iran (Iran), which agreed to the modified Code 3.1 in 2003, announced in 2007 that it was suspending its implementation of the modified Code 3.1 and reverting to the previous formulation of that provision. It renewed implementation of the modified Code 3.1 as part of the Joint Comprehensive Plan of Action (JCPOA), but suspended such implementation following the US withdrawal from the JCPOA in 2018. For more information about the JCPOA, see Vez Carmona, M.d.L. and C. de Francia (2021), "Legal developments in the implementation of safeguards agreements and other IAEA verification activities", *infra*, pp. 330-357.

45. The standardised model text for such agreements is contained in IAEA (1974), "The Standard Text of Safeguards Agreements in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. GOV/INF/276, Annex A.

I. Scope

Safeguards agreements concluded pursuant to INFCIRC/66/Rev.2 are designed to cover only specified items, such as certain facilities, equipment, nuclear material and non-nuclear material. Therefore, they must describe in detail their scope of application. This is usually done in the basic undertaking and in the provision on the inventory of safeguarded items. Agreements with NNWSs along the lines of INFCIRC/153 cover all source and special fissionable material in all peaceful nuclear activities of the state party. Hence, there is no elaborate provision on the scope of the agreement and/or on the inventory. The scope of the VOAs varies from agreement to agreement. However, while some provide for the application of safeguards to all of the state's civil nuclear activities and others to only some of the state's civil programme, all provide for the discretionary selection by the Agency for the application of safeguards of all, some or none of the facilities or material offered by the state concerned.

II. Basic undertaking

Safeguards agreements under INFCIRC/66/Rev.2 prohibit the use of safeguarded items in such a way as to further any military purpose (including non-explosive uses, such as nuclear naval propulsion). Agreements with NNWSs party to the NPT prohibit the diversion of nuclear material from peaceful nuclear activities to nuclear weapons or other nuclear explosive devices. There is, however, no prohibition against non-explosive military applications of nuclear material under the NPT. Accordingly, agreements with NNWS parties to the NPT contain provisions for the withdrawal from safeguards of nuclear material for use in non-proscribed military nuclear activities (see INFCIRC/153 (Corr.), para. 14). As regards VOAs, the NWSs' undertaking is limited to a commitment not to use nuclear material for proscribed purposes while it is subject to the agreement, and not to withdraw material or facilities from safeguards except in accordance with the terms of the relevant agreement, which provide in each case for withdrawal at the state's discretion.

III. Subsidiary arrangements

The nature and content of subsidiary arrangements are discussed below under Section E.

IV. Design verification and inspections

All safeguards agreements require states parties to submit to the Agency information on the design of facilities where safeguards are applied. They also provide for Agency access to verify the design information. All of the agreements contemplate a three-tier approach to inspections (as distinguished from design information verification visits), consisting of *ad hoc* inspections (those carried out prior to entry into force of detailed arrangements for routine inspections and those used to verify exports/imports of nuclear material), routine inspections and special inspections.

Safeguards agreements concluded in accordance with INFCIRC/66/Rev.2 incorporate the Agency's statutory right of access to all persons, places and information relevant to the implementation of safeguards. INFCIRC/153-type agreements, on the other hand, limit the Agency's access to carry out routine inspections to strategic points identified in the Subsidiary Arrangements (as do the VOAs). However, it should be noted that this limitation does not apply to *ad hoc* inspections, nor does it apply to special inspections.

INFCIRC/66/Rev.2 limits the maximum number of routine inspections annually at nuclear facilities based on the inventory or throughput of nuclear material at the facility in question, while providing for a right of access at all times to facilities with an inventory or annual throughput in excess of 60 effective kilograms of nuclear material. INFCIRC/153-type agreements, on the other hand, limit the Agency's "inspection effort", permitting the Agency to distribute its inspection activities within categories of facilities in the state, depending on the type and size of facility.

V. Privileges and immunities; visas

As referred to above, each of the safeguards agreements contains a provision obliging the state or states party to extend to IAEA inspectors while on mission certain privileges and immunities. It must be pointed out that these privileges and immunities are granted to inspectors in the interest of the Agency and not for the personal benefit of the inspectors. Therefore, the IAEA has the right and duty to waive immunity in any case where, in the Agency's opinion, the immunity would impede the course of justice and can be waived without prejudice to the interest of the Agency.

Before an inspector begins to travel for the Agency, he or she must apply for a *laissez-passer* through the Visa Section. Where required by the state concerned, visas must be secured in the *laissez-passer*, which is honoured by most member states of the IAEA. In an effort to streamline this process, and to allow the IAEA to deploy its inspectors more efficiently, the Model Additional Protocol includes a provision that requires a state that insists on visas (and not all do) to grant IAEA inspectors multiple-entry/exit/transit visas for a period of at least one year.

VI. Duration

The duration of INFCIRC/153-type agreements is generally linked to the state's adherence to the NPT, to the Tlatelolco Treaty or to other underlying treaties or agreements. There is no provision for the survival of safeguards on produced special fissionable material upon expiry of such an agreement. However, as noted above, more recent safeguards agreements concluded on the basis of INFCIRC/66/Rev.2 include a provision requiring continuation of the agreement until safeguards are terminated in accordance with the provisions of the safeguards document.

VII. Safeguards on exports

INFCIRC/66/Rev.2 contains provisions requiring, in general, the application of safeguards as a condition of re-transfer of safeguarded items. INFCIRC/153 contains no such condition as it was considered unnecessary in light of the requirement in Article III.2 of the NPT prohibiting the transfer of nuclear material to NNWSs unless the material will be subject to safeguards in that state.[46] However, INFCIRC/153 does contain a provision requiring notification to the IAEA if safeguards will not be applied in the importing state, a provision included to address the circumstance of transfers to NWSs (paras. 91 and 94).

VIII. Disputes resolution

Because safeguards agreements are treaties, the principles of international law, rather than the rules of domestic national law, are used in the interpretation and application of safeguards agreements. While the court systems of most countries are available to resolve differences between private parties to a contract, the International Court of Justice (ICJ) is available to sovereign states to resolve disputes concerning treaties if the requirements of the Statute of the ICJ[47] are met. The IAEA, however, is not subject to the jurisdiction of national courts, nor under

46. However, a number of CSAs not concluded pursuant to the NPT do contain undertakings by the state(s) concerned to require safeguards on exports of nuclear material (e.g. early CSAs concluded pursuant to the Tlatelolco Treaty).

47. Charter of the United Nations with the Statute of the International Court of Justice annexed thereto (1945), 59 Stat. 1031, USTS 993, entered into force 24 Oct. 1945 (ICJ Statute).

the Statute of the ICJ is it eligible to be a party to an action before that tribunal. Thus, there is no court or established judicial tribunal that has competence to resolve a dispute between the IAEA and a state relating to the interpretation and application of a safeguards agreement.

For this reason, all safeguards agreements contain provisions for resolving disputes concerning the interpretation and application of the agreement. Principally, they provide that the parties shall, at the request of either, consult about any question arising out of the interpretation or application of the agreement and that the state has the right to request that any question arising out of the interpretation or application of the agreement be considered by the Board. The agreements also include the possibility of submitting disputes to binding arbitration. Although several versions of these provisions have been developed, they all basically provide for the establishment of an arbitration panel (or arbitral tribunal) composed of one member selected by each of the parties to the dispute, plus one or two members designated by the panel members chosen by the parties to the dispute, plus one or two members designated by the panel members chosen by the parties. The arbitration provisions are designed to ensure that the panel is always composed of either three or five members to avoid the possibility of a tie vote. However, as of June 2021, no recourse to arbitration has been made in the course of implementing safeguards.

1. Compliance and enforcement

Because a safeguards agreement is a treaty, the responsibility to fulfil the obligations of the agreement rests with the government of the state that is party to the agreement. For example, if the operator of a privately-owned facility subject to safeguards refused to allow IAEA inspectors to conduct a properly scheduled inspection, the IAEA would request the government of the state concerned to take whatever steps were necessary to ensure that Agency inspectors have adequate access to the facility. If the government did not or could not obtain adequate access for the inspectors, then the government, not the operator, would have violated the agreement, unless the failure to do so was excused. It is the government's responsibility to ensure that persons under its jurisdiction or control act in accordance with the treaty obligations assumed by that government.

The information that a safeguards inspector is likely to uncover, however, is such that, rather than demonstrating a clear violation of the agreement it would raise doubts as to whether the state were fulfilling its obligations under the agreement. Regardless of the type of agreement, the IAEA has the right and the duty to try to resolve these doubts through the examination of the information assembled and by obtaining from the state additional information and/or access to additional locations.

If such doubts cannot be resolved to the satisfaction of the Director General, he would, under paragraph 18 of an INFCIRC/153 agreement, report to the Board of Governors that action by the state concerned is essential and urgent to ensure the verification of non-diversion or report to the Board the Agency's inability to verify that nuclear material required to be safeguarded has not been diverted, or, under an INFCIRC/66/Rev.2 agreement, that the state is in non-compliance with the agreement.

The nature of non-compliance by a state with its safeguards obligations may vary. Non-compliance could derive, for example, from the unaccounted for presence or absence of nuclear material, from misleading and/or falsified records or reports, from the denial of access to Agency inspectors or from the tampering with Agency instruments or seals.

Upon report by the Director General to the Board under an INFCIRC/66-type agreement, the Board is to call upon the state concerned to remedy forthwith any non-compliance which the Board finds to have occurred. The Board is also required to report such non-compliance to all members of the IAEA.

Under INFCIRC/153, any actions considered by the Board to be "essential and urgent" are required to be implemented by the state without delay. If the state does not take the required action, the Board may conclude, on the basis of the information reported to it by the Director General, that the IAEA cannot fulfil its obligation under the agreement to verify non-diversion (INFCIRC/153, para. 19); the Board may also find that the state is in further non-compliance with its safeguards agreement.

Under the Statute of the Agency, failure by a state "to take fully corrective action within a reasonable time" with respect to non-compliance could subject the state to curtailment or suspension of assistance provided by the Agency or by a member state, to the recall of material and equipment and to the suspension of the privileges and rights of Agency membership (Article XII.C). Non-compliance can also be reported to the Security Council and to the UN General Assembly, which may trigger measures by the Security Council within the framework of the United Nations Charter (Articles III.B.4 and XII.C.).

Since the inception of safeguards, the IAEA has reported to the Security Council cases of non-compliance by six states: the DPRK, Iraq, Iran, Libya, Romania and Syria. In the cases of Romania and Libya, the non-compliance was reported to the Council "for information" in light of the fact that those states had themselves brought their respective non-compliance to the attention of the IAEA.[48]

C. Protocols to safeguards agreements

A number of protocols to INFCIRC/153 agreements have been concluded by the Agency, including co-operation protocols, suspension protocols, small quantities protocols and additional protocols.

I. Co-operation protocols

Protocols for co-operation and co-ordination with multinational or national inspectorates have been concluded with Euratom, with ABACC and with Japan. In each case, the IAEA's ability to reach independent conclusions concerning compliance with the agreement is reaffirmed as an indispensable element.

II. Suspension protocols

Paragraph 24 of INFCIRC/153 requires the suspension of the application of safeguards under other agreements with the state or states concerned while a comprehensive safeguards agreement is in force. Accordingly, the IAEA has concluded protocols giving effect to this article ("suspension protocols") in cases where states have had pre-existing safeguards agreements with the Agency. In cases where a state concerned had concluded a trilateral agreement for the application of safeguards (i.e. between that state, the IAEA and another party), the third party to the trilateral agreement is also a party to the suspension protocol.

48. See e.g. the Libyan example: IAEA (2014), "Implementation of the NPT Safeguards Agreement of the Socialist People's Libyan Arab Jamahiriya: Resolution adopted by the Board on 10 March 2004", IAEA Doc. GOV/2004/18, para. 4.

III. Small Quantities Protocols

The standardised text for INFCIRC/153 agreements also provides for the conclusion of protocols with states having little or no nuclear material and no nuclear material in facilities (the so-called "Small Quantities Protocols" or SQPs). As originally developed, the model for SQPs provided that implementation of most of the provisions of Part II of the CSA be held in abeyance, with the exception of those relating to the starting point of safeguards, subsidiary arrangements, design information and international transfers, until such time as the quantity of nuclear material in the state exceeds certain prescribed limits or the state has nuclear material in a nuclear facility.[49]

In 2005, the Board of Governors, acting on the advice of the Director General, decided that the SQP, in its original form, constituted a weakness in the Agency's safeguards system and that although SQPs should remain part of the system, they should be subject to certain modifications in the standard text and a change in the SQP criteria.[50] Now, in order for a state to qualify for an SQP, it must not only have only limited quantities of nuclear material, but also no existing or planned nuclear facility. In addition, the post-2015 SQPs require submission by the state of an initial report on nuclear material and notification as soon as a decision has been taken to construct or to authorise construction of a nuclear facility and will permit the Agency to carry out inspections in the state.

IV. Additional protocols

As mentioned above, a number of states have concluded additional protocols along the lines of the Model Additional Protocol. Those concluded with NNWSs are substantively identical to, and contain all of the measures referred to in, the model. The additional protocols concluded with the NWSs vary in scope and content, ranging from those which include all of the measures, but exclude activities with direct national security significance, to the protocols which contain only those measures which the states have concluded have a relevance to NNWSs. Only two APs have been concluded in connection with INFCIRC/66-type safeguards agreements, one with Cuba, which was signed but not brought into force prior to Cuba's conclusion of an NPT CSA and one signed with India.

D. Negotiation of safeguards agreements and protocols

While the IAEA is not a nation or a state under international law, it is an entity having an "international personality". That is to say, governments have recognised the IAEA as an entity that has some of the powers and privileges normally associated with a sovereign state. One of the IAEA's recognised powers is to become a party to treaties. In simple terms, a treaty is an agreement between two or more entities, usually governments, having international personality.[51] Thus, the IAEA's safeguards agreements, and the protocols thereto, which are negotiated and concluded between the IAEA and governments of states or other non-governmental entities with international personality (such as Euratom or ABACC) are treaties.

49. IAEA (1974), "The Standard Text of Safeguards Agreements in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons: Note by the Director General", IAEA Doc. GOV/INF/276/Annex B.

50. IAEA (2006), "The Standard Text of Safeguards Agreements in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons: Revision of the Standardized Text of the 'Small Quantities Protocol'", IAEA Doc. GOV/INF/276/Mod.1 and Corr.1.

51. Vienna Convention on the Law of Treaties (1969), 1155 UNTS 331, entered into force 27 Jan. 1980, Article 2(1)(a). See also Vienna Convention on the Law of Treaties between States and International Organizations or between International Organizations (1986), UN Doc. A/CONF.129/15, not yet entered into force, Article 2(1)(a).

The process of concluding a safeguards agreement is begun with a request by the state or states concerned that the Secretariat prepare a text in accordance with the particular underlying obligations and commitments of that state or states. The Secretariat then prepares a draft text of the agreement, along with any relevant protocols, and submits it to the state or states for consideration. If necessary, negotiations are held between the Agency and the state authorities with a view to agreeing *ad referendum* to a text that provides for adequate safeguards. In conducting these negotiations, the Secretariat is guided by the policies and practices previously approved by the Board of Governors. Upon conclusion of the negotiations, the safeguards agreement, along with any protocol(s), is presented by the Secretariat to the Board of Governors for its approval.

In approving the text, the Board authorises the Director General to sign and implement the safeguards agreement and protocol(s) where relevant. Depending upon the state and its own national legislation, the agreement/ protocol then enters into force either upon signature or upon receipt by the Agency of notification from the state that its statutory and constitutional requirements for entry into force of the agreement have been met. The choice of mechanism for entry into force is for the state concerned to make.

E. Subsidiary arrangements

INFCIRC/153-type agreements expressly require the conclusion of subsidiary arrangements between the state and the IAEA detailing how the procedures in the agreement are to be implemented. These subsidiary arrangements consist of a general part and facility attachments, and generally an attachment or attachments for locations outside facilities, where applicable. Although INFCIRC/66/Rev.2 itself does not refer to "subsidiary arrangements", most agreements based on INFCIRC/66/Rev.2 do include a specific reference to them. However, this only formalises the Agency's practice of making detailed arrangements for the implementation of safeguards in all states with such agreements. Subsidiary arrangements are also concluded with NWSs in implementation of their VOAs.

The Model Additional Protocol permits, but does not require, the conclusion of subsidiary arrangements with respect to the measures laid down in an AP, unless requested by one of the parties to the safeguards agreement (Article 13).

The procedures for concluding the subsidiary arrangements are not the same as for the conclusion of the safeguards agreements. The process is generally initiated by the Secretariat before or shortly after the entry into force of the relevant agreement with the drafting of subsidiary arrangements based on standardised texts. Efforts are made to maintain the standardisation of these documents in the interest of non-discrimination, while taking into account the technical differences and circumstances of the individual states. The negotiations are conducted both in writing and in meetings with the state authorities. Agreement on the texts of the subsidiary arrangements is reflected in exchanges of letters, not, as is the case with the safeguards agreements, by formal signature. Nor do they normally require review or approval by the Board of Governors. They may be amended at any time upon agreement between the Agency and the state. The subsidiary arrangements are treated as confidential documents and are not published by the Agency.

F. Amendment and renegotiation

The parties to an agreement concluded pursuant to INFCIRC/66/Rev.2 are required to consult, at the request of either party, on the amendment of such an agreement. If the Board modifies the safeguards document, the Inspectors Document or the scope of the safeguards system, the agreement shall be amended if the government(s) party to the agreement so request(s). Amendments to INFCIRC/66/Rev.2 safeguards agreements are usually made for the purpose of extending the duration of the agreement, and occasionally, the scope.

INFCIRC/153-type agreements provide that either party (the state or the IAEA) may request consultations on the amendment of the agreement. Any amendment would require the agreement of all parties to the agreement. Entry into force of such an amendment would be subject to the same conditions as entry into force of the agreement. As of June 2021 there have been no amendments to the substance of INFCIRC/153 agreements, except to add parties to an agreement.

Amendments to APs may be modified in accordance with the same procedures as are provided for in the relevant safeguards agreement, with the exception of amendments to the two annexes to the AP. Annexes I and II to the Model Additional Protocol[52] may be amended by the Board of Governors upon the advice of an open-ended working group of experts which would be established by the Board. Any such amendment would take effect automatically for all APs four months after its adoption by the Board.

G. Implementation and analysis

As of 1 June 2021, of the 186 NNWSs party to the NPT, 177 have brought CSAs into force.[53] Of the 9 remaining NNWS NPT parties, 6 have signed CSAs and 2 more have had a CSA approved by the Board.[54] In addition, each of the NWSs has a voluntary offer agreement in force. The IAEA is applying safeguards under INFCIRC/66-type agreements in three other states.

The programme for strengthening safeguards was originally developed for states with CSAs. However, it was acknowledged early in the evolution of the programme that the implementation of certain of the measures identified thereunder in other states (i.e. the NWSs and the INFCIRC/66 states) could improve the effectiveness and efficiency of the safeguards implemented in such states while enhancing the effectiveness of safeguards implementation in comprehensive safeguards agreement states. This so-called "universality" issue was a central feature in the negotiation of the Model Additional Protocol. Both the Board and the open-ended committee of the Board that negotiated the Model Additional Protocol (Committee 24) expressed their expectation that its adoption by CSA states (in its entirety) and by non-CSA states (selected measures) would maintain a certain "parallelism". Several CSA states indicated that evidence of action towards adoption of the Model Additional Protocol in other states would be necessary to obtain approval of an additional protocol in their own countries. As a consequence, during the 15 May 1997 meeting of the Board at which the Model Additional Protocol was approved, each of the five NWSs announced its intention to conclude an AP and indicated which of the measures contained in the model they were prepared to accept.[55]

As of 1 June 2021, additional protocols were in force for 131 NNWSs party to the NPT, all 5 of the NPT NWSs and India.[56] An additional 14 states have signed an additional protocol, and the Board of Governors has approved 2 others.[57]

52. Annex I, List of activities referred to in Article 2.a.(iv) of the Protocol, and Annex II, List of specified equipment and non-nuclear material for the reporting of exports and imports according to Article 2.a.(ix).

53. IAEA (2021), "Status List: Conclusion of Safeguards Agreements, Additional Protocols and Small Quantities Protocols", available at: www.iaea.org/sites/default/files/20/01/sg-agreements-comprehensive-status.pdf (accessed 19 July 2021).

54. *Ibid.*

55. IAEA (1997), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System: Report by the Director General to the General Conference", IAEA Doc. GC(41)/22, Annex 3, "Report of the Committee on Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System (Committee 24) to the Board of Governors", IAEA Doc. GOV/2914, p.2.

56. IAEA (2021), "Status List: Conclusion of Additional Protocols", available at: www.iaea.org/sites/default/files/20/01/sg-ap-status.pdf (accessed 19 July 2021).

57. *Ibid.*

Since 1997, the IAEA Secretariat's implementation of APs has required the development of a whole new infrastructure, including:

- the development of guidelines and formats for use by states in the preparation and submission of declarations under APs;
- the development of model subsidiary arrangements and model language for required communications to and from states under APs;
- the development of detailed internal guidelines for complementary access; and
- the development of integrated safeguards.

It was recognised early in the field trial phase of Programme 93+2 and acknowledged at several junctures during Committee 24 negotiations that it would be necessary to develop specific guidelines defining the additional, largely qualitative information to be provided by states to the Agency under Article 2 of the Model Additional Protocol. Such guidelines were needed by states to help them formulate internal procedures and regulations to ensure that the necessary information, with the appropriate level of detail and timeliness, would be available to them. For the Secretariat's part, the guidelines were needed to ensure consistency in the declarations from states, both in terms of level of detail and reporting formats. The most recent iteration of the guidelines, *Guidelines and Format for Preparation and Submission of Declarations Pursuant to Articles 2 and 3 of the Model Protocol Additional to Safeguards Agreements*, was issued in May 2004.[58] This document provides specific guidance on each sub-article including a description of the purpose and use of the information and a definition of reporting format through example. A simplified version of the guidelines for states with SQPs was issued in April 1999 and updated and reissued in 2016.[59]

Guidelines for complementary access were also developed for the internal use of the Secretariat to ensure that complementary access is carried out in an efficient, technically effective and non-discriminatory manner.

Using all of the information available to it, the IAEA carries out annual analysis of the safeguards situation in each state with a safeguards agreement in force. The state evaluation reports reflect the results of those analyses and the conclusions which the IAEA is able to draw from the analyses. These conclusions are collectively summarised and reported to the Board of Governors in the safeguards implementation report in June each year for the previous calendar year.

For those states with only a CSA in force, the Agency draws a conclusion about the non-diversion of declared nuclear material. While the IAEA has the authority to verify the absence of undeclared nuclear material and activities in states with CSAs only and no AP in force, without an AP for a state, the Agency provides assurances only with respect to declared nuclear material in the state. If a state has both a CSA and an AP in force, the IAEA will, after full verification and resolution of any questions or inconsistencies, provide, where appropriate, confirmation not only of the non-diversion of declared nuclear material, but the absence of undeclared nuclear material and activities.

When a state has in place a CSA and an AP, and the IAEA is able to find that there are no indications of the diversion of declared nuclear material and no indications of undeclared nuclear material or activities, it is then in a position to draw what is referred to as the "broader conclusion",

58. IAEA (2004), *Guidelines and Format for Preparation and Submission of Declarations Pursuant to Articles 2 and 3 of the Model Protocol Additional to Safeguards Agreements*, IAEA Services Series No. 11, IAEA, Vienna.

59. IAEA (2016), *Safeguards Implementation Guide for States with Small Quantities Protocols*, IAEA Services Series No. 22, IAEA, Vienna.

i.e. that all nuclear material in the country remains in peaceful activities. In such situations, the IAEA is then able to implement "integrated safeguards" in the state. Integrated safeguards is defined as an optimum combination of all safeguards measures available to the Agency under CSAs combined with APs which achieves the maximum effectiveness and efficiency within available resources in implementing safeguards. The premise of integrated safeguards is that, if the Agency is able to conclude that there are no undeclared nuclear material or activities in the state as a whole, reductions in the IAEA's verification effort with respect to declared nuclear material which would need further processing to make it nuclear weapon usable is possible.

Legal developments in the implementation of safeguards agreements and other IAEA verification activities

by Maria de Lourdes Vez Carmona and Cristian de Francia[*]

Reflecting on the current era of International Atomic Energy Agency (IAEA) safeguards, it is notable that there have been no new types of legal instruments introduced since the modification of the standard text of the small quantities protocol in 2005 (following the approval of the Model Additional Protocol by the Board of Governors in 1997). The challenge of the recent period has therefore been in the implementation of safeguards to meet the growing demands of ensuring that increasing amounts of nuclear material and facilities subject to safeguards remain in peaceful activities, while assuring states that safeguards are implemented squarely within the existing legal framework.

Continuing to meet the objective of providing credible assurance that states are honouring their safeguards obligations in today's expanding nuclear landscape involves applying the IAEA's legal authority effectively and efficiently. In undertaking to further optimise the implementation of safeguards through the "conceptualization and development of safeguards implementation at the State level", for example, the IAEA has instituted internal standardised processes that are responsive to change while remaining firmly rooted in and consistent with the relevant legal instruments, notably the safeguards agreements and relevant protocols thereto, which are in force with particular states in which they are implemented. In this regard, one is reminded that the legal framework for the application of IAEA safeguards has not changed substantially over recent years.

The IAEA has also during the current era demonstrated its capacity to respond to requests by relevant parties to carry out other verification and monitoring activities. This was particularly evident through the IAEA Board of Governors' authorisation of the Director General's implementation of the necessary verification and monitoring of the Islamic Republic of Iran's (Iran) nuclear-related commitments under the Joint Comprehensive Plan of Action (JCPOA). This work has confirmed both the authority and capacity of the IAEA to accommodate requests from

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relevant states and/or the United Nations (UN) Security Council in order to enhance international confidence in the exclusively peaceful nature of states' nuclear programmes.

This article examines the legal aspects of IAEA practice in both the implementation of safeguards agreements and the verification activities carried out pursuant to additional authorisation by the IAEA Board of Governors. The first section of the article focuses on the conceptualisation and development of safeguards implementation at the state level within the existing legal framework. The second section considers cases in which the IAEA has engaged in activities reported to the IAEA Board of Governors involving the verification of the correctness and completeness of state declarations under comprehensive safeguards agreements (or CSAs). The third section considers the IAEA's practice of meeting requests of member states and/or the UN Security Council in conducting other verification activities, which are additional to those provided for in safeguards agreements.

Decades of practice in the implementation of safeguards agreements and protocols thereto, as well as the Board of Governors' flexibility to authorise other verification activities, are reflective of the enduring character of the legal framework for IAEA safeguards – including the IAEA Statute,[1] safeguards agreements and protocols to safeguards agreements (as applicable) – upon which the IAEA has carried out its mission since 1957 in a continually changing and technologically advancing environment.

I. Legal aspects of the conceptualisation and development of safeguards implementation at the state level

Improving the efficiency of safeguards implementation while maintaining or strengthening its effectiveness has been a critical objective of the IAEA in light of the increase in the number of safeguards agreements in force and the number of nuclear facilities under safeguards.[2] From late 2013 and through 2014, the IAEA engaged in a collaborative effort to address aspects essential to the maintenance of the effectiveness of safeguards implementation in order to provide for the continued drawing of soundly based safeguards conclusions while maintaining confidence that states are abiding by their safeguards obligations. This process was known as "the conceptualisation and development of safeguards implementation at the state level".

In 2013, the IAEA Director General issued a report entitled *The Conceptualization and Development of Safeguards Implementation at the State Level (GOV/2013/38)*, which was followed by an intensive period of consultation between IAEA member states and the IAEA Secretariat. The product of this further work was set out in a report produced by the IAEA Director General in 2014 entitled the *Supplementary Document to the Report on The Conceptualization and Development of Safeguards Implementation at the State Level (GOV/2013/38)*, which continues to serve as a standard reference on the topic.[3]

1. Statute of the International Atomic Energy Agency (1956), 276 UNTS 3, entered into force 29 July 1957 (IAEA Statute).

2. In the ten years from the end of 2009 to the end of 2019, 13 states that did not previously have safeguards agreements in force concluded safeguards agreements with the IAEA (7.6% increase); 42 states concluded additional protocols with the IAEA (44.6% increase); the number of significant quantities of nuclear material subject to IAEA safeguards rose from 165 419 to 216 448 (30.8% increase); and the IAEA operational regular budget, including price adjustment, for Nuclear Verification grew by 24%. See IAEA (2010), *IAEA Annual Report for 2009*, IAEA Doc. GC(54)/4, pp. 103-111, Tables A4, A5 and A6; IAEA (2020), *IAEA Annual Report for 2019*, IAEA Doc. GC(64)/3, pp. 113-124, Tables A4, A5 and A6.

3. IAEA (2014), "Supplementary Document to the Report on The Conceptualization and Development of Safeguards Implementation at the State Level (GOV/2013/38)", IAEA Doc. GOV/2014/41 and Corr.1 ("Supplementary Document").

An important element in strengthening the effectiveness and improving the efficiency of IAEA safeguards in this context includes the development and implementation of state-level safeguards approaches.[4] As of the end of 2019, the IAEA had developed and implemented state-level safeguards approaches for 131 states with comprehensive safeguards agreements in force – states that collectively held 97% of all nuclear material (by significant quantity) under IAEA safeguards – as well as for one state with a voluntary offer agreement in force.[5] The standardisation of internal processes within the IAEA Department of Safeguards for the development and implementation of a tailor-made state-level safeguards approach for each of the above-mentioned states within the scope of each state's safeguards agreement was a significant achievement of the IAEA in the past decade. An important element of this work is the development and implementation of state-level approaches in a manner consistent with the relevant safeguards legal instruments, i.e. the safeguards agreements and protocols thereto which are in force for the particular state.

State-level safeguards approaches have enabled the IAEA to better focus its safeguards activities on attaining safeguards objectives for a state, taking into consideration state-specific factors in planning, conducting and evaluating its verification activities. Over the past years, the Agency has progressively developed and implemented these approaches as set out in the Supplementary Document described above.[6] The Supplementary Document was produced in response to member states' requests made during meetings of the IAEA's Board of Governors and involved a series of technical meetings between the IAEA Secretariat and its member states. From January to July 2014, six interactive technical meetings took place during which the Secretariat provided presentations on the relevant topics and gathered additional input from member states in the process of preparing the Supplementary Document.[7] Although it is only in the past decade that state-level safeguards have become applicable to all states with safeguards agreements in force, the process of developing and standardising of modalities for safeguards implementation at the state level for states with comprehensive safeguards agreements has been ongoing for several decades within the IAEA.

A. Background of the "State-level concept"

The terms "State level" and "State as a whole" were used in IAEA documents in the late 1990s and early 2000s, specifically in the context of the implementation of comprehensive safeguards agreements. At that time, the IAEA began to shift its focus from safeguards implementation at the facility level to "the State as a whole".[8] Efforts to strengthen the IAEA's safeguards system in the 1990s originated specifically in the context of the implementation of comprehensive

4. IAEA (2020), "Safeguards Statement for 2019", para. 49, Fact Box 2, available at: www.iaea.org/sites/default/files/20/06/statement-sir-2019.pdf. Other factors cited include: an increase in the conclusion of safeguards agreements and additional protocols, amendment of small quantities protocols, upgrading technology, strategic planning, effectiveness evaluation, and quality management. Annual Safeguards Statements are available at: www.iaea.org/publications/reports or upon request from the IAEA Archives based on the referenced document.

5. *Ibid*., para. 51.

6. Supplementary Document, *supra* note 3.

7. See *ibid*., para. 5 and Annex 2.

8. See *ibid*., para. 49, n. 33.

safeguards agreements, as reflected in the work of the Secretariat, member states and the IAEA Board of Governors on Programme 93+2.[9]

Support for efforts to strengthen the safeguards system for the implementation of comprehensive safeguards agreements has been reflected in numerous IAEA reports. It was noted in the *IAEA Annual Report for 1994*, for example, that "Member States of the Agency are strongly supportive of a strengthened safeguards regime that, *inter alia*, is better equipped to provide assurance regarding both the correctness and the completeness of a State's nuclear programme declaration".[10] The *IAEA Annual Report for 2002* noted that this shift was connected to efforts to strengthen the safeguards system as a result of events of the early 1990s, when a clandestine nuclear weapons programme was discovered in Iraq. Specifically, the report indicated that "[u]nderlying the implementation of strengthened safeguards was the shifting focus from safeguards implementation at the facility level to the State as a whole."[11]

Verification of the correctness and completeness of state declarations under comprehensive safeguards agreements has been emphasised over the years dating back to resolutions of the Board of Governors and General Conference in 1991 and 1992. This was specifically the case in the context of the Policy-Making Organs' requests that the Director General verify the completeness of the inventory of South Africa's nuclear programme[12] as well as reporting on efforts to verify the correctness and completeness of the initial report of the Democratic People's Republic of Korea (DPRK) under its comprehensive safeguards agreement.[13] The verification of the correctness and completeness of states' declarations under comprehensive safeguards agreements was specifically addressed by the Board of Governors in 1995 in the context of Programme 93+2 Part I measures.[14] Finally, in every safeguards resolution adopted since 2010, the IAEA General

9. In 1993, the Board of Governors requested the Director General to submit to it concrete proposals for the assessment, development and testing of measures for strengthening safeguards and improving its cost effectiveness, known as Programme 93+2. The Programme addressed in Part 1 such measures that were in its existing legal authority under comprehensive safeguards agreements and in Part 2 measures that would require additional, or complementary, legal authority. See Reports by the Director General, IAEA (1995), "Strengthening the Effectiveness and Efficiency of the Safeguards System: Programme 93 + 2", IAEA Doc GOV/2784 and IAEA (1995), "Strengthening the effectiveness and improving the efficiency of the safeguards system: Proposals for a strengthened and more efficient safeguards system", IAEA Doc. GOV/2807. Both reports are included as annexes to IAEA (1995), "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System, Report by the Director General to the General Conference", IAEA Doc. GC(39)/17, Annexes 1 and 4.

10. IAEA (1995), *IAEA Annual Report for 1994*, IAEA Doc. GC(39)/3, p. 175.

11. IAEA (2003) *IAEA Annual Report for 2002*, IAEA Doc. GC(47)/2, p. 68.

12. IAEA (1991), "Draft Resolution Submitted by Egypt, Morocco, Nigeria and Tunisia on behalf of the African Group" Doc. GOV/2547/Rev.1, para. 2; IAEA (1991), "Record of GOV/OR Meeting 762", IAEA Doc. GOV/OR.762, para. 75; IAEA (1991) (adopting resolution contained in IAEA document GOV/2547/Rev.1), "Resolution adopted during the 341st plenary meeting on 20 September 1991, South Africa's Nuclear Capabilities", IAEA Doc. GC(XXXV)RES/567. For more details on the South Africa case as well as an overview of the executive role of the Board of Governors in the implementation of safeguards in light of the IAEA Statute, see Part II of this article.

13. IAEA (1993), *IAEA Annual Report for 1992*, IAEA Doc. GC(37)/1060, pp. 4, 135, and 137. The IAEA also referenced the need to verify the correctness and completeness in other States during the 1990s. For example, in the same report, it was noted that "the Agency had sought assistance from Member States to verify the correctness and completeness of its inspection results in Iraq." *Ibid*., p. 38.

14. See IAEA (1995), "Record of GOV/OR Meeting 864", IAEA Doc. GOV/OR.864, para. 49; IAEA (1995), "Record of GOV/OR Meeting 865", IAEA Doc. GOV/OR.865, paras. 53-54.

> The Board reiterates that the purpose of comprehensive safeguards agreements… is to verify that [nuclear material subject to safeguards] is not diverted to nuclear weapons or nuclear explosive devices. To this end, the safeguards system for implementing comprehensive safeguards agreements should be designed to provide for verification by the Agency of the correctness and completeness of States' declarations, so that there is credible assurance of the non-diversion of nuclear material from declared activities and of the absence of undeclared nuclear activities.

Conference has recognised that the "implementation of comprehensive safeguards agreements should be designed to provide for verification by the Agency of the correctness and completeness of a State's declarations".[15]

B. Application safeguards in the context of the "State-level concept": Moving beyond comprehensive safeguards agreements

Considering that the initial shift in focus in safeguards implementation from the facility level to the state as a whole took place in the context of strengthening safeguards for the implementation of comprehensive safeguards agreements, the Agency's need to further evolve the implementation of safeguards, as described in the 2013 report of the IAEA Director General, "The Conceptualization and Development of Safeguards Implementation at the State Level", IAEA Doc. GOV/2013/38, addressed only safeguards implementation under comprehensive safeguards agreements. The application of state level safeguards in the context of other types of safeguards agreements (i.e. voluntary offer agreements and item-specific safeguards agreements), as well as its application for states without an additional protocol in force, was addressed in 2014 in the Supplementary Document.

The concept of implementing safeguards at the state level manifested itself over time in both a general and a specific form. In its general sense, the concept related to improvements in the underlying processes for safeguards implementation. As noted in the 2013 report, the term "State-level concept" was first introduced in the *Safeguards Implementation Report for 2004* to describe safeguards implementation that is based on state-level approaches developed using safeguards objectives common to all states with CSAs and taking state-specific factors into account, which was then being implemented for states with integrated safeguards but was planned to be extended to all other states with comprehensive safeguards agreements in force.[16] It was noted in the *IAEA Annual Report for 2004* that the IAEA was moving from rigid, criteria-based safeguards implementation and evaluation to a more flexible and effective approach based on state-level considerations. This new approach was said to take into account a wider range of factors and information, such as the scope and extent of a state's nuclear fuel cycle, the co-operation of the state in implementing safeguards and information on nuclear-related research available in open sources. It was emphasised in this context that IAEA safeguards implementation remained non-discriminatory, as the verification objectives applied are common to all states.[17]

Aside from this description of a general process of improving the effectiveness and enhancing the efficiency of safeguards implementation under comprehensive safeguards agreements, "State-level approaches" had also been introduced in the specific context of the implementation of safeguards in states with both CSAs and additional protocols in force. As the IAEA gained experience with the implementation of additional protocols based on the Model Additional Protocol (IAEA document INFCIRC/540 (Corr.)), which was approved by the Board of Governors in 1997, the IAEA initiated a plan to develop what is known as "integrated

15. The resolutions were titled either as "Strengthening the effectiveness and improving the efficiency of the safeguards system and application of the Model Additional Protocol", IAEA Doc. GC(54)/RES/11 (2010), para. (f), and IAEA Doc. GC(56)/RES/13 (2012), para. (g); or as "Strengthening the effectiveness and improving the efficiency of the safeguards system", IAEA Doc. GC(57)/RES/13 (2013), para. (g); IAEA Doc. GC(58)/RES/14 (2014), para. (i); IAEA Doc. GC(59)/|RES/13 (2015), para. (i); IAEA Doc. GC(60)/RES/13 (2016), para. (i); IAEA Doc. GC(61)/RES/12 (2017), para. (i); IAEA Doc. GC(62)/RES/10 (2018), para. (i); IAEA Doc. GC(63)/RES/11 (2019), para. (i); IAEA Doc. GC(64)/RES/13 (2020), para. (i).

16. See IAEA (2013), "The Conceptualization and Development of Safeguards Implementation at the State Level", IAEA Doc. GOV/2013/38, para. 12.

17. IAEA Annual Report for 1994, *supra* note 10, p. 61.

safeguards".[18] Integrated safeguards involved an optimised combination of all safeguards measures available to the Agency under CSAs and additional protocols. Integrated safeguards are implemented for states with both a CSA and an additional protocol in force, and for which the broader conclusion had been drawn.[19]

In the *IAEA Annual Report for 1999*, it was noted that a concept was being developed involving "a State level approach that combines integrated safeguards approaches with allowance for the nuclear fuel cycle in the particular State and other State specific features."[20] In the subsequent decade, "State level integrated safeguards approaches" became a fixture in safeguards reporting, creating a strong association between "State-level" considerations and the implementation of integrated safeguards for states with both CSAs and additional protocols in force. How state-level approaches would function where there was no such additional protocol in force was not addressed during the early development of integrated safeguards.

During the past decade, the move towards the implementation of state-level approaches for all states with safeguards agreements in force involved the provision of assurances to member states that this was within the scope of existing safeguards agreements and did not entail any expansion of legal authorities or re-interpretation of rights and obligations of the parties under safeguards agreements, and that the implementation of these process improvements remained consistent with the legal instruments in force for the particular states concerned. These assurances, developed in the context of the consultative process, are described below.

It was noted in the *2010 Annual Report* that work was being done within the Secretariat "to further develop the State level concept for the planning, implementation and evaluation of safeguards activities for all States with CSAs in force".[21] The development and implementation of state-level safeguards approaches outside of the specific context of integrated safeguards at this point invited greater attention from the IAEA's Policy-Making Organs. In 2012, the General Conference requested the Secretariat to report to the Board of Governors on the conceptualisation and development of the state-level concept for safeguards.[22] Responding to this request, the IAEA

18. Integrated safeguards was described in detail in the following reports of the IAEA Director General to the Board of Governors: IAEA (2000), "The Development of Integrated Safeguards", IAEA Doc. GOV/INF/2000/4; IAEA (2000), "The Development of Integrated Safeguards", IAEA Doc. GOV/INF/2000/26); IAEA (2002), "The Conceptual Framework for Integrated Safeguards", IAEA Doc. GOV/2002/8. For the Model Additional Protocol, see IAEA (1998), "Model Protocol Additional to the Agreement(s) Between State(s) and the International Atomic Energy Agency for the Application of Safeguards", IAEA Doc. INFCIRC/540 (Corr.).

19. A broader conclusion is a safeguards conclusion, for a state with a comprehensive safeguards agreement and an additional protocol in force, that all nuclear material in a state remains in peaceful activities. A broader conclusion is drawn on the basis of a comprehensive evaluation by the Agency to ascertain that there are no indications of diversion of declared nuclear material from peaceful nuclear activities in a state, and no indications of undeclared nuclear material or activities in a state. When the evaluation has been completed, and no indication has been found by the Agency that, in its judgement, would give rise to a proliferation concern, the Secretariat can draw the broader conclusion that all nuclear material in a state remains in peaceful activities. See "Safeguards Statement for 2019", *supra* note 4, para. 13.

20. IAEA (2000), *IAEA Annual Report for 1999*, IAEA Doc. GC(44)4, p. 12.

21. IAEA (2011), *IAEA Annual Report for 2010*, IAEA Doc. GC(55)/2, p. 15.

22. IAEA (2012), "Strengthening the effectiveness and improving the efficiency of the safeguards system and application of the Model Additional Protocol, Resolution adopted on 21 September 2012 during the ninth plenary meeting", IAEA Doc. GC(56)/RES/13, para. 21.

Director General issued the 2013 report described above and the matter was discussed in the Board of Governors and the General Conference in September 2013.[23]

The Director General's 2013 report recounted the history of strengthening safeguards, further noting that safeguards implementation had previously focused primarily on nuclear material and facilities declared by the state and was based on safeguards approaches for specific facility types using the "safeguards criteria, which, *inter alia*, set out the frequency, scope and intensity of safeguards activities to be undertaken at declared facilities within a State".[24] Although the safeguards criteria continued to serve as guidance for conducting certain safeguards activities (e.g. a physical inventory verification at a light water reactor, nuclear material balance evaluations), the report noted that little consideration had been given previously to the state as a whole within that framework.[25] The report further stated that the IAEA had needed "to continue to strengthen the effectiveness of safeguards implementation by better utilizing the experience that has been gained in the implementation of state-level approaches (e.g. the greater use of unannounced and randomised inspections and streamlined verification activities in the field) and in the detection of indications of undeclared nuclear material and activities."[26] Finally, basic elements of the state-level concept were elaborated in the report, including: the establishment of generic and technical safeguards objectives; consideration of six state-specific factors and process elements including collecting and evaluating information; development of state-level approaches; planning, conducting and evaluating safeguards activities; and drawing safeguards conclusions.[27]

A number of member states raised questions about different aspects of the state-level concept during meetings of the Board of Governors in 2013, including about its legal basis. The Director General stated at those meetings that he would prepare a supplementary document to provide the Board of Governors with more information before the 2014 General Conference.[28] On 20 September 2013, the General Conference adopted resolution GC(57)/RES/13 noting the Director General's report and his intention to produce, after consulting with member states, a supplementary document for consideration and action by the Board of Governors, providing further clarification and information to address questions and issues raised.[29]

Areas of questions raised by member states were identified in a Note by the Secretariat in the autumn of 2013.[30] These areas included, *inter alia*, the scope of application of the state-level concept, i.e. whether it applied for all states as some states had suggested, including those with CSAs, voluntary offer agreements and item-specific safeguards agreements and the compatibility

23. IAEA Doc. GOV/2013/38, *supra* note 16.

24. As noted in the 2013 report, "the safeguards criteria, developed in the late 1980s, concentrate on the quantity and type of nuclear material, and the type of nuclear facilities, placed under Agency safeguards in a State and are based on the assumption that a State might have all the necessary capabilities to produce a nuclear explosive device." *Ibid*., p. 3, n. 16.

25. *Ibid*., para. 9.

26. *Ibid*., para. 13.

27. *Ibid*., paras 14-25. These elements were elaborated and clarified further in the Supplementary Document, *supra* note 3.

28. IAEA (2013), "Record of the 1360th Meeting", IAEA Doc. GOV/OR.1360, paras. 151-274; IAEA (2013) "Record of the 1361st Meeting", IAEA Doc. GOV/OR.1361, paras. 1-97; and IAEA (2013), "Record of the 1362nd Meeting", IAEA Doc. GOV/OR.1362, paras. 1-41.

29. IAEA Doc. GC(56)/RES/13, *supra* note 22, para. 21.

30. IAEA (2013), "Note by the Secretariat, The Conceptualization and Development of Safeguards Implementation at the State Level", IAEA Doc. 2013/Note 70.

of the state-level concept with, and any impact of its practical implementation on, states' obligations under their respective safeguards agreements and, where applicable, additional protocols.[31]

C. Establishment of standardised safeguards processes for developing and implementing state-level approaches within the legal framework for IAEA safeguards

The Supplementary Document, issued in August 2014, outlined in considerable detail the basic elements of the state-level concept and provided important assurances regarding its scope and its relationship to the legal framework. The document reiterated that the state-level concept "refers to the general notion of implementing safeguards in a manner that considers a State's nuclear and nuclear-related activities and capabilities as a whole, within the scope of the State's safeguards agreement"[32] and clarified that it is "applicable to all States with safeguards agreements in force."[33] The document differentiated the application of the state-level concept in varying scenarios where different types of safeguards agreements are in force.

Clarifications regarding the scope of application of the state-level concept and state-level approaches were an essential element of assurance of their consistency with the legal framework. The Supplementary Document explained that a state-level approach, which is an internal safeguards document prepared by the Secretariat, involved the establishment of generic safeguards objectives for the state on the basis of the state's safeguards agreement, and that these objectives are common to all states with the same type of safeguards agreement in force.[34] The scope of application of the safeguards agreement, it was noted, "is determined by the State's undertaking and the Agency's right and obligation to apply safeguards as set out in each agreement."[35] To address these generic objectives, the Secretariat establishes technical objectives to guide the planning, conduct and evaluation of safeguards activities for a state, which remain within the scope of the state's safeguards agreement.[36] The safeguards measures that will be included in a state-level approach in order to address the generic objectives are those specified in the safeguards agreement and, where applicable, the additional protocol. In this regard, the Supplementary Document noted that "a State-level approach will not introduce any new

31. Others areas in which questions had been raised related to the exhaustiveness of state-specific factors; the differentiation of technical objectives from one state to another; the relationship of the objectives to the acquisition path analysis, the procedures for handling and using open source and third party information; the relevance of such information for the implementation of the SLC and the drawing of safeguards conclusions, the determination of intensity and focus of in-field inspection activities, especially in states with comprehensive safeguards agreements but without an additional protocol; and the SLC's impact on Agency verification (e.g. increase or decrease) across states or facility types, the means by which the effectiveness and efficiency of the implementation of the SLC is to be measured, the type of consultations to be held between the Secretariat and states on the development and implementation of individual SLAs. *Ibid*.

32. Supplementary Document, *supra* note 3, para. 9.

33. *Ibid*., para. 10.

34. *Ibid*., para. 13.

35. *Ibid*., para. 46. It was further noted in the Supplementary Document that "[t]he scope of a safeguards agreement does not change when the State concludes an AP. AP measures, which provide the Agency with broader access to information and locations will continue to be implemented only in those States that have an AP in force." *Ibid*.

36. *Ibid*., at para. 14. As noted in the Supplementary Document, the technical objectives are established through the conduct of either an acquisition path analysis (for states with CSAs) or a diversion path analysis (for states with item-specific safeguards agreements or VOAs). Acquisition and diversion path analyses are structured, technical methods and do not involve judgements about a state's intention to pursue any such path. *Ibid*., paras. 14-15. For more on acquisition and diversion path analysis, see *ibid*., paras. 58-71.

safeguards measures beyond those set out in the State's safeguards agreement and, where applicable, the [additional protocol]."[37]

As noted in the Supplementary Document, safeguards implementation for a state in the context of the state-level concept is governed by the safeguards agreement and, where applicable, the Additional Protocol concluded by that state with the Agency.[38] According to the document, implementation of safeguards in this context is "designed to enable the Agency to meet the requirements of the safeguards agreement in a more effective and efficient manner." An important additional element of the legal aspect of these assurances was that the state-level concept "will not entail the introduction of any additional rights or obligations on the part of either States or the Agency, nor any modification in the interpretation of existing rights and obligations under a safeguards agreement and, where applicable, [additional protocols]."[39] Finally, the Supplementary Document clearly states that "the [State-level concept] is not a substitute for the [Additional Protocol (AP)], i.e. it is not designed as a means for the Agency to obtain from a State without an AP in force the information and access provided for in the AP."[40]

In September 2014, the IAEA Board of Governors took note of the clarifications and additional information provided in the Supplementary Document and the Director General's intention to keep the Board informed on the matter.[41] The General Conference adopted a resolution in which it "welcomed the important assurances contained in GOV/2014/41 and its Corrigenda, and in the statements by the Director General and the Secretariat as noted by the Board of Governors in its September 2014 session," including, in particular the legal aspects of these assurances referred to in this article.[42] These assurances have been reiterated in every IAEA General Conference resolution on safeguards since that time and the development and implementation of state-level safeguards approaches have become part of the routine business of the IAEA, as described in IAEA annual reports and Safeguards Statements.[43]

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37. *Ibid*., para. 16.
38. *Ibid*., para. 43.
39. This statement is made several times throughout the Supplementary Document. See *ibid*., page ii and paras. 11, 43 and 44.
40. *Ibid*., para. 13, n. 11.
41. IAEA (2014), "Record of the 1389th Meeting", IAEA Doc. GOV/OR.1389, paras. 17-39.
42. IAEA (2014), "Strengthening the Effectiveness and Improving the Efficiency of Agency Safeguards, Resolution adopted on 26 September 2014 during the tenth plenary meeting", IAEA Doc. GC(58)/RES/14, para. 24. More specifically, the resolution referred in paragraph 24 to the following assurances:

    > The State-level concept (SLC) does not, and will not, entail the introduction of any additional rights or obligations on the part of either States or the Agency, nor does it involve any modification in the interpretation of existing rights and obligations;
    >
    > The SLC is applicable to all States, but strictly within the scope of each individual State's safeguards agreement(s);
    >
    > The SLC is not a substitute for the Additional Protocol and is not designed as a means for the Agency to obtain from a State without an Additional Protocol the information and access provided for in the Additional Protocol;
    >
    > The development and implementation of State-level approaches requires close consultation with the State and/or regional authority, particularly in the implementation of in-field safeguards measures;
    >
    > Safeguards-relevant information is only used for the purpose of safeguards implementation pursuant to the safeguards agreement in force with a particular State – and not beyond it.

    Ibid.
43. On 31 July 2018, an additional report was provided on experience gained and lessons learned under certain types of state-level safeguards approaches. See IAEA (2018), "Report by the Director General, Implementation of State-level Safeguards Approaches for States under Integrated Safeguards – Experience Gained and Lessons Learned", IAEA Doc. GOV/2018/20.

The safeguards measures included in state-level approaches are exclusively those provided in the relevant legal instruments. In implementing safeguards, the IAEA is careful in this regard to differentiate state-level approaches, which are internal documents, from subsidiary arrangements, which are legal documents agreed with states to provide, for example, more details on the provision of nuclear material accounting reports and the implementation of routine inspections under a safeguards agreement.[44] Consistency of state-level safeguards approaches with the relevant legal instruments in force for the state provides a basis for the parties to optimise their use of available tools under those legal instruments in an effective and efficient manner. In the years since the issuance of the Supplementary Document, the establishment of a process for ensuring consistency of state-level approaches supports the view that the legal assurances provided in connection with the issuance of that document have proved to be a reflection of IAEA practice.

The development and implementation of state-level safeguards approaches for all states with safeguards agreements in force has entailed intensive consultation between the Secretariat and member states, including provision of reports and clarifications, as well as legal assurances for the application of these important safeguards "concepts". The emphasis on continuing consultation with states in the development and implementation of state-level safeguards approaches is a product of the effective functioning of the Agency's constitutive statutory elements – the General Conference, the Board of Governors and the Director General – as well as states in their capacity as parties to safeguards agreements. The establishment and maintenance of the process improvements relating to the state-level concept within the legal framework for IAEA safeguards represents one of the significant developments in IAEA safeguards of the past decade.

II. Verification of the correctness and completeness of state declarations under comprehensive safeguards agreements

As noted in Section I.A above, since the early 1990s, the verification of correctness and completeness has been emphasised in IAEA practice relating to the implementation of CSAs. The IAEA has on numerous occasions co-operated with states to perform activities that, while distinct from routine activities under CSAs, have better equipped the IAEA to meet its legal obligation to ensure that safeguards are applied as required under such agreements.[45,46] A brief consideration

44. See e.g. IAEA (1972), "The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/153 (Corr.), para. 76(c).

45. See *ibid*., para. 2. Comprehensive safeguards agreements provide specifically for the Board of Governors to take certain measures in relation to the non-diversion of nuclear material. For example, the Board of Governors may request a state to take "essential and urgent" action "in order to ensure verification that nuclear material subject to safeguards under [the agreement] is not diverted to nuclear weapons or nuclear explosive devices". *Ibid*., para. 18. Additionally, if the Board of Governors,

> upon examination of relevant information reported to it by the Director General finds that the Agency is not able to verify that there has been no diversion of nuclear material required to be safeguarded under the Agreement to nuclear weapons or other nuclear explosive devices, it may make the reports provided for in paragraph C of Article XII of the [IAEA] Statute.

Ibid., para. 19. Such reports include reports to the United Nations Security Council and General Assembly, which in certain cases has issued resolutions on the matter and/or related topics. The IAEA Statute also provides that "if in connexion with the activities of the Agency there should arise questions that are within the competence of the Security Council, the Agency shall notify the Security Council, as the organ bearing the main responsibility for the maintenance of international peace and security." IAEA Statute, Article III.B.4, *supra* note 1.

46. In the *Annual Report for 1995*, for example, it was noted that "[m]ajor installations in [Argentina and Brazil] were also visited to verify the correctness and completeness of the initial report" shortly after the safeguards agreement between Argentina, Brazil, ABACC and the IAEA entered into force. IAEA (1996), *IAEA Annual Report for 1995*, IAEA Doc. GC(40)/8, p. 46; see IAEA (1994), "Agreement of 13 December 1991 between the Republic of Argentina, the Federative Republic of Brazil, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials and the International Atomic Energy Agency for the Application of Safeguards", IAEA Doc. INFCIRC/435.

of cases in which the Board of Governors has specifically requested the Director General to verify the correctness and completeness of state declarations under CSAs is essential to understanding the differences between such activities performed pursuant to safeguards agreements and examples of the exercise of the Board of Governors' authority to authorise the additional verification and monitoring activities considered in Section III of this article.

In some cases, the Board of Governors specifically requested states to co-operate with the Agency so that such activities could be undertaken. An early example was in the case of South Africa. On 12 September 1991, the Board of Governors requested the Director General "verify the correctness and completeness of the inventory of South Africa's nuclear installations and material" in a resolution accompanying its authorisation of the conclusion of a comprehensive safeguards agreement with that country, which entered into force on 16 September 1991.[47] The IAEA General Conference subsequently requested the Director General "to verify the completeness of the inventory of South Africa's nuclear installations and material and to report to the Board of Governors and to the General Conference."[48]

After the South African President on 24 March 1993 announced the former existence and the subsequent abandonment of South Africa's nuclear weapons capability, the IAEA was invited by the South African Government to carry out an assessment of the status of South Africa's former nuclear weapons programme with particular respect to its origin, scope and the adequacy of the measures taken to dismantle and destroy sensitive components of the weapons and to recover the nuclear material involved.[49] This was subsequently done and the results were reported to the IAEA Board of Governors and General Conference.[50]

Additional instances in which the Board, prompted by Director General reports on safeguards implementation issues, requested states to declare to the Agency all nuclear material and facilities subject to safeguards included, for example: Iraq (1991),[51] the DPRK (1992-1993),[52] Iran

47. See IAEA Doc. GOV/2547/Rev.1, *supra* note 12, para. 2; IAEA Doc. GOV/OR.762, *supra* note 12, para. 75.

48. IAEA General Conference Resolution GC(XXXV)/RES/567, *supra* note 12.

49. See IAEA (1993), "The Denuclearization of Africa (GC(XXXVI)/RES/577), Report by the Director General", IAEA Doc. GC(XXXVII)/1075), para. 10.

50. This included, *inter alia*, assessing that:

> all non-nuclear weapons-specific components of the devices had been destroyed; all laboratory and engineering facilities involved in the programme had been fully decommissioned and abandoned or converted to peaceful usage (commercial non-nuclear usage or peaceful nuclear usage); [and] all weapons-specific equipment had been destroyed and that all other equipment had been converted to peaceful usage.

Ibid.

51. See IAEA (1991) "Iraq's Non-Compliance with its Safeguards Obligations, Draft Resolution", IAEA Doc. GOV/2531 and Add.1, para. 2, and IAEA (1991), "Record of GOV/OR Meeting 759", IAEA Doc. GOV/OR.759, paras. 23 and 32-35 (The Board: "Calls upon the Government of Iraq to remedy this non-compliance forthwith, including placing any and all additional source and special fissionable material within Iraq's territory, under its jurisdiction or its control, regardless of quantity or location under Agency safeguards in accordance with the relevant provisions of INFCIRC/172 and in accordance with relevant technical determinations of the Agency.").

52. See IAEA (1993), "Resolution adopted by the Board on 25 February 1993", IAEA Doc. GOV/2636, para. 2 ("it is essential to verify the correctness and assess the completeness of the Democratic People's Republic of Korea's Initial Report").

(2003),[53] the [then] Socialist People's Libyan Arab Jamahiriya (2004),[54] Korea (2004),[55] Egypt (2005),[56] and the Syrian Arab Republic (2011).[57] Additional details regarding Iraq, the DPRK and Iran, respectively, are provided below.

III. Other IAEA verification and monitoring activities

The IAEA Board of Governors has on a number of occasions exercised its executive authority, as the organ responsible for carrying out the functions of the IAEA under its Statute, to authorise the Director General to conduct nuclear verification and monitoring activities relevant to nuclear non-proliferation, as requested by IAEA member states and/or the UN Security Council.

53. See IAEA (2003), "Resolution adopted by the Board on 12 September 2003", IAEA Doc. GOV/2003/69, para. 4 ("Decides that it is essential and urgent in order to ensure IAEA verification of non-diversion of nuclear material that Iran remedy all failures identified by the Agency and cooperate fully with the Agency to ensure verification of compliance with Iran's safeguards agreement by taking all necessary actions by the end of October 2003, including: …(ii) granting unrestricted access, including environmental sampling, for the Agency to whatever locations the Agency deems necessary for the purposes of the verification of the correctness and completeness of Iran's declarations").

54. See IAEA (2004), "Resolution adopted by the board on 10 March 2004", IAEA Doc. GOV/2004/18 (the Board "looks forward to receiving a further report from the Director General at its June 2004 meeting, or earlier as appropriate, and thereafter when the Secretariat has formed a complete and coherent understanding of past and present nuclear activities in the Socialist People's Libyan Arab Jamahiriya and can verify the completeness and correctness of its declarations with the goal that the matter will then be resolved and concluded by the Board"). See also IAEA (2004), "Implementation of the NPT Safeguards Agreement of the Socialist People's Libyan Arab Jamahiriya, Report by the Director General", IAEA Doc. GOV/2004/12.

55. See IAEA (2004), "Implementation of the NPT Safeguards Agreement in the Republic of Korea Report by the Director General", IAEA Doc. GOV/2004/8 (noting that Korea had "informed the Secretariat that the ROK Government had discovered, in June 2004, that laboratory scale experiments involving the enrichment of uranium using the atomic vapour laser isotope separation (AVLIS) method had been carried out, in 2000, by scientists at the Korea Atomic Energy Research Institute (KAERI) in Daejeon"); IAEA (2004) "Record of the 1114th Meeting", IAEA Doc. GOV/OR.1114, paras. 1-3 ("The Board welcomed the corrective actions taken by the Republic of Korea, and the active cooperation it has provided to the Agency.").

56. See IAEA (2005), "Implementation of the NPT Safeguards Agreement in the Arab Republic of Egypt, Report by the Director General", IAEA Doc. GOV/2005/9, paras. 22-25 (finding failures to report nuclear material and certain information relating to nuclear facilities as well as relevant corrective actions taken by Egypt); IAEA (2005), "Record of the 1122nd Meeting", IAEA Doc. GOV/OR.1122, paras. 17-18 ("The Board had expressed the view that, bearing in mind the nature of the activities referred to in the report, the fact that some of them had been the subject of open-domain publications and therefore not clandestine, the fact that some of them had taken place 15 to 40 years previously, and the small amount of nuclear material involved, the issue was not a matter of proliferation concern. The Board had welcomed the corrective actions taken by Egypt and the active cooperation it had extended to the Agency, and had encouraged it to continue that cooperation.").

57. IAEA (2011), "Implementation of the NPT safeguards agreement in the Syrian Arab Republic, Resolution adopted by the Board of Governors on 9 June 2011", IAEA Doc. GOV/2011/41, paras 1-2 (The Board: "1. Finds, based on the report of the Director General, that Syria's undeclared construction of a nuclear reactor at Dair Alzour and failure to provide design information for the facility in accordance with Code 3.1 of Syria's Subsidiary Arrangements are a breach of Articles 41 and 42 of Syria's NPT Safeguards Agreement, and constitute non-compliance with its obligations under its Safeguards Agreement with the Agency in the context of Article XII.C of the Agency's Statute; 2. Calls upon Syria to remedy urgently its non-compliance with its Safeguards Agreement and fulfill its May 26 pledge to the Director General by responding positively and without delay to the Director General's requests for updated reporting from Syria under its Safeguards Agreement and access to all information, sites, material and persons necessary for the Agency to verify such reporting and resolve all outstanding questions so that the Agency can provide the necessary assurances as to the exclusively peaceful nature of Syria's nuclear program pursuant to Syria's Safeguards Agreement").

The IAEA's verification and monitoring of such "other" measures as have been agreed to or requested by such states, or adopted by the UN Security Council, have generally served the purpose of building confidence in the exclusively peaceful nature of a state's nuclear programme. By authorising the IAEA to conduct such verification and monitoring activities, subject to availability of funds, the IAEA Board of Governors has confirmed on a number of occasions that it considers such activities to be within the IAEA's authority provided under its Statute. The IAEA has demonstrated through its implementation of these activities its institutional and technical capacity to carry them out.

IAEA verification activities are authorised pursuant to Article III.A.5 of the IAEA Statute,[58] which outlines safeguards as one of the IAEA's core functions. Article III.A.5 of the Statute provides that the IAEA is authorised, *inter alia*, to "apply safeguards, at the request of the parties, to 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 Article VI.F of the IAEA Statute, the Board of Governors "shall have the authority to carry out the functions of the Agency in accordance with this Statute, subject to its responsibilities to the General Conference as provided in the Statute."[59]

In practice, the Board of Governors authorises the IAEA Director General to "conclude… and subsequently implement" a safeguards agreement or additional protocol with a state.[60] Similarly, as discussed below, it has been within the prerogative of the Board of Governors to authorise the Director General to implement verification and monitoring activities that the IAEA has been requested to conduct additional to those provided for in safeguards agreements and additional protocols, when requested by relevant parties.

In a number of specific cases, the IAEA has been requested to undertake verification and monitoring activities, on the basis of UN Security Council resolutions and/or co-operation between states, namely with respect to Iraq, the DPRK and Iran.[61]

58. See e.g. IAEA (2013), "Committee of the Whole, Record of the Sixth Meeting", IAEA Doc. GC(57)/COM.5/OR., para. 107 ("The Legal Officer for the Committee of the Whole said that Article III.A.5 of the Statute authorized the Agency to apply safeguards. All Agency safeguards agreements were concluded and implemented, and all Agency verification activities were carried out, pursuant to Article III.A.5."). See also IAEA (2007), "Monitoring and Verification in the Democratic People's Republic of Korea, Report by the Director General", IAEA Doc. GOV/2007/36, para. 1 (discussed below).

59. By contrast, the Statute provides that the General Conference "shall have the authority: 1. To take decisions on any matter specifically referred to the General Conference for this purpose by the Board; 2. To propose matters for consideration by the Board and request from the Board reports on any matter relating to the function of the Agency." IAEA Statute, *supra* note 1, Article V.F.

60. See e.g. IAEA (2016), "Nuclear Verification, The Conclusion of Safeguards Agreements and Additional Protocols, An Agreement with the Republic of Liberia in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. GOV/2016/30.

61. Other states' requests for the IAEA to assist with other verification tasks, including in connection with nuclear disarmament or arms control agreements, as requested by States and approved by the Board of Governors have not been carried out to date. See e.g. IAEA (1999), "Report by the Director General, IAEA Verification of Weapon Origin Fissile Material in the Russian Federation and the United States of America", IAEA Doc. GOV/INF/1999/8 (describing an initiative of the Russian Federation, the United States and the IAEA relating to the submission of weapon-origin fissile material to IAEA verification); IAEA (1999), "Financing Agency Verification of Nuclear Arms Control and Reduction Measures", IAEA Doc. GOV/INF/1999/9; IAEA (1999), "Record of the Nine Hundred and Eighty-First Meeting", IAEA Doc. GOV/OR.981, paras. 1-6 (containing summing-up of Board discussion of financing nuclear arms control and reduction measures); IAEA (2011), "Report by the Director General, Request from the Government of the Russian Federation and the Government of the United States of America to the IAEA to Verify the Disposition of Plutonium Designated by Russia and the United States as No Longer Required for Defense Purposes [PMDA]", IAEA Doc. GOV/INF/2011/16. See also IAEA (2019), "The Agency's Programme and Budget 2020–2021", IAEA Doc. GC(63)/2, p. 127.

A. IAEA verification activities in Iraq: Security Council Resolution 687

Iraq became a party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[62] upon its entry into force on 5 March 1970 and concluded a CSA with the IAEA on 29 February 1972.[63] Questions arose in the 1980s and early 1990s about activities in Iraq related to a programme for the development of nuclear weapons.[64] After the first Gulf War, the IAEA was requested under Security Council Resolution 687 to conduct a broad range of verification activities that extended beyond the IAEA's previous verification work for Iraq under its CSA.

The IAEA's work in Iraq in the 1990s was conducted largely under specific UN Security Council resolutions by virtue of which the IAEA was accorded expanded authority and utilised enhanced verification techniques. This was the result in particular of UN Security Council Resolution 687, which implemented a cease-fire in Iraq and requested the Director General, with the assistance of the United Nations Special Commission (UNSCOM), to conduct verification activities related to Iraq's nuclear capabilities, which involved a number of verification activities not specified in the Safeguards Agreement.[65]

The IAEA authority for the implementation of those activities[66] was confirmed by the Board of Governors on 6 May 1991 when the Board "[took] note with appreciation of the actions already taken and being taken pursuant to UN Security Council Resolution 687 and to request the Director General to keep it informed as appropriate."[67] In his reports on those actions, the Director General provided a number of additional legal references relating to the IAEA's co-operation with the Security Council under the relevant Security Council resolutions.[68]

62. Treaty on the Non-Proliferation of Nuclear Weapons (1968), IAEA Doc. INFCIRC/140, 729 UNTS 169, entered into force 5 Mar. 1970 (NPT). Status of the Treaty is available at: http://disarmament.un.org/treaties/t/npt.

63. See IAEA (1972), "The Text of the Agreement between Iraq and the Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/172.

64. See e.g. IAEA (1989), "Statement of the Official Spokesman of the Iraqi Ministry of Foreign Affairs", IAEA Doc. INFCIRC/362.

65. UN Security Council Resolution (UNSCR) 687, "Iraq-Kuwait (3 Apr)", UN Doc. S/RES/687, adopted 8 Apr. 1991.

66. The IAEA Director General referred to IAEA (1990), "Action Taken by the Director General in connection with Security Council Resolution 661, Resolution adopted by the Board on 23 September 1990", IAEA Doc. GOV/2480.

67. IAEA (1991), "Record of GOV/OR Meeting 748", IAEA Doc. GOV/OR.748, paras. 115-116. In reporting to the Board on the implementation of UNSCR 687, the IAEA Director General provided an explanation of his actions pursuant to the resolution prior to the Board's meeting on the matter. *Ibid*., para. 6 ("The Director General must at all times act in such a way as to have the confidence of the Board of Governors and must therefore maintain continuous close contact with Board members. The resolution adopted by the Board on 24 September 1990 had underlined 'the obligation of the Director General to take such measures as may be necessary to give effect to Security Council resolution 661 and all Security Council resolutions having relevance to this matter', but had also requested the Director General 'to consult and inform the Board as appropriate'. Considering the importance and magnitude of the tasks ahead, he had felt it appropriate not only to undertake urgently the planning necessary to perform those tasks, but also to request the convening of the present Board meeting rather than wait until June."). This analysis was also contained in IAEA (1991), "Agency Activities Pursuant to Security Council Resolution 687", IAEA Doc. GOV/INF/609, para. 3.

68. IAEA Doc. GOV/OR.748., *supra* note 67, para. 12 ("as the Security Council had acted under Chapter VII of the United Nations Charter, Members of the United Nations were obliged under Article 25 of the Charter to accept and carry out the decisions of the Security Council. For its part, the Agency was obliged under Article IX of its Relationship Agreement with the United Nations [IAEA Doc. INFCIRC/11] to co-operate with the Security Council by furnishing to it 'assistance as may be required in the exercise of its responsibility for the maintenance or restoration of international peace and security'. Article III.B.1 of the Agency's Statute provided the Agency with broad authority to furnish such assistance."). An expanded rendering of this legal analysis is contained in the Director General's related report. See IAEA Doc. GOV/INF/609, *supra* note 67, paras 3-4.

The activities specifically requested of the IAEA Director General under UN Security Council Resolution 687, confirmed and elaborated through subsequent resolutions,[69] included carrying out immediate on-site inspection of Iraq's nuclear capabilities at a broad range of locations, developing a plan for monitoring the destruction, removal, or rendering harmless as appropriate of specifically listed nuclear-weapons-usable material, and ongoing monitoring and verification of Iraq's compliance that involved placing Iraq's nuclear-weapons-usable material under the exclusive control, for custody and removal, of the IAEA.[70]

The IAEA's verification and monitoring activities in Iraq under relevant Security Council resolutions were so extensive that they were not differentiated from the normal safeguards activities carried out under Iraq's Safeguards Agreement, which were subsumed under the activities undertaken pursuant to the Security Council resolution.[71] However, when the IAEA was not able to implement its verification and monitoring activities under the relevant Security Council resolutions, such as the period when the IAEA was unable to implement its mandate under Resolution 687 from 12 December 1998 to 27 November 2002, the IAEA scheduled inspections under Iraq's Safeguards Agreement and differentiated such activities in its subsequent reporting to the Board of Governors.[72]

When the IAEA resumed inspections in Iraq pursuant to relevant Security Council resolutions on 27 November 2002, it was noted that "[f]rom then on, the Agency's safeguards activities in Iraq under the NPT safeguards agreement were again subsumed under these resolutions."[73] The IAEA "was able to implement its Security Council resolution-related mandate in 2003 until March and, as of that time, had not found any plausible indication of the revival of a nuclear

69. Pursuant to Security Council Resolution 1441, Iraq was found to be in "material breach of its obligations under relevant resolutions, including resolution 687 (1991), in particular through Iraq's failure to cooperate with United Nations inspectors and the IAEA", and was required to "complete the actions required under paragraphs 8 to 13 of resolution 687 (1991)." UNSCR 1441, "The situation between Iraq and Kuwait", UN Doc. S/RES/1441, adopted 8 Nov. 2002, para. 1. UNSCR 1441 also set up an "enhanced inspection regime with the aim of bringing to full and verified completion the disarmament process" established by resolution 687 and subsequent Security Council resolutions. *Ibid*., para. 2. On 17 December 1999, Security Council resolution 1284 was adopted which, *inter alia*, replaced UNSCOM with the United Nations Monitoring, Verification and Inspection Commission (UNMOVIC). UNSCR 1248, "The situation between Iraq and Kuwait", UN Doc. S/RES/1248, adopted 17 Dec. 1999.

70. UNSCR 687, *supra* note 65, para. 12.

71. In describing the activities carried out pursuant to UNSCR 687, the Director General noted to the Board of Governors that "[t]he activities which the Agency would be embarking upon in Iraq did not, however, come under safeguards rules, procedures and techniques. They were sui generis, designed to deal with a specific situation. It was nevertheless clear that many of those activities would be inspired by the Agency's safeguards experience, procedures and techniques. The safeguards verification which would normally have occurred in Iraq during the spring would be subsumed under the activities currently being undertaken pursuant to the Security Council resolution." IAEA Doc. GOV/OR.748, *supra* note 67, para. 16.

72. See e.g. IAEA (2000), *The Safeguards Implementation Report for 1999*, "Executive Summary", IAEA Doc. GOV/2000/23, p. 2.

73. IAEA (2003), *The Safeguards Implementation Report for 2002*, "Executive Summary", IAEA Doc. GOV/2003/35, p. 2. It was noted in this statement that:

> [i]n response to advice from the United States Government received on the night of 16-17 March 2003, and in consultation with the President of the Security Council and in co-ordination with the UN Secretary-General and the United Nations Monitoring, Verification and Inspection Commission (UNMOVIC), the Director General decided on the withdrawal of Agency inspectors from Iraq for security reasons. The inspectors left Iraq on 18 March and since that time the Agency's verification activities in Iraq were suspended because of ongoing hostilities.

Ibid., p. 2, n. 3.

programme."[74] On 29 June 2007, Security Council Resolution 1762 "terminate[d] immediately the mandates of UNMOVIC and the IAEA under the relevant resolutions."[75]

B. IAEA verification activities in the DPRK: The Agreed Framework and Six-Party Talks

Another example of the IAEA's implementation of verification and monitoring measures that were distinct from those provided in a CSA was in the DPRK. In the case of the DPRK, various bilateral and multilateral arrangements and activities have been pursued simultaneously or in parallel to the implementation of the DPRK's safeguards agreements, some of which provided for an IAEA role and others which did not.[76]

The DPRK concluded an item-specific safeguards agreement with the IAEA in 1977,[77] acceded to the NPT as a non-nuclear-weapon state in 1985,[78] and concluded a CSA with the IAEA on 10 April 1992.[79] On 9 February 1993, the IAEA requested access for a special inspection in connection with the possible undeclared reprocessing of irradiated fuel in the DPRK.[80] After considering the matter in a closed session, the IAEA Board of Governors adopted a resolution finding that the provision of such access was essential and urgent pursuant to Article 18 of the DPRK's CSA.[81] This was followed by a second resolution adopted on 1 April 1993 finding the DPRK to be in non-compliance with its obligations under its safeguards agreement with the IAEA and deciding "as required by Article XII.C. of the Statute and in accordance with Article 19 of the Agreement, to report the DPRK's non-compliance and the Agency's inability to verify non-diversion of nuclear material required to be safeguarded, to all Members of the Agency and to the Security Council and General Assembly of the United Nations".[82]

The Security Council subsequently adopted a resolution which, *inter alia*, requested the Director General to continue to consult with the DPRK with a view to resolving the issues which were the subject of the Board of Governors' findings and to report to the Security Council on his efforts in due time.[83] After a period of negotiations in which the DPRK provided notice of its

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74. IAEA (2004), "Safeguards Statement for 2003", para. 6, available at: www.iaea.org/sites/default/files/es2003.pdf.

75. UNSCR 1762, "The Situation concerning Iraq", UN Doc. S/RES/1762, adopted 29 June 2007, para. 1.

76. See e.g. Joint Declaration of South and North Korea on the Denuclearization of the Korean Peninsula (1992), IAEA Doc. GOV/INF/660, 33 ILM 569, entered into force 19 Feb. 1992 (establishing the South-North Joint Nuclear Control Commission, in which the IAEA had no role).

77. IAEA (1977), "Agreement between the International Atomic Energy Agency and the Democratic People's Republic of Korea for the Application of Safeguards in Respect of a Research Reactor Facility", IAEA Doc. INFCIRC/252, entered into force 20 July 1977; and IAEA (Dec. 1992), "The Text of the Agreement of 20 July 1977 between the Agency and the Government of the Democratic People's Republic of Korea for the Application Of Safeguards to the Research Reactor Facility (IRT), Suspension of the application of safeguards", IAEA Doc. INFCIRC/252/Mod.1 (suspension of application of safeguards as of 10 Apr. 1992).

78. NPT, *supra* note 62.

79. IAEA (1992), "Agreement between the Government of the Democratic People's Republic of Korea and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/403, entered into force 10 Apr. 1992.

80. See IAEA (1993), "Communications Addressed to the Director General by the Minister for Atomic Energy of the Democratic People's Republic of Korea", IAEA Doc. GOV/INF/684, Annex 7.

81. IAEA (1993), "Resolution adopted by the Board on 25 February 1993", IAEA Doc. GOV/2636 (26 Feb. 1993), para. 5.

82. IAEA (1993), "Resolution adopted by the Board on 1 April 1993", IAEA Doc. GOV/2645, paras. 1 and 4.

83. UNSCR 825 (1993), "Democratic People's Republic of Korea (11 May)", UN Doc. S/RES/825, adopted 11 May 1993, para. 3.

withdrawal from the NPT[84] and then suspended this withdrawal prior to the expiration of the three-month notice period for NPT withdrawal,[85] an "Agreed Framework between the United States and the DPRK" was agreed in 1994 between those parties, which envisioned a specific role for the IAEA.[86]

The Agreed Framework provided for the IAEA to undertake specific functions, notably to monitor a "freeze on the DPRK's graphite-moderated reactors and related facilities", to continue verification activities at facilities not covered by the freeze, and to take measures required with a view to verifying the accuracy and completeness of the DPRK's initial report under its CSA on all nuclear material in the DPRK.[87] In this connection, the Director General stated to the Board of Governors that a bilateral instrument such as the Agreed Framework "could not replace, supersede or detract from the Safeguards Agreement between the Agency and the DPRK."[88]

In subsequent documentation, the monitoring of the freeze was clearly differentiated as a verification measure from those that fell under the DPRK's CSA with the IAEA. For example, in the Presidential Statement adopted by the Security Council requesting the IAEA to take all steps it may deem necessary to monitor the freeze, the freeze was described as "a voluntary measure beyond what is required by the Treaty and the IAEA-DPRK Safeguards Agreement."[89] The Board of Governors subsequently "authorized the Director General to carry out all the tasks requested of the Agency as outlined in the Presidential Statement of the United Nations Security Council on 4 November 1994" and "requested the Director General to report to it periodically and to the Security Council as appropriate on the implementation of the IAEA/DPRK safeguards agreement *and on Agency activities related to monitoring the voluntary measure of the freeze on specified facilities in the DPRK*."[90]

The IAEA monitored the freeze on the DPRK's graphite-moderated reactors and related facilities from 1994 through 2002, in addition to conducting limited measures under the DPRK's

84. IAEA (1993), "Report by the Director General on the Implementation of the Resolution Adopted by the Board on 25 February 1993 (GOV/2636) and of the Agreement Between the Agency and the Democratic People's Republic of Korea for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (INFCIRC/403)", IAEA Doc. GOV/INF/683, Annex 4 (Statement of the Government of the Democratic People's Republic of Korea). See also IAEA (1993), "Resolution adopted by the Board on 18 March 1993", IAEA Doc. GOV/2639 (confirming that "that INFCIRC/403 remains in force and that it is essential and urgent that the DPRK enable the Agency to take the necessary measures to resolve differences and to ensure verification of compliance with that Safeguards Agreement").

85. See IAEA (1993), "Report by the Director General on the Implementation of the Agreement Between the Democratic People's Republic of Korea and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (INFCIRC/403)", IAEA Doc. GOV/2687, para. 25 (noting "the DPRK's decision of 11 June 'unilaterally to suspend, as long as it considers it necessary, the effectuation of its withdrawal' from the NPT").

86. See IAEA (1994), "Agreed Framework of 21 October 1994 between the United States of America and the Democratic People's Republic of Korea", IAEA Doc. INFCIRC/457.

87. *Ibid*.

88. IAEA (1994), "Report by the Director General on the Implementation of the Agreement Between the Democratic People's Republic of Korea and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (INFCIRC/403) and on the Presidential Statement Adopted by the United Nations Security Council on Friday, 4 November 1994", IAEA Doc. GOV/2687/Add.9, para. 3.

89. "Statement by the President of the Security Council", UN Doc. S/PRST/1994/64 (4 Nov. 1994).

90. IAEA (1994), "Record of GOV/OR Meeting 853", IAEA Doc. GOV/OR.853, paras. 121 and 122 (emphasis added).

CSA.[91] After the Director General reported to the Board of Governors in late 2002 on the possible existence of a programme to enrich uranium for nuclear weapons, the Board of Governors adopted a resolution, *inter alia*, urging co-operation between the IAEA and the DPRK with a view to opening immediately all relevant facilities to IAEA inspections and safeguards.[92] In response, the DPRK informed the IAEA on 12 December 2002 that it was lifting the freeze.[93]

On 31 December 2002, IAEA inspectors left the DPRK and IAEA verification activities were suspended.[94] The DPRK issued a public statement on 10 January 2003 that it had "lifted the moratorium on the effectuation of its withdrawal from the NPT."[95] The IAEA Board of Governors subsequently adopted a resolution "confirming" that the DPRK's comprehensive safeguards agreement remained in force, and the Security Council later adopted a resolution deciding that the DPRK shall act strictly in accordance with the NPT and its comprehensive safeguards agreement.[96,97] In 2006, the DPRK was reported to have conducted its first nuclear weapons test.[98]

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91. See e.g. IAEA (2001), *The Safeguards Implementation Report for 2000*, "Executive Summary", IAEA Doc. GOV/2001/21, p. 2 ("Although the safeguards agreement between the DPRK and the Agency remains binding and in force, the Agency is able to implement only some of the required safeguards measures in the State."); IAEA (2002), "Implementation of Safeguards in the Democratic People's Republic of Korea", IAEA Doc. GOV/2002/62, para. 4 (noting that "[t]here are four other facilities, and one 'location outside facilities' (LOF), which were not subject to the 'freeze' but continue to be subject to safeguards under the DPRK's safeguards agreement with the Agency. These are the IRT research reactor, the critical assembly, the sub-critical assembly, the nuclear fuel rod storage facility and the LOF.").

92. IAEA (2002), "Resolution adopted by the Board on 29 November 2002", IAEA Doc. GOV/2002/60.

93. See IAEA (2002), "Report by the Director General on the Implementation of the NPT Safeguards Agreement Between the International Atomic Energy Agency and the Democratic People's Republic of Korea", IAEA Doc. GOV/INF/2002/17, Annex I.

94. See "Implementation of Safeguards in the Democratic People's Republic of Korea", *supra* note 91, paras. 5-22; IAEA (2003), *The Safeguards Implementation Report for 2002*, *supra* note 73, p. 1.

95. For a copy of the letter from the DPRK, see IAEA (2003), "Report by the Director General on the Implementation of the NPT Safeguards Agreement Between the International Atomic Energy Agency and the Democratic People's Republic of Korea", IAEA Doc. GOV/INF/2003/3, Attachment 2.

96. See e.g. IAEA (2003), "Resolution adopted by the Board on 12 February 2003", IAEA Doc. GOV/2003/14 ("Confirming that the Agency's Safeguards Agreement with the DPRK pursuant to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) remains binding and in force and that it is essential and urgent that the DPRK enable the Agency to take the necessary measures to ensure verification of compliance with that Agreement"); UNSCR 1718 (2006), "Non-proliferation/Democratic People's Republic of Korea", UN Doc. S/RES/1718, adopted 14 Oct. 2006, para. 6 ("Decides that the DPRK shall abandon all nuclear weapons and existing nuclear programmes in a complete, verifiable and irreversible manner, shall act strictly in accordance with the obligations applicable to parties under the Treaty on the Non-Proliferation of Nuclear Weapons and the terms and conditions of its International Atomic Energy Agency (IAEA) Safeguards Agreement (IAEA INFCIRC/403) and shall provide the IAEA transparency measures extending beyond these requirements, including such access to individuals, documentation, equipments and facilities as may be required and deemed necessary by the IAEA").

97. In July 2003, the Director General informed the Board that,

> until the legal status of the DPRK *vis-à-vis* the NPT is clarified, the Agency's safeguards responsibilities as regards the DPRK remain uncertain. If the DPRK is considered to still be a party to the NPT, then its comprehensive NPT safeguards agreement remains in force, its nuclear material and facilities should be declared to the Agency and the Agency should resume its verification of the correctness and completeness of the DPRK's declarations. However, if the DPRK is considered no longer to be a party to the NPT, the Agency's INFCIRC/66-type safeguards agreement with the DPRK would have to be implemented. The Director General has not yet received guidance in the matter from the States parties to the NPT.

IAEA (2008), "Record of the 1206th Meeting", IAEA Doc. GOV/OR.1206, para. 18.

98. *Ibid*.

The IAEA Director General informed the Board of Governors in March 2007 that multilateral negotiations between the People's Republic of China (China), the DPRK, Japan, Korea, the Russian Federation (Russia) and the United States, known as the "Six-Party Talks", had produced an agreement on "Initial Actions" for the implementation of the Joint Statement that had been issued by them on 19 September 2005.[99] These Initial Actions included, *inter alia*, that the DPRK "will shut down and seal, for the purposes of eventual abandonment, its Yongbyon nuclear facilities, including the reprocessing facility, and invite back IAEA personnel to conduct all necessary monitoring and verification as agreed between the IAEA and the DPRK."[100]

The Director General sought the Board of Governors' authorisation for the implementation of *ad hoc* arrangements that had been agreed with the DPRK for the implementation of the Initial Actions.[101] In this connection the Director General referred to Article III.A.5 of the IAEA Statute and noted that the authorisation for the IAEA to apply safeguards under that article "does not require the State to be a member of the Agency and *does not prescribe a particular form or substance for safeguards arrangements*. The monitoring and verification in the DPRK will therefore be consistent with the Statute."[102] The Board of Governors subsequently "authorize[d] the Director General, subject to the availability of funds, to implement the *ad hoc* arrangement" referred to above.[103] The implementation of the Initial Actions in the context of the Six-Party Talks did not include the implementation of measures under the DPRK's comprehensive safeguards agreement during this time period.[104]

IAEA inspectors left the DPRK again on 16 April 2009, following a cessation of further co-operation with the IAEA.[105, 106]

99. On 23 February 2007, the IAEA Director General had received from the DPRK an invitation to visit that country in order to "develop the relations between the DPRK and the Agency, as well as to discuss problems of mutual concerns". Also, he had been notified by China, in its capacity as Chairman of the Six-Party Talks, of the initial actions for the implementation of the joint statement adopted in Beijing on 13 February 2007. As indicated in Doc. GOV/INF/2007/6, those actions envisioned, *inter alia*, the DPRK shutting down and sealing, for the purposes of eventual abandonment, its Yongbyon nuclear facilities, including the reprocessing facility, and the return of Agency personnel to conduct all necessary monitoring and verification. See IAEA (2007), "Communication dated 2 March 2007 received from the Resident Representative of the People's Republic of China to the Agency", IAEA Doc. GOV/INF/2007/6 (transmitting a text entitled "Initial Actions for the Implementation of the Joint Statement"). The Director General "welcomed the Beijing agreement and the invitation to visit the DPRK as positive steps towards the denuclearization of the Korean Peninsula and the normalization of the DPRK's relationship with the Agency. He would report to the Board on developments and any required action." See IAEA (2007), "Record of the 1175th Meeting", IAEA Doc. GOV/OR.1175, para. 23.

100. IAEA Doc. GOV/2007/36, *supra* note 58, para. 1.

101. *Ibid*., paras. 5 and 8.

102. *Ibid*., para. 6 (emphasis added).

103. IAEA (2007), "Record of the 1189th Meeting", IAEA Doc. GOV/OR.1889, paras. 138-139.

104. As indicated by the Director General in his statement to the Board on 2 June 2008. See also IAEA (2008), "Safeguards Statement for 2007", p. 1, n. 1 and paras. 42-45, available at: www.iaea.org/sites/default/files/es2007.pdf; IAEA (2011), "Safeguards Statement for 2010", p. 1, n. 1 and paras. 38-41, available at: www.iaea.org/sites/default/files/es2010.pdf.

105. See IAEA (2009), "Application of Safeguards in the Democratic People's Republic of Korea, Report by the Director General", IAEA Doc. GOV/2009/45-GC(53)/13, para. 10.

106. On 29 February 2012, the United States and the DPRK announced the DPRK's agreement to a moratorium on uranium enrichment, and the IAEA and the DPRK subsequently engaged in talks on the IAEA's possible monitoring of such a moratorium. See IAEA (2012), "Communication dated 16 March 2012 from the Democratic People's Republic of Korea to the Agency and the Director General's Reply", IAEA Doc. GOV/INF/2012/9; IAEA (2012), "Application of Safeguards in the Democratic People's Republic of Korea, Report by the Director General", IAEA Doc. GOV/2012/36-GC(56)/11, paras. 6-9. These activities were not agreed to or considered by the IAEA Board of Governors, however.

C. IAEA verification activities in Iran: Joint Plan of Action and Joint Comprehensive Plan of Action

A current example of the IAEA's implementation of verification and monitoring activities additional to those provided for in a safeguards agreement is in the context of Iran.

Iran became a party to the NPT upon its entry into force on 5 March 1970 and concluded a CSA with the IAEA on 15 May 1974.[107] From late 2002, the IAEA Director General reported to the Board of Governors a number of findings and open questions related to Iran's nuclear activities. The "possible military dimensions" of Iran's nuclear programme, including indicators of possible nuclear explosive development activities, were outlined in an Annex to the Director General's November 2011 report to the Board of Governors.[108]

i. IAEA Board of Governors and UN Security Council resolutions from 2003 to 2015

From September 2003 to September 2012, the IAEA Board of Governors adopted 12 resolutions requesting Iran to, *inter alia*, suspend its enrichment-related activities and heavy water-related projects, including related research and development, and reprocessing activities.[109] In its resolutions, the Board stressed the need to resolve "outstanding issues" relating to Iran's nuclear programme. Several of the resolutions state that it was essential and urgent for steps to be taken to resolve those issues.

On 12 September 2003, the IAEA Board of Governors adopted a resolution in which it, *inter alia*, called on Iran "to suspend all further uranium enrichment-related activities … and, as a confidence-building measure, any reprocessing activities".[110] On 21 October 2003, in a statement on Iran's nuclear programme agreed in Tehran by Iran, France, Germany and the United Kingdom, Iran indicated that it had "decided voluntarily to suspend all uranium enrichment and reprocessing activities as defined by the IAEA."[111] On 10 November 2003, Iran informed the IAEA that it had decided to suspend, with effect from that day, all enrichment-related and reprocessing activities in Iran, and specifically to suspend all activities on the site of Natanz, not to produce feed material for enrichment processes and not to import enrichment-related items.[112] The Director General noted in

107. See IAEA (1974), "The Text of the Agreement between Iran and the Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/214.

108. See IAEA (2011), "Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran, Report by the Director General", IAEA Doc. GOV/2011/65, Annex, sec. C.

109. See multiple resolutions adopted by the IAEA Board of Governors entitled "Implementation of the NPT Safeguards Agreement [and relevant provisions of Security Council resolutions] in the Islamic Republic of Iran", IAEA Doc. GOV/2003/69 (2003); IAEA Doc. GOV/2003/81 (2003); IAEA Doc. GOV/2004/21 (2004); IAEA Doc. GOV/2004/49 (2004); IAEA Doc. GOV/2004/79 (2004); IAEA Doc. GOV/2004/90 (2004); IAEA Doc. GOV/2005/64 (2005); IAEA Doc. GOV/2005/77 (2005); IAEA Doc. GOV/2006/14 (2006); IAEA Doc. GOV/2009/82 (2009); IAEA Doc. GOV/2011/69 (2011); IAEA Doc. GOV/2012/50 (2012).

110. IAEA Doc. GOV/2003/69, *supra* note 109, para. 3.

111. IAEA (2003), "Implementaion of the NPT Safeguards Agreement in the Islamic Republic of Iran, Report by the Director General", IAEA Doc. GOV/2003/75, para. 19, note 2.

112. *Ibid.*, para. 19. Iran also indicated in a letter of the same date that it was prepared to sign the Additional Protocol, and that, pending its entry into force, Iran would act in accordance with the provisions of that Protocol. *Ibid*., at para. 18. In December 2003, Iran further informed the IAEA that it would suspend operation and/or testing of centrifuges at the pilot fuel enrichment plant at Natanz, would suspend further introduction of nuclear material into any centrifuges, would suspend installation of new centrifuges, and would withdraw nuclear material from any centrifuge enrichment facility if and to the extent practicable. IAEA Doc. GOV/2004/21, *supra* note 109, paras (b) and 3. In February 2004, Iran informed the IAEA of further decisions voluntarily taken by Iran relating to assembly, manufacture and testing of centrifuge components, as well as storage of related components under IAEA seal. The IAEA Board of Governors subsequently requested the Director General to verify the full implementation of these additional steps. *Ibid.*

his introductory statement to the Board of Governors that "[v]erification of the suspension, as mentioned in the report, could be implemented as part of the Agency's verification activities in Iran under Iran's safeguards agreement and additional protocol."[113] On 26 November 2003, the Board of Governors endorsed the Director General's acceptance of Iran's invitation to verify the implementation of Iran's decision to suspend such activities.[114]

On 1 June 2004, the Director General reported that the IAEA's verification of Iran's suspension was delayed in some cases, was not yet comprehensive because of the continued production of centrifuge equipment by some private companies, and that Iran's decision to proceed with certain uranium conversion activities was at variance with the IAEA's previous understanding as to the scope of Iran's decision regarding suspension.[115] On 23 June 2004, Iran informed the IAEA that it "plan[ned] to suspend implementation of the expanded voluntary measures" and that Iran "thus, intend[ed] to resume, under IAEA supervision, manufacturing of centrifuge components and assembly and testing of centrifuges as of 29 June 2004."[116] On 14 November 2004, Iran notified the IAEA that, in the context of an agreement reached on that day between Iran and France, Germany and the United Kingdom, with the support of the High Representative of the European Union (E3/EU), Iran had "decided, on a voluntary basis and as further confidence building measure, to continue and extend its suspension to include all enrichment related and reprocessing activities" and invited the IAEA to verify this suspension starting from 22 November 2004.[117] In its resolution of 29 November 2004, the Board of Governors "[recognized] that this suspension is a voluntary confidence building measure, not a legal obligation" and requested the Director General to continue verifying the suspension.[118]

The IAEA continued to verify and monitor Iran's voluntary suspension of enrichment-related and reprocessing activities until Iran communicated on 1 August 2005 to the IAEA its decision to resume enrichment-related activities involving the production of feed material at a uranium conversion facility.[119] On 8 August 2005, Iran started to feed uranium ore concentrate into the first part of the process line at that facility.[120] The Board of Governors subsequently urged Iran, *inter alia*, to re-establish full suspension of all enrichment-related activities, including the production of feed material at the conversion facility.[121]

113. IAEA (2003), "Record of the 1083rd Meeting", IAEA Doc. GOV/OR.1083, para. 14.

114. IAEA Doc. GOV/2003/81 (2003), *supra* note 109, para. 10.

115. IAEA Doc. GOV/2004/49, *supra* note 109, paras (b) and (e).

116. IAEA (2004), "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, Report by the Director General", IAEA Doc. GOV/2004/60 (2004), para. 7.

117. IAEA (2004), "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, Report by the Director General", IAEA Doc. GOV/2004/83 (2004), para. 132. In its letter, Iran also "recall[ed] and reconfirm[ed] that Iran does not have any reprocessing activity" or "any activity for undertaking plutonium separation, or for constructing or operating any plutonium separation installation". It also stated that "material at Isfahan UCF will be brought to a safe, secure and stable state, not beyond UF4, in coordination with the Agency." *Ibid.*

118. IAEA Doc. GOV/2004/90, *supra* note 109, para. (h).

119. See IAEA (2006), "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, Report by the Director General", IAEA Doc. GOV/2005/67 (2005), para. 59. Iran later resumed its uranium enrichment activities. IAEA (2006), "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, Report by the Director General", IAEA Doc. GOV/2006/53 (2006), para. 4.

120. IAEA Doc. GOV/2005/67, *supra* note 119, para. 59.

121. See e.g. IAEA Doc. GOV/2005/64, *supra* note 109, para. 3.

On 24 September 2005, the Board of Governors found that "Iran's many failures and breaches of its obligations to comply with its NPT Safeguards Agreement, as detailed in GOV/2003/75, constitute non-compliance in the context of Article XII.C of the Agency's Statute" and further noted that "absence of confidence that Iran's nuclear programme is exclusively for peaceful purposes [has] given rise to questions that are within the competence of the Security Council, as the organ bearing the main responsibility for the maintenance of international peace and security."[122]

On 3 January 2006, Iran informed the IAEA that it had decided to resume research and development, which had been part of the suspension and, on 7 January 2006, Iran requested the IAEA to remove seals that had been applied at Natanz, Faray and Technique and Pars Trash for the monitoring of the suspension of enrichment-related activities.[123] On 4 February 2006, the Board of Governors adopted a resolution in which it "[deemed] it necessary" for Iran, *inter alia*, to re-establish full suspension of all enrichment-related activities, including research and development, to be verified by the IAEA, as well as to "implement [additional] transparency measures, as requested by the Director General, including in GOV/2005/67, which extend beyond the formal requirements of the Safeguards Agreement and Additional Protocol, and include such access to individuals, documentation relating to procurement, dual use equipment, certain military-owned workshops and research and development as the Agency may request in support of its ongoing investigations".[124] In this resolution, the Board of Governors also requested the Director General "to report to the Security Council of the United Nations that these steps are required of Iran by the Board and to report to the Security Council all IAEA reports and resolutions, as adopted, relating to this issue."[125]

On 6 February 2006, Iran informed the IAEA, *inter alia*, that from that date its commitment on implementing safeguards measures would only be based on its safeguards agreement with the IAEA and that "all voluntarily suspended non-legally binding measures including the provisions of the Additional Protocol and even beyond that will be suspended."[126]

From 2006 to 2010, the UN Security Council adopted one Presidential Statement and six resolutions, five of which were adopted under Article 41 of Chapter VII of the UN Charter, reaffirming that Iran "shall" suspend all its enrichment-related activities and heavy water-related projects, including R&D, and reprocessing activities and co-operate with the IAEA on these outstanding issues.[127]

In November 2013, the IAEA and Iran signed a "Joint Statement on a Framework for Cooperation" (Framework for Cooperation) in order to "strengthen their cooperation and dialogue aimed at ensuring the exclusively peaceful nature of Iran's nuclear programme through the

122. IAEA Doc. GOV/2005/77, *supra* note 109, paras. 1-2. The Board further stated in this resolution that "[the] Board will address the timing and content of the report required under Article XII.C and the notification required under Article III.B.4". *Ibid*., para. 3.

123. See IAEA (2006), "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, Report by the Director General", IAEA Doc. GOV/2006/15 (2006), para. 31.

124. IAEA Doc. GOV/2006/14, *supra* note 109, para. 1.

125. *Ibid.*, para. 2.

126. IAEA Doc. GOV/2006/15, *supra* note 123, para. 31. Iran had previously stated that it would act in accordance with the provisions of the Additional Protocol, pending its entry into force. See *supra* note 112.

127. "Statement by the President of the Security Council" (29 Mar. 2006), UN Doc. S/PRST/2006/15; UNSCR 1696, "Non-proliferation", UN Doc. S/RES/1696, adopted 31 July 2006; UNSCR 1737, "Non-proliferation", UN Doc. S/RES/1737, adopted 27 Dec. 2006; UNSCR 1747, "Non-proliferation", UN Doc. S/RES/1747, adopted 24 Mar. 2007; UNSCR 1803, "Non-proliferation", UN Doc. S/RES/1803, adopted 3 Mar. 2008; UNSCR 1835, "Nuclear Weapons", UN Doc. S/RES/1835, adopted 27 Sept. 2008; UNSCR 1929, UN Doc. S/RES/1929, adopted 9 June 2010. Resolution 1696 was adopted under Article 40 of Chapter VII of the Charter of the United Nations, 1 UNTS XVI, entered into force 24 Oct. 1945. See UNSCR 1696, *supra*, p. 2.

resolution of all outstanding issues that have not already been resolved by the IAEA."[128] The Framework for Cooperation initially involved six "practical measures", including provision of information and access to certain mines and a heavy water plant, information on all new research reactors and sites designated for the construction of nuclear power plants, clarification relating to new enrichment plants, and clarification relating to laser enrichment technology.[129] These measures were later supplemented by additional practical measures.[130]

Iran was required under Security Counsel resolutions adopted from 2006 to 2010, *inter alia*, to implement the modified Code 3.1 of the Subsidiary Arrangements General Part to its Safeguards Agreement; to suspend all enrichment-related and reprocessing activities; and to suspend all heavy water-related activities.[131] As of late 2015, Iran had continued to conduct enrichment-related activities, although it had not produced uranium hexafluoride enriched above 5% uranium-235 at any of its enrichment facilities since 20 January 2014, the date on which the Joint Plan of Action (referred to below) took effect.[132] Iran also continued work on heavy water-related projects. However, it neither installed any major components at the IR-40 Reactor nor produced nuclear fuel assemblies for the IR-40 Reactor at the Fuel Manufacturing Plant after the Joint Plan of Action took effect.[133] Security Council Resolution 2231 (2015), adopted in July 2015 and discussed below, included terms providing for the termination of the provisions of six Security Council resolutions adopted between 2006 and 2010.

ii. Joint Plan of Action

In parallel with the efforts of the IAEA to resolve the outstanding issues with Iran, China, France, Germany, Russia, the United Kingdom and the United States (the E3+3) separately (without IAEA participation) engaged in negotiations with Iran "to reach a mutually-agreed long-term comprehensive solution that would ensure Iran's nuclear programme will be exclusively peaceful."[134] The initial results of these negotiations produced the "Joint Plan of Action" in late 2013, which involved "voluntary", "near-term measures" to be implemented by Iran as well as the establishment of a Joint Commission of E3/EU+3 and Iran "to monitor the implementation of the near-term measures and address issues that may arise, with the IAEA responsible for verification of nuclear-related measures."[135] It was noted further in the Joint Plan of Action that a "Joint Commission will work with the IAEA to facilitate resolution of past and present issues of concern."

The measures envisioned under the Joint Plan of Action included agreed limitations on the scope and level of enrichment activities, a bar on further advances to be made on Iran's heavy

128. See IAEA (2013), "Joint Statement on a Framework for Cooperation", IAEA Doc. GOV/INF/2013/14, Attachment, p. 1.

129. *Ibid*, p. 2.

130. See also IAEA (2014), "Practical Measures in relation to the Framework for Cooperation", IAEA Doc. GOV/INF/2014/3.

131. For a summary, see IAEA (2016), *IAEA Annual Report for 2015*, IAEA Doc. GC(60)/9, p. 98, n. 15. UN Security Council Resolution UNSCR 2231 (2015) "Non-proliferation", UN Doc. S/RES/2231, adopted 20 July 2015, which is discussed below, included terms providing for the termination of the provisions of the six Security Council resolutions adopted between 2006 and 2010.

132. IAEA (2015), "Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran, Report by the Director General", IAEA Doc. GOV/2015/65 (2015), para. 22.

133. *Ibid.*, para. 49.

134. See IAEA (2013), "Communication dated 28 November 2013 received from the Permanent Mission of the Islamic Republic of Iran to the Agency concerning the text of the Joint Plan of Action", IAEA Doc. INFCIRC/856, Attachment, Joint Plan of Action, Preamble.

135. *Ibid*., p. 1-3.

water reactor and enrichment plants, and enhanced monitoring activities, pending negotiation of a final, comprehensive solution.[136]

Following the announcement of the Joint Plan of Action, the Director General requested "that a meeting of the Board of Governors be convened on 24 January 2014 to enable him to consult the Board on the Agency's monitoring and verification in relation to the nuclear-related measures set out in the [Joint Plan of Action]."[137] The Director General noted that he had convened a meeting of the Board to seek the Board's endorsement of the Agency's undertaking the monitoring and verification, in response to the request received from seven member states of the IAEA.[138] In his report outlining the nuclear-related measures that the IAEA had been requested to monitor and verify under the Joint Plan of Action, the Director General noted in this connection that "[t]he Agency has the authority to implement monitoring and verification in relation to the nuclear-related measures set out in the [Joint Plan of Action]."[139]

On 24 January 2014, the IAEA Board of Governors "endorse[d] the Agency undertaking monitoring and verification in relation to the nuclear-related measures set out in the Joint Plan of Action, in response to the request by the E3+3 and Iran, subject to the availability of funds."[140] The Joint Plan of Action took effect on 20 January 2014, initially for six months. It was extended three times, including on 30 June 2015, when the E3+3 and Iran requested the Agency, on behalf of the E3/EU+3 and Iran, to continue to undertake the necessary nuclear related monitoring and verification activities in Iran under the Joint Plan of Action (JPA) "until further communication".[141]

The Board's authorisation of the IAEA's implementation of monitoring and verification activities under the Joint Plan of Action was a reaffirmation of its practice of authorising the IAEA to undertake activities that are additional to those outlined in safeguards agreements and additional protocols. It was noted in the *Annual Report for 2014* that the Joint Plan of Action had required an approximate "doubling" of its verification activities compared with those the Agency had already been carrying out pursuant to Iran's Safeguards Agreement and the relevant resolutions of the Board of Governors and the Security Council.[142]

The IAEA's monitoring and verification activities dovetailed with its activities related to the Joint Comprehensive Plan of Action. On 19 January 2016, the E3+3 and Iran, on behalf of the E3/EU+3 and Iran, informed the Agency that, with the Director General's report (GOV/INF/2016/1) confirming Iran's completion of the necessary preparatory steps to start the implementation of the JCPOA, the Joint Plan of Action was no longer in effect.[143] The JCPOA is considered further in the following sub-section.

136. *Ibid*., p. 4.

137. IAEA (2014), "Monitoring and Verification in the Islamic Republic of Iran in relation to the Joint Plan of Action, Report by the Director General", IAEA Doc. GOV/2014/2, para. 5.

138. IAEA (2014), "Record of the 1370th Meeting", IAEA Doc. GOV/OR.1370, para. 7.

139. *Ibid*., para. 6.

140. *Ibid*., paras. 167-168.

141. IAEA Doc. GOV/2015/65, *supra* note 132, para. 13.

142. IAEA (2015), *IAEA Annual Report for 2014*, IAEA Doc. GC(59)/7, p. 16.

143. See IAEA (2016), "Verification and Monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015), Report by the Director General", IAEA Doc. GOV/INF/2016/1, Annex. Between January 2014 and January 2016 the IAEA provided 22 reports in relation to the Joint Plan of Action: IAEA Docs. GOV/INF/2014/1 (2014), GOV/2014/10, Annex 3 (2014), GOV/INF/2014/6 (2014), GOV/INF/2014/10 (2014), GOV/2014/28, Annex 3 (2014), GOV/INF/2014/14 (2014), GOV/INF/2014/16 (2014), GOV/INF/2014/19 (2014), GOV/INF/2014/21 (2014), GOV/INF/2014/23 (2014), GOV/INF/2014/26 (2014), GOV/INF/2014/29 (2014), GOV/2015/15, Annex IV (2015), GOV/INF/2015/7 (2015), GOV/INF/2015/8 (2015), GOV/2015/34, Annex IV (2015), GOV/INF/2015/12 (2015), GOV/2015/50, Annex V (2015), GOV/INF/2015/17 (2015), GOV/INF/2015/19 (2015), GOV/INF/2015/20 (2015) and GOV/INF/2016/3 (2016).

iii. Joint Comprehensive Plan of Action

The IAEA and Iran continued their co-operation during the period of implementation of monitoring and verification activities related to the Joint Plan of Action to resolve outstanding issues under Iran's comprehensive safeguards agreement through the Framework for Cooperation (referred to above). In this context, a "Road-map for the clarification of past and present outstanding issues regarding Iran's nuclear [programme]" was agreed between Iran and the IAEA on 14 July 2015.[144] The JCPOA, originally agreed between Iran and the E3/EU+3 (China, France, Germany, Russia, the United Kingdom and the United States, with the High Representative of the European Union for Foreign Affairs and Security Policy) was also agreed on that date.

The JCPOA contained several elements directly related to the implementation of Iran's CSA and the Additional Protocol it had signed in 2003 but which was not yet in force.[145] For example, the JCPOA explicitly required Iran to implement the above-referenced "Road-map" with the IAEA.[146] Moreover, under the JCPOA, Iran committed to notify the IAEA of its provisional application of the Additional Protocol to its Safeguards Agreement in accordance with Article 17(b) of the Additional Protocol, pending its entry into force (and subsequently seek ratification and entry into force, consistent with the respective roles of the President and the Majlis) and that it will fully implement the modified Code 3.1 of the Subsidiary Arrangements to its Safeguards Agreement as long as the Safeguards Agreement remains in force.[147] The JCPOA also established a Joint Commission comprised of representatives of the E3/EU+3 and Iran, with which it was envisioned that the IAEA would consult and exchange information.[148]

The JCPOA contained provisions for the IAEA to verify and monitor a host of nuclear-related measures to be implemented by Iran, which would continue through various phases envisioned in the JCPOA.[149] The nuclear-related measures included certain steps to be verified by the IAEA as a prerequisite for the JCPOA's "Implementation Day", when additional provisions of the JCPOA would come into effect (e.g. the termination of Security Council Resolutions 1696 (2006), 1737 (2006), 1747 (2007), 1803 (2008), 1835 (2008), 1929 (2010) and 2224 (2015) subject to re-imposition in the event of significant non-performance of JCPOA commitments).[150]

144. IAEA (2015), "Road-map for the Clarification of Past and Present Outstanding Issues regarding Iran's Nuclear Program", IAEA Doc. GOV/INF/2015/14.

145. UNSCR 2231, *supr*a note 131, Annex A: JCPOA.

146. *Ibid*., para. 14 and Annex I, sec. M. On 2 December 2015, the Director General provided a report to the Board of Governors on the final assessment of all past and present outstanding issues and, on 15 December 2015, the Board of Governors adopted a resolution in which, *inter alia*, it noted that all activities in the road-map had been implemented and that its consideration of this item was closed. IAEA (2015), "Resolution adopted by the Board of Governors on 15 December 2015", IAEA Doc. GOV/2015/72, para. 9.

147. *Ibid*., Annex I, sec. L.

148. See UNSCR 2231, *supr*a note 131, Annex A, JCPOA, secs. B.6 and I.52 and JCPOA Annex IV, secs. 6.4.1 and 6.4.6.

149. The JCPOA provided for an Adoption Day (90 days after endorsement by the Security Council), an Implementation Day (when the Security Council received the relevant report from the IAEA), a Transition Day (eight years from Adoption Day or upon receipt by the Security Council of the report from the IAEA stating that the IAEA has reached the Broader Conclusion that all nuclear material in Iran remains in peaceful activities), and a Resolution 2231 (2015) Termination Day (ten years from Adoption Day, provided that the provisions of the previous Security Council resolutions have not been reinstated in the interim (see below), all the provisions of Resolution 2231 (2015) shall be terminated and the Security Council will have concluded its consideration of the Iranian nuclear issue). See UNSCR 2231, s*upra* note 131, Annex A: JCPOA.

150. See UNSCR 2231, *supra* note 131, paras 5-9.

The JCPOA's nuclear-related measures that were additional to those provided for in Iran's CSA and Additional Protocol included, *inter alia*, a re-design of the heavy water research reactor at Arak and modification of a related fuel fabrication plant at Esfahan, specification of quantities of heavy water at a heavy water production plant, adjustments to its enrichment capacity and verification that Iran was not enriching above 3.67% U-235, agreed limitations on centrifuge research and development, modification of the enrichment plant at Fordow, verification that no uranium enrichment or related research and development was taking place at Fordow, limitations on stocks of enriched uranium to under 300 kg enriched up to 3.67%, and use of on-line enrichment measurement technology.[151] The IAEA provided a report confirming these measures had been implemented on 16 January 2016, which was accordingly the JCPOA Implementation Day.[152]

Upon endorsing the JCPOA, the Security Council in Resolution 2231 requested the Director General of the IAEA to "undertake the necessary verification and monitoring of Iran's nuclear-related commitments for the full duration of those commitments under the JCPOA" and requested the Director General:

> to provide regular updates to the IAEA Board of Governors and, as appropriate, in parallel to the Security Council on Iran's implementation of its commitments under the JCPOA and also to report to the IAEA Board of Governors and in parallel to the Security Council at any time if the Director General has reasonable grounds to believe there is an issue of concern directly affecting fulfilment of JCPOA commitments.[153]

In his first report to the Board of Governors on the JCPOA, the Director General stated that "[s]ubject to the authorization of the Board of Governors, the Director General will implement the necessary verification and monitoring of Iran's nuclear-related commitments as set out in the JCPOA (see para. 8.i) consistent with the Agency's standard safeguards practices."[154] Following that report, on 25 August 2015, the Board of Governors authorised the Director General

> to implement the necessary verification and monitoring of Iran's nuclear-related commitments as set out in the JCPOA, and report accordingly, for the full duration of those commitments in light of Security Council Resolution 2231 (2015), subject to the availability of funds and consistent with the Agency's standard safeguards practices; and authorize the Agency to consult and exchange information with the Joint Commission, as set out in the [Director General's] report.[155]

The IAEA's post-Implementation Day verification and monitoring of Iran's nuclear-related commitments under the JCPOA have included, *inter alia*, activities related to heavy water and reprocessing; activities related to enrichment and fuel; centrifuge research and development, manufacturing and inventory; Iran's enriched uranium stockpile; and transparency measures, including the IAEA's use of on-line enrichment monitors, long-term visas for IAEA inspectors, and monitoring of uranium ore concentrate.[156]

151. See IAEA Doc. GOV/INF/2016/1, *supra* note 143.

152. *Ibid*.

153. UNSCR 2231, *supra* note 131, paras. 3-4.

154. IAEA (2015), "Verification and Monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015), Report by the Director General", IAEA Doc. GOV/2015/53, paras. 4-6.

155. IAEA (2015), "Record of 1412th Meeting", IAEA Doc. GOV/OR.1412, paras. 186-187.

156. See e.g. IAEA (2020), "Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015), Report by the Director General", IAEA Doc. GOV/2020/51.

On 8 May 2018, the United States announced that it would "withdraw from the Iran nuclear deal"[159] although Iran continued to implement its nuclear-related commitments. One year later, on 8 May 2019, Iran announced, *inter alia*, that it had issued an order to stop some of Iran's measures under the JCPOA from that day.[160] Shortly thereafter, Iran started to incrementally scale back the implementation of its nuclear-related commitments under the JCPOA.[161] On 5 January 2020, Iran announced that its nuclear programme would no longer be "subject to any restrictions in the operational sphere", although it stated that it would continue to co-operate with the Agency "as in the past".[162] The IAEA subsequently reported that so far it had not observed any changes "in the level of cooperation by Iran in relation to Agency verification and monitoring activities under the JCPOA."[163]

On 23 February 2021, Iran stopped its "implementation of voluntary transparency measures as envisaged in the JCPOA", including the provisions of the Additional Protocol, modified Code 3.1 of the Subsidiary Arrangements to Iran's Safeguards Agreement, and access pursuant to the provisions of the JCPOA.[164] The IAEA continued to submit regular reports to the Board of Governors, and in parallel to the Security Council on verification and monitoring in Iran in light of Security Council Resolution 2231.[165]

The JCPOA parties and the UN Security Council resolution clearly indicate that the provisions and measures of the JCPOA should not be considered as "precedents for any other state or for fundamental principles of international law and the rights and obligations under the NPT and other relevant instruments, as well as for internationally recognised principles and practices."[166] The Board of Governors specifically affirmed in this context

> that the Agency's verification and monitoring of Iran's nuclear-related commitments as set out in the JCPOA should not be considered as setting a precedent for the IAEA's standard verification practices, and further affirms that it shall not be interpreted so as to conflict with or alter in any way the Agency's right and obligations to verify compliance by States with Safeguards Agreements and where appropriate Additional Protocols and to report to the Board as appropriate.[167]

While the JCPOA was expressly not considered to be a precedent for standard IAEA verification practices, the IAEA Board of Governors' authorisation of verification and monitoring activities under the JCPOA in light of Security Council Resolution 2231 served as a further reinforcement

159. "Remarks by President Trump on the Joint Comprehensive Plan of Action", issued on 8 May 2018, available at: https://trumpwhitehouse.archives.gov/briefings-statements/remarks-president-trump-joint-comprehensive-plan-action/ (accessed 18 Nov. 2021).

160. "Statement by Supreme National Security Council of Iran", available at: https://president.ir/en/109588.

161. See e.g. IAEA (2019), "Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015), Report by the Director General", IAEA Doc. GOV/INF/2019/8 and IAEA (2019), "Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015), Report by the Director General", IAEA Doc. GOV/INF/2019/9.

162. *Ibid*., paras. 4-5 and 39.

163. IAEA (2020), "Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015), Report by the Director General", IAEA Doc. GOV/2020/51, para. 5.

164. IAEA (2021), "Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015), Report by the Director General", IAEA Doc. GOV/2021/10, para. 8.

165. For updates, see relevant reports at: www.iaea.org/newscenter/focus/iran/iaea-and-iran-iaea-reports.

166. UNSCR 2231, *supra* note 131, para. 27 and Annex A, JCPOA, Preamble.

167. IAEA (2015), "Resolution adopted by the Board of Governors on 15 December 2015", IAEA Doc. GOV/2015/72, para. 3.

of the IAEA's authority to undertake activities that are requested of it by the Security Council and/or relevant parties to ensure the exclusively peaceful nature of states' nuclear programmes.

Conclusion

The developments described in this article relate to legal aspects of IAEA practice in two main areas, namely the implementation of safeguards agreements (and protocols thereto) and verification and monitoring activities carried out pursuant to additional authorisation by the Board of Governors following the request of relevant states and/or the UN Security Council.

State-level safeguards have permitted the establishment of a process for optimising a system for safeguards implementation within the framework of relevant legal agreements, namely safeguards agreements and the relevant protocols to those agreements. The IAEA's work in the area of the state-level concept and state-level approaches has permitted the establishment of routine processes that are both adaptive and faithful to the terms of agreements in force for particular states. These processes provide a basis for states and the IAEA to co-operate with maximum flexibility to meet the objectives provided for in safeguards agreements in an effective and efficient manner.

Additionally, the implementation of comprehensive safeguards agreements has on a number of occasions prompted the IAEA Board of Governors to request the Director General to verify the correctness and completeness of state declarations under such agreements. This has in some cases led to requests, from relevant states and/or the UN Security Council, for the IAEA to undertake other nuclear verification and monitoring activities. Such activities, which also serve to build confidence in the exclusively peaceful nature of a state's nuclear programme, are to be differentiated from those which are conducted pursuant to safeguards agreements or protocols thereto.

The IAEA Board of Governors has for nearly three decades established a practice that carrying out such verification and monitoring activities is within the IAEA mandate. Moreover, the Board has been favourable to the idea, reflected in the requests of its member states and requests of the UN Security Council, that the IAEA is the appropriate international organisation for implementing such monitoring and verification activities, particularly given the IAEA's functions outlined in its Statute and the technical questions involved. Drawing on its technical expertise, the IAEA has been able to perform such activities in an independent and impartial manner and even on very short notice. With the JCPOA as a recent example, the IAEA has made an important contribution to multilateral and international negotiations in which the relevant parties can rely upon the services of the IAEA for verification and monitoring of relevant arrangements.

IAEA practice in the past decade in the area of "state-level safeguards", and for nearly three decades in verifying and monitoring activities additional to those provided for in safeguards agreements is a testament to the enduring character of the legal framework for IAEA safeguards in a world in which the demands of providing assurance of the peaceful nature of nuclear activities continue to grow.

Chapter 5

Nuclear third party liability and compensation for nuclear damage and insurance

Liability and compensation for third party damage resulting from a nuclear incident

by Julia A. Schwartz[*]

During the early stages of development of the nuclear industry, the governments of many technologically advanced countries viewed nuclear power as an attractive source of indigenously produced energy that would enable their economies to rapidly expand and prosper. There were, however, a number of major barriers to this development.

First, it was recognised that the peaceful utilisation of nuclear energy would involve risks which, because of their potential magnitude and peculiar characteristics, could lead to far greater damage being suffered in the case of an accident than would normally be the case with conventional industrial activities. In addition, that damage might not manifest itself until many years after the accident that caused it, as might be the case, for example, with radiation-induced cancers. While governments at the time might not have envisaged the types of accidents that occurred at the Chernobyl or Fukushima Daiichi nuclear power plants, they were very much aware that in the case of a serious nuclear incident involving a large scale emission of ionising radiation, there could be widespread and severely detrimental effects to human health, public and private property, the environment, and the economy.

States wanting to promote nuclear energy production were conscious of their responsibility to protect the welfare of their citizens and of the need to ensure adequate financial compensation to persons suffering damage in the event of a nuclear accident. However, it was not only the public that needed protection; fear of financially debilitating liability claims that might be instituted by victims following a nuclear accident was inhibiting investment in the construction of new power plants by potential investors, builders, and suppliers of equipment, services and technology. All were concerned that a liability threat that was potentially unlimited both in time and amount, and for which there was little or no likelihood of obtaining adequate insurance in the normal course of business, could result in their financial ruin. Naturally, under these circumstances they were reluctant to commit to the growth of the industry.

Governments realised that a solution to these conflicting interests was essential; the need to protect the public from the exceptional risks posed by the production of nuclear energy, the economic benefits of a developed nuclear power industry, and the need to protect investors and suppliers from ruinous liability claims all had to be reconciled. It quickly became obvious that the answer lay in removing legal and financial impediments to the industrial development of nuclear energy while at the same time ensuring adequate compensation for any damage that might be suffered by victims in the event of a nuclear accident.

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One major legal obstacle to this development was the application of the ordinary rules of tort law[1] to nuclear incidents. Those rules, while appropriate for activities involving conventional risks, were seen to inhibit rather than facilitate victims from discerning which of the many potential parties involved in a nuclear accident (designers, builders, suppliers, etc.) was legally liable therefor, particularly given the overwhelming technical complexities of such a task. They were also seen to inhibit victims from successfully proving which act or omission of those many possible defendants actually caused the accident.

Doing away with the ordinary rules of tort law opened the door for the imposition of liability and compensation rules that address these conflicting objectives, rules which, when taken together, form a special regime that takes into account the exceptional risks involved in nuclear power production. That regime forms the basis of national nuclear liability law in most nuclear energy producing countries and it has been adopted as the foundation for today's international conventions on civil nuclear liability.

1. Application of a special regime

While there are some slight variations in the way different countries apply this special regime under their national laws, there is general agreement that it should apply only to a "nuclear incident" that occurs at a facility in which highly dangerous nuclear substances are used or kept, where highly dangerous processes involving those nuclear substances are carried out, or during the transport of such nuclear substances. In short, the operator of a nuclear installation will be held liable for injury to or loss of life of any person, and for damage to or loss of any property of any person or other legal entity if it can be proved that such injury, damage or loss was caused by a nuclear incident in that operator's nuclear installation or involving nuclear substances coming from, or going to, that operator's nuclear installation.[2] For the purposes of this article, the term "damage" is used to describe a loss or injury to any person or to any person's property, while the term "damages" is used to describe money that is claimed by, or to be paid to, a person as compensation for the loss or injury that person has suffered.

A "nuclear incident" is generally understood to mean an event that causes damage, provided that either the event or the damage is due to the radioactive properties of nuclear fuel or of radioactive products or waste.[3] Nuclear fuel is fissionable material (i.e. uranium and plutonium in all forms) and radioactive products or waste is essentially any material produced or made radioactive by exposure to the radiation incidental to producing or using nuclear fuel;[4] the event

1. Under the ordinary rules of tort law, claims are based upon an injured party (the "plaintiff") being able to establish that another party (the "defendant") owed a duty of care to the plaintiff, that it breached that duty through carelessness or negligence, and that such breach of duty was the cause of the injury, damage or harm suffered by the plaintiff. The claim may, alternatively, be based upon an intentional act or omission by the defendant. There is no limit upon the amount of damages that may be awarded to a successful plaintiff; a plaintiff may bring a legal action against one or more defendants thereby enlarging the potential pool of funds available to be awarded and finally the plaintiff will usually have the right to bring a legal action in the courts of the country of residence of the plaintiff.

2. There are a few relatively standard exceptions to the operator's liability for loss of or damage to property and these are referred to later on in this article.

3. A precise definition of "nuclear incident" can be found in Article 1(a)(i) of the Convention on Third Party Liability in the Field of Nuclear Energy of 29th July 1960, as amended by the Additional Protocol of 28th January 1964, and by the Protocol of 16th November 1982 and by the Protocol of 12 February 2004, unofficial consolidated text available at: NEA (2017), "Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004", NEA Doc. NEA/NLC/DOC(2017)5/FINAL (Revised Paris Convention).

4. *Ibid*., Articles 1(a)(iii) and (iv) respectively.

or damage may also be due to radiation emitted by any other source inside a nuclear facility. For purposes of this article, the terms "incidents" and "accidents" can be used interchangeably when considering the applicability of a nuclear liability regime.[5]

"Nuclear installations" encompass quite a broad spectrum of activity. They normally include power and research reactors;[6] factories or facilities for the manufacture, processing, storage or disposal of nuclear substances; factories for the separation of isotopes of nuclear fuel; and facilities for the reprocessing of irradiated nuclear fuel.[7]

Activities that do not involve high levels of radioactivity, such as uranium mining or milling or the manufacture and processing of natural or depleted uranium, do not fall within the scope of the special regime; nor do research laboratories in which only very small amounts of fissionable material are kept. Also excluded from the regime are radioisotopes that may be used for any industrial, commercial, agricultural, medical, scientific or educational purpose once they have reached the final stage of fabrication and are outside of a nuclear installation.[8]

2. The basic principles

Five basic principles underlie the special nuclear third party[9] liability and compensation regimes at both national and international levels.

a. Strict liability

The operator of a nuclear installation is strictly liable for damage to third parties resulting from a nuclear incident occurring at its installation or during the course of transport of nuclear substances to or from that installation. Due to the unusual risks associated with the operation of a nuclear installation or the transport of nuclear substances, it was clear that those who carried out those activities should be fully responsible for any injurious consequences therefrom. Strict liability relieves a victim from the burden of proving fault or negligence on the part of the operator, leaving that victim to merely establish a causal link between the nuclear accident itself and the damage that has been suffered.

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5. Under the International Nuclear and Radiological Event Scale (INES), events are rated as "incidents" (levels 1 to 3) or "accidents" (levels 4 to 7). Such distinction does not apply to nuclear liability where "nuclear incident" covers all INES levels that comply with the requisites under the international conventions on civil liability. For more information on the INES scale, see IAEA (n.d.), "INES: The International Nuclear and Radiological Event Scale", www.iaea.org/resources/databases/international-nuclear-and-radiological-event-scale (accessed 22 June 2021).

6. Land-based small modular reactors (SMRs) are generally considered to be included in the definition of "nuclear installation" while reactors comprised in any means of transport are excluded from the special regime. For more information on nuclear liability and SMRs, see NEA (2021) *Small Modular Reactors: Challenges and Opportunities,* OECD Publishing, Paris, pp. 36-37.

7. Revised Paris Convention, *supra* note 3, Article 1(a)(ii).

8. A Recommendation adopted by the NEA Steering Committee for Nuclear Energy in 2018 concerning the definition of "radioisotopes which have reached the final stage of fabrication" is set out in NEA (2020), "Recommendation Concerning the Definition of 'Radioisotopes Which Have Reached the Final Stage of Fabrication' in the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960 as Amended", NEA Doc. NEA/NE(2018)3/FINAL.

9. A "third party" is anyone other than the operator of the nuclear installation at which, or in the case of transport in relation to which, the accident occurs and other than a supplier of goods, services or technology used, or to be used, in connection with that nuclear installation. A third party includes the employees of the operator of that nuclear installation, although such employees may be required under their national legislation to seek redress under a public health insurance, social security, workers' compensation, or other scheme or system relating to occupational accidents or diseases in case of accident or illness.

Since it would be virtually impossible for a victim to have the necessary knowledge of what had taken place in a nuclear installation or in the course of transport when the nuclear incident occurred, strict liability provides a large measure of equity that would not otherwise be available to victims. The concept has been applied in a number of different fields but it is most commonly associated with cases of damage caused by dangerous or defective products, dangerous pets, and ultra-hazardous activities.

b. Exclusive liability (legal channelling)

As already noted, from the very beginning owners and operators of nuclear installations as well as their suppliers of nuclear goods, services and technology were fearful that soaring liability claims in the event of a nuclear incident could ruin their businesses and exhaust their assets. To encourage investment in a burgeoning nuclear business, governments introduced the concept of exclusive liability or "channelling" of all liability for damage suffered by third parties directly to the operator of the nuclear installation at which the incident took place or to or from which nuclear substances were being transported; in other words, the operator of the nuclear installation is the only entity legally liable for such damage regardless of whose act or omission was the actual cause of the incident.[10]

A supplier of defective goods, for example, may not be held liable for nuclear damage caused to third parties even if it has been negligent or at fault, unless it has accepted nuclear liability pursuant to the terms of its supply contract with the operator, in which case the operator would have a right of recourse against that supplier.[11] There are also cases where the operator may have recourse against an individual who has acted with intent to cause damage.[12] Regardless of its right of recourse, the operator remains exclusively liable *vis-à-vis* third party victims.

For victims, channelling liability to the operator obviates the need to identify and pursue all defendants who are potentially responsible for causing the accident. This is a significant benefit when one considers the difficulty victims would face trying to obtain the evidence necessary to establish cause after an accident has occurred. With channelling, victims are able to avoid possibly fruitless and certainly expensive investigations, claims and counterclaims. In addition to rendering victims' claims easier to establish, "channelling" has the effect of sparing non-operator owners and suppliers of goods, services and technology from having to defend complicated and expensive lawsuits or from purchasing costly third party liability insurance which, given the restricted market capacity for such coverage, could result in less coverage being available to respond to operators' needs for the same.

The advantages enjoyed by suppliers and contractors are extended to carriers who are generally not responsible for the packaging or containment of nuclear substances, who do not normally have the specialised knowledge of how to handle them and who would otherwise also be required to purchase special and costly third party liability insurance to cover their exposure. Thus, liability for third party damage will lie with the operator of the nuclear installation that sends the substances, until liability therefor is transferred to the operator of another installation or the latter has taken charge of the shipment.

10. Legal channelling as described here does not exist in the United States, which has a unique system of "economic channelling" that produces much the same end result and which is described later in this article.

11. It is important to note that suppliers may still be liable for non-nuclear damage caused to the operator or third parties under their contractual arrangements or national laws.

12. This would cover, for example, the case of sabotage.

The United States, under the Price-Anderson Act,[13] imposes a system of "economic" rather than "legal" channelling. While "legal" channelling means that all legal liability is channelled to the nuclear operator and to no other entity, "economic" channelling means that any entity may be held legally liable for the damage incurred, but the economic consequences of that liability are channelled to the responsible nuclear operator of the nuclear installation where the accident has occurred. Thus, any person who is held legally liable for compensating damage suffered by a third party will be indemnified by that operator and victims will receive the same compensation as if the "legal channelling" principle applied.

Generally speaking, "channelling" of liability does not affect any rights under public health insurance, social security, workers' compensation or other schemes or systems relating to occupational accidents or diseases under national law. If a victim is compensated or cared for under other legislation, the entity that has expended the funds for such compensation or care may, in certain specified cases, have a right of recourse against the operator.

c. Compulsory financial security

To ensure that funds will actually be available to pay victims' claims for compensation when the time comes, it was believed necessary to require nuclear operators to financially secure their liability. In the vast majority of cases that security is provided by the private insurance market,[14] although it may take other forms, such as bank guarantees, operator pooling systems, self-insurance[15] or even an indemnity provided by the state in which the operator's installation is located where private insurance is simply not available.

Operator pooling schemes, although very different one from the other, are in use in Germany, Japan and the United States. In Germany, operators of nuclear power plants must have financial security of up to EUR 2.5 billion, which is currently provided by two tiers: EUR 255 million by private insurance with the remainder to be provided under a 2001 Solidarity Agreement among the parent companies of nuclear operators. The parties to the Agreement commit to providing operators of nuclear power plants with the necessary financial means to make available coverage up to EUR 2.5 billion. The joint contributions are only due if neither the operator liable nor its parent company can provide the required coverage.[16]

In Japan, following the TEPCO Fukushima Daiichi nuclear power plant accident (the "Fukushima Daiichi accident"), the Japanese government established the Nuclear Damage Compensation and Decommissioning Facilitation Corporation as a means of preparing for future accidents in respect of which compensation payments would exceed the required financial security amount of JPY 120 billion (approximately USD 1.084 billion/EUR 900 million as of 22 June 2021). The operators of nuclear installations situated in Japan must pay an annual contribution to the Corporation based on certain criteria, such as the total electricity generated by each operator's nuclear power plant. Such contributions will constitute the reserves that may be called upon in the future by any nuclear operator in order to compensate victims for nuclear damage beyond JPY 120 billion. There is no requirement upon the operator to repay those funds.[17]

13. Title 42 United States Code Section 2210.

14. Nuclear third party liability insurance is addressed in a comprehensive manner in Reitsma, S.M.S and M.G. Tetley, "Insurance of nuclear risks", *infra*, pp. 445-465.

15. Self-insurance is usually only permitted in respect of nuclear installations that are owned or operated by a state.

16. For more information on the German nuclear liability regime, see Raetzke, C. (2016), "Nuclear third party liability in Germany", *Nuclear Law Bulletin,* No. 97, OECD Publishing, Paris, pp. 9-33. More information about the Solidarity Agreement, including reference details, can be found on p. 26 n. 91, *supra*.

17. For more information on the Japanese nuclear liability regime and the Fukushima Daiichi accident, see NEA (2012), *Japan's Compensation System for Nuclear Damage As Related to the TEPCO Fukushima Daiichi Nuclear Accident*, OECD Publishing, Paris; NEA (2016), *Five Years After the Fukushima Daiichi Accident*, OECD Publishing, Paris; and NEA (2021), *Fukushima Daiichi Nuclear Power Plant Accident: Ten Years On,* OECD Publishing, Paris.

In the United States, licensees of nuclear power plants pay an annual premium for USD 450 million (approximately EUR 370 million as of 22 June 2021) worth of private insurance coverage for each reactor "site" (not each "reactor"). If the damages exceed that amount, each licensee would be assessed a prorated share of the excess up to approximately USD 131 million (approximately EUR 107.5 million as of 22 June 2021) per reactor ("maximum deferred premium"). With 96 reactors currently subject to assessments (as of 30 March 2021), this secondary tier contains about USD 13.66 billion (approximately EUR 11.2 billion as of 22 June 2021). If damages still remain outstanding, operators must pay a surcharge of up to 5% of the maximum deferred premium, and if that is still not sufficient then Congress must determine whether additional relief is required.

Another method of obtaining financial security is the utilisation of mutual insurance companies, such as European Liability Insurance for Nuclear Industry (ELINI) and Nuclear Electric Insurance Limited (NEIL). In this case, the insurance coverage is provided and managed by a separate entity that is owned in common by all of the participating entities, usually nuclear utilities. Historically these mutual insurance companies only provided physical damage insurance but they have become active in the third party liability market although their financial resources are relatively limited, thus affecting the amount of insurance they can provide. A more recent development in the area of financial security is the creation of captive insurance companies that are fully owned by one or a group of companies outside of the insurance industry, usually nuclear operators, but that provide a relatively small proportion of the required financial security given their limited capacity.[18]

The necessity of relying significantly upon the private insurance market means that monetary limits on compensation are imposed. Although the market capacity for nuclear third party liability insurance has expanded considerably since its inception some 60 years ago, it is not unlimited. Governments have therefore historically been careful to impose an amount of financial security that does not exceed the capacity of the private insurance market and for which the premiums would not be beyond the means of operators to pay. Governments have also been generally careful to take into account the private insurance market concerns regarding coverage of particular risks. Some nuclear insurance pools have been reluctant to cover certain risks in full, such as damage to the environment, or even to cover them at all, such as claims for personal injury or loss of life beyond ten years after the nuclear incident. A continuous dialogue between the private insurance market, nuclear operators and concerned governments will hopefully allow for insurance coverage to expand in time to cover all the heads of nuclear damage provided under the 2004 Paris Protocol,[19] the 1997 Vienna Protocol[20] and the CSC.[21]

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18. For a more detailed description of alternate methods of providing financial security, see Reitsma, S.M.S, and M.G. Tetley, "Insurance of Nuclear Risks", *infra*, pp. 445-465.

19. Protocol to Amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004), entered into force 1 Jan. 2022, available at: www.oecd-nea.org/law/paris_convention.pdf (2004 Paris Protocol). A table showing nuclear operators' liability amounts and financial security limits to cover the heads of damage under the 2004 Paris Protocol is available at NEA (2020), "Nuclear Operators Nuclear Liability Amounts Currently Applicable and Following the Entry into Force of the 2004 Protocol", www.oecd-nea.org/jcms/pl_49308/cppc-table-on-nuclear-liability-amounts-currently-applicable-and-following-the-entry-into-force-of-the-2004-protocol-non-official-updated-december-2020 (accessed 22 June 2021).

20. Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997), IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force 4 Oct. 2003 (1997 Vienna Protocol).

21. Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 Apr. 2015 (CSC).

In most jurisdictions, the state in whose territory the operator's installation is situated will govern the terms and conditions applicable to obtaining and maintaining financial security in viable form. Recognising that there are not many nuclear operator clients that require coverage, but that when they do require such coverage the amount is relatively high, domestic insurance companies usually organise themselves into some form of "pool" in order to amass the maximum amount of market capacity. In some cases, national law stipulates that where the financial guarantor fails to provide the required security partially or in full, for example for reasons of insolvency, the state will step in and provide the funds required.[22]

d. Liability limits: amount[23]

Under ordinary tort law rules there is no limit on the amount of compensation payable for damage caused by an accident; the person liable for the damage will have to pay the full amount of any judgment or settlement. However, in many countries wishing to develop, expand or maintain their nuclear industry, relieving operators from the burden of ruinous liability claims is practically a necessity and their national laws therefore impose a limit upon the amount for which an operator may be held liable for third party damage. Since private insurance is by far the method most utilised by operators to financially secure their liability, the limit usually corresponds to the amount of private insurance coverage available on the market for that purpose.

The limit constitutes the operator's total liability for nuclear damage caused to third parties regardless of the amount of damage actually suffered or claimed. Without such a limit, an operator would have to pay from its own assets any compensation awarded in excess of the amount financially secured. This could spell financial ruin for operators and in practice, victims might not receive much more than what was already available under the insurance coverage, especially if the incident resulted in destruction of the nuclear installation itself, one of the operator's major assets if not "the" major asset. This principle is, so to speak, the *quid pro quo* for the benefits to victims of the imposition of strict and exclusive liability upon a nuclear operator.

However, some countries have provided for unlimited liability (e.g. Germany, Japan and Switzerland). With regard to the Fukushima Daiichi accident, even though the operator had unlimited liability, the Japanese government had to provide support in accordance with Section 16 of the Act on Compensation for Nuclear Damage, which generally provides that where nuclear damage occurs in excess of the financial security amount, the government must give the operator such aid as is required for it to compensate the damage and as approved by the National Diet.[24] The Japanese government wanted to ensure that all victims received sufficient compensation promptly, that the supply of electricity was maintained (TEPCO provided power to 35% of the Japanese population and more particularly Tokyo, through a mix of energies that included thermal, hydro and nuclear) and that TEPCO be in charge of stabilising the damaged reactors at the Fukushima Daiichi nuclear power plant. In addition, liquidating TEPCO was not a solution as it would have increased the procedural burden on the victims; the latter would have been ranked equal to other general creditors and secured creditors (such as the ones holding corporate bonds issued by TEPCO) would have been paid in priority; the victims would not have been entitled to

22. This obligation is reflected in most of the international nuclear liability conventions described later in this article.

23. A table on "Nuclear Operators' Third Party Liability Amounts and Financial Security Limits (non-official) (updated October 2020)" is available on the NEA website at: www.oecd-nea.org/jcms/pl_31866/table-on-operator-liability-amounts-and-financial-security-limits-non-official-updated-october-2020 (accessed 22 June 2021).

24. Act on Compensation for Nuclear Damage (Act No. 147 of 1961), as amended by Act No. 19 of 17 Apr. 2009.

submit claims for damage suffered until after the start of the liquidation procedure; and compensation would only have been paid after the conclusion of the liquidation procedure.[25]

e. Liability limits: time

Private insurers have also limited their coverage in time, usually to not more than ten years from the date of the nuclear incident. Insurers (and other financial guarantors for that matter) generally do not wish to maintain reserves against expired or outstanding policies for potentially large amounts of liability over extended periods of time. In addition, insurance companies are well aware of the difficulty they would encounter, for example, in defending claims in respect of radiation-induced cancers that are instituted 20, 25 or 30 years after a nuclear accident has occurred as it would be extremely hard to demonstrate whether the nuclear incident or some other factor(s) actually caused the illness. This principle may also be viewed as a *quid pro quo* for the benefits resulting from the strict and exclusive liability of the operator.

Hence, most countries have historically adopted nuclear liability legislation under which the time for submission of claims is limited to a period of ten years following a nuclear accident.

Nevertheless, as the nuclear industry has grown and matured, and as the private insurance market has continually increased its capacity to support higher liability amounts, there has been a strong desire on the part of both governments and the public to extend the time limit for instituting claims in respect of personal injury or death to 30 years from the date of the nuclear incident. The time limit for instituting claims in respect of property damage or any other permitted form of damage would remain at ten years.[26]

In addition, under the international nuclear liability conventions and in most jurisdictions, there is usually a discovery rule requiring claims to be filed within two or three years of the discovery of the damage and of the identity of the liable nuclear operator.

3. International repercussions

The same states that were encouraging the growth of a new nuclear industry in the 1950s recognised that the repercussions of a nuclear accident might not stop at political or geographical borders. Ensuring adequate compensation to victims in one country who suffer damage as a result of a nuclear incident in a neighbouring country meant that some sort of international arrangement had to be adopted. This was particularly true for Western Europe, where a large proportion of the world's reactors and associated facilities were located or were being constructed. Treaty arrangements between these countries would resolve the complicated questions of which country's courts would be competent to judge nuclear damage claims, which country's laws would apply and how those judgments could be enforced for the benefit of victims.

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25. For more detailed information, see Takahashi, Y., "The Financial Support by the Nuclear Damage Compensation Facilitation Corporation" in NEA (2012), *Japan's Compensation System for Nuclear Damage As Related to the TEPCO Fukushima Daiichi Nuclear Accident*, *supra* note 17, pp. 41-59.

26. The Paris Convention as amended in 1964 and 1982 and the 1963 Vienna Convention (Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977 (Vienna Convention)) both provide for a prescription period of ten years, which was also incorporated into the CSC. The 2004 Paris Protocol and the 1997 Vienna Protocol extended the prescription period to 30 years for personal injury or loss of life, maintaining the ten-year prescription period for all other types of nuclear damage.

Furthermore, the possible magnitude of a nuclear incident required international collaboration between national insurance pools.[27] Only by an effective marshalling of the resources of the international insurance market by co-insurance and re-insurance[28] could sufficient financial security be made available to meet possible compensation claims. The establishment at an international level of uniform third party liability rules was essential if collaboration by insurers at an international level was to be achieved. As a result, third party liability became a subject of discussion within all of the international organisations responsible for the peaceful uses of nuclear energy: the Organisation for European Economic Co-operation (OEEC, later to become the Organisation for Economic Co-operation and Development or OECD), the International Atomic Energy Agency (IAEA) and the European Atomic Energy Community (Euratom).

Harmonising national laws was seen to create legal certainty, to eliminate the possibility of discrimination between victims and to ensure that claimants in states with harmonised legislation would have their actions judged by similar laws, regardless of the location of the accident or the damage. For potential victims, it was extremely important to adopt a common set of rules prescribing cross-border actions, allocating liability for damage arising from the transport of nuclear substances from one country to another and resolving the often complicated questions of which country's courts should have jurisdiction to hear compensation claims and which country's laws should apply to those claims.

Within a few years, two major conventions on civil liability for nuclear damage came into being. In 1960, the Paris Convention on Third Party Liability in the Field of Nuclear Energy[29] was adopted under the auspices of the OEEC by its Western European member countries. However, it was not only this regional group of nations that foresaw the need for an international regime. Just three years later, in 1963, a number of IAEA member states from Central and South America, Africa, Asia Pacific and Eastern Europe adopted a second international instrument, incorporating the same fundamental principles as those set out in the Paris Convention, but intended to have a wider geographic scope: the Vienna Convention on Civil Liability for Nuclear Damage.[30] Both the Paris Convention and the Vienna Convention enable their states parties to achieve their desired objectives at international levels not only because they are founded upon the five basic principles described earlier, but because each international instrument incorporates two additional principles that are designed to address the complexities raised by the transboundary scope of nuclear damage and the institution of cross-border compensation claims.

a. Additional principle #1: Jurisdiction, applicable law, enforcement of judgments

In adopting such international arrangements, the first question to be answered was: which country's courts would have jurisdiction to hear and determine nuclear damage compensation claims in the case of an accident resulting in transboundary damage? To answer this question the Paris Convention and the Vienna Convention both provide that jurisdiction over nuclear damage claims lies only with the courts of the contracting party in whose territory the accident has

27. National nuclear insurance pools normally resort to the international nuclear insurance market to obtain sufficient capacity.

28. "Co-insurance" means that a number of insurers collectively insure a certain risk with the sum of their individual shares totalling 100%. "Re-insurance" is where an insurer or co-insurer cedes part of the risk it has assumed to another insurer for which it pays a premium, essentially insuring the risk which it, itself, has insured.

29. Convention on Third Party Liability in the Field of Nuclear Energy of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1960), 1519 UNTS 329 (Paris Convention).

30. Vienna Convention, *supra* note 26.

occurred,[31] or if the accident occurs in a non-contracting state then jurisdiction lies with the courts of the state where the liable operator's nuclear installation is located. Furthermore, the courts with jurisdiction shall apply the relevant convention and its own national law in determining claims. Finally, judgments rendered by such courts are to be enforceable in all other contracting parties to the same convention.

b. Additional principle # 2: Non-discrimination

Similarly, in order to ensure that the law applicable to the determination of victims' nuclear damage claims is the one most closely associated with the country whose courts have jurisdiction, which is generally the country where the nuclear incident occurred, it was determined that such competent courts should apply the international nuclear liability convention to which its state is a party and its own national law without discrimination on the basis of the nationality, domicile or residence of the victims. Such a provision would not necessarily be found in the domestic legislation of any one particular country.

4. The Paris-Brussels regime

The Paris Convention, as the first nuclear civil liability instrument to be established at an international level, constitutes the "precedent" upon which later nuclear third party liability conventions and many countries' national laws are modelled. At about the time of the adoption of the Vienna Convention in 1963, the Paris Convention states recognised that the liability amount fixed under their own convention would not likely be adequate to cover the damage suffered in the event of a serious nuclear accident. To remedy that deficiency, most of those states adopted an international instrument to supplement the Paris Convention, known as the 1963 Brussels Supplementary Convention[32] under which additional compensation to that provided under the Paris Convention would be made available to victims through the establishment of a three-tier system, the second and third of which would comprise public funding. This convention, which is described briefly below, applies only to incidents occurring within one of its states party and only to damage for which a Paris Convention state operator is liable.

Both the Paris Convention and the Brussels Supplementary Convention were amended in 1964, 1982 and again in 2004. The Paris Convention entered into force in 1968, and the Brussels Supplementary Convention entered into force in 1974. The most recent revision of these instruments, the 2004 Paris Protocol[33] and the 2004 Brussels Protocol[34] each call for a number of significant changes to those conventions, most of which are summarily described later in this article.

31. Both conventions also contain specific provisions determining which courts will have jurisdiction where the place of the accident cannot be determined with certainty or where jurisdiction would lie with the courts of more than one contracting party.

32. Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1963), 1041 UNTS 358 (Brussels Supplementary Convention).

33. 2004 Paris Protocol, *supra* note 19.

34. Protocol to Amend the Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004), entered into force 1 Jan. 2022, available at: www.oecd-nea.org/law/brussels_supplementary_convention.pdf (2004 Brussels Protocol).

a. The Paris Convention[35]

The Paris Convention is an international convention open to all member countries of the OECD by simple accession and to any non-OECD member with the unanimous consent of all Paris Convention parties. At present the Paris Convention is essentially a regional European agreement, with non-European countries not having joined for various reasons, not the least important of which is geographical remoteness from Europe.[36]

In keeping with the premise that this special regime should be limited to risks of an exceptional nature for which tort law rules are not suitable, the term "nuclear incident" is defined in Article 1(a)(i) of the convention as:

> any occurrence or succession of occurrences having the same origin which causes damage, provided that such occurrence or succession of occurrences, or any of the damage caused, arises out of or results either 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 or with any of them, or arising from ionizing radiations emitted by any source of radiation inside a nuclear installation.

Not covered are activities and substances involving a low level of radioactivity bearing only a minor risk that may be covered by the conventional insurance market, such as radiological accidents caused by the use of radioisotopes for industrial, commercial, agricultural, medical, scientific or educational purposes as is set out in Article 1(a)(iv)(2).

Article 1(a)(ii) provides that a "nuclear installation" refers to:

> reactors other than those comprised in any means of transport; factories for the manufacture or processing of nuclear substances; factories for the separation of isotopes of nuclear fuel; factories for the reprocessing of irradiated nuclear fuel; facilities for the storage of nuclear substances other than storage incidental to the carriage of such substances; and such other installations in which there are nuclear fuel or radioactive products or waste as the Steering Committee for Nuclear Energy[37] shall from time to time determine.

35. For a comprehensive explanation of the Paris Convention as amended in 1964 and 1982, see NEA (1982), "Exposé des Motifs", revised text approved by the OECD Council on 16 Nov. 1982, OECD Doc. C/M(82)24(Final), p. 17, para. 8, available at: www.oecd-nea.org/law/nlparis_motif.html.

36. A list of the 16 contracting parties is available on the NEA's website at: NEA (n.d.), "Paris Convention: Latest status of ratifications or accession", www.oecd-nea.org/jcms/pl_31798/paris-convention-latest-status-of-ratifications-or-accession (accessed 22 June 2021).

37. The Steering Committee for Nuclear Energy is the body established pursuant to Article 2 of the "Statute of the OECD Nuclear Energy Agency" to carry out the tasks assigned to the Agency. (The NEA Statute is available at www.oecd-nea.org/upload/docs/application/pdf/2020-07/nea_statute.pdf). The NEA Statute takes the form of a Decision originally adopted by the OEEC Council on 20 December 1957 and subsequently approved by the OECD Council on 30 September 1961. The OECD Council is the organisation's overarching decision-making body, established in accordance with the provisions of the Convention on the Organisation for Economic Co-operation and Development (1960), 888 UNTS 181, entered into force 30 Sept. 1961. At that time, the Agency's members included European countries only, and it was called the European Nuclear Energy Agency. In step with the Agency's growing membership, the Statute was amended by successive decisions of the Council, and the name of the Agency was changed accordingly. Finally, the Statute was modernised by several decisions of the Council, dated respectively 5 April 1978, 10 December 1992 and 13 July 1995.

The NEA Steering Committee supplemented this provision in 1984 with a legally binding "Decision" that installations for the disposal of nuclear substances shall be considered as nuclear installations in their pre-closure phase[38] and again in 1990 with a legally binding "Decision" that the Paris Convention should apply to nuclear installations in the process of decommissioning until certain technical criteria are met, such latter Decision having been updated in 2014.[39] Under the 2004 Paris Protocol, the definition of "nuclear installation" now includes installations for the disposal of nuclear substances and any nuclear installation that is in the course of being decommissioned.

i. Who is liable and under what circumstances?

Under the convention, the "operator" of a nuclear installation is the person recognised or designated as such by the competent public authority (Article 1(a)(vi)). If nuclear substances are in an installation at the time of an accident, the operator of that installation is liable to compensate any third party damage thereby caused (Article 3(a)). If the accident has occurred during the course of transporting nuclear substances, the operator responsible is the sender, until the receiver has assumed responsibility in accordance with the express terms of a written contract or has taken charge of the substances (Article 4(a)(i) and (ii)).

Where nuclear substances are being sent to a person/entity in a state not party to the convention, the sender is liable until the substances are unloaded from the means of transport (Article 4(a)(iv)). Conversely, where substances are being sent from a person/entity in a state not party to the convention to an operator in a state party with the latter's written consent, the latter will be liable from the time the substances are loaded onto the means of transport (Article 4(b)(iv)).

There are, however, a limited number of cases in which the operator is exonerated from liability. Under the convention, the operator is not "liable for damage caused by a nuclear incident directly due to an act of armed conflict, hostilities, civil war [or] insurrection", these circumstances being considered as the responsibility of the state;[40] nor is it liable for damage caused by a nuclear incident due to "a grave natural disaster of an exceptional character" unless the legislation of the installation state[41] provides to the contrary (Article 9). A number of states have taken advantage of this latter exception to hold the operator liable in the case of an accident due to a natural disaster, believing

38. NEA (1984), "Decision of the Steering Committee of 11.4.1984, Definition of 'Nuclear Installation'", NEA Doc. NE/M(84)1, available in NEA (1990), *Paris Convention: Decisions, Recommendations, Interpretations*, OECD Publishing, Paris, p. 6, para. 3. Since the adoption of the Paris Convention, various related decisions, recommendations and interpretations have been adopted by the OECD Council and the Steering Committee for Nuclear Energy. Article 1(a)(ii) and (iii) and (b) of the Paris Convention empowers the Steering Committee to make decisions that are binding on the contracting parties. In addition, the OECD Council and the Steering Committee may adopt recommendations concerning the Paris Convention under Article 5(b) of the OECD Convention and Articles 8(b)(i) and 10(b) of the NEA Statute, respectively; such recommendations are not legally binding. Interpretations are adopted by the Steering Committee to provide clarifications as to the meaning of specific provisions of the Paris Convention to support their implementation; they emerged from the practice as early as 1967 and are not legally binding.

39. NEA (2014), "Decision and Recommendation of the Steering Committee Concerning the Application of the Paris Convention to Nuclear Installations in the Process of being Decommissioned", NEA Doc. NEA/NE(2014)14/REV1, available at: www.oecd-nea.org/jcms/pl_20232/decision-and-recommendation-of-the-steering-committee-concerning-the-application-of-the-paris-convention-to-nuclear-installations-in-the-process-of-being-decommissioned-2014.

40. Note that an operator is not exonerated from liability for damages resulting from a nuclear accident caused by "terrorism" or a "terrorist act".

41. The "installation state" is the contracting party in whose territory the installation of the liable operator is located.

that nuclear operators should foresee the possibility of such events and take the appropriate and necessary precautions. The exclusion in case of a grave natural disaster has been removed by the 2004 Paris Protocol.

Finally, an individual may be held liable for nuclear damage caused by a nuclear incident for which the operator is not liable under the convention, such as, for example, damage to on-site property and that results from that individual's act or omission done with intent to cause damage; an example of which could be sabotage (Article 6(c)(i)(1)).

ii. Who may be compensated?

Generally speaking, the convention does not apply to nuclear incidents occurring in non-contracting states or to damage suffered there, unless the national law of the liable operator's state provides otherwise (Article 2). In 1968, the Steering Committee for Nuclear Energy adopted a legally non-binding "Interpretation" according to which the Paris Convention should be understood to apply to nuclear incidents occurring, and to damage suffered, on the high seas.[42] In 1971, the same Committee adopted a legally non-binding "Recommendation" that the application of the Paris Convention be extended by national legislation to cover damage suffered in a contracting state, even if the nuclear incident causing the damage has occurred in a non-contracting state.[43] Once again, these NEA Steering Committee instruments have been reflected in the 2004 Paris Protocol.

iii. What damage may be compensated?

Under the existing convention, an operator of a nuclear installation is liable only for "damage to or loss of life of any person; and damage to or loss of any property, other than the nuclear installation itself and any other nuclear installation … on the site where that installation is located; and any property on that same site which is used or to be used in connection with any such installation" (Article 3(a)(i) and (ii)(1)-(2)). The extent of the damage so covered is determined by the national law of the country whose courts have jurisdiction to hear and decide upon nuclear damage claims, including any rules relating to the conflict of laws (Article 14). Under the 2004 Paris Protocol, the concept of nuclear damage has been significantly expanded to expressly include many of the heads of damage that were suffered as a result of the Chernobyl accident but which, at that time, were not subject to compensation under either international conventions on civil nuclear liability or national law, such as damage to the environment or economic loss (see 2004 Paris Protocol, Article I(a)(vii)).

"The nature, form and extent of the compensation … as well as the equitable distribution thereof [are] governed by national law." (Article 11) The convention provides that insurance premiums and monetary compensation as well as amounts in respect of interest and costs are to be freely transferable between the parties (Article 12), while judgments are to be enforceable in the territory of any contracting party (Article 13(d)).

42. NEA (1968), "Recommendation of the Steering Committee of 25.4.1968, Territorial Scope", NEA Doc. NE/M(68)1, available in NEA (1990), *Paris Convention: Decisions, Recommendations, Interpretations*, *supra* note 38, p. 9, para. 8.

43. NEA (1971), "Recommendation of the Steering Committee of 22.4.1971, Extension of the Territorial Scope", NEA Doc. NE/M(71)1, available *ibid.*, p. 9, para. 9.

iv. Liability amounts and financial security

Pursuant to the Paris Convention as amended in 1964 and 1982, the maximum liability to be imposed upon a nuclear operator may not be greater than SDR 15 million[44] and not less than SDR 5 million[45] although a country may fix a higher ceiling if financial security for that excess is available (Article 7(b)). A contracting party may also set a lower limit for less dangerous installations or activities, of at least SDR 5 million (Article 7(b)(ii)). However, a Recommendation by the OECD Council in 1982 proposed that where contracting parties do set such a lower limit, they should take steps to make available public funds to satisfy any claim for compensation in excess of that lower amount up to a total of the amount established for nuclear operators generally.[46] If more than one operator is liable, then they are all jointly and severally liable (Article 5(d)). Interest and costs are payable in addition to the liability amount (Article 7(g)).

In 1990, in order to promote harmonisation among the various national laws, the NEA Steering Committee for Nuclear Energy adopted a legally non-binding "Recommendation" that parties raise their liability limits to at least SDR 150 million.[47] In many contracting parties however, the operator's liability is, in fact, far higher than SDR 150 million and in some, such as Germany and Switzerland,[48] it is unlimited.[49]

The convention requires an operator "to have and maintain insurance or other financial security" approved by the installation state for the amount of its liability established in accordance with the convention (Article 10). Although insurance is the most common form of financial security, it is also possible to furnish a bank guarantee, to pledge liquid assets, to establish a mutual insurance company or a captive, to set up an operator pooling scheme or to benefit from a guarantee or other form of indemnity or insurance provided by the state. The state will determine the terms and conditions under which the financial security is to be acquired and maintained. In the case of unlimited liability of the nuclear operator, it will also provide for the amount of financial security to be applicable.

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44. SDR stands for "Special Drawing Rights", which is a unit of account used by the International Monetary Fund (IMF) and is based upon a basket of five weighted currencies. As of 22 June 2021, SDR 1 equals approximately EUR 1.19/USD 1.42. Therefore, SDR 15 million is approximately equal to EUR 17.85 million/USD 21.3 million. All equivalent amounts in EUR and in USD referred to in this article are based upon this exchange rate, which is found at IMF (2021), "SDRs per Currency unit and Currency units per SDR last five days", www.imf.org/external/np/fin/data/rms_five.aspx (accessed 22 June 2021).

45. This amount is approximately equal to EUR 5.9 million/USD 7.1 million.

46. OECD (1982), "Recommendation of the Council with respect to the Paris Convention of 29th July 1960 on Third Party Liability in the Field of Nuclear Energy, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982", available at https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL/0197.

47. NEA (1990), "Recommendation of the Steering Committee of 20.4.90, Raising and Harmonising of Liability Amounts", NEA Doc. NE/M(90)1, available in NEA (1990) *Paris Convention: Decisions, Recommendations, Interpretations*, *supra* note 38, p. 13, para. 15. This amount is approximately equal to EUR 178.5 million/ USD 213 million.

48. Switzerland signed the 1960 Paris Convention, the 1964 Additional Protocol to amend the Paris Convention and the 1982 and 2004 Protocols to amend the Paris Convention. On 9 March 2009, Switzerland deposited its instrument of ratification of the 1960 Paris Convention as amended by the 1964, 1982 and 2004 amending Protocols. This ratification was effective only with respect to the 1960 Paris Convention as amended by all three Protocols; entry into force for Switzerland of the Paris Convention as so amended only took place when the 2004 Protocol to Amend the Paris Convention entered into force.

49. For more information, see NEA (2020), "Nuclear Operators Nuclear Liability Amounts Currently Applicable and Following the Entry into Force of the 2004 Protocol", *supra* note 19.

v. Time limits

Since nuclear third party liability insurance is not generally available for more than ten years, the time limit for making claims was originally ten years from the date of the incident,[50] with a possible exception under national law if measures have been taken by the installation state to secure the liability of the operator for actions instituted during an extended period (Article 8(a)). However, national legislation may provide for a discovery period of at least two years from the date the victim has knowledge, or reasonably should have knowledge, of both the nuclear damage and the operator liable (Article 8(c)).

vi. Jurisdiction and applicable law

The right to compensation may be exercised only against a liable operator or, if provided under national law, against the insurer or other provider of financial security (Article 6(a)). The courts having jurisdiction are those of the contracting party in which the nuclear incident has occurred, except if the place of the incident cannot be determined with certainty or if the incident occurs outside the territory of any party, in which case several special rules apply (Article 13(a), (b) and (c)). This "unity of jurisdiction" principle is essential. Without it, there would be little chance of the operator's liability limit being respected and of victims being treated equally.

In addition, although the existing convention provides for jurisdiction to lie with the courts of the incident state, there is no requirement that only one court have such jurisdiction. To facilitate consistency of decisions and the equitable distribution of compensation, the NEA Steering Committee adopted a legally non-binding "Recommendation" in 1990 that parties designate a single court as the competent court.[51] This Recommendation is a mandatory obligation under the 2004 Paris Protocol.

The courts with jurisdiction to hear and determine claims are required to apply the terms of the convention and their own national law to all matters not specifically covered by the convention (Article 14(b)). In addition, both must be applied without discrimination on the grounds of nationality, domicile or residence (Article 14(a) and (c)).

b. The Brussels Supplementary Convention

The Paris Convention contemplates that its parties may wish to take additional measures outside the ambit of the convention to provide for an increase in the amount of compensation to be granted (Preamble, para. 3). This refers to the provision of public funds to compensate victims when the cumulated claims exceed the compensation amount provided for under the Paris Convention.

50. As will be seen later in this article, the time limits for instituting claims in respect of personal injury or death have been extended to 30 years. The 2004 Paris Protocol contains just such a provision.

51. NEA (1990), "Recommendation of the Steering Committee of 3.10.1990, Single Competent Court", NEA Doc. NE/M(90)2, available in NEA (1990), *Paris Convention: Decisions, Recommendations, Interpretations*, *supra* note 38, p. 15, para. 19.

The Brussels Supplementary Convention currently counts 13 contracting parties, all of whom are, and in fact must be, states parties to the Paris Convention.[52] The convention's scope is limited to damage caused by nuclear incidents, except those occurring entirely in the territory of a non-contracting state, for which an operator would be liable under the Paris Convention and for which the courts of a contracting party would have jurisdiction (Article 2(a)).

The convention establishes a three-tiered compensation system (Article 3(b)). Under the first tier, compensation is provided by the financial security of the nuclear operator under the Paris Convention up to the maximum liability amount imposed by national law (Article 3(b)(i)). The second tier comprises the difference between the first tier and SDR 175 million[53] and is provided by the state in which the nuclear installation of the liable operator is situated (Article 3(b)(ii)). The third tier, if required, falls between SDR 175 million and SDR 300 million[54] and is contributed jointly by all contracting parties according to a formula based upon a party's gross national product (GNP) and the thermal nuclear power capacity of the reactors situated in that state (Articles 3(b)(iii) and 12).[55]

However, some contracting parties require financial security of an amount higher than the first two tiers and the OECD Council issued a Recommendation in 1992 to clarify that the contracting parties shall not invoke Article 3 of the Brussels Supplementary Convention (providing for a call for funds under the 3rd tier) in cases where the amount of insurance or other financial security of the operator is higher than the second tier (SDR 175 million) and that the third tier will be mobilised when the financial security required from the operator is fully exhausted.[56] As will be seen later on, this principle has been significantly modified by the 2004 Brussels Protocol so as not to penalise states that impose high limits of operator financial security.

To implement the convention, parties may provide, either that the operator is liable up to the full SDR 300 million, or that the operator's maximum liability is equal to at least SDR 5 million with the balance between that amount and SDR 300 million being made available as public funds by some means other than as cover for the liability of the operator (Article 3(c)). If there is a nuclear incident in a state party to the Brussels Supplementary Convention from which damage exceeds the operator's liability, that state party would contribute additional funds, up to a maximum of SDR 175 million, and if damage still remained to be compensated, all of the other contracting parties would contribute public funds in accordance with their predetermined share,

52. A list of the 13 contracting parties is available on the NEA's website at: NEA (n.d.), "Brussels Supplementary Convention: Latest status of ratifications or accessions", www.oecd-nea.org/jcms/pl_31514/brussels-supplementary-convention-latest-status-of-ratifications-or-accessions (accessed 22 June 2021). Switzerland signed the Brussels Supplementary Convention, the 1964 Additional Protocol to amend the Brussels Supplementary Convention and the 1982 and 2004 Protocols to amend the Brussels Supplementary Convention. On 11 March 2009, Switzerland deposited its instrument of ratification of the 1963 Brussels Supplementary Convention as amended by the 1964, 1982 and 2004 amending Protocols. As this ratification was effective only with respect to the 1963 Brussels Supplementary Convention as amended by all three Protocols, entry into force for Switzerland of the Brussels Supplementary Convention as so amended only took place when the 2004 Protocol to Amend the Brussels Supplementary Convention entered into force.

53. This amount is approximately equal to EUR 208 million/USD 248.5 million.

54. This amount is approximately equal to EUR 357 million/USD 426 million.

55. As will be seen further on, both the amounts of the three tiers and the method of calculating contributions to the international tier have been significantly modified under the 2004 Brussels Protocol.

56. OECD (1992), "Recommendation of the Council on the Application of the Brussels Supplementary Convention, in the Field of Nuclear Liability", adopted by the Council at its 793rd Session on 26-27 November 1992, OECD Doc. C(92)166/Final, available at https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0272.

up to a maximum of SDR 125 million[57] to total SDR 300 million (Article 3(b)(ii)-(iii)). In calculating the public funds to be made available under the convention, account is to be taken only of claims made within the basic ten-year limitation period (Article 6).

5. The Vienna Convention

In May 1963, member states of the IAEA adopted the Vienna Convention, which came into force in 1977. Unlike the Paris Convention, the Vienna Convention is universal in scope although up to the time of the Chernobyl accident it had attracted only ten adherents, eight of which had no operational nuclear reactors. During the ten years following that accident, however, the number of parties rose considerably, particularly among the states of Central and Eastern Europe.[58]

The Vienna Convention is very similar to the Paris Convention in that it embodies the same seven basic principles that form the foundation of the latter convention. Yet there are also differences between the two conventions. For example, the Vienna Convention stipulates only a minimum liability amount of USD 5 million,[59] permitting a state party to set its own maximum limit or even to set no limit at all (Article V(1)); in addition, the amount of financial security to be provided by the operator is left to the discretion of the contracting party (Article VII(1)). The concept of "nuclear damage" is defined in the Vienna Convention (Article I(1)(k)) and the operator's liability is explicitly stated to be absolute (strict) (Article IV(1)), neither of which is the case for the Paris Convention as amended in 1964 and 1982 (but is so under the 2004 Paris Protocol). Finally, it explicitly requires a state to guarantee payment of compensation in cases where the operators' financial security fails (Article VII(1)), a benefit that is available only under the 2004 Paris Protocol.

6. The 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention[60]

The international nuclear liability regimes established by the Paris Convention and the Vienna Convention retained most of their original features until the late 1980s. Victims in states party to the Paris Convention would receive the benefits available under its provisions if a nuclear incident occurred in a Paris Convention state, supplemented by the additional compensation provided for under the Brussels Supplementary Convention if the victim's state and that of the liable operator were parties to that convention as well. Likewise, victims in states party to the Vienna Convention were entitled to the benefits available under that convention in the event a nuclear incident occurred in one of its contracting parties. Neither the Paris nor Vienna Convention applied to nuclear damage suffered in the territory of a party to the other.

57. This amount is approximately equal to EUR 148.7/USD 177.5.

58. There are currently 43 parties to the Vienna Convention, and a list of parties along with dates of entry into force can be found at IAEA (2020), "Vienna Convention on Civil Liability for Nuclear Damage", https://www-legacy.iaea.org/Publications/Documents/Conventions/liability_status.pdf (accessed 22 June 2021).

59. This amount is defined by reference to its value in gold on 29 April 1963, the date upon which the Vienna Convention was adopted. Vienna Convention, *supra* note 26, Article V(3). That value was USD 35 per one troy ounce of fine gold. *Ibid.* The USD 5 million amount is generally considered to have a value of approximately USD 254 million, based on the current value of gold at USD 1781 per troy ounce (as of 22 June 2021).

60. Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (1988), IAEA Doc. INFCIRC/402, 1672 UNTS 293, entered into force 27 April 1992 (Joint Protocol). For a comprehensive study of the Joint Protocol, see IAEA (2013), *The 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention – Explanatory Text*, IAEA International Law Series No. 5, IAEA Doc. STI/PUB/1593, IAEA, Vienna. As of 22 June 2021, there are 31 parties to the Joint Protocol, and the list of parties can be found at IAEA (2020), "Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention", http://www-legacy.iaea.org/Publications/Documents/Conventions/jointprot_status.pdf.

The 1986 accident at Chernobyl changed all that. The range of damage suffered in that case was far-reaching: loss of life, personal injury and illness including severe psychological stress, property damage, economic loss, damage to the environment and other socio-economic disruptions. In addition, in 1986 there was no special legislation in place in the former Soviet Union (officially the Union of Soviet Socialist Republics) that would have entitled victims in the most severely affected republics (today Belarus, the Russian Federation and Ukraine) to claim compensation for nuclear damage suffered. Nor did there exist an international nuclear liability regime to which the former Soviet Union was party and under which victims in neighbouring countries would have had a right to claim compensation in respect of nuclear damage incurred.

Victims both inside and outside of the Soviet Union were obliged to either fall back on civil law remedies, if any, or the political goodwill of their governments to provide compensation in one form or another. The international nuclear community recognised the need to significantly expand the geographical application of the (then) existing liability regimes and to improve the benefits available thereunder if broader adherence to those regimes was expected to take place.

The Joint Protocol was the first mechanism adopted at the international level to help fulfil these needs. By effectively abolishing the status of non-contracting state between the parties to the Paris Convention and the parties to the Vienna Convention, it permits victims in a party to either of the conventions to obtain compensation for an accident occurring in a party to the other as long as both parties are also bound by the Joint Protocol (Article II).[61] In addition to creating this system of mutual benefits, the Joint Protocol also prevents conflicts of jurisdiction by ensuring that only one convention is applied to any one nuclear accident (Article III(1)).[62] The Joint Protocol equally applies to amended versions of the Paris Convention and the Vienna Convention (Article I).

At the time of the Joint Protocol's adoption, it was believed that a link to the Paris Convention would induce a greater number of countries to join the Vienna Convention, in particular those that had formed part of the former Soviet Union. To some extent this has proved to be true. Some 20 countries from Central and Eastern Europe have ratified or acceded to that convention (as of 22 June 2021); yet only 13 of them have ratified or acceded to the Joint Protocol (as of 22 June 2021), a disappointing development for those that had hoped to link all of Europe with essentially one single nuclear liability and compensation regime.

The international community soon recognised that the Joint Protocol was not enough to redress the liability and compensation problems brought to harsh light by the Chernobyl accident. Reform had to ensure that more compensation would be made available to significantly more victims in respect of a much broader scope of damage. The Joint Protocol could only target the second of these goals, and it could only do so to the extent that Paris Convention and Vienna Convention states were prepared to adhere to it.

61. For example, if a nuclear incident occurs for which an operator in a Paris Convention/Joint Protocol state is liable and damage is suffered by victims in a Vienna Convention/Joint Protocol state, those victims will be able to claim compensation for damage suffered against the liable operator as if they were victims in a Paris Convention state.

62. The exclusive application of only one of the two conventions is accomplished by means of a conflict rule contained in Article III of the Joint Protocol, *supra* note 60.

7. The 1997 Protocol to Amend the Vienna Convention[63]

Revising the Vienna Convention was viewed as a means of better protecting victims and of attracting new members to it, thereby extending the convention's benefits to potentially many more victims of any future accident with transboundary consequences. The following is a short summary of the major features of the 1997 Vienna Protocol.

- More money available

Nuclear operator liability amounts are increased from a USD 5 million minimum to an SDR 300 million minimum (Article V(1)(a)).[64] The operator may provide as little as SDR 150 million but in that case the installation state is obliged to make available an additional amount in order to reach the SDR 300 minimum requirement (Article V(1)(b)). Contracting parties may fix a liability amount as low as SDR 5 million where the nature of the nuclear installation or nuclear substances involved so justifies,[65] but should the nuclear damage incurred exceed that lower amount, the installation state must ensure that public funds are available to make up the difference up to the amount of liability generally required of nuclear operators (Article V(2)).

States are free to impose unlimited liability on their nuclear operators if they wish. Financial security limits must match liability amounts and where unlimited liability is imposed, the financial security requirement for operators is fixed at not less than SDR 300 million (Article VII(1)(a)).

- More victims compensated

The Vienna Convention is generally viewed as only applying to damage suffered within the territory of a contracting party and on or over the high seas. The 1997 Vienna Protocol significantly extends that geographic scope so that the revised convention will apply to nuclear damage wherever suffered,[66] subject to a permitted exclusion for a non-contracting state that has a nuclear installation on its territory and does not provide equivalent reciprocal benefits (Article IA(3)).

In addition, claims for personal injury or death may now be brought within 30 years from the date of the nuclear incident (Article VI(1)(a)(i)) rather than the 10-year period provided for under the Vienna Convention. Equally, if not more importantly, the amended convention establishes the principle that priority is to be given to claims relating to loss of life or personal injury in cases where the total cost of the damage is likely to exceed the amount of money available for compensation (Article VIII(2)).

Another significant amendment now authorises a state to pursue a class action for compensation in the competent court on behalf of all persons who are nationals of or resident in that state and who have agreed to allow the state to bring such an action (Article XIA(a)). The advantage of this provision lies mainly in the fact that it allows persons or entities who have suffered nuclear damage to seek redress or compensation in foreign courts in a more streamlined and cost-efficient manner.

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63. For a comprehensive study of the 1997 Vienna Protocol, see IAEA (2020), *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage – Explanatory Texts*, IAEA International Law Series, No. 3 (Rev. 2), IAEA Doc. STI/PUB/1906, IAEA, Vienna.

64. References in this section are to the consolidated text of the Vienna Convention on Civil Liability for Nuclear Damage of 21 May 1963 as amended by the Protocol of 12 September 1997, the so-called "1997 Vienna Convention on Civil Liability for Nuclear Damage", which is included as an Annex to the 1997 Vienna Protocol, *supra* note 20.

65. Generally, this applies to lower risk activities such as nuclear substance transport or small research laboratories.

66. See 1997 Vienna Protocol, *supra* note 20, Article I(A)(1). Technically, this means damage suffered anywhere in the world, including in non-contracting states.

- More damage compensated

The Vienna Convention covers personal injury (including death), loss of or damage to property, and other damage that may be compensated under the law of the court with jurisdiction to determine nuclear damage claims. Under the 1997 Vienna Protocol, and largely in response to what occurred following the Chernobyl accident, several additional heads of damage are covered, although to what extent will depend on the law of the court with jurisdiction to hear nuclear damage claims. These new heads of damage cover economic loss resulting from personal injury or loss of life or from loss of or damage to property; 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; the cost of preventive measures taken to minimise damage and any further loss or damage suffered as a result of taking those measures; and finally any other economic loss permitted by the general law on civil liability of the court with jurisdiction to hear and determine nuclear damage claims (Article I(1)(k)).

Furthermore, a "nuclear incident" will now include the concept of an occurrence that "creates a grave and imminent threat of causing [nuclear] damage", for the sole and express purpose of permitting compensation to be paid for the costs incurred in taking those preventive measures (Article I(1)(l)).

The 1997 Vienna Protocol does not make explicit mention of installations intended for the disposal of radioactive waste. However, the powers of the Board of Governors of the IAEA to include new types of installations within the scope of the convention, or to exclude them where the risk in question is deemed sufficiently low, have been extended, which will make it easier to adapt the convention to new needs in the future.[67]

- Status

The adoption of the 1997 Vienna Protocol was one of the most significant developments to have taken place in the evolution of nuclear liability law. Yet despite the many years of difficult negotiations required to reach agreement on this instrument, the keen interest it elicited from a broad range of interested states, and the many provisions it contains to encourage and facilitate adherence to it, the 1997 Vienna Protocol has not drawn the wide support originally hoped for or expected. Some 80 states participated in its negotiation and in the Diplomatic Conference that culminated in its adoption. Yet, of the 43 contracting parties to the Vienna Convention, only 15 of them have become parties to the 1997 Vienna Protocol and only 4 of them have any nuclear generating capacity.

For many of the Vienna Convention countries, the minimum liability requirement under the 1997 Vienna Protocol is seen as too steep notwithstanding the multiple benefits of the phasing-in provisions. Others may find that the expanded geographical scope provisions or the extended definition of nuclear damage are so broad as to be politically unacceptable, thus creating challenges for wider adherence.

67. For example, the IAEA Board of Governors adopted a Resolution on 20 November 2014 to exclude from the application of the Vienna Convention and the 1997 Vienna Protocol, certain quantities of nuclear material provided that the required conditions are fulfilled (GOV/2014/63) available at: www.iaea.org/sites/default/files/19/03/gov2014-63.pdf. For further information on this issue, see IAEA (2020), *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage – Explanatory Texts*, *supra*, note 63, pp. 27-28.

8. The 1997 Convention on Supplementary Compensation for Nuclear Damage

During the 1997 Vienna Protocol deliberations, negotiating states decided to establish a mechanism for mobilising supplementary funds to compensate nuclear damage, in addition to the funds to be provided by the operator under either the Paris Convention, the Vienna Convention or the 1997 Vienna Protocol. One of the favoured approaches to this idea was to establish a system of supplementary state funding at both national and international levels in respect of which the Brussels Supplementary Convention proved to be a very useful model.

The result was the adoption, in September 1997, of the Convention on Supplementary Compensation for Nuclear Damage[68] a description of which is set out below. This Convention has the particularity that it combines in a single document the international nuclear liability principles established under the Paris Convention, the Vienna Convention, the 1997 Vienna Protocol and the 2004 Paris Protocol; and a supplementary international fund similar to the one established by the Brussels Supplementary Convention and the 2004 Brussels Protocol.

- More money available

The new convention envisages a first tier of compensation consisting of at least SDR 300 million, which is similar to the new minimum amount required under the 1997 Vienna Protocol, to be provided by the liable nuclear operator, by the installation state or by a combination of the two (Article III(1)(a)(i), Annex Article 4(1)). It is to be distributed on a non-discriminatory basis to victims both inside and outside of the installation state (Article III(2)(a)).

A second tier of compensation consists of an international fund to which all contracting parties will contribute when it appears that the damage to be compensated exceeds the first tier amount (Article III(1)(b)). The size of this tier will be determined by the number and type of states adhering to the convention (Article IV).[69] Half of the fund is to be allocated to victims both inside and outside of the installation state and the other half to transboundary victims only (Article XI(1)(a)-(b)). This 50-50 division is an important innovation in nuclear liability law; the only exception to it is where a contracting party makes available at least SDR 600 million[70] under the first tier, in which case that entire amount is to be distributed as compensation for nuclear damage suffered in and outside the installation state (Article XI(2)).

- More victims compensated

In order to attract as many nuclear power generating states as possible to participate in this new regime, the CSC is specially designed as a free-standing convention, open to any state, whether they are or not already parties to either the Paris Convention, the 1963 Vienna Convention or the 1997 Vienna Protocol. States that are not party to any of those conventions, however, must have national legislation in place that reflects their principles,[71] and where such a

68. For a comprehensive study of the CSC, see IAEA (2020), *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage – Explanatory Texts*, *supra* note 63.

69. The fund is expected to reach approximately SDR 300 million if all major nuclear power generating states join the convention. An online calculator has been developed by the IAEA to run scenarios of actual and possible amounts to be contributed to the international fund established under the CSC. It is available at IAEA (n.d.), "Online calculator – Article IV (Calculation of contributions), www.iaea.org/publications/documents/treaties/convention-supplementary-compensation-nuclear-damage/online-calculator (accessed 22 June 2021).

70. This amount is approximately equal to EUR 714 million/USD 852 million.

71. The relevant requirements are set out in the Annex to the CSC and such states are referred to as the "Annex States".

state has a nuclear installation on its territory it must also be a contracting party to the 1994 Convention on Nuclear Safety.[72] Special provisions (the "grandfather clause") are included in the convention to permit the United States, with its legal system of "economic" rather than "legal" channelling of liability, to participate in the regime.[73]

The scope of application of the convention is determined by reference to the two different compensation tiers: as to the first tier, the law of the installation state determines to what extent nuclear damage suffered in non-contracting states will be covered (Article III(2)(a)); as to the second tier, the convention prohibits its distribution to compensate nuclear damage suffered in non-contracting states (Article V(1)(a)), a restriction which is also found in the Brussels Supplementary Convention and is in keeping with the philosophy that a fund comprising "public" money should be distributed only to victims in states that contribute to that fund.

- More damage compensated

Both "nuclear damage" (Article I(f)) and a "nuclear incident" (Article I(i)) are defined in the same broad fashion as they are under the 1997 Vienna Protocol. These expanded definitions are important in terms of attracting states that have historically viewed the Paris Convention and the Vienna Convention as too narrowly restricting the types of damage for which compensation will be given.

- Status

The CSC was adopted at the same time as the 1997 Vienna Protocol with the intent of attracting as many countries as possible to participate in a global liability and compensation regime, and being the only such regime to which the United States was able to adhere. The entry into force requirements of this convention were strict compared to those of other international nuclear liability instruments. It had to be ratified, accepted or approved by least 5 states with a combined minimum of 400 000 units of installed nuclear capacity,[74] a requirement designed to encourage the participation of "major nuclear power generating states" whose adherence was thought necessary to the global character of the convention.[75]

The convention entered into force on 15 April 2015 and to date, it counts 11 contracting parties (as of 22 June 2021), the latter including such major nuclear power generating states as Canada, India, Japan and the United States. Japan was not a contracting party to any of the international nuclear liability conventions when the Fukushima Daiichi accident occurred, but had nuclear liability legislation in place that reflected all of the basic principles underlying the international nuclear liability conventions, except that it had adopted a regime of unlimited liability on the part of its operators.[76] The accident has not, at the time of writing and to the author's knowledge,

72 Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996 (CNS).

73. More information about the "grandfather clause" is available at IAEA (2020), *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage – Explanatory Texts*, *supra* note 63, pp. 62, 65-66.

74. CSC, *supra* note 21, Article XX(1). The term "installed nuclear capacity", defined in Article I(j) of the CSC, is the total number of megawatts of thermal power authorised by the competent national authority.

75. See IAEA (2020), *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage – Explanatory Texts*, *supra* note 63, p. 77 n. 293.

76. For more information about Japan's compensation regime in place at the time of the Fukushima Daiichi nuclear power plant accident, see Vásquez-Maignan, X. (2012), "The Japanese nuclear liability regime in the context of the international nuclear liability principles" and Nomura, T., T. Hokugo and C. Takenaka (2012), "Japan's nuclear liability system", in NEA, *Japan's Compensation System for Nuclear Damage As Related to the TEPCO Fukushima Daiichi Nuclear Accident*, *supra* note 17, pp. 9-27.

resulted in any transboundary damage caused by the radiation exposure that occurred during that accident, but Japan's compensation scheme demonstrated the effectiveness of the basic principles set forth in the international nuclear liability conventions at the national level. Japan eventually joined the CSC in 2015, allowing the convention to enter into force.

There is still a certain reluctance to join the CSC on the part of a number of nuclear power generating states, whether they are party to the Vienna Convention, the 1997 Vienna Protocol or the Paris Convention, for a variety of reasons. Some consider that the international fund would require parties to the convention to apply similar safety standards, while others have a more "regional" approach considering that nuclear accidents would have a limited area of impact and they are reluctant to provide funds for accidents that would occur in distant parts of the world.

Many of the parties to the Brussels Supplementary Convention, for example, have claimed "it hard to envisage signing two complementary conventions with different mechanisms, allocation rules and beneficiaries".[77] The regime established under the Brussels Supplementary Convention is designed to benefit its contracting parties alone and allowing its third (international) tier to be allocated in satisfaction of an obligation under another supplementary funding regime would only be workable, in practice, if all of the Brussels Supplementary Convention contracting parties were to agree.[78] Under the 2004 Brussels Protocol, Article 14(d) provides that where "all" of its contracting parties have ratified, accepted, approved or acceded to any other such regime, a contracting party to the revised "Brussels regime" may use the funds to be provided under the third tier to satisfy any obligation it may have under such other regime, a provision which clearly contemplated that possibility in respect of the CSC.[79]

However, it is questionable whether the 2004 Brussels Protocol states would be keen to join the CSC unless they could be assured that in the event of a nuclear incident occurring in a 2004 Brussels Protocol state there would be sufficient second tier funds coming from the other CSC states to balance any obligation that the 2004 Brussels Protocol states might have to contribute to the second tier fund under the CSC where a nuclear incident occurs in a CSC state not party to the 2004 Brussels Protocol.

9. The 2004 Protocols to Amend the Paris Convention and the Brussels Supplementary Convention

The Paris Convention states began their revision negotiations in April 1998, less than a year after the adoption of the 1997 Vienna Protocol and the CSC. Approximately two years later, the contracting parties to the Brussels Supplementary Convention decided to revise that convention as well. As with the 1997 Vienna Protocol and the CSC, the 2004 Paris Protocol and the 2004 Brussels Protocol both aim to make more money available to compensate more victims for more damage than ever before. At the same time, the Paris and Brussels Supplementary Convention states conducted their revision work so as to ensure their revised conventions would be aligned with both the new 1997 Vienna Protocol and the new CSC.

77. Dussart Desart, R. (2005), "The reform of the Paris Convention on Third Party Liability in the Field of Nuclear Energy and of the Brussels Supplementary Convention: An overview of the main features of the modernisation of the two Conventions", *Nuclear Law Bulletin,* No. 75, OECD Publishing, Paris, p. 30.

78. *Ibid.*

79. *Ibid.*

a. The 2004 Paris Protocol[80]

- More money available

When the 2004 Paris Protocol enters into force, the nuclear operator's liability amount will increase substantially, from its current "maximum" level of SDR 15 million to a new "minimum" amount of EUR 700 million[81] (Article 7(a)). This is very significant, even if one takes into account the legally non-binding 1990 NEA Steering Committee Recommendation pursuant to which contracting parties were encouraged to raise their operator liability amount to not less than SDR 150 million referred to earlier. While reduced liability amounts for low-risk installations and transport will still be permitted, the revised convention imposes minimum amounts of EUR 70 million for low-risk installations and EUR 80 million for transport activities (Article 7(b)(i)-(ii)). In fixing the liability amount as a minimum, the Revised Paris Convention now clearly allows states to impose unlimited liability upon their nuclear operators. It is interesting to note that a significant number of contracting parties have raised their nuclear liability amounts up to EUR 700 million and beyond before the entry into force of the 2004 Paris Protocol.[82]

Operators will still be required to provide financial security in the amount for which they are liable, but for those subject to unlimited liability, their financial security obligations will be limited to either the full minimum or one of the reduced minimum liability amounts provided under the 2004 Paris Protocol, whichever is applicable (Article 10(a)-(b)). Paris Convention states will also be required to ensure the payment of nuclear damage claims up to EUR 700 million where the operator's financial security is unavailable or insufficient to satisfy such claims, or if the state has opted for a reduced liability amount (Article 10(c)).

- More victims compensated

Under the existing convention, a nuclear incident must occur in the territory of a contracting party and damage must be suffered there before the convention will apply. The 2004 Paris Protocol relaxes that rule considerably. The Revised Paris Convention will also apply to any nuclear damage suffered in a non-contracting state (both territories and maritime zones) if that state is a party to either the Vienna Convention or the 1997 Vienna Protocol and the Joint Protocol, or if it has no nuclear installations, or if it has a nuclear installation and its nuclear liability legislation provides for equivalent reciprocal benefits and is based on Paris Convention principles (Article 2(a)).

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80. Article references in this section will be to the unofficial consolidated text NEA (2017), Paris Convention as amended by the 2004 Protocol, *supra* note 3. For a comprehensive explanation of the 2004 Paris Protocol, see NEA (2020), "Exposé des Motifs of the Paris Convention as amended by the Protocols of 1964, 1982 and 2004", adopted by the Contracting Parties to the Paris Convention on 18 Nov. 2016, NEA Doc. NEA/NLC/DOC(2020)1/FINAL; and NEA (2004), "Explanatory Report by the Representatives of the Contracting Parties on the Revision of the Paris Convention and the Brussels Supplementary Convention", Annex IV to the Final Act of the Conference on the Revision of the Paris Convention and of the Brussels Supplementary Convention, 12 Feb. 2004, available at: www.oecd-nea.org/jcms/pl_20424/final-act-of-the-conference-on-the-revision-of-the-paris-convention-and-of-the-brussels-supplementary-convention.

81. As of 22 June 2021, this amount is approximately equal to USD 833 million or SDR 583 million.

82. Germany adopted a regime of unlimited liability in the mid-1980s despite the Paris Convention's fundamental principle that a nuclear operator's liability is limited in amount. While certain of the Convention's contracting parties disputed the concept of unlimited liability, it was eventually accepted as a *fait accompli*. A number of signatories to the 2004 Paris Protocol have indicated that they will adopt an unlimited liability regime either in whole or in part. For example, Finland has indicated that unlimited liability is provided for in respect of nuclear damage suffered in Finland under its implementing legislation, Sweden has indicated that unlimited liability is provided for in its implementing law and Switzerland already provides for unlimited liability under its national legislation. For more information, see NEA (2020), "Nuclear Operators Nuclear Liability Amounts Currently Applicable and Following the Entry into Force of the 2004 Protocol", *supra* note 19.

In addition, as with the contracting parties to the 1997 Vienna Protocol and the contracting parties to the CSC, the contracting parties to the 2004 Paris Protocol have agreed that the time limit for instituting claims in respect of personal injury or death should be extended to 30 years from the date of the nuclear incident and have so provided for in that Protocol (Article 8(a)(i)). The time limit for instituting claims in respect of property damage or any other permitted form of damage remains at ten years (Article 8(a)(ii)). The discovery period was, however, extended to not less than three years (Article 8(d)).

The 30-year requirement has been, to some degree, a major cause of the delay in the ratification of the 2004 Paris Protocol[83] as governments, operators and insurers attempted to find a measure by which that new period could be financially secured. Such attempts have been successful as the contracting parties have accepted to provide insurance or guarantees to the operators to cover the insurance gap with regard to the 30-year prescription period.

Unlike the 1997 Vienna Protocol, however, no "priority" rule is included in the 2004 Paris Protocol for claims relating to bodily injury or loss of life. Where the compensation is, or is likely to be, insufficient to cover all of the damage suffered, the national law or the competent court will determine whether, and to what degree, priority will be given to claims for loss of life and personal injury (Article 11).[84]

As with the 1997 Vienna Protocol, the 2004 Paris Protocol authorises a state to pursue a class action for compensation in the competent court on behalf of all persons who are nationals of or domiciled or resident in that state and who have agreed to allow the state to bring such an action (Article 13(g)(i)).

- More damage to be compensated

For the first time ever, the Revised Paris Convention will contain a definition of "nuclear damage". The new definition is almost identical to that found in the 1997 Vienna Protocol and the Supplementary Compensation Convention, with specific references to personal injury and loss of life, and loss of or damage to property, economic loss resulting from either of these heads of damage, the cost of measures of reinstatement of a significantly impaired environment, loss of income resulting from that impaired environment and the cost of preventive measures (Article 1(a)(vii)). Measures of reinstatement and preventive measures are defined as in those other two instruments (Article 1(a)(viii)-(ix)). The only major difference is that the 2004 Paris Protocol does not include a reference to other economic loss permitted by the civil liability law of the competent

83. The other major reason that delayed the ratification of the 2004 Paris Protocol is the European Council Decision (Council Decision 2004/294/EC of 8 March 2004 authorising the Member States which are Contracting Parties to the Paris Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy to ratify, in the interest of the European Community, the Protocol amending that Convention, or to accede to it, *Official Journal of the European Union* (OJ) L 97 (1 Apr. 2004), p. 53. That decision requires that those contracting parties to the Paris Convention who are also EU member states deposit their instruments of ratification simultaneously. This decision, however, does not include Denmark (Article 1(3)) or Slovenia, for which a separate decision was adopted by the European Council (Council Decision 2007/727/EC of 8 November 2007 authorising the Republic of Slovenia to ratify, in the interest of the European Community, the Protocol of 12 February 2004 amending the Paris Convention of 29 July 1960 on Third-Party Liability in the Field of Nuclear Energy, OJ L 294 (13 Nov. 2007), p. 23) that required Slovenia deposit its instrument of ratification if possible with the other EU member states parties to the Paris Convention. EU member states signatory to the 2004 Paris Protocol are: Belgium, Denmark, Finland, France, Germany, Greece, Italy, the Netherlands, Portugal, Slovenia, Spain and Sweden. The United Kingdom was a member state of the EU at the time it signed the 2004 Paris Protocol.

84. For more information, see NEA, (2020), "Priority Rules on Compensation for Nuclear Damage in National Legislation" available at www.oecd-nea.org/jcms/pl_31888/table-on-priority-rules-on-compensation-for-nuclear-damage-in-national-legislation-non-official-updated-october-2020?details=true.

court, a head of damage which was thought to be already covered under the other specified categories of damage.[85]

b. The 2004 Brussels Protocol[86]

- More money available

The 2004 Brussels Protocol maintains the existing three-tier compensation system found in the original convention but the amounts of those tiers are increased significantly: the first tier of compensation continues to come from the nuclear operator's financial security and will continue to be distributed in accordance with the 2004 Paris Protocol, but the amount of that tier rises from a minimum of SDR 5 million to not less than EUR 700 million; the second tier will continue to be provided by the installation state, but its cap will be raised from SDR 175 million to EUR 500 million; and the third tier will continue to come from public funds made available by all of the contracting parties, increasing in amount from SDR 125 million to EUR 300 million (Article 3(b)). The total amount of compensation available to victims of a nuclear accident under the revised Paris-Brussels regime therefore rises from SDR 300 million to EUR 1.5 billion.

Another important innovation under this Protocol is that payment of the third tier of compensation will no longer be deferred until after all of the liable operator's required financial security has been utilised where that financial security exceeds the second tier amount (Article 9(c)). The principle reason for this change is to avoid penalising states that impose high limits of operator financial security, limits that would otherwise have to be fully paid before the third tier of compensation under the Revised Brussels Supplementary Convention could be mobilised. It was also deemed more equitable to mobilise the international tier at the same time for all contracting parties.

Following the CSC's example, the formula for calculating contributions to the international tier under the 2004 Brussels Protocol moves from one based equally on gross national product and installed nuclear capacity to one based 35% on gross domestic product and 65% on installed nuclear capacity, thereby taking into account the "polluter pays" principle (Article 12(a)).

The 2004 Brussels Protocol allows for increases in the third tier amount through the adherence of new states, but such adherence does not affect the contributions of the existing parties (Article 12bis).

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85. Excluding this head of damage from the 2004 Paris Protocol means, in relation to the operation of the Joint Protocol, that no liable Paris Convention state operator is obliged to compensate victims for such damage, regardless of whether those victims are in a Paris Convention state or in a 1997 Vienna Protocol/Joint Protocol state. Similarly, no liable Paris Convention state operator would be obliged to compensate such damage under the CSC as the latter would only apply to damage for which the operator is liable under the Paris Convention.

86. Article references in this section are to the unofficial consolidated text NEA (2017), "Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004", NEA Doc. NEA/NLC/DOC(2017)6/FINAL (Revised Brussels Supplementary Convention). For a comprehensive explanation of the 2004 Brussels Protocol, see NEA (2020), "Exposé des Motifs of the Brussels Supplementary Convention as amended by the Protocols of 1964, 1982 and 2004", adopted by the Contracting Parties to the Brussels Supplementary Convention on 23 Dec. 2010, NEA Doc. NEA/NLC/DOC(2017)4/FINAL; and the "Explanatory Report by the Representatives of the Contracting Parties on the Revision of the Paris Convention and the Brussels Supplementary Convention", *supra* note 80.

- More victims compensated

The 2004 Brussels Protocol does not reflect the new geographic scope provisions of the 2004 Paris Protocol, which permit compensation to be paid to victims in certain non-contracting states. Compensation will continue to be made available only to victims in the territory of Brussels Supplementary Convention states, although that territory has been extended to include a contracting party's exclusive economic zone and its continental shelf with respect to exploration or exploitation of natural resources within those areas (Article 2(a)(iii)). The rationale behind this distinction is simply that since the supplementary compensation established by the second and third tiers is essentially "public" money, it should only be used to compensate victims in states that have agreed to participate in that supplementary regime.

- More damage compensated

The 2004 Brussels Protocol is a mechanism by which supplementary funding is distributed in accordance with the provisions of the Paris Convention. It contains no definition of nuclear damage itself, but the funding to be made available under this Protocol will be allocated to the broader range of damage that may be compensated under the 2004 Paris Protocol.

- Status

The 2004 Paris Protocol has been signed by 16 states and the 2004 Brussels Protocol has been signed by 13 of those same states.[87] In order for the 2004 Paris Protocol to enter into force, it had to be ratified, accepted or approved by two-thirds of the contracting parties. In the case of the 2004 Brussels Protocol, it came into force only when all contracting parties ratified, accepted or approved it.

Both protocols entered into force on 1 January 2022. Historically, the Paris and Brussels Supplementary Convention states have always negotiated their conventions and their various amending protocols on the understanding and with the intent that all signatories to the conventions or amending protocols will also ratify them, and will do so as expeditiously as possible. In addition, no country can accede to either convention unless it joins the protocols amending that convention at the same time.[88]

10. The "non-convention" countries and economies

What about the countries that are not yet party to any international nuclear liability convention? According to IAEA figures,[89] there are 444 nuclear power plants in operation of which 84 units, or approximately 19% of the total, are located in countries and economies not currently party to any international nuclear liability convention. Among that 19%, one finds important nuclear power generating countries such as the People's Republic of China (China), Korea and Pakistan. Annex 1 illustrates whether nuclear power generating countries and economies have joined one or more international conventions in the nuclear liability field.

87. Greece, Portugal and Turkey are the only Paris Convention states that are not contracting parties to the Brussels Supplementary Convention.

88. See 2004 Paris Protocol, *supra* note 19, Part II, para. (d) and 2004 Brussels Protocol, *supra* note 34, Part II, para. (d).

89. IAEA, "Power Reactor Information System" data as of 1 July 2021, available at: https://pris.iaea.org/PRIS/home.aspx.

Nevertheless, many of these non-convention countries have already incorporated some, if not all of the fundamental principles contained in these conventions into their national law, thereby making legislative implementation that much easier if and when the time comes for them to join one or more of these instruments. China and Korea both fall into this category, although in the case of China, the nuclear liability principles adopted in the international conventions are not reflected in a national law, but in administrative documents, which raises concerns about their legally binding nature.

The reason for this uncertainty is that while most of the convention principles are to be found in the "1986 Reply of the Council to the Ministry of Nuclear Industry, the National Nuclear Safety Bureau and the State Council Atomic Energy Board in respect of Resolving Third Parties' Nuclear Liability" and in the "2007 Reply to Questions on the Liabilities of Compensation for Damages Resulting from Nuclear Accidents", the Replies themselves do not fit squarely within the Chinese hierarchy of laws and regulations as they are "administrative rules" only; thus their legally binding effect is open to debate even though the Chinese State Council and the Chinese nuclear industry both consider that the 2007 Reply (as supplemented by the 1986 Reply) sets forth binding rules on the subject.[90]

One of the reasons explaining the reluctance of certain countries to join an international nuclear liability regime is that up until recently, "limited liability" has been a foundation block of the existing regimes. These countries see no reason why victims should have their compensation rights so restricted now that the nuclear industry has matured and the liability risks are much better known and managed. In fact, it is obvious to those who follow what might be deemed "trends" in nuclear liability law that this basic principle is being rejected more and more often.

The rejection of the "limited liability" principle has been embraced by both convention and non-convention countries alike. Germany, Japan and Switzerland are good examples of convention states that have rejected the principle and Austria is a good example of a non-convention state with a comprehensive nuclear liability statute in place that calls for the operator's unlimited liability. As noted earlier, the concept of "unlimited liability" is now incorporated into the 2004 Paris Protocol, matching the other international conventions. It must also be remembered that non-convention countries that embrace general tort law principles, whether codified or otherwise, also embrace unlimited liability.

Another reason that may explain the reluctance of certain countries to join an international nuclear liability regime is the idea that the international conventions protect the suppliers of nuclear goods, services and technology. Adherents of this view believe that the industry is now sufficiently developed economically to assume its normal share of nuclear risks and thus the concept of channelling all liability for third party damage to the nuclear operator should also fall by the wayside. However, following the entry into force of the Indian nuclear liability legislation (the Civil Liability for Nuclear Damage Act, 2010[91] and the Civil Liability for Nuclear Damage

90. The State Council's Written Reply Relating to Nuclear Third Party Liability, Guo Han [1986] No. 44; and the Official Reply of the State Council to Questions on the Liabilities of Compensation for Damages Resulting from Nuclear Accidents, Guo Han [2007] No. 64. The English version of these two Guo Han are available at NEA (n.d.), "China: Nuclear legislation", www.oecd-nea.org/jcms/pl_24008/regulatory-and-institutional-framework-for-nuclear-activities-china (accessed 22 June 2021).

91. "The Civil Liability for Nuclear Damage Act, 2010", Act No. 38 of 2010, 21 Sept. 2010 (CLNDA). The Indian government has attempted to clarify issues surrounding supplier liability in the CLNDA through the issuance of two "Frequently Asked Questions": Ministry of External Affairs, Press Release, "Frequently Asked Questions and Answers on Civil Liability for Nuclear Damage Act 2010 and related issues" (8 Feb. 2015), www.mea.gov.in/press-releases.htm?dtl/24766/Frequently_Asked_Questions_and_Answers_on_Civil_Liability_for_Nuclear_Damage_Act_2010_and_related_issues; Department of Atomic Energy (2020), "FAQs Version 2.0 on CLND Act 2010", https://dae.gov.in/writereaddata/CLND_FAQ_v2_2020.pdf (accessed 22 June 2021).

Rules, 2011[92]) discussion on the effect on suppliers' nuclear liability was launched. Even though the international nuclear liability conventions provide that "the operator shall have a right of recourse only […] if and to the extent that it is so provided expressly by contract",[93] the Indian legislation provides that the operator may also have a right of recourse if "the nuclear incident has resulted as a consequence of an act of supplier or his employee, which includes supply of equipment or material with patent or latent defects or sub-standard services".[94]

Concerns about the insurance capacity to cover the numerous suppliers participating in the construction or operation of a nuclear power plant were raised, as well as the negative impact that such insurance request may have on the insurance availability to cover the nuclear operator. One of the benefits of the channelling principle established under the nuclear liability conventions is to concentrate the insurance capacity on the operators, increasing thus the amount of insurance available. Removing the channelling on the operator may put at stake the insurance coverage on which the nuclear liability system is based.

11. A system dependent on the insurance sector

a. Impact of insurance capacity on the determination of nuclear liability amounts

During the negotiations to amend or adopt these various new protocols and conventions, representatives of the nuclear insurance industry made it clear that some of the proposed provisions would be problematic. They noted, in particular, that there may not be sufficient market capacity to insure nuclear operators for the increased liability amounts, at least not in all countries, given that insurance capacity varies from one country to another as a reflection both of national insurance markets and the available amount of re-insurance on the international markets. Their position has evolved over time as insurance capacity has increased, allowing states to impose higher amounts of liability on their nuclear operators.[95]

b. Insurance needs for clear definitions of nuclear damage

In addition, during those negotiations the insurers were particularly concerned with the lack of precise definitions with regard to certain concepts provided under the new heads of damage. For example, "measures of reinstatement of impaired environment" is not defined either in terms of minimum levels of radioactivity or the effects of radioactive contamination. Even where insurers were prepared to provide that coverage, policies would more than likely exclude damage arising from the release of radioactive materials within authorised limits as part of the day-to-day operations of the nuclear installation concerned. Moreover, they expressed serious doubts about the insurability of "preventive measures" for the same reason, that is, the lack of a clear definition of such a term.

At an NEA workshop held in 2019 to address the challenge of defining the "nuclear damage" to be compensated under the international nuclear liability conventions, it was agreed that there is no detailed definition of any of the concepts related to nuclear damage in the conventions, and therefore it is up to the court with jurisdiction to hear nuclear damage claims to interpret them at its own

92. "Civil Liability for Nuclear Damage Rules, 2011", 11 Nov. 2011, *The Gazette of India*, No. 611.

93. See Article 6(f)(ii) of the current and Revised Paris Convention, *supra* notes 3 and 80; Article X(a) of the Vienna Convention, *supra* note 26, (also as amended by the 1997 Vienna Protocol, *supra* note 20); and Article X(a) of the CSC, *supra* note 21.

94. CLNDA, *supra* note 91, Article 17(b).

95. See Annex 2 for a comparison of operator liability amounts under the international nuclear liability conventions.

discretion.[96] It was acknowledged that interpretations might differ, depending on the circumstances of the accident, the convention(s) that will apply (if any), and the particularities of the national legislation and case law of the state whose court is competent to hear those claims. As a result, and to avoid future disputes concerning victims' rights to compensation, states were encouraged, to the extent possible, to provide a detailed definition of each head of damage in their national legislation or at least a framework allowing for such definitions to be established when necessary, in the same manner as Guidelines[97] were issued following the Fukushima Daiichi accident.

c. Insurance concerns with regard to the extended prescription/extinction periods

Finally, the nuclear insurance industry warned that coverage would not likely be available for the full 30-year duration of the extended prescription/extinction periods under the revised conventions in respect of personal injury actions. As has already been noted, one basic reason for this refusal is simply that many cancers resulting from exposures following a nuclear accident are likely to manifest themselves only many years after exposure to ionising radiation. At that point in time, those cancers will most probably be indistinguishable from those suffered naturally by the population. While it may be possible to establish causality in a small number of cases, for the vast majority of cancer victims it will be impossible and the courts might well be more inclined to favour the unfortunate victim's claim that his or her cancer is due to the radiation exposure received during a nuclear incident many years earlier. Also, of course, was the reluctance of insurance companies to retain a long-term liability on their books and the increased likelihood that such liability would not be enforceable due to the winding up, consolidation or insolvency of individual insurers.

During the years since the adoption of the 2004 Paris Protocol and the 2004 Brussels Protocol, the international insurance markets have evolved and with increasing funds becoming available from the private sector, certain nuclear risks become less burdensome than originally believed. In addition, there is increasing competition for nuclear risk business with the result that practically all nuclear risks that were considered uninsurable at the time those Protocols were adopted have now been accepted by the private insurance market, with two possible exceptions: first, liability coverage for environmental impairment may not be available in the required amounts in all countries due to limited experience with this type of risk, and secondly, the 30-year limitation period on personal injury/death claims poses real problems for insurers on the grounds of both causation and increased volatility in the insurance market generally. That latter risk will most likely be covered by some form of state indemnity where the private insurance market simply refuses to cover it, but this remains an evolving issue.

d. On-site property damage and insurance

There remains, in addition, a potential problem with damage to property on the site of the installation that is used or to be used in connection therewith. There is no right to compensation under the international nuclear liability conventions for damage to the nuclear installation itself or to any property on that same site that is used or to be used in connection with any such installation.

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96. The 4th International Workshop on the Indemnification of Damage in the Event of a Nuclear Accident was held on 8-10 October 2019 in Lisbon, Portugal. The workshop proceedings are being finalised at the time of publication.

97. Pursuant to the Japanese "Act on Compensation for Nuclear Damage", a committee of experts known as the Dispute Reconciliation Committee for Nuclear Damage Compensation issued several sets of "Guidelines" beginning as early as April 2011 and extending through December 2014. Their purpose was to define the types of nuclear damage suffered and to assess the appropriate compensation for a given type of damage. Even though such Guidelines are not legally binding upon either TEPCO or the victims, compensation has been paid out according to their terms in a generally uncontested manner.

The purpose of this exclusion is to prevent the financial security maintained by the operator from being used to compensate damage to such property to the detriment of third party victims.

Owners of nuclear installations are obliged to assume the risk of loss of or damage to their own property and they are able to include the cost of this risk in the cost of the installation. Similarly, contractors whose property is on the site of a nuclear installation are obliged to assume the risk of loss or damage thereto, and they too are able to include the cost of this risk in the price of their supply contracts. In both cases, material damage insurance is available from the private sector to cover property damage, machinery breakdown and business interruption.

The conventions, however, are unclear on the question of how to deal with damage to the nuclear installation itself and property on the site of the installation ("on-site property") caused by a nuclear incident. The provisions that channel liability for nuclear damage to the operator are silent on the issue. It is thus not clear whether an operator has a right of action against a negligent supplier of goods, services or technology that has caused damage to the operator's property at its installation.[98]

In this regard, there are two opposing points of view: on the one hand, since the overriding principle of the conventions is to channel liability to the operator, on-site property damage should not be recoverable from any person other than the operator; on the other hand, since the overriding purpose of the conventions is to compensate damage suffered by third parties, on-site property damage should fall outside the conventions' scope and be recoverable under ordinary civil law principles.

The most effective way of solving this problem would be to amend the text of the conventions to make it clear that operators either do, or do not, have any such right, or at least to require contracting parties to include a specific provision, one way or the other, in their national legislation. During the negotiations to adopt the 2004 Paris Protocol, states were asked by representatives of the nuclear industry to adopt the first point of view, claiming that this would lead to legal clarity and certainty, but the contracting parties to the Paris Convention declined to do so. The problem thus remains, especially with the construction of new reactors on sites of existing plants.

12. The way ahead

The post-Chernobyl response of the international nuclear community was comprehensive; modernising two international civil nuclear liability regimes, linking them together and adopting a brand new global one – all in the hope of enhancing the situation of victims of a nuclear accident, wherever they may be found and providing liability protection to the owners and operators of nuclear power plants as well as to their suppliers of goods, services and technology.

Some improvements have already been partially brought about with the entry into force of the 1997 Vienna Protocol and the CSC. Yet there is still much to be done. There needs to be greater adherence to the 1997 Vienna Protocol, to the Joint Protocol linking together the Paris and Vienna regimes and to the CSC. Fortunately, the 2004 Paris Protocol and the 2004 Brussels Protocol entered into force on 1 January 2022. Nuclear power generating countries such as China and Korea should be encouraged to come into the "convention" fold, regardless of which regime(s) they choose to adopt. Finally, it is essential that emerging nuclear power generating countries adopt legally binding laws and regulations in the nuclear liability field that will enable them to join one or more of the existing international regimes.

98. However, the operator may have a right of action based on the terms of its contract with the supplier or under general tort law for non-nuclear property damage.

On the other hand, there will always be countries that are not interested in adhering to any of these conventions for a variety of political and legal reasons. Some governments may simply take the view that the conventions are too regional in scope or that their countries are geographically too remote for them to be of real value. This could well be the case for certain Asian countries that might wish to explore the idea of concluding bilateral or multilateral regional arrangements with their neighbouring countries, be they nuclear power generating or otherwise. Japan's ratification of the CSC may dilute any possible thought of a specific Asian regional convention, but China and Korea are, for the moment at least, outside of any legally binding international convention on civil nuclear liability.

Following the 2011 Fukushima Daiichi accident, the IAEA General Conference endorsed an "Action Plan on Nuclear Safety" to strengthen the global nuclear safety framework.[99] That Plan, among other things, calls upon member states to "work towards establishing a global nuclear liability regime that addresses the concerns of all States that might be affected by a nuclear accident with a view to providing appropriate compensation for nuclear damage" and "to give due consideration to the possibility of joining the international nuclear liability instruments as a step towards achieving such a global regime".[100]

It is not enough to simply establish international liability regimes, however. They will constantly be in need of improvements to take into account burgeoning technological advances, such as small modular reactors, floating nuclear power plants, and transportable micro-reactors that will likely be built at one location and transferred to other specific locations that may be densely populated, to supply electrical energy for very specific purposes. There will also need to be a decision at some point in the future on the application of these international instruments to fusion technology.

The international nuclear liability and compensation instruments are the result of compromise – between states that utilise nuclear energy for peaceful purposes and those that do not, states that impose liability limits on their operators and those that do not, states that implement the principle of legal channelling of liability and those that do not, states that have thousands of units of installed nuclear capacity and those that have relatively few units, states that are primarily concerned with a nuclear accident occurring during the transport of nuclear substances and states that are major transporters of those substances, and finally, states that hold significantly differing opinions as to the manner in which nuclear damage is to be determined.

Whether a nuclear accident affects only the territory of the installation state, as with the Fukushima Daiichi accident, or has transboundary effects, such as with the Chernobyl accident, it is important that victims are adequately and timely compensated. As explained in the NEA's five-year follow-up report from the Fukushima Daiichi accident:

> Broader adherence [to an international nuclear liability regime] would lead to greater harmonisation of national nuclear liability and compensation schemes, and thus promote more similar treatment of victims and operators on a worldwide basis. In addition, greater adherence to any one of the international nuclear liability regimes would result in the extension of treaty relations between states which may be affected

99. IAEA (2011), "Draft IAEA Action Plan on Nuclear Safety", Report by the Director General, IAEA Doc. GOV/2011/59-GC(55)/14, endorsed by the IAEA General Conference in Resolution, "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. No. GC(55)/RES/9 (22 Sept. 2011). In response to the Action Plan, the Director General's International Expert Group on Nuclear Liability, known as INLEX, proposed "Recommendations on how to facilitate achievement of a global nuclear liability regime, as requested by the IAEA Action Plan on Nuclear Safety" that were developed at its May 2012 meeting, available at: www.iaea.org/sites/default/files/17/11/actionplan-nuclear-liability.pdf.

100. *Ibid.*, p. 4.

> by a nuclear accident falling within the scope of that regime.[101] This would, in turn, provide greater certainty both to nuclear industry investors and suppliers as well as to the general public regarding which country's courts have exclusive jurisdiction to hear nuclear damage claims, which country's laws shall apply to the adjudication of such claims and in which countries judgements for compensation may be enforced. In addition, depending on the applicable convention, increased compensation funds may become available to victims through the operation of a supplementary international fund, such as is provided for under the Brussels Supplementary Convention or the CSC.[102]

It is significant that the CSC has now entered into force and has attracted the participation of major nuclear power generating countries such as Canada, India, Japan and the United States. It is also significant that the entry into force of the 2004 Paris Protocol and of the 2004 Brussels Protocol occurred on 1 January 2022.

Both are signs of positive progress but continuing efforts still need to be made in attracting greater adherence to the various international nuclear liability conventions; in particular, by those countries which are considering developing a nuclear power programme for the first time, by those that are considering investing further in nuclear power generation as an important means by which to generate electrical capacity while at the same time reducing greenhouses gas emissions and global warming and by those that view the international nuclear liability conventions as the most effective and efficient manner in which to compensate victims who suffer damage as a result of a nuclear incident. This can best be achieved through international co-operation with strong and committed support from the NEA and the IAEA, both of which are there to encourage and help.

101. This would include both states in whose territory an accident may occur as well as states within whose borders damage may occur.

102. NEA (2016), *Five Years After the Fukushima Daiichi Accident*, *supra* note 17, p. 60. See also NEA (2021), *Fukushima Daiichi Nuclear Power Plant Accident: Ten Years On*, *supra* note 17, p. 41.

Annex 1

Contracting Party Status of World's Nuclear Power Generating Countries

Argentina	VC; RVC; CSC	**Mexico**	VC
Armenia	VC	**Netherlands**	PC; BSC; JP; RPC; RBSC
Belarus	VC; RVC	**Pakistan**	*None*
Belgium	PC; BSC; RPC. RBSC	**Romania**	VC; RVC; JP; CSC
Brazil	VC	**Russia**	VC
Bulgaria	VC; JP	**Slovak Republic**	VC; JP
Canada	CSC	**Slovenia**	PC; BSC; JP; RPC; RBSC
China (People's Republic of)	*None*	**South Africa**	*None*
Czech Republic	VC; JP	**Spain**	PC; BSC; RPC; RBSC
Finland	PC; BSC; JP; RPC; RBSC	**Sweden**	PC; BSC; JP; RPC; RBSC
France	PC; BSC; JP; RPC; RBSC	**Switzerland**	PC; BSC; JP; RPC; RBSC
Germany	PC; BSC; JP RPC; RBSC	**Chinese Taipei**	*None*
Hungary	VC; JP	**Ukraine**	VC; JP
India	CSC	**United Arab Emirates**	RVC; JP; CSC
Iran	*None*	**United Kingdom**	PC; BSC; RPC; RBSC
Japan	CSC	**United States**	CSC
Korea	*None*		

- PC: 1960 Paris Convention on Nuclear Third Party Liability
- RPC: Paris Convention as revised by the 2004 Protocol to Amend the Paris Convention
- BSC: 1963 Brussels Supplementary Convention
- RBSC: Brussels Supplementary Convention as revised by the 2004 Protocol to amend the Brussels Supplementary Convention
- VC: 1963 Vienna Convention on Civil Liability for Nuclear Damage
- RVC: 1963 Vienna Convention as revised by the 1997 Protocol to Amend the Vienna Convention
- JP: Joint Protocol relating to the Application of the Vienna Convention and the Paris Convention
- CSC: Convention on Supplementary Compensation for Nuclear Damage

Annex 2

Operator Liability Amounts under the International Nuclear Liability Conventions

Regimes Under OECD Auspices	
1960 Paris Convention	
Maximum liability amount	SDR 15 million
1990 NEA minimum "recommended" limit[103]	SDR 150 million
Minimum liability amount	SDR 5 million
Revised Paris Convention (as amended by the 2004 Protocol)	
Maximum liability amount	None
Minimum amount	EUR 700 million
Reduced minimum liability amounts[104]	
Low-risk installation	EUR 70 million
Transport	EUR 80 million
1963 Brussels Supplementary Convention	
First tier (operator, as under the Paris Convention)	maximum SDR 15 million (recommended SDR 150 million)
Second tier (installation state)	first tier up to SDR 175 million
Third tier (all Brussels Supplementary Convention states)	SDR 125 million [difference between SDR 175 million and SDR 300 million]
TOTAL amount available under 1960 Paris and 1963 Brussels Supplementary Conventions combined	**minimum SDR 300 million**
Revised Brussels Supplementary Convention (as amended by the 2004 Protocol)	
First tier (operator, as under the Paris Convention)	minimum EUR 700 million
Second tier (installation state)	first tier up to EUR 1.2 billion
Third tier (all Brussels Supplementary Convention states)	EUR 300 million [difference between EUR 1.2 billion and EUR 1.5 billion]
TOTAL amount available under the Revised Paris and Brussels Supplementary Conventions combined	**minimum EUR 1.5 billion**

103. NEA (1990), *Paris Convention: Decisions, Recommendations, Interpretations*, *supra* note 38, p. 13, para. 15.

104. State guarantees up to the liability amount specified for operators of nuclear installations generally.

Regimes Under IAEA Auspices	
1963 Vienna Convention	
Maximum liability amount	None
Minimum liability amount	
Gold value of USD 35/oz. at 29 Apr. 1963	USD 5 million
Gold value of USD 1781/oz. at 22 June 2021	USD 254 million
1997 Vienna Protocol	
Maximum liability amount	None
Minimum amount	SDR 300 million
Reduced minimum liability amounts[105]	
Low-risk activities	SDR 5 million
1997 Convention on Supplementary Compensation (CSC)	
First tier (operator or operator and installation state)	minimum SDR 300 million
Reduced minimum liability limit	
Low-risk activities	SDR 5 million
Second tier (all CSC states)	SDR 103 million (as of 22 June 2021); SDR 300 million (estimated) if all major nuclear power generating states join
TOTAL amount available under the CSC	**SDR 403 million (as of 22 June 2021);** **SDR 600 million (estimated) if all major nuclear power generating states join**

105. State guarantees up to SDR 300 million.

Insurance of nuclear risks

by Sebastiaan M.S. Reitsma and Mark G. Tetley[*]

Insurance is an essential lubricant in the machine of private commerce and its role in the development of both the civil nuclear industry and its legal arrangements has been critical. As the 2004 Protocol to Amend the Paris Convention[1] just entered into force, the insurance market is once again poised to provide greater financial certainty for those building, financing, operating and co-existing with a new generation of nuclear facilities.

Insurance is all about rectifying the financial *status quo* following an accident, whether it is helping victims of a severe nuclear accident or simply providing the funds to repair a motor vehicle accidentally damaged. The most important feature of insurance is the ability to call on the balance sheet of an unaffected entity once an accident has occurred. This transfer of financial risk to a specialist third party whose sole objective is to handle claims and compensate for loss – the insurance company – ensures that both the buyer of insurance and, just as important, those the insurance buyer is liable to are assured of swift compensation.

This article examines the close relationship between the development of the civil nuclear industry, its insurance arrangements and how the insurers assisted with the creation of the nuclear liability regimes that exist today. First, however, it is important to understand a few basic principles of insurance and to look at some history.

I. What is insurance?

Insurance is a precaution against a possible unwanted outcome; thus, both in life and in business, it is a way of managing risk. Almost everyone uses insurance to protect against the possibility of financial loss. When we buy an insurance policy, we transfer our financial risk to someone else in exchange for a payment or premium; then, if we suffer a loss, the insurance reinstates all or part of our financial loss. Without insurance, we could not run businesses or drive cars, own homes or operate nuclear power stations because the potential risk of financial loss would be too great. Insurance gives the peace of mind and security needed to lead our lives.

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1. Protocol to Amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004), entered into force 1 Jan. 2022, available at: www.oecd-nea.org/law/paris_convention.pdf (2004 Paris Protocol).

There are several key principles that form the basis for most contracts of insurance. It is important to understand these and several other concepts of insurance before looking at the application of insurance to nuclear liability.

- ***Uberrimae Fidei*** **or utmost good faith:** all known material facts about the risks to be assumed by the insurer must be disclosed prior to the insurance being taken out. If a claim occurs and it is discovered that some of the key facts relating to the subject insured were not disclosed, the policy can be cancelled. However, legislation only requires those facts that a reasonable person would be expected to know to be disclosed.
- **Insurable interest:** it is generally not possible for someone to insure something that is not theirs; it would indeed seem strange to insure someone else's house or car. This interest in whatever is to be insured is called insurable interest and is an essential part of any contract, so that the "owner" of something stands to lose financially if it is damaged.
- **Fortuity:** whatever accident that befalls the thing insured must be fortuitous, which is why insurers refuse life insurance to those knowingly suffering terminal diseases because their death is a certainty in the short term.
- **Indemnity:** indemnity means that a financial amount is actually payable to the person who is the beneficiary of the insurance.
- **Subrogation:** if a claim occurs under the policy of insurance, subrogation allows the insurer to assume the rights of any recovery once that claim is paid. The insurer can step into the shoes of the person who made the claim and perhaps pursue some other party who may have been responsible for causing the loss. Any recovery will be due back to the insurers.

II. Nuclear insurance history

Radiation exposure was known to be damaging to the skin as early as the late 19th century, following Röntgen's discovery of X-rays. This knowledge spurred the development of safety standards that resulted in the foundation of the International Commission on Radiological Protection (ICRP) in 1928; this body survives to this day and has contributed significantly to the development of acceptable levels of radiation for those involved in the nuclear industry. However, prior to and during the Second World War, government scientists in several countries turned away from developing peaceful uses for nuclear energy and focused on the development of nuclear weapons; consequently, much of the nuclear sector's development during this period took place in the hands of the state.

After the Second World War, although governments in nuclear countries maintained their involvement in nuclear technology, the desire to see industrial use of nuclear energy meant that increasing private sector involvement was inevitable. In the United Kingdom, during the early 1950s work commenced on what was to become the world's first commercial nuclear power station. The government of the time set up a statutory corporation that was intended to take nuclear power production out of government hands. Elsewhere, the recognition of the impact of the commercial development of nuclear energy on the private sector was also becoming clear, especially in the United States and Western Europe. For most countries, this required consideration of liability and statutory controls of radiation exposure to workers.

Meanwhile, insurers had been aware of the risks posed by radiation since the 1920s, when radioisotopes and X-rays began to be used in industrial processes; the risks associated were viewed generally without concern, as the scale of application was small. It was not until the nuclear bombs were dropped on Hiroshima and Nagasaki and the post-war nuclear weapon tests of the late 1940s that insurers' eyes were opened to the wider implications of nuclear explosions. In several European countries, insurance markets began to concentrate on what a nuclear explosion could mean to insurers despite some in the scientific community playing down the possible outcomes of a nuclear accident. Some markets unilaterally began to exclude "radioactive contamination" from homeowner insurance policies and by 1950, several European countries had such exclusions. However, these exclusions did not catch on everywhere and it was only in 1953, when an article in the *Economist* magazine considered the possibility of private sector involvement in the nuclear industry on both sides of the Atlantic, that nuclear power became more of a concern for insurers.[2] In particular in the United States and the United Kingdom, it was becoming clear that insurers were going to have to consider providing insurance to the nuclear industry if nuclear power was to be developed commercially. In the United States, the United Kingdom and other countries, insurance trade associations began to form committees to consider the risks with the preliminary conclusions being that radioactive contamination should be excluded from general insurance policies, that the insurance associations should manage special underwriting entities to accept these risks and that liability and compensation should be limited. However, there was still no definitive study on the risks posed by nuclear power generation and how insurers should deal with these risks.

In 1957, a committee of insurers in the United Kingdom prepared such a report that analysed the insurance requirements and problems associated with nuclear power,[3] which was still well before any of the nuclear third party liability conventions existed. Notwithstanding the peaceful use of radioactivity, it was recognised at this early stage that a catastrophic loss could occur causing the release of radioactive material into the atmosphere, as well as nuclear damage to the site and its surrounding area. Even today, many of the conclusions reached by insurers are still highly relevant. The catastrophic potential of any nuclear accident was noted and this meant that from the earliest stages of the nuclear industry's development, the insurance market was heavily involved in the parallel creation of legislation and insurance policies. Ever since, insurers have remained an essential party to the development of the nuclear industry and the nuclear third party liability regimes.

With insurers playing such a key role in the early days of the nuclear industry's development, the insurance industry itself had to design and implement structures and processes to deal with the new hazard, the most important of these being the insurance pool.

III. Insurance pools

To calculate the premium accurately, the insurer needs to know how many of the covered risks are likely to be exposed to loss. This may not just be the consequences of loss at a single location, it may also be an accumulation of losses arising from the same consequence through the aggregation of multiple policies. Insurance contracts can be concluded to cover the perils involved in all kinds of occurrences. Frequently insured perils are, among others, loss of life, fire, storm, theft, transport and various liabilities, inclusive of nuclear liability. For the latter a special vehicle is used – an insurance pool.

A pool is essentially a group of insurance companies jointly participating up to a fixed proportion in the insurance of a particular risk or class of business. This is known as "co-insurance", which is where several insurers collectively insure a certain risk, the sum of their individual shares equalling 100%. An associated term is "re-insurance", which is where an insurer or a co-insurer might decide to only keep a percentage of the risk for their own account and cede the remaining percentage to one or more other insurers, called re-insurers, for which a certain premium is paid; basically the insurer itself takes out insurance for part of the assumed risk.

2. "Franchise for Atomic Energy", *The Economist*, Vol. 169, 14 Nov. 1953, pp. 505-508.

3. British Insurance (Atomic Energy) Committee (BI(AE)C) (1957), "Report of the Advisory Committee".

Before going into the concept of nuclear insurance in a more detailed fashion, this article will address the reason why nuclear insurance pools were established in the first place. With the knowledge that radiation resulting from a nuclear accident could cause widespread damage, insurance markets all over the world decided to protect their solvency by the exclusion of radioactive contamination from those classes of business where the risk of such exposure was considered uninsurable. However, to provide for alternative cover to the nuclear industry, in many countries insurers agreed to co-operate for this particular risk by forming pools.

Pools are usually formed for a number of reasons: first, when the consequences of the hazards concerned are unknown but the number of risks is low, the development of specific know-how at individual insurance companies would be too costly. Therefore, it makes sense to build up jointly the knowledge needed to estimate the insurance exposure involved. The pooling mechanism is also employed where the risk in question requires an amount of insurance that could not possibly be provided by the individual means of a single insurer. Furthermore, it is applied where the risk presents some particularly hazardous aspect that would render acceptance by conventional methods difficult if not impossible. All these characteristics are problems underlying the insurance of nuclear risks. It is therefore clear that the pooling mechanism has proven to be a suitable arrangement to serve the cover requirements of this particularly sensitive industrial sector.

A. Pools' modes of operation

The operation of nuclear insurance pools varies depending on their constitutions and procedures, reflecting the various legal, economic and market conditions and practices in their domestic territory. In some countries, for instance, individual pool members have decided to abstain from direct acceptance of nuclear risks and leave it to a third party to act, in effect, as their joint agent. In other countries, a member company may be empowered to accept nuclear business, within clearly defined parameters, on behalf of all members of the pool.

Furthermore, some pools were formed merely to provide capacity to enhance the worldwide market by the re-insurance of nuclear risks in other territories. These pools could generally be found in countries not operating commercial nuclear power stations themselves. Others prefer to limit their activities to the insurance of their national nuclear installations, relying on re-insurance support from foreign pools without themselves offering re-insurance capacity to other pools. The constitutions of yet another group of pools prevent them from taking re-insurance from other pools; in these cases, national risks are co-insured with a limited number of other pools, which in turn buy re-insurance from the international pool market. However, the majority of the 31 nuclear insurance pools operating worldwide today have been formed both to insure nuclear risks in their national markets and at the same time to provide re-insurance cover to their counterparts in other countries.

B. Fundamental principles of pools

Despite the differences in their modes of operation, nuclear insurance pools operate based on several fundamental principles that are common to all of them. One principle is that the pools deploy the maximum insurance capacity for nuclear risks on a market-wide basis. All, or at least the majority, of the non-life insurance companies of a national insurance market can participate in the domestic pool. Apart from this, the nuclear pooling mechanism provides maximum security to insured parties through controlled membership and the security implied in a spread of risk through a worldwide commitment of pool members. Moreover, with some incidental exceptions, each pool's security is enhanced by the automatic acceptance of a defaulting pool member's exposure by the remaining pool members.

A key objective that permits the concentration of nuclear risks in a pool is to ensure that all pool members only commit for a net retention, which means no recourse to individual company re-insurance protection is permitted. Instead re-insurance is arranged with the other nuclear pools throughout the world. Through this mechanism, insurers participating in national pools can be certain that their commitment is limited to the amount of their participation in the pool and that, following the same nuclear incident, no accumulation of loss exposure via other channels can occur.

These principles have allowed a greater commitment of individual pool members to nuclear risks than would be the case if they felt a substantial uncertainty as regards their own exposure following a significant loss. Moreover, the pooling mechanism has induced many individual pool members to make a greater commitment to nuclear insurance than they normally make in respect of other first-class industrial risks. Furthermore, the pooling mechanism enables an efficient claims regulation on a scale that no doubt will be unprecedented in the case of a nuclear catastrophe; in some cases, even governments have entered into claims settlements agreements with pools. These enable them to utilise the pools' claims regulation organisation for claims settlements pertaining to government guarantees in addition to insurance covers.

The pooling mechanism has also delivered cost efficiency, both at a national and an international level. Nationally, the concentration of knowledge and experience in the field of insurance of nuclear business in one body has, of course, lead to an economy of costs. At the international level, re-insurance between national markets is conducted on a direct basis where there is no intervention of intermediaries. Within the international pooling mechanism, both the relevant re-insurance market and the insurance products are well known and easily accessible. Apart from providing a forum for the rapid interchange of professional information, this obviates the intervention of brokers (intermediaries between the insured and the insurer) and facilitates the rapid deployment of the maximum available secure capacity worldwide; as a result, expenses are kept to a minimum.

C. Pools' subject of insurance

It has been explained already that several fundamental principles are common to nuclear insurance pools in all countries, and that these do not preclude pools throughout the world from adopting different modes of operation. An example of operational differences between pools relates to the subject of insurance cover which they provide. Most of them do not, for instance, insure radioisotopes or nuclides used for industrial, agricultural and medical purposes. They argue that it is not necessary to insure the risk in the pooling system as it cannot entail an unforeseeable catastrophe; a few, however, do include such risks on the grounds that all nuclear risks, however insignificant, should be treated in the same way.

Contrary to this, cover for nuclear power stations is offered by all pools without exception and almost all pools insure uranium conversion facilities, fuel manufacturing factories, reprocessing facilities and facilities for the storage of nuclear waste. Although it is sometimes argued that catastrophic accidents at nuclear installations other than nuclear power stations can hardly happen, serious accidents can and have occurred; examples include an accident at a Japanese uranium conversion facility that occurred at the end of 1999 and an explosion at a French nuclear waste site in 2011. Thus, including guarantees for transports of nuclear substances between nuclear installations, nuclear insurance responds to the full definition of a nuclear installation in the international liability conventions.

D. Alternatives to pools

Although the conventions oblige the operator to have and maintain private insurance cover or some other form of financial security, as was noted initially only the private insurance industry was prepared to provide financial protection at an affordable price using nuclear pools. However, in recent decades insurers, operators and governments have investigated and established alternative forms of financial security in addition to the established network of nuclear pools. The private sector alternatives fall mainly into three categories:

- **Risk retention:** As the sector has matured, individual operators of nuclear installations in a few countries have developed their own insurance entities to finance retained losses. Such structures are called captive insurance companies. As their financial capacity is relatively small, in practice they operate in parallel to other risk finance techniques and can only provide limited, specific insurance coverage.

  More widespread is the use of mutual insurance companies, which various nuclear industry-owned groups have developed since the late 1970s. The concept of mutual insurance has existed since the 19th century and mutual insurance entities are well suited to a homogeneous sector of economic activity, such as the nuclear industry. The insurance cover provided is underwritten and managed by an entity owned mutually by the participating nuclear utilities themselves. These entities seek limited re-insurance in the conventional insurance market to underpin and enhance their insurance capacity. Initially, they only provided physical damage insurance, but in recent years their scope has expanded to include nuclear third party liability insurance. With limited financial resources and access to only restricted re-insurance capacity, the amount of insurance mutual insurance companies can offer for nuclear third party liability is limited, both in amount and the number of losses payable. These shortcomings have prevented the mutual insurers from fully satisfying the obligations imposed by the liability conventions on operators, where effective financial security is required for each site at all times; however, mutual insurers now participate in nuclear liability insurance alongside the nuclear pools.
- **Risk transfer:** Within the last decade further competition for the nuclear pools has come from within the risk transfer market. Some insurance companies prefer to operate outside of the nuclear pooling system and offer competing insurance cover individually. A new managing general agent[4] that operates independently of the nuclear insurance pools and mutual insurance companies has also entered the nuclear insurance market, offering capacity in a number of countries for both physical damage and third party liability insurance. A key differentiator between this new entity and the pools is that it is not established on a national basis but can operate internationally where it is licensed; it also now can offer limited capacity for the full scope of cover demanded by the revisions to the nuclear liability conventions.
- **Other financial instruments:** the nuclear industry itself has sought other financial instruments as a means of fulfilling its liability obligations, often with the use of capital markets. Only in recent years have the capital markets become involved in a limited way to provide nuclear insurance; the potential volatility and length of exposure of nuclear third party liability remain challenging for the capital markets and their risk appetite has not been sufficiently whetted. However, as the nuclear sector matures, further development of new nuclear insurance capacity from the capital markets is likely.

One key advantage that the above-mentioned industry-owned risk retention vehicles have is that they can accept the full scope of an operator's legal obligations since they are generally owned by the utility itself. A limited number of the latest liability obligations are difficult for many risk

4. A managing general agent (MGA) is the generic term for an insurance entity that is permitted to insure a specific type or class of insurance on behalf of a group of insurers. Pools are MGAs as they insure with delegated authority from their participating members. MGAs offer insurers access to specialist or niche sectors of insurance without having to invest in the necessary expertise individually.

transfer insurers to accept as the focus is on maintaining solvency, not generating electricity. However, one should also recognise that if the operator of a nuclear power installation had retained the risk itself (so-called self or – in case of several operators collectively retaining their risks – mutual insurance), following a catastrophic loss its share price could fall, the sector share values could fall and its assets as well as its credit rating may be materially compromised. It also may not be in a strong enough position to handle independently claims from third party victims, let alone fund them. The substantial claims settlement infrastructure of the insurance industry, with its independent attitude, is also of benefit to the victims of nuclear accidents. Generally speaking, so far operators largely seem to share the above opinion as self and mutual insurance of the statutory liability has remained limited.

Overall, and particularly for nuclear third party liability cover, risk transfer-based insurance has hitherto provided the most affordable method open to operators to meet their obligations. In 2019, approximately 17% of the worldwide nuclear third party insurance capacity was provided by the new MGA and mutual insurance companies, with the remaining 83% provided by the nuclear insurance pools.

IV. Nuclear third party liability insurance and risk

A. Types of insurance

There are two major types of insurance relevant to the nuclear sector: first, a physical damage policy will cover all the operator’s assets on the nuclear facility against various types of actual damage and in some cases loss of operating income that may result. This article is primarily concerned with the second type of insurance, which is the nuclear third party liability policy. The liability insurance covers all aspects of off-site nuclear damage suffered by people, businesses and other property off the nuclear site that arises because of nuclear damage originating from the insured nuclear facility. The extent of off-site nuclear damage will depend upon many factors including the exact location of the plant, the weather at the time of the accident and the number of large population centres nearby. This type of insurance is critical to the nuclear operator, which has a strict liability to compensate victims of any nuclear accidents and often requires insurance before a construction and operating licence can be obtained.

The risk faced by nuclear insurers on both their third party liability and physical damage policies is mostly of a catastrophic nature, that is to say the accident is likely to be severe and have widespread consequences. Insurers model a maximum loss assuming a full payment of the site material damage (property) policy and widespread off-site radioactive contamination causing many thousands or even hundreds of thousands of claims to be made against the operator; this would lead to exhaustion of the third party liability insurance policy limit. It is to the remote possibility of this event that insurers commit their capital. However, insuring the nuclear industry is very different to insuring other businesses; there are few other single risks that could produce such a severe loss from a single site, with chemical or oil facilities the only comparable risks in the world.

B. Determining premium

Insurers rely on assessing many hundreds of thousands of risks and using the loss experience from a wide sample of risks as the basis for a realistic premium calculation. Through analysis of many events, insurers can use actuarial techniques to calculate the frequency, cost and other consequences of most events for which insurance is sought. From this analysis, insurers can work out the likelihood and severity of any occurrence, thus calculating the loss that could be payable and then the premium that is the cash consideration paid to the insurer by the business concerned to transfer the risk to the insurance company.

It is immediately obvious that insuring motor cars, with millions of cars and an abundance of data is very different to insuring moon landings or nuclear power plants, where actual data is much scarcer. The nuclear industry does not have many risks: today there are 443 operating power reactors[5] supported by a smaller number of nuclear fuel cycle facilities and research reactors globally. Not all of these sites are insured; therefore, the premium generated from the sector is relatively small (estimated to be between EUR 650 and 700 million globally). With limited sites, premium and (fortunately) claims, nuclear insurers have little data on which to base premiums and a relatively small portfolio of risks to insure. There is a substantial amount of theoretical loss data available from the nuclear industry (for example some of the site probabilistic safety analysis studies required for nuclear site licensing), and these have proved to be especially useful to insurers. However, one outcome of this dearth of real data is that much of the modelling and premium assessment is done on an actuarial and theoretical basis, which makes many insurers reluctant to commit their capital to nuclear risks.

Other factors that insurers consider when setting a premium are the actual financial cost of past events and the precise amount the insurer is exposing to loss. This loss exposure may not just be the consequence of a single item, but an accumulation of losses through the aggregation of multiple policies arising from the same consequence. Also, the duration of an insurer's exposure has a significant influence on premiums, as exposures that endure well into the future are considered more volatile and thus more costly to insure.

C. Application of insurance principles to those in the nuclear liability conventions

How do the general principles of insurance apply to nuclear insurance in particular which, as has been described, is a unique type of insurance? The principles of insurance apply equally to nuclear as to motor insurance, with some differences of emphasis. First, the requirement to provide financial security is essential to ensure there are funds to pay any claims. This requirement is also the foundation for the insurance principle of insurable interest where the operator's obligation to provide security by way of insurance is what becomes the object of the insurance.

Channelling of liability is achieved in the insurance sector by the application of a radioactive contamination exclusion clause to most non-life insurance policies, i.e. most policies issued to businesses, people and homes outside of a nuclear plant. If you look closely at the famous insurance policy small print, this exclusion is almost certain to be found. By excluding this exposure from all "normal" insurance policies, insurers are able to offer the nuclear site operator nuclear liability insurance that provides cover for any liability arising from the site's obligations to third parties (everyone outside the nuclear site), safe in the knowledge that the only liability the insurer faces from a nuclear accident that causes off-site damage will be channelled back to the operator's nuclear liability policy. In this way, no exposure will arise from any other policies issued for homes, motor cars or factories in the surrounding area and the insurer is able to quantify with some precision his final loss outcome from the event. Without this exclusion, the claims made and financial cost incurred could be enormous and would involve hundreds of thousands of policies spread across continents, a situation that would threaten the insurers' balance sheets.

In the same way, in most countries, contractors and suppliers to the nuclear operator have exclusions clauses or "hold harmless" agreements that also steer liability back to the operator. However, in the United States (described later) the situation is different as in some circumstances contractors can be liable. In the normal course of events, subrogation would allow insurers to step

5. IAEA, "Power Reactor Information System" data as of 21 June 2021, available at: https://pris.iaea.org/PRIS/home.aspx (accessed 25 June 2021).

into the shoes of an operator who suffers a loss and to try to recover damages from others, such as contractors working on the site, who could have caused the accident. In the nuclear field, subrogation is waived as the operator's liability is strict and contractors, too, have the radioactive contamination exclusions on their insurance policies. All these arrangements result in one source of exposure and one point of claim, which is vital to ensuring private insurance market participation in nuclear insurance, as it gives insurers control over exposure and financial loss and any victims of an accident certainty of how and from who to claim.

As already discussed, nuclear operators have *strict liability*. Recognising the complexity of operating a nuclear installation and that damage could be widespread, the operator's liability was made strict and absolute from an early stage of the industry's development; the operator can have no defence and must always compensate regardless of fault or negligence. This strict liability formed part of the "bargain" struck in the early days of the industry, where in return for strict and total liability, the operator was given financial and time limitations to its exposure. The introduction of the radioactive contamination exclusion clauses across most non-nuclear insurance policies emphasises the need for liability to attach to someone, and the imposition of strict liability means this someone is always the nuclear site operator.

With the *financial limit* to operators' liability as the other part of the bargain in most countries and a specific financial security amount established by law when the operators' liability is unlimited, the operator has a known financial exposure to a nuclear accident. And, as demonstrated above, this financial limit coupled with the radioactive contamination exclusion is also vital for insurers who can then calculate the cost of an event and use this to set the premium. This is the indemnity and if there was no certainty in this respect, it would be impossible to calculate the premium or the capital requirement for an unlimited exposure, and insurers would not have been able to provide insurance.

The other critical exposure limiting safeguard is the *time limit*. Until recently all nuclear claims needed to be made to insurers within ten years of an occurrence. A time limit for liability exposure allows financial security providers to offer the necessary insurance cover easily; time limitations of this length are found in many classes of liability insurance, therefore capitalising and setting premium for such periods is well understood. This is not the case for the extended period of 30 years for claims relating to bodily injury and death as part of the latest revisions to the nuclear liability conventions. Such a long period materially increases volatility and insuring it has proved challenging for many insurers. However, currently nuclear insurers can provide almost all the cover required by the liability conventions, with the majority provider still being the nuclear pools.

Other provisions in the conventions provide further comfort and certainty for both operators and insurers, thus ensuring that the modern scheme for financial compensation is fully available for all nuclear sites. For example, clarity with respect to applicable definitions and jurisdiction is essential in any contract, no less so in nuclear insurance. After all, the most likely time that any contract is revisited is when there is a claim to be made; in this situation, the benefit of clear terms and definitions is essential for both sides. In the case of nuclear liability, it is important to remember that following a large nuclear accident, a quick and clear route to compensation will be essential for suffering victims.

D. Insurers' major loss experience

The 1957 analysis of the risk incurred in the operation of nuclear installations prepared by a committee of insurers in the United Kingdom attracted a good deal of attention from the media.[6] The introduction noted that nuclear fission involved unfamiliar hazards, it also noted that "The magnitude of the values at risk … confined to a relatively small compass, together with the extent of the third party risk involved in the production of atomic energy, necessitate new approaches by the (insurance) Market if adequate insurance cover is to be made available."[7] The scope and depth of this report, which was widely distributed, guaranteed insurers an important role in the late 1950s as the United States, the United Kingdom and other European governments were developing nuclear legislation. For example, in the United Kingdom, the first Act of Parliament that provided for liability to be channelled to the operator and a fixed amount of compensation to be available was called the Nuclear Installations (Licensing and Insurance) Act, 1959. This demonstrates the close co-operation provided by insurance markets in that country during the development of the nuclear legal liability framework. Moreover, some of the underlying principles of either the Paris[8] or the Vienna Convention[9] were already part of some of the earlier legislation in Germany, Sweden, the United Kingdom and the United States; indeed, it is fair to say that many of the principles that have been incorporated into the conventions arose directly as a result of the concerns of the insurance market at the time.

Since the first nuclear pools were formed in the 1950s, the insurance industry has developed products as the nuclear sector has demanded and as products have developed in the general insurance market. Greater market capacity for nuclear insurance has also developed over the decades to the extent that the full financial security amounts required today by all nuclear liability regimes can easily be met by the nuclear insurance market.

Despite insurers' many comments bemoaning losses, the reality is that claims (while unwelcome) do provide insurers with an important learning experience. This is no less true of the nuclear sector. Many smaller losses and notably the three events at Three Mile Island, Chernobyl and Fukushima Daiichi nuclear power stations have helped insurers to improve their products on offer and to understand the complexities of the nuclear sector. These events have helped to shape insurers' response to a large nuclear event.

The reactor explosion at Chernobyl in 1986 demonstrated how quickly radioactive contamination can spread following a severe accident. Although Chernobyl was not insured, it is estimated that the eventual cost of the Chernobyl accident could be hundreds of billions of euros.[10]

6. BI(AE)C, *supra* note 3.

7. *Ibid.*, p. 1 para. 2.

8. Convention on Third Party Liability in the Field of Nuclear Energy of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1960), 1519 UNTS 329 (Paris Convention).

9. Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977 (Vienna Convention).

10. There is a wide variation amongst estimates of the economic cost of the Chernobyl accident. In 1988, a US paper estimated a cost of USD 15 billion (Anspaugh, L.R., R.J. Catlin and M. Goldman (1988), "The Global Impact of the Chernobyl Reactor Accident", *Science*, Vol. 242, Issue 4885, American Association for the Advancement of Science, pp. 1513-1519 (1988); in another 2016 report focusing on health, the cost was estimated at USD 700 billion (Samet, J.M. and J. Seo (2016), "The Financial Costs of the Chernobyl Nuclear Power Plant Disaster: A Review of the Literature", University of Southern California Institute for Global Health, p. 15, available at: https://globalhealth.usc.edu/wp-content/uploads/2016/01/2016_chernobyl_costs_report.pdf (accessed 25 June 2021)).

There were over 100 000 evacuations with people requiring re-housing and eventually over 600 000 people were involved in the recovery operation.[11] Radioactive contamination spread across Europe and caused severe disruption to food supplies and food consumption over a wide area, reaching as far west as France and the United Kingdom.[12] Ultimately, it is difficult to assess how many people were affected as a direct consequence of the accident and both the incidence of cancer and final number of deaths were relatively low. However, the accident marked a low point in the fortunes of the nuclear industry, and it is still cited today by nuclear opponents as an example of the unacceptable consequences of nuclear power.

On the other hand, the accident at the Three Mile Island nuclear power station in 1979 caused relatively little damage outside of the plant. Both accidents were the result of human error and resulted in a core melt, but in the case of Three Mile Island this was fortunately contained by the solid containment structure built around the reactor. Much of what went on after the accident was precautionary, including 144 000 evacuations[13] and the payments of hardship money by insurers to people disrupted by the accident.[14] However, this event was insured and has proved to be the largest insurance claim paid to a nuclear operator. Both the physical damage policy covering the plant itself and the third party liability policy were affected, with the former being a total loss to the insurance policy.[15]

Human error did not play a direct role in the accident at the Fukushima Daiichi nuclear power station in 2011, which was triggered by an earthquake and the following tsunami. This resulted in a core melt and an escape of radioactivity from the facility, albeit limited to the wider area around it. The authorities reacted quickly and around 150 000 inhabitants of the affected region were evacuated.[16] Although there were no cases of physical bodily injury and death directly due to radiation,[17] the number of psychological and physical trauma cases arising from the accident and evacuation was considerable;[18] also some physicians now suspect a causal link with several cases of thyroid cancer.[19] The economic impact of the contamination was also extensive, with substantial amounts of compensation paid to businesses. With over 95% of the claims having

11. UNSCEAR (2008), *Sources and Effects of Ionizing Radiation*, Vol. II, Annex D. “Health Effects Due to Radiation from the Chernobyl Accident”, Appendix B. “Radiation Doses to Exposed Population Groups”, “I. Summary from Previous UNSCEAR Reports”, pp. 103 and 108, paras. B7 and B38.

12. See e.g. NEA (2002), *Chernobyl: Assessment of Radiological and Health Impacts (2002) – 2002 Update of Chernobyl: Ten Years On*, OECD Publishing, Paris, pp. 44-46.

13 Walker, J.S. (2006), *Three Mile Island: A Nuclear Crisis in Historical Perspective*, University of California Press, Berkeley, p. 138.

14. US Nuclear Regulatory Commission (NRC) (2019), “Backgrounder on Nuclear Insurance and Disaster Relief”, www.nrc.gov/reading-rm/doc-collections/fact-sheets/nuclear-insurance.html (accessed 21 June 2021).

15. The total insured loss for both physical damage and liability policies was USD 371 million. Insurance Information Institute (2011), “Insurance coverage for nuclear accidents”, www.iii.org/article/insurance-coverage-nuclear-accidents (accessed 23 June 2021).

16. NEA (2021), *Fukushima Daiichi Nuclear Power Plant Accident, Ten Years On: Progress, Lessons and Challenges*, OECD Publishing, Paris, pp. 15, 21.

17. Citing ICRP (2016), “Increase in Disaster-Related Deaths: Risks and Social Impacts of Evacuation”, Report by A.M. Hayakawa, Annals of the ICRP, Vol. 45, Issue 2, Supp., pp. 123-128, ICRP, Sage, London, the NEA states that “the evacuation is reported to have resulted in early deaths from the lack of health care or medicines, stress-related problems, etc.” NEA (2021), *supra* note 16, p. 15.

18. See e.g. World Health Organization (2020), *A Framework for Mental Health and Psychosocial Support in Radiological and Nuclear Emergencies*, WHO, Geneva.

19. Takamura, N. et al. (2016), “Radiation and risk of thyroid cancer: Fukushima and Chernobyl”, Correspondence, *The Lancet Diabetes & Endocrinology*, Vol. 4, Issue 8, p. 647.

been settled to date, the total loss amount today is the equivalent of around EUR 76 billion.[20] The operator of the facility had taken out third party liability insurance, but – like other insurance contracts in Japan – the insurance cover excluded losses resulting from earthquake and tsunami. However, because the Japanese government acknowledged that in a country where earthquakes can hardly be considered a fortuitous event (it has been explained before that this is a key condition for private insurance), it had issued a state provided insurance policy up to the statutory liability limit required under the Japanese nuclear liability act. It was this state insurance that was triggered by the nuclear operator to compensate victims. Thus, the nuclear operator led the claims handling process with Japanese insurers' participation.

These three accidents represent the total experience in the world today of a major nuclear reactor failure; it should be noted that today's new reactor designs make the consequences of off-site accidents much less likely and less externally damaging and certainly nowhere near the scale of the accident at Chernobyl or even Fukushima Daiichi. With multiple, strong safety barriers, the total effects of the accident may well be contained to within an 8-16 kilometre radius of the plant. However, the necessary financial and physical infrastructure needs to be in place just in case such an accident does happen again. It is for this eventuality that nuclear insurers always need to maintain funds sufficient to provide immediate compensation for victims of a catastrophic accident.

E. Risk selection

Why were the accidents at Chernobyl and Fukushima Daiichi not insured by the private insurance market? Insurers must select risks carefully to protect their balance sheets; it is thus wrong to assume that every nuclear site is automatically insurable. Certain conditions must be satisfied before nuclear insurers can take on a new third party liability risk; the most important of these are:

- The legal arrangements must be adequate; for example the national law must follow the principles of one of the international nuclear liability conventions.
- The risks to be covered by insurance must be fortuitous and the insurance policy must adhere to the basic principles of insurability.
- The site itself must be technically acceptable and independently well regulated.
- There must be a domestic insurance industry capable of claims handling and of sufficient solvency level to act as a reliable local representative for the international insurance markets.
- The local economy needs to be largely free and able to trade internationally without hindrance.
- The country of the risk must not be subject to international trade restrictions.

If the site meets these criteria, underwriters commence an assessment of the likelihood and severity of a liability loss using some form of rating model. These models enable all the factors relevant to the risk, such as its location, type of nuclear reactor or use, natural hazards exposure and population densities around the site to be assessed. With this information, steps toward setting a premium are taken. Modelling is common in the insurance industry, particularly in relation to catastrophic events such as nuclear, windstorms or earthquake, where the frequency is not as great as in other classes of insurance.

20. The latest compensation amounts payable (as of 18 June 2021) are available at TEPCO (2021), "Records of Applications and Payouts for compensation of Nuclear Damage", www.tepco.co.jp/en/hd/responsibility/revitalization/pdf/comp_result-e.pdf. The main TEPCO website on compensation for nuclear damage is available at: www.tepco.co.jp/en/hd/responsibility/revitalization/compensation-e.html (accessed 21 June 2021).

Had insurance been required in 1986, Chernobyl would have failed the insurability test because there was no local private insurance market in existence at the time, the plant was technically unacceptable and the national legislation was insufficiently developed to accommodate insurers' demands.

F. Insurers' responsibilities in nuclear liability

Although the frequency of major nuclear accidents has been extremely low, insurers nevertheless have felt an obligation to have in place the necessary infrastructure and planning to deal with a major nuclear incident. Such an interest in planning is not done just for altruistic motives, it is also done for financial ones as it is the insurers' capital that in almost every jurisdiction is the first money to be called on in the event of a major accident, and it is each insurer's responsibility to safeguard its capital and to make sure that any payments made are valid and totally justifiable.

All mature insurance markets have built up a complex, independent and efficient infrastructure for the handling of severe claims of a catastrophic nature. A myriad of different professionals is ready to act upon a catastrophic occurrence to ensure that members' capital is preserved, but also to ensure that any victims of any accident are swiftly and justifiably compensated. This infrastructure will be particularly important in an accident of the severity of a major nuclear incident with off-site implications. A large third party liability claim will require the mobilisation of the sort of resources that are more readily available to a nuclear pool with a wider membership from the insurance market of its whole country and possibly region; a diverse representation from each national insurance market can more easily provide call centres, adjustments facilities, claims handling and file storage areas. In addition, nuclear pools have put in place bilateral cross-border claims handling agreements so that an accident that spreads across borders can be handled co-operatively between nuclear pools; other non-pool insurers have also recently developed sophisticated mechanisms for handling large claims.

In general, the insurance market is best placed to mobilise quickly a total claims handling service although the value of this is often underestimated as no major loss has occurred recently. However, it is not just insurers who will benefit from this; governments too should consider that by having this infrastructure available they may also benefit politically from having any nuclear catastrophe efficiently and fairly handled. Insurers take their responsibility to provide such a service very seriously and handling a large accident will require considerable commitment and co-operation from most insurance market participants in a region to provide victims with fair, efficient and independent compensation.

G. Why insurers are comfortable with nuclear risks

Insurers have provided insurance for nuclear sites for more than 60 years and the private insurance market in that time has contributed much to the development of the nuclear industry. Why has this support for insurers been forthcoming? It would be easy to imagine, particularly in the wake of the atomic bombs in Japan, that consideration of a nuclear risk would be inconceivable for many insurers and the perception of the risk would be too poor for them to persuade their shareholders to participate. However, the key principles of the international conventions adopted into national law and ultimately into the insurance policies have enabled the private market to participate in the insurance of nuclear risks. The financial certainty that results from a sure knowledge of the *amount* that you can lose, *when* you can lose it, *who* is being paid and exactly *what is being paid for* is critical for all insurers.

Following the legal disputes over insurance coverage that followed the World Trade Center attacks in New York in 2001, insurers realised more than ever that having certainty in the contract is vital. At that stage, some policies were still not completed despite the insurance being on risk. After the loss, there was a high-profile court case[21] that had to decide on the interpretation of what was actually insured and since then, there has been a greater determination among all insurance companies and markets in the world to improve this "contract certainty". In addition, the same attack caused insurers to become more aware of the potential of accumulation of exposure from multiple businesses involved in the same event. Both these problems were understood at the earliest stages of the nuclear insurance development, and the principles of the nuclear conventions and insurance arrangements are consistent with all the current trends in regulatory development in the insurance market. Ultimately, should insurers ever have to pay out a claim for a third party liability event at a nuclear power station, the amount will be known as insurers are able to place a cap on the maximum financial commitment they will have to make. One last point why the insurance market has been attracted to underwriting nuclear risks is that, as already described, there have been few severe nuclear accidents, with only one insured total loss at the Three Mile Island nuclear power station.

Therefore, there has been some profit for insurers in insuring nuclear third party liability, although the funds accumulated over time could be exhausted in the event of a major nuclear accident today. In addition, to provide the required capital to support nuclear insurance, insurers demand a certain price for that capital allocated, regardless of the loss history.

V. Nuclear third party liability conventions and insurance

A. Development outside the convention regimes: United States and Japan

Not all countries are signatories to the nuclear liability conventions; yet to attract private insurance market participation, nuclear legislation needs to reflect the convention principles, such as channelling of liability, financial and temporal limitation, and clear definitions. There are two useful examples of countries with substantial nuclear sectors that were outside the current convention regimes for a long time.

The first example is the United States, which operates about 20% of the operating nuclear power plants in the world (as of 21 June 2021, 93 of 443 reactors), so its activities in this field are of global importance to the nuclear industry. In 1954, Section 170 of the original Atomic Energy Act set out certain provisions regarding indemnification and limitation of liability.[22] However, in 1957 an amendment to this law was introduced by two members of Congress – Representative Charles Price and Senator Clinton Anderson – and the eponymous Price-Anderson Act thus became the primary US nuclear liability legislation.[23] This Act requires the operator to provide funds of sufficient means to meet their financial obligations by way of insurance. Liability is not channelled to the operator as such, but the operator's financial funds must provide for both the operator and any suppliers of goods and services to the operator. In effect it covers the personal liability of all those who may have some responsibility for a nuclear incident, hence liability is absolute to the site and is economically channelled to the site, its operator and their insurance. In this way, liability is still channelled for the benefit of the victims and there is little material difference with the channelling arrangements under the conventions.

21. Gralla, J. and D. Wilchins, "World Trade Center insurers in $2 bln settlement", *Reuters* (23 May 2007).

22. Section 170 is codified at 42 USC Section 2210.

23. Pub. L No 85-256, s. 4, 71 Stat. 576 (1957). The Price-Anderson Act also added several new definitions to Section 11 of the Atomic Energy Act of 1954 Act, 42 USC 2014.

The Price-Anderson Act is valid for a fixed time period and requires renewal. At the time of its second renewal in 1975, a secondary layer of financial protection was provided by the nuclear industry in excess of the insurance arrangements.[24] A so-called "retrospective premium payment" provided for an obligation for each reactor operator to pay an additional amount of money towards compensating victims, should a severe accident occur. If this layer of financial protection is exhausted, the US Government will step in and pay any additional amount. Together, the nuclear industry and insurers provide today approximately USD 13.5 billion (EUR 11.3 billion)[25] as initial compensation.

The operator's liability is not entirely strict, but if the regulator declares an "extraordinary nuclear occurrence", the liability of the licensee does become absolute. The insurance for the US nuclear third party liability policy is limited to liability for bodily injury and off-site property damage caused by nuclear material at the defined location, and currently the indemnity limit is USD 450 million (as of June 2021), which also includes costs and expenses (unlike the conventions). At present, the US policy does not cover environmental clean-up costs arising from any governmental decree, order or directive. The only exceptions to this exclusion are clean-up costs that result from an "extraordinary nuclear occurrence" or a transportation incident as defined.

In August 2005, the Act was renewed again by the US Congress and is now valid until 31 December 2025. In August 2006, the US Senate consented to the ratification of the Convention on Supplementary Compensation for Nuclear Damage;[26] this decision by the United States to join for the first time an international nuclear liability convention represented a major milestone and, with the CSC's entry into force in 2015, arguably brought the world closer to a more harmonised global nuclear liability system.

The second useful example is Japan, which is also a significant force globally, with 33 reactors now operating in the country and a nuclear component supply sector active elsewhere. The relevant law in Japan is the Act on Compensation for Nuclear Damage (Act No. 147 of 1961), which largely conformed, and now fully conforms, to the international conventions since Japan joined the CSC in 2015. The operator's liability is strict, absolute and has no financial limit, although the operator is required to provide financial security through insurance, cash deposits or the equivalent up to JPY 120 billion (approximately EUR 912 million as of 21 June 2021). Given the seismically active nature of the Japanese archipelago, the government provides a state insurance (also referred to as an indemnity) to nuclear operators for all earthquake and volcanic eruption events; as has been seen, this means that insurers and operators are in the fortunate position of having these natural disasters excluded. With the Japanese liability arrangements following the principles of the conventions, insurers provide the other full coverage required by law.

Both Japan and the United States illustrate that the initial liability arrangements were not wholly consistent with the conventions. With this lack of harmonisation, insurers had to adapt their product to the national market conditions where the conventions did not apply; however, the full adherence to convention principles by these two countries in the past decade is an important step towards simplifying the provision of financial security by the international insurance market.

24. See Pub. L. No. 94-197, 89 Stat 1111 (1975).

25. This currently consists of USD 450 million primary insurance and USD 13 billion total as secondary financial protection. Memorandum from J. Palaia, Vice President, Underwriting Department, American Nuclear Insurers, to Operating Power Reactor Risk Managers and their Brokers (10 June 2021), "Notification of Change in the Number of Power Reactors in the Secondary Financial Protection (SFP) Program".

26. Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 Apr. 2015 (CSC).

B. Paris and Vienna Convention revisions and insurance

Having investigated the major aspects and principles of the original nuclear liability conventions, it is appropriate to look at the revisions to the conventions that were agreed in 1997[27] (for the Vienna Convention, which was the basis for the drafting of the CSC) and 2004[28] (for the Paris Convention and Brussels Supplementary Convention[29]). The key objective of the participating governments was to update both the Paris and the Vienna Conventions by offering more compensation to more people for a wider range of nuclear damage. Some of these updates have proved challenging for the insurance markets and initially insurers were particularly concerned about two aspects: the introduction of environmental damage and the extension of the time limitation.

Insurers in all sectors of the market (not just nuclear) have been reluctant to offer insurance for some aspects of environmental damage, in particular biodiversity damage, as there has been relatively little experience anywhere as to how loss patterns might develop. In addition, an increasingly litigious and compensation seeking culture and a poor history with pollution insurance claims in certain jurisdictions made providing such compensation difficult for insurers. In the nuclear liability conventions, extending the scope of nuclear damage to include damage to the environment is a material change from the original texts and represents a step into the unknown and a significant loss of certainty, a feature of the early legislation that attracted insurers to nuclear activities. Full environmental liability insurance is now available, but in small amounts and for less complex industries, without long and unattractive environmental track records. With no data for more hazardous and poorly perceived industries (such as nuclear), setting a premium for an uncertain type of loss is difficult, thus insurers have been reluctant to commit to this less clearly defined head of damage. However, experience and knowledge has grown over the past two decades and it is likely that once the 2004 Paris Protocol enters into force in 2022, most insurers will provide this cover, although perhaps to a limited extent in some countries.

As already described, the reasons why insurers struggle to set a premium for any exposure that arises more than ten years after an event are the increased volatility of outcome and difficulty of establishing causation. Also, an additional consideration is that the longer the period of time from any occurrence, the more likely it is that individual insurer's commitments may be harder to enforce because of company consolidation, insolvency or closure.

Previously, longer periods to make a claim were incorporated sporadically around the world, for example as regards claims relating to bodily injury and death. With the incidence of many everyday diseases and the cost of litigating against or dealing with them increasing all the time, there is a threat to nuclear operators and insurers alike from people assuming that, for example, a cancer is the result of living near to a nuclear facility. Therefore, some countries also legislated that any claims beyond ten years are to be made to government, which pushes the possible societal aspect of claims onto the state. With the entry into force of the revised conventions, the prescription period with respect to loss of life and personal injury will become 30 years. Some insurers, notably the operators-

27. Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997), IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force 4 Oct. 2003 (1997 Protocol to Amend the Vienna Convention).

28. In addition to the 2004 Paris Protocol, *supra* note 1, there is also the Protocol to Amend the Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004), entered into force 1 Jan. 2022, available at: www.oecd-nea.org/law/brussels_supplementary_convention.pdf (2004 Brussels Protocol).

29. Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1963), 1041 UNTS 358 (Brussels Supplementary Convention).

owned mutual insurance companies, are now prepared to provide cover for the full 30 years, albeit for a small portion of the statutory liability limit in most countries. Nuclear installation operators, being stakeholders of mutual insurance companies, face the liability for 30 years anyway and so it is understandable that their mutual entities are prepared to fund it. However, at present, this cover is not readily available from the insurance pools, where concerns about their solvency and capital requirements weigh more heavily. With that in mind, they are currently considering whether, how and up to what amount they could provide cover for the new 30-year period.

In addition to insurers' concerns about coverage for environmental damage and the extended time limits, other developments relating to the revision of the conventions raised concerns. In some northern European countries, operators are required to provide the highest limit globally of EUR 1.2 billion. This amount is within the current capacity of the global insurance market; however, it is the wide international variation in limits that is more of a problem. In China, the current limit still is the equivalent of a mere EUR 37 million, yet nuclear insurance pool members will need to have available sufficient capital to cover the highest of these indemnity limits, that of Japan. This wide range of indemnity limits reduces both capital utilisation and the return on capital, which can make insurers more reluctant to commit to this type of insurance. Therefore, providing for such widely varying and relatively few limits for nuclear third party liability is a challenge. It would be easier for insurers if every country legislated for the highest financial security limit because insurers would then be assured that the capital required would be well utilised, instead of the current situation with great variation in limits. The 2004 revision of the Paris Convention has provided for a new limit of EUR 700 million; this is an important first step in harmonising the amounts of indemnity available, and this aspect is welcomed by insurers.

A frequently asked question is whether these revisions mark progress towards legal harmonisation, a key objective of the conventions. The short answer is "yes", but there is still some way to go as many of the world's reactors remain outside the liability convention system, most notably in China where the number of reactors is increasing. The United States' adoption of the CSC may be a sign that encourages other nations outside the convention system to join at least one convention. However, it should be noted that from the insurer's point of view, the scope of the CSC also has troublesome aspects since it too is based on the revised Vienna regime's liability language.

VI. Current issues with nuclear third party liability insurance

A. Nuclear new build and decommissioning

The nuclear industry has been transformed in recent years from a largely state-owned industry to one in which private capital is routinely supporting nuclear operators in decommissioning, extending the life of or building new nuclear facilities. A consequence of these more complex ownership structures has been a greater focus on clarifying the rights and responsibilities of the various parties, especially where there is an involvement of financiers or other entities whose knowledge of the nuclear industry is not as good. Facilities have seen the arrival of industrial consortia with multiple owners on or near their sites. This development presents a new challenge for nuclear insurers who previously have rarely had to contend with more than one operator per nuclear site. If there were a serious nuclear accident on an existing nuclear site either during operation or decommissioning, even after the introduction of higher liability limits by the revised conventions, the liability arrangements will be wholly inadequate to cover an adjacent new nuclear build site that may contain two new nuclear power stations. Insurers therefore need to make financiers of new nuclear projects aware of the relatively limited compensation available from the liability arrangements. After exhaustion of the insured security amounts, accident victims will most probably be compensated ahead of financiers for political reasons by the government, which is why supplementary insurance may be required for some construction projects. These supplementary financial requirements may be beyond the nuclear insurance market's capacity, but when the demand for such insurance becomes clear, insurers will seek to supply what is required.

Decommissioning activities also provide challenges for insurers because the work undertaken when demolishing a nuclear facility presents different risks to insurers; the rigorous controls exercised during the operational years of a plant are often relaxed, which changes the risk profile. Care also must be exercised when working alongside parts of the nuclear site that may remain operational. Once a site has been closed down, the third party liability insurance arrangements will need to continue until the site has had its operating licence terminated, although for some of this period the site may be permitted to have a lower financial security limit, given the lower hazard.

Thus, both new build and decommissioning require continued vigilance and support by the insurers to ensure that any third parties in the surrounding area continue to have adequate compensation available, whatever activity is occurring on the nuclear site.

B. Insurance of terrorism exposure

The scale of the attacks on targets in the United States on 11 September 2001 and on other targets more recently has redefined the public's perception of terrorism. For insurers, the resultant accumulation of possible claims was unforeseeable, incalculable and threatened the solvency of many insurance companies.

The concept of "terrorism" can mean different things to different people; in the world of insurance, terrorism is understood to mean the *use of violence or the threat thereof to achieve political, religious, ethnic, ideological or comparable goals*. Victims understand terrorism to consist of carefully and covertly planned illegal acts of violence *against the existing political and societal order that shock the public at large or at least part thereof*. Terrorism differs from common violent crime by its explicit intention to impact the public and/or *to influence a government or government organisations*. The characteristics, printed above in italics, have found their way into most insurance contracts by way of the addition of terrorism clauses; use by insurers of these phrases serves to clarify or exclude insurers' exposure to the threat of terrorist acts.

The risk of terrorist attacks was, until recently, usually not explicitly excluded from nuclear insurance policies. Insurers of the nuclear industry have always had to reckon with the possibility that an accident could cause catastrophic damage. There has always been a latent threat of attacks by opponents of nuclear energy and in this respect the threat of terrorism cannot be a totally new phenomenon to insurers. What was new, or at least not thought of as a realistic scenario before 2001, is the risk of a simultaneous series of terrorist attacks on several nuclear installations, all resulting in a total loss under both material damage and liability covers. A consolidated attack on multiple targets simultaneously could not only threaten the solvency of any of the insurers concerned but also of the entire nuclear insurance mechanism. This threat is enhanced by the fact that nuclear installations are considered to rank among possible targets of terrorism. Therefore, following developments in the non-nuclear insurance market, nuclear insurers also had to reconsider their exposure to nuclear terrorism.

Immediately after the 2001 attacks insurers providing physical damage cover adjusted their policies to either limit or exclude terrorism cover; this development occurred in practically all countries where no specific market-wide terrorism insurance scheme existed. In those countries where schemes were established already, often with state support (notably France, South Africa, Spain and the United Kingdom), these schemes were adjusted to include the nuclear insurance market.

The relationship between international nuclear third party liability conventions and nuclear insurance rendered the situation as regards nuclear third party liability cover more complicated. In both the original and revised Paris and Vienna Conventions, as well as in the CSC, the operator, and indirectly the insurer, are exempted from liability for nuclear damage caused by a nuclear incident directly due to an act of armed conflict, hostilities, civil war or insurrection.[30] In the *Exposé des Motifs* to the original Paris Convention, reference is made to "a nuclear incident directly due to certain disturbances of an international character such as acts of armed conflict and hostilities, of a political nature such as war and insurrection […] on the grounds that all such matters are the responsibility of the nation as a whole".[31] Although some differences in opinion among the contracting parties to the convention existed as to whether the exemption should be considered to include this new type of international terrorism, ultimately it was decided that all terrorism of whatever nature should remain outside the scope of the war exoneration.[32] This put the insurance market in a difficult position as the exclusion of war and warlike events is widespread in all insurance contracts and many insurers considered that this new concept of terrorism should not be included under nuclear third party liability policies.

Therefore, with uncertainty as to whether terrorism was within the scope of the war exoneration immediately after the attacks in 2001, insurers quickly moved to exclude terrorism from nuclear third party liability policies. However, as insurance underpinned the required financial security for most nuclear sites, its removal would have jeopardised many site operating licences. Intense negotiations in the early part of 2002 between insurers and governments quickly resulted in the introduction of state support schemes to guarantee continued third party liability cover, although many of these schemes offered only a limited duration for state support. Within a few years of 2001, insurers generally accepted terrorism exposure within the scope of the nuclear third party liability cover, but with an additional premium charge to reflect the exposure.

Today, insurance capacity for terrorism up to the amount equalling the statutory insurance limit in any country depends on a number of conditions that vary by country. Apart from a few countries that either are considered to be exceptionally exposed to terrorism or have introduced an above average statutory insurance limit, terrorism cover is now available for the majority of cases under nuclear third party liability policies. At first, this largely related to the fact that statutory liability limits in the national legislation of the countries concerned were still relatively modest. Meanwhile, there is a trend to increased limits. That this has not resulted in a shortage of terrorism insurance capacity that one would have expected some time ago almost certainly relates to a lack of large scale repetitions of violent attacks. However, another large terrorist attack, which does not necessarily need to be a nuclear one, could result in a withdrawal of insurers' capital to support terrorism insurance from the market.

The status of terrorism cover has also been clarified elsewhere. For example, in the *Exposé des Motifs* of the Revised Paris Convention, it is now clearly indicated that "An operator is not, however, exonerated from nuclear damage caused by a nuclear incident directly due to an act of

30. Paris Convention, *supra* note 8, Article 9 ("The operator shall not be liable for damage caused by a nuclear incident directly due to an act of armed conflict, hostilities, civil war, insurrection …"); 2004 Paris Protocol, *supra* note 1, Article I.J., with text to replace Article 9 in the Paris Convention ("The operator shall not be liable for nuclear damage caused by a nuclear incident directly due to an act of armed conflict, hostilities, civil war, or insurrection."); CSC, *supra* note 26, Article 3(5)(a) ("No liability shall attach to an operator for nuclear damage caused by a nuclear incident directly due to an act of armed conflict, hostilities, civil war or insurrection.").

31. NEA (1982), *Revised text of the Exposé des Motifs of the Paris Convention, approved by the OECD Council on 16 November 1982*, para. 48, available at: www.oecd-nea.org/law/nlparis_motif.html (accessed 25 June 2021).

32. NEA (2002), "Summary Record of the [Nuclear Law Committee] Meeting Held 29-30 November 2001", NEA Doc. NEA/SEN/NLC(2002)1.

terrorism, whatever its scale".[33] Also, as explained in the Revised Explanatory Texts of the revised Vienna Convention and the CSC, "'the phrase '… armed conflict, hostilities, civil war or insurrection' … was not intended to include acts of terrorism, as an exoneration'".[34]

The insurance industry is certainly willing and able to bear its share of the responsibility. However, it also aims to protect its long-term solvency and continuity, thus avoiding disruption to the international economy that would be caused should it collapse. There are good reasons why the state has an interest in maintaining the insurability of international terrorist attacks. An important one is that democratic states have the self-imposed constitutional responsibility of ensuring public safety and order; if the state is unable to fulfil this duty in its entirety it should at least contribute to the ensuing costs. This point is acknowledged by governments in those countries where the state participates in covering terrorism risks, although to-date state support for terrorism insurance schemes is mostly confined to the physical damage (first party) aspects of terrorism. Therefore, the majority of third party liability exposure arising from terrorist attacks of any sort is indemnified by insurers up to the policy limits available – this certainly remains the case today for nuclear liability exposure.

C. Nuclear transport and liability

Transport plays a vital role in the nuclear fuel cycle; every part of the cycle is linked by transportation and all these journeys require insurance and some require special arrangements, similar to the insurance for nuclear installations. There are specific issues related to the provision of insurance for nuclear third party liability during transportation that have often resulted in a lower commitment by insurers, despite the actuarial risk being much lower than that of an operating nuclear plant.

The first difficulty with third party nuclear transport liability in the eyes of the insurer are the low premium volumes, particularly when compared with the relatively high limit of indemnity required. Journeys often last a few days only and the exposure is low, so premiums are low too, yet insurers are aware that substantial payments could be made in the event of a loss and this mismatch discourages insurers; they are simply unable to obtain the necessary return on the capital required. Second, there is flexibility in some legislation as to the identity of the operator; for example, some transport companies can assume liability in agreement with the relevant operator. To establish clear, single responsibility for the journey is essential to the insurer and there must be no doubt where legal responsibility lies, but this is not always clear. Third, the process for arranging liability insurance is cumbersome and bureaucratic. Many regimes require certificates of financial security before a shipment can move; these are provided by insurers but require official countersignature, thus establishing all the necessary details can sometimes delay the journey. This process could be improved with more use of electronic media, but bureaucratic requirements often prevent this. Finally, a further issue is that more contentious environmental claims are likely, following the revision of the convention regime.

One further unique feature of the nuclear transport liability market is "forum shopping"; some operators, aware of the current disparity in financial security limits required by different countries, seek to ensure that the operator with the lowest financial security amount will be deemed to retain

33. NEA (2020), *Exposé des Motifs of the Paris Convention as amended by the Protocols of 1964, 1982 and 2004*, NEA Doc. NEA/NLC/DOC(2020)1/FINAL, para. 80(a).

34. IAEA (2020), *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage—Explanatory Texts*, IAEA International Law Series No. 3 (Rev. 2), IAEA, Vienna, p. 47, fn. 166.

the title over the material for as long as possible during the transport, thus paying the lowest insurance premium for the longest time possible. This gives insurers two difficulties: it reduces the already inadequate premium received and it leaves potential victims unfairly underinsured. However, the Revised Paris Convention helps reduce this by introducing a common liability limit.

VII. Conclusion

Insurance plays an essential but discreet role in everyday life for almost everyone on the planet; this role applies equally to the nuclear industry, although the amount at risk is undoubtedly on a larger scale. The specialist nature of nuclear insurance has contributed to the development over the past 60 years of a unique relationship between the nuclear industry and the global insurance markets on the basis of co-operation and mutual understanding. The revised language in the nuclear liability conventions has challenged the basis of this relationship through the introduction of new heads of damage and some aspects of these changes will prove difficult for some insurers to underwrite.

However, there are grounds for optimism. The insurance market is one of the purest markets in existence with little state intervention at any level; as such, the market reacts to changes in profitability, the investment climate, capital costs and changes in legal frameworks very quickly. Although there have been initial doubts as to whether insurers would be able to provide sufficient support for the revised conventions' new, wider heads of damage, the market has moved already to provide cover as circumstances are always changing. For example, many insurers have already accepted the environmental damage cover, and some provide cover for the new, longer time periods; in time, the availability of capacity will doubtless increase as required.

Moreover, insurers are encouraged by the responses the market is developing to react to the revised conventions, with assistance from governments and the nuclear industry. The insurance cover adopted will encourage a rejuvenation of the relationship that has existed between the stakeholders for so long, thus allowing the insurance market to remain a partner of the nuclear industry, perhaps for the next 60 years and beyond.

Chapter 6

Nuclear trade and project development

The control of international nuclear trade: Difficult balance between trade development and non-proliferation of nuclear weapons

by Quentin Michel[*]

Since the possible uses of atomic fission were first discovered, nuclear energy has always generated a degree of fascination. The manufacture of the bomb and its use in 1945 indelibly marked the potential risks of this new source of energy. However, for political reasons and in order to meet the constantly growing energy needs of 20th century industrial societies, the development of peaceful uses of nuclear fission seemed to be indispensable. Faced on the one hand with the need to develop nuclear power and on the other hand with the difficulty of clearly distinguishing the facilities and technology required for peaceful uses from those required for military applications, the international community set up a regime of control relating to nuclear trade. This regime, comprised of rules of international law together with political commitments undertaken by governments, is undoubtedly one of the rare examples of an industrial activity in which trade is subject to such restrictive rules.

This article aims to provide a brief overview of the main stages in the development of the international nuclear control regime since the entry into force of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[1] and to set out the main points thereof. In order to facilitate the reading, the expression "nuclear items" has been used to refer to nuclear materials, equipment and technology.

The increasing number of informal instruments on the control of trade in nuclear items

From the perspective of a certain number of states party to the NPT, states intending to become party to the NPT and also current or potential exporters of nuclear items, the scope of the undertakings made under this treaty needed to be clarified in order to avoid differing interpretations. To this end, consultations were initiated, aimed at agreeing on the export conditions to be required by the supplier state. In particular, there was a need to define on the one hand the meaning of "equipment or material especially designed or prepared for the processing, use or production of special fissionable material" and on the other hand the conditions and procedures governing exports of such equipment and materials to non-nuclear-weapon states (NNWS) that are not party to the NPT.[2]

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1. Treaty on the Non-Proliferation of Nuclear Weapons (1968), IAEA Doc. INFCIRC/140, 729 UNTS 169, entered into force 5 Mar. 1970 (NPT).

2. *Ibid.*, Article III.

These discussions – known as the Zangger Committee[3] – were conducted outside of any formal structure and resulted in 1974 in an agreement defining the fundamental rules which the participating states intended to apply to their export policies in the future. If it was not formally linked to the NPT, the precondition to participate in the Committee was to sign and ratify the NPT. Consequently, France, one of the major nuclear suppliers, did not participate and was not constrained by the principles defined by the Zangger Committee Guidelines. Although these fundamental rules did not have any validity under international law,[4] they marked the first step towards a concerted policy of non-proliferation of nuclear weapons.

However, in May 1974, the Indian atomic explosion[5] using plutonium, qualified as being peaceful by the Indian government, and the conclusion of two agreements, first between the Federal Republic of Germany and Brazil and second between France and Pakistan,[6] renewed the controversy about the adequacy of the mechanisms to prevent the proliferation of nuclear weapons. It appeared indeed that the success of the Indian military atomic programme was partly thanks to the material and technical support for peaceful purposes provided by Canada, France and Germany. Even if the essential aspects of this support were provided before the NPT came into force (a treaty that India subsequently refused to sign), stricter compliance by the major powers with their national export policies relating to the non-proliferation of nuclear weapons could have prevented India from developing a nuclear weapon.[7] The fierce competition for nuclear contracts[8] combined with the arrival of new suppliers[9] on the international stage undoubtedly promoted a degree of laxity with regard to the required safeguards as to the use of the items transferred by the supplier state.

In spite of this, the United States was once again the originator of a new policy to combat the horizontal proliferation of nuclear weapons. The principle of this new policy, which formed the basis of the current one, was to prevent states from using transferred nuclear facilities for non-peaceful purposes, by imposing on them a certain number of technical protective devices. Prior

3. From the name of its first Chairman, Claude Zangger; the Committee met for the first time in March 1971.

4. They simply amounted to unilateral undertakings by the member states of the Committee. These undertakings were made public by means of sending a letter to inform the Director General of the IAEA of the sender state's decision to bring its nuclear items export policy into compliance with the attached documents in the future and asking the Director General to communicate the decision to all other member states.

5. Two months after the adoption of the Zangger Committee's guidelines.

6. These agreements provided for the supply of spent fuel reprocessing plants as well as of nuclear power plants. Neither Brazil nor Pakistan had ratified the NPT.

7. Canada was awarded a contract to build an experimental heavy water reactor in 1955. India undertook to use the plutonium manufactured for peaceful purposes only but refused all forms of verification controls relating to this undertaking. The reactor was completed in 1960. In 1962, Germany supplied a heavy water production facility. France contributed to the construction of a pilot spent fuel reprocessing plant, which was completed in 1966 (this plant enabled the extraction of the plutonium required for the construction of the Indian nuclear bomb). See in this respect Courteix, S. (1978), *Exportations nucléaires et non-prolifération* [Nuclear exports and non-proliferation], Recherches Panthéon-Sorbonne, Université de Paris I, Sciences juridiques, Droit des relations internationales, Économica, p. 7.

8. The extremely wealthy oil-producing states of the Middle East decided to launch ambitious nuclear programmes for which the commercial competition between supplier countries was tough. Germany won the orders for the first two Iranian nuclear power plants, France supplied the next two plants and a research reactor to Iraq, and the Soviet Union was awarded the Libyan contract.

9. In particular, Belgium and Germany (e.g. through SA Ateliers de Constructions Electriques de Charleroi's (ACEC) nuclear division, which was incorporated into Westinghouse Electric Nuclear Systems Europe, Inc.).

to this, the possession of nuclear materials that could be used for military purposes,[10] as well as facilities capable of manufacturing such materials, were generally considered not to be dangerous when these materials were subject to peaceful uses, guaranteed by international control and verification. However, this control, which was designed to detect the diversion of fissile materials, was ineffective when faced with a state that unilaterally decided to ban access to its territory by international inspectors and convert its civilian nuclear programme into a military research programme.

The new non-proliferation policy, put forward by the United States to combat effectively this risk of diversion of facilities, incited supplier states of nuclear items to refuse in a drastic fashion the direct transfer to NNWS of fissile materials that could be used for military purposes or of facilities considered to be sensitive and enabling the production of such materials.[11] It was suggested that alternatives considered to be less conducive to proliferation be offered.[12]

At the beginning of 1975, seven main supplier states of nuclear items, including France, met at the United States' initiative in London in an attempt to reach agreement on a common nuclear weapons non-proliferation policy. The negotiations, based on a new US approach, resulted in a compromise being reached in September 1977 setting out a policy that the states agreed to apply in the future to exports of nuclear items. However, it proved impossible to reach consensus on a formal agreement, and an adoption process by unilateral commitment was consequently accepted, based on the method previously tested by the Zangger Committee.[13]

These guidelines, referred to as the Nuclear Suppliers Group (NSG) Guidelines were gradually adopted by an increasing number of states[14] and were viewed, in particular by developing countries, as a further manifestation of the intention of industrialised countries to continue their monopoly or at the very least their undue interference in the energy development of countries purchasing nuclear materials, equipment and/or technology. The guidelines appeared to them to be all the more unfair in that they manifestly contradicted one of the fundamental principles of the NPT that granted NNWS the right "to develop research, production and use of nuclear energy for peaceful purposes" in exchange for formally renouncing nuclear weapons.[15] The NSG Guidelines strongly encouraged suppliers to exercise restraint in the transfer to NNWS of

10. Nuclear materials for military purposes generally mean uranium enriched by more than 20% in ^{235}U and plutonium containing less than 7% of ^{240}Pu. Although these definitions are the most regularly quoted, they do not imply that said concentrations are sufficient to manufacture a nuclear weapon. For example, uranium must contain at least 93% of ^{235}U in order to be of military quality, and consequently enable initiation and expansion of the fission chain reaction in a very short period of time. See e.g. on these points Albright, D., F. Berkhout and W. Walker (1995), "Plutonium and Highly Enriched Uranium: Characteristics, Sources of Information and Uncertainties", in *SIPRI Yearbook 1995 Armaments, Disarmament and International Security*, Oxford University Press, Oxford, UK, p. 334.

11. Plutonium, enrichment and reprocessing facilities have been particularly targeted.

12. This notably involved providing guarantees to states that renounced reprocessing that their reactors would be supplied. See President Carter's statement of 7 April 1977 set forth in Appendix 12 of Courteix, S., *Exportations nucléaires et non-prolifération, supra* note 7, p. 236.

13. The meetings of the supplier states of nuclear items were subsequently referred to as the Nuclear Suppliers Group or the London Club. This group is usually referred to by its English acronym "NSG". The founding members were Canada, the Federal Republic of Germany, France, Japan, the Soviet Union, the United Kingdom and the United States.

14. Including some NNWS in the European Community (Belgium, Italy and the Netherlands) which added a Community clause upon adoption whereby the application of these guidelines was obligatory for the undertakings made within the scope of the Treaty of Rome with regard to intra-Community trade.

15. NPT, *supra* note 1, Article IV.

"sensitive facilities, technology and weapons-usable materials",[16] despite the application of the safeguards system of the International Atomic Energy Agency (IAEA), which in fact constituted the initial step towards a blanket refusal of all such transfers.

Unlike the Zangger Committee, the NSG intentionally positioned itself on the margins of the NPT in order to meet the demands of France, which had not signed the Treaty at the time. Therefore, the text of the guidelines did not include any references to the NPT. The aim of the NSG is to harmonise policies relating to the transfer of nuclear items by the main states possessing and supplying nuclear know-how by agreeing on minimum competition rules in order to avoid compromises with respect to the fight against proliferation of nuclear weapons. The modalities of the control regime applying to transfers of nuclear items laid down by the NSG Guidelines are based on a number of fundamental principles on the policy, to be adopted by states when considering transfer applications, and on a so-called "trigger list". Thus, in order to prevent circumvention of this policy by the establishment of a *non-peaceful/military* nuclear research programme through a series of purchases, the NSG Guidelines specify that the applicable control regime for the transfers of items included in the trigger list cannot be rendered ineffective by the transfer of the various components of these items.[17]

Also, unlike the Zangger Committee, the NSG Guidelines pay particular attention to technology transfers associated with any item on the list. Technology transfers associated directly with any item on the list "will be subject to as great a degree of scrutiny and control as will the item itself, to the extent permitted by national legislation".[18] The NSG Guidelines also apply to transfers for peaceful purposes to any NNWS, regardless of whether the said state has ratified the NPT and, with respect to controls on re-transfer, to transfers to all states without distinction.[19]

In line with its actions within the NSG, the United States, under President Carter, fundamentally changed its international nuclear co-operation policy. Considering that the civilian use of plutonium posed a major risk with regard to non-proliferation and that the world had adequate uranium resources to satisfy nuclear power development, the US Congress on 10 March 1978 passed the Nuclear Non-Proliferation Act, 42 USC 3201 *et. seq*., which introduced a regime incorporating all the embargo and veto measures that both the United States and Canada had proposed in the NSG but that had nevertheless been rejected by their partners. The new international co-operation policy, which remains largely applicable today, was based on the reinforcing of both safeguards of the peaceful uses and the veto on the transfer and development of certain technologies. Thus, an embargo was imposed on the transfer of nuclear items relating to enrichment, reprocessing and breeding. The embargo also applied domestically and resulted in the cancellation or deferral of national reprocessing and breeding programmes.[20] The new Section 123 of the Atomic Energy Act[21] subjected all future co-operation agreements to nine conditions

16. Paragraph 7 of the Guidelines, "Appendix – Guidelines for nuclear transfers", as published in IAEA (1978), "Communication Received from Certain Member States Regarding Guidelines for the Export of Nuclear Material, Equipment or Technology", IAEA Doc. INFCIRC/254.

17. "The object of these controls should not be defeated by the transfer of component parts." IAEA (2007), "Communication Received from the Permanent Mission of Brazil regarding Certain Member States' Guidelines for the Export of Nuclear Material, Equipment and Technology", IAEA Doc. INFCIRC/254/Rev.9/Part.1, Annex A, "Trigger List Referred to in Guidelines – General Notes", para. 1, p. 7.

18. *Ibid*., Annex A, "Technology Controls", p. 7.

19. *Ibid*., "Guidelines for Nuclear Transfers", para. 1, p.1.

20. Completion of the only private spent fuel reprocessing plant built by Allied Chemical (Barnwell in the United States) was consequently postponed *sine die*.

21. 42 USC 2153, as amended by section 401 of the Nuclear Non-Proliferation Act (NNPA), Public Law No. 95-242, 92 Stat. 142.

that are reduced to seven when the other contracting party is a nuclear-weapon state (NWS). These conditions mainly imposed comprehensive and permanent safeguards, an undertaking not to use explosive nuclear devices, to return materials and equipment under certain conditions and the recognition of the principle of prior consent in the case of a re-transfer of nuclear items or in the event of reprocessing, enrichment or alteration of the materials produced or supplied. However, this new Act could not put an end to the co-operation established under previous co-operation agreements. The President of the United States was therefore asked to renegotiate them in order to bring them into compliance with the new provisions.[22]

In terms of the non-proliferation of nuclear weapons, the gradual reinforcement of the export control mechanisms and a seemingly stricter policy appear to have curbed, if not put an end to, the increase in the number of NWS. Indeed, in 1990 only 11 states had nuclear weapons, if one counts also those that had reached the nuclear threshold or had tried to do so.[23]

The tacit confidence relating to the proliferation of nuclear weapons was shattered in 1992 by the "dual shock" of the collapse of the Union of Soviet Socialist Republics (USSR or Soviet Union) and the revelation of the Iraqi military programme. The breakup of the USSR caused a degree of uncertainty regarding ownership of the nuclear weapons stationed in the four successor states of the Soviet Union (the Russian Federation (Russia), Ukraine, Belarus and Kazakhstan). Russia, which proclaimed to be the heir of the USSR,[24] considered that all tactical and strategic nuclear weapons should be repatriated to its territory. For a long time, this repatriation was contested to varying degrees by the other three successor states,[25] which considered that these weapons formed part of their heritage. However, there were a number of technical problems involved with this approach, for example the fact that Russia held the launch and arming codes. Following lengthy nuclear bargaining, the three Republics finally agreed to ratify the NPT as NNWS.[26] The breakup of the Soviet Union also raised a series of concerns regarding the security of the systems relating to the non-proliferation of nuclear weapons in the splinter states and also, more generally, in the new political systems of the Warsaw Pact countries.[27] While the majority of them had the expertise and industrial potential to help manufacture nuclear weapons, the political, administrative and customs structures to combat the proliferation of weapons of mass destruction (WMD) were often ill suited to the economic liberalism that they aspired to implement in the future.[28] A laborious process of adjusting national control systems to their new political and economic environment was consequently undertaken.

The revelations about the scale of the Iraqi military research programme, just after the Gulf War, provoked an unprecedented crisis in relation to the non-proliferation of nuclear weapons. They proved that ratification of the NPT and the conclusion of a safeguards agreement with the

22. Sections 404 and 405 of the NNPA, Public Law No. 95-242, 92 Stat. 147-148.

23. The five Nuclear Weapons States (NWS), as recognised by the NPT, plus Argentina, Brazil, India, Israel, Pakistan and South Africa.

24. It had assumed its seat on the UN Security Council.

25. In particular, Ukraine.

26. Belarus ratified the treaty on 22 July 1993, followed by Kazakhstan on 14 February 1994 and Ukraine on 16 November 1994.

27. Treaty of Friendship, Co-operation and Mutual Assistance between the People's Republic of Albania, the People's Republic of Bulgaria, the Hungarian's People's Republic, the German Democratic Republic, the Polish People's Republic, the Romanian People's Republic, the Union of Soviet Socialist Republics and the Czechoslovak Republic (1955), 219 UNTS 24, entered into force 6 June 1955.

28. See on these aspects notably Potter, W.C. (Oct. 1995), "Before the Deluge, Assessing the Threat of Nuclear Leakage from Post-Soviet States", *Arms Control Today*, Arms Control Assoc., Washington, DC, pp. 9-16.

IAEA did not adequately guarantee the absence of any action or conduct involving proliferation. On the contrary, ratification of the NPT had enabled Iraq to benefit from a degree of respectability and did not at all prevent it from secretly developing a military nuclear research programme.[29] Officially, Iraq submitted all of its nuclear facilities to regular inspections by IAEA inspectors, who never discovered the diversion of the materials used.[30] Iraq proved to be particularly skilful in avoiding suspicion by the various secret services about its covert programme. The purchases of items, required to conduct its military programme, were carried out through import and export shell companies. Shipment was effected by carriers sailing under a flag of convenience to non-suspect states, which acted in reality simply as transfer points. Finally, in order to avoid suspicion, no weapon system or turnkey nuclear device was imported or purchased as such. They were purchased as components and the orders being placed with different suppliers. Moreover, Iraq resorted widely to goods and technology that were especially designed for nuclear use and controlled by the Zangger Committee and NSG. However, neither regime was controlling items that could potentially contribute to the development of a nuclear explosive device but are usually used for a non-nuclear application like medical, agricultural or industrial development. Those items, later called dual-use items,[31] were imported by concealing the nuclear use and declaring, if necessary, its industrial application. One of the most worrying aspects of the Iraqi nuclear military research programme was also that the Iraqis did not refrain from using techniques that were deemed to be obsolete and fell under the public domain.

The breakup of the Eastern Bloc and the disbanding of the Soviet Union also meant that serious doubts were expressed about the need to maintain a specific embargo regime, COCOM,[32] with respect to certain transfers to states that had emerged from the dissolution of the Warsaw Pact. A number of these states, including the Czech Republic, Hungary, Poland and the Slovak Republic, publicly expressed their wish to join the European Union (EU) and the North Atlantic Treaty Organization (NATO) as soon as possible. They, along with Russia, requested the easing or indeed abolishment of this embargo. This request was received favourably by the European members of NATO that pushed their US ally to ease the transfer rules with regard to these states. Negotiations over reviewing this regime were started. Against all expectations, they resulted on 16 November 1993 in a decision to clearly and simply abrogate this regime.[33]

At the same time, informal discussions among the member states of the former COCOM, including Russia, Hungry, Poland, the Czech and the Slovak Republic, were initiated on the elaboration of a new multilateral export control regime. On 18 December 1995, in Wassenaar in the Netherlands, the representatives of the 28 participating states established new export control rules for conventional weapons, ammunition and some dual-use items and technology that could be used to develop a WMD, rules better known as the "Wassenaar Arrangement". This arrangement was intended to supplement existing export control instruments.

29. On the discovery and scope of the Iraqi nuclear programme for military purposes, see for instance: Thorne, L. (1992), "IAEA nuclear inspections in Iraq", *IAEA Bulletin*, Vol. 34, No. 1, IAEA, Vienna, pp. 16-24.

30. This was logical insofar as the main part of the Iraqi military programme was located at secret sites that were by definition not reported to the IAEA. At the time, the Agency was not authorised to inspect suspect sites, and the major powers' various intelligence services had not yet detected or realised the scale of the secret programme.

31. "Dual-use item" in this context means an item that can be used equally for civilian or military nuclear purposes, and for non-nuclear purposes (medical, agricultural etc.).

32. The Co-ordinating Committee for Multilateral Export Controls.

33. Anthony, I. (1995), *SIPRI Yearbook 1995 Armaments, disarmament and international security*, Oxford University Press, Oxford, United Kingdom, p. 619.

The revelations relating to the secret Iraqi programme together with the attitude of the Democratic People's Republic of Korea (DPRK)[34] provided sufficient proof that accession to the NPT and the conclusion of a safeguards agreement were not enough to guarantee that a state did not simultaneously carry out a secret programme to develop a nuclear weapon. It was therefore clear that even when trading with NNWS parties to the NPT, supplier states needed to be more careful and to rigorously apply a more restrictive export policy.

The concern over reinforcing the system against the proliferation of nuclear weapons was raised not only by supplier states but also by some developing countries, even before the revelations about the Iraqi programme. In order to address this concern, an informal meeting of the NSG participating governments was convened in The Hague between 5 and 7 March 1991. The reactivation of the NSG – no meeting had been convened since 1978 – set its objectives to first review and complete the Guidelines in light of the events in Iraq and, second, to consider ways of controlling transactions relating to dual-use items not covered by the Guidelines. It was also an attempt to convince new suppliers to adhere to the Guidelines.

Given this favourable context for the reinforcement of the system, three fundamental decisions were adopted in the NSG's subsequent meetings. First, further to several unilateral declarations by certain supplier states such as France,[35] the United Kingdom[36] and Belgium,[37] it was decided that recipient states should be requested to apply the principle of full scope safeguards[38] as a prerequisite for the granting of export licences relating to items listed by the NSG Guidelines for the export of nuclear material, equipment and technology.[39]

Secondly, guidelines governing the principles and conditions of transfers of dual-use nuclear items and a list of items to which these guidelines apply were adopted.[40] A memorandum of understanding was also agreed to in order to ensure the consistent application of the Guidelines. It established information exchange mechanisms between member states as regards applications for an export licence. A significant aspect of this wish to reinforce the coherence of the system was the definition, for the first time and within the guidelines relating to dual-use items, of the objectives set by the NSG with respect to the non-proliferation of nuclear weapons.[41] These objectives consisted of a commitment by the supplier states to avoid all transfers of dual-use items

34. During the IAEA's first inspection in 1992 to implement the safeguards agreements, the inspectors recorded a number of inconsistencies between their analysis and the analysis provided by the DPRK. According to the Agency, the DPRK had nuclear materials and facilities which it had not reported. For a comprehensive analysis and details of this affair, see "Activities of the International Atomic Energy Agency relevant to Article III of the Treaty on the Non-Proliferation of Nuclear Weapons", prepared by the Secretariat of the IAEA for the 1995 Conference of the Parties to the NPT, presented in Geneva in the Preparatory Committee for the 1995 Conference of the Parties to the NPT (12-16 Sept. 1994), Doc. NPT/CONF.1995/PC.III/7, p. 9.

35. Requirement announced in the speech by Roland Dumas, French Foreign Minister, to the 49th United Nations General Assembly in New York on 24 September 1991.

36. Requirement announced in the speech by the Hon. Douglas Hurd MP, Secretary of State for Foreign and Commonwealth Affairs, to the 49th United Nations General Assembly in New York on 25 September 1991.

37. Statement by the Belgian delegation at the third meeting of the "Nuclear-Related Dual-Use Working Group" in Annapolis on 7 October 1991.

38. Full scope safeguards: application of IAEA controls to all existing or future raw or special fissile materials located in the territory of a state or under its jurisdiction. This requirement already applied to NNWS that had adhered to the NPT, which is not the case for India, Algeria or Pakistan.

39. List included in Annexes A and B in IAEA (1992), "Communication Received from Certain Member States Regarding Guidelines for the Export of Nuclear Material, Equipment or Technology", IAEA Doc. INFCIRC/254/Rev.1/Part.1.

40. Plenary meeting of the NSG held in Warsaw on 3 April 1992.

41. Similar objectives were added to the NSG Guidelines on nuclear items during the NSG Plenary Conference held in Madrid (1994).

that could have a major contribution to the pursuit of "nuclear explosive activities" or a "nuclear fuel cycle activity not subject to safeguards" required under the NPT. In practical terms, this meant that all transfers of dual-use items had to be refused when the risk of diversion could not be ruled out. The NSG's new export policy was going to unhinge the apparent equality between non-proliferation and peaceful development, which formed the cornerstone of the NPT, and replaced it by a hierarchy of priorities. Afterwards, even if the guidelines stated explicitly that they were not designed to impede international co-operation in relation to the peaceful uses of nuclear energy, they only authorised such co-operation if it was deemed not to conflict with the NSG's non-proliferation objectives. Moreover, they introduced the concept of universality by making this non-proliferation principle applicable not only to NNWS but also to NWS where in general an unacceptable risk of diversion existed.

Finally, the third decision adopted by the NSG was related to the revision of its list of nuclear items subject to export controls and the incorporation of all updates since 1978 drawn up by the Zangger Committee.[42]

The majority of the NNWS saw their last chance to entice NWS to comply more adequately with their commitments in the NPT extension conference. Article X.2 of the NPT indeed provides that the treaty was concluded for a term of 25 years. Therefore, in 1995, an extension conference of the parties to the treaty was held to decide whether the treaty should be extended indefinitely or by one or several fixed terms.[43] The possible imposition of a conditional extension of the NPT had already been the principal subject of the discussions at the 1990 NPT Review Conference forming the main reason for its failure. Under the impetus of the conference chairman,[44] the parties endeavoured to reach a compromise which, assuring an indefinite extension, would appeal to the greatest number of states while allowing those that were opposed to save face. Three decisions[45] were adopted at the plenary meeting on 10 May 1995.[46]

Although the extension conference succeeded in finalising its work and adopting a decision to extend the treaty indefinitely and unconditionally, the three main committees[47] set up by the treaty review conference did not succeed in reaching agreement on the wording of a final declaration.[48]

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42. The Zangger Committee had regularly reviewed its lists since the adoption of its fundamental rules.

43. By imposing formal and verifiable undertakings to be fulfilled in accordance with a precise schedule.

44. The Sri Lankan, Jayantha Dhanapala.

45. It included:
    - a decision establishing the mechanisms for periodic review of the application of the treaty;
    - a decision relating to the principles governing the application of the treaty with regard to nuclear non-proliferation and disarmament;
    - a decision recognising the majority in favour of extending the treaty indefinitely.
    - The decisional documents are incorporated in the Annex to the 1995 Review and Extension Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (1995), Final Document, Part I, "Organisation and Work of the Conference," Doc. NPT/CONF.1995/32 (Part I), which was also reprinted by the IAEA with the same title in IAEA Doc. INFCIRC/474 (1995).

46. *Ibid*.

47. Committee I: Disarmament; Committee II: Export Safeguards and Controls; Committee III: International Cooperation, Technology Transfers.

48. Under Article VIII.3 of the NPT and the Decision of the General Conference of the NPT in 1995 entitled "Strengthening the Review Process of the Treaty", NPT/CONF.1995/32/DEC.l [Doc. NPT/CONF.1995/L.4], in the Annex to the Final Document, *supra* note 45, an NPT Review Conference is organised every five years. The purpose of such conferences is to "evaluate the results of the period they are reviewing, including the implementation of undertakings of the states parties under the treaty, and identify the areas in which, and the means through which, further progress should be sought in the future". "Review Conferences should also address specifically what might be done to strengthen the implementation of the treaty and to achieve its universality", [paragraphs 2 and 7 of the Decision entitled "Strengthening the Review Process of the Treaty", as published in *Nuclear Law Bulletin*, No. 56 (1995), OECD Publishing, Paris, pp. 108-109.

However, in one of the four documents adopted in the plenary session, entitled "Principles and Objectives for Nuclear Non-Proliferation and Disarmament" and focusing on "peaceful uses of nuclear energy", it was recognised that the need for "transparency in nuclear-related export controls should be promoted within the framework of dialogue and co-operation among all interested states party to the treaty".[49] The move to establish genuine transparency of the control measures for nuclear trade was one of the main demands of a large number of NNWS. In an attempt to meet this demand, the supplier states within the NSG have taken a series of measures since 1996.[50]

In order to promote dialogue and co-operation between member states of the NSG and non-member states, the NSG drafted a paper entitled "The Nuclear Suppliers Group: its Origins, Role and Activities".[51] The document was initially communicated on 15 September 1997 and reviewed subsequently in 2000, 2003 and 2005, its objective being to enhance the transparency of NSG activities.

The issue of transparency was again discussed during the NPT Review Conference in May 2000. The conference recognised for the first time the need to control transfers of dual-use items in order to effectively combat the proliferation of nuclear weapons. However, the conference's work was largely tarnished by a context less favourable with respect to the adoption of a final document.[52] An agreement was reached undoubtedly due to the fact that NWS, giving preference to co-operation rather than exploiting their different views, agreed to negotiate with the "new agenda coalition".[53] They jointly agreed on the principles, which were subsequently included in the final review document, setting out a 13-step Action Plan for progressive and systematic nuclear disarmament.

Post 11 September 2001: impact of terrorism

The terrorist attacks of 11 September 2001 paradoxically provoked a number of questions about the need to reinforce measures relating to the non-proliferation of WMD even though this type of weapon was not used in these attacks. The acquisition of WMD by non-state actors and a terrorist attack against nuclear facilities were two types of threat which had previously not been considered by international non-proliferation regimes. It appeared to be necessary to include the fight against terrorism not only in the guidelines of informal instruments such as the NSG, the Wassenaar Arrangement and the Missile Technology Control Regime (MTCR) in relation to the proliferation of nuclear weapons, but also within specific bodies[54] "whose natural role was not in

49. Paragraph 17 of the Final Document, *supra* note 45, p. 12.

50. Of the most critical states *vis-à-vis* the NSG, only India accepted to participate therein.

51. It is included as an attachment to IAEA (1997), "Communication Received from the Permanent Mission of Australia on Behalf of the Member States of the Nuclear Suppliers Group", IAEA Doc. INFCIRC/539.

52. In particular, the following circumstances shaped the context for the conference: the refusal by the US Senate in 1999 to ratify the 1996 CTBT (Comprehensive Nuclear-Test-Ban Treaty) (not yet entered into force, available at: www.ctbto.org/fileadmin/content/treaty/treaty_text.pdf), the concern prompted by the Indian and Pakistani nuclear tests in 1998, the disagreements between the United States, Russia and the People's Republic of China (China) regarding the deployment of the US national missile defence system (NMD) ("Star Wars") and the Preparatory Committees' failure to draft substantive recommendations. Moreover, uncertainty remained regarding Iraq's nuclear capacity while NATO intervention in Kosovo was creating tension among the major powers.

53. The group established in 1998 was comprised of Brazil, Egypt, Ireland, Mexico, New Zealand, South Africa and Sweden. Its purpose was to formulate proposals relating to the progress of nuclear disarmament.

54. These are global bodies such as the UN and more restricted regional bodies, such as the EU and the Organization for Security and Co-operation in Europe (OSCE), or strategic bodies such as NATO.

principle to handle these issues",[55] such as the G8 Summit,[56] NATO,[57] the OSCE,[58] the EU[59] and the UN.[60]

In 2002, at its annual plenary meeting held in Prague on 16 and 17 May, the NSG was one of the first to react by amending its guidelines to include the prevention of terrorist nuclear attacks. Thus, the non-proliferation principle laid down in the guidelines relating to nuclear items was amended.[61] In addition to verifying that these transfers do not contribute to the proliferation of nuclear weapons or explosive devices, the participating states undertake to export nuclear materials, equipment or technology only if they are convinced that these transfers will not be "diverted to acts of nuclear terrorism".[62] This "unacceptable risk of diversion to acts of nuclear terrorism" also became a condition to be taken into account in relation to granting export licences for nuclear-related dual-use items.[63] Moreover, the NSG Guidelines relating to transfers of nuclear items also referred to the IAEA, recognising its role in the prevention of proliferation and of the threat of nuclear terrorism.[64]

In 2004, a catch-all clause was introduced into the NSG Guidelines relating to transfers of dual-use items.[65] It provides that "suppliers should ensure that their national legislation requires an authorisation for the transfer of items not listed in the Annex 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'".[66] This clause became a preferred instrument in the fight against the proliferation of

55. Dahan, P. (Dec. 2005), "La PSI, poste avancé de la lutte contre la prolifération: De la diplomatie de réaction à la diplomatie d'anticipation", *Annuaire français de relations internationales* (*AFRI*), Vol. VI, Centre Thucydide, Université Panthéon-Assas, Paris, pp. 436-449.

56. The G8 adopted an "Action Plan on Non-Proliferation" at the Sea Island Summit on 9 June 2004.

57. NATO referred to non-proliferation in paragraph 14 of the communiqué issued on 28 June 2004 at the end of the Istanbul Summit.

58. Pursuant to the document entitled "OSCE Strategy to Address Threats to Security and Stability in the Twenty-First Century", adopted by the Ministerial Council meeting in Maastricht on 2 December 2003.

59. On 13 December 2003, the European Council adopted the "EU Strategy against Proliferation of Weapons of Mass Destruction", Doc. 15708/03.

60. UN Security Council Resolution (UNSCR) 1540, "Non-proliferation of weapons of mass destruction", UN Doc. S/RES/1540, adopted 28 Apr. 2004.

61. Paragraph 10 of the "Guidelines for Nuclear Transfers", set out in IAEA (2003), "Communications Received from Certain Member States Regarding Guidelines for the Export of Nuclear Material, Equipment and Technology", IAEA Doc. INFCIRC/254/Rev.6/Part 1, and paragraph 2 of the "Guidelines for Transfers of Nuclear-Related Dual-Use Equipment, Materials, Software, and Related Technology", set out in IAEA (2003), "Communications Received from Certain Member States Regarding Guidelines for the Export of Nuclear Material, Equipment and Technology", IAEA Doc INFCIRC/254/Rev.5/Part 2.

62. INFCIRC/254/Rev.6/Part 1, *supra* note 61.

63. Paragraph 4 of the guidelines set out in INFCIRC/254/Rev.5/Part 2, *supra* note 61.

64. A second type of threat was also taken into account by the NSG: a terrorist attack against nuclear facilities. The guidelines promote the reinforcement of the physical protection of plants in order to better take account of the risk of a nuclear attack.

65. An agreement had already been reached within the consultative group, which met in Vienna in October 2003. It agreed to recommend the insertion of a catch-all clause into the NSG Guidelines at the plenary meeting in Gothenburg in 2004.

66. Paragraph 5 of the "Guidelines for Transfers of Nuclear-Related Dual-Use Equipment, Materials, Software, and Related Technology", set out in IAEA (2006), "Communications Received from Certain Member States Regarding Guidelines for Transfers of Nuclear-related Dual-use Equipment, Materials, Software and Related Technology", IAEA Doc. INFCIRC/254/Rev.7/Part 2. The paragraph continues as follows: "Suppliers will implement such an authorisation requirement in accordance with their domestic licensing practices. Suppliers are encouraged to share information on 'catch all' denials."

WMD in the 2000s. It had indeed become clear that the use of control lists was, under certain circumstances, of limited effectiveness since updates to the lists can take a certain period of time given that they need to be negotiated at an intergovernmental level. As a result, technology that may be used by states or importers seeking proliferation technology may be available on the international market before the lists have been updated.

A fundamental review of NSG control lists was initiated in 2010. Since the adoption of the first control list in 1975, the regular update exercises consisted essentially of adding items to the lists as soon as new proliferation risks were identified but not in conducting a global review to address all potential technological developments. As a result, 28 amendments to the NSG control lists were adopted and made public in 2013.[67]

The MTCR also took measures to prevent their means of delivery from falling into the hands of terrorist individuals and groups. The attacks of 11 September 2001 equally led the states participating in the plenary meeting held between 24 and 27 September 2002 in Warsaw to consider this type of risk. The following statement was adopted:

> In view of growing concern over the continuing proliferation of weapons of mass destruction and their delivery systems, and of the fact that not only states but also terrorist groups and individuals may acquire such weapons, and remembering the tragic events of September 11, 2001, the Partner countries of the MTCR stress the need to give the necessary impetus to actions to combat terrorism. The MTCR will continue to contribute to the fight against terrorism by limiting the risk of controlled items and their technology falling into the hands of terrorist groups and individuals and calls upon all states to take similar action. Partner countries will further study how possible changes to the MTCR guidelines may contribute to this objective.[68]

Following the NSG's example, the MTCR guidelines were amended to specify that "the risk of controlled items falling into the hands of terrorist groups and individuals" must be taken into account when evaluating transfer applications for items contained on the appended list of controlled equipment and technology.[69]

The Wassenaar Arrangement considered the issue of the fight against terrorism at its plenary meeting held in December 2002, adopting several significant initiatives. Thus, a decision was taken to enhance co-operation between participating states in order to prevent the acquisition by terrorist organisations or groups of conventional arms and dual-use items. To this end, new methods for sharing information between participating states and implementing concrete action to strengthen export controls were developed.[70] An *ad hoc* group was also set up aimed at, first, examining to what extent export controls can help combat terrorism and, second, identifying the goods and technology used by terrorists and the methods they use to acquire them.

67. NSG (2013), "Public Statement (Final), Plenary meeting of the Nuclear Suppliers Group, Prague, Czech Republic, 13-14 June 2013", www.nsg-online.org/images/Files/Documents-page/Public_Statements/2013-06-Prague-NSG_6_PUBLIC_STATEMENT_HOD_final.pdf.

68. See Press Release, "Plenary Meeting of the Missile Technology Control Regime, Warsaw, Poland, 24-27 September 2002", available at: https://mtcr.info/plenary-meeting-of-the-missile-technology-control-regime-warsaw-poland-24-27-september-2002/ (accessed 28 May 2021).

69. See "MTCR Guidelines and the Equipment, Software and Technology Annex", available on the MCTR website at: https://mtcr.info/mtcr-guidelines/ (accessed 28 May 2021).

70. In this respect, a series of agreements on the transfer of specific non-nuclear items were reached relating to man-portable air defence systems (MANPADs), small arms and light weapons (SALWs) etc.

As with the NSG negotiations, the question of inserting a catch-all clause was discussed during the eighth plenary meeting of the Wassenaar Arrangement in 2002,[71] and at the following plenary meeting in December 2003 approval was obtained. The clause provides that participating states must take appropriate measures to ensure that their national legislation requires authorisation for the transfer of non-listed items to destination countries subject to a UN Security Council arms embargo or any other arms embargo to which a participating state has voluntarily consented to adhere, when the authorities of the exporting country inform the exporter that the items in question are or may be intended, entirely or in part, for a military end-use.[72] Moreover, this catch-all clause specifies that if the exporter is aware or suspects that the items in question are intended, entirely or in part, for a military end-use, he must notify his authorities who will decide whether or not it is expedient to make the export concerned subject to authorisation.[73] This catch-all clause differs from the one added to the NSG Guidelines in terms of its implementation methods and the risks that it takes into account. It is for the authorities of the participating states and the exporters to implement it. The authorities must notify the exporters that the items in question may be used for military purposes and, likewise, exporters must notify the authorities if they are aware of, or suspect, such a risk. However, the latter case does not systematically trigger a requirement for an export licence, which continues to be evaluated by the authorities, its main result being to release the exporter from any future liability as to any illicit use of the transferred item. To help exporters detect suspicious situations, a list of questions was adopted specifying various (non-exhaustive) suspicious signs and situations with regard to which the exporter is required to contact his national authorities.[74]

The second issue concerns taking into account the risk incurred. For the NSG, the risk relates to "nuclear explosive activity" whereas the risk under the Wassenaar Arrangement concerns "military end-use". However, a problem lies in the definition of the scope of "military end-use". The catch-all clause provides that each participating state must adopt its own definition of this term, while at the same time specifying that it refers to uses of a controlled item on the national list of military items. With a view to harmonisation or a shared definition, the catch-all clause provides furthermore that participating states are encouraged to share information on their respective national definitions.[75]

While the development of informal anti-proliferation control regimes appears to be essential in order to better deal with the new global challenges, the introduction of specific provisions on terrorism in these instruments nevertheless appears to be inappropriate. They were essentially created to structure and harmonise the export control rules between participating and non-participating states, and not between states and sub-national entities or groups, including terrorists.[76] Thus, their fundamental guidelines contain undertakings made by the participating states to adopt export control rules, share information on proliferation with other participating

71. A proposal to add a catch-all clause into the initial wording of the Wassenaar Arrangement had already been put forward in 1999, but it was not accepted.

72. "Statement of Understanding on Control of Non-Listed Dual-Use Items", agreement reached during the plenary meeting held in 2003, available at: www.wassenaar.org/app/uploads/2019/consolidated/Non-listed_Dual_Use_Items.pdf (accessed 28 May 2021).

73. *Ibid*.

74. "List of Advisory Questions for Industry", agreement reached during the plenary meeting held in 2003 as amended in 2018, available at: www.wassenaar.org/app/uploads/2019/consolidated/Advisory-Questions-for-Industry-Amended.pdf (accessed 28 May 2021).

75. "Statement of Understanding on Control of Non-Listed Dual-Use Items", *supra* note 72.

76. Michel, Q. (2005), "The evolution of nuclear export control regimes: from export control list to catch-all clause", *Atoms for Peace: An International Journal*, Vol. 1, No. 1, Inderscience Publishers, Geneva, p. 81.

states, notify export refusals and examine a list of criteria before issuing an export licence. In this respect, the risk that sensitive nuclear items fall into terrorists' hands had already been indirectly taken into account in these undertakings. For example, the NSG had taken measures to deny export licences if there was an unacceptable risk of diversion, including a terrorist risk, in which case the transfer of nuclear items or dual-use items must be refused.[77] Furthermore, the Guidelines require a statement by the end user specifying the end use of the item and its ultimate location. In addition, nuclear suppliers have undertaken to demand an explicit safeguard that the item to be transferred or any replica thereof "will not be used for explosive nuclear activities or an unsafeguarded nuclear fuel cycle".[78]

Moreover, a series of events at the beginning of the 2000s seemed to demonstrate that these instruments reinforcing the various non-proliferation treaties were no longer capable of combatting alone the proliferation of WMD.[79] The 2003 crisis when Iraq was suspected of manufacturing WMD, the DPRK's announcement of its withdrawal from the NPT, the interception of a ship sailing towards Libya containing items that could be used to manufacture WMD and the discovery of Dr Khan's network in 2004,[80] prompted states to seek new ways in which to combat proliferation. Although there were many initiatives, this analysis is limited to those taken in the framework of the United Nations and those relating to implementation of the Proliferation Security Initiative (PSI). The Hague Code of Conduct against Ballistic Missile Proliferation will also be discussed.

The PSI was proposed by the United States in Kraków in May 2003 and subsequently endorsed by the G8 at the Evian Summit in June of the same year. The PSI is not a formal international organisation but rather a variable-geometry group of activities open to all states, structured around the fundamental principle of intervention.[81] This principle introduced the mutual recognition of the participating states in the conducting of interception operations relating to illicit transfers within their territories.[82] The objective was to combat trafficking in WMD and their means of delivery and components, to or from any states or non-state actors raising concerns relating to proliferation. In this respect, the PSI's main role is to intercept suspect transfers associated with

77. Paragraph 2 of the "Guidelines for Nuclear Transfers", in IAEA (2000), "Communications Received from Certain Member States Regarding Guidelines for the Export of Nuclear Material, Equipment and Technology", IAEA Doc. INFCIRC/254/Rev.4/Part 1.

78. *Ibid.*, para. 5.

79. For example, Chapter III of the "EU Strategy against Proliferation of Weapons of Mass Destruction", *supra* note 59, adopted by the Council of the European Union on 9 December 2003, highlighted with regard to multilateral treaties and their control mechanisms that "While all are necessary, none is sufficient in itself."

80. Abdul Qadeer Khan, the father of the Pakistani nuclear bomb, formed an acquisition network to enable his country to build the nuclear bomb. He subsequently used his network based at hubs and operating by means of false end-user certificates, to provide technological support to other countries such as Iran, Libya and even the DPRK. He was also suspected of trading with Iraq and the Syrian Arab Republic (Syria) and maintaining contacts with some Sub-Saharan African countries. The discovery of this network proved that non-state actors could have access to WMD technologies (though Khan acted alone and not on behalf of Pakistan) and that an illicit international WMD-related market existed. See in this respect Clary, C. (2004), "A.Q. Khan and the limits of the non-proliferation regime", *Disarmament Forum*, No. 4, UN Institute for Disarmament Research, Geneva, pp. 33-42.

81. As of 28 May 2021, 107 states had adhered to the PSI. However, by adhering to the PSI, a state does not commit to any formal undertakings. The most active states meet in the Operational Experts Group, which discusses past and future activities of the initiative. More information is available on the PSI website, at: www.psi-online.info (accessed 28 May 2021).

82. For example, since the end of 2004, the United States has concluded seven bilateral inspection agreements to intercept ships in international waters, six of which with flag-of-convenience countries: Belize, Cyprus, Liberia, Malta, Marshall Islands and Panama (and another agreement with Croatia).

WMD. Originally, the PSI mainly related to sea transport, but it was subsequently extended to land and air transport. Based on the finding that the various non-proliferation treaties lacked effective mechanisms for ensuring compliance with the undertakings made, the PSI accordingly proposed moving away from an approach of verifying treaties towards one of monitoring cargoes and from a non-proliferation approach towards an anti-proliferation one by introducing concrete and effective measures against those engaged in proliferation.[83] To this end, it introduced co-operation mechanisms between states and between their authorities.[84] On 4 October 2003, the PSI allowed US and British forces to intercept in Italian waters a ship coming from Malaysia and heading to Libya under the German flag on which centrifuge components were seized.[85]

The PSI is above all a co-ordination instrument based on a series of one-off measures implemented solely through the goodwill of the participating states.[86] These states do not make a legally binding undertaking and are not obliged to participate in all related activities.[87] They may limit themselves to approving the fundamental interception principle and then decide whether to take part in measures on a case-by-case basis only. Thus, like the NSG and other export control regimes, it is an informal instrument, but unlike them, it does not have a permanent operating structure.

The Hague Code of Conduct, adopted in November 2002, was the first multilateral instrument against ballistic missile proliferation.[88] It resulted from an undertaking by member states of the MTCR,[89] which considered that export controls could not be the sole solution to the proliferation of missiles and that a new, more global policy was required. Accordingly, the Code, open to all states, aims to fill a loophole in the international system of controlling weapons by laying down principles with a universal scope in relation to the non-military use of ballistic technology. Thus, using a structure similar to the NPT, the Code recognises, on the one hand, the need to combat the proliferation of ballistic missiles for military purposes while at the same time acknowledging the right of states to use outer space for peaceful purposes.[90] In other words, the Hague Code of

83. Dahan, P., *supra* note 55.

84. This relates to co-operation between the customs, intelligence and diplomatic authorities.

85. Lewis J. and P. Maxon (2010), "The Proliferation Security Initiative", *Disarmament Forum*, No. 2 (Maritime Security issue), UN Institute for Disarmament Research, Geneva, p. 38.

86. It is not possible to refer to member states as it relates to a group of activities in which states participate and not to an institution or an informal group of states.

87. Heupel, M. (2007), "The Proliferation Security Initiative: advancing commitment and capacity for WMD interdictions", *Disarmament Forum*, No. 4, UN Institute for Disarmament Research, Geneva, pp. 57-66.

88. International Code of Conduct against Ballistic Missile Proliferation, UN Doc. A/57/724, entered into force 25 Nov. 2002.

89. The participating states of the MTCR prepared an International Code of Conduct (ICOC). This was ultimately separated from the MTCR and a process, open to all states, supported strongly by the EU, was launched. Two preparatory meetings were organised in Paris and Madrid in 2002. They resulted in the drafting of the Code of Conduct, which was finally launched at the conference in The Hague on 25 and 26 November 2002. The ICOC was transmitted as the Enclosure to UN Doc. A/57/724 (6 Feb. 2003), "Letter dated 30 January 2003 from the Permanent Representative of the Netherlands to the United Nations addressed to the Secretary General". Two other multinational initiatives were taken but ultimately did not result in anything: the global control system (GSK) proposed by Russia in 1999 and a governmental panel of experts decided by the 55th of the General Assembly of the United Nations pursuant to an Iranian proposal in 2000. See Pal, W., S. Sidhu, and C. Carle (Aug.-Sept. 2003), "Managing missiles: blind sport or blind alley?", *Disarmament Diplomacy,* No. 72, Acronym Institute, London.

90. Provided that space programmes are not used to conceal ballistic programmes.

Conduct sets itself up as a legitimate regulator of "demand" for missiles, whereas the MTCR rather establishes common rules between supplier states dealing with "missile supply".[91]

The Code is comprised of an introduction and five politically "binding" paragraphs. Like the PSI, it aims to be a flexible instrument that establishes acceptable rules for all. The legitimacy of this informal instrument was reinforced by the adoption of Resolutions A/RES/59/91 and A/RES/60/62 by the United Nations General Assembly, which invited all states that had not subscribed to the Code to do so.[92] Participation in the Code is voluntary; 143 states have adhered to it as of October 2020 and have thus undertaken to respect its principles.[93] They recognise the need to prevent and curb worldwide the proliferation of ballistic missile systems capable of delivering WMD, the need to continue pursuing international endeavours, the importance of strengthening and gaining wide adherence to multilateral disarmament and non-proliferation mechanisms, the need to ensure that states are not deprived of the possibility of benefitting from the use of outer space for peaceful purposes, the need to ensure that space launch vehicle programmes are not used to conceal ballistic missile programmes, and finally the need for appropriate transparency measures on ballistic missile programmes and space launch vehicle programmes in order to increase confidence and promote non-proliferation of ballistic missiles and ballistic missile technology. Paragraphs 3 and 4 of the Code lay down measures for the implementation of paragraph 2: the first targets ballistic missile non-proliferation while the second is aimed at implementing measures to ensure transparency, thus fostering mutual trust. It should be noted that the Code does not prohibit the development, possession, deployment or even use of ballistic missiles.

In 2004, the United Nations Security Council unanimously adopted Resolution 1540.[94] This resolution, which has become a reference document in the combat against proliferation, stipulates that "states shall refrain from providing any form of support to non-state actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery".[95] It legitimises the reinforcement of multilateral and unilateral political rules to control exports of sensitive items. In order to fulfil the objectives of the resolution, all member states "shall 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".[96] To this end, the resolution lists the elements that national export regimes must include in order to combat effectively the proliferation of WMD. Laws and regulations must be adopted to control exports, providing funds and services related to such exports, transit, trans-shipment and re-export

91. Bertolotti, D. (2006), "Le code de conduite de La Haye contre la prolifération des missiles balistiques : le régime qui n'existait pas ?" [The Hague Code of Conduct against Ballistic Missile Proliferation: The Regime that Didn't Exist], *AFRI*, Vol. VII, Centre Thucydide, Université Panthéon-Assas, Paris, pp. 802-819.

92. This invitation has been restated regularly by the UN General Assembly and recently in the Resolution adopted on 5 December 2018, "The Hague Code of Conduct against Ballistic Missile Proliferation", UN Doc. A/RES/73/49.

93. Hague Code of Conduct against Ballistic Missile Proliferation Subscribing States, Press Release, "19th Regular Meeting of the Subscribing States to The Hague Code of Conduct against Ballistic Missile Proliferation (HCoC)" (21 Oct. 2020), available at: www.hcoc.at/documents/HCOC-19th-ARM-Press-Release.pdf.

94. The negotiation of this resolution vastly exceeded the restrictive framework of the Security Council. Thus, in addition to many bilateral discussions (in particular, between France and Russia), regional groups were consulted (such as the French-speaking world), as was the movement of the unaligned parties, and the G8 played an important role. Japan was not a member of the Security Council at the time.

95. UNSCR 1540, "Non-proliferation of weapons of mass destruction", UN Doc. S/RES/1540, adopted 28 Apr. 2004, para. 2, pp. 2-3.

96. *Ibid.*, para. 3, p. 3.

operations; control measures relating to end users are needed; appropriate criminal and civil sanctions must be introduced; item control lists must be adopted and kept up to date; and finally co-operation mechanisms between states must be introduced.

This resolution was adopted pursuant to Chapter VII, entitled "Action with Respect to Threats to the Peace, Breaches of the Peace, and Acts of Aggression" of the United Nations Charter.[97] Article 41 of the UN Charter provides that the Security Council may decide what measures not involving the use of armed force are to be adopted in the event of threats to the peace, breaches of the peace and acts of aggression, and it may call upon the members of the United Nations to apply such measures. These may include a decision resulting in the "complete or partial interruption of economic relations" in relation to dual-use arms and items. For example, in 2006, Security Council Resolution 1718 imposed a ban on delivering, selling or transferring to the DPRK a list of items that could contribute directly or indirectly to the elaboration of WMD.[98]

However, these provisions applied only to states found clearly in breach on a temporary basis. On the other hand, Resolution 1540 has legislative force, is general and permanent.[99] An objection to this resolution was raised by China, which objected to the prescriptive power thereby granted to the Security Council, arguing that its role should be limited strictly to re-establishing peace. The text was consequently amended[100] but its application continues to be general and permanent, as the Security Council[101] considered that "the proliferation of weapons of mass destruction constitutes a threat to international peace and security".[102]

The failure of the 2005 NPT Review Conference

In May 2005, the seventh quinquennial NPT Review Conference was held in a difficult international context that prevented the adoption of a final declaration.[103] Examples for this difficult context are: the threat followed by the announcement by the DPRK of its intention to

97. Some states, including China, were not in favour of this reference which gave the resolution greater weight, preferring wording of an incentive rather than binding nature, under Chapter VI of the UN Charter. Charter of the United Nations (1945), 1 UNTS XVI, entered into force 24 Oct. 1945 (UN Charter):

98. UNSCR 1718 (2006), UN Doc. S/RES/1718, adopted 14 Oct. 2006. This ban has been renewed and extended regularly and most recently by UNSCR 2515, "Non-proliferation/Democratic People's Republic of Korea. Letter from the President of the Council on the voting (S/2020/246, added)", UN Doc. S/RES/2515, adopted 30 Mar. 2020.

99. Sur, S. (2004), "La Résolution 1540 du Conseil de sécurité (28 avril 2004) entre la prolifération des armes de destruction massive, le terrorisme et les acteurs non étatiques" [Security Council Resolution 1540 (28 April 2004) between the proliferation of weapons of mass destruction, terrorism and non-state actors], *Revue Générale de Droit International Public* [General Review of Public International Law], Vol. 108, No. 4, Editions Pedone, Paris, pp. 855-882.

100. See Tercinet, J. (May 2005), "Le pouvoir normatif du Conseil de sécurité : le Conseil de sécurité peut-il légiférer ?" [The normative power of the Security Council: Can the Security Council legislate?], in *Arès, Défense et sécurité de la France, sécurité européenne et internationale, Course aux armements et Désarmement, Économie de la défense* [Defence and security of France, European and international security, Arms race and Disarmament, Defence economics], Vol. XXI, No. 55, Fascicule 3 [Booklet 3], Société pour le développement des études de défense et de sécurité internationale [Society for the Development of Defence and International Security Studies], Grenoble, p. 77.

101. Action by the Security Council was preferred to other types of measures such as a recommendation of the UN General Assembly (to which the Charter entrusts the task of adopting recommendations on the principles governing disarmament), negotiation of a new treaty or action taken within the framework of the conference on disarmament or of the PSI.

102. Paragraph 1 of the Recitals to UNSCR 1540, *supra* note 95.

103. Only one procedure-related final document was adopted.

build a nuclear weapon, which was confirmed by its decision to withdraw from the NPT in 2003; the discovery of the Libyan nuclear programme for military end-use; the Islamic Republic of Iran's (Iran) undeclared enrichment programme; the threat of terrorist use of nuclear technology which became credible following the discovery of Dr Khan's underground network of nuclear technology and materials. Moreover, the little effort made by the NWS with regard to disarmament did not contribute to fill the conference with optimism. Three reasons can explain the failure to reach consensus on a final declaration: first, problems relating to procedures; second, the matter of compliance by the member states with their commitments and obligations; third, the blocking tactics adopted by certain parties during the discussions.

The problems relating to procedures and in particular the failure to reach agreement on the agenda, the subsidiary bodies and the working programme of the conference, prevented the beginning of work for more than two and a half weeks out of the four weeks scheduled for the review conference. Inevitably, this left hardly any time to address and debate the fundamental issues and even less time to reach an agreement on a final declaration. These problems were unfortunately foreseeable in that the three preparatory sessions for the conference (PrepCom) failed to achieve anything concrete and demonstrated the states parties' lack of willingness to compromise.[104]

The issues of compliance with the states parties' commitments and obligations were the second reason for the conference's failure. The NWS asked for the measures against the proliferation of nuclear weapons to be reinforced while the NNWS called for more serious action on disarmament from the NWS. One of the most sensitive issues was the reference to the 13 steps invoked in the final declaration of the 2000 Conference.[105] The delay in the entry into force of the CTBT, the deadlock at the Disarmament Conference, the United States' withdrawal from the Anti-Ballistic Missile Treaty in 2002 and Russia's reaction in response to it,[106] as well as the increase in the Chinese budget for military end-use nuclear activities were other factors hampering serious negotiations.

Finally, the third factor contributing to the conference's failure was the attitude adopted by some states during the discussions. Although the NWS reached agreement during the 2000 Conference, they were not able to agree on a joint declaration, while the "new agenda coalition" appeared to be strongly divided. Egypt, a member of this coalition, played a major role in blocking any consensus on the agenda of the conference for five days. Iran took advantage of Egypt's position to prevent its case from being discussed. In addition, the United States blocked all progress, followed by France, which also had an interest in no result being achieved.

Although the failure of the 2005 Conference is undeniable, it should nevertheless be stressed that the essentials were preserved: the review conference was held and no member state called the treaty into question. Furthermore, there was no longer any formal challenge to the legitimacy of the supplier groups.[107] The universal nature of the IAEA's additional protocol also seems to

104. Gonneville, E. de (2006), "La septième Conférence de révision du NPT : une étape dans une crise de régime?" [The Seventh NPT Review Conference: A Stage in a Regime Crisis], *AFRI*, Vol. VII, Centre Thucydide, Université Panthéon-Assas, Paris.

105. The United States, France and the United Kingdom objected to any reference to these 13 steps as they considered that they had been overtaken by events. The 13 practical steps for the systematic and progressive efforts to implement article VI of the NPT are listed in the Final Document, Vol. I, Part I, 2000 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, NPT/CONF.2000/28, p. 14.

106. Immediately after the withdrawal of the United States from the Anti-Ballistic Missile (ABM) Treaty, Russia broke with Strategic Arms Reduction Treaty (START) II. In 2004, it announced the acquisition of new nuclear weapons.

107. Gonneville, E. de, *supra* note 104.

have been more widely accepted, despite some minority opposition. Finally, the matter of withdrawing from the NPT was discussed for the first time by a specific subsidiary body.[108]

The exception that overrules the rule: the case of India

An agreement was signed between the US President George W. Bush and the Indian Prime Minister Manmohan Singh on 18 June 2005. This agreement announced the creation of a global partnership including full co-operation on civilian nuclear energy between these two countries. Under this agreement, the re-opening of the nuclear market to foreign exporters, in particular US suppliers, was made conditional on implementation of a series of commitments by the Indian authorities. In order to make this re-opening possible, President Bush undertook in return to persuade the US Congress to amend the Arms Export Control Act, 22 USC 2751 *et seq*., and the Nuclear Non-Proliferation Act of 1978, 22 USC 3201 *et seq*., and convince the NSG member states to introduce a specific exception into their guidelines for trade with India. But India does not meet the NSG's two main export conditions, namely to authorise nuclear transfers only if the supplier state is convinced that the planned transfers will not be used to develop a nuclear weapon and that the recipient state has ratified and implemented an agreement with the IAEA on full scope safeguards.

In practical terms, India undertook to identify its civilian nuclear installations and to separate them from all military activities, to voluntarily make its civilian nuclear activities subject to a full scope safeguards agreement with the IAEA and to sign and implement an additional protocol, to maintain its unilateral moratorium on nuclear testing, to develop an export control regime in line with existing informal regimes (NSG and MTCR), to "secure" the technologies and materials in its possession in order to prevent their proliferation, to support the proposed treaty banning the production of fissile material for nuclear weapons and to promote nuclear disarmament.[109]

In order to implement these undertakings, India, on 7 March 2006, adopted a plan to separate its nuclear civilian and military activities, listing the civilian facilities or activities to be subject to IAEA safeguards.[110] This separation plan was the essential basis for the resumption of international co-operation with India, as the United States could only envisage such co-operation for Indian civilian facilities and activities that are subject to IAEA safeguards. India had not in the past separated the development of its military programme from its civilian programme, which resulted in problems in identifying facilities designed strictly for civilian use. Therefore, with the adoption of the separation plan combined with a statement affirming that it was in the process of harmonising its export rules with international regimes, India was able, by showing its good faith, to exercise a degree of pressure on the United States to comply with its 2005 undertakings.[111]

108. *Ibid*.

109. Squassoni, S. (3 Mar. 2006), "U.S. Nuclear Cooperation with India: Issues for Congress", Congressional Research Service (CRS) Report for Congress, Order Code RL33016, p. 3.

110. The separation plan provided that ten operating reactors and four reactors under construction be made subject to IAEA safeguards. It also provided that future civilian reactors and some other facilities for transforming nuclear materials into fuel would also be subject to safeguards. For additional information, see IAEA (July 2005), "Communication dated 25 July 2008 received from the Permanent Mission of India concerning a document entitled 'Implementation of the India-United States Joint Statement of July 18, 2005: India's Separation Plan'", IAEA Doc. INFCIRC/731.

111. Paile, S. (under the guidance of Q. Michel) (2006), "Note d'actualité décembre 2006 : commentaire de l'Accord intervenu entre l'Inde et les États-Unis sur la coopération dans le domaine du nucléaire civil" [December 2006 News Note: Commentary on the Agreement between India and the United States on Civil Nuclear Co-operation], available at: http://local.droit.ulg.ac.be/jcms/service/file/20091007134309_note-d-actualit-ao-t-2007-Commentaire-sur-l-accord-de-coop-ration-commercial-Inde-US-sur-le-nucl-aire-civil.pdf (accessed 28 May 2021).

The United States applied a two-step approach at a domestic level to implement this co-operation process. Section 123 of the Atomic Energy Act of 1954, as amended,[112] lays down the conditions for the United States to engage in nuclear co-operation with other states. Under the act, transfers of nuclear items are conditional on the negotiation of a co-operation agreement, referred to as a 123 Agreement, which must be approved by Congress. However, the Nuclear Non-Proliferation Act of 1978, which transposes NSG Guidelines into domestic law and consequently lays down the conditions for the export of nuclear items and technology, indirectly prevents the conclusion of any nuclear agreement with states with nuclear weapons that have not signed the NPT, such as India.

It was consequently necessary first to amend the Nuclear Non-Proliferation Act with a view to introducing a specific exception for India. The Hyde Act was adopted on 27 July 2006 in a plenary meeting of the United States House of Representatives by 359 votes in favour and 68 votes against. The act was then approved by the Senate on 16 November 2006 with 85 votes in favour and 12 votes against during an extraordinary "lame-duck" session. It is interesting to observe that these votes were void of partisan politics and the Act was approved by a majority comprising both Republican and Democrat members.[113] Finally, President Bush signed the Hyde Act on 18 December 2006.[114] This act introduced an exemption from US legislation in order to envisage nuclear co-operation with India and authorised President Bush to negotiate the details of the co-operation process through a 123 Agreement. This peaceful nuclear co-operation agreement was concluded in July/August 2007. It related to civilian nuclear trade and specified that the signatory states must facilitate their mutual trade in nuclear materials as well as, in very specific cases, trade between third states and one of the signatories.[115] The conditions for transfers of nuclear materials and equipment were also laid down.[116] However, it was decided that this agreement could only be implemented in "accordance with its respective applicable treaties, national laws, regulations, and license requirements concerning the use of nuclear energy for peaceful purposes".[117] This provision meant that the NSG Guidelines absolutely needed to be amended. Moreover, the US authorities committed *vis-à-vis* the Indian authorities to defend this exception and attempt to obtain its adoption by the NSG.

Although the Indian-US negotiations in 2005 were the precursor to nuclear co-operation with India, the prospect of the end of Indian isolation and the potential opening of a market that had previously been closed did not leave the other supplier states indifferent. France, which was anxious to prevent the United States from monopolising the Indian market, reacted rapidly by means of statements issued in September 2005 and February 2006. A meeting in 2005 between Indian and French authorities resulted in the recognition by France of the "need for full international civilian nuclear co-operation with India". Moreover, France undertook to "work towards this objective by working with other countries and the NSG and by deepening bilateral cooperation".[118] This statement announced that both countries would in the future work towards

112. 42 USC 2153. Section 123 originated in the Atomic Energy Act of 1954, Public Law No. 83-703, 68 Stat. 940.

113. Paile, S., *supra* note 111.

114. Henry J. Hyde United States-India Peaceful Atomic Energy Cooperation Act of 2006, Public Law 109-401, 120 Stat. 2726.

115. "Agreement for Cooperation between the Government of the United States of America and the Government of India Concerning Peaceful Uses of Nuclear Energy (123 Agreement)", Art. 4 (Aug. 2007).

116. *Ibid*., Art. 2.2.

117. *Ibid*., Art. 2.1.

118. "Joint statement issued by the President of the Republic of France and the Prime Minister of India", Elysée Palace (12 Sept. 2005).

concluding a bilateral nuclear co-operation agreement. In 2006, a new statement confirmed the "fruitful bilateral dialogue", asserting their mutual wish to further develop international co-operation in promoting the use of nuclear energy and laid the foundations for such co-operation. It reaffirmed the negotiations concerning conclusion of a bilateral nuclear co-operation agreement for peaceful purposes. To this end, the two countries stated that they looked forward to an adjustment of the international civilian nuclear co-operation framework with respect to India and accordingly confirmed their intention to work towards this objective so that the agreement could be fully implemented.[119]

On 1 August 2008, the IAEA Board of Governors approved by consensus a safeguards agreement between India and the IAEA, which entered into force on 11 May 2009. On 15 May 2009, India also signed the additional protocol that gave the IAEA the widest possible powers to inspect and control civilian nuclear facilities and nuclear activities subject to safeguards. Thus, India fulfilled the essential points of its undertakings and the United States was able to initiate the second stage of its commitment, namely, to attempt to put pressure on the NSG to introduce an exception authorising nuclear trade with India after a nuclear embargo lasting almost 35 years.

At an extraordinary plenary meeting held on 6 September 2008, the NSG adopted the decision relating to the exception for India. The adoption of this exemption was undoubtedly the result of an intensive lobbying campaign by the United States, the initiator of the proposal, backed by the main supplier states with the notable exception of Japan. In light of India's commitments, the NSG now authorises its members to transfer items or technology[120] designed for peaceful use to Indian civilian nuclear facilities subject to IAEA safeguards. This represents a right for the participating states to trade with India but not an obligation to do so. The states parties to the NSG are not obliged to apply this exception for their exports of nuclear items, as decided, for example, by Japan. It should be noted that the use of the exception for India is nevertheless restricted by a specific notification mechanism whereby the states parties, during plenary meetings, are asked to inform each other about any transfers to India and also, on a voluntary basis, to notify any national bilateral agreement concluded with that country.[121] Thus, in 2008, France, the United States and Russia concluded co-operation agreements with India, joined, in the following years by Argentina, Australia, Bangladesh, Canada, Kazakhstan, Korea, Sri Lanka, the United Kingdom, Viet Nam and even Japan.[122]

The exception for India granted by the NSG is one of the Bush administration's biggest successes. Russia provided support throughout the process, even if it had in the past provided some Indian facilities with nuclear fuel well before adoption of the exception for India by the NSG.[123] Moreover, France, strongly encouraged by the French companies Areva and Airbus, was also in favour of the exception. The French hoped to be supported by the whole EU, which saw the conclusion of these agreements as a means of action to combat climate change.[124] However,

119. "Declaration by India and France on the Development of Nuclear Energy for Peaceful Purposes", New Delhi, 20 Feb. 2006.

120. These are items shown on the NSG list relating to nuclear items and that relating to dual-use items.

121. IAEA (2008), "Communication dated 10 September 2008 received from the Permanent Mission of Germany to the Agency regarding a 'Statement on Civil Nuclear Cooperation with India'", IAEA Doc. INFCIRC/734 (Corrected), attachment.

122. Important Agreements, Department of Atomic Energy, Government of India, available at: https://dae.gov.in/node/75 (accessed 28 May 2021).

123. To this end, Russia relied in an abusive fashion on the safeguards provision laid down by Article 4 of INFCIRC/254/Rev.8/Part.1.

124. Pop, V. (29 Sept. 2008), "EU extends nuclear cooperation with India", *EU Observer*, EUobserver.com ASBL, Brussels.

this reasoning was not supported by several member states, including notably Austria, Ireland and the Netherlands. These countries, along with New Zealand, Norway and Switzerland, were sceptical about the impact of the NSG exception, in particular in the event that India resumed a series of nuclear tests after having been granted the exception.[125] In order to meet these concerns, New Delhi undertook to refrain from contributing to proliferation and to suspend all nuclear testing.[126] China was initially one of the most strongly opposed countries with regard to the approval of the exception for India by the NSG.[127] Nevertheless, in the end, it did not object, thus enabling the exception to be approved by consensus. However, a joint statement by the Indian Prime Minister and his Chinese counterpart asserted that these two countries undertook to support their co-operation with regard to civilian nuclear energy.[128] Argentina, Brazil and South Africa also backed the agreement.

In addition to opening up the Indian nuclear market, the NSG exception radically changed the principles of non-proliferation of nuclear weapons as established by the NPT by granting India *de facto* NWS status. If proof of this is needed, it is enough to look at the conditions laid down by the NSG for resumption of nuclear trade, which are very similar to the voluntary undertakings made by the NWS signatories of the NPT. The most striking example here is the agreement on full scope safeguards, which mirrors that concluded by the NWS and applies exclusively to the facilities listed by the Indian authorities. India is at present the only non-signatory party to the NPT equipped with nuclear weapons to benefit from such wide access to the civilian nuclear market. By relying on their objectively similar situations, Pakistan and Israel are currently seeking to obtain a similar exception from the NSG.[129]

It is argued by some that no provision of the NPT prohibits peaceful nuclear co-operation with states not party to the treaty, provided that such co-operation is subject to IAEA safeguards in order to verify the exclusively civilian nature of the co-operation. Moreover, they argue that by developing its military nuclear programme, India has not breached any international commitment since it is not a party to the NPT.[130]

In 2011, discussions on the NSG's relationship with India and India's potential membership were initiated by the US Government, but even if the question is still pending on the NSG plenary

125. These same countries wanted at the outset to include a suspension clause to the exception agreement, in case India resumed nuclear testing.

126. It was, however, pointed out by some that this only appeared in a statement by the Minister of Foreign Affairs, Pranab Mukherjee, and not in the Statement on Civil Nuclear Cooperation with India published in INFCIRC/754.

127. Some sources state that China attempted to thwart the U.S. proposal throughout the negotiations. It encouraged the coalition of opposing countries in order to prevent the required consensus. The Chinese representatives apparently even left the meeting room for a moment. These sources also argue that it was only further to a telephone call from the U.S. President to his Asian counterpart that China finally decided not to block the agreement. See Kumara, K. and D. Jayasekera (17 Sept. 2008), "Nuclear Supplier Group gives India unique 'waiver,' but only after row between Delhi and Beijing", *World Socialist Web Site*, International Committee of the Fourth International, available at: www.wsws.org/en/articles/2008/09/nucl-s17.html (accessed 28 May 2021).

128. "A Shared Vision for the 21st Century of the People's Republic of China and the Republic of India", 14 Jan. 2008, available at: www.lawinfochina.com/display.aspx?id=7707&lib=tax&SearchKeyword=&SearchCKeyword= (accessed 28 May 2021).

129. China is also aiming for a similar exception to be granted to Pakistan.

130. Senator Xavier Pintat's report, *Senat Rapport* No. 620 (16 Sept. 2009) conducted on behalf of the Senate of the Republic of France's Committee on Foreign Affairs, Defence and Armed Forces on Bill No. 335 authorising approval of the co-operation agreement between the Government of the French Republic and the Government of the Republic of India for the development for peaceful use of nuclear energy (2008-2009).

agenda no consensus has been found yet.[131] It seems that some states, in particular China, are not ready to derogate from the condition of a country being a non-nuclear weapons state as defined by the NPT in order to have the right to apply for NSG membership.

The United Nations Security Council's growing interest in nuclear non-proliferation matters

At a meeting of heads of state and government on 24 September 2009 chaired by the United States,[132] the UN Security Council unanimously adopted Resolution 1887[133] granting a vital role to the United Nations in reinforcing the global framework for the non-proliferation of WMD, with emphasis on nuclear weapons. This resolution reaffirmed the Security Council's involvement in the combat against proliferation, which is now placed in a more global framework.

The first paragraph of Resolution 1887 states that all situations of non-compliance with non-proliferation obligations shall be brought to the attention of the Security Council, which will determine if the situation constitutes a threat to international peace and security. The resolution accordingly grants the Security Council primary responsibility in addressing such threats. The scope of the expression "compliance with non-proliferation obligations", within the meaning of the resolution, also needs to be defined. It relates mainly to the various undertakings made by states with regard to non-proliferation, such as the NPT, the Chemical Weapons Convention, the Biological Weapons Convention and Resolution 1887.

The resolution places particular importance on the NPT, calling upon, on the one hand, states parties to the NPT to "comply fully with all their obligations and fulfil their commitments under the Treaty", and on the other hand, all states that are not party to the NPT to accede to the treaty as NNWSs and, pending their accession to the treaty, to adhere to its terms.[134] It is somewhat paradoxical that the states which voted in favour of this resolution also backed the adoption of the NSG exception for India.

Resolution 1887 also refers to Resolution 1540 and its principles.[135] The Security Council affirmed its determination to promote Resolution 1540 in its entirety and to provide its backing

131 See e.g. the "Public Statement: Plenary Meeting of the Nuclear Suppliers Group, Seoul, Republic of Korea, 23-24 June 2016", stating that "the NSG had discussions on the issue of 'Technical, Legal and Political Aspects of the Participation of non-NPT States in the NSG' and decided to continue its discussion", available at: www.nsg-online.org/images/2016_Public_Statement_Final.pdf (accessed 28 May 2021).

132. Except for Libya. It was the fifth time in the history of the United Nations that the Security Council held a meeting of heads of state and government. The Secretary-General of the UN and the IAEA Director General also participated in this meeting.

133. UNSCR 1887 (2009), "Maintenance of international peace and security: Nuclear non-proliferation and nuclear disarmament", UN Doc. S/RES/1887, adopted 24 Sept. 2009.

134. *Ibid*., paras. 2 and 4).

135. *Ibid*., paras. 22 and 23:

22. *Welcomes* the March 2009 recommendations of the Security Council Committee established pursuant to resolution 1540 (2004) to make more effective use of existing funding mechanisms, including the consideration of the establishment of a voluntary fund, and affirms its undertaking to promote full implementation of resolution 1540 (2004) by member states by ensuring effective and sustainable support for the activities of the 1540 Committee;

23. *Reaffirms* the need for full implementation of resolution 1540 (2004) by member states and, with an aim of preventing access to, or assistance and financing for, weapons of mass destruction, related materials and their means of delivery by non-state actors, as defined in the resolution, calls upon member states to cooperate actively with the Committee established pursuant to that resolution and the IAEA, including rendering assistance, at their request, for their implementation of resolution 1540 (2004) provisions, and in this context welcomes the forthcoming comprehensive review of the status of implementation of resolution 1540 (2004) with a view to increasing its effectiveness, and calls upon all states to participate actively in this review.

to the 1540 Committee. It added that the resolution must be fully implemented by all members of the United Nations. There is no doubt that the Security Council considered implementation of this resolution as one of the non-proliferation obligations within the meaning of paragraph 1 of Resolution 1887.

It should be noted that the Security Council did not explicitly refer to other international treaties such as, for example, the Chemical Weapons Convention or the Biological Weapons Convention. However, it is not unreasonable to consider that they are also covered by Resolution 1887. Although the bulk of the resolution focuses on non-proliferation of nuclear weapons, the first paragraph states that the Security Council will look into any case of failure to comply with non-proliferation obligations. The use of this general term in preference to other more specific references such as "non-proliferation of nuclear weapons" or "non-proliferation of weapons of mass destruction" shows that Resolution 1887 covers non-proliferation in the broad sense of the term, not only that of nuclear weapons.

However, Resolution 1887 does not contain any obligations incumbent on states similar to those provided in the first five paragraphs of Resolution 1540. In fact, it affirms the Security Council's responsibility in the field of non-proliferation and calls on states to help prevent the proliferation of WMD and, in particular, "to create the conditions for a world without nuclear weapons".[136] Moreover, it is on the basis of this responsibility that the Security Council sets out a series of recommendations relating to non-proliferation of WMD in the other paragraphs.

First, some recommendations call on states to ratify and implement a number of instruments with a view to improving the international non-proliferation framework. Thus, the resolution calls on states to sign and ratify the CTBT,[137] calls upon the Conference on Disarmament to negotiate a treaty banning the production of fissile materials for nuclear weapons,[138] encourages the IAEA's work and calls upon states to conclude full scope safeguards agreements together with an additional protocol,[139] and asks states to adhere to the Convention on Physical Protection of Nuclear Materials,[140] among other things.

Resolution 1887 also contains requests regarding measures that states must take to combat proliferation and reinforce national export control systems. Thus, the Security Council urges states to take all appropriate measures to prevent nuclear proliferation financing and shipments, strengthen export controls, secure sensitive materials and control access to intangible transfers of technology.[141] Moreover, it calls upon states to adopt stricter national controls for the export of sensitive goods and technologies of the nuclear fuel cycle[142] and urges them to improve their national capabilities to detect, deter and disrupt illicit trafficking in nuclear materials throughout their territories. The resolution also encourages states to require as a condition of nuclear exports that the recipient state agrees that, in the event that it should terminate, withdraw from or be found by the IAEA Board of Governors to be in non-compliance with its IAEA safeguards agreement, the supplier state would have the right to require the return of nuclear material and equipment

136. *Ibid*., Introduction.

137. *Ibid*., para. 7.

138. *Ibid*., para. 8.

139. *Ibid*., para 15.

140. *Ibid*., para. 21; Convention on the Physical Protection of Nuclear Material, (1980), IAEA Doc. INFCIRC/274 Rev. 1, 1456 UNTS 125, entered into force 8 Feb. 1987.

141. UNSCR 1887, *supra* note 133, para. 27.

142. *Ibid*., para. 13.

provided prior to such termination, non-compliance or withdrawal, as well as any special nuclear material produced through the use of such material or equipment.[143] Finally, the third category relates to co-operation between states with regard to non-proliferation.[144]

The particular importance given by the resolution to nuclear matters should be noted. Apart from the first paragraph, paragraph 10, which deals with non-proliferation in general, paragraphs 22 and 23, which focus on the application of Resolution 1540, and paragraph 29 in which the Security Council decided "to remain seized of the matter", the remaining provisions of the resolution relate exclusively to nuclear matters.

The 2010, 2015 and 2020 NPT Review Conferences: success, failure and postponement

If the 2010 NPT Review Conference succeeded in adopting a Final Document and an Action Plan, nuclear trade control was not the most debated topic. The adoption of Resolution 1540 and the establishment of its related Committee have partly attracted the attention of the international community and the Conference almost restated the various elements of the resolution related to nuclear trade. The Action Plan re-endorsed the main actions already raised at the previous conferences but which had not yet been achieved. It concerns in particular the universalisation of IAEA comprehensive safeguards, the encouragement to conclude and bring into force the additional protocol. The main add-on of the Action Plan that was detailed as explicitly by the previous conferences was the encouragement to "States parties to make use of multilaterally negotiated and agreed guidelines and understandings in developing their own national export controls".[145] This new wording was, without naming them, referring to the NSG and the Wassenaar Arrangement and not only to the Zangger Committee as was the case in the documents of the previous conferences.[146]

The 2015 Review Conference did not succeed in adopting a final declaration for reasons not related to trade control. It was essentially due to the lack of consensus on the Middle East Resolution and on nuclear weapons disarmament. However, the draft of the final documents restated, on trade control, essentially the content of the 2010 Conference.[147]

Finally, the 2020 the Review Conference has been postponed to a date no later than August 2021 due to the COVID-19 pandemic.[148]

143. *Ibid*., para. 18.

144. *Ibid*., paras. 24 and 26.

145. 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Final Document, NPT/CONF.2010/50, Vol. I, Part I, Action 36, p. 26.

146. The Zangger Committee has been regularly mentioned by NPT Review Conference documents and specifically 1985, 1990, 1995, 2000, 2010.

147. 2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Final Document, Part I, "Organization and work of the Conference", p.11, notes that "Despite intensive consultations, the Conference was not able to reach agreement on the substantive part of the draft Final Document, as contained in NPT/CONF.2015/R.3." See the Working Paper of the Vienna Group of Ten (2 Mar. 2015), "Addressing 'Vienna issues': the Comprehensive Nuclear-Test-Ban Treaty, compliance and verification, export controls, cooperation in the peaceful uses of nuclear energy, nuclear safety, nuclear security and withdrawal from the Non-Proliferation Treaty", NPT/CONF.2015/WP.1, pp. 3, 10-11, referenced in Final Document, NPT/CONF.2015/50, Part 2, "Documents issued at the Conference", p. 7.

148. Letter from Gustavo Zlauvinen, President-Designate of the 10th Review Conference to NPT States Parties' Permanent Representatives and Observers (28 Oct. 2020), available at: www.un.org/sites/un2.un.org/files/npt_president-designate_letter_28_oct_2020.pdf (accessed 28 May 2021).

Strengthening national trade control system: the outreach competition

Since the adoption of Resolution 1540, calling upon states to offer "assistance as appropriate in response to specific requests to the States lacking the legal and regulatory infrastructure, implementation experience and/or resources for fulfilling" provisions 1-6 of Resolution 1540, several states and international regimes have developed extensive outreach activities. In the nuclear sector, the NSG as well as the Zangger Committee organise regular activities with non-members states to promote their control lists and guidelines. It is difficult to assess the efficacy of such outreach activities; the number of new participating states in both regimes has not increased significantly but it was not the objective. However, considering the discussion in the different meetings related to the NPT Review Conferences it could be said that their principles are internationally recognised.

The EU, the United States, Canada and Japan, as well as other states, have initiated large outreach activities to promote the strengthening or the establishment of WMD-related items trade control systems in third states. If the EU list of controlled items has been progressively considered as an international standard, the system promoted by donors is usually their national one. In this regard, donors are competing to convince third states to align their system to their own and beneficiary countries are, sometimes, facing several offers of assistance that are almost overlapping.

Conclusion

The aim of this article has been to provide a brief overview of the main stages in the development of international nuclear export control regimes since the entry into force of the Treaty on the Non-Proliferation of Nuclear Weapons and to set out the main features of the current regime. Although the constant tendency in the development of non-proliferation regimes has been to reinforce transfer control rules by filling in any gaps created by a number of more or less successful proliferation attempts, it must be recognised that this has also resulted in increasing and complicating international non-proliferation instruments. The lists of nuclear items covered by these regimes have become longer and longer and more technically elaborate, which has made it difficult for some states lacking the necessary technical expertise to detect effectively such items when they go through customs.

Moreover, the arrival of new forms of actual or supposed proliferation, linked in particular to nuclear terrorism, has led to the adaptation of these regimes, which were initially designed to combat institutional proliferation by states. Finally, the continuing development of technology and the use of new means of exporting it, in particular via intangible transfers, have also weakened national export control regimes essentially geared towards the control of physical transfers based on an export licence verified by the customs authorities upon leaving the territory.

Nevertheless, it must be recognised that, while non-proliferation regimes have not been able to prevent some states from procuring nuclear weapons, they have succeeded in curbing significantly the number of nuclear weapons states. We are a long way from the pessimistic predictions made at the beginning of the 1980s, which forecast some 20 nuclear weapons states by early 2000.

However, in the case of a number of states, the decision to renounce nuclear weapons was taken on political rather than technical grounds, based first and foremost on the NPT's essential principle of access to civilian technology in return for renouncing nuclear weapons. The NSG broke with this principle by allowing an exception for India, and this has led to the risk that some states, feeling that their efforts have not been adequately rewarded, might reconsider their political decisions.

Nuclear project development: The lawyer's perspective

by Ákos Frank[*] and William Fork[**]

It is a bright and sunny morning as you stride through your nuclear vendor company's entrance. You have just settled at your desk when the company's general counsel appears at your door with a stern expression. "We just received the draft contract from our customer for the new nuclear power plant! 3 000 pages. It is a top priority project for our company – and we are counting on you! Please have a key-points analysis and a presentation prepared for management by next week." You recline in your chair… your plans for the week just changed.

This could be a scenario that happens to you as in-house counsel to a nuclear vendor. *How should you conduct this analysis? What points are important for corporate management? What is important to the General Counsel? How far can we deviate from the draft contract? What are the most concerning issues for our customer? What will our competitors do?...* This article explores the answers to these questions based on the differing perspectives of:

- a lawyer working for a civil nuclear vendor that builds and modernises nuclear power plants; and
- a lawyer who advises owners of new build civil nuclear programmes regarding legal requirements and best practices.

Part I. Synthesising public law knowledge into private law transactions

A. *Moving from public to private law*

On which norms do transactional lawyers in the civil nuclear industry focus? Private law commercial transactions must be consistent with a broad framework of public law instruments. The long-standing distinction between public and private law, discussed in Roman law and other

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historical legal treatises, is helpful in understanding these norms. As a general matter, private law is concerned with relations between individuals and corporate personalities.[1] In contrast, public law is concerned with state functions and includes laws, regulations and administrative procedures of a host country, criminal laws, and laws that incorporate international obligations and norms. Relevant instruments that shape civil nuclear projects include public procurement laws, nuclear licensing and permitting laws, environmental laws and laws governing private international transactions.

Unique hazards associated with nuclear power stations require the highest levels of regulation to ensure public safety and nuclear security. Typically, in the planning stages of a new build project, a utility owner or operator will lead an effort to map relevant public law regulations and translate them into private law procurement strategies and contract terms. The necessary procurement process may also be prescribed by national law (often transposing international treaties or supranational law). The subsequent procurement process establishes the scope, parameters and risk allocation between the owner and nuclear vendor.[2] The parties achieve a major milestone when they conclude a private law transaction for the engineering, procurement and construction of a nuclear power plant.

Considered another way, public and private law is distinguished because public law is relatively fixed; nuclear projects are constrained by detailed and often complex laws and regulations. For this reason, nuclear lawyers spend significant effort mapping applicable public law requirements to ensure permitting and contract success in new build projects. In contrast, private law provides flexibility. It enables commercial negotiations between contracting parties on, e.g. allocation of risk, work scope and rules related to project execution. The largest volume of legal work in the civil nuclear industry relates to private law relationships, including negotiating and managing contracts.

B. Nuclear law, nuclear contract law, international nuclear contract law

Nuclear contract law is a specialised area of law that relates to the sale and purchase of goods and services for nuclear power projects. Not only does this area of law encompass all aspects of traditional nuclear law – nuclear safety, regulation and licensing, security and transport, safeguards, non-proliferation and export control, environmental and radiological protection, and nuclear liability and compensation – but it also differs from "conventional" contracts for power generation plants or other large infrastructure projects in a number of ways.

The nuclear industry today is international. Over the past 60 years, the nuclear industry has evolved, expanded and fragmented. It is hard to conceive of a new build nuclear project today constructed with only domestic supplies and services. The overwhelming majority of the larger transactions involve the transboundary movement of goods, services and technology. Therefore, practitioners dealing with international nuclear contract law must look beyond the provisions of a single country's national civil codes and domestic regulations.

1. See Nicholas, B. (1962), *An Introduction to Roman Law*, Oxford Univ. Press, Clarendon Law Series.

2. Examples include the Agreement on Government Procurement (1994), 1915 UNTS 103, entered into force 1 Jan. 1996; and the Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC, *Official Journal of the European Union* (OJ) L94 (28 Mar. 2014), p. 243.

C. Large nuclear projects

The work of nuclear lawyers today is concentrated in the domain of large nuclear projects. These projects are diverse. As of 2021:

- Some 52 reactors are under construction, translating to approximately 54 GWe net installed electric capacity.[3]
- In addition to Generation III and III+ reactors, promising new technologies will increasingly reach international commercial markets in the form of small modular reactors and Generation IV reactors.
- However, large nuclear projects extend beyond new build projects. Today, the IAEA counts 444 land-based nuclear power reactors in operation.[4] Legal work associated with plant modernisation, power uprate and major plant refurbishment and plant lifetime extension will continue in the future.
- Another area of legal activity involves work associated with reactors in permanent shutdown (today, nearly 200 units),[5] which will be decommissioned, placed in long-term safe storage or entombed.
- The last main category of large nuclear projects relates to the other facilities of the nuclear fuel cycle infrastructure: enrichment, milling, mining, reprocessing and encapsulation, as well as interim and final repositories.

Part II. Developing nuclear new build power programmes

The legal process for the procurement of a new build nuclear programme is most typically framed in the context of a competitive bidding process, which applies in many cases. However, other procurement approaches include “strategic partners, sole suppliers and direct negotiations through intergovernmental agreements.”[6]

A. The owner’s goal is safe and reliable power – the vendor’s goal is safety and profitable project delivery

As a threshold matter, we assume that all major civil nuclear technologies that are available for large electricity generation procurement today are safe; thus, the owner must plan its contracting procedure to enable competition and to procure the nuclear plant that is best adapted to its unique procurement aims and objectives. To enable a successful project, the owner and the vendor should create a relationship in which they are *partners* rather than working within an adversarial framework to meet the owner’s goal of safe and reliable power and the vendor’s goal of safe and profitable project delivery.

Legal planning can be a major contributing factor to programme success. This is because the work of all other disciplines is organised around the creation, negotiation, execution and management of key contracts. Minimising overall project risk – both in terms of cost and schedule – is a key issue for the vendor and the owner.

3. IAEA (n.d.), “Power Reactor Information System (PRIS), The Database on Nuclear Power Reactors”, https://pris.iaea.org/PRIS (accessed 4 May 2021).
4. *Ibid*.
5. IAEA (n.d.), “Power Reactor Information System (PRIS): Permanent Shutdown Reactors”, https://pris.iaea.org/PRIS/WorldStatistics/ShutdownReactorsByCountry.aspx (accessed 4 May 2021).
6. IAEA (2015), *Milestones in the Development of a National Infrastructure for Nuclear Power*, IAEA Nuclear Energy Series No. NG-G-3.1 (Rev. 1), IAEA, Vienna, Foreword.

B. Lawyer's role at a nuclear vendor and a nuclear owner

The role of transactional legal counsel in advising a nuclear owner and a nuclear vendor can differ significantly. The owner's lawyer (or external legal counsel) is typically embedded within the highest-level owner organisation and its procurement planning process. Nuclear power plant permitting and contracting is so strictly and densely regulated that mapping of the process is only possible with experienced counsel. Multiple legal disciplines are involved, including commercial experts, regulatory experts, legislative experts, public international law experts and contracting specialists. A greenfield new build procurement may employ dozens of in-house and external legal experts at its peak.

In contrast, the vendor's legal experts sell nuclear power stations for a living. Guiding the nuclear vendor through the procurement processes and negotiation of the contracts is their full-time activity, often in multiple countries at the same time. The vendor's legal team will typically consist of one or two lead in-house counsels and a few external lawyers in specialised areas of national or international law. Additional specialist lawyers can assist to handle vendor purchasing requirements and contracts as the vendor identifies its sub-suppliers and partners for a new build project.

C. Areas of legal interest

The IAEA has identified a list of 19 "infrastructure issues" to analyse in each step of a nuclear development programme. "Insufficient attention to any of them may compromise safety or lead to costly delays or even project failure."[7] These are:[8]

1. national position
2. safeguards
3. nuclear security
4. nuclear safety
5. public law legal framework (including international legal instruments)
6. regulatory framework
7. funding and financing
8. management (including organisation, staff, management system and strategy)
9. industrial involvement
10. procurement
11. emergency planning
12. electrical grid
13. nuclear fuel cycle
14. radioactive waste management
15. site and supporting facilities
16. human resource development
17. environmental protection
18. radiological protection
19. stakeholder involvement

In nuclear project development, the key legal areas of interest must be considered that affect the main procurement contract for engineering, procurement and construction, which can also govern nuclear operations and fuel procurement.

7. *Ibid*., p. 1.

8. *Ibid*., p. 7. The order and category names have been modified by the authors.

The above list provides a good starting point for legal counsel to use in commencing their work. Special emphasis is given to the public law environment, necessity of regulating certain topics in the private law contract, scope of the future contract and procurement strategy.

D. Organisation and stakeholders

The owner and its staff are in the centre of a web of diverse relationships. These relationships range from the supranational (e.g. IAEA, Euratom) through international (e.g. banks, shareholders) to national (e.g. government, regulatory authority, media) and to the local level (e.g. local community and emergency response). The owner must carefully manage a myriad of relationships and contracts.

The main procurement contract with the nuclear vendor is perhaps the most important legal instrument governing the most important of these relationships. The most significant legal work in a new build project is typically expended in the drafting, negotiation and subsequent management of this agreement.

The counterparty to this contract is the nuclear vendor. However, the nuclear vendor is not a single monolithic entity. It manages a professional supply chain of many certified subcontractors and suppliers and integrates their work. In some cases, the vendor may exist as a special purpose vehicle containing multiple vendor companies. Thus, "below" the surface of the main contract are hundreds, if not thousands, of local and international subcontracts.

The owner and vendor organisations themselves are dynamic in terms of size as the project develops. In the early stages of a nuclear programme, an owner's "task force" organisation might derive from select personnel from the nuclear energy programme implementing organisation (NEPIO)[9] or a handful of new personnel. By the end of the procurement process, the owner's organisation can grow to well over a hundred individuals responsible for all aspects of the programme. The size of the project team within the vendor's organisation can also include a core team of 20 personnel, supported by over 60 part-time experts who provide specialised support during key points in the procurement bid and negotiation process.

E. Contracting and procurement

The main parameters of a nuclear procurement process are highlighted in this section. Valuable insights are summarised in the IAEA Nuclear Energy Series publication relating to the *Invitation and Evaluation of Bids for Nuclear Power Plants*[10] and supporting IAEA materials.

1. Forms of agreements

Typical forms of agreement are used at the different phases in the development of a nuclear power programme. These include the use and peculiarities of the:

- Memorandum of Understanding (MoU): This agreement, which is typically non-binding, allows the parties to express a willingness to enter into a contract before or at the commencement of negotiations and can include an indicative project conceptual plan and schedule, among other clauses. Often the first written contract document between the parties, an MoU can provide symbolic power and influence subsequent agreement terms.

9. *Ibid*., p. 6.
10. IAEA (2011), *Invitation and Evaluation of Bids for Nuclear Power Plants*, IAEA Nuclear Energy Series No. NG-T-3.9, IAEA, Vienna.

- Early Works Agreement (EWA): This agreement is typically designed to enable certain works (e.g. conceptual engineering, site survey and studies) before conclusion of a final award or project agreement. An EWA is a complete and standalone contract and often includes "easy termination" and limited cancellation cost provisions.
- The Main Contract or Prime Contract: This is a single contract or package of contracts resulting from a tendering process covering the entire project. Mutually binding, the main contract is difficult to terminate and directly governs the parties' relationship for about ten years. The main contract can cover engineering, procurement and construction, as well as finance, operations, nuclear fuel supply and other key contractual terms.
- Follow-on Contracts: These typically relate to fuel supply and service and maintenance agreements.

2. The IAEA milestones and private contracts

To describe the progression of a national nuclear programme, the IAEA milestones framework provides an internationally accepted reference system:

> The three phases in developing the infrastructure necessary to support a nuclear power programme are:
>
> - Phase 1: Considerations before a decision to launch a nuclear power programme is taken;
> - Phase 2: Preparatory work for the contracting and construction of a nuclear power plant after a policy decision has been taken;
> - Phase 3: Activities to implement the first nuclear power plant.
>
> The completion of each phase is marked by a specific milestone at which the progress of the development effort can be assessed, and a decision can be made to move on to the next phase. These milestones are:
>
> - Milestone 1: Ready to make a knowledgeable commitment to a nuclear power programme;
> - Milestone 2: Ready to invite bids/negotiate a contract for the first nuclear power plant;
> - Milestone 3: Ready to commission and operate the first nuclear power plant.[11]

The key private law contracts that an owner must develop over the term of the programme's development (between 10 to 30 years) can be superimposed over the IAEA milestone framework. This model can be extended until the end of the plant's operating lifetime and subsequent decommissioning. The time between the commencement of a civil nuclear programme and the decommissioning of the resulting first nuclear power plant can span 100 years. During this time, strong and lasting ties are established between the vendor and the owner, the regulatory authorities of their respective host states and even their governments.

11. IAEA (2015), *supra* note 6, p. 5.

3. Different delivery models and scopes

A decisive moment in the development of a new build programme is the decision regarding the plant delivery model. Common categories are used to describe typical delivery models. These provide a good orientation regarding delivery strategy and organisation, but the details must be carefully defined in each type of contract:[12]

- The "turnkey" contract (EPC: engineering, procurement, construction), whereby a single contractor or consortium of contractors assumes overall responsibility for completing all parts and all phases of the project design and construction.
- Split package contract (EPCM: engineering, procurement and construction management), also referred to as the "Island Approach", whereby the overall responsibility for design and construction of the project is divided among a relatively small number of contractors, with each contractor being separately in charge of a large section of the work.
- The multiple package contract or "Components Approach", whereby the plant owner, possibly with the assistance of an architect-engineer or consultants, assumes overall responsibility for managing the project design and construction. Multiple contracts are issued to various contractors that carry out work under the project.
- Build, own and operate (BOO) or build, own, operate and transfer (BOOT), whereby the investor-vendor must plan, construct, operate and provide the financing for the plant. This investor must also assume the risk over the entire plant life, or part of the risk.

The main drivers of this strategic choice include:[13]

- the national nuclear programme;
- economic considerations;
- owner experience and capability in handling such a project;
- potential vendors and their experiences and attributes;
- development of national engineering and industry capability;
- availability of qualified management, co-ordinating and engineering manpower;
- plant design criteria and engineering features;
- standardisation and proven quality;
- warranty and liability considerations, including nuclear liability;
- government and industrial relationships domestically and in the supplier's country;
- financing possibilities (foreign investment);
- subsequent projects and technology transfer; and
- export controls.

The consequences of the choices may affect:

- operational complexity and interfaces;
- licensing complexity;
- owner involvement and responsibility;
- owner's "hands-on experience"; and
- owner's future independence from vendors.

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12. IAEA (2012), *Project Management in Nuclear Power Plant Construction: Guidelines and Experience*, IAEA Nuclear Energy Series No. NP-T-2.7, IAEA, Vienna, p. 20.

13. *Ibid*.

4. Some standard contracts

A defining moment occurs when the owner's lawyer decides to produce the main contract draft. *Should you start with a sheet of white paper and start typing? Should you research earlier, similar transactions? Will you use an international standard contract and adapt it?* This choice is probably the single most consequential decision the owner's lawyer will make related to a power plant project; it will affect the most important legal relationship in the project for over a decade. The vendor's lawyers will live with this draft and the vendor will deliver under its terms.

Today, no standardised international model contract exists for nuclear new build projects. Accordingly, the in-house and external lawyers' role in negotiating the prime contract is significant for both sides. To understand how this assessment is made, some standard forms of construction contracts can be explored:

- the recommendations of the IAEA;[14]
- International Chamber of Commerce (ICC) Model Turnkey Contract for Major Projects;
- Fédération Internationale des Ingénieurs-Conseils (FIDIC) Yellow Book and Silver Book;
- New Engineering Contract (NEC3) Engineering and Construction Contract;
- Orgalime Turnkey Contract for Industrial Works; and
- Institution of Civil Engineers (ICE) Conditions of Contract Design and Construct.

The choice of the contractual baseline is a paramount decision and, in practice, its importance is not always recognised. Corporate traditions and country-specific requirements may prevail, resulting in suboptimal solutions. While standard contracts can be a starting point, tailoring of any non-nuclear standard construction contract to a nuclear project is a long, collaborative task requiring management, commercial, technical and legal experts.

5. Visible and invisible contract documents

What does one find in a final contract? A signed contract package includes the terms of the contract (generally 150 to 200 pages); technical and commercial appendices and schedules (generally 3 000 to 10 000 pages); and in some cases codes, standards and regulations are also included in appendices. While a contract package can be printed and held physically, it also contains an "invisible component" that can be equally important:

- the law applicable to the terms of the contract (contract law of a chosen country);
- the applicable mandatory law in the host country (e.g. environmental protection, safety at work, procurement law, tax law); and
- the applicable mandatory laws relevant to the vendor and its sub suppliers (e.g. export control, anti-bribery laws and laws with universal jurisdiction).

F. Negotiation of the prime contract

Prime contract negotiations involve reaching agreement regarding the parties' scope of work and terms and conditions. The owner and the vendor make hundreds of risk-allocation choices during this process. Some are made consciously while some obligations can be hidden outside the language of the contract and industry best practices.

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14. IAEA (2000), *Economic Evaluation of Bids for Nuclear Power Plants*, IAEA Technical Reports Series No. 396, IAEA, Vienna, p. 28.

1. What about risk management?

"Risk and opportunity" management is an important task of the lawyer. *Which risks belong on the risk list? Where should you start? How deeply are you, as the lawyer, involved in risk management?* The steps of risk management are identified as:

- identification (known unknowns, unknown unknowns);
- evaluation and monitoring;
- avoidance;
- management;
- assumption;
- control; and
- transfer.

Legal risks within a civil nuclear project are assessed and quantified within the same framework as other risks. Typically, this effort includes an analysis of the probability of occurrence weighted against estimated financial consequence. Various legal and management tools exist to mitigate and prevent risks. We emphasise the importance of risk transfer and thorough preparation for the period when risks materialise.

Risk analysis should consider lessons learnt as a matter of best practice. For example, a useful review is provided in the analysis of high-level risks explained in the World Nuclear Association (WNA) document *Structuring Nuclear Projects for Success – An Analytic Framework*.[15] The same methodology that is used for risk mapping should be used for identifying opportunities, i.e. identifying possible actions during the execution of a project that can improve the project objectives. The nuclear industry and governments have identified key drivers with significant potential to decrease costs in nuclear projects.[16] These can guide lawyers and decision makers for future nuclear projects.

2. Key drivers of a contractual deal

A challenge for lawyers advising both owners and vendors is to identify key drivers for the commercial deal. These drivers affect project team and management decisions. The lawyers serve a crucial role in guiding and moderating the decision-making process for risks:

- Which are handled at an individual expert level?
- Which require the involvement of multiple disciplines?
- Which must be reported to (and evaluated by) the entire team?
- Which need top-level management approval?

Do you decide this allocation? Do corporate internal policies allocate risks to a particular decision-making level? Can the risk ever be "all encompassing"? How do you know which risks to include in your "key-points" presentation to senior leadership? How will you document your choices for the lawyers that succeed you? Some of the key "business levers for top management"[17] are highlighted below.

15. WNA (2012), *Structuring Nuclear Projects for Success an Analytic Framework*, WNA Report, available at: www.world-nuclear.org/our-association/publications/online-reports/structuring-nuclear-projects-for-success.aspx (accessed 21 May 2021).

16. Ingersoll, E., et al. (2020), *The ETI Nuclear Cost Drivers Project: Full Technical Report*, Energy Systems Catapult, Birmingham, United Kingdom, available at: https://es.catapult.org.uk/reports/nuclear-cost-drivers (accessed 21 May 2021).

17. von Branconi, C. and C.H. Loch (2004), "Contracting for major projects: eight business levers for top management", *International Journal of Project Management*, Vol. 22, Issue 2, Elsevier BV, Amsterdam, pp. 119-130.

a. Single point of responsibility

If issues arise during construction, the owner ideally looks to a single party, the vendor, to address them. A vendor is traditionally responsible for all design, engineering, procurement, construction, commissioning and testing activities. The vendor can be a single entity or can be a consortium. If the vendor is a consortium, the prime contract can provide that all entities comprising the consortium are jointly and severally liable to the owner.

b. Technical specification

The technical specification is essentially the "scope" of the contract; however, it is usually divided into the owner's requirements and the vendor's offer describing its solution. Key here is the legal challenge of adequacy, completeness and consistency of the description of the contract's scope of work, as well as the challenge of consistency between technical and commercial contract provisions. Multiple legal and techno-commercial items must be considered, such as:

- acceptance tests (test structure, hold-points, witness points);
- quality management system (inspections, audits, supply chain); and
- documentation requirements (a key element in every nuclear project).

Defining a "reference plant" is important to avoid disputes regarding the agreed scope. Additionally, in a prime contract, the vendor will normally be responsible for completing gaps between allocated scopes of work as well as performing additional services. The owner can, for example, contract for a nuclear power plant that meets broad requirements (i.e. requirements for safety, quality, security, delivery of power to the grid by a certain date, legal and regulatory compliance, project management, technology and workforce), rather than specified scopes of supply and services. Ultimately, an owner is seeking to purchase a nuclear power plant that will operate in accordance with projected electrical outputs, rather than separate systems, equipment and services. The vendors are able to promise this, but they require clarity regarding what is included in the price and what will be paid for under variation orders.

c. Price and payment terms

There are three types of price mechanisms, each of which is typically deployed for different aspects of contract work:

- fixed price: where a fixed amount per unit of supply is agreed (e.g. a fixed price cost for major aspects of the delivery of a nuclear unit, operating support services, specialised engineering work or fuel fabrication);
- fixed-rate price: a fixed amount per unit of a variable quantity of a unit of supply or unit construction work (e.g. metres of piping); and
- cost reimbursable price: where a vendor is paid for the full proven costs incurred in conducting work plus profit, up to an agreed maximum.

Crucial for long-lasting nuclear projects are the chosen price adjustment and escalation mechanisms for labour, materials and cost protections related to currency fluctuations.

d. Schedule and delays

Historically, large nuclear construction projects are prone to delay. Planning integration and creating a mechanism to handle delays are essential. Manufacturing and construction completion risks are compounded by unplanned events, including design changes and quality issues, that can require the performance of additional or amended work scopes. Lawyers are integral to the risk assessment process, including analysis of the:

- achievability of key (intermediate and final) completion dates and related milestones. Important to this analysis is exactness and certainty of key definitions;
- impact of possible project delay/acceleration costs relative to contractual liquidated damages;
- liquidated damage caps and the exclusivity of liquidated damages; and
- possible bonus rules and project alliancing provisions.

Prime contracts normally include a guaranteed completion date. This date can either be a fixed date (e.g. 1 January 2028) or a fixed period after the commencement of the prime contract (e.g. 60 months). If the vendor does not deliver the unit by the guaranteed completion date, the vendor can be liable to the owner for delay liquidated damages. Delay liquidated damages are designed to compensate the owner for loss and damage suffered as a result of delay in commercial operation.

e. Guaranteed performance parameters

Prime contracts typically contain guarantees that the power station will meet certain performance criteria, e.g. electrical output, efficiency and reliability. Such guarantees are essential for the owner because the owner's revenue from the sale of electricity will depend on the ability of the power station to meet projected performance indicators.

Performance guarantees provided by the vendor can be backed by performance liquidated damages, which the vendor pays to the owner if it fails to meet the performance guarantees, up to a certain tolerance limit. Typically, parameter tolerances are defined by the parties to measure the economic performance of the installed technology and its ability to generate electricity.

f. Warranties after take-over

Depending on the legal tradition (civil law vs. common law) extensive warranties can be agreed upon in the contract with corresponding agreement regarding repair or replacement of unsuitable or defective equipment or defects in service. The parties typically agree on a limited and defined set of remedies and the financial liabilities in addition to the repair obligations, excluding indirect consequences. Typical areas of interest also include warranty of continuing technical support, spare parts availability and service and response time warranty. Often, a "general equipment warranty" is agreed with a set of longer warranties for narrowly defined characteristics of major equipment.

g. Conventional liability and nuclear liability

Executives are keen to understand the maximum exposure of the company deriving from a transaction. "Non-nuclear" liability in nuclear projects can be handled in a similar manner to conventional power plant contracts:

- The contract must set the maximum extent of the contractor's total liability (including contractual and tort liability) towards the owner under the contract. The practice shows that this amount can vary materially from transaction to transaction.
- The contract must exclude liability for incalculable and uncontrollable damage, such as liability for indirect and consequential damage. This includes, for example, loss of production, the price for replacement energy, loss of profit and revenue and loss of business opportunity.

Intense negotiations often define the (few) exceptions to the generality of the above and various sub-caps for other forms of liability (e.g. delay, performance guarantees and – if allowed – penalties).

With respect to nuclear liability, the standard practice under the international conventions is to channel nuclear liability to the operator and to procure insurance. The conventions are intricately drafted. For simplicity, the following distinctions can be made:

- nuclear third party liability (which generally applies to damage "outside the fence" of the power plant), where liability is channelled by the international conventions and national laws to the operator;
- nuclear liability for damage to the installation itself, where the contract may ensure that there is a channelling by contract if the conventions do not already provide this; and
- nuclear liability for property on the site of the installation, which property is used in connection with that installation, where again, contractual channelling is necessary, e.g. by agreeing on indemnification by the operator to the vendor.[18]

This is a specialised area of law for which the international and national nuclear liability provisions must be complemented with the provisions of the contract. Insurance generally rests with the owner.

h. Securities

Nuclear new build projects are of such financial magnitude that they can force both vendors and operators into economic ruin. How does a nuclear vendor ensure its performance towards the owner? How does a nuclear utility ensure its payment obligations towards the vendor? The contracts therefore establish a set of instruments, which correspond to the assessed commercial risks. These typically can include deposits, bank guarantees, letters of credit, parent company guarantees and state guarantees. These often overlap with certain insurance products (e.g. export credit insurance), impact on the project's financing and ensure protection of the parties regarding performance.

3. Bid evaluation and awarding of the contract

Ideally, at this stage of the process, there are still multiple competing vendors. The analysis of the final bids is an extensive task "generally taking not less than six months to complete."[19] The aim is to select the best overall proposal for the owner and, with that, the host nation (i.e. compatibility with the national nuclear programme).

18. Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982, and by the Protocol of 12 February 2004, Art. 3(a), entered into force 1 Jan. 2022, unofficial consolidated text available at: NEA (2017), "Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004", NEA Doc. NEA/NLC/DOC(2017)5/FINAL (Revised Paris Convention); Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977, Article II, para. 1 and Article IV, paras. 5(a) & (b); Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997), IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force 4 Oct. 2003, Article 6, para. 2; Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 Apr. 2015, Annex, Article 3, paras. 1, 7(a) & (b).

19. IAEA (2011), *supra* note 10, p. 27.

By this time, the contracts have been extensively negotiated and they are diverging on significant points between the vendors. Therefore, establishing comparability is a challenge. Typically, "first of a kind" and "first in country" reactors are constructed on a turn-key basis. Clauses requiring "is equal to or better than the reference plant" are commonly used. The owner's legal advisers will prefer a largely fixed price contract in normal circumstances. In contrast, a vendor's advisers will typically insist on variable prices regarding terms like site-specific construction adaptations and the support work necessary for the licensing of the plant by the owner with its regulatory authority.

Bid evaluation is often split into technical, economic, commercial, contractual and organisational components, each in a multi-stage approach. On the owner's side "the total number of personnel required is typically around 70 people."[20] Normally, this analysis should include not only submitted material, but also involve a review of the safety of each technology with its home country regulator; the bidder's performance with other foreign buyers; and each vendor's price books (if requested by the owner) to verify applicable price components.

A legal analysis (for both owner and vendor) is essential in this final stage. Lawyers advising the vendor are involved in modelling the evaluation and providing advice regarding the offer strategy and price implications for each contractual deviation. Contractual deviations may also influence the technical, economic and commercial evaluation. Conversely, technical, economic and commercial risks may be solved by contractual provisions. Therefore, the lawyers must legally contribute to and understand these "non-legal" workstreams.

How to best organise this internal interface? How deep are the lawyers involved in the review of non "purely legal" documents? The owner's legal team will be leading the contractual evaluation. This team will endeavour to ensure the risk assessment results developed during the contract negotiation process are reflected in the weighing criteria for the contract evaluation. Since the contracts are not identical, a lower price may be counterbalanced by risks that a particular vendor is not willing to accept. The legal team quantifies, documents and briefs senior management regarding these items.

G. Conventional and nuclear insurance

There are additional legal relationships with other stakeholders that are tightly connected to the main contract. This includes, for example, the insurers. As a principle, insurance must follow the liability. This can mean that parties agree on split liability, whereby parties retain certain liability risks, capped and insured at a reasonable level. However, a common insurance structure in large nuclear construction projects is an "owner controlled insurance programme" (OCIP), which provides umbrella insurance over the site controlled by the owner. This insurance can then be supplemented by generic and project-specific insurances.

A local insurance leader is needed early in the project, along with a regional or international insurance pool. The cost of insurance is significant and must be carefully assessed and planned. Financing also depends on reasonable insurance levels. This includes special insurance regimes, like export risk coverage programmes (often backed by intergovernmental agreements). Nuclear insurance obligations and requirements will vary on national laws and international obligations.

20. *Ibid*., p. 29.

H. Financing

External financing can play an important role in professionalising projects as well as strengthening a project's financial viability and bankability. Financiers ask key questions about economic viability, stability risk assessment and risk allocation. To date, no nuclear power plant has been fully project financed, though there have been a variety of hybrid financing models. In the nuclear sector, financing arrangements are typically a blend of state and commercial sources, cross-border in nature and often involve banking consortia and intergovernmental loan agreements (IGAs). IGAs are particularly used in the context of "build, own and operate" structures where financing is provided by the vendor.

Financing structures also have a strong impact on the contractual arrangements. Some state-owned companies can finance a new build project from their balance sheet. Others create project companies for this purpose.

I. Export controls

The owner's host country is responsible for creating a legal and political environment in which nuclear vendors may successfully operate. Civil nuclear exports require careful analysis and a strong legal foundation, including corresponding bilateral nuclear co-operation agreements. Vendors typically condition nuclear technology and equipment exports on assurances regarding export control compliance. Among other things, nuclear vendors generally insist, as a matter of best practice, that "nuclear power plants and related materials, equipment, and technology shall be provided to and used by Customer States exclusively for peaceful purposes, consistent with the Treaty on the Non-Proliferation of Nuclear Weapons, and in conformity with Nuclear Suppliers Group Guidelines and pertinent United Nations Security Council Resolutions."[21] The lawyers and export control professionals on both sides of a new build project must understand the national legislation in the vendor and customer states, and the national regulatory authority's processes.

Part III. Nuclear lawyers for nuclear projects

A. What is so special about nuclear?

Considering the foregoing review of legal areas of interest in the development of nuclear projects, are nuclear contracts justified in having their own megaproject category? Are they, in fact, special when compared to contracts in large oil and gas, infrastructure, or conventional power projects? In short, the answer is yes. Some of the main distinguishing features are:

- highly complex projects in an intense regulatory environment;
- national security and diplomatic considerations and requirements;
- an elevated need for government political support;
- regulatory intervention as requirements evolve in parallel to the lengthy construction period;
- in the case of large nuclear projects involving existing plants: after decades of operation and ongoing modernisation, plants can require extensive redesign to meet state of the art for lifetime extensions;

21. Carnegie Endowment for International Peace, Interim Secretariat for the Nuclear Principles (2015), "Nuclear Power Plant and Reactor Exporters' Principles of Conduct, Seoul, Korea January 1, 2015", Principle 5, pp. 7-8, available at: www.mhi.com/company/aboutmhi/domain/power/exporter/pdf/March2015.pdf (accessed 21 May 2021).

- front-heavy financing costs coupled with long project times (more than five years), which typically require state financing support; and
- fuel price is not the primary operational cost driver.

Certain sectors of the international nuclear industry are overcoming some of these challenges, including lack of standardisation in project execution, insufficient integration of time schedules, and lack of competencies on the part of the owner ("operation is not a large project"), vendor ("first of a kind," "first in the country") and regulator.

B. Lawyers' role

Experienced legal counsel can significantly contribute to the success of a civil nuclear project. Experience in the process is important regarding:

- documents for each step of the process;
- advice on what is available;
- advice on key project risks;
- knowledge of industry practices; and
- advice on how to structure transactions to facilitate financing.

This knowledge saves time on the front end, enables agreements to be drafted in a short time, streamlines negotiations and enhances compliance with key IAEA recommendations.

C. Conclusions

Three years have passed since that sunny morning in your office when you were tasked with your new build project. You are excited because today is the signature ceremony: your company won the bid! Maybe you are one of the few people who can better predict how things will go from here. One thing is for sure: nuclear project development does not stop once the prime contract is signed – it is only the beginning of the next exciting phase.

The following are key takeaway points from the foregoing review of the contracting process:

- Lawyers can make a significant contribution to the success of a civil nuclear power project.
- Lawyers must venture beyond "purely legal" questions and understand a wide spectrum of project issues, including risk management, process thinking, finance, and technical limitations.
- The owner is in the "driver's seat" of the process: vendors adapt to the owner's rules and documents.
- "Turn-key" never means "hands-off": intense owner and vendor co-operation is necessary for project success.
- Take all the time necessary to obtain an informed and well-founded decision to build a nuclear plant.
- Significant changes will occur – "be prepared" and make sure that the contracts have the necessary mechanisms to deal with changes.

Ultimately, a new nuclear build programme is a marriage that lasts for more than 100 years. What is drafted on paper will have an enormous impact on this long-term relationship between the companies, countries and people involved in the project.

Annex 1

Inventory of international instruments in the nuclear field: The international framework[1]

General

- 1956: International Atomic Energy Agency (IAEA), Statute (29 July 1957)
- 1957: Treaty establishing the European Atomic Energy Community (Euratom), Treaty of Rome (1 January 1958)
- 1957: Nuclear Energy Agency (NEA), Statute (1 February 1958)

Nuclear safety and radiological protection

- 1960: Convention No. 115 concerning the Protection of Workers against Ionising Radiations (17 June 1962)
- 1960: Resolution No. 114, Radiation Protection Recommendation
- 1963: Nordic Mutual Emergency Assistance Agreement in Connection with Radiation Accidents (19 June 1964)
- 1986: Convention on Early Notification of a Nuclear Accident (27 October 1986)
- 1986: Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency (26 February 1987)
- 1994: Convention on Nuclear Safety (24 October 1996)
- 1997: Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (18 June 2001)
- 2004: Code of Conduct on the Safety of Research Reactors

1. NOTE: This inventory of international nuclear law instruments does not claim to be exhaustive. Rather, it is a selection of the most relevant texts. In particular, a large number of international recommendations, codes and standards also exist on various aspects of the safe use of nuclear energy that are not mentioned because of their mostly technical and highly specialised content. Such texts are often not legally binding.

   For reference:

   - multilateral instruments deposited with the Secretary-General of the United Nations can be accessed at: https://treaties.un.org
   - texts adopted under the auspices of the NEA can be accessed at: www.oecd-nea.org/law/legal-documents.html
   - international texts under IAEA auspices are available at: www.iaea.org/resources/treaties/treaties-under-IAEA-auspices
   - texts adopted under the auspices of the European Union can be accessed at: https://eur-lex.europa.eu/homepage.html

   Further, it should be noted that the year following the bullet point corresponds to the year in which the instrument was opened for signature. The date in parentheses at the end of an entry corresponds to the date in which the instrument entered into force.

- 2006: Fundamental Safety Principles, Safety Fundamentals No. SF-1
- 2007: International Commission on Radiological Protection (ICRP) Publication 103
- 2014: International Basic Safety Standards: Radiation Protection and Safety of Radiation Sources, latest revision
- 2015: Vienna Declaration on Nuclear Safety (CNS/DC/2015/2/Rev.1)

Environmental protection

- 1958: Convention on the High Seas (30 September 1962)
- 1972: London Convention on the Prevention of Marine Pollution by the Dumping of Waste and Other Matter (30 August 1975)
- 1974: Convention on the Protection of the Marine Environment of the Baltic Sea Area (3 May 1980)
- 1977: Decision of the Council Establishing a Multilateral Consultation and Surveillance Mechanism for Sea Dumping of Radioactive Waste
- 1982: United Nations Convention on the Law of the Sea (16 November 1994)
- 1989: Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (5 May 1992)
- 1991: Convention on Environmental Impact Assessment in a Transboundary Context (10 September 1997)
- 1992: Convention for the Protection of the Marine Environment of the North-East Atlantic (25 March 1998)
- 1992: Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention) (17 January 2000)
- 1995: Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region (21 October 2001)
- 1996: Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (24 March 2006)
- 1998: Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (30 October 2001)
- 2003: Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (11 July 2010)
- 2018: Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean (22 April 2021)

Transport of radioactive material

- 1956: UN Recommendations for the Transport of Dangerous Goods – Model Regulations
- 1961: IAEA Regulations for the Safe Transport of Radioactive Materials (latest revision, 2018)
- 1964: Universal Postal Union, Vienna Constitution
- 1965: International Maritime Dangerous Goods Code
- 1974: International Convention for the Safety of Life at Sea (25 May 1980)
- 1980: Convention concerning International Carriage by Rail (COTIF) (1985)

- 1980: Regulations concerning the International Carriage of Dangerous Goods by Rail (RID)
- 1981: The Safe Transport of Dangerous Goods by Air, Annex 18 to the Chicago Convention on International Civil Aviation (1 January 1984)
- 1983: ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air, revised every year
- 1990: IAEA Code of Practice on the International Transboundary Movement of Radioactive Waste (INFCIRC/386)
- 1993: IMO International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes in Flasks on Board Ships (January 2001)

Regional agreements on transport of radioactive materials

- 1957: European Agreement concerning the International Carriage of Dangerous Goods by Road (29 January 1968)
- 1994: MERCOSUR/MERCOSUL Agreement of Partial Reach to Facilitate the Transport of Dangerous Goods (Brazil, Argentina, Paraguay and Uruguay)
- 2000: European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (29 February 2008)

Nuclear security and physical protection

- 1971: Convention for the Suppression of Unlawful Acts Against the Safety of Civil Aviation (26 January 1973)
- 1980: Convention on the Physical Protection of Nuclear Material (8 February 1987)
- 1984: Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (26 June 1987)
- 1988: Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation (1 March 1992)
- 1988: Protocol for the Suppression of Unlawful Acts Against the Safety of Fixed Platforms Located on the Continental Shelf (1 March 1992)
- 1997: International Convention for the Suppression of Terrorist Bombings (23 May 2001)
- 1999: International Convention for the Suppression of the Financing of Terrorism (10 April 2002)
- 2001: UN Security Council Resolution 1373 (prevention/suppression of financing and of preparation of terrorist acts)
- 2003: Code of Conduct on the Safety and Security of Radioactive Sources (January 2004)
- 2005: Amendment to the Convention on the Physical Protection of Nuclear Material (8 May 2016)
- 2005: International Convention for the Suppression of Acts of Nuclear Terrorism (7 July 2007)
- 2005: Protocol of 2005 to the Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation (28 July 2010)
- 2005: Protocol of 2005 to the Protocol for the Suppression of Unlawful Acts against the Safety of Fixed Platforms Located on the Continental Shelf (28 July 2010)
- 2011: Recommendations on the Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.5)

Non-proliferation and safeguards

- 1957: Convention on a Security Control in the Field of Nuclear Energy and Protocol Creating a European Nuclear Energy Tribunal (NEA) (22 July 1959)
- 1959: Antarctic Treaty (23 June 1961)
- 1963: Treaty Banning Nuclear Weapons Tests in the Atmosphere, in outer Space and under Water (10 October 1963)
- 1967: Treaty Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and the Other Celestial Bodies (10 October 1967)
- 1967: Treaty for the Prohibition of Nuclear Weapons in Latin America (22 April 1994)
- 1968: Treaty on the Non-Proliferation of Nuclear Weapons (5 March 1970)
- 1971: Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil Therefore (18 May 1972)
- 1979: Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (11 July 1984)
- 1985: South Pacific Nuclear Free Zone Treaty (11 December 1986)
- 1992: Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction (29 April 1997)
- 1995: Treaty on the Southeast Asia Nuclear Weapon-Free Zone (27 March 1997)
- 1996: African Nuclear-Weapon-Free Zone Treaty (15 July 2009)
- 1996: Comprehensive Nuclear-Test-Ban Treaty (not yet entered into force)
- 2004: UN Security Council Resolution 1540 (non-proliferation of WMD)
- 2006: Treaty on a Nuclear-Weapon-Free Zone in Central Asia (21 March 2009)
- 2006: UN Security Council Resolution 1673 (non-proliferation of WMD)
- 2009: UN Security Council Resolution 1887 (nuclear non-proliferation and nuclear disarmament)
- 2017: Treaty on the Prohibition of Nuclear Weapons (22 January 2021)

Legal framework for IAEA safeguards

- 1968: INFCIRC/66/Rev.2 – Agency’s Safeguards System (1965, as Provisionally Extended in 1966 and 1968)
- 1968: INFCIRC/140 – Treaty on the Non-Proliferation of Nuclear Weapons (5 March 1970)
- 1972: INFCIRC/153 (Corr.) – The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons
- 1974: GOV/INF/276 – Standard Text of an Agreement between the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation (latest revision in 2006)
- 1997: INFCIRC/540 (Corr.) – Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards

Nuclear third party liability

- 1960: [Paris] Convention on Third Party Liability in the Field of Nuclear Energy of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 (1 April 1968) and by the Protocol of 16th November 1982 (7 October 1988)
- 1962: Brussels Convention on the Liability of Operators of Nuclear Ships (not yet entered into force)
- 1963: Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 (4 December 1974) and by the Protocol of 16th November 1982 (1 August 1991)
- 1963: Vienna Convention on Civil Liability for Nuclear Damage (12 November 1977)
- 1971: Brussels Convention relating to the Civil Liability in the Field of Maritime Carriage of Nuclear Material (15 July 1975)
- 1988: Joint Protocol relating to the Application of the Vienna Convention and the Paris Convention (27 April 1992)
- 1997: Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (4 October 2003)
- 1997: Convention on Supplementary Compensation for Nuclear Damage (15 April 2015)
- 2004: Protocol to amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (1 January 2022)
- 2004: Protocol to Amend the Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (1 January 2022)

Nuclear trade control

- 1947: General Agreement on Tariffs and Trade (1 January 1948) [Article XXI, Security Exceptions]
- 1974: Zangger Committee Trigger List – Communication Received from Members Regarding the Export of Nuclear Material and of Certain Categories of Equipment and Other Material (INFCIRC/209 and revisions)
- 1978: Nuclear Suppliers Group Guidelines for Nuclear Transfers (INFCIRC/254, Part 1) and Guidelines for Transfers of Nuclear-Related Dual-Use Equipment, Materials, Software, and Related Technology (INFCIRC/254, Part 2) (revised over time, latest revisions in 2019)
- 1996: Wassenaar Arrangement
- 2011: Nuclear Power Plant and Reactor Exporters' Principles of Conduct (latest update, 2015)

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Principles and Practice of International Nuclear Law

Principles and Practice of International Nuclear Law examines the various interrelated legal issues for the safe, efficient and secure use of nuclear energy. It provides an overview of the complex body of laws and legal regimes in international nuclear law, as well as the many developments that have unfolded in recent years impacting all aspects of nuclear safety, security, safeguards and liability. It also gives a concise overview of the main international institutions, and addresses such issues as radiological protection, nuclear safety, environmental protection, nuclear transport, nuclear security, safeguards, nuclear third party liability and compensation for nuclear damage, insurance, nuclear trade and project development.

The articles in *Principles and Practice of International Nuclear Law* are largely authored by lecturers at the International School of Nuclear Law (ISNL), which was established in 2001 by the OECD Nuclear Energy Agency (NEA) in co-operation with the University of Montpellier and which benefits from the support of the International Atomic Energy Agency. For over 20 years the ISNL has offered a unique educational opportunity to the next generation of nuclear professionals from more than 100 countries.

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