Legal Affairs
2022

Nuclear Law Bulletin No. 108/109

Volume 2022/1&2

OECD
BETTER POLICIES FOR BETTER LIVES

NEA
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Legal Affairs

Nuclear Law Bulletin
No. 108/109

NEA No. 7639

NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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NUCLEAR ENERGY AGENCY

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- 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, 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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Cover photos: 24th International Nuclear Law Association (INLA) Inter Jura Congress, Washington D.C., United States, 23-27 October 2022; An artist's rendering of NuScale Power's small modular nuclear reactor plant (courtesy of NuScale).

Acknowledgements

In addition to the authors of the articles, the Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA) would like to thank the following individuals for their contributions to this edition of the *Nuclear Law Bulletin*: Mr D.J. Lobach (Belarus); Ms L. Thiele (Canada); Ms F. Touïtou-Durand and Ms L. Roehrich (France); Mr C. Raetzke (Germany); Ms A. Demeter (Hungary); Mr Y. Hashimoto (Japan); Mr B. Biksadský and Ms K. Manczalová (Slovak Republic); Mr A. Škraban (Slovenia); Ms S. Knopp Pisi (Switzerland); Mr V. Türkeş (Türkiye); Ms C. Drillat and Dr Z. Vovchok (United Arab Emirates); Ms M. Albert, Mr B. Ayersman, Mr E. Michel and Mr E. Stocking (United States); Ms L. Budinova, Ms A.P. Chirtes and Mr R. Rende Granata (European Commission); Ms J. Silye (International Atomic Energy Agency); Mr W. Horin (International Nuclear Law Association); and Mr I. Salter (International Nuclear Law Association – United Kingdom). We also would like to thank Mr S.G. Burns for his careful review and support in finalising this edition of the NLB.

The information submitted to the NEA by these individuals represents the opinions of the authors alone and does not purport to represent the official views or the policies of their governments or of any other entity.

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The future of nuclear energy and the role of nuclear law

*by Kimberly Sexton Nick**

I. Introduction

> *… more and more governments, as well as regional and international organisations, are focusing greater attention on nuclear energy's potential role in combating global climate change. At the same time, the nuclear energy sector is facing many complex issues, with legal systems playing an increasingly vital role in adjudicating public policy and regulatory questions, particularly in countries with long-established nuclear power programmes.*[1]

If the world is going to meet the carbon emission reduction targets of the 2015 Paris Agreement, nuclear power must play a significant role. Many organisations, including the Intergovernmental Panel on Climate Change, United Nations Economic Commission for Europe (UNECE), Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA), International Energy Agency (IEA) and the International Atomic Energy Agency (IAEA) recognise this fact. In 2020, nuclear power accounted for 10% of the global electricity generation and 18% in advanced economies,[2] where it was also the largest low-carbon source of electricity.[3] But, nuclear power's share of the global electricity supply has been declining in recent years. This is driven by two trends in advanced economies: (1) new nuclear capacity is not being added to the grid; and (2) the ageing nuclear fleets, largely built in the 1970s and 1980s, are being retired.[4]

Some of the scenarios put forward for addressing climate change have called for as much as a doubling of nuclear capacity by 2050.[5] To do that, the trends leading to nuclear energy's decline must be addressed. First, new capacity must be built. And second, the fleet

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1. NEA (2019), *Legal Frameworks for Long-Term Operation of Nuclear Power Reactors*, OECD Publishing, Paris, p. 3.
2. "Advanced economies" is an IEA-defined grouping of Australia, Canada, Chile, the 27 members of the European Union, Iceland, Israel, Japan, Korea, Mexico, New Zealand, Norway, Switzerland, Türkiye, the United Kingdom and the United States.
3. IEA (2022), *Nuclear Power and Secure Energy Transitions: From today's challenges to tomorrow's clean energy systems*, IEA, Paris, pp. 14, 44.
4. IEA (2019), *Nuclear Power in a Clean Energy System*, IEA, Paris, p. 3.
5. NEA (2021), *Long-Term Operation of Nuclear Power Plants and Decarbonisation Strategies*, OECD Publishing, Paris, p. 13. See also NEA (2021), *Nuclear Energy in the Circular Carbon Economy (CCE): A Report to the G20*, OECD Publishing, Paris.

of existing reactors must be able to stay online to continue generating electricity. This means concentrating efforts on pursuing long-term operation (LTO).

This is not new information, especially for those working in the nuclear field. But despite countless meetings, conferences and debates on the topic, many of the same challenges persist. These challenges are generally addressed from one of three perspectives: technological, economic or policy. As they are often addressed separately, all too often the solutions are left to the engineers, scientists, economists and policymakers.

New approaches to problem solving are necessary, and this is where lawyers come into play. In most instances, the challenges that engineers, scientists, economists and policymakers attempt to solve have critical legal dimensions that require expert legal support. But, lawyers are not always a part of the process. This often stems from antiquated notions of the role of a lawyer, especially in the nuclear field. Lawyers write contracts and negotiate agreements, but what value do they add to substantive nuclear issues? Lawyers can help draft high-level laws, but what utility do they have in drafting detailed regulations? Lawyers may be specialists in national dispute resolution, but what role do they play in international co-operation?

This narrow conception of "the law" fails to consider the lawyer as the problem-solver, the solution-finder, the one who can synthesise information from multiple angles to develop a path forward. Integrating legal counsel into the earliest stages of decision making not only helps to prevent legal issues becoming obstacles down the line, but also enables more holistic planning and policymaking at the outset.

The nuclear energy field is risk-averse by nature – and for good reason. But, there seems to be a fear that including another layer of risk-averse lawyers into the mix can jeopardise progress. This doesn't have to be the case. It should be universally acknowledged in this field – by lawyers as well – that one simply cannot risk progress through inaction or indecision with the global energy future at stake. There are innumerable ways nuclear lawyers – and by extension nuclear law – can and must contribute to the future of nuclear energy.

Building new capacity and enabling LTO requires assistance from those with specific expertise in the field of nuclear law. But, to solve the challenges, nuclear lawyers must be knowledgeable in not just one of the discrete areas of safety, security, safeguards and liability, but all of them. And not just all of them individually, but also in the interrelationships between these areas and how they inform and impact broader issues, like environmental protection and transport, among others. They must understand not only national law, but international law as well. They must recognise the lines of distinction between hard law and soft law, and when and where to make use of each.

Being a subject matter specialist will not move the needle these days, but having a holistic understanding of the universe of issues will. As such, nuclear lawyers will need to embrace and embody the positivity of the old adage: "A jack of all trades is a master of none, but oftentimes better than a master of one."

While this article will outline a number of stumbling blocks in the road ahead, it will not attempt to provide solutions. Instead, the aim of this article is to argue for and defend the role of nuclear lawyers in the critical debates and decision-making processes in the days, months and years ahead. Part II of this article focuses on small modular reactors (SMRs), highlighting some of the main issues with the legal frameworks for licensing and regulation, environmental assessments and public participation. Part III looks at LTO, again focusing on the legal frameworks for licensing and regulation and environmental assessments. Part IV provides some brief conclusions.

II. Small modular reactors

A. *Legal frameworks for licensing and regulation*

The world needs not just some new capacity of nuclear energy, but an abundance of it. And this is also not about building a few plants; it's about building hundreds of them. The world has not seen nuclear energy construction growth like that in decades. Take the example of the United States, which produces just over 30% of the world's total nuclear electricity.[6] Between 1957 and 1969, 22 reactors were connected to the grid. In the 1970s, 59 reactors were connected to the grid. Then, from 1990 to today, a span of 32 years, only 5 reactors were connected and 1 of those had started construction in 1973. For advanced economies, to return to the previous fast pace of nuclear energy construction would be a paradigm shift.

Future nuclear capacity must come in different forms to meet different needs. Those forms are mainly in three categories. First, in some instances, large Generation-III and Generation-III+ reactors will be needed in emerging countries to meet electricity demand growth, while in advanced economies they may be needed for fleet renewal.[7] In other instances, Generation-IV reactors will be needed both for power production as well as for a number of non-power applications. These non-power applications can also support climate change initiatives through the production of carbon-free hydrogen and the use of process heat in energy intensive industrial sectors.[8]

Then, there are SMRs, which are "defined today as nuclear reactors with a power output between 10 megawatt electric (MWe) and 300 MWe" designed to be modular and standardised and capable of being constructed in a factory "to maximise economies of series".[9] "The different modules can then be transported [around the world] and assembled onsite".[10] Beyond the benefits of series construction, SMRs have special features, such as the fact that they could be considered as replacement options for ageing coal power plants;[11] they could be installed as single modules, which could be useful "in remote regions or as dedicated sources of electricity for industrial complexes".[12] They can also provide more significant amounts of electricity, like a traditional nuclear power reactor, by grouping several modules together.[13] Finally, non-nuclear power countries, "especially those with smaller and less robust electricity grids", may be interested in SMRs due to their economic advantages and simpler operation.[14]

If SMR development and deployment has these particular advantages, what is holding it up? Unfortunately, despite the many opportunities for SMRs, there are a number of outstanding challenges, mostly related to economics, which relies "heavily on the existence of a sufficiently large market to support the economies of series needed to counterbalance diseconomies of scale."[15] While that portends a great deal of work ahead

6. IEA (2021), *Key World Energy Statistics 2021*, IEA, Paris, p. 19.
7. NEA (2021), *Nuclear Energy in the Circular Carbon Economy (CCE): A Report to the G20*, *supra* note 5, p. 5. Gen-III reactors are advanced LWRs. Gen-III+ are "[e]volutionary designs offering improved economic and safety features". Examples are the ABWR, AP1000 and the EPR. Generation IV International Forum (GIF) (2014), *Technology Roadmap Update for Generation IV Nuclear Energy Systems*, p. 13.
8. NEA (2021), *Nuclear Energy in the Circular Carbon Economy (CCE): A Report to the G20*, *supra* note 5, p. 21.
9. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, OECD Publishing, Paris, p. 15.
10. *Ibid*.
11. NEA (2021), *Nuclear Energy in the Circular Carbon Economy (CCE): A Report to the G20*, *supra* note 5, p. 5.
12. IEA (2019), *Nuclear Power in a Clean Energy System*, *supra* note 4, p. 85.
13. *Ibid*.
14. *Ibid*., p. 88.
15. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, *supra* note 9, p. 43.

for the engineers and financiers, there is a significant role that can be played by legal experts proficient in nuclear law regarding the licensing and regulation of SMRs at a national level and addressing the potential for harmonisation of licensing and regulatory frameworks internationally. And the economies of series relate to the legal work as well; regardless of whether a country is considering 1 or 100 SMRs, teams of lawyers are still required to work hand-in-hand with the technical staff of multiple government bodies to review existing frameworks to determine their adaptability to the deployment of SMRs.

i. *National legal frameworks*

Most national legal frameworks for licensing and regulating nuclear power reactors are based on large single-unit light-water reactors (LWRs) that use uranium oxide fuel with enrichment below 5%.[16] Although there are a number of SMR designs that are LWR-style designs, with similar operating conditions and fuel arrangements, there are many other unique and novel designs that differ substantially from the current fleet.[17] Such design differences will translate into necessary deviations from the licensing and regulatory regime currently in place.[18]

Questions often arise with respect to specific licensing issues, such as emergency planning zone size, staffing requirements and site security requirements. How SMRs should be licensed and regulated to ensure safety is a technical question. Whether the existing framework must be changed to accommodate SMR licensing and regulation is a legal question.

Determining the adequacy of current legal frameworks to support SMR deployment depends on whether such legal frameworks are flexible enough to adapt to SMRs without needing to re-write laws, acts, regulations, decrees, ordinances, codes, standards, etc. As explained in the cross-cutting NEA publication *Small Modular Reactors: Challenges and Opportunities*, which addresses not only the technical, economic and market aspects of SMR deployment, but also the licensing, regulatory, legal and supply chain issues, those "[c]ountries with a technology-neutral licensing framework, performance-based regulatory systems and a widely used graded approach will likely find [their] system easier to adapt to SMRs than [those] countries with a technology-specific licensing framework or a prescriptive regulatory system."[19]

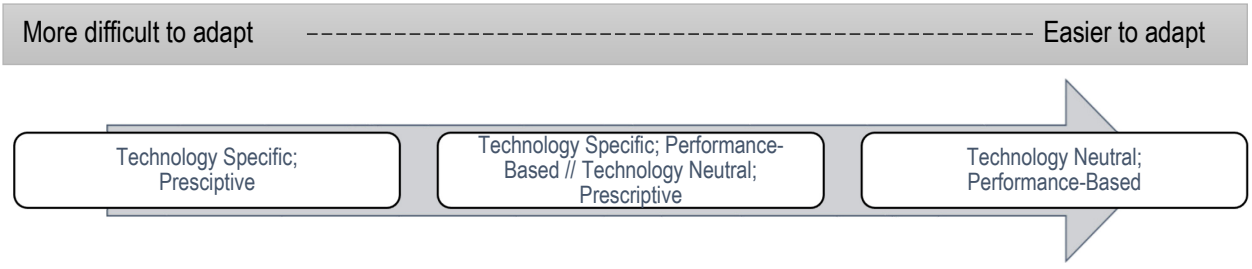

Figure 1. Relative difficulty of adapting licensing frameworks based on type

When the nuclear licensing framework is discussed, the focus, for good reason, is generally on the national nuclear regulatory body. But, one aspect of licensing not often considered is the vast number of licences, permits, consents and authorisations issued by bodies other than the national nuclear regulatory body. Permits related to construction and zoning, power connections, transport, historic sites, habitats and species, emergency planning, security planning, import and export controls, etc. could all be applicable (in addition to technology-dependent permits related to radioactive material and non-radioactive material discharges as well as water usage). These various licences, permits,

16. *Ibid.*, p. 10.
17. *Ibid.*
18. *Ibid.*
19. *Ibid.*, p. 43.

consents and authorisations are often issued by other ministries, regulatory bodies, authorities, agencies, commissions, etc. that must all consider how this new technology does or does not fit within the existing legal frameworks and whether changes are needed.

This is just speaking about the more traditional permits needed for the current fleet of nuclear power plants. SMRs present an even more complex issue as there are novel questions that could require a multitude of additional licences and permits – both ones that already exist and ones that need to be created – depending on the type of SMR, how it is manufactured, where it is commissioned, how it will be transported, who is doing the transporting, how it will be operated, and where and how it will be decommissioned. As just one example, much closer co-ordination and co-operation will be needed with ministries in charge of transportation, with additional licences and permits required.[20]

This may all be simpler – in a way – for new entrant countries since they are starting with a relatively blank slate rather than trying to adapt something old to fit something new, unique and still undefined. But joining conventions, passing laws, setting up a competent regulatory body and adopting regulations takes time. Under the traditional

20. There is precedent for this type of situation, however. In 1973, Offshore Power Systems submitted a licence application to the US Nuclear Regulatory Commission for a manufacturing licence to construct eight floating nuclear power plants to be built "on a repetitive assembly line basis … [and] undergo testing (without nuclear fuel) at the manufacturing site and subsequently … be towed to selected sites." "Offshore Power Systems Notice of Receipt of Application for Manufacturing License and Availability of Applicant's Environmental Reports", 38 *Federal Register* (Fed. Reg.) 34008 (10 Dec. 1973). In a situation remarkably similar to today's, "[u]sing a generic manufacturing license and mass production techniques, Westinghouse … predicted this approach could cut in half typical plant construction time and make floating reactors economical." Wellock, T. (2021), "Floating Nuclear Power Plants: A Technical Solution to a Land-based Problem (Part I)", available at: www.nrc.gov/reading-rm/basic-ref/students/history-101/floating-nuclear-power-plants.html (accessed 28 Dec. 2022). Even the US Atomic Energy Commission (AEC, the predecessor to today's US NRC) noted at the time that "[t]his concept is viewed as one possible approach to standardization of nuclear plant design." US AEC (1973), *1972 Atomic Energy Programs: Regulatory Activities*, US AEC, Washington, DC, p. 15. Public Service Electric and Gas Company (PSEG) filed a construction authorisation application in 1974 for Atlantic Generating Station, Units 1 and 2 (1150 MWe pressurised water reactors), which were to be moored behind a protective breakwater in the Atlantic Ocean approximately 2.8 statute miles (approximately 4.5 kilometres) off the coast of the US state of New Jersey. "Public Service Electric and Gas Co. Receipt of Application for Site Construction Permits and Facility Licenses and Availability of Applicant's Environmental Report; Time for Submission of Views on Antitrust Matters", 39 Fed. Reg. 11329 (27 Mar. 1974). As noted by the US NRC in a historical rendering of the story, one notable concern was the "challenge of creating a new regulatory process for floating reactors" while others "worried about the 'incredibly tangled mass of overlapping jurisdictions, state, national, and international law, inter-agency authority' that included new players such as the U.S. Coast Guard." Wellock, T. (2021), "Floating Nuclear Power Plants: Waves of Uncertainty: (Part II)", available at: www.nrc.gov/reading-rm/basic-ref/students/history-101/waves-of-uncertainty.html (accessed 28 Dec. 2022). But, over the course of nine years, the US NRC issued a safety evaluation report and a three-volume final environmental statement, held a hearing on the licence application, and ultimately in 1982 issued the first manufacturing licence to Offshore Power Systems. "Offshore Power Systems Floating Nuclear Plants 1-8; Notice of Issuance of Manufacturing License", 47 Fed. Reg. 58402 (30 Dec. 1982). In the end, however, Westinghouse ended the project in 1984 following PSEG's 1978 cancellation of its order for four reactors due to decreased electricity demand and the impact of the 1979 Three Mile Island accident. While the licensing process may not have been perfect, repeatable, or even advisable to follow today, it is a data point that suggests that today's circumstances do not present insurmountable obstacles. For further reading of the various legal issues associated with the proposed Atlantic Generating Station, see Selfridge, G.P. (1976), "Floating Nuclear Power Plants: A Fleet on the Horizon?", *Environmental Law Review*, Vol. 6, No. 3, Lewis & Clark Law School, pp. 791-830.

IAEA rubric it is expected to take 10-15 years,[21] though the nature of SMRs may shorten this time frame.[22] Regardless of the time it takes, it will still require substantial legal expertise to enable these national nuclear programme infrastructure issues to be resolved.

ii. International harmonisation

Co-existent with the discussion of national legal frameworks is the discussion of international harmonisation. Why is harmonisation so important? Last year, the IAEA found that there were "more than eighty (80) SMR designs under development and deployment at different stages in 18 [IAEA] Member States".[23] This is a lot in and of itself, but it is even more significant when ones realises that this alone is a 60% increase from just four years earlier.[24] The economic competitiveness and commercial viability of SMRs is reliant upon exploiting the economies of series.[25] Building 1 each of 80 different designs presents a very different economic picture than building 80 each of only 1 design.

Besides just picking the few right designs and focusing efforts there, the designs that are selected must meet the regulatory requirements in the country where they will be located. If SMR vendors can focus design changes solely on site-specific characteristics rather than on different licensing and regulatory requirements in countries A, B, C and Z, global markets and global supply chains can be facilitated.[26]

There are two dimensions to this discussion. First, at a high level, can national licensing and regulatory frameworks be harmonised internationally? This is mainly a question for the mature nuclear power countries with well-developed and well-established legal frameworks. Second, will the licensing authority be able to rely on safety assessments performed by another country? While this is a broad question for all countries interested in pursuing SMRs, it is more of an issue for the less-developed nuclear power countries and new entrant countries, both with less mature regulatory systems.

The first dimension – the true harmonisation of legal frameworks – may be too difficult to address in practice. There is no international nuclear regulatory body. The IAEA's safety standards, in the form of principles, requirements and guidance, are widely respected but in themselves non-binding on the IAEA member countries. The NEA issues best practice recommendations, but again, these are non-binding on the NEA member countries. While conventions like the Convention on Nuclear Safety[27] and the Joint Convention[28] are hard law, they are referred to as "incentive conventions" because they do not have any kind of enforcement mechanism. Thus, there is no international forcing function for harmonisation.

At the national level, in most countries it is a difficult enough endeavour to amend laws; and modifying regulations is not always a simple – or quick – task either. Including an additional layer of international collaboration to harmonise legal frameworks among different countries with different regulatory regimes, different levels of prescription in

21. IAEA (2015), *Milestones in the Development of a National Infrastructure for Nuclear Power*, Nuclear Energy Series, No. NG-G-3.1 (Rev. 1), IAEA, Vienna, p. 2.
22. Wetherall, A. and C. Scotto de Cesar (2022), "Developing Internationally and Nationally an Enabling Environment for a Potential Future International SMR Deployment", *Nuclear Law Institute: A Collective View on a Decade of Capacity Building and Development in Nuclear Law*, IAEA, Vienna, p. 232.
23. IAEA (2022), *Advances in Small Modular Reactor Technology Developments*, IAEA, Vienna, p. 2.
24. IAEA (2018), *Advances in Small Modular Reactor Technology Developments*, IAEA, Vienna, p. 2.
25. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, *supra* note 9, p. 31.
26. *Ibid*.
27. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996 (CNS).
28. 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).

their regulatory framework,[29] and utilising different technologies (with different codes and standards) would likely overburden the task to the point of impossibility.

Thus, the better approach is to look into the possibility for regulatory bodies to rely on the safety assessments of other regulatory bodies. This question is a matter of degree:

- Will a country's laws allow its licensing authority to rely entirely on the safety and design assessment of another country (or groups of countries)?[30]
- Do the laws of the country prohibit the reliance on any part of another country's or countries' safety and design assessment, thus requiring a fully independent safety assessment?
- Or, do the laws of the country allow for at least partial reliance on another country's or countries' safety and design assessment, with only minor validation requirements?

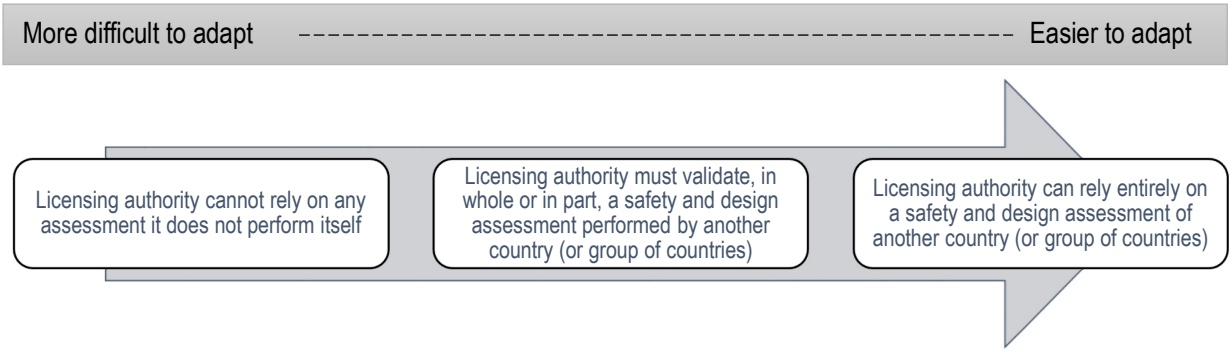

Figure 2. Relative difficulty of adapting licensing and regulatory frameworks based on need for regulatory sovereignty in decision making

Any kind of harmonised licensing process will ultimately have to be based on agreements between countries. National regulators can work together to streamline work processes,[31] collaborate on reviews, share information and highlight lessons learnt, among other activities. In fact, such co-operation has already been proven at the international regulatory level by the Multinational Design Evaluation Programme (MDEP), for which the NEA provides Secretariat services. Established in 2006, MDEP is a multinational initiative taken by national safety authorities to develop innovative approaches to leverage the resources and knowledge of the national regulatory authorities involved in the review of new nuclear power reactor designs. It works to increase co-operation within already existing regulatory frameworks and establish mutually agreed-upon positions, all to improve the effectiveness and efficiency of regulatory design reviews.[32] As highlighted by the NEA, "It is possible to build upon the success of MDEP and move even further towards multi-national licensing approaches."[33]

29. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, *supra* note 9, p. 30.
30. This raises a number of potential challenges associated with the need for regulatory independence, which is well addressed by Anthony Wetherall and Camille Scotto de Cesar in their article "Developing Internationally and Nationally an Enabling Environment for a Potential Future International SMR Deployment" referenced *supra* in footnote 22.
31. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, *supra* note 9, p. 30.
32. A point to be made here, however, is that one of MDEP's "key concepts" "is that national regulators retain sovereign authority for all licensing and regulatory decisions." See NEA (2019), *Multinational Design Evaluation Programme: Annual Report April 2018 – April 2019*, OECD Publishing, Paris, pp. 7, 12. This speaks to the same regulatory independence issues noted earlier, which will have to be addressed in any sort of harmonisation initiative.
33. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, *supra* note 9, p. 44.

A notable example of this at the national level is the 2019 "Memorandum of Cooperation on Advanced Reactor and Small Modular Reactor Technologies between the Canadian Nuclear Safety Commission [(CNSC)] and the United States Nuclear Regulatory Commission".[34] Under the terms of the agreement, the two regulatory bodies committed to sharing "best practices and experience reviewing advanced reactor and SMR technology designs", which "may expand to facilitate a joint technical review of an advanced reactor or SMR design."[35] This agreement was put into practice in 2021 with the US NRC and CNSC co-operating on the review of a white paper by X-energy (Xe-100) on construction codes, which "allowed the CNSC and the NRC to take into account the results and insights produced by each other's technical reviews …, without prejudicing any decisions they might make as independent licensing authorities in their respective countries."[36] In 2022, the CNSC and US NRC completed a joint technical review of Terrestrial Energy's Integral Molten Salt Reactor advanced nuclear power plant, which some have said is "clear evidence that international regulatory harmonization is possible."[37]

Another example can be found in Europe with the recent announcement regarding the NUWARD SMR, which will be subject to a joint regulatory review led by the French Autorité de sûreté nucléaire (ASN, the Nuclear Safety Authority) with the participation of the Czech Republic's Státní úřad pro jadernou bezpečnost (SÚJB, the State Office for Nuclear Safety) and the Finnish Säteilyturvakeskus (STUK, the Radiation and Nuclear Safety Authority). Taking the MDEP, CNSC/US NRC, and NUWARD examples, there are workable international and national approaches that can be pursued. With the potential for a global supply chain, these types of co-operation mechanisms may shift from beneficial to necessary if factories and manufacturing facilities are located in different countries and regulatory inspection and oversight is needed during the construction and commissioning processes. Ultimately, this will all depend on creating appropriate legal frameworks to facilitate the necessary co-operation mechanisms.

B. Environmental assessments

For the vendors, however, such co-operation does not go far enough. Their ambition is for an off-the-shelf, internationally-certified design that can be built anywhere with no additional regulatory review. This level of harmonisation is not realistic for most, if not all, SMR technologies. Even if a country can rely entirely on the safety and design assessment of another country (or group of countries), additional country-specific and site-specific questions will need to be addressed.

To support an entirely off-the-shelf approach, the international review process must conclude that the SMR technology in question could be sited anywhere, under any site-specific severe accident conditions, under any emergency scenario, with any possible site-specific safety and security concerns, in either remote or urban areas, with any environmental considerations, etc. In most, perhaps all, circumstances, this will not be possible. So, even if there can be strong and close co-operation and co-ordination on the

34. CNSC (2019), "CNSC signs memorandum of cooperation with the U.S. Nuclear Regulatory Commission", https://nuclearsafety.gc.ca/eng/resources/international-cooperation/international-agreements/cnsc-usnrc-smr-advanced-reactor-moc.cfm (accessed 28 Dec. 2022).
35. *Ibid*. Most recently, in September 2022, the CNSC and US NRC signed a Charter on collaboration on the review of the GE Hitachi BWRX-300 SMR that is "intend[ed] to enhance their cooperative work under the Memorandum of Cooperation". CNSC (2022), "A Collaborative Information Sharing Effort by the U.S. Nuclear Regulatory Commission and the Canadian Nuclear Safety Commission", https://nuclearsafety.gc.ca/eng/resources/international-cooperation/international-agreements/cnsc-usnrc-smr-advanced-reactor-charter.cfm (accessed 28 Dec. 2022).
36. World Nuclear News (2021), "Regulators complete first licensing cooperation", www.world-nuclear-news.org/Articles/Regulators-complete-first-licensing-cooperation (accessed 28 Dec. 2022).
37. Terrestrial Energy, Press Release, "US and Canadian Regulators Complete Joint Technical Review of IMSR" (7 June 2022).

international licensing of SMRs, there are still certain national licensing requirements that will need to be met.

These requirements will largely impact site-specific issues, which often relate to environmental protection. It has been argued that there are 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.[38] The last two – environmental impact assessments (EIAs) and public participation – are especially important in this area because there is a possibility that regardless of what the national laws state about the potential for harmonised, collaborative approaches to licensing, international law could dictate additional requirements that must still be met to progress to reactor operation.

For the member states of the Espoo Convention[39] (mostly European countries), additional legal procedures will be necessary depending on the interpretation of the definition of activities within the scope of those conventions.[40] Beyond that, countries will need to determine to what extent they believe EIAs are required, necessary and sufficient in the licensing of SMRs. These additional procedures do not necessarily have to be an impediment; and they should not be viewed as a box ticking exercise. Done properly, these additional steps are not about creating unnecessary delay but about ensuring that well-informed decisions are made, which benefits all parties in the end.

Under the Espoo Convention, parties are required "to carry out [an EIA] procedure, which includes participation by members of the public from both the party of origin and those of affected parties and the preparation of an EIA [] for those proposed activities listed in the Convention that are 'likely to cause significant adverse transboundary impact'."[41] It has not yet been determined if SMRs – all, some or none – are now or will eventually be covered by Appendix I of the Espoo Convention. But, even if they are, there is still a second step of the screening process related to whether such proposed activity is "likely to cause a significant adverse transboundary impact". The transboundary nature of the adverse impact must be emphasised; Espoo does not apply to strictly domestic impacts.

As briefly addressed in an earlier article on "Nuclear activities and environmental protection: The international legal framework":

> 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.[42]

However, all of this will have to be done case-by-case if one wants to exclude SMRs, and this will create significant legal uncertainty – and with it the attendant risk for time consuming and costly litigation – given the multitude of SMR types and potential siting locations.

Separate from any decisions or outcomes at the Espoo Convention level, at a national level, there remains the strong likelihood of some type of necessary environmental review

38. Nick, K.S. and P. Bowden (2022), "Nuclear activities and environmental protection: The international legal framework", *Principles and Practice of International Nuclear Law*, OECD Publishing, Paris, p. 221.
39. Convention on Environmental Impact Assessment in a Transboundary Context (1991), 1989 UNTS 310, entered into force 10 September 1997 (Espoo Convention).
40. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, *supra* note 9, p. 34.
41. *Ibid.*, pp. 34-35.
42. Nick, K.S. and P. Bowden (2022), *supra* note 38, p. 254.

prior to the licensing of an SMR. For example, currently, in the United States, "[i]n general, the approach for developing an [environmental report] to support environmental reviews of SMR or non-LWR applications will be the same as the approach for developing an [environmental report] to support [traditional LWR] applications."[43] This means a full environmental impact statement, the US equivalent of an EIA, will be required.

While "there may be differences in the amount of information and analysis needed for an SMR or a non-LWR depending on application specific factors such as the size of the reactor, its footprint and the amount of resource it uses," the fact remains that significant time and resources will be spent going through a full environment impact statement process.[44] Further complications arise over what type of application is submitted, as the flexibility of a multi-module site approach can run up against the finality needed for an efficient licence application review process:[45]

- If the licence application is only for the currently planned SMRs, future licence applications will be needed for any additional SMRs to be constructed on the same site, which would require a new environmental review.
- If the licence application is only for the currently planned SMRs as well as reasonably foreseeable SMRs, the plans should be concrete enough that any deviation from the plan does not result in changes to the original analysis, thus requiring a supplemental or new environmental review.

Efforts are underway in the United States to analyse the legal and regulatory framework for environmental reviews of SMRs to find ways to streamline the review process. One example is the development of an advanced nuclear reactor generic environmental impact statement (GEIS) with a "technology-neutral approach using a plant parameter envelope (PPE)" with "bounding values or parameters for different reactor designs located on a site."[46] In addition, the NRC is looking into developing a site parameter envelope with similar bounding values to describe the affected environment.[47]

Circumstances like what is seen at the intersection of SMRs and environmental protection – where novel approaches to regulatory processes are needed to incorporate new technology – require close co-operation between the technical staff and the legal staff to determine not only what is feasible legally but also what is most sensible technically.

C. Public participation

Public participation is recognised as a central tenant of the nuclear regulatory process. Under Principle 2 of the IAEA's *Fundamental Safety Principles*, the nuclear 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.[48]

43. US NRC (2018), "Preparation of Environmental Reports for Nuclear Power Stations", Regulatory Guide 4.2, Rev. 3, Appendix C, "Small Modular Reactors and Non-Light Water Reactors", p. C-1.
44. *Ibid.*
45. *Ibid.*, pp. C-1-3.
46. O'Neill, M. (2021), "Forging a clear path for advanced reactor licensing in the United States: Approaches to streamlining the NRC environmental review process", *Nuclear Law Bulletin*, No. 105, OECD Publishing, Paris, p. 55.
47. *Ibid.*
48. IAEA (2006), *Fundamental Safety Principles*, IAEA Safety Standards Series No. SF-1, IAEA, Vienna, p. 8.

For those states parties to the Aarhus Convention,[49] there is the potential that the siting, construction and operation of an SMR is an activity within the scope of the Convention. As such, the provisions on access to information, public participation in decision making and access to justice in environmental matters would be as equally applicable to the operation of a 30 MWe SMR as to a 300 MWe SMR or to a 1 100 MWe AP1000 Generation-III+ LWR. This means that "environmental information [must] be provided upon request and that environmental information [must] be proactively collected and disseminated".[50] As explained by the NEA,

> [s]hould all or some SMR technologies be covered by this definition, the public concerned must be provided with information about the proposed activity, and be allowed to provide comments. In addition, the outcomes of public participation must be taken into account in the final decision []. Should a member of the public believe that their rights under the first and second pillars were violated, the third pillar would then ensure access to justice, which provides procedures for the public to enforce their rights under the Aarhus Convention.[51]

But, public participation in nuclear energy is not just about fulfilling the mandatory minimum public consultation process; what is needed is to ensure public trust. The reason for going above and beyond the minimum requirements is that it is clear that public opposition to nuclear energy in general, or a certain project in particular, cannot be ignored – either from a legal perspective or a practical perspective. From a practical perspective, ignoring, discounting or simply not listening to the public has many potential consequences, both from an individual plant perspective and from an overall nuclear policy perspective.

For example, in the United States, opposition from the public, local and state government prevented the Shoreham Nuclear Power Plant on Long Island, New York, from being put into operation after construction was completed. More recently, public opposition played a part in the early retirements of plants in New York (Indian Point, 2020), Vermont (Vermont Yankee, 2014), Massachusetts (Pilgrim, 2019) and California (San Onofre 2 & 3, 2013, and potentially Diablo Canyon).

In India, protests against the Kudankulam Nuclear Power Plant have been ongoing since 1990, before construction on the reactors even began, and continue to this day. A landmark public interest litigation was brought before the Indian Supreme Court and in a 2013 judgment, the Court found, *inter alia*, that "steps should be taken to educate the people of the necessity of the plant".[52] Extensive reference was made in the judgment to the "National Disaster Management Guidelines: Management of Nuclear and Radiological Emergencies" and specifically the section on public awareness.[53]

In Japan, there was a sharp increase in the annual number of civil and administrative challenges introduced against nuclear power plant operation following the 2011 accident at Fukushima Daiichi. In particular, members of the public have been seeking injunctions

49. 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).
50. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, *supra* note 9, p. 35.
51. *Ibid*.
52. *G. Sundarrajan v. Union of India & Ors.*, Civil Appeal No. 4440 of 2013, p. 92, 6 May 2013.
53. National Disaster Management Authority (2009), *National Disaster Management Guidelines: Management of Nuclear and Radiological Emergencies*, No. 26, Government of India, New Delhi, pp. 22-23.

against the restart of nuclear power plants and have seen a number of successes, even if only temporary.[54]

In Germany, the anti-nuclear movement has a long history, with the first phase-out law enactment in 2002. The Fukushima Daiichi Nuclear Power Plant accident accelerated those plans and that same year the German parliament overwhelmingly voted to phase out nuclear energy entirely by 2022.[55] The case is similar in Belgium, where an initial phase-out law was enacted in 2003 and subsequently confirmed over the years with the last nuclear power reactor set to be shut down by 2025.[56]

All of these examples – from the plant level to the national policy level – lead to, at the very least, lost time and money, and at most the loss of an entire energy plan. And, when a country reduces or even loses nuclear energy's contribution to an energy system, it becomes harder to meet climate goals. In Germany, nuclear electricity production lost to the phase out is being replaced by coal-fired production, which has resulted in Germany not meeting its current climate targets and has put it on track to miss the future targets as well.[57] And missing climate targets can result in serious litigation, as was the case in the Netherlands, where the Dutch Supreme Court in 2019 concluded that by failing to reduce greenhouse gas emissions by at least 25% (compared to 1990 levels) by end-2020, the Dutch government was acting unlawfully in contravention of a duty of care under Dutch law arising from the constitutionally direct effect of certain provisions of the European Convention on Human Rights.[58]

54. For additional information on injunctions in Japan, see Hase, H. (2018), "Legal challenges to the operation of nuclear reactors in Japan", *Nuclear Law Bulletin*, No. 100, OECD Publishing, Paris, pp. 37-59. For the most recent cases, see NEA (2022), "Injunction against nuclear power plant operation based on inadequate evacuation plans (Tokai-2)", *Nuclear Law Bulletin*, No. 107, OECD Publishing, Paris, pp. 51-55; NEA (2021), "Request for injunction against prior consent to restart nuclear power plant", *Nuclear Law Bulletin*, No. 105, OECD Publishing, Paris, pp. 88-90; NEA (2020), "Update on the situation regarding preliminary injunctions against nuclear power plant operations since the Fukushima Daiichi nuclear power plant accident", *Nuclear Law Bulletin*, No. 104, OECD Publishing, Paris, pp. 10-12.
55. The 2022 date was pushed back by a few months with a decision to extend the life of three German reactors until 15 April 2023 due to concerns about security of electricity supply. World Nuclear News (2022), "German cabinet approves extended reactor operations", www.world-nuclear-news.org/Articles/German-cabinet-approves-extended-reactor-operation (accessed 10 Jan. 2023). For a history of the German phase-out see Mann, T. (2014), "The legal status of nuclear power in Germany", *Nuclear Law Bulletin*, No. 94, OECD Publishing, Paris, pp. 43-75.
56. However, the Belgian government later announced a decision to extend the operating life of the Doel 4 and Tihange 3 nuclear reactors by ten years from 2026 to ensure the security of electricity supply. Gayet, A.-S., "Belgian nuclear reactors extended for another 10 years", EURACTIV (10 Jan. 2023), available at: www.euractiv.com/section/politics/news/belgian-nuclear-reactors-extended-for-another-10-years (accessed 10 Jan. 2023).
57. Nuclear Engineering International (2020), "Reflections on Germany's nuclear phase-out", www.neimagazine.com/features/featurereflections-on-germanys-nuclear-phaseout-7941915 (accessed 28 Dec. 2022).
58. *Urgenda Foundation v. State of the Netherlands*, ECLI:NL:HR:2019:2007, Judgment, Supreme Court of the Netherlands (20 Dec. 2019). See also the later judgment in the factually similar case of *Vereniging Milieudefensie & Ors. v. Royal Dutch Shell*, Judgment, The Hague District Court, ECLI:NL:RBDHA:2021:5339 (26 May 2021) where the Court has ordered Royal Dutch Shell to reduce CO2 emissions by 45% by 2030 (compared to 2019 levels) and in which the corporate defendant's duty of care under Dutch law to plan for quantitative reductions in its group's contributions to greenhouse gas emissions was formulated by reference to the UN Guiding Principles on Business and Human Rights. For more information, see Bowden, P. (2021), "The UN Guiding Principles on Business and Human Rights: Taking Stock of their Impact at Ten Years", *Commonwealth Judicial Journal*, Vol. 25, No. 4, Commonwealth Magistrates' and Judges Association, London, pp. 27-35. The relationship between climate change litigation and nuclear energy, and the impact of such litigation on the future of nuclear energy, is a fascinating one that could be the subject of an interesting study in the future.

Given the economic challenges that are already at the heart of SMR development and deployment, public perception and engagement must be addressed early and fully for SMRs to ever become a reality. There is a possibility that regulators, vendors and operators can get lured into a false sense of security due to their own enthusiasm for SMRs. There is the possibility of groupthink, with the idea that because SMRs are smaller and safer, with smaller emergency planning zones and smaller overall footprints, public outreach is less important because: (a) the public will not know the installations are there or (b) the public simply will not care. This is a recipe for disaster, both from a policy perspective and a legal perspective.

This is where lawyers come in. Lawyers, in this regard, really are the protectors of the process. As legal advisors, they must ensure that the legal requirements are met. Failure to follow the legal process for public participation and information sharing can and does lead to protracted legal challenges at national, regional and international levels. Years-long back-and-forth litigation is not in anyone's best interest. Thus, it is better to do it right the first time.

Lawyers – as trusted advisors – must ensure that parties go beyond the bare minimum to ensure that stakeholders understand and accept the decisions being made, and ultimately that they find no reason to object. As explained by former NRC Chairman Stephen G. Burns, it all comes down to trust. "Trust is built on relationships; relationships are built on communication and respect. Respecting your stakeholders, even those with opinions very different from your own, listening carefully to their viewpoint, looking for common ground, considering their input, examining their evidence: all of this is part of building trust."[59]

This is not always easy because, as former Chairman Burns emphasises, "[s]takeholders are not only the ones who support your organisation and its objectives or who express confidence in what you do, but also those who are deeply sceptical, who offer critiques, constructive and otherwise, and even those who are largely indifferent, except when [organisations] receive media attention."[60] The process must be open, inclusive, fulsome and continuous in order to be successful. In moulding public perception and ensuring public trust, lawyers must not only be co-operative partners with the bodies responsible for such processes, but they must also be the advocates for co-operative partnerships with stakeholders.

III. Long-term operation

A. Legal frameworks for licensing and regulation

As of 2022, the oldest operating nuclear power reactor had been connected to the grid for 53 years. A total of 16 reactors passed the 50-year mark since they were first connected to the grid by the end of 2022. Although deployment of SMRs is the subject *du jour*, interest in long-term operation remains high for many reasons, not least of which is that "issues that were raised when LTO was first being considered – the need for economic power generation in the future if new nuclear power reactors are not licensed and brought online – continue to be relevant to this day."[61] "For many countries, if nuclear energy is to remain a part of their strategy to achieve a low-carbon energy future, the safe, environmentally sound and economical, long-term operation of nuclear power reactors must be ensured."[62] Ensuring that a proper legal framework for LTO is in place is a key component of such considerations.[63]

"Decisions to pursue long-term operation do not simply involve technical matters, but are complex, national decisions that concern long-term energy policy, economics and

59. NEA (2017), *NEA Workshop on Stakeholder Involvement in Nuclear Decision Making*, OECD Publishing, Paris, p. 56.
60. *Ibid.*, p. 19.
61. NEA (2019), *Legal Frameworks for Long-Term Operation of Nuclear Power Reactors*, *supra* note 1, p. 17.
62. *Ibid.*, p. 3.
63. *Ibid.*, p. 13.

social licence. As a result, many of these decisions have been subjected to legal reviews in [NEA] member and partner countries".[64] Having a proper legal framework in place can help to ensure sound decision-making processes and lawyers are needed not only to create those proper legal frameworks but also to defend them. And it is essential to look at the whole legal framework for licensing nuclear activities – and the legal implications thereof – because a decision to renew or extend a licence does not just impact the activities of one nuclear power plant. There are downstream impacts, particularly on waste management, that must be addressed as well.

It is imperative that lawyers be involved in drafting the legislation, crafting the regulations, and reviewing the applications and/or documentation associated with any decision to extend the life/licence/operating parameters associated with a nuclear power reactor. A report published by the NEA in 2019 addressing the *Legal Frameworks for Long-Term Operation of Nuclear Power Reactors* found that legal challenges related to the LTO process were allowed in almost all 20 nuclear generating countries that responded to an extensive inquiry on the subject. In those countries where challenges were allowed, half reported having already had legal challenges.[65] Although this may not seem that significant, it should be borne in mind that not all countries have reactors old enough to be considered at the LTO stage.

For those challenges that have occurred, the subject matter relates to all manner of issues associated with the LTO process. Looking only at cases before national judicial tribunals, for example, in Switzerland, a challenge was raised about modifications to the 40-year limitation on the original operating licence for the Mühleberg Nuclear Power Plant.[66] In Belgium, the legality of an act extending the lifetime of two nuclear power reactors was challenged in a case related to the Doel 1 and Doel 2 nuclear power reactors.[67]

64. *Ibid.*, p. 3.
65. *Ibid.*, p. 40.
66. *BKW FMB Energie AG und Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation gegen X. und 115 Mitbeteiligte* [BKW FMB Energie AG and the Federal Department for the Environment, Transport, Energy and Communication (DETEC) v. X. and 115 Participants], BGE 139 II 185, 2C_347/2012; 2C_357/2012, Federal Supreme Court (28 Mar. 2013). See also NEA (2012), *Nuclear Law Bulletin*, No. 89, OECD Publishing, Paris, p. 110; NEA (2012), *Nuclear Law Bulletin*, No. 90, OECD Publishing, Paris, p. 109; NEA (2013), *Nuclear Law Bulletin*, No. 91, OECD Publishing, Paris, p. 108. In 2009, the government repealed the time limit for the operating licence, but this decision was challenged by members of the public due to safety concerns over the continued operation of the plant. In the first instance, the Court confirmed the revocation of the original time limitation, but stated that a new time limitation was required for safety and that if the licensee wished to extend the licence beyond the time limitation, it must file an application for such extension along with a comprehensive maintenance plan for the plant. After a few years of litigation, the Court found in favour of the government, deciding that the Mühleberg plant should be granted an unlimited-duration operating licence.
67. Judgment of 29 July 2019, *Inter-Environnement Wallonie*, C-411/17, EU:C:2019:622. At the time of the case, in 2019, the legal framework for LTO in Belgium was articulated in the Act of 31 January 2003 on the Progressive Phase-out of Nuclear Energy for the Industrial Production of Electricity (Nuclear Phase-out Act), as amended in 2013, 2015, and 2016. According to 2015 amendment, the so-called "Nuclear Life Extension Act", the Doel 1 and 2 nuclear power reactors, which were connected to the grid in 1974 and 1975 respectively, were allowed to generate electricity for a total period of 50 years, to 2024 and 2025, allowing 10 additional years of operation over what was allowed under the Nuclear Phase-out Act. Following a governmental decision that such lifetime extension did not require an EIA, the Nuclear Life Extension Act was challenged before the Belgian Constitutional Court and then the Court of Justice of the European Union (CJEU). The CJEU ultimately found that in this specific case, an EIA was required before a decision was taken on the lifetime extension of the Doel 1 and 2 reactors. For more information on this case, see Emmerechts, S. and P. Bourdon (2021), "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.

In the Netherlands, a challenge was brought against the operating licence amendment for the extension of the design lifetime of the Borssele Nuclear Power Plant.[68]

In the United States, challenges come early and often. For example, challenges have been raised as to the regulatory requirements for both the initial licence renewal and subsequent licence renewal. In *Natural Resources Defense Council v. NRC*,[69] petitioners challenged a regulatory provision that would exempt the applicant from including a site-specific severe accident mitigation alternatives (SAMA) analysis in its environmental report for the licence renewal of Limerick Units 1 and 2 because the US NRC had previously considered such in its review for the initial operating licence. In *Friends of the Earth v. NRC*,[70] petitioners challenged the subsequent licence renewals for Turkey Point Units 3 and 4 arguing that the NRC failed to adequately analyse major issues regarding the environmental consequences of operating nuclear reactors for 60-80 years.

In another *Friends of the Earth v. NRC* case, this time about the adequacy of the safety review for licence renewal, petitioners challenged the licence renewal for Diablo Canyon Units 1 and 2 stating that the NRC must address, in an evidentiary hearing, the impact of certain seismic information on the safe operation of the plant.[71] In *New Jersey Environmental Federation v. NRC*, petitioners challenged the adequacy of the licensee's ultrasonic testing corrosion monitoring programme and other related programmes and actions for the renewal of the Oyster Creek licence, as well as the NRC's administrative and adjudicatory responses thereto.[72]

Additionally, numerous lawsuits have been brought at the intersection of waste management and licence renewal in the United States.[73] In the US state of Vermont, there was litigation regarding federal pre-emption by the US Atomic Energy Act of state laws – motivated by nuclear safety concerns – preventing the Vermont Yankee licence renewal that had been authorised by the federal regulatory body.[74] Even the procedures that the regulatory body employs for hearing and resolving challenges to licence renewal have been subject to litigation.[75]

Despite numerous challenges, licence renewals in the United States have largely proceeded at pace due to the integration of lawyers at all stages of the nuclear regulatory process – from drafting the laws, to crafting the regulations, to supporting the technical staff in their examination of the licence renewal application, including reviewing the safety analysis and participating in the environmental assessment. This critical engagement on the "front end" helps to ensure that a proper process is followed not only in the enactment

68. *Stichting Greenpeace Nederland v. Minister van Economische Zaken* [Greenpeace Netherlands Foundation v. Minister of Economic Affairs], Judgment, Raad van State, ECLI:NL:RVS:2014:517 (19 Feb. 2014). The Borssele plant was granted an indefinite duration authorisation at the start, but the reactor had a design life of 40 years as laid out in the Safety Report, which forms a part of its licence. In 2013, the Safety Report was updated with an extended design life of 20 years, to 60 years. Greenpeace and others raised a number of challenged to this decision, but the Council of State found in favour of the government.
69. 823 F.3d 641 (D.C. Cir. 2016).
70. No. 20-1026 (D.C. Cir., 4 March 2021).
71. Petition for Review, No. 16-1004 (D.C. Cir.), filed 8 Jan. 2016. Friends of the Earth's challenges are laid out in Pacific Gas & Elec. Co. (Diablo Canyon Nuclear Power Plant, Units 1 & 2), CLI-15-21, 82 NRC 295 (2015). The court dismissed the case as moot on 25 September 2018.
72. 645 F.3d 220 (3d Cir. 2011).
73. *New York v. NRC*, 824 F.3d 1012 (D.C. Cir. 2016), a consolidated case also addressing *Prairie Island Indian Community v. NRC*, No. 14-1212; *Beyond Nuclear, Inc. v. NRC*, No. 14-1216; and *Natural Resources Defense Council v. NRC*, No. 14-1217.
74. *Entergy Nuclear Vermont Yankee v. Shumlin*, 733 F.3d 393 (2d Cir. 2013).
75. In *Connecticut Coalition Against Millstone v. NRC*, No. 04-3577 (2nd Cir., decided 6 Oct. 2004), the petitioner challenged the use of a new 10 CFR Part 2 hearing procedure rather than the "old" Part 2 hearing procedure in a licence renewal proceeding for the Millstone nuclear power plant. In *National Whistleblower Center v. NRC*, 208 F.3d 256 (D.C. Cir. 2000), petitioners sought to overturn an NRC decision denying petitioner's intervention request in the Calvert Cliffs license renewal proceeding.

of the laws and regulations for LTO, but also in the review and approval process for any decisions made regarding LTO. Thus, when the lawyers are called in again at the "back end", to defend the enactment, review and approval process, one can be assured that there are no surprises and that the litigation strategy is already in place. Failing to include lawyers on the front end ensures a far more difficult road on the back end.

B. Environmental assessments

Assessing the environmental impacts of the construction and operation of new nuclear power reactors is a "long-standing and widely agreed" upon requirement.[76] "While the requirement to perform an environmental review is generally clear and consistent in the initial licensing of major nuclear activities," it is neither clear nor consistent among nuclear generating countries regarding whether there is a requirement to perform such an environmental review as part of the LTO-approval process.[77]

The principal controversy today is the applicability of the Espoo Convention to lifetime extensions. "[I]n most countries, a licence extension does not systematically necessitate an EIA."[78] "Currently, only a handful of Espoo contracting parties perform a full scope transboundary EIA as part of the authorisation process for LTO."[79] Questions in this regard have been raised before national courts, with environmental NGOs challenging the legality of lifetime extensions that were not preceded by an EIA. For example, the earlier mentioned Borssele case in the Netherlands also had a significant EIA component, with petitioners arguing that an EIA procedure should have taken place prior to the decision to amend the operating licence for the plant because the changes authorised by the decision have significant adverse effects on the environment. In 2014, the Raad van State (Council of State) found that because there were no actual changes taking place, no EIA was required under either the EU's EIA Directive[80] or the Espoo Convention.[81] In another case, in 2016, the Republic and Canton of Geneva, Switzerland, challenged the additional safety measures imposed by the ASN at the time of the third periodic safety review of the Bugey Nuclear Power Plant for a variety of reasons, including that they should have been subject to an EIA procedure under the Espoo Convention. The French Conseil d'État (State Council) found that no EIA is required as the additional safety requirements were not implicit authorisation decrees because reactors in France have no set time period for the operating life and as long as no decree is passed enforcing final shutdown and decommissioning, a reactor is authorised to operate under safe conditions.[82]

However, the most likely venue for challenges is the Espoo Implementation Committee. The LTO cases before the Espoo Implementation Committee are not new. In what is generally regarded as the starting point for discussion of this issue, in 2011 a Ukrainian NGO provided information to the Implementation Committee alleging that Ukraine was in non-compliance with the Espoo Convention for its 2010 decision to extend the lifetimes of Units 1 and 2 of the Rivne Nuclear Power Plant. Specifically, the decision to extend the lifetimes of a nuclear

76. NEA (2019), *Legal Frameworks for Long-Term Operation of Nuclear Power Reactors*, *supra* note 1, p. 32.
77. *Ibid.*
78. Nick, K.S. and P. Bowden (2022), *supra* note 38, p. 252.
79. 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. 50.
80. 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, *Official Journal of the European Union* (OJ) L 26 (28 Jan. 2012). This has since been amended and the current version of the EIA Directive can be found at Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, OJ L 124 (25 Apr. 2014).
81. *Stichting Greenpeace Nederland v. Minister van Economische Zaken*, *supra* note 68.
82. *EDF v. Republic and Canton of Geneva relative to the Bugey NPP*, Decision, Conseil d'État, ECLI:FR:CESSR:2016:373516.20160222 (22 Feb. 2016).

power plant and subsequent issuance of new licences for an additional 20 years of operation qualifies as a "major change" under the Convention and therefore falls under the definition of a "proposed activity". In 2014, the Meeting of the Parties of the Espoo Convention endorsed the findings of the Implementation Committee, which agreed with the NGO, but limited the scope of the decision to that particular situation.[83]

Since the first case, an additional nine cases related to lifetime extensions have been brought to the Committee, with six information gathering cases currently open related to Bulgaria, the Czech Republic, France, the Netherlands, Spain and Ukraine. In an effort "to clarify whether and in what circumstances lifetime extensions of nuclear power plants require a transboundary environmental impact assessment in accordance with the [Espoo] Convention", the States Parties to the Convention endorsed the *Guidance on the applicability of the [Espoo] Convention to the lifetime extension of nuclear power plants* to "assist Parties in the practical application of the Convention and to support the Implementation Committee in reviewing compliance by Parties with their obligations under the Convention, with a view to assisting them in fully meeting their commitments."[84] However, rather than providing a clear pathway to determining when an environmental impact statement is required, it provides scenarios, factors and considerations. Acknowledging that "there is no one-size-fits-all approach", the *Guidance* states that "a case-by-case determination through the consideration of the principles and factors laid down in the guidance is recommended."[85] Thus, it is certain that the legal outlook remains uncertain.

And, even when there is a clear requirement, legal challenges still occur. For example, in both Canada and the United States, the regulatory body's environmental reviews for licence renewal have been subjected to challenges, with petitioners arguing that the responsible public authorities did not properly analyse all the required information. In Canada, four non-governmental organisations argued that the CNSC had erred by excluding from the scope of the environmental assessment for the Darlington Nuclear Generating Station refurbishment project low-probability severe nuclear accidents.[86] In the United States, the Commonwealth of Massachusetts challenged the NRC's licence renewal process for the Pilgrim Nuclear Power Station, stating that "new and significant information" from the Fukushima Daiichi Nuclear Power Plant accident necessitated a re-analysis of both the SAMAs in the NRC's supplemental EIS for the Pilgrim plant as well as the spent fuel pool environmental impacts in the Agency's GEIS for licence renewal.[87]

Ultimately, the environmental review process is intended to help achieve well-informed decisions, not to dictate go/no go decisions. Those are left to the licensing and regulatory process. Thus, a process that is purely procedural should not be unduly burdensome. Lawyers can help to ensure a proper, sufficient process on the front end and provide effective advice, counsel and representation, should such be needed, on the back end. As protectors of the process, nuclear lawyers can help all parties involved – not just the proponents of the project – move forward in a timely and well-informed manner, acting as the guarantors of good governance and sound decision making.

83. 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. 14, paras. 68-71.
84. UNECE (2021), *Guidance on the applicability of the Convention to the lifetime extension of nuclear power plants*, UN Publication, Geneva, p. 9.
85. *Ibid.*, p. 10.
86. *Greenpeace Canada et al. v. Attorney General of Canada and Ontario Power Generation Inc.*, 2016 FCA 114.
87. *Massachusetts v. NRC*, 708 F.3d 63 (1st Cir. 2013).

IV. Conclusion

Much of this article is tied to the role of nuclear energy in combating climate change; however, recent events have demonstrated without a doubt that nuclear energy also has a significant role to play in energy security. Almost 50 years ago, many countries turned their attention to the role of nuclear in their national energy supply due to the oil crisis of the 1970s.[88] In 1970, there were 90 nuclear power reactors in operation, but by 1980 there were 253.[89] In that decade, on average, construction started on 25-30 reactors each year.[90] In the European Community alone, "[t]he proportion of nuclear electricity rose from 6% to 11% between 1973 and 1979".[91] This was aided by countries like France, where in 1974 Prime Minister Pierre Messmer announced a nuclear power revolution, proposing "the construction of 80 nuclear power plants by 1985 and 170 plants by 2000."[92]

Today's dual concerns of, on the one hand, climate change, and on the other security and affordability of energy supplies have created a similar enabling environment. Nearly 50 years after the announcement of the Messmer Plan, current French President Emmanuel Macron announced a second French nuclear resurgence, proposing six new reactors with the possibility of eight more, as well as the intention to extend the life of the current fleet of reactors from 40 to 50 or more years.[93] On opposite ends of the spectrum, there are non-nuclear countries indicating strong interest in SMRs as well as countries determined to phase out that are now rethinking their policies. And in between are nuclear countries that are now considering LTO or even building new reactors when previously such a prospect was not on the table.

But, nuclear renaissances and resurgences (or even just sustained periods of nuclear enthusiasm) have failed in the past. In the case of the ill-fated nuclear renaissance of the 2000s, there was no forcing function like there was in the 1970s or today. Climate change was not the topic of the day. Energy security was not a troubling concern. The affordability of energy was not felt in individual wallets. In order to meet nuclear energy's potential, one that was anticipated 50 years ago, silos must be broken to ensure communication and collaboration between subject matter experts. And co-operation must be facilitated among the functional participants (engineers, scientists, economists, policymakers and lawyers), stakeholders (governments, industry and members of the public), interested countries, and organisations (both intergovernmental and non-governmental).

Key to all of this will be not only competent and enthusiastic legal counsel, but legal counsel that are well versed in the technical aspects of nuclear energy. It is this unique marriage between legal expertise and technical competence that makes a nuclear lawyer's role exceptional. The NEA has been at the vanguard on this issue, creating the *Nuclear Law Bulletin* in 1968, a specialist legal journal for professionals and academics in the field of nuclear law. Over 20 years ago, the NEA created the first specialist school for nuclear lawyers, the International School of Nuclear Law, which is run in partnership with the University of Montpellier and notably offers a University Diploma in International Nuclear Law. Merging the longstanding nuclear law publication work of the Agency with its nuclear law education programmes, *Principles and Practice of International Nuclear Law* was published in 2022 and serves as the authoritative textbook for this field. Finally, cementing the unique status of nuclear law and nuclear lawyers, the NEA then created the Division of Nuclear

88. NEA (2008), *NEA 50th Anniversary*, OECD Publishing, Paris, p. 17.
89. Char, N.L. and B.J. Csik (1987), "Nuclear power development: History and outlook", *IAEA Bulletin*, No. 3, IAEA Vienna, p. 19.
90. *Ibid*.
91. Commission of the European Communities (10 July 1980), "Energy Policy in the European Community: Perspectives and Achievements", COM(80)397 final, p. 2.
92. Sovacool, B.K. (2016), "How long will it take? Conceptualizing the temporal dynamics of energy transitions", *Energy Research & Social Science*, Vol. 13, p. 209.
93. Dalton, D. (2022), "Macron Announces Ambitious Plans For Up To 14 New Nuclear Reactors", *NucNet*, www.nucnet.org/news/macron-announces-ambitious-plans-for-up-to-14-new-nuclear-reactors-2-4-2022 (accessed 28 Dec. 2022).

Law to function as a programmatic division alongside other Divisions like "Nuclear Safety Technology and Regulation" and "Radioactive Waste Management and Decommissioning". This is a long-awaited and necessary acknowledgement that nuclear law is a substantive subject area just like any other in the nuclear field. And it recognises that nuclear lawyers are equally critical to effectuating the Agency's mission of "assist[ing] 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."[94]

Nuclear law tends to be a reactive rather than proactive endeavour. But today, the nuclear energy field is in a unique situation of needing to be forward-looking rather than focusing on the rear view mirror. To meet this need, five key questions must be asked and answered as soon as possible in the nuclear law community:

1. How can regulators from different countries work together on licensing actions to increase effectiveness and efficiency while maintaining sovereignty in regulatory decision making?
2. How can regulators work more co-operatively with prospective licensees? And how can they do so while also maintaining public trust in the regulator's integrity (remembering that independence does not imply isolation)?
3. How can regulators analyse the adequacy of current legal frameworks vis-à-vis potential new technologies when there are so many technologies, many of which will not come to fruition?
4. Given the variety of new technologies, how can regulators standardise safety and environmental reviews and encourage generic regulatory approaches so that licensing actions are not addressed on a case-by-case basis?
5. How can nuclear regulators, vendors, operators and other key stakeholders be encouraged to integrate lawyers at the earliest stage of strategic policy planning?

Lawyers, as the jack of all trades, will need to work in partnership with the engineers, scientists, economists and policymakers to answer these questions so that all parties can, together, chart an innovative path forward and support the future of nuclear energy.

94. NEA (2022), *The Strategic Plan of the Nuclear Energy Agency: 2023-2028*, OECD Publishing, Paris, p. 17.

The rule of law: A fragile tool for the development of emerging nuclear technologies

*by Cyril Pinel & Hugo Lopez**

Before the Fukushima Daiichi Nuclear Power Plant accident in Japan in 2011, the nuclear industry had strongly promoted the idea that the time of nuclear renaissance had come after a long, fallow period in the wake of the nuclear accidents at Three Mile Island (1979) and Chernobyl (1986). During the post-Fukushima period, there were few new projects, but growing demand for energy and anxieties raised by climate change have brought us to a turning point. Despite the Fukushima accident, which led to some nuclear projects being delayed or cancelled, there is still a great deal of interest in the use of nuclear power for civil purposes. This is primarily because, as the International Energy Agency's (IEA) Executive Director Fatih Birol has rightly pointed out: "Without an important contribution from nuclear power, the global energy transition will be that much harder."[1] In this regard, in 2010, 67 reactors were under construction, 120 planned and 441 in operation.[2] In 2022, 11 years after the Fukushima Daiichi accident, there were 60 under construction, 104 planned and 338 proposed.[3] The International Atomic Energy Agency (IAEA) estimates that nuclear electric power capacity will have increased by as much as 23% by 2030 and more than doubled by 2050.[4] In addition to this renewed interest, many projects are now in development, opening up new prospects for the use of the atom for civil purposes. Nuclear fusion, small modular reactors (SMRs), the use of artificial intelligence, floating, underwater and space reactors, and nuclear batteries, to name but a few of the projects on the table, lead us to think that the "nuclear renaissance" is slowly shifting to a "nuclear spring". In this view, where the concept of a renaissance involves new impetus for nuclear energy, with the construction of new facilities, the concept of "spring" refers to a determination to break with nuclear traditions, in terms of concepts, means and players. Consequently, this phenomenon calls for new legal rules which, in some cases, have already started to be debated.[5]

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1. IEA (2019), "Steep decline in nuclear power would threaten energy security and climate goals", www.iea.org/news/steep-decline-in-nuclear-power-would-threaten-energy-security-and-climate-goals (accessed 4 Jan. 2023).
2. IAEA (2011), *Nuclear Power Reactors in the World*, Reference Data Series No. 2, 2011 Edition, 2011, IAEA, Vienna.
3. These numbers are tabulated by the World Nuclear Association (Nov. 2022), "World Nuclear Power Reactors & Uranium Requirements", https://world-nuclear.org/information-library/facts-and-figures/world-nuclear-power-reactors-and-uranium-requireme.aspx (accessed 4 Jan. 2023).
4. IAEA (2022), "*Energy, electricity and nuclear power estimates for the period up to 2050*", Reference Data Series, No.1, IAEA, Vienna, p.18.
5. For instance, new recommendations on the safety of SMRs have been discussed and adopted by the SMR Regulators' Forum under the auspices of the IAEA.

While mainly a matter for each individual state to decide, the use of nuclear energy is now governed by a combination of national law, international law and international peer control.[6] This complex system aims to "regulate the conduct of legal or natural persons engaged in activities related to fissionable materials, ionising radiation and exposure to natural sources of radiation",[7] in relation to safety, security and proliferation issues. In this way, it is a field of the law that one could qualify as reactive and empirical since it is built, in the majority of cases, in response to current or past issues, rather than in anticipation of future issues. This is typical of regulation in scientific and technical fields. In environmental law,[8] for example, it is often asserted that "The law codifies things regarding a state of knowledge. Thus, it cannot precede science."[9] Examples in nuclear law are numerous and nuclear accidents, whether small or large in scale, have widely contributed to the development of both national and international law in this field.[10] For instance, the Convention on Early Notification[11] and the Convention on Assistance[12] were negotiated within a few months following the Chernobyl accident, which is, to a certain extent, the accident that has had the most significant impact on nuclear law.[13] This type of normative process does, however, have its limits, mainly because, on the one hand, it prevents risks only after they have occurred and, on the other hand, it adds to the complexification of the rule of law.

In parallel to the development of nuclear law, the uses and misuses of nuclear energy have largely contributed to a reluctance on the part of the general public to embrace its use for both civil and military purposes. The last disaster in 2011 has slowed the course of the nuclear renaissance around the world, and it has also resulted in raising public awareness and objections to nuclear energy. The Fukushima Daiichi accident has reminded us of the key role of public opinion in the development of the nuclear industry and of the fragility of this sector. Indeed, in some nations, the public was consulted by way of referenda or similar mechanisms to decide the future use of nuclear power, either locally or in the whole country. This, for instance, was the case in Austria, Italy and Switzerland, where such consultations led to a "nuclexit". In other countries, controversy over the role of nuclear power has led either to constant public confrontation over nuclear issues,[14] to a nuclear phase-out without consultation or to the shutdown of specific nuclear power plants. Therefore, and contrary to what the continuation of the nuclear renaissance after the Fukushima Daiichi accident

6. Pelzer, N. (2009), "Nuclear New Build – New Nuclear Law?", *Nuclear Law Bulletin,* No. 84, OECD Publishing, Paris, p. 7.
7. Stoiber, C. et al. (2003), *Handbook on Nuclear Law*, IAEA, Vienna, p.4.
8. Van Langa, A. (2016), *Droit de l'environnement*, Presses Universitaires de France, Paris, 4th ed., pp. 2-5.
9. Mission Agrobiosciences (2007), "Le silence des clones, Pourquoi ne parle-t-on plus du clonage dans les médias ?", Les restitutions de la conversation de la Maison Midi-Pyrénées, Séance du 28 mars 2007, p. 13, www.agrobiosciences.org/IMG/pdf/conversation_le_silence_des_clones.pdf (accessed 4 Jan. 202). The original quote is attributed to Jean-Pierre Zalta: "La loi codifie les choses par rapport à un état de la connaissance. Elle ne peut donc pas précéder la science."
10. For more information on the impact of nuclear accidents on the development of nuclear law, see Burns, S. (2022), "The impact of the major nuclear power plant accidents on the international legal framework for nuclear power", *Principles and Practice of International Nuclear Law*, OECD Publishing, Paris, pp. 83-105.
11. 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).
12. Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, (1987), IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987 (Assistance Convention).
13. Burns, S. (2022), *supra* note 10, p. 83.
14. This is the case for instance in France or in the United States. In these countries, the risks of the use of nuclear energy are often raised by non-governmental organisations, the public or politicians. In France, the nuclear debate has occupied an important place in all presidential elections for more than 40 years.

suggests, it seems that the nuclear industry lies on top of a house of cards, where the slightest gust of wind or wrong move could topple the entire structure.

As these considerations show, new nuclear technologies and projects would have to fit into a very complex and delicate legal, political and social context. Some, such as SMRs, will have to overcome larger obstacles than others. Indeed, SMRs aspire to be built everywhere thanks to their modular and transportable structure, and are attracting both newcomers and states with established nuclear energy programmes. However, the development of this technology will potentially increase nuclear safety and security risks, particularly by increasing the number of facilities and radioactive material transport operations as well as, in some cases, through the use of what are not yet mature technologies and techniques in different types of environment. To protect people, the environment and industry, it is obviously not possible to await the next disaster before adapting nuclear law. The new legal frameworks for these emerging technologies must therefore comprehend the risks beforehand and be aligned to the social and political needs necessary for the proper development and operation of new nuclear technologies. If the content of these rules is, for some, currently under discussion within different institutions, the legal instruments containing them must still be decided upon and could have, to a certain extent, a significant impact on the viability of these projects. Indeed, to fit into the complex ecosystem that is nuclear law, several solutions are possible regarding the legal basis, which could be national, regional or international and could be binding or non-binding in nature. The choices must be carefully tailored to best respond to the societal, commercial and legal issues underpinning the emergence of these new nuclear technologies.

These considerations raise all sorts of questions regarding the role of the rule of law, depending on its form, not on its substance, relative to the development of new nuclear technologies. In what follows, we will first discuss the impact of the law on the emergence of these innovative projects and, secondly, present the risks inherent in the development of new nuclear regulation, notably in terms of the complexification and fragmentation of the overall system, as well as the role of international co-operation in this regard.

I. The role of the law in mitigating the emergence of nuclear technologies under pressure

New nuclear technology, like every other technology and activity, requires a legal framework. With this in mind, the IAEA has, for example, already proposed new recommendations for SMRs that still need to prove their worth.[15] To date, there is only one operational SMR, located on the Akademik Lomonosov ship sailing along the Russian Arctic coastline, but other projects are under development or construction. However, as history has repeatedly shown, it is not enough for a product to emerge for it to be viable. Some are "dead in the water" and deserve to be tossed onto the rubbish heap of history, for any number of reasons: they pose security issues, they fail to meet a real need, there is inadequate supply, the cost or competition is too high, etc. In addition to making a real contribution, new technologies must also emerge in a legal, societal and political environment allowing their entry into a market. The nuclear industry is no exception to this rule, quite the contrary.[16] In this section, we will present the two major social and economic issues regarding the emergence of these technologies and how the rule of law, by its form, can influence them.

15. See Broussard, E. (2020), "New Recommendations on Safety of SMRs from the SMR Regulators' Forum", IAEA, www.iaea.org/newscenter/news/new-recommendations-on-safety-of-smrs-from-the-smr-regulators-forum (accessed 4 Jan. 2023).
16. In line with this, many nuclear projects have been cancelled for several reasons: e.g. Flexblue (underwater reactor), the project Orion and NERVA (nuclear launchers) and the Convair X-6 (plane with nuclear propulsion).

A. New nuclear technologies: Development under pressure

As mentioned above, the nuclear sector is fragile and rapidly expanding. Some of the current projects, including SMRs, are part of a process of developing the nuclear industry within the borders of the countries in which the companies involved are based, as well as on the international markets. In this sense, this type of reactor, which can be operated in remote areas – as can be seen in the case of the first SMR already in service, in the Russian Arctic – has been designed to be developed ever closer to the point of supply, either in other countries or in areas with low population density. However, to create or enter a market, these new technologies must overcome two important issues. On the one hand, they need to be acceptable to the public, which, in the wake of major disasters, has increasingly shown a certain reluctance towards nuclear power. On the other hand, if we want to develop these technologies, they need a legal framework that is favourable for investment, insurance and commercialisation; otherwise, the rule of law could potentially strangle an emerging market.

1. *Public awareness*

The role of public opinion in the use of nuclear energy for civil purposes is a well-documented and widely monitored topic, underlining its importance in determining a state's energy policy. One commentator has gone so far as to say that "Public knowledge and acceptance of nuclear power will be the most serious problem in the course of nuclear power development in the future, but we ignored it at the very beginning."[17] This is intrinsically linked to the democratic system that aims to give the people the power to decide state policy and, beyond that, their well-being in society. This is all the more true in the case of nuclear technology and, more broadly, any new technology or activity. Public acceptance seems to be the result of a delicate balance between the social risk and the social benefit the technology brings.[18] Within the nuclear sector, the various accidents and incidents have shaped the public's views, resulting in a certain mistrust that is now widely shared around the world. In some states, this has led to the use of nuclear power being rejected, while in others, the public tends to worry about this type of electricity generation, even if a large part of the population still recognises its usefulness for climate change mitigation and energy security.

In 2021, 19% of the French population said they would be willing to live near a power plant, compared to 37% in 1982. Similarly, since 1985, less than 10% of the population would accept living next to a nuclear waste storage facility.[19] This phenomenon is called the "not in my backyard" movement, whose supporters may accept the use of nuclear energy as long as it does not take place in the vicinity of their comfort zones. The root cause of this way of thinking seems to lie "in the conflicts and imbalance between development of public interest and protection of personal interest".[20] The lack of consultation with local citizens could then result in mass protests and lead, in certain cases, to cancelling an entire nuclear plant project, for example. Legal instruments, and notably international conventions, have been adopted to establish a right for the public to participate in the decision-making process regarding projects that could have an impact on the environment. This is the case of the Aarhus Convention[21] and the Regional Agreement on Access to Information, Public Participation and Justice in Environmental

17. Wu, A. and W. Liu (2014), "A study of legal issues relating to public acceptance of nuclear power", in R.F. Manóvil (ed.), *Nuclear Law in Progress, Proceedings of the 21st INLA Congress*, Legis, Buenos Aires, pp. 481, 482 (quoting Alvin Weinberg).
18. Shi, Z. et al. (2000), "Research on Public Acceptance of Nuclear Power", *China Soft Science*, Issue 8, People's Republic of China Ministry of Science and Technology, pp. 71-75.
19. IRSN (2022), *Barometer 2022: The perception of risk and security in France*, p. 95, available at: https://barometre.irsn.fr/wp-content/uploads/2022/07/1542_IRSN_All-Charts2022-HD.pdf.
20. Wu, A. and W. Liu (2014), *supra* note 17, p. 489.
21. Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (1998), 2161 UNTS 447, entered into force 30 Oct. 2001 (Aarhus Convention).

Matters in Latin America and the Caribbean,[22] but similar legislation exists in the national law of many countries. On this subject, some authors argue that the adoption of the Aarhus Convention "is indicative of the crystallisation of the principle".[23]

In light of such considerations, we may ask whether, in having the right to participate in decision-making and having a strong influence on nuclear power projects – and other large industrial projects, such as airports and dams – the public in fact has the last word in the decision–making process.

2. *Development and commercialisation*

Alongside the issue of public awareness and opinion, the industry's capacity to supply the emerging nuclear technology remains uncertain and seems to be conditioned by certain factors. Indeed, if the societal and environmental benefits of these emerging technologies are to a certain extent known, their economic benefits are not so obvious.[24] The absence of a clear legal framework could be a source of despondency for investors and insurers, which would be critical for such a costly industry. Without certainty of the legality of a nuclear project or of its completion – which, as seen before, can be significantly affected by public opinion as well as by other factors – investors could be discouraged due to fears that they will not receive the expected returns. Similarly, insurers could have some reservations about insuring projects that are likely to evolve in an uncertain framework because indemnity payouts could be impossible to predict. In addition, the lack of a clear framework for new nuclear activities could be very risky for them since the legal consequences could be very heavy if a project they are backing is cancelled or in case of harm to the population. This "lack of a globally unified nuclear liability regime was identified as a 'continuous impediment to nuclear commerce'" some twenty years ago.[25]

In addition to these obstacles to the development of nuclear technologies due to the lack of a clear legal framework, a non-harmonised framework could affect their commercialisation by restricting exports. Without a safety and security regime common to all nations, whether they already have nuclear energy or wish to develop a civilian nuclear programme, companies could be forced to review every product to comply with the conditions established by each nation. One possible way to address this issue is, as within the framework of the International Civil Aviation Organization (ICAO), to establish an international licensing system recognised by all states. Such a mechanism allows an aircraft registered under minimum conditions set at the international level to be considered as safe and secure and permitted to fly within the various ICAO member states. Such an international licence or other international standard would help emerging nuclear technologies developed by one state to be introduced in other states without requiring the companies to review their products for each country to which they want to export. At the present time, as will be shown below, agreement on such a system is far from being reached.

Thus, in order to be developed and operated, emerging nuclear technologies will have to find their place in a strained social, political and commercial context. Governments will have to pursue national discussions at all levels of society, first to provide all the information needed to fully understand the issues at stake and, second, to build unity between the public, regulator, industry and decision makers. This multi-party symbiosis

22. Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean, signed at Escazú on 4 Mar. 2018, UN No. C.N.195.2018.TREATIES-XXVII.18, entered into force 22 Apr. 2021.
23. Duvic-Paoli, L. (2019), "Public Participation in the Context of Energy Activities: The Role of the Aarhus Convention Compliance Committee", in Ozawa, M. et al. (eds), *In Search of Good Energy Policy*, Cambridge Univ. Press, Cambridge, p. 225.
24. For SMRs for example see NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, OECD Publishing, Paris, pp. 47-48.
25. Pelzer, N. (2009), *supra* note 6, p. 20, quoting Brown II, O. (1999), "Nuclear Liability: A Continuous Impediment to Nuclear Commerce", 24th Annual International Symposium 1999 of the Uranium Institute.

appears to be a key tool for the development of nuclear technologies and industry with regard to the justified fears of the public. From this perspective, the form of the rule of law, in addition to the contribution made by its content, can also have an impact.

B. The impact of the form of the law on the development of emerging nuclear technologies

As seen above, the rule of law can have a significant influence on the development of a market for emerging nuclear technologies and, therefore, of the entire nuclear sector. After presenting this impact in the preceding section, we will now discuss the impact that the form of the law, i.e. the instrument itself, has on the establishment of a legal framework that meets the constraints and ambitions of the industry players wishing to initiate new nuclear programmes. Nuclear law is currently a complex ecosystem of national, regional and international legal instruments that may be binding or non-binding. Each type has different consequences for nuclear regulation, as will be discussed in light of the issues mentioned above.

1. International vs. national

Historically, electric power has mainly been generated at a local level. Therefore, local authorities have been responsible for regulation, and the content of this regulatory control has depended on whether the generating facilities were publicly or privately owned. In contrast, nuclear energy regulation developed as a combination of national and international law. The first generally allows for the establishment of a licensing or other authorisation regime as well as liability for nuclear damage, while the second plays a role in the safe and secure delivery of nuclear-generated electricity.[26] Since its beginnings, international nuclear law has slowly diversified, first to support and promote the use of nuclear energy, and second, to prevent and mitigate the risks of nuclear power in order to counterbalance increasingly sceptical attitudes.[27]

National legislation is better at taking into consideration and reconciling the expectations and needs of each civil, industrial or institutional entity. As such, mechanisms for information dissemination, public participation or consultation with industry players are often established and are of critical importance in the development of nuclear policy and, consequently, the nuclear sector. Moreover, in the event of changes in the needs, expectations or context for nuclear energy, the affected state is best positioned to amend, reform or renew its national legislation. However, a purely national system can also give rise to difficulties in terms of the development and commercialisation of new nuclear projects abroad. In this sense, national frameworks can be sources of difficulties for foreign investors that do not know the legal system of other countries or the language of the countries in which they are investing. This does not allow for a favourable framework for exports, either, since designers then have to comply with each national law and not with universal standards.

The international legal system raises issues that are at odds with the national system. In fact, while international law makes it possible to promote international trade and to facilitate the development of emerging technologies, it does not appear to be best able to take the needs of the various nuclear stakeholders, including the public, into consideration. Regarding the trade framework, the international system, by its universal scope, can enable the establishment of a common system, for example a licensing or liability system, agreed upon by most nations at the same time. This therefore gives a company wishing to export a technology or a whole programme, for instance an SMR, greater certainty that, if it meets international requirements, the technology can be installed and operated without too many problems in the importing country. However, this mode of regulation seems to have its limits in the nuclear field. First, states are generally reluctant to restrict their sovereignty in

26. Zillman, D. et al. (eds.) (2018), *Innovation in energy law and technology: Dynamic solutions for energy transition*, Oxford University Press, Oxford, p. 418.
27. Pelzer, N. (2009), *supra* note 6, p. 7

matters of nuclear safety and prefer to "jealously" guard their national nuclear fuel cycle programmes, deemed to be factors of national independence and pride.[28] Second, this mode of regulation is not the most suitable to take into consideration the needs and expectations of national nuclear stakeholders. This is mainly due to the normative process of international law – at least in the conventional sense, and most significantly with regard to nuclear activities – which is based on a system of negotiations in which the opinions and interests of states are played off against each other through their representatives. Although the various national industries and institutional players are generally included in determining a national position in preparation for the negotiations, any agreement adopted at the end of the diplomatic discussions will nonetheless be the result of a multilateral consensus in which each of the parties has had to make concessions. Also, this process does not guarantee that the agreement would not be based on the lowest common denominator and thus that a high safety level would be maintained within national safety levels.[29]

Following this process, and in order to make any agreement binding, the international instruments must be implemented within the body of law of each state, as provided for under their constitutions, through the process of ratification. Thus, international law extends into the various national legal orders and leads to the establishment of principles and rules common to each of the states that are party to the negotiated instrument. However, this will result in a set of norms, binding in domestic law, that are not necessarily a perfect fit with the original expectations of all the entities that participated in drawing up the national position, including public entities. While reservations and interpretative declarations can generally be made prior to ratification, they cannot release states from certain obligations or create new obligations that would suit them better.

Finally, unlike national law, this system does not make it easy to make amendments or modifications when a new need or new problem arises. For example, after the Fukushima Daiichi accident in 2011, proposals were put forward to amend the Convention on Nuclear Safety. Many political and procedural obstacles had been raised.[30] This phenomenon had already been pointed out by Pierre Strohl at the time when the Convention was conceived: "The convention ultimately conceived has a universal vocation, […] not easy to change, because it is relatively difficult to revise."[31]

To sum up, it seems that, on the one hand, international law should make it possible to promote the commercial aspects of nuclear technologies through the establishment of a global framework common to all states. On the other hand, this system appears to be incompatible with the expectations of the public, which can really only be taken into account within the framework of national law. As seen above, both these aspects are fundamental to the development of emerging nuclear technologies.

2. *Binding v. non-binding*

In addition to the international or national character of the legal standards relative to emerging nuclear technologies, a choice can be made regarding their binding or non-binding character. This choice would mainly depend on the state of the international order. Indeed, it seems that today the multilateral process, and therefore the adoption and application of binding agreements, is increasingly fragile. This is the case in many fields of international

28. Pelzer, N. (2013), "Safer nuclear energy through a higher degree of internationalisation? International involvement versus national sovereignty", *Nuclear Law Bulletin,* No. 91, OECD Publishing, Paris, p. 43.
29. *Ibid*., p. 45.
30. Durant-Poudret, E. (2015), "Towards a new international framework for nuclear safety: Developments from Fukushima to Vienna", *Nuclear Law Bulletin*, No. 95, OECD Publishing, Paris, p. 27.
31. Strohl, P. (1994), "*La Convention de l'AIEA sur la sûreté nucléaire*", *Annuaire français de droit international*, Vol. 40, CNRS Éditions, Paris, pp. 809-810. Original quotation: "*C'est finalement la conception d'une Convention à vocation universelle, […] peu évolutive parce que relativement difficile à réviser*."

law and is a result of geopolitical tensions, unilateralism and "ad hocery".[32] States are more and more reluctant to accept international obligations that are binding on them, but the long process and the consensus system may also not correspond to the expectations of the stakeholders, at least in the nuclear field. Besides, other types of instruments have been adopted to regulate the use of nuclear power for civil purposes that are not binding. This is the case of "standards" that include, but are not limited to, guidelines, codes of conduct and recommendations. If all these types of instruments are "soft law", they may not have the same impact on emerging nuclear technologies. For instance, recommendations seem to be "softer" and, according to Norbert Pelzer, insufficient to respond either to the international general public's expectations regarding safety or to the needs of the stakeholders.[33] The codes of conduct are located halfway between recommendations and binding law. Indeed, while they are not binding in the strict sense of the word, it is more difficult for a state to politically justify why it does not follow them.

The main creator of this type of law is the IAEA, which according to its Statutes has the authority "to establish or adopt […] standards of safety for protection of health and minimization of danger to life and property […]"[34], but other organisations may also do this.[35] While all the forms of soft law are non-binding, that does not mean that they are not of great importance. In its Pulp Mills judgment, the International Court of Justice emphasised that "while not being formally binding, [they] are, to the extent they are relevant, to be taken into account by the State so that the domestic rules and regulations and measures it adopts are compatible ('con adecuación') with those guidelines and recommendations".[36] Moreover, it is possible for soft law to gain a binding character as time passes by two different routes. First, they may be the source of a general state practice and turn into a customary international law, which is binding for all states except those that are persistent objectors. Second, the standard can then be incorporated within a binding agreement, as has been the case with the Convention on Early Notification and Assistance or the Convention on the Physical Protection of Nuclear Material.[37]

Overall, nuclear soft laws offer various advantages that compensate for their non-binding nature, for both industry and the public's concerns. They are generally the result of meetings among technical experts, who are by nature assumed to be neutral and devoid of strong political interests. This type of regulation seems more appropriate for informing and raising public awareness since the public may have greater trust in experts than in the governments and politicians in their respective countries.[38] As for the industry, soft law, although not binding, also has its advantages because any action taken toward implementation should be consistent with the applicable principles and norms of the law. For their part, insurers and investors can then be sure that the nuclear technologies are at least legally based in theory and, for industry, soft law provides a general direction for development and commercialisation abroad. However, the non-binding character of a soft law could be a source of difficulties if some parties decide not to comply or in the case of dispute settlement.

32. Statement by H.E. Mrs. María Fernanda Espinosa Garcés, President of the 73rd Session of the UN General Assembly, "Current challenges to international law: The role of societies of international law", 3 Sept. 2019, www.un.org/pga/73/2019/09/03/current-challenges-to-international-law-the-role-of-societies-of-international-law (accessed 4 Jan. 2023).
33. Pelzer, N. (2013), *supra* note 28, p. 75.
34. Article III.A.6, Statute of the International Atomic Energy Agency (1956), 276 UNTS 3, 6, entered into force 29 July 1957.
35. For example, Euratom and the NEA.
36. International Court of Justice, Pulp Mills on the River Uruguay (Argentina v. Uruguay), Judgment of 20 April 2010, *ICJ Reports* 2010, p. 45.
37. Lamm, V. (2017), "Reflections on the development of international nuclear law", *Nuclear Law Bulletin*, No. 99, OECD Publishing, Paris, p. 41.
38. See e.g. IRSN (2022), *supra* note 19, p.129.

II. The regulation of emerging nuclear technologies: The rule of law under pressure

As seen in the previous section, emerging nuclear technologies will have to be covered by new legal provisions that could be contained in different forms of legal instruments to best respond to the issues while taking into account a plurality of expectations and needs that are sometimes incompatible. These instruments can be national, regional or international law and law or guidance from multilateral organisations such as the IAEA, NEA, Euratom and others, whether binding or non-binding in nature. Moreover, the different designs, such as SMRs, nuclear fusion, floating or underwater reactors, and potential risks, such as cyber-threats and the use of artificial intelligence, might involve the introduction of not one but numerous rules. Whether they should be incorporated directly into new instruments or into existing ones, they will necessarily add to the complexification and fragmentation of nuclear law, as discussed in section II.A). The role of international co-operation should be approached from the perspective of its limitations, as discussed in section II.B.

A. The complexification and fragmentation of nuclear law

Nuclear law is a system of law that affects a broad range of issues, mainly relating to the safety and security of facilities but also other topics, such as non-proliferation, liability, transport law, environmental law and labour law. In this sense, it is a field of law that could be described as multifaceted. In addition, nuclear law involves a significant number of players and regulatory bodies that has increased over the course of time. Besides the national ministries and agencies for the regulation of nuclear energy,[39] there is a large number of international organisations that have to deal directly or indirectly with nuclear matters. The main ones are the IAEA, the United Nations Scientific Committee on the Effects of Atomic Radiation, the NEA and Euratom, each of which has a direct jurisdiction, though there are other international organisations that may have an interest in nuclear activities, such as, but not limited to, the World Health Organisation, International Labour Organisation, International Maritime Organisation (IMO), Committee on the Peaceful Uses of Outer Space, ICAO and the Food and Agriculture Organization. Private scientific organisations also exist and can be sources of regulation, notably the International Commission on Radiological Protection and the International Commission on Radiation Units and Measurements. Finally, other international networks should be mentioned: the International Nuclear Regulators Association, the Western European Nuclear Regulators Association, the Forum of Nuclear Regulatory Bodies in Africa and the European Nuclear Safety Regulators Group. Thus, nuclear law appears to be governed by a multitude of complex technical systems, which at times gives rise to difficulties.

This is even more the case with emerging nuclear technologies since several types of regulation are possible, all of which will have a direct impact on this complexity. Indeed, decision-makers of various national or international organisations, when facing a new legal issue related to emerging nuclear technologies, could, case-by-case, either adopt new rules by creating a new legal instrument or amend the existing rules. For instance, in the case of SMRs, should they develop a specific type of regulation, or simply modify the existing conventions on safety, liability, security and transportation? Similarly, for floating

39. In France, the nuclear sector depends on the Ministry of Energy, the Ministry of Foreign and European Affairs, the General Secretariat for European Affairs (which is under the authority of the Prime Minister) through its co-operation with the Euratom Technical Committee, the Ministry of Economy and Industry, the Ministry of Defence and the Ministry of Environment. In addition, there are the Nuclear Safety Authority and the Institute for Radioprotection and Nuclear Safety. Other public institutions are also important in French nuclear governance. For a complete overview of the nuclear actors in France see Ministère de la Transition écologique et de la Cohésion des Territoires et Ministère de la Transition énergétique (2021), "Acteurs et gouvernance du nucléaire", www.ecologie.gouv.fr/acteurs-et-gouvernance-du-nucleaire (accessed 4 Jan. 2023).

reactors, would it be better to amend the Law of the Sea Convention (UNCLOS)[40] or other IMO conventions to best cover these technologies or adopt a new convention or guidelines? On the one hand, and as seen above, amending international conventions is a highly complicated process, but, on the other hand, the continuous adoption of new legal instruments can only add to the proliferation and thus the complexification of nuclear law.

Fragmentation is not unique to nuclear law. It has already sparked much debate and discussion within both national and international systems and it seems to eat away at the systems from the inside. The background of this phenomenon was first studied by Wilfred Jenks, when in 1953 he observed that "law making treaties are tending to develop in a number of historical, functional and regional groups which are separate from each other and whose mutual relationships are in some respects analogous to those of separate systems of municipal law"[41] that could lead to conflict between treaty-based regimes. It was not until the fall of the communist bloc in 1989 that the fragmentation took on a real scale and put an end to the stable bipolar world order.[42] At this time, numerous multilateral treaties were negotiated, notably in the field of environmental law, bilateral investment treaties, treaties establishing new international organisations (such as the World Trade Organisation [WTO]) and international tribunals (e.g. the WTO dispute settlement body, the International Criminal Court, the International Tribunal for the Law of the Sea) which in some cases are open to other entities than the state exclusively.[43] In 2006, the International Law Commission (ILC) submitted a report on the issues regarding the fragmentation of international law. In its conclusions, the ILC affirms, among other things, that this phenomenon of fragmentation "puts to question the coherence of international law", which is considered as "positively owing to the connection it has with predictability and legal security".[44]

In the context of nuclear law, such a phenomenon has already been observed on various occasions, gradually increasing the complexity, and for some, the unintelligibility,[45] of an already highly technical domain of law. For example, in the field of nuclear liability, the Chernobyl accident highlighted the gap in the two coexisting liability conventions, the Vienna Convention and the Paris Convention. Those suffering damage in states that were not parties to the convention in force in the state in which the accident occurred would not be entitled to compensation under either convention. To solve this problem, a common Protocol was adopted, creating a "bridge" between the two conventions for facilitating compensation for cross-border nuclear damage.[46] Another example, again in the field of nuclear liability, relates to damage caused during the transportation of nuclear material. In this context, nuclear law must be combined with the law governing the mode of transport (air, sea, rail, road or post). However, each of these modes has its own liability system and the question has been raised as to which has precedence: the nuclear or the "modal" one. In 1968, this problem was studied in the context of the maritime transport of nuclear

40. United Nations Convention on the Law of the Sea (1982), 1833 UNTS 397, entered into force 16 Nov. 1994.
41. Jenks, C.W. (1954), "The Conflict of Law-Making Treaties", *British Yearbook of International Law*, 1953, Vol. 30, Oxford Univ. Press, Oxford, p. 403.
42. Peters, A. (2017), "The refinement of international law: From fragmentation to regime interaction and politicization", *International Journal of Constitutional Law*, Vol. 15, Issue 3, Oxford Univ. Press and New York Univ., Oxford, p. 673.
43. This is notably the case for human rights courts.
44. ILC (2006), "Fragmentation of international law: difficulties arising from the diversification and expansion of international law", Report of the Study Group of the International Law Commission, ILC 58th Session, UN Doc. A/CN.4/L.682 and Add. 1, 13 Apr. 2006, p. 100, para. 491.
45. Martiquet, Y. (2015), "*L'autonomie du droit nucléaire : Contribution à l'étude de la nature et des caractères d'un droit nouveau*", Droit., Université de Nîmes, Français, No. NNT 2015NIME0001, p. 414, https://tel.archives-ouvertes.fr/tel-01681281/document (accessed 4 Jan. 2023).
46. Lamm, V. (2017), *supra* note 37, p. 38.

material,[47] which ended with the adoption of a specific convention that acknowledges and details the primacy of the nuclear liability system over the maritime system.[48] Finally, these sources of uncertainty can be further exacerbated by divergent interpretations relating to nuclear law.[49] However, the overlap between systems is not only a source of legal uncertainty but of complexification of the entire nuclear legal order. Viewed from this angle, the proliferation of international, regional and national rules can lead to additional constraints for the nuclear industry, which must constantly "be aware of these regulations and should implement compliance programs to mitigate risk in an increasingly complex regulatory environment."[50]

Thus, the complexification of nuclear law could, in the long term, give rise to difficulties, calling into question the nuclear industry and, in the worst case scenario, the safety and security of facilities as well as the scheme of compensation for the victims of damage. Some authors have even argued that it affects the coherence of the national and international standards set out for nuclear activities.[51] The cause of this issue may be found in the very empirical and reactive nature of nuclear law. Indeed, these two characteristics tend toward the establishment of a "day-to-day" law, created in response to various accidents or incidents and their consequences, resulting in the creation of new instruments placed one on top of the other, like a legal *millefeuille*. Not limited to nuclear law, this situation may explain the increasingly widespread use of soft law. Indeed, according to Robert Kolb, "A special effort was made to show that the existence of soft law bore witness to an increasingly more fragmented and complex political situation of international society subject to the speeding up of the historical process and requiring more flexible instruments capable of giving legislative expression to domains in which traditional sources are inadequate."[52] Others also see a correlation between the complexification of law and soft law, which for them seems to be a social and legal response.[53] However, is this response really appropriate or does it not just exacerbate the complexity, like the mythical snake biting its own tail? Indeed, the proliferation of binding rules may not fully resolve the legal questions since they establish an *à la carte* regime by not creating a unified system to all states, but an unstable and non-protective legal mishmash.

47. On the question of the reconciliation of the nuclear law framework and the maritime one, see Strohl, P. (1972), "*La convention de 1971 relative à la responsabilité civile dans le domaine des transports maritimes de matières nucléaires : Un essaie de conciliation entre le droit maritime et le droit nucléaire*", *Annuaire Français de Droit International*, Vol. 18, Centre national de la recherche scientifique, Paris, pp. 753-784.
48. Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (1971), 974 UNTS 255, entered into force 15 July 1975).
49. For an example of the consequences of different interpretation of a nuclear law provision, see case study no. 5 on the Indian "peaceful nuclear explosion" in Tzeng, P. (2015), "Nuclear arbitration: Interpreting non-proliferation agreements", *Nuclear Law Bulletin*, No. 95, OECD Publishing, Paris, pp. 52-53.
50. Stenger, D., A. Kuntamukkala and D. Dholakia, (2009), "The Globalization of the Nuclear Industry and the Impact of Nuclear Export Controls", in International Nuclear Law Association (INLA), *Nuclear Inter Jura 2009 Proceedings*, INLA, Toronto, p. 220.
51. Martiquet, Y. (2015), *supra* note 45, p. 414.
52. Kolb, R. (2003), *Réflexions de philosophie du droit international. Problèmes fondamentaux du droit international public : Théorie et philosophie du droit international*, Bruylant, Brussels, pp. 58-59. Original quotation: "*On s'est plu à mettre en évidence que l'existence de la soft law révélait une certaine situation politique de la société internationale de plus en plus éclatée et complexe, soumise aux accélérations de l'histoire, et ayant besoin d'instruments plus flexibles, susceptibles de donner une expression normative à des domaines où les sources traditionnelles s'avéraient inadaptées*."
53. Duplessis, I. (2007), "*Le vertige et la soft law: réactions doctrinales en droit international*", *Revue québécoise de droit international*, Société québécoise de droit international, Montréal, p. 248.

B. International co-operation as a vector for mitigating the complexification of nuclear law

While the nuclear power industry, and more generally the entire nuclear sector, seems to be continuously developing, nuclear law is at an impasse. It needs to respond to the conflicting desires of the various stakeholders while preventing the perpetual complexification and fragmentation of the legal system. To mitigate this problem, or at least to ensure that it is dealt with effectively by the decision-makers, international co-operation can and must play a key role. These considerations, as much in favour of the industry as they are of citizens around the globe, transcend the borders of a single state.

International nuclear co-operation is a key mechanism in the peaceful uses of nuclear energy, which has its roots in the famous "Atoms for Peace" speech made by US President Eisenhower at the United Nations General Assembly in 1953 and which, four years later, led to the founding of the IAEA.[54] This co-operation has developed to face each new challenge and is now materialised by a multitude of bilateral and multilateral agreements, but also of joint actions for safer use of nuclear energy. International nuclear co-operation has always been able to demonstrate innovation when it comes to developing appropriate tools, of which the IAEA, the Treaty on Non-Proliferation of Nuclear Weapons, or even the *sui generis* nuclear liability regime are just examples.

From the point of view of emerging nuclear technologies, such co-operation will need, once again, to be imaginative in order to provide the needed solutions. However, beyond international co-operation, the fragmented framework and organisations first require international co-ordination. This is essential before any attempt can be made to standardise the law. Co-ordination is a familiar issue among the international organisations, including within the framework of the United Nations' specialised agencies.[55] The separation and partitioning of the various nuclear institutions, such as the IAEA, the NEA and Euratom, can create obstacles to the definition of a global and coherent strategy for the accomplishment of their objectives, which are, to a certain extent, shared objectives. It appears necessary, in order both to avoid a useless proliferation of legal rules and to maintain the coherence and unity of nuclear law, that nuclear organisations co-ordinate their activities before any attempt is made to find legal solutions. The ILC, in its aforementioned report on the fragmentation of international law, approaches this issue in its presentation of the complex interactions between co-operation and co-ordination, arguing that, "If international law is needed as a structure for coordination and cooperation between (sovereign) States, it is no less needed in order to coordinate and organize the cooperation of (autonomous) rule-complexes and institutions."[56] Within the framework of nuclear law, we can, once again, use the example of liability for nuclear damage for which, until the adoption of a Joint Protocol and therefore the creation of a remedy, there existed two conventions resulting from two different negotiations dealing with the same theme. An effort of co-operation was necessary in this case,[57] although an upstream co-ordination effort could have avoided any of the difficulties that arose subsequently. The IAEA now maintains close relations with several international organisations on specific issues.[58] However, in the context of the rapid

54. Laraia, M. and C. Pescatore (2013), "International nuclear cooperation", in Devgun, J. (ed.), *Managing Nuclear Projects*, Woodhead Publishing Ltd., Cambridge, Woodhead Publishing Series in Energy, p. 322.
55. See e.g. de Senarclens, P. (2001), "*Les organisations internationales face aux défis de la mondialisation*", *Revue internationale des sciences sociales*, No. 170, Érès, Toulouse, pp. 556-572.
56. ILC (2006), *supra* note 44, p. 99, para. 487.
57. For a global view on the preparation of the Joint Protocol, see Von Busekist, O. (2006), "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", in NEA, *International Nuclear Law in the Post-Chernobyl Period*, OECD Publishing, Paris, pp. 129-153.
58. The IAEA has collaboration programs with other nuclear and non-nuclear organisations such as the United Nations Framework Convention on Climate Change, the NEA, the Generation IV International Forum, the International Framework for Nuclear Energy Cooperation, and others. For a complete list see IAEA (n.d.), "Collaboration with international partners", www.iaea.org/topics/energy-planning/collaboration (accessed 4 Jan. 2023).

emergence of new nuclear technologies, there should not be a central link that weaves relations among the various partners to ensure co-ordination but rather all institutions should form a network in which, through co-operation, they form a co-ordinated whole. Having a central link would not allow good visibility between the institutions, which would not necessarily have regular contact with each other. A network instead enables real dialogue and a shared distribution of tasks. Once this co-ordination effort is achieved, it would be possible, thanks to international co-operation, to think about solutions in order to develop nuclear law, whatever its form or its content, in line with the expectations of industry, national institutions and the public. From this perspective, and in order to avoid the continued fragmentation of nuclear law due to the development of nuclear technologies, several solutions are possible.

First, the stakeholders could be included in international discussions, a system that already exists in some international organisations. For instance, the International Telecommunications Union (ITU) has, in addition to its 193 member states, over 700 private and academic members that can choose to be included in the work of the various ITU sectors (radiocommunications, development and standardisation). The IMO should also be mentioned here since, in the same manner as the ITU, it includes not only member states and intergovernmental organisations but also non-governmental organisations. Other international organisations include members from the public or private sectors in their work, something which, beyond doubt, leads to better interactions and decisions that are more aligned to global needs. This type of structure could be applied at the IAEA, which only includes passive observers, although this seems unrealistic given the extremely sensitive nature of some of the issues involved – especially relating to non-proliferation – and the complexity of the restructuring programme such an operation would require. Another, more realistic solution, could be to adapt standardisation processes similar to those existing at technical organisations such as the IMO and the ICAO. In the framework of the IMO, UNCLOS acknowledges the roles of the IMO and Regional Fisheries Management Organizations by reference to "competent international organisations", as well as to their decisions, by means of references to "generally accepted international rules and standards". In this way, UNCLOS Parties are, to a certain extent, bound by these decisions even if they are not parties to these organisations.[59] A "similar" system of reference can be found in the 1944 Chicago Convention, which provides the ICAO Council with the authority to adopt binding standards and recommended practices, designated "for convenience" as Annexes.[60] Thus, in the context of nuclear law, it could be imagined that, within the main conventions (present and future), reference could be made to standards adopted by nuclear organisations, where co-ordination would have first allowed for a better system of sharing and visibility in the field of their work. These two mechanisms enable rapid and organised legal adaptation on a mainly technical basis. Thus, even if the opinions and fears of both the industry and the public are not directly taken into account, the standards developed by these organisations are not significantly affected by the purely political considerations of a small group of states. Furthermore, this solution would allow nuclear law to be reorganised according to pyramidal systems separated by sectors, instead of a disorganised system.

Finally, one other solution, relating to regional organisations, should be mentioned. Such organisations have a good overview of both the needs of the population and the industry they represent at the regional level. They are thus mid-way between a purely national system and an international one. Euratom is a good example, and it is possible to ask whether this organisation might have a role in the future determination of rules for new nuclear technologies.

59. On the indirectly binding effect of UNCLOS, see Van Reenen, W. (1981), "Rules of reference in the new Convention on the law of the sea, in particular connection with pollution of the sea by oil from tankers", *Netherlands Yearbook of International law*, Vol. 12, T.M.C. Asser Institute, The Hague, pp. 3-44.

60. Article 54(l), Convention on International Civil Aviation (1944), 15 UNTS 295, 335, entered into force 4 Apr. 1947 (Chicago Convention).

We can conclude that solutions are possible on different bases to prevent a crisis in nuclear law and allow the industry to develop in accordance with public expectations. Now it is up to the states to hold discussions through international co-operation on these questions and to adopt a position or a method for considering the growing demands of stakeholders worldwide.

Conclusion

The nuclear sector must deal with many issues that place it in a complex position. On the one hand, there is the rapid development of emerging technologies, driven by industry, that break with the nuclear "traditions" and promise to be revolutionary for society. On the other hand, this same society seems to be hesitant as to whether or not to continue with this type of activity, leading to a situation in which each of the two protagonists needs the other to move forward. Nuclear law, for its part, cannot remain at a standstill in the face of this rapid development and will have to be adapted on a national, regional or international basis and to be binding or non-binding in nature. However, it is at an impasse, caught "between a rock and a hard place" – the wishes of the industry and the wishes of the public – as well as falling victim to its own complexity due to the multiple directions in which nations and specialised organisations are tempted to push it. Regarding these issues that transcend national borders, the solution, whatever its nature, must be found by strengthening co-ordination and co-operation between states and the international organisations that they form.

Viewed from this perspective, it will be interesting to use the momentum of the "nuclear spring" to put these questions on the table. Thinking about the future is a responsibility shared by all nuclear stakeholders and one that the lawyers must lead on to open up this new chapter of nuclear law.

Legal frameworks for nuclear energy in non-nuclear countries: An Irish case study

*by Veronica Smith**

1. Introduction

Embarking upon a nuclear power programme presents challenges for any country because of the financial investment and the commitment required to establish the legal and institutional frameworks for:

- safety, to protect people and the environment;
- security, to prevent and detect the unauthorised removal of radioactive material and its potential use for malicious acts; and
- safeguards, to prevent the diversion of radioactive material from peaceful nuclear power programmes to make nuclear weapons and other nuclear explosive devices.

Ionising radiation has a wide range of applications in medicine and industry that deliver enormous benefits to societies throughout the world. The regulation of practices using ionising radiation and the degree to which safety standards are implemented vary from country to country. This existing infrastructure for regulating ionising radiation can be used as the foundation for the legal and institutional frameworks for the safe use of nuclear power in a country embarking upon a nuclear power programme.

The appetite for nuclear power waned significantly after the Fukushima Daiichi Nuclear Power Plant accident in 2011. Some countries, such as Germany, decided to phase out the use of nuclear power altogether while others, such as Spain, decided not to build any new nuclear power plants. Between 2011 and 2020, 65 reactors were either shut down or did not have their operational lifetimes extended.[1] The climate crisis has brought nuclear power back into the spotlight as the need to transition away from fossil fuels intensifies. Some countries, such as Bangladesh, have made the decision to embark upon a nuclear power programme because they see nuclear power as a reliable source of energy that can help improve living standards and air quality.[2] In January 2023, there were 57 nuclear power reactors under various stages of construction in 19 International Atomic Energy Agency (IAEA) member states.[3]

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1. Paillere, H. and J. Donovan (2021), "Nuclear Power 10 Years After Fukushima: The Long Road Back", IAEA, www.iaea.org/newscenter/news/nuclear-power-10-years-after-fukushima-the-long-road-back.
2. International Atomic Energy Agency (IAEA) (2020), *Climate Change and Nuclear Power 2020*, IAEA, Vienna, p. 34.
3. IAEA (2023), "Power Reactor Information System (PRIS)", https://pris.iaea.org/PRIS/home.aspx (accessed 23 Jan. 2023).

The development of large conventional nuclear power plants of approximately 1 000 MW requires significant capital investment and long construction times due to their size and complexity.[4] New nuclear energy technologies such as small modular reactors (SMRs) provide a promising solution to these challenges, particularly in countries where the national grid may not be compatible with a conventional reactor.

Ireland, as a non-nuclear state, will be used as a case study to examine the legal and institutional challenges facing a country that wishes to embark upon a nuclear power programme. Although Ireland does not have any nuclear facilities, it has well-established legal and institutional frameworks for managing the safety, security and safeguards requirements applicable to radioactive sources. Section 2 describes these frameworks. Section 3 explains why Ireland has not embarked upon a nuclear power programme. Section 4 describes the challenges of implementing the changes required in Ireland's legal and institutional frameworks should Ireland wish to embark upon a nuclear power programme.

No two countries are the same and the challenges faced by a country will depend on its existing constitutional and legal frameworks, its participation in relevant international conventions and treaties, and its cultural characteristics, technical capabilities and resources.[5] Nonetheless, this study can be used as a resource by other countries to help identify the key legal and institutional elements that should be considered before embarking upon a nuclear power programme.

2. Current legal and institutional frameworks for radiological protection and nuclear safety in Ireland

2.1 Ireland's legal system

Ireland's parliament is called the Oireachtas and it is made up of two Houses – the Lower House, called Dáil Éireann, and the Upper House, called Seanad Éireann (Senate) – and also includes the office of the president of Ireland.[6] The government is chosen by members of Dáil Éireann and the government is responsible only to Dáil Éireann and not to Seanad Éireann. The Oireachtas is the body responsible for making laws.

The Constitution of Ireland (Bunreacht na hÉireann) was ratified in 1937 and is the fundamental law of the state.[7] The Constitution sets out Ireland's basic laws and describes how the country should be governed, the main institutions of the state and the fundamental rights of Irish citizens. All legislation enacted by the Oireachtas must be compatible with the Constitution. The Constitution can only be amended through a referendum whereby the public votes to accept or reject proposed changes to the Constitution. Proposals to amend the Constitution are introduced by the Oireachtas in Dáil Éireann as a Bill. A referendum cannot take place unless the Bill is passed by both Dáil Éireann and Seanad Éireann. The third amendment to the Constitution in 1972 permitted Ireland to join the European Economic Community, now the European Union (EU), and the European Atomic Energy Community (Euratom) in 1973.[8]

The EU has a supranational character, which means that "powers of member states in various fields are delegated to EU institutions and that the rules adopted at the EU level within the defined powers and procedures bind the member states and establish rights

4. IAEA (2020), *supra* note 2, p. 6.
5. Stoiber, C. et al. (2003), *Handbook on Nuclear Law*, IAEA, Vienna, p. 25.
6. Houses of the Oireachtas (n.d.), "How Parliament Works", www.oireachtas.ie/en/visit-and-learn/how-parliament-works (accessed 23 Jan. 2023).
7. Irish Statute Book (n.d.), "Constitution of Ireland", www.irishstatutebook.ie/eli/cons/en/html (accessed 23 Jan. 2023).
8. *Ibid.*, "Third Amendment of the Constitution Act, 1972", www.irishstatutebook.ie/eli/1972/ca/3/enacted/en/html (accessed 23 Jan. 2023).

and obligations of the citizens."[9] The Treaty on the Functioning of the EU (TFEU) requires Ireland, as a member state, to transpose EU Directives into Irish legislation within the prescribed deadline, either through primary or secondary legislation.[10] The third amendment to the Constitution recognises the primacy of European law over Irish national law by asserting that there is no provision of the Constitution that can invalidate laws enacted by the state as part of its obligations of membership of the Communities.

Acts are primary legislation in Ireland. Secondary legislation, known as statutory instruments (SIs), can take the form of ministerial orders, regulations, rules, by-laws and schemes.[11] The Oireachtas is not required to enact SIs, as the power to enact them is delegated to certain people or bodies including government ministers, local authorities and regulatory bodies. Just as primary legislation must be compatible with the Constitution, secondary legislation must also be compatible with, and based on, primary legislation. If it is not, then it can be overturned by the courts.

2.2 Euratom Treaty

The treaty establishing Euratom was signed on 25 March 1957, the same day as the treaty establishing the European Economic Community.[12] The two treaties were initially signed by six countries: Belgium, France, Germany, Italy, Luxembourg and the Netherlands. Euratom now has 27 member states, including Ireland. It was established to "contribute to the raising of the standard of living in the Member States and to the development of relations with the other countries by creating the conditions necessary for the speedy establishment and growth of nuclear industries."[13]

The Euratom Treaty, which is binding primary law for all 27 member states of the EU, applies only to the civil use of nuclear power. It covers research in the nuclear field, dissemination of information, health and safety of workers and the public against the dangers arising from ionising radiation, and nuclear safeguards to ensure nuclear materials are not diverted from their intended peaceful purposes. Radiological protection and nuclear safety legislation and arrangements in Ireland are implemented through the provisions of Euratom directives, regulations and decisions.

The Euratom Supply Agency, which was established under Article 52 of the Euratom Treaty, ensures member states have access to nuclear fuels.[14] The Euratom Supply Agency has legal personality, financial autonomy and the exclusive right to conclude contracts for the supply of nuclear materials in the EU.[15] As a member state, Ireland is represented on the Advisory Committee that assists the Agency.

9. Kilb, W. (2010), "The European Atomic Energy Community and its Primary and Secondary Law" in NEA, *International Nuclear Law: History, Evolution and Outlook*, OECD Publishing, Paris, p. 45.
10. Consolidated Version of the Treaty on the Functioning of the European Union (TFEU), *Official Journal of the European Union* (OJ) C 202/47 (7 June 2016), Art. 288, pp. 171-72.
11. Houses of the Oireachtas (n.d.), "How Laws are Made", www.oireachtas.ie/en/visit-and-learn/how-parliament-works/how-laws-are-made (accessed 23 Jan. 2023).
12. Treaty Establishing the European Atomic Energy Community (1957), 298 UNTS 167, entered into force 1 Jan. 1958 (Euratom Treaty); see the 2016 consolidated version at OJ C 203/1 (7 June 2016).
13. Euratom Treaty, Art. 1, OJ C 203, p. 6.
14. European Union (n.d.), "Supply Agency of the European Atomic Energy Community", https://euratom-supply.ec.europa.eu/index_en (accessed 23 Jan. 2023).
15. Bouquet, A. (2001), "How Current are Euratom Provisions on Nuclear Supply and Ownership in View of the European Union's Enlargement?", *Nuclear Law Bulletin*, No. 68, OECD Publishing, Paris, pp. 7-38.

2.3 Nuclear safety and radiological protection legislation in Ireland

The legislative framework governing nuclear safety and radiological protection in Ireland is the Radiological Protection Act 1991 (No. 9/1991), as amended by Section 26 of the Energy (Miscellaneous Provisions) Act 1995 (No. 35/1995), the Radiological Protection (Amendment) Act 2002 (No. 3/2002) and the Radiological Protection Act 1991 (Ionising Radiation) Regulations 2019 (No. 30/2019).

The production of electricity by nuclear fission is currently prohibited in Ireland under primary legislation. The Electricity Regulation Act 1999 (No. 23/1999), section 18(6) states that "An order under this section shall not provide for the use of nuclear fission for the generation of electricity."

2.3.1 Euratom Basic Safety Standards Directive

Article 30 of the Euratom Treaty states that "Basic standards shall be laid down within the Community for the protection of the health of workers and the general public against the dangers arising from ionizing radiations." The first Directive to implement this was adopted in 1959 and there have been a number of amendments since then, with the most recent Directive adopted in 2013 as Council Directive 2013/59/Euratom of 5 December 2013 laying down the basic safety standards for protection against the dangers arising from exposure to ionising radiation.[16] This new Directive reflects the updated guidance from the International Commission on Radiological Protection (ICRP).[17] It is more closely aligned with the International Basic Safety Standards published by the IAEA.[18] The new Directive also brought together existing legislation covering, *inter alia*, outside workers (Council Directive 90/641/Euratom)[19] and the control of high-activity sealed radioactive sources and orphan sources (Council Directive 2003/122/Euratom).[20]

This Directive was transposed into Irish law through two SIs: the Radiological Protection Act 1991 (Ionising Radiation) Regulations 2019 (SI 30/2019), hereafter referred to as IRR19, and the EU (Basic Safety Standards Arising from Medical Exposure to Ionising Radiation) Regulations 2018 (SI 256/2018).

The competent authority for protection of workers and the public under IRR19 is the Environmental Protection Agency (EPA) as established under Section 19 of the Environmental Protection Agency Act 1992 (No. 7/1992). The competent authority for protection of patients under SI 256/2018 is the Health Information and Quality Authority as established under Section 6 of the Health Act 2007 (No. 23/2007).

2.3.2 Euratom Nuclear Safety Directive

Council Directive 2009/71/Euratom of 25 June 2009 establishes a Community framework for the nuclear safety of nuclear installations and the safe management of spent fuel and radioactive waste, including at storage and disposal facilities. This Directive recognises that nuclear safety is the national responsibility of member states and that prime responsibility for the nuclear safety of a nuclear installation belongs to the licence holder under the

16. 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 13/1 (17 Jan. 2014).
17. 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.
18. IAEA (2014), *Radiation Protection and Safety of Radiation Sources International Basic Safety Standards*, IAEA GSR Part 3, IAEA, Vienna.
19. Council Directive 90/641/Euratom of 4 December 1990 on the operational protection of outside workers exposed to the risk of ionizing radiation during their activities in controlled areas, OJ L 349/21 (13 Dec. 1990).
20. Council Directive 2003/122/Euratom of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources, OJ L 346/57 (31 Dec. 2003).

supervision of its national competent regulatory authority.[21] The 2009 Euratom Nuclear Safety Directive was amended in 2014 based on nuclear stress tests carried out in 2011 and 2012, the lessons learnt from the Fukushima Daiichi Nuclear Power Plant accident, the safety requirements of the Western European Nuclear Regulators Association (WENRA) and the IAEA and input from the European Nuclear Safety Regulators Group (ENSREG).

This Directive provides binding legal force to the IAEA Fundamental Safety Principles.[22] It applies to civil nuclear installations such as enrichment plants, nuclear fuel fabrication plants, nuclear power plants, reprocessing plants, research reactors, spent fuel storage facilities and radioactive waste storage facilities that are on the same site or directly related to such nuclear installations. It was transposed into Irish Law through SI 332/2017. The primary objectives of this Directive are to maintain and promote the continuous improvement of nuclear safety and its regulation and to ensure that member states have appropriate arrangements for a high level of nuclear safety to protect workers and the public against the dangers arising from nuclear installations.

Under Article 9, member states are required to submit a report to the Commission on the implementation of this Directive every three years. ENSREG provides reporting guidelines to assist member states in fulfilling this requirement.[23] Ireland's most recent report was submitted in 2020 and it addresses the relevant Articles for a non-nuclear state.

2.4 Environmental assessment and transboundary consultation

Strategic environmental assessments (SEAs), environmental impact assessments (EIAs) and transboundary consultations are tools to protect the environment and ensure all interested parties can contribute to the decision making process for new policies or planning applications that have the potential to impact the environment and human health. SEAs are carried out at an early stage when a policy is being developed. EIAs are carried out at a project level during the planning stages for individual facilities.

European Directive 2001/42/EC, OJ L 197/30 (21 July 2001), on the Assessment of the Effects of Certain Plans and Programmes on the Environment (the SEA Directive) was transposed into Irish national legislation by the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (SI 435/2004) and the Planning and Development (Strategic Environmental Assessment) Regulations 2004 (SI 436/2004). Both pieces of legislation were amended in 2011 under SI 200/2011[24] and SI 201/2011.[25] The EPA is one of five environmental authorities specified in the SEA Regulations. The EPA must be consulted in all cases at the SEA screening, scoping and environmental report/draft plan stages so that the EPA can promote full integration of the findings of the SEA into the plan and ensure that the key environmental challenges for Ireland are addressed.[26] Ireland is also

21. Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations, OJ L 172/18 (2 July 2009).
22. IAEA et al. (2006), *Fundamental Safety Principles: Safety Fundamentals*, IAEA Safety Standards Series, Safety Fundamentals, No. SF-1, IAEA, Vienna.
23. ENSREG (2019), "ENSREG Reporting Guidelines on the EU Nuclear Safety Directive Final + Annex", www.ensreg.eu/document/reporting-guidelines-eu-nuclear-safety-directive (accessed 23 Jan. 2023).
24. European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2011, SI 200/2011.
25. Planning and Development (Strategic Environmental Assessment) (Amendment) Regulations 2011, SI 201/2011.
26. EPA (n.d.), "Strategic Environmental Assessment", www.epa.ie/our-services/monitoring--assessment/assessment/strategic-environmental-assessment/epas-role-in-sea (accessed 23 Jan. 2023).

a signatory to the SEA Protocol, which is an international agreement that is similar to the European Directive and came into force in 2010.[27]

Ireland is a Contracting Party to the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention).[28] Ireland ratified the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in environmental Matters (Aarhus Convention) in 2012 and all the provisions of the Convention have been implemented in national law.[29] The Aarhus Convention confers rights to individuals to seek environmental information from a state even if they are not a citizen of that state.

2.5 OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) entered into force on 25 March 1998 and its purpose is to protect the marine environment of the North-East Atlantic through the co-operation among 15 countries, including Ireland, and the EU.[30] One of the objectives of OSPAR (Recommendation 2018/01) is "to prevent and eliminate pollution caused by radioactive discharges from all nuclear industries and their associated radioactive waste treatment facilities and decommissioning activities, by applying the best available techniques (BAT) and the best environmental practice (BEP)."[31] Ireland has commitments under OSPAR to ensure radioactive discharges to the marine environment are kept as low as possible, to monitor and review activity concentrations and to report annually to the OSPAR Commission.

2.6 IAEA and United Nations conventions

The IAEA has a number of conventions on nuclear safety, nuclear security and nuclear liability that form part of the international nuclear legal framework. Many of these conventions were developed in the aftermath of the Chernobyl accident and they must be implemented through national laws and regulations to give effect to their provisions. Ireland is not a party to any nuclear liability conventions. The key nuclear safety and nuclear security conventions that Ireland is a party to are described here.

2.6.1 Convention on Nuclear Safety

The Convention on Nuclear Safety (CNS) is a legally-binding international treaty that applies to land-based civil nuclear power plants under a Contracting Party's jurisdiction. It entered into force on 24 October 1996 and aims to achieve and maintain a high level of nuclear safety worldwide, establish and maintain effective defences in nuclear installations against potential radiological hazards, prevent accidents with radiological

27. 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.
28. Convention on Environmental Impact Assessment in a Transboundary Context (1991), 1989 UNTS 310, entered into force 10 Sep. 1997 (Espoo Convention).
29. 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). See Department of the Environment, Climate and Communications (2021), "Aarhus Convention", www.gov.ie/en/publication/b3b1a-aarhus-convention (accessed 23 Jan. 2023).
30. Convention for the Protection of the Marine Environment of the North-East Atlantic (1992), 2354 UNTS 70, entered into force 25 Mar. 1998 (OSPAR Convention).
31. OSPAR Commission (2020), Overview of national statements on the 7th round of implementation of PARCOM Recommendation 91/4, available at: www.ospar.org/documents?v=42730 (accessed 23 Jan. 2023).

consequences and mitigate the consequences of accidents should they occur.[32] Ireland is a Contracting Party to the CNS. The CNS is known as an "incentive convention" because compliance is assessed through participation in a peer review process that takes place every three years and there are no enforcement or penalty provisions.

To strengthen nuclear safety in the aftermath of the Fukushima Daiichi Nuclear Power Plant accident, the Vienna Declaration on Nuclear Safety (VDNS) was unanimously adopted by the Contracting Parties to the CNS in 2015. The VDNS contains a series of principles to guide countries in the implementation of the objectives of the CNS and it brings the IAEA Fundamental Safety Principles into the CNS peer review process.[33]

2.6.2 Joint Convention on the Safety of Radioactive Waste and the Safety of Spent Fuel Management

The Joint Convention on the Safety of Radioactive Waste and the Safety of Spent Fuel Management (Joint Convention) is another legally binding international treaty. It is sometimes referred to as a sister convention to the CNS. Its scope includes spent fuel from the operation of civilian nuclear reactors, radioactive waste from civilian applications and certain discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.[34] The aims of the Joint Convention are to achieve and maintain a high level of safety worldwide, to ensure there are effective defences against potential hazards so that individuals, society and the environment are protected from harmful effects of ionising radiation, to prevent accidents with radiological consequences and to mitigate their consequences, should they occur. The Joint Convention was adopted on 5 September 1997 and entered into force on 18 June 2001. Like the CNS, it also has a peer review mechanism that takes place every three years.

Ireland deposited an instrument of ratification of the Joint Convention with the Director General of the IAEA on 20 March 2001, triggering the entry into force of the convention on 18 June 2001.[35]

2.6.3 Convention on Early Notification of a Nuclear Accident

The Convention on Early Notification of a Nuclear Accident (Early Notification Convention) applies in the event of any accident involving facilities or activities of a state party from which "a release of radioactive material occurs or is likely to occur and which has resulted or may result in an international transboundary release that could be of radiological safety significance for another State."[36] In the event of a nuclear accident, the state party is obliged to directly or through the IAEA notify states that are or may be physically affected and the IAEA of the accident, its nature, the time of its occurrence and its exact location where appropriate (Article 2(a)) and provide those states and the IAEA with available information relevant to minimising the radiological consequences in those states (Article 2(b)).

Ireland ratified the Early Notification Convention in 1991 and the EPA is designated as the National Competent Authority for the Convention under the Radiological Protection Act, 1991 (as amended).

32. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996 (CNS).
33. 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.
34. 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 Jun. 2001 (Joint Convention).
35. Department of Foreign Affairs (2007), Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management Treaty Series 2007 No. 27, www.dfa.ie/media/dfa/alldfawebsitemedia/treatyseries/uploads/documents/legaldivisiondocuments/no-27-of-2007.pdf (accessed 23 Jan. 2023).
36. Convention on Early Notification of a Nuclear Accident (1986), IAEA Doc. INFCIRC/335, 1439 UNTS 276, entered into force 27 Oct. 1986, Art. 1.

2.6.4 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency

The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) provides an international framework to facilitate prompt assistance and support between states parties in the event of a nuclear accident or radiological emergency.[37] Ireland ratified the Assistance Convention in 1991 and the EPA is designated as the National Competent Authority for the Convention under the Radiological Protection Act, 1991 (as amended).

The IAEA's Response and Assistance Network (RANET) supports the practical implementation of the Assistance Convention and participation in the network contributes towards fulfilling a state's obligations under the Convention. Ireland joined RANET in May 2018 when the EPA registered National Assistance Capabilities such as expertise in atmospheric dispersion modelling, radiation dose assessment and environmental sampling along with radiological measurement capabilities that could be offered to states affected by a nuclear or radiological emergency. Ireland's RANET registration was updated in 2022 when the Irish meteorological service (Met Éireann) and University College Dublin included additional National Assistance Capabilities.

2.6.5 Convention on the Physical Protection of Nuclear Material

The Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 Amendment is the only internationally legally binding undertaking concerning the physical protection of nuclear material. The aims of the CPPNM are to achieve and maintain worldwide effective physical protection of nuclear material and nuclear facilities used for peaceful purposes, to prevent and combat offences relating to such material and facilities worldwide and to facilitate co-operation among states parties to those ends.[38]

Ireland ratified the CPPNM in 1991 and the Radiological Protection (Miscellaneous Provisions) Act 2014 (No. 20/2014) gives effect to the Amendment to the CPPNM and designates the EPA as the National Competent Authority. Ireland deposited an instrument of ratification of the Amendment with the Director General of the IAEA on 22 September 2014.[39]

2.6.6 Treaty on the Non-Proliferation of Nuclear Weapons

While supporting the development of nuclear technologies in Ireland in the 1950s and 1960s, the Irish government drew a sharp distinction between civil and military uses of nuclear energy.[40] The Irish Minister for External Affairs, Frank Aiken, introduced the first of what became known as the "Irish Resolutions" to the United Nations (UN) in 1958 to control the proliferation of nuclear material and he urged the use of nuclear energy for peaceful purposes.[41] This culminated in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in 1967 and, in recognition of Aiken's work, Ireland received an invitation

37. 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.
38. Convention on the Physical Protection of Nuclear Material, (1980), IAEA Doc. INFCIRC/274 Rev. 1, 1456 UNTS 125, entered into force 8 Feb. 1987.
39. United Nations (n.d.), "Amendment to the Convention on the Physical Protection of Nuclear Material", treaties.un.org/Pages/showDetails.aspx?objid=0800000280478876 (accessed 23 Jan. 2023).
40. McDermott, V. (2008), *Going Nuclear: Ireland, Britain and the Campaign to Close Sellafield*, Irish Academic Press, Newbridge, IE, p. 122.
41. Department of Foreign Affairs (n.d.), "Nuclear Disarmament", www.dfa.ie/pmun/geneva/disarmament-and-non-proliferation/nuclear-disarmament (accessed 23 Jan. 2023).

to be the first signatory.[42] Ireland entered into a Safeguards Agreement with the IAEA on 29 February 1972.[43]

The NPT forms the cornerstone of the nuclear non-proliferation regime and it is a foundation for the pursuit of nuclear disarmament.[44] Its objective is to prevent the spread of nuclear weapons and weapons technology, to promote co-operation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament. Article III of the NPT requires all Non-Nuclear Weapon states (NNWS) who are party to the NPT to conclude safeguards agreements with the IAEA, which "shall be applied 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."[45] The NPT had an initial duration of 25 years after which parties had to decide whether to indefinitely extend it. In 1995 the parties decided to indefinitely extend the Treaty so there is currently no termination date.[46] A review meeting called a RevCon takes place every five years to review how the Treaty is functioning.

2.7 Regulation of ionising radiation in Ireland

The regulation of ionising radiation is a national responsibility.[47] Under the Radiological Protection Act, 1991 (as amended), the EPA is responsible for regulating the use of ionising radiation in Ireland. The EPA was established in July 1993 under the Environmental Protection Agency Act of 1992. In August 2014, the Radiological Protection Institute of Ireland (RPII) was merged with the EPA with the functions and responsibilities of the RPII being transferred to the EPA under the Radiological Protection (Miscellaneous Provisions) Act 2014 (No. 20/2014). The EPA is an independent public body that reports to the government. It is partially funded by grants from the Exchequer and has other income from activities such as licensing and the provision of laboratory services.[48]

The EPA's responsibilities with respect to ionising radiation cover the protection of workers and members of the public and its functions are clearly set out in section 7 of the Radiological Protection Act 1991. These functions include:

- provision of advice to the government and the public on matters relating to radiological safety;
- maintenance and development of a national laboratory for the measurement of radioactivity in the environment and assessment of the significance of these levels for the Irish population;
- control by licence the custody, use, manufacture, importation, transportation, distribution, exportation and disposal of radioactive substances, irradiating apparatus and other sources of ionising radiation and preparation of codes and regulations for the safe use of ionising radiation; and

42. McDermott, V. (2008), *supra* note 40, p. 123.
43. IAEA (1973), "The Text of the Agreement between Ireland and the Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/184.
44. Treaty on the Non-Proliferation of Nuclear Weapons (1968), IAEA Doc. INFCIRC/140, 729 UNTS 169, entered into force 5 Mar. 1970.
45. *Ibid*.
46. UN Office for Disarmament Affairs (n.d.), "Treaty on the Non-Proliferation of Nuclear Weapons", www.un.org/disarmament/wmd/nuclear/npt/#:~:text=On%2011%20May%201995%2C%20the,testament%20to%20the%20Treaty%27s%20significance (accessed 23 Jan. 2023).
47. IAEA et al. (2006), *supra* note 22, p. 1.
48. Environmental Protection Agency (EPA) (2022), *EPA Annual Report and Accounts 2021*, EPA, Ireland, available at: www.epa.ie/publications/corporate/governance/epa-annual-report--accounts-2021.php.

- assisting relevant stakeholders in preparedness and response to nuclear accidents and acting in support of national plans for emergencies arising from nuclear accidents.

The regulation of ionising radiation practices and the protection of workers and the public is based on the three fundamental principles of radiological protection:

- justification;
- optimisation ("as low as reasonably achievable"); and
- dose limitation.[49]

The EPA is the national competent authority for the European Community Urgent Radiological Information Exchange arrangements, which were set up within the EU to implement Council Decision 87/600/Euratom providing for the early exchange of information in the event of a radiological emergency.[50] The EPA is also the national competent authority for the European Radiological Data Exchange Platform (EURDEP) where radiological monitoring data from most European countries is available in nearly real-time. The participation of the EU member states is regulated by Council Decision 87/600/Euratom.

The Radiation Protection Regulation unit within the Office of Environmental Enforcement in the EPA is responsible for the authorisation, compliance assurance, enforcement and the provision of guidance with respect to the use of ionising radiation in Ireland. A graded approach is used for authorisation, which includes registration and licensing and depends on the magnitude and likelihood of any exposures resulting from the practice as well as the impact that regulatory control may have in improving radiological safety.[51] Compliance assurance includes announced and unannounced inspections by EPA inspectors of licensees' facilities, equipment and records. An annual inspection programme is developed that is risk-based and considers the complexity of practices, number and size of radioactive sources, the consequences of an accident and the potential for doses to workers or members of the public through routine operations or emergency situations. Enforcement measures including prosecution may be implemented where there is a failure to comply with either a regulatory requirement or a condition attached to an authorisation.

2.8 National plan for nuclear emergencies

Ireland adopts an all-hazards and an all-of-government approach to emergency preparedness and response (EPR).[52] The Government Taskforce on Emergency Planning, which includes all government departments and some state agencies, meets approximately every two months and one of its roles is to assess new and emerging risks. The representatives on the Government Taskforce on Emergency Planning also participate in the National Emergency Co-ordination Group when it is convened to co-ordinate the response to a national emergency.

Ireland's first national plan for preparedness and response to nuclear emergencies was developed after the Chernobyl accident in 1986. There have been revisions to the plan since then to reflect changes in international guidance, updates to emergency response arrangements in Ireland and experience gained from responses to accidents and exercises. The current plan, which was published in 2019, is called the "National Plan for Nuclear and

49. International Commission on Radiological Protection (ICRP) (2007), The 2007 Recommendations of the International Commission on Radiological Protection, ICRP Publication 103, Ann. ICRP 37 (2-4), p. 1.
50. Council Decision 87/600/Euratom of 14 Dec. 1987 on Community arrangements for the early exchange of information in the event of a radiological emergency, OJ L 371, 30 Dec. 1987, pp. 76-78.
51. EPA (n.d.), "Regulating the use of radiation sources", www.epa.ie/our-services/licensing/radiation/graded-authorisation (accessed 23 Jan. 2023).
52. Department of Defence (2017), *Strategic Emergency Management National Structures and Framework*, Defence Forces Printing Press, Ireland, p. 3.

Radiological Emergency Exposures" (the National Plan) and it has a statutory basis in Article 55 of IRR19.[53]

To test the arrangements in the National Plan, Ireland participates in emergency response exercises at regular intervals including those organised by the IAEA, the European Commission, the OECD Nuclear Energy Agency (NEA) and bilaterally with the United Kingdom (UK).

2.9 IAEA review missions

At the request of the Government of Ireland, an Integrated Regulatory Review Service (IRRS) mission was conducted in Ireland by a team of experts assembled by the IAEA in 2015 to review Ireland's regulatory framework for radiation safety.[54] The final report set out the review team's assessment of Ireland's compliance with the IAEA's Fundamental Safety Principles and Safety Requirements and included a series of explicit recommendations, suggestions and good practices. An Action Plan was developed to address the IRRS findings as well as other significant issues identified during the self-assessment phase of the IRRS process. Eight good practices were identified by the IRRS mission team including the following:

- the EPA's radiation safety inspection activities are formally accredited to an ISO standard, which provides for openness and transparency and ensures continuous assessment and improvement;
- the systematic co-operation between the EPA and the police significantly supports an integrated approach to the safety and security of radiation sources;
- preparedness for nuclear and radiological emergencies is well-integrated at national and regional levels; and
- information to the public on emergency planning prior to an emergency is very efficient in reaching all sectors of the population in Ireland and a co-ordination mechanism to inform the public in case of an emergency has been established.

In October 2021, Ireland hosted an Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) mission that found there is strong commitment from the government for the safe management of disused radioactive sources and radioactive waste.[55]

2.10 International engagement

While regulation of the use of ionising radiation from radioactive sources and nuclear facilities is a national responsibility, radiation released to the atmosphere during an emergency does not respect national borders and international co-operation is necessary to promote and enhance safety globally. Ireland has a history of international engagement to promote nuclear safety and security.

The EPA as the regulatory body for radiation safety has representatives on the IAEA Standards Committees, the NEA Committee on Radiation Protection and Public Health and the Working Party on Nuclear Emergency Matters, the Heads of European Radiological Protection Competent Authorities, ENSREG and WENRA.

53. Government of Ireland (2019), *National Plan for Nuclear and Radiological Emergency Exposures*, www.epa.ie/publications/monitoring--assessment/radiation/national-plan-for-nuclear-and-radiological-emergency-exposures-.php (accessed 12 Jan. 2023).
54. IAEA (2015), "Integrated Regulatory Review Service (IRRS) Mission to Ireland", Doc. IAEA-NS-2015/11, www.iaea.org/sites/default/files/documents/review-missions/irrs_ireland_mission_report_.pdf.
55. IAEA (2021), "IAEA Mission Says Ireland Committed to Safe Management of Radioactive Waste, Sees Areas for Further Enhancement", IAEA Press Release No. 64/2021.

There is also a history of interaction between the United Kingdom and Ireland on nuclear matters, both at a government and a regulatory level. In 2004, a bilateral agreement was signed to ensure the swift exchange of information between the United Kingdom and Ireland in the event of a major nuclear accident or other radiological emergency occurring in either country.[56] At a government level, the main forum for exchange of information is the UK-Ireland Contact Group on Radiological Matters, which meets twice-yearly. The Contact Group is led by Ireland's Department of Environment, Climate and Communications and the UK's Department of Business, Energy and Industrial Strategy. The membership of this group was expanded following the legal action brought by Ireland under the United Nations Convention on the Law of the Sea (see section 3.6.1) and now includes the Irish and UK's regulators (the EPA, the UK Office for Nuclear Regulation [ONR] and the UK Environment Agency), the Isle of Man Government Laboratory and the UK Nuclear Decommissioning Authority.

3. Electricity generation and the potential role of nuclear energy in Ireland

Climate change is one of the greatest challenges facing humanity. In this section, the role of nuclear power in reducing greenhouse gas emissions and the opportunities and challenges associated with using nuclear power in electricity generation in Ireland are examined.

3.1 Electricity generation in Ireland

Gas has been the largest input to electricity generation in Ireland since the late 1990s, accounting for 48.6% of energy input in 2021.[57] In the same year, coal and peat accounted for 15.4% of fuel input, renewable sources for 23.9% and the remainder coming from oil, other renewables and wastes and electricity imports.

The amount of electricity generated varies depending upon the type of energy input. While electricity generated from wind is 100% efficient since other fuels are not used in the generation process, this is not the case with coal and gas, where energy is lost during the generation process. In Ireland natural gas provides the largest share of electricity generated, followed by wind and coal.[58] The amount of electricity generated from renewables has been increasing with a 114.1% increase between 2011 and 2021. In 2021, 23.7% of all electricity generated in Ireland was from wind. This reliance on wind is problematic during periods of low wind. In 2022, "amber alerts"[59] were issued in Ireland indicating a potential failure to meet the electricity demand because of low levels of wind power generation due to calm weather conditions, outages at other generation plants and limited electricity imports.[60] Although there is no risk of a system-wide "blackout" during the winter period of 2022-2023, "late November to mid-December and early-January to mid-February are expected to be the most onerous periods from a capacity margin perspective."[61]

56. Department of Foreign Affairs (2004), Agreement between the Government of Ireland and the Government of the United Kingdom of Great Britain and Northern Ireland on the early Notification of a Nuclear Accident or Incident of Radiological Significance and the Exchange of Information concerning the Operation and Management of Nuclear Facilities or Activities, Irish Treaty Series 2004 No. 3, www.dfa.ie/media/dfa/alldfawebsitemedia/treatyseries/uploads/documents/treaties/docs/200403.pdf (accessed 23 Jan. 2023).
57. Sustainable Energy Authority of Ireland (SEAI) (2022), *Energy in Ireland 2022 Report*, www.seai.ie/data-and-insights/seai-statistics/key-publications/energy-in-ireland (accessed 22 Jan. 2023).
58. *Ibid*.
59. EirGrid Group (2017), Demonstration of Amber, Red & Blue Alerts Procedure, available at: www.eirgridgroup.com/site-files/library/EirGrid/Test63_ORB_Alerts.docx.
60. Shortt, R. (2022), "'Perfect storm' as supply of electricity threatened", RTE News, www.rte.ie/news/business/2022/0810/1314893-amber-electricity-alert (accessed 23 Jan. 2023).
61. Eirgrid Group (2022), *Winter Outlook 2022/23*, available at: www.eirgridgroup.com/site-files/library/EirGrid/210963-EirGrid-Winter-Outlook-2022-2023.pdf (accessed 23 Jan. 2023).

The EirGrid Group is the licensed electricity Transmission System Operator and Market Operator in Ireland and Northern Ireland. It has a multi-year programme to deliver a secure and sustainable electricity system in Ireland while increasing the percentage of electricity generated from renewables.[62] Currently, wind generation accounts for most of the renewables, along with small amounts of hydro, bio energy, ocean energy and "renewable combined heat and power".[63] As previously discussed, wind generation depends on weather conditions, which presents a challenge in ensuring that the demand for electricity is met at all times. In addition, wind generation is a non-synchronous technology, which poses an operational challenge when integrating into the synchronous system in Ireland.[64]

Electricity interconnectors are in place between Ireland and the United Kingdom for the import and export of electricity using sub-marine cables running between converter stations in Ireland and Wales.[65] An interconnector with France called the "Celtic Interconnector" is at the planning stage and, if approved, is expected to be complete in 2026.[66] Ireland changed from being a net importer to a net exporter of electricity in 2016 and this continued in 2017 and 2018, which resulted in increased amounts of energy required for electricity generation over this period.[67] However, this situation changed in 2021, when Ireland's net electricity imports were the highest since 2014.[68]

3.2 Carbon emissions and climate change

Climate change is defined by the UN as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".[69] Since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas.[70]

The 26th Conference of the Parties to the UN Framework Convention on Climate Change (COP26) took place between 31 October and 12 November 2021 in Glasgow. The Glasgow Pact from this conference reaffirmed the long-term global goal to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, to significantly reduce the risks and impacts of climate change.[71] The following year, the 27th Conference of the Parties to the UN Framework Convention on Climate Change (COP27) took place between 6 and 18 November 2022 in Sharm el-Sheikh. One of the key outcomes from this conference was

62. EirGrid Group (n.d.), "DS3 Programme", www.eirgridgroup.com/how-the-grid-works/ds3-programme (accessed 23 Jan. 2023).
63. EirGrid Group (2021) "Renewable Generation Accounts for 43% of Electricity Consumption in 2020 as EirGrid Further Increases Amount of Renewable Energy on the Grid", www.eirgridgroup.com/newsroom/electricity-consumption-f (accessed 23 Jan. 2023).
64. EirGrid Group (n.d.), *supra* note 62.
65. EirGrid Group (n.d.), "Interconnection", www.eirgridgroup.com/customer-and-industry/interconnection (accessed 23 Jan. 2023)
66. EirGrid Group (n.d.), "Celtic Interconnector", www.eirgridgroup.com/the-grid/projects/celtic-interconnector/the-project (accessed 23 Jan. 2023).
67. SEAI (2018), *Energy in Ireland 2018 Report*, available at: www.seai.ie/publications/Energy-in-Ireland-2018.pdf; SEAI (2019), *Energy in Ireland 2019 Report,* www.seai.ie/publications/Energy-in-Ireland-2019.pdf (accessed 23 Jan. 2023).
68. SEAI (2021), *Energy in Ireland 2021 Report*, available at: www.seai.ie/publications/Energy-in-Ireland-2021_Final.pdf (accessed 23 Jan. 2023).
69. United Nations Framework Convention on Climate Change (1992), 1771 UNTS 165, entered into force 21 Mar. 1994, Art. 1(2).
70. NASA (n.d.), "The Causes of Climate Change", https://climate.nasa.gov/causes (accessed 23 Jan. 2023).
71. Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (2021), "Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on its third session, held in Glasgow from 31 October to 13 November 2021: Decision 1/CMA.3 – Glasgow Climate Pact", UN Doc FCCC/PA/CMA/2021/10/Add.1.

the adoption of an implementation plan to guide climate actions that includes a fund for responding to loss and damage resulting from climate change.[72]

Around 70% of the world's electricity was produced from burning fossil fuels in 2018.[73] More than 130 countries have now set or are considering setting a target of net zero emissions (NZE) by 2050. Although carbon dioxide emissions from electricity generation in Ireland have reduced in recent years due to the growth in the use of renewables and a decline in the use of fossil fuels,[74] Ireland must continue to reduce its reliance on fossil fuels for transport, heating and electricity production in order to reach NZE. Ireland's 2020 Programme for Government committed to an average 7% per annum reduction in overall greenhouse gas emissions from 2021 to 2030 and to achieving NZE by 2050.[75] This will be achieved through measures such as electrification of heat and transport, harnessing the potential of Ireland's offshore renewables and incentivising microgeneration including roof-top solar energy to deliver a phase-out of fossil fuels.

3.3 Potential role of nuclear energy in combatting climate change

The demand for electricity in Ireland is increasing largely due to the expansion of data centres, which use a lot of energy and could account for 27% of all electricity demand in Ireland by 2029.[76] In addition, the electrification of heat and transport in Ireland to achieve NZE will in turn increase the demand for electricity in the coming years. The Intergovernmental Panel on Climate Change (IPCC) special report on *Global Warming of 1.5°C* calls for full decarbonisation of the energy sector by 2050 to limit the average global temperature increase to 1.5°C.[77]

Nuclear power has a low carbon footprint that is comparable with that of wind energy.[78] The process of nuclear fission does not produce carbon dioxide or other greenhouse gases, but there are some indirect emissions from uranium mining and uranium enrichment in the front end of the nuclear fuel cycle.[79] While the IAEA does not attempt to influence countries' decisions to implement nuclear power programmes, the IAEA Director General, Rafael Mariano Grossi, argues that nuclear power is part of the solution to achieve the goal of limiting global warming to 1.5°C above pre-industrial levels as set out in the 2015 Paris Agreement.[80] It is likely that a combination of technologies rather one single technology will be employed by countries to reduce carbon emissions from the energy sector.

72. Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (2022), "Sharm el-Sheikh Implementation Plan", Draft decision -/CMA.4, UN Doc. FCCC/PA/CMA/2022/L.21.
73. International Energy Agency (2019), *Global Energy and CO2: Status Report*, IEA, Paris, p. 4.
74. SEAI (2021), *Energy-related CO2 Emissions in Ireland 2020: Companion Note to 2020 National Energy Balance*, available at: www.seai.ie/publications/Energy-CO2-emissions-2020-Short-Note-FINAL.pdf (accessed 23 Jan. 2023).
75. Department of the Taoiseach (2020), *Programme for Government: Our Shared Future*, available at: www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future (accessed 23 Jan. 2023).
76. EirGrid Group and SONI (2020), *All-Island Generation Capacity Statement 2020-2029*, p. 14, available at: www.eirgridgroup.com/site-files/library/EirGrid/EirGrid-Group-All-Island-Generation-Capacity-Statement-2020-2029.pdf (accessed 23 Jan. 2023).
77. Masson-Delmotte, V. et al. (eds.) (2018), *Global Warming of 1.5°C: An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change*, International Governmental Panel on Climate Change (IPCC), Geneva, p. 112.
78. World Nuclear Organisation (n.d.), "How can Nuclear Combat Climate Change?", https://world-nuclear.org/nuclear-essentials/how-can-nuclear-combat-climate-change.aspx (accessed 23 Jan. 2023).
79. NEA (2015), *Nuclear Energy: Combatting Climate Change*, OECD Publishing, Paris, p. 5.
80. Liou, J. (2021), "IAEA at COP26: How Nuclear Power and Technologies Can Help Tackle Climate Change", IAEA, www.iaea.org/newscenter/news/iaea-at-cop26-how-nuclear-power-and-technologies-can-help-tackle-climate-change (accessed 23 Jan. 2023).

The European Commission has developed a common classification system for sustainable economic activities called an "EU taxonomy" which will help direct investments towards sustainable projects and activities.[81] Following an in-depth assessment, the European Commission made the decision to include nuclear power in the list of investments that meet the taxonomy requirements and this came into force in January 2023. This decision may have a positive impact on investment in nuclear power and could influence a country's decision to embark upon nuclear new build.

3.4 Historical considerations of nuclear energy in Ireland

In March 1956, the Irish government established an Atomic Energy Committee (AEC) to advise on the potential peaceful uses of atomic energy in Ireland, including the type and location of a research reactor.[82] This committee included the Irishman Ernest Walton, who won the Nobel Prize in Physics with Sir John Cockcroft in 1951 "for their pioneer work on the transmutation of atomic nuclei by artificially accelerated atomic particles".[83] The Taoiseach (Prime Minister) at the time, John A. Costello, supported the development of nuclear energy and the setting up of the AEC was seen as the first step in this process.[84] The AEC recommended the purchase of a US reactor in 1958 but this was rejected by the government, at the time led by Eamonn de Valera, because of an economic crisis in Ireland rather than any opposition to nuclear power.[85]

Around the same time, in 1955, Daniel Dixon, the second Lord Glentoran of Antrim and the Minister for Commerce in Northern Ireland, called for nuclear power to be developed in Northern Ireland as part of the UK's civil nuclear power programme.[86] A white paper on energy policy for Northern Ireland in 1956 was welcomed by the Irish government and it was hoped that any developments in this area could be on an all-island basis.[87] This interest from the Irish government was not received favourably in Northern Ireland as it was seen as an attempt to promote Irish unity. In the early 1970s the bitter sectarian war in Northern Ireland between unionists and nationalists and the repeated bombing of the north-south electricity interconnector from 1975 onwards ended any possibility of a nuclear facility being established in Northern Ireland.

In 1966, as demand for electricity grew in Ireland, the Electricity Supply Board (ESB) recommended the construction of a nuclear reactor in Ireland.[88] The ESB sent engineers to train at nuclear sites in the United Kingdom while actively researching electricity generation by nuclear power and they were confident that this could be achieved by 1978. The site that was selected for a nuclear power plant was Carnsore Point in County Wexford on the south coast of Ireland.[89]

81. European Commission (n.d.), "EU taxonomy for sustainable activities", https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en (accessed 23 Jan. 2023).
82. Houses of the Oireachtas (n.d.), "Dáil Éireann Debate – Tuesday, 8 May 1956", www.oireachtas.ie/en/debates/debate/dail/1956-05-08/17 (accessed 23 Jan. 2023).
83. The Nobel Prize (n.d.), "The Nobel Prize in Physics, Ernest T.S. Walton - Facts", www.nobelprize.org/prizes/physics/1951/walton/facts (accessed 23 Jan. 2023).
84. Houses of the Oireachtas (n.d.), *supra* note 82.
85. McDermott, V. (2008), *supra* note 40, p. 122.
86. *Ibid.*, p. 119.
87. *Ibid.*, p. 121.
88. Manning, M. and M. McDowell (1984), *Electricity Supply in Ireland: The History of the ESB*, Gill and MacMillan, Dublin, p. 209.
89. Sinnott, R. (1995), "Ireland and the Diplomacy of Nuclear Non-Proliferation: The Politics of Incrementalism", *Irish Studies in International Affairs*, Vol. 6, Royal Irish Academy, Dublin, pp. 59–78.

In 1971, legislation was introduced to create a new independent regulatory body called the Nuclear Energy Board (NEB) to advise the government on all aspects of a nuclear power programme.[90] At this time, the government was favourably disposed to nuclear power, particularly since the oil crisis in the early 1970s had exposed Ireland's dependency on oil for electricity generation.[91] This led to the government decision to give permission to the ESB to prepare a planning application for the construction of a nuclear power plant at Carnsore Point in November 1973.[92]

In 1978, a free three-day anti-nuclear music festival was staged at Carnsore Point.[93] Many prominent Irish musicians played at the event, which attracted thousands of young people and led to a growth in the anti-nuclear campaign, which was supported by international non-governmental organisations (NGOs).[94] Repeat concerts were held in 1979 and 1980. Political support for nuclear power began to wane due to these protests. The nuclear accident involving the newly commissioned second reactor at Three Mile Island in March 1978 brought an end to the ESB's plans to build a nuclear power plant at Carnsore Point.[95] Not only did it highlight the radiological implications of a nuclear accident, but it also raised economic concerns about investing in a power plant that could be shut down shortly after opening, as happened at Three Mile Island, with the potential costs for clean-up operations being more expensive than the cost of the reactor itself.

The Programme for Government of the Fine Gael-Labour coalition in 1981 promised that it would not develop nuclear power if there was a potential for environmental problems.[96] This signalled an end to Ireland's plans for a nuclear power programme. Political and public debate over the safe operation of the Sellafield nuclear fuel reprocessing plant by British Nuclear Fuels Ltd (BNFL) in the 1980s, 1990s and 2000s led to a strongly anti-nuclear viewpoint in Irish politics (see section 3.6.1).[97]

3.5 Current Irish government policy on nuclear power

The TFEU in Article 194(2) establishes a member state's right to determine its own energy sources. While the objective of the Euratom Treaty (Article 1) is to create the conditions for the speedy establishment and growth of nuclear industries, member states are not obliged to use nuclear energy.

The Department of Environment, Climate and Communications is responsible for developing and implementing government policy on nuclear safety and radiological protection. The white paper *Ireland's Transition to a Low Carbon Energy Future 2015-2030* sets out a framework to guide policy in the energy sector up to 2030 and nuclear power is not included in this.[98]

90. Irish Statute Book (1971), Nuclear Energy (An Bord Fuinnimh Nuicleigh) Act, 1971, No. 12/1971, www.irishstatutebook.ie/eli/1971/act/12/enacted/en/html?q=nuclear+energy+act (accessed 23 Jan. 2023).
91. McDermott, V. (2008), *supra* note 40, p. 139.
92. Manning, M. and M. McDowell (1984), *supra* note 88, p. 209.
93. RTE Archives (n.d.), "3 Day Anti-nuclear Rally 1979", www.rte.ie/archives/2014/0818/637809-anti-nuclear-rally-at-carnsore-point-1979 (accessed 23 Jan. 2023).
94. McDermott, V. (2008), *supra* note 40, p. 164.
95. *Ibid.*
96. Dalby, S. (1984), "The Nuclear Syndrome: Victory for the Irish Anti-nuclear Power Movement", *DawnTrain*, No. 3, Dublin/Belfast, p. 6, available at: https://innatenonviolence.org/pamphlets/nuclearsyndrome.pdf.
97. Sinnott, R. (1995), *supra* note 89.
98. Department of Communications, Energy & Natural Resources (2020), *Ireland's Transition to a Low Carbon Energy Future 2015 – 2030*, available at: www.gov.ie/en/publication/550df-the-white-paper-irelands-transition-to-a-low-carbon-energy-future-2015-2030 (accessed 23 Jan. 2023).

Ireland's policy on nuclear safety is set out in Ireland's seventh national report for the CNS.[99] Factors informing this policy include concerns about public health and safety, environmental protection and security and the long-term management of radioactive waste. Ireland's priorities are improving nuclear safety, radiological protection and emergency preparedness, in close co-operation with regulatory authorities in other countries as well as through participation in IAEA, NEA and EU committees and working groups related to nuclear safety. Although the government currently has no plans for a change of policy with respect to developing a nuclear power programme, Ireland recognises the rights of other states to determine their own energy mix and expects that the highest international standards will be observed.

3.6 Current public attitudes to nuclear power in Ireland

One of the key factors influencing a country's decision to embark upon a nuclear power programme is public acceptance.[100] The opinion of many people in Ireland has been shaped by events in the nuclear industry in the United Kingdom. The Windscale fire in 1957 and discharges into the Irish Sea from the Sellafield nuclear fuel reprocessing plant have led to anti-nuclear public sentiment. In the latter quarter of the 20th century, the Sellafield site frequently appeared in the Irish media and it was a defining issue in Anglo-Irish relations.[101]

3.6.1 Windscale fire and the "Close Sellafield" campaign

Facilities at the Windscale site were initially established for military purposes, and the first routine discharges of radioactive waste took place in 1952.[102] Calder Hall, the world's first full-scale nuclear power station, began generating electricity in 1956 and from the 1960s, reprocessing of spent nuclear fuel began at Windscale. Due to the secrecy surrounding Windscale's military purpose and to protect the US-UK co-operation agreement on military technology exchange, the UK Prime Minister personally ordered that pollution of the environment from activities at Windscale in the 1950s remain secret.[103]

During the Cold War and amidst the Cuban Missile Crisis, many citizens in Ireland and around the world feared international nuclear war. In 1966, the Irish Civil Defence issued a booklet to every household in the country entitled *Bás Beatha* (*Death Life*) that provided advice on actions to be taken in a nuclear war.[104]

In the early 1980s, reports of clusters of childhood leukaemia in Cumbria emerged and this raised concerns about a potential link to exposure to ionising radiation from the nearby Sellafield complex (renamed from Windscale in 1981) and in particular the Windscale fire in 1957.[105] Around the same time a cluster of children with Down's Syndrome was identified in Dundalk, County Louth on the east coast of Ireland, which raised similar concerns for people in Ireland.[106] Information received from BNFL was disputed because the full extent of the releases from the Windscale fire had been previously supressed. In 2000, a report by Irish epidemiologist Dr Geoffrey Dean showed that the link between the children with Down's

99. Department of Communications, Climate Action and Environment (2016), "Convention on Nuclear Safety, Seventh National Report by Ireland", available at: www.iaea.org/sites/default/files/ireland_nr-7th-rm.pdf.
100. IAEA (2020), *supra* note 2, p. 29.
101. McDermott, V. (2008), *supra* note 40, p. xi.
102. *Ibid*., p. 97.
103. *Ibid*., p. 101.
104. Irish Election Literature (n.d.), "Cosaint Shibhialta, Bás Beatha, a 1965 Civil Defence Booklet on Survival in a Nuclear War", available at: https://irishelectionliterature.com/2018/12/30/cosaint-shibhialta-bas-beatha-a-1965-civil-defence-booklet-on-survival-in-a-nuclear-war (accessed 23 Jan. 2023).
105. Wakeford, R. (2014), "Childhood Leukaemia and Nuclear Installations: The Long and Winding Road", *British Journal of Cancer*, Vol. 111, Springer Nature, London, pp. 1681–1683.
106. Dean, G. et al. (2000), "Investigation of a Cluster of Children with Down's Syndrome Born to Mothers who had Attended a School in Dundalk, Ireland", *Occupational and Environmental Medicine*, Vol. 57, Issue 12, BMJ Journals, London, pp. 793–804.

Syndrome and the Windscale fire was unfounded as three of the six mothers who gave birth to these children had not been living in the Dundalk area at the time of the Windscale fire.[107] However, this story had been circulating in the media for almost 20 years, causing anxiety for many people and increasing anti-nuclear sentiment.

The RPII and its predecessor, the NEB, advised that discharges from the Sellafield site posed no risk to people in Ireland.[108] However, many people were sceptical of this information as the Irish Sea was described by some as being the most radioactive sea in the world.[109] The government were "totally opposed to any discharges of radioactivity from Sellafield into the Irish Sea and [wanted] to see these discharges minimised and eliminated as soon as possible using the best available technology."[110] In 1986, amid heightened concerns about nuclear safety following the Chernobyl accident, the Irish government tabled a motion debate calling for the closure of Sellafield.

Dumping of low-level radioactive waste in the North-East Atlantic was carried out by Belgium, France, Germany, Italy, Netherlands, Sweden, Switzerland and the United Kingdom between 1949 and 1982.[111] At the disposal site closest to Ireland, off the north-west coast, disposal of radioactive material took place between 1951 and 1953. While routine monitoring by the EPA does not show any evidence of releases of radioactivity from these North-East Atlantic dumping sites, in line with surveys by other institutions, this historical activity continues to contribute to Irish concerns about nuclear practices.[112,113]

The prominence of Sellafield in the Irish media in the 1980s and 1990s led to a strong anti-nuclear bias in Ireland. In the 1990s, media attention was focused on the opening of the Thermal Oxide Reprocessing Plant (THORP). In 2001, the Irish government took legal action against the United Kingdom over Sellafield by bringing a case under the UN Law of the Sea to halt the operation of the MOX (mixed oxide nuclear fuel) plant on the site. This action failed as Ireland had broken EU law by taking the case against a fellow EU member state to the UN tribunal instead of to the European Court of Justice.[114] In 2002, a "Shut Sellafield" postcard campaign was launched by a group of anti-Sellafield campaigners in Ireland who asked the public to send postcards calling for the closure of Sellafield, which were delivered for free by the Irish postal service to the British Prime Minister (Tony Blair), Prince Charles and the Chief Executive of BNFL.[115] In recent years Sellafield has not featured prominently in the media, but the public continues to be concerned about how nuclear power plants abroad affect Ireland (see section 3.6.2).

107. Houston, M. (2000), "Down's births 'not linked' to Windscale fire", *The Irish Times*, www.irishtimes.com/news/down-s-births-not-linked-to-windscale-fire-1.1115342 (accessed 23 Jan. 2023).
108. Houses of the Oireachtas (n.d.), "Joint Committee on Environment, Culture and the Gaeltacht Debate – Tuesday, 5 Nov. 2013", www.oireachtas.ie/en/debates/debate/joint_committee_on_environment_culture_and_the_gaeltacht/2013-11-05/4 (accessed 23 Jan. 2023).
109. Ahlstrom, D. (1998), "Irish Sea radioactivity 'worse than at nuclear site'", *The Irish Times*, www.irishtimes.com/news/irish-sea-radioactivity-worse-than-at-nuclear-site-1.161463.
110. Houses of the Oireachtas (n.d.), "Dáil Éireann Debate - Wednesday 26 Nov. 1986", www.oireachtas.ie/en/debates/debate/dail/1986-11-26/10 (accessed 23 Jan. 2023).
111. OSPAR Commission (n.d.), Historic Dumping of Low-Level Radioactive Waste in the North-East Atlantic, available at: www.ospar.org/site/assets/files/1173/factsheet_historic_dumping_final.pdf.
112. IAEA (1999), *Inventory of Radioactive Waste Disposals at Sea*, IAEA-TECDOC-1105, IAEA, Vienna.
113. Smith, K. et al. (2011), "Plutonium Measurements at NEA's North East Atlantic Dumpsites", Radioprotection, vol. 46(6), pp. 271–275.
114. McDermott, V. (2008), *supra* note 40, p. 266.
115. Institute for Agriculture & Trade Policy (2002), "Irish nuclear protesters plan postcard blitz on UK", www.iatp.org/news/irish-nuclear-protesters-plan-postcard-blitz-on-uk (accessed 23 Jan. 2023).

3.6.2 Public surveys

In October 2020, the EPA commissioned an online survey of the public in Ireland to assess levels of awareness of radiation and to find out what, if any, aspects of radiation people were concerned about.[116] Previous surveys were conducted in 2004, 2010 and 2013. When participants were asked if they were concerned about radiation, 28% said they were concerned while 67% said they were not. When compared with the earlier surveys, there has been a steady decline in the percentage of the population concerned about radiation (Figure 1).

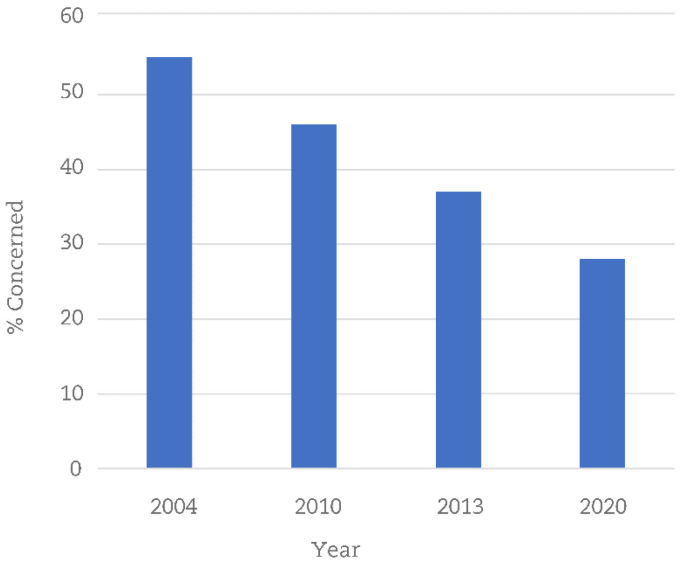

Figure 1. Percentage of survey participants in Ireland concerned about radiation[117]

This reduction is significant because the Fukushima Daiichi Nuclear Power Plant accident occurred during this time-period and the UK government commenced a programme of new nuclear build. However, when the participants who were concerned about radiation were asked to select the aspects of radiation that they were most concerned about from a list of ten items, which included mobile phones, 5G wireless technology and radon gas, the aspect that they were most concerned about was "how NPPs abroad affect Ireland".[118] Another finding of the survey was that people were more concerned about the risk of a nuclear accident somewhere near the country than they were about radon gas, even though radon accounts for more than half of the average person in Ireland's annual radiation exposure.[119]

116. Amárach Research (2021), "Attitudes to Radiation" (survey performed on behalf of EPA), www.epa.ie/publications/monitoring--assessment/radiation/survey-on-attitudes-to-radiation-in-ireland-october-2020.php (accessed 23 Jan. 2023).
117. *Ibid.*, p. 4; MillwardBrown (2013), "Radioactivity & Radiation Quantitative Research Summary Prepared for PRII 26th August 2013", p. 4.
118. *Ibid.*, p. 5.
119. *Ibid.*, p. 19; O'Connor, C. et al. (2014), *Radiation Doses Received by the Irish Population 2014*, Radiological Protection Institute of Ireland (RPII), Dublin, RPII No. 14/02.

An "Ireland Thinks" poll that was part of Journal Media Ltd.'s "Good Information" project in October 2021 asked the question "Should Ireland build a nuclear power station to increase clean energy supplies?"[120] There was an even split between those in favour and those not in favour of the proposal, with 43% saying "yes", 43% saying "no" and the remainder responding that they did not know. The poll's findings revealed that the highest support for introducing nuclear power was among 18- to 24-year-olds, while 45- to 54-year-olds were less supportive.

3.7 Non-governmental organisations

There are pro-nuclear and anti-nuclear NGOs active in Ireland at present and some of these are briefly summarised here.

3.7.1 18for0

18for0 is a voluntary group of professionals that is promoting the development of a nuclear power programme to achieve NZE by 2050.[121] The name of this group comes from their call to introduce 18% nuclear energy to eliminate fossil fuels from the electricity sector and reduce emissions to their minimum by 2037. In 2020, they published a report on nuclear energy development in Ireland that called for a national debate on nuclear energy and outlined the main factors that must be considered to establish a nuclear energy programme.[122] 18for0 promotes the use of nuclear energy in Ireland through online public webinars, media interviews, their website and publications.

3.7.2 Better Environment with Nuclear Energy

Better Environment with Nuclear Energy (BENE) is a voluntary, independent pro-nuclear group that seeks to bring balance to the Irish energy debate concerning nuclear power.[123] BENE's core group includes a former chief executive of the RPII, a retired professor of health physics from Trinity College Dublin and the son of Nobel Laureate Ernest Walton, who is himself an emeritus professor of the National University of Ireland, Galway. BENE's website provides information on issues such as past nuclear accidents, SMRs and the management of radioactive waste. Like 18for0, BENE argues that nuclear power could help Ireland achieve NZE.

3.7.3 Friends of the Earth Ireland

Friends of the Earth Ireland is a not-for-profit company whose mission is "to bring about the system change needed for a just world where people and nature thrive."[124] Although their Strategic Plan 2021-2025[125] does not make any reference to nuclear power, their sister organisation, Friends of the Earth UK, sets out their anti-nuclear position on their website.[126] In a recent media interview, Friends of the Earth Ireland argued that a nuclear

120. Journal Media Ltd. (2021), "Ireland Split on Whether to Build a Nuclear Power Station for Clean Energy", www.thejournal.ie/climate-policies-nuclear-power-cars-economy-poll-5586969-Nov2021 (accessed 23 Jan. 2023).
121. 18for0 (n.d.), www.18for0.ie (accessed 23 Jan. 2023).
122. 18For0 (2020), *Nuclear Energy Development in Ireland, Preliminary Study*, available at: www.18for0.ie/_files/ugd/c8b045_87f20ba044304e4fa2a11f5d61957a40.pdf?index=true (accessed 23 Jan. 2023).
123. BENE-Better Environment with Nuclear Energy (n.d.), "Why Nuclear?", http://bene.ie (accessed 23 Jan. 2023).
124. Friends of the Earth Ireland (n.d.), "Our Mission & Vision", www.foe.ie/about/mission (accessed 23 Jan. 2023).
125. Friends of the Earth Ireland (2020), "Friends of the Earth Strategic Plan 2021-2025", available at: www.foe.ie/assets/files/pdf/friends_of_the_earth_ireland_strategic_plan_2021-2025_-_web_version.pdf (accessed 23 Jan. 2023).
126. Friends of the Earth UK (2017), "Nuclear Energy: Our Position", https://policy.friendsoftheearth.uk/policy-positions/nuclear-energy-our-position (accessed 23 Jan. 2023).

power programme would not help achieve NZE as the time required to implement such a programme would be too long and instead Ireland should focus on alternative solutions such as increasing energy efficiency and retrofitting homes.[127]

3.7.4 Nuclear Free Local Authorities

Nuclear Free Local Authorities (NFLA) is a group of approximately 50 local authorities in the United Kingdom and Ireland whose aim is to raise concerns about nuclear issues, influence national and international nuclear policy and encourage local authorities to adopt anti-nuclear policies.[128] The NFLA is the United Kingdom's and Ireland's partner for "Cities for a Nuclear Free Europe" which is "an informal network of cities and city leaders who wish to reduce or avoid the risks, dangers and costs of nuclear power in Europe".[129] The NFLA produces a monthly newsletter and regular policy briefing documents and organises online webinars.

3.8 Hazard assessments of nuclear accidents abroad

Hazard assessments have shown that a nuclear accident in Europe could result in widespread but low-level contamination of the Irish environment. In line with EU reporting requirements, the Government Task Force on Emergency Planning carries out a national risk assessment for Ireland approximately every three years, with the most recent one published in March 2021.[130] This national risk assessment identified 16 key risks which could pose a challenge to Ireland, one of which is the risk from a nuclear incident abroad. The risk assessment considered the reasonable worst-case scenario, which is a severe nuclear incident in the United Kingdom or northwestern Europe. The likelihood of this type of emergency was assessed as low (51 to 100 years between occurrences), but if it occurred it would have a very high impact on Ireland, including widespread effects for an extended duration.

When the United Kingdom announced that it was planning to embark on a new build nuclear programme, the RPII carried out an assessment of the potential radiological impacts on Ireland from day-to-day operations and various postulated severe accidents.[131] This assessment showed that routine discharges from the proposed nuclear power plants would be of no radiological significance for people living in Ireland. However, in the event of a severe accident, food controls and agriculture protective actions would be required for many years to reduce radiation doses from the consumption of contaminated food.

In 2012, the Department of the Environment, in co-operation with the United Kingdom, published a summary of a probabilistic risk assessment of the Sellafield site and the nearby Low-Level Waste Repository, which was conducted by a team of independent, international nuclear experts.[132] The EPA subsequently published a report on the potential radiological impact for people in Ireland from the four most severe hypothetical accident scenarios at

127. Mooney, S. (2021), "Could Going Nuclear Help Ireland Achieve its Climate Targets?", *Irish Times DAC*, Dublin), www.breakingnews.ie/ireland/could-going-nuclear-help-ireland-achieve-its-climate-targets-1199834.html (accessed 23 Jan. 2023).
128. NFLA (n.d.), "About NFLA", www.nuclearpolicy.info/about/about-nfla (accessed 23 Jan. 2023).
129. Cities for a Nuclear Free Europe (n.d.), "Cities for a Nuclear Free Europe", www.cnfe.eu (accessed 23 Jan. 2023).
130. Department of Defence, Office of Emergency Planning (2021), *A National Risk Assessment for Ireland 2020*, Defence Forces Printing Press, Dublin, available at: www.gov.ie/en/press-release/5e685-national-risk-assessment-for-ireland-2020 (accessed 23 Jan. 2023).
131. McMahon, C. et al. (2013), *Proposed NPPs in the UK – Potential Radiological Implications for Ireland*, RPII No. 13/01, RPII, Dublin.
132. Irish Government News Service (2012), "New Report Assesses the Risks to Ireland from Incidents at Sellafield", https://merrionstreet.ie/en/category-index/environment/protecting-the-environment/new-report-assesses-the-risks-to-ireland-from-incidents-at-sellafield.html (accessed 23 Jan. 2023).

Sellafield.[133] Although the predicted radiation exposure for people in Ireland was found to be below the levels that would require protective actions such as sheltering, relocation or evacuation, significant radiation doses could be incurred through the consumption of contaminated foods, if food controls were not introduced.

In 2016 Ireland's Economic and Social Research Institute (ESRI) published a report on the economic impacts of a nuclear emergency in northwestern Europe based on four different scenarios with varying amounts of contamination.[134] ESRI estimated the costs to Ireland's economy from the impacts on agriculture, tourism, business through lost days and monitoring costs would range from EUR 4 billion where there was no contamination in Ireland up to EUR 161 billion for the worst-case scenario.

4. Legal and institutional challenges of embarking on a nuclear power programme

When a government decides to embark upon a nuclear power programme, legal and institutional frameworks must be established to protect people and the environment nationally and internationally from the harmful effects of ionising radiation. The IAEA has published guidance on the process and milestones in the development of a national nuclear power programme, the establishment of a national nuclear safety infrastructure and the governmental, legal and regulatory frameworks.[135] The IAEA has also identified the infrastructural issues that must be considered for a nuclear power programme to be successful and to ensure nuclear safety, nuclear security and safeguards requirements are met.[136] This section will examine the challenges in implementing the legal and institutional frameworks should Ireland wish to embark upon a nuclear power programme.

4.1 Stakeholder involvement

Before embarking upon a nuclear power programme, it is essential that there be a consensus of public opinion in favour of the programme. The local communities where nuclear facilities will be constructed, including radioactive waste management facilities, must support these developments. Important factors influencing the acceptance of nuclear power by the public include the level of information and knowledge that people have and the provision of this information by trusted third party sources.[137]

Public acceptance can only be achieved through an open and transparent consultation process. The public should be provided with all the facts about the risks and benefits of nuclear power so that they can make an informed choice. A continuous process of stakeholder engagement is essential for addressing public concerns. Every aspect of the planned development, including the risks and implications of a severe nuclear emergency, should be made available and opportunities provided where they can be discussed openly. All relevant stakeholders, including representatives from the nuclear industry, vendors, the regulatory body and NGOs, should be included in these dialogues. In the United Kingdom, the government is working closely with communities to find a site for a

133. EPA (2016), *Potential Radiological Impact on Ireland of Postulated Severe Accidents at Sellafield*, EPA, Ireland.
134. Curtis, J., E. Morgenroth and B. Coyne (2016), "The Potential Economic Impact of a Nuclear Accident - An Irish Case Study", Department of the Environment, Community and Local Government, Dublin, available at: www.esri.ie/publications/the-potential-economic-impact-of-a-nuclear-incident-an-irish-case-study (accessed 23 Jan. 2023).
135. 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; 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; IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 1 (Rev. 1), IAEA, Vienna.
136. IAEA (2015), *supra* note 135, p. 7.
137. IAEA (2020), *supra* note 2, p. 77.

geological disposal facility (GDF). Community partnership initiatives are being employed to give communities an opportunity to learn and ask questions about what hosting a GDF might mean for them without having to make any early commitments.[138]

Given the history of fear and anxiety amongst many members of the public in Ireland regarding nuclear power, public acceptance for a nuclear power programme could be difficult to achieve. The role which nuclear power could play in reducing greenhouse gases and the advent of new technologies such as SMRs may make nuclear power more acceptable. A national debate with all the interested parties in favour of and against nuclear power could be the first step in prompting the public to consider and discuss nuclear power.

4.2 National position

It is unlikely that an Irish government would change its policy on nuclear power unless there was a noticeable shift in public opinion in favour of embarking upon a nuclear power programme. A rigorous justification process to assess the benefits and detriments of a nuclear power programme would be required before a government decision could be made to change the current policy.

In the last general election, in 2020, the three main parties, Fine Gael, Fianna Fáil and Sinn Féin, each received between 20% and 25% of the electorate's first preference votes.[139] Therefore, it is unlikely that any of these parties would adopt a policy that might jeopardise their share of the vote in the next general election. The Workers Party, which currently has no representatives in Dáil Éireann, recently became the first political party to support the development of nuclear energy in Ireland.[140]

Since nuclear power programmes take at least 10 to 15 years from the policy decision to embark on a nuclear power programme until its implementation,[141] it is likely that there could be several governments in power during this time. Even if one government's policy was in favour of nuclear power, a subsequent government could overturn this decision.

4.3 Legal framework

The IAEA *Handbook on Nuclear Law* sets out 11 fundamental principles of nuclear law.[142] These include principles of safety, security, responsibility, compliance, independence, transparency and international co-operation. National legislation covering the regulation of nuclear power should address all 11 fundamental principles.

As a member of the EU and Euratom, Ireland is bound by the Treaty on the EU, the TFEU and the Euratom Treaty. Although the EU and Euratom are separate institutions, the treaties governing them are linked by several legal provisions that cover many fields, including energy.[143] The Nuclear Safety Directive and the Basic Safety Standards Directive (Council Directive 2013/59/Euratom) have been transposed into Irish law as described in section 2.3. Article 11 of IRR19 includes the "operation and decommissioning of any

138. World Nuclear News (2021), "First Community Partnership Established in Cumbria", https://world-nuclear-news.org/Articles/First-Community-Partnership-established-in-Cumbria (accessed 23 Jan. 2023).
139. Houses of the Oireachtas (2020), "33rd Dáil General Election, 8 February 2020 Election Results", https://data.oireachtas.ie/ie/oireachtas/electoralProcess/electionResults/dail/2020/2020-05-01_33rd-dail-general-election-results_en.pdf (accessed 23 Jan. 2023).
140. The Workers' Party (n.d.), "Workers' Party Become First Irish Party to Back Nuclear Energy", https://workersparty.ie/workers-party-become-first-irish-party-to-back-nuclear-energy (accessed 23 Jan. 2023).
141. IAEA (2015), *supra* note 135, p. 2.
142. Stoiber, C. (2003), *supra* note 5, p. 5.
143. Kilb, W. (2010), *supra* note 9.

nuclear facility" as a practice that requires licensing. Therefore, no changes are required in this legislation to allow the EPA to license a nuclear facility.

However, as described in section 2.3, the production of electricity by nuclear fission is banned in Ireland. For Ireland to embark on a nuclear power programme the 1999 Electricity Regulation Act would need to be repealed or amended. This would require a bill to be brought forward by a government minister and it must go through five stages before it can be enacted, as shown in Table 1.[144]

Once a bill has passed the above five stages in both Houses of the Oireachtas it is ready to be enacted by being signed into law by the president. The president may refer a bill to the Supreme Court to seek a judgment where there are any doubts on whether it is compatible with the Constitution. In the event that the Supreme Court finds that the bill is unconstitutional, the president can decline to sign the bill so that it is not enacted.

The introduction of a new act or the repealing or amending of an existing act is not a straightforward process. To do this requires political will and it is unlikely that an attempt to amend or repeal the 1999 Electricity Regulation Act would be made without there being a majority of the Oireachtas in favour of it.

Stage	Process
1	The bill is initiated by a member of the Oireachtas. This process depends on whether the bill is initiated by a member of the government, Dáil Éireann or Seanad Éireann. While a government member may present a bill, other members of Dáil Éireann may only present a bill as a group of seven or more deputies and a member of the opposition must seek leave to introduce a Private Members' Bill. If leave is granted, the bill is added to the Order Paper and proceeds to the second stage. In Seanad Éireann, the leader may present a bill on behalf of the government and groups of five or more senators may also present bills.
2	The general principles of the bill are debated and, following this, the House may or may not agree by a vote to allow the bill to proceed to the Committee Stage.
3	At the **Committee Stage** a detailed examination of the bill is carried out and amendments may be made. Once each section of the bill is agreed, the bill moves to the Report Stage.
4	At the **Report Stage**, members have the final opportunity to make amendments to the text of a bill. Members may speak only twice on each amendment, and their second contribution is limited to two minutes. When all the amendments have been dealt with, the bill moves to final consideration. The government may also recommit the bill to the Committee Stage in respect of an individual amendment.
5	At the **Final Stage** of a bill, it is passed by the House. When a bill passes the Final Stage in the House in which it was initiated, it is then sent to the other House of the Oireachtas where it begins at the second stage above. If the second House proposes amendments to the bill, these are returned the House in which the bill was initiated where they are debated and can be rejected.

Table 1. Stages for enacting a bill in Ireland.

4.4 Regulatory framework

As described in section 2.7, the EPA regulates practices using ionising radiation in medicine, industry and education in Ireland. Authorisation of practices follows a graded approach and takes the form of either licensing or registration, with the more high-risk practices being licensed. Practices that are subject to licensing are listed on the EPA's website and include radiotherapy, veterinary nuclear medicine and the use of high activity

144. Houses of the Oireachtas (n.d.), "How laws are Made", www.oireachtas.ie/en/visit-and-learn/how-parliament-works/how-laws-are-made (accessed 23 Jan. 2023).

of sealed sources.[145] Authorisation and inspection activities carried out by the EPA in 2021 are shown in Table 2.

Activity	Number in 2021
New licences	21
New registrations	111
Technical amendments	529
Closed licences	106
Inspections	75
Incidents reported	8

Table 2. Regulation of radiation by EPA in 2021[146]

If Ireland embarked upon a nuclear power programme, several major changes would be required to the regulatory framework to facilitate the licensing, compliance assessment and enforcement of activities at different stages of the nuclear fuel cycle, including siting, design, construction, commissioning, operation, decommissioning as well as transport, storage and disposal of nuclear fuel and radioactive waste. In accordance with the second IAEA Fundamental Safety Principle, it is the responsibility of the government to ensure that the legal and institutional frameworks are in place for the regulation of facilities and activities that give rise to radiological risks and for the establishment of an independent regulatory body.[147] The government and the regulatory body must work together to establish standards and the regulatory framework for protecting people and the environment against radiological risks. However, the licensee is the one who is ultimately responsible for safety throughout the lifetime of facilities and activities, and this responsibility cannot be delegated.

The government would first need, through legislation, to assign the body with responsibility for regulating nuclear activities. In the United Kingdom, the Environment Agency is responsible for the regulation of radioactive substances while the ONR is responsible for regulating nuclear facilities.[148] The EPA could be assigned responsibility for regulating practices associated with nuclear facilities, given that under IRR19 the EPA is responsible for licensing the operation and decommissioning of any nuclear facility. If the EPA were the regulatory body, this might ensure a harmonised approach to radiological protection and environmental protection because of the EPA's role in environmental regulation and advocacy for the environment. However, the regulation of nuclear facilities would require significant changes to the structure of the EPA and it may be more prudent to establish a new authority.

The regulatory body and the government department with responsibility for overseeing the introduction of the nuclear power programme would need to be sufficiently resourced to allow them to develop the regulations for each stage of the nuclear fuel cycle. These regulations, including those for management of spent fuel and decommissioning of facilities at their end of life, should be available in advance of any licensing applications being made. A decision would be required on whether separate licences are needed for each stage of the nuclear fuel cycle, e.g. whether to issue separate licences for construction and operation, as occurs in Finland, or whether to adopt the UK model, which relies on a nuclear site licence that covers both construction and operation. Regardless of the type of licence, the technical assessment is the same.

145. EPA (n.d.), "Practices subject to registration", www.epa.ie/our-services/licensing/radiation/graded-authorisation/list-of-practices (accessed 23 Jan. 2023).
146. EPA (2022), *Annual Report and Accounts 2021, supra* note 48, pp. 14, 21.
147. IAEA (2016), *supra* note 135, pp. 6-8.
148. UK Department for Environment, Food and Rural Affairs (DEFRA) (2011), *Environmental Permitting Guidance Radioactive Substances Regulation*, Version 2.0, DEFRA, London, p. 8.

Once the regulations are in place and regulatory guidance has been prepared for prospective licence applicants, the regulatory body needs to be sufficiently resourced to be able to perform the technical assessments for licensing, compliance assessment and enforcement. In the United Kingdom, the ONR has five regulatory purposes: nuclear safety, nuclear security, nuclear safeguards, the safety of transport of nuclear and radioactive material, and nuclear site health and safety.[149] The regulatory body for nuclear facilities in Ireland would have to provide all these functions, and inspectors in each area would require different skills and expertise.

4.5 *Expert personnel*

The IAEA provides guidance to assist member states in developing an effective workforce plan to meet the needs of the national infrastructure when developing a new nuclear power programme during three distinct phases, as shown in Table 3.

Phase	Activity
1	Considerations prior to a decision to launch a nuclear power programme
2	Preparatory work for construction of a nuclear power plant after a policy decision is taken
3	Activities to implement a first nuclear power plant

Table 3. Phases for development of a workforce plan[150]

The majority of the staff required to support a nuclear power programme in government departments, the regulatory body and the utility will be at the professional or graduate level, in addition to technical staff who will require less "nuclear" knowledge than their graduate counterparts but will need considerable training to understand the nuclear safety requirements.[151] The legal profession in Ireland also requires competence in nuclear law and associated disciplines, such as planning law.

The resources of the regulatory body and the number of appropriately qualified and competent staff should be commensurate with the radiological risks associated with facilities and activities being regulated.[152] The United Arab Emirates took its first step on the road to a nuclear power programme in 2008 with the publication of a policy document on the potential use of nuclear energy.[153] By 2017, the Federal Authority for Nuclear Regulation employed approximately 200 staff.[154] This was three years before commissioning of the first unit of the Barakah Nuclear Power Plant.[155] The regulatory function over ionising radiation in Ireland's EPA is currently made up of ten inspectors and two administrative staff. Based on the UAE example, this means that the staff complement would need to be increased approximately 20-fold, if Ireland were to embark upon a nuclear power programme.

149. ONR (n.d.), "Aims and Objectives", www.onr.org.uk/aims-and-objectives.htm (accessed 23 Jan. 2023).
150. See IAEA (2011), *Workforce Planning for New Nuclear Power Programmes*, IAEA Nuclear Energy Series, No. NG-T-3.10, IAEA, Vienna, p. 1.
151. *Ibid*., p. 19.
152. IAEA (2016), *supra* note 135, p. 21.
153. United Arab Emirates (2008), "Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy", www.enec.gov.ae/doc/uae-peaceful-nuclear-energy-policy-5722278a2952f.pdf (accessed 23 Jan. 2023).
154. United Arab Emirates (2017), "UAE National Report for the 7th Review Meeting of the Convention on Nuclear Safety," p. 25, www.iaea.org/sites/default/files/uae_nr-7th-rm.pdf (accessed 23 Jan. 2023).
155. World Nuclear Association (2022), "Nuclear Power in the United Arab Emirates", www.world-nuclear.org/information-library/country-profiles/countries-t-z/united-arab-emirates.aspx (accessed 23 Jan. 2023).

The IAEA acknowledges that the required expertise may not be available nationally and the IAEA recommends recruiting expatriates who are working in the nuclear sector abroad and are interested in returning home, attracting experienced foreign personnel with appropriate remuneration packages, and recruiting experienced personnel from other national energy industries.[156] Non-expert staff can also be trained through secondment to regulatory bodies in other nuclear countries, through IAEA training courses and overseas study.[157] At present, Ireland has no third-level courses in nuclear engineering, nuclear law or related disciplines. An educational infrastructure to support a nuclear power programme should be established rather than relying solely on international opportunities.

4.6 Nuclear security and safeguards

Chapter 7 of the Euratom Treaty sets out the rights and duties of member states, operators and European Commission Safeguards Inspectors with respect to nuclear safeguards and Regulation No. 302/2005 sets out the application of Euratom Safeguards and the requirements placed on holders of nuclear materials.[158] Article 77 of the Euratom Treaty requires the Commission to satisfy itself that ores, source materials and special fissile materials are not diverted from their intended uses in member states and that safeguarding obligations assumed by the Community under an agreement concluded with a third State or an international organisation are complied with.

Under Article 78 of the Euratom Treaty, "[a]nyone setting up or operating an installation for the production, separation or other use of source materials or special fissile materials or for the processing of irradiated nuclear fuels shall declare to the Commission the basic technical characteristics of the installations". Under Article 81, "[t]he Commission may send inspectors into the territories of Member States" and in the event of an infringement, a range of sanctions are available to the Commission against the member state or the operator as specified in Article 83, which can be appealed to the European Court of Justice.

Euratom is not a party to the NPT but it meets all the non-proliferation requirements through the Comprehensive Safeguards Agreement concluded with the IAEA in 1973. Ireland had already entered into a Safeguards Agreement with the IAEA in 1972 (see section 2.6.6) but the Comprehensive Safeguards Agreement replaces this. Euratom safeguards are performed in close partnership with the IAEA and, under the Comprehensive Safeguards Agreement, the IAEA carries out its routine safeguards' inspections at the same time as some, but not all, of Euratom's inspections.[159]

Ireland and Euratom concluded Agreement 78/164/Euratom with the IAEA in implementation of Article III (1) and (4) of the NPT.[160] Agreement 78/164/Euratom entered into force on 21 February 1977 and was supplemented by Additional Protocol

156. IAEA (2011), *supra* note 150, p. 20.
157. *Ibid*., p. 20.
158. Commission Regulation (Euratom) No. 302/2005 of 8 February 2005 on the application of Euratom safeguards, OJ L 54 (28 Feb. 2005), pp. 1-70. See Kilb, W. (2010), *supra* note 9.
159. Fischer, D.A.V. (1973), "IAEA/Euratom Agreement - An Explanation," *IAEA Bulletin*, Vol.15, No. 3, IAEA, Vienna, p. 16, available at: www.iaea.org/sites/default/files/publications/magazines/bulletin/bull15-3/15303581016.pdf (accessed 23 Jan. 2023).
160. Agreement between the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the European Atomic Energy Community and the International Atomic Energy Agency in implementation of Article III (1) and (4) of the Treaty on the non-proliferation of nuclear weapons (78/164/Euratom) - Protocol, OJ L 51/1 (22 Feb. 1978). See also IAEA (1973), "The Text of the Agreement between Belgium, Denmark, the Federal Republic of Germany, Ireland, Italy, Luxembourg, the Netherlands, the European Atomic Energy Community and the Agency in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/193.

1999/188/Euratom, which entered into force on 30 April 2004.[161] "The Subsidiary Arrangements (General Part) to the Safeguards Agreement (78/164/Euratom in OJ L51/1, also known as INFCIRC 193) for the NNWS, were revised and came into force on 1 March 2014," and the updated text now includes the accession of new member states of the EU and the entry into force of the Additional Protocol to INFCIRC 193.[162]

In summary, if Ireland were to embark on a nuclear power programme, nuclear safeguards arrangements are in place with the IAEA through Euratom and, apart from the additional reporting and inspection requirements, this should not present a challenge to Ireland once the activity is adequately staffed and financially resourced.

4.7 Radioactive waste management

The management of spent fuel and radioactive waste is the responsibility of individual EU member states. Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste is given effect in Irish legislation through IRR19.[163] Licensing is required under Article 11(1)(e) of these Regulations for the siting, design, construction, commissioning, operation, decommissioning and closure of a radioactive waste management facility and Article 17 sets out the requirements of the undertaking in managing the radioactive waste and the requirements of the EPA in assessing a licence application for a radioactive waste facility.

Government policy on radioactive waste management includes the requirement that those responsible for radioactive waste and disused sealed radioactive sources pay for their management and that take-back agreements be in place for all new radioactive sources. Ireland does not currently have any facilities for the long-term storage or disposal of radioactive waste. One of the recommendations from the recent IAEA ARTEMIS mission to Ireland was that the government continue to explore options to provide a long-term solution for the management of radioactive waste and disused sealed radioactive sources.[164]

If Ireland wished to embark upon a nuclear power programme, the government would need to develop a policy on spent fuel and radioactive waste management that takes account of waste generated during routine operations and the potential for waste arising from decontamination and remedial actions should a nuclear accident occur. A programme of work would then be required to implement the policy to ensure the safety of the spent fuel and radioactive waste. The strategy for radioactive waste management should include criteria for the characterisation of waste and the acceptance criteria for waste disposal.

Under Article 37 of the Euratom Treaty, Ireland is required to submit general data to the European Commission before implementing any plan for the disposal of radioactive waste so that the Commission can issue an opinion, after consulting with the Group of Experts referred to in Article 31 of the Euratom Treaty, on whether the implementation of the plan is liable to result in the radioactive contamination of the water, soil or airspace of another member state.

161. Doc. COM(1998) 314, OJ L 67/1 (13 Mar. 1999); IAEA (2005), "Protocol Additional to the Agreement between the Republic of Austria, the Kingdom of Belgium, the Kingdom of Denmark, the Republic of Finland, the Federal Republic of Germany, the Hellenic Republic, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the Portuguese Republic, the Kingdom of Spain, the Kingdom of Sweden, the European Atomic Energy Community and the International Atomic Energy Agency in implementation of Article III, (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons", IAEA Doc. INFCIRC/193/Add.8.
162. European Commission (2015), *Report on the Implementation of Euratom Safeguards in 2014*, European Commission, Luxembourg, p. 15.
163. 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 199/48 (2 Aug. 2011).
164. IAEA (2021), *supra* note 55.

High level waste (HLW) with a very long half-life and spent fuel for which no future use is foreseen pose a challenge for radioactive waste management.[165] While the management of radioactive waste is the responsibility of the licensee, HLW and spent fuel will need to be managed for many decades and arrangements will need to be in place for the funding of long-term storage so that it does not place an undue burden on future generations.[166]

In the last 10 years Ireland has undertaken a successful disused radioactive source reduction programme with just 24 disused sources remaining in 2018 with a half-life greater than 10 years.[167] Given the small inventory of radioactive waste currently in the country, the long-term storage of spent fuel and radioactive waste from a nuclear industry would present a significant challenge for Ireland.

4.8 Transport

Radioactive materials are vulnerable to theft, loss or sabotage during transport in the public domain. Transport is a complex legal subject that is governed by national law, regional law, international nuclear law, modal law and general international law and there is no single international legal instrument available that addresses all relevant safety, security and safeguards aspects of transport in a comprehensive manner.

The IAEA *Regulations for the Safe Transport of Radioactive Material* (No. SSR-6, Rev. 1) establish the standards of safety that provide an acceptable level of control of the hazards to persons, property and the environment that are associated with the transport of radioactive material.[168] These regulations are supported by six IAEA Safety Guides that provide explanations and guidance for the transport requirements in SSR-6, Rev. 1, to facilitate harmonised implementation.

The UN Recommendations on the Transport of Dangerous Goods Model Regulations represent a worldwide recognised authoritative regulatory regime for the transport of dangerous goods and provide a comprehensive legal and technical regulatory framework for all categories of dangerous goods and all shipping modes.[169]

A European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) under the auspices of the UN Economic Commission for Europe entered into force on 29 January 1968 and was amended in April 1985.[170] Ireland became a contracting party to the ADR in 2006.[171] Therefore, the transportation of radioactive material by road in Ireland must be in accordance with the ADR regulations.

The EPA is the competent authority for the transportation of radioactive material within, to, or from Ireland and all businesses and practices involved in the transportation of radioactive materials must be licensed by the EPA in accordance with IRR19. In these regulations, radioactive material is defined as material incorporating radioactive substances and it includes nuclear material.

165. IAEA (2015), *supra* note 135, p. 55.
166. IAEA et al. (2006), *supra* note 22, p. 12.
167. Department of Communications, Climate Action and Environment (2018), "Ireland's Report on the Implementation of 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", p. 5, available at: https://energy.ec.europa.eu/system/files/2020-03/ie_2nd_nr_0.pdf (accessed 23 Jan. 2023).
168. IAEA (2018), *Regulations for the Safe Transport of Radioactive Material*, IAEA Safety Standards Series, Specific Safety Requirements, No. SSR-6 (Rev. 1), IAEA, Vienna.
169. UNECE (2019), "UN Model Regulations", https://unece.org/rev-21-2019 (accessed 23 Jan. 2023).
170. UNECE (n.d.), "About the ADR", https://unece.org/about-adr (accessed 23 Jan. 2023).
171. Department of Foreign Affairs (2007), European Agreement Concerning the International Carriage of Dangerous Goods by Road. Treaty Series 2007 No. 8, available at: www.dfa.ie/media/dfa/alldfawebsitemedia/treatyseries/uploads/documents/legaldivisiondocuments/treatyseries2007/no-8-of-2007.pdf (accessed 23 Jan. 2023).

Transport of radioactive material by sea is covered by SI 306/1983, which includes the requirements of the International Maritime Organisation Dangerous Goods Code. The Marine Survey Office in the Department of Transport is the Irish regulator for safety, security, environmental protection and living and working conditions for vessels and ports in Ireland and Irish ships abroad.[172] The Irish Aviation Authority is responsible for safety regulation and has oversight of security of the civil aviation industry in Ireland and it is the competent authority for the carriage of radioactive material by air.[173] The IRRS mission team in Ireland in 2015 noted that there was no formal arrangement for co-ordination among the competent authorities for transport by sea, air and road.[174] This is being addressed through the establishment of a Memorandum of Understanding among the three organisations.

Currently, the majority of the 5 000 radioactive material packages transported by road in Ireland each year are Excepted or Type A packages with only a small proportion of the packages being Type B packages.[175] There is no transport of radioactive material by rail; transport by sea is undertaken infrequently; and most of the radioactive material transported by air is for medical purposes. If Ireland decided to embark upon a nuclear power programme, the radioactive material being transported would change significantly in terms of type, quantity, activity and packaging, also requiring different security measures. The regulatory framework for the transport of radioactive material would need to be strengthened to deal with this increased level of activity and risk.

4.9 Emergency planning

The IAEA has grouped radiation hazards into five emergency preparedness categories numbered I to V to facilitate a graded approach to developing and optimising EPR arrangements.[176] Ireland does not have any facilities in categories I (nuclear power plants) or II (research reactors and nuclear reactors used for the propulsion of vessels). Ireland's EPR arrangements for radiological emergencies are based on hazard assessments that identified activities in categories III (facility in which an emergency would warrant protective actions and other response actions on the site, e.g. industrial irradiation facilities), IV (activities and acts that could give rise to a radiological emergency in an unforeseen location, e.g. theft of a source) and V (emergency in a category I or II facility located in another state which is within emergency planning zones and emergency planning distances). Ireland's National Plan as described in section 2.8 is commensurate with these hazard assessments.

If Ireland wished to embark upon a nuclear power programme, new hazard assessments that evaluate the risks to people and the environment from different accident scenarios associated with a nuclear power plant within Ireland would be required. These hazard assessments should be based on the type and number of reactors proposed in the nuclear power programme. Following these hazard assessments, the National Plan would need to be updated. While the overall structure and co-ordination of a response may not change since Ireland adopts an all-hazards approach to emergency management, the scale and the nature of the response to a nuclear accident on the territory of Ireland would be significantly different to the response to a nuclear accident abroad.

The nearest nuclear power plant from Ireland is over 200 km away in the United Kingdom. A severe nuclear accident at the closest nuclear power plant to Ireland would not require evacuation of any people in Ireland and iodine thyroid blocking would not be required to reduce exposure to radioactive iodine. If Ireland had a nuclear power plant on

172. Department of Transport (2022), "Marine Survey Office", www.gov.ie/en/organisation-information/111f0e-marine-survey-office-mso (accessed 23 Jan. 2023).
173. Irish Aviation Authority (n.d.), "Who we are", www.iaa.ie/who-we-are (accessed 23 Jan. 2023).
174. IAEA (2015), *supra* note 54, p. 13.
175. *Ibid.*, p. 45.
176. IAEA (2015), *Preparedness and Response for a Nuclear or Radiological Emergency*, IAEA Safety Standards, General Safety Requirements, No. GSR Part 7, IAEA, Vienna, pp. 13-14.

its territory, robust arrangements that are routinely exercised would need to be in place to implement these urgent protective actions in the aftermath of a nuclear accident at that plant. The off-site emergency planning zones and emergency planning distances around any nuclear power plant that would need to be established in accordance with IAEA GSR Part 7 are shown in Table 4.

Robust arrangements would need to be developed and exercised for notifying and communicating with affected people in the event of an emergency, providing them with information on how they can protect themselves and their families and the actions that need to be taken. Arrangements would also be required to protect emergency workers and helpers in a nuclear emergency and to manage the medical response for them and others affected by the emergency.

The development, implementation, co-ordination and exercising of these arrangement would cross over many government departments and agencies and each one of them would need to be sufficiently resourced to fulfil their EPR responsibilities.

Zones and distances	Arrangements required
Precautionary action zone (PAZ)	Arrangements shall be made for taking urgent protective actions and other response actions before any significant release of radioactive material occurs, to prevent deterministic effects.
Urgent protective action planning zone (UPZ)	Arrangements shall be made to initiate urgent protective actions and other response actions, if possible before any significant release of radioactive material occurs and after a release occurs, to reduce the risk of stochastic effects.
Extended planning distance (EPD)	Arrangements shall be made to conduct monitoring and assessment of the radiological situation offsite to identify areas where the risk of stochastic effects could be effectively reduced by taking protective actions and other response actions within a day to a week(s) following a significant radioactive release.
Ingestion and commodities planning distance (ICPD)	Arrangements shall be made to take response actions for protecting the food chain and water supply and protecting other commodities from contamination and for protecting the public from the ingestion of food, milk and drinking water and from the use of commodities with possible contamination following a significant radioactive release – this would apply to all of Ireland.

Table 4. Off-site emergency planning zones and distances around a nuclear power plant[177]

4.10 Radiological protection services

If Ireland decided to embark upon a nuclear power programme, there would be an increased demand for radiological protection services. The operator of the nuclear power plant would require the services of Radiation Protection Advisers who are approved by the EPA in accordance with IRR19 to develop and implement radiation safety procedures and support investigations into radiological incidents.

Staff working in any nuclear facilities would require personnel dosimetry. Dosimetry services are approved by the EPA under Article 78 of IRR19. At present there are six approved dosimetry services in Ireland, five of which are located outside the EU.[178] This situation would be inadequate if Ireland had nuclear facilities because of the time required to send dosimeters abroad for processing, especially if a worker had a radiation exposure that potentially exceeded statutory dose limits. If it were not commercially viable for private companies to establish personnel dosimetry services in Ireland, the government might need to establish a national service.

177. *Ibid.*, p. 30.
178. EPA (n.d.), "Approved Dosimetry Services", www.epa.ie/our-services/licensing/radiation/approved-dosimetry-services (accessed 23 Jan. 2023).

The EPA operates Ireland's only ISO 17025 instrument calibration service for radiological protection instruments such as survey meters, contamination monitors and electronic personal dosimeters. In 2021, 310 calibrations were undertaken.[179] If Ireland embarked upon a nuclear power programme, the number of radiological protection instruments would increase, and the EPA's instrument calibration service would need to expand to meet this demand to avoid the need for instruments to be sent abroad for calibration.

The EPA's Radiation Monitoring Laboratory is the only ISO 17025 accredited laboratory in Ireland for the measurement of radioactivity in food and other sample types. If Ireland embarked upon a nuclear power programme, increased measurement capacity would be required for an expanded routine monitoring programme and to have backup capacity that could be utilised in the event of a nuclear emergency.

4.11 Planning, procurement and financing

The Planning and Development Act 2000 (as amended) forms the legal framework for planning in Ireland and it is underpinned by planning and development regulations.[180] The Department of Housing, Local Government and Heritage is responsible for issuing national planning policy and guidance. Regional authorities are responsible for preparing regional planning guidelines and local authorities must ensure development plans adhere to national or regional spatial and economic policies.[181] Obtaining planning permission for large strategic infrastructure such as a nuclear power plant would be a lengthy and extremely challenging process involving pre-applications, EIAs, design studies, public consultation and oral hearings.[182]

The first step in any procurement project is the preparation of a specification for what is to be bought so that potential solutions can be reviewed against the specification. The same process applies when deciding which nuclear reactor would best suit the needs of a country embarking upon a new nuclear programme. One of the key factors in this decision would be the requirements and size of the national electricity grid. A small country like Ireland, where the peak electricity demand in 2020 was 5 357 MW,[183] may be more suited to an SMR. These reactors are typically less than 300 MW in output and they are manufactured and tested before being shipped for installation, which reduces construction times and costs.[184] A large number of SMR designs are being developed internationally, including transportable marine-based floating and seabed-based SMRs.

Financing the investment costs of a new nuclear power plant is extremely challenging and projects are sensitive to interest rate changes, delays in construction and lead times and political risks.[185] The new nuclear power plant being built at Hinkley Point C in Somerset in the United Kingdom is estimated to cost approximately GBP 26 billion.[186] The United Kingdom has faced challenges financing their new nuclear build programme, which has led to the cancellation of recent proposed projects such as Hitachi's project at Wylfa Newydd in Wales and Toshiba's project at Moorside in Cumbria because developers were required to finance construction. Construction can take 7 to 15 years and revenue is only

179. EPA (2022), *supra* note 146, p. 33.
180. Irish Statute Book (2000), Planning and Development Act, 2000 (No. 30 of 2000), available at: www.irishstatutebook.ie/eli/2000/act/30/enacted/en/html (accessed 23 Jan. 2023).
181. Office of the Planning Regulator (n.d.), Guide to the Planning Process, available at: www.opr.ie/wp-content/uploads/2020/06/The-OPRs-Guide-to-the-Planning-Process.pdf (accessed 23 Jan. 2023).
182. An Bord Pleanála (2021), Strategic Infrastructure Development, An Bord Pleanála, Dublin.
183. SEAI (2020), *Energy in Ireland 2020 Report*, available at: www.seai.ie/publications/Energy-in-Ireland-2020.pdf, p.14.
184. IAEA (2021), *Technology Roadmap for Small Modular Reactor Deployment*, Nuclear Energy Series No. NR-T-1.18, IAEA, Vienna, p. 2.
185. IAEA (2018), *Financing Nuclear Power in Evolving Electricity Markets*, IAEA, Vienna, p.1.
186. World Nuclear News (2022), "EDF revises Hinkley Point C schedule and costs", www.world-nuclear-news.org/Articles/EDF-revises-Hinkley-Point-C-schedule-and-costs (accessed 21 Jan 2023).

received when the station starts generating electricity. The United Kingdom has recently introduced a new financing model that aims to encourage a wider range of private investment and reduce the United Kingdom's reliance on overseas developers for financing new nuclear projects.[187] The UK's Nuclear Energy (Financing) Bill will use the Regulated Asset Base model, where consumers contribute to the cost of the project to fund future nuclear power plants.

Ireland has experience in procurement, financing and insurance of major capital projects, such as the new children's hospital that is being built in Dublin and represents "the most significant capital investment project in the healthcare system undertaken in Ireland".[188] However, procurement and financing of a new nuclear project would have additional complexities due to the scale and costs of the project. To attract investment in a project of this size, the Irish government would need to create a mix of incentives, government support and guarantees.[189] There are several financing models available for developing nuclear projects and a team of financial and legal experts would need to review these and recommend the best option to the Irish government. Legislation would then be required to give this funding a statutory basis.

4.12 Nuclear liability and insurance of nuclear risks

In the aftermath of a nuclear accident it is important that adequate compensation be provided in a timely manner to victims in the state where the nuclear installation is situated and victims in other states that are affected by the accident. If a state is a contracting party to a nuclear liability convention, this clarifies which law applies and the competent court, and facilitates the enforcement of judicial decisions.[190]

Unlike other aspects of nuclear safety in the EU, there is no harmonised approach to nuclear liability among the 27 member states; some countries are contracting parties to the Paris Convention, others to the Vienna Convention and some, such as Ireland, to no nuclear liability convention at all.[191] The main principles common to these international conventions include:

- exclusive liability of the operator (no one else is liable);
- absolute liability of the operator (victims need not prove fault or negligence);
- minimum liability amount borne by the operator (amount in national legislation shall not be less than the minimum amount provided by the international convention);
- obligation for the operator to have and maintain financial security (up to its liability amount to ensure availability of funds);
- obligation of the victims to file claims within a certain period;
- competent jurisdiction and enforcement of judgments (only one court should be competent, and judgments rendered by the competent court are enforceable in any contracting party); and

187. Department of Business, Energy and Industrial Strategy (2021), Press Release, "New finance model to cut cost of new nuclear power stations", (26 Oct. 2021), www.gov.uk/government/news/new-finance-model-to-cut-cost-of-new-nuclear-power-stations (accessed 23 Jan. 2023).
188. National Paediatric Hospital Development Board (NPHDB) (n.d.), "About NPHDB", www.newchildrenshospital.ie (accessed 23 Jan. 2023).
189. IAEA (2018), *supra* note 185, p. 6.
190. NEA (2014), "Progress Towards a Global Nuclear Liability Regime", *Nuclear Law Bulletin*, No. 93, OECD Publishing, Paris, pp. 9-23.
191. Kilb, W. (2010), *supra* note 9, p. 88.

- applicable law and equal treatment (the courts having jurisdiction will apply the relevant convention and their own national law, without any discrimination of victims based upon nationality, domicile or residence).[192]

If Ireland embarked upon a nuclear power programme, it should become a contracting party to one of the international nuclear liability conventions. Most countries in western Europe, including the United Kingdom, are contracting parties to the Paris Convention and the Brussels Supplementary Convention.[193] Regardless of which international nuclear liability convention Ireland ratified, Ireland would need to establish a national legal framework for a nuclear liability regime that reflects the principles and requirements of the international convention that has come into force in the country.

In most countries, the operator's nuclear liability is limited to a specified amount and only a few countries at present have provided for unlimited liability under their nuclear liability legislation, e.g. Finland (only for damage suffered within its territory), Germany, Japan and Switzerland.[194] Insurance plays a critical role in the civil nuclear industry and helps to provide greater financial certainty for those building, financing and operating new nuclear facilities.[195] Insurance is also important for covering third party nuclear liability. For nuclear liability, an insurance pool, which is a group of insurance companies jointly participating, is generally used because the risk requires an amount of insurance that could not be provided by a single insurer. In the United States, owners of nuclear power plants pay an annual premium of USD 450 million in private insurance for offsite liability for each reactor site (not per reactor) and this is supplemented in the event of a nuclear accident up to USD 131 per reactor plus a 5% surcharge.[196]

5. Conclusion

International nuclear law has developed since the 1950s with the expansion of nuclear power programmes and in response to nuclear incidents – particularly the accident at Chernobyl – as well as to concerns over the robustness of the security of nuclear installations and materials, leading to the development of the following legally-binding instruments:

- Convention on Nuclear Safety;
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;

192. NEA (2014), *supra* note 190.
193. World Nuclear Association (n.d.), "Liability for Nuclear Damage", https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/liability-for-nuclear-damage.aspx (accessed 23 Jan. 2023). See 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; 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).
194. NEA (2014), *supra* note 190, p. 14.
195. Reitsma, S. and M. Tetley (2022), "Insurance of Nuclear Risks", *Principles and Practices of International Nuclear Law*, OECD Publishing, Paris, pp. 445-465.
196. US Nuclear Regulatory Commission (n.d.), "Backgrounder on Nuclear Insurance and Disaster Relief", www.nrc.gov/reading-rm/doc-collections/fact-sheets/nuclear-insurance.html (accessed 23 Jan. 2023).

- Convention on the Physical Protection of Nuclear Material and its Amendment;
- Convention on Early Notification of a Nuclear Accident; and
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

The Chernobyl accident also led to reforms in the international conventions for third party liability for nuclear damage. Many non-nuclear states are contracting parties to these conventions and have implemented national laws and regulations to give effect to their provisions. States also have legal and institutional frameworks in place to balance the benefits and the risks of using ionising radiation and radioactive sources in medicine and industry to ensure that people and the environment are protected. Therefore, when a country embarks upon a nuclear power programme for the first time, it is not starting from a zero position and the legal and institutional changes required will depend on the gaps identified between existing frameworks and the nature of the planned programme.

The legislative framework for a nuclear power programme forms part of a state's general legal system and it covers many diverse areas such as environmental protection, industrial safety, land use planning, transport and electricity rate regulation.[197] Some of the legislation required for developing nuclear power may already be covered by other national laws and new legislation may not be specifically required.

In this article, the key legal and institutional challenges that Ireland would face in developing a nuclear power programme have been reviewed. In many cases these legal and institutional challenges are closely intertwined, as is the case with the establishment of the regulatory body. While every step of the process, from developing a national policy framework to licensing a nuclear power plant, will present challenges, there are specific aspects of developing a nuclear power programme that would be particularly difficult for Ireland. These are:

- gaining public acceptance and confidence in nuclear power;
- securing planning permission;
- financing the programme;
- recruiting skilled personnel;
- managing radioactive waste and spent fuel;
- expanding EPR arrangements; and
- implementing a nuclear liability regime.

These challenges, while significant, could be overcome through careful planning and the guidance and support of the IAEA, the NEA and neighbouring countries who already have nuclear power programmes.

197. Stoiber, C. (2003), *supra* note 5, p. 4.

The qualification of nuclear substances and nuclear liability

*by Elena de Boissieu**

Introduction

Organising transport of nuclear substances presents a number of challenges, including how to properly qualify the substances from a nuclear liability perspective. The nuclear liability conventions provide a generic definition of "nuclear substances" (referred to as "nuclear material" under certain conventions), which gives wide discretion to national legislation in its interpretation. Moreover, the nuclear liability conventions also exclude certain categories of nuclear substances, subject to specific conditions being met, to ensure that the risk associated with their transport may be dealt with under general tort law. The implementation or application of these exclusions is carried out by each concerned country in accordance with its domestic legislation, which may lead to discrepancies in the qualification of substances to be transported by different stakeholders.

A common understanding of the types of substances covered by the nuclear liability conventions is important to determine whether the specific nuclear liability regime established by such conventions or general tort law would apply in case of damage caused by an accident. The system established by the nuclear liability conventions is based on the following principles: strict liability (or liability without fault) of the operator of the nuclear installation; exclusive liability of the operator (i.e. the channelling principle); establishing a minimum amount of liability for the operator; limitation upon the operator's liability in time; and obligation on the operator to cover its liability by insurance or other financial security.

This system deviates from general tort law principles. Consequently, the proper qualification, from a nuclear liability perspective, of nuclear substances is particularly relevant in the context of international transport, during which several liability regimes, whether international or national, may apply to the same carriage. The lack of harmonisation in this area has a practical impact on the organisation of transport of nuclear substances: all carriages need to be covered by a relevant insurance or other financial security to cover liability for damage in case of an incident and therefore require a clear identification of which legal regimes apply to the substances being transported throughout the journey. A clear understanding of the process of qualification of nuclear substances based on the applicable legal regime(s) in countries through which an international transport will cross enhances the visibility of the requirements necessary to organise the appropriate insurance or financial security (either a compulsory nuclear liability insurance or a conventional financial security, when relevant).

This study will analyse definitions and exclusions provided in the nuclear liability conventions in an attempt to clarify what substances or material are covered by the special regime established in the conventions. The paper will also elaborate on the relevance of a

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common understanding, from a nuclear liability perspective, of the process of qualification of nuclear substances in the context of international transport and the challenges relating to the lack of harmonisation in this area. It will finally provide some tentative recommendations to address those challenges.

I. Definitions

A. Nuclear third party liability conventions

The scope of the nuclear liability conventions is delimited by the definitions of "nuclear installation", "nuclear reactor", "nuclear fuel" and "radioactive products or waste". The conventions apply to liability for "nuclear damage" caused by a "nuclear incident" occurring in a "nuclear installation" or involving "nuclear material" coming from, or originating in, such an installation. The definitions of these terms are therefore essential to correctly understand the scope of application of the conventions.

The nuclear liability conventions provide similar definitions of "nuclear substances" or "nuclear material" without entering into any specific technical description or providing technical criteria that the concerned substances or material shall meet to qualify as "nuclear substances" or "nuclear material" within the meaning of the conventions.

1. Paris Convention

Article 1(a)(iv) of the Paris Convention[1] provides the following definition of substances covered by the Convention:

> "Nuclear substances" means "nuclear fuel (other than natural uranium and other than depleted uranium) and radioactive products or waste".

Article 1(a)(iii) of the Convention further defines the term "nuclear fuel":

> "Nuclear fuel" means "fissionable material in the form of uranium metal, alloy, or chemical compound (including natural uranium), plutonium metal, alloy, or chemical compound, and such other fissionable material as the Steering Committee shall from time to time determine".

Finally, the following definition of "radioactive products or waste" is provided in Article 1(a)(iv) of the convention:

> "Radioactive products or waste" means "any radioactive material produced in or made radioactive by exposure to the radiation incidental to the process of producing or utilizing nuclear fuel, but does not include (1) nuclear fuel, or (2) radioisotopes outside a nuclear installation which have reached the final stage of fabrication so as to be usable for any industrial, commercial, agricultural, medical, scientific or educational purpose".

1. 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 on 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 (Paris Convention or PC).

2. IAEA conventions

Article I.1(h) of the Vienna Convention[2] defines material covered by the Convention as follows:

> "Nuclear material" means "(i) nuclear fuel, other than natural uranium and depleted uranium, capable of producing energy by a self-sustaining chain process of nuclear fission outside a nuclear reactor, either alone or in combination with some other material; and (ii) radioactive products or waste".

Article I.1(f) of the Vienna Convention defines the term "nuclear fuel" as follows:

> "Nuclear fuel" means "any material which is capable of producing energy by a self-sustaining chain process of nuclear fission".

As regards "radioactive products or waste", Article I.1(g) of the Vienna Convention provides the following definition:

> "Radioactive products or waste" means "any radioactive material produced in, or any material made radioactive by exposure to the radiation incidental to, the production or utilization of nuclear fuel, but does not include radioisotopes which have reached the final stage of fabrication so as to be usable for any scientific, medical, agricultural, commercial or industrial purpose".

The same definitions of "nuclear material", "nuclear fuel" and "radioactive products or waste" are provided in the 1997 Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (the "revised Vienna Convention")[3] and the Convention on Supplementary Compensation.[4]

It is worth mentioning that the definitions of "nuclear fuel" provided in all nuclear liability conventions, and the definitions of "nuclear material" and "nuclear reactor" provided in the IAEA conventions, explicitly refer to fission.[5] A closer look at those definitions leads to the following conclusions:

(i) The conventions narrow their scope of application by expressly excluding certain types of substances from the nuclear liability regime they establish. The reference is made here to natural and depleted uranium and radioisotopes outside a nuclear installation which have reached the final stage of fabrication. These exceptions, along with other exclusions that stem from the conventions, will be further analysed in Section II of this study;

2. Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force on 12 Nov. 1977 (Vienna Convention).
3. See Articles I.1(h), I.1(f) and I.1(g) of the Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997), IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force on 4 Oct. 2003 (1997 Protocol to Amend the Vienna Convention). For the purposes of this study, the "Vienna Conventions" will hereinafter refer to the Vienna Convention and the revised Vienna Convention jointly.
4. See Articles 1.1(a), 1.1(c) and 1.1(e) of the Annex to the Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force on 15 Apr. 2015 (CSC). For the purposes of this study, the term "IAEA Conventions" refers to the Vienna Convention, the revised Vienna Convention and the CSC.
5. In this regard, the Explanatory Texts of the 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage further explain that "In Article I.1(f) 'nuclear fuel' is more broadly defined as meaning 'any material which is capable of producing energy by a self-sustaining chain process of nuclear fission', but this broader definition does not apply to the transport of 'nuclear material' and, more generally, to all cases where the Convention refers to 'nuclear material' as defined in Article I.1(h)". 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.9, n. 20 (*Explanatory Texts*).

(ii) Apart from the exceptions and exclusions mentioned above, any fissionable material and any radioactive material produced in or made radioactive by exposure to the radiation incidental to the process of producing or utilising "nuclear fuel", are covered by the conventions;

(iii) Except for what is expressly provided in the conventions, there are no detailed technical descriptions, references or links to specific technical regulations or documents to define exactly what "radioactive products or waste" or "nuclear fuel" are. This matter is left to the discretion of national legislators and the competent courts, which may lead to discrepancies in the qualification of substances to be transported by different stakeholders.

B. Other sources

There is no single legal instrument that would address all relevant aspects of qualification of nuclear substances or material to be transported in a comprehensive manner. Instead, there is a patchwork of international treaties, regional legislation, regulations, standards, recommendations, etc. that may potentially overlap and even conflict. Those sources provide their own definitions of substances or material. These are only few examples:

1. Nuclear safety

- *IAEA Nuclear Safety and Security Glossary*

The *IAEA Nuclear Safety and Security Glossary*[6] does not employ the terms "radioactive products", "nuclear substances" or "nuclear material" used in the nuclear liability conventions. Instead, and depending on the context (i.e. scientific, legal or regulatory), it provides, among others, definitions of "nuclear fuel", "radioactive material" and "radioactive waste".[7]

> Nuclear fuel:[8] Fissionable *nuclear material* in the form of fabricated elements for loading into the reactor core of a civil nuclear power plant or *research reactor*.
>
> Radioactive material [from a regulatory perspective]: Material designated in national law or by a *regulatory body* as being subject to *regulatory control* because of its *radioactivity*.
>
> Radioactive waste [for legal and regulatory purposes]: […] material for which no further use is foreseen that contains, or is contaminated with, radionuclides at *activity concentrations* greater than *clearance levels* as established by the *regulatory body*.

The *Glossary* (p. 186) further specifies that "[…] in regulatory terminology in some States, radioactive material ceases to be radioactive material when it becomes radioactive waste; the term radioactive substance is used to cover both, that is radioactive substance includes radioactive material and radioactive waste". Finally, the *Glossary* emphasises the

6. IAEA (2022), *IAEA Nuclear Safety and Security Glossary: 2022 (Interim) Edition,* IAEA, Vienna.
7. *Ibid*., pp. 136, 169-70. The *Glossary* also provides the following definition of "radioactive substance" (from a scientific perspective): "The 'scientific' meaning of *radioactive* [] – as in ***radioactive substance*** – refers only to the presence of *radioactivity*, and gives no indication of the magnitude of the *hazard* involved. The term *radioactive substance* is also used to indicate that the 'scientific' meaning of radioactive […] is intended, rather than the 'regulatory' meaning of *radioactive* […] suggested by the term *radioactive material*." *Ibid*., p.169 (emphasis in original). It is worth mentioning that the same definitions of "radioactive material", "radioactive substance" and "radioactive waste" can be found in the 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, pp. 412-413 (IAEA GSR Part 3).
8. The *Glossary* also uses the term "spent fuel", defined as "*Nuclear fuel* removed from a reactor following irradiation that is no longer usable in its present form because of depletion of *fissile material*, *poison* buildup or *radiation* damage". *Ibid*., p. 203.

specificity of the definition of "radioactive material" provided in the IAEA *Regulations for the Safe Transport of Radioactive Material*, No. SSR-6 (Rev. 1)[9] that should be used within the framework of those regulations only.

- Joint Convention

The 1997 IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the "Joint Convention")[10] provides its own definitions of "radioactive waste" and "spent fuel". Article 2(h) of the Joint Convention defines the term "radioactive waste" as follows:

> "*radioactive waste*" means radioactive material in gaseous, liquid or solid form for which no further use is foreseen by the Contracting Party or by a natural or legal person whose decision is accepted by the Contracting Party, and which is controlled as radioactive waste by a regulatory body under the legislative and regulatory framework of the Contracting Party.

The Joint Convention also provides in its Article 2(n) a definition of "spent fuel":

> "*spent fuel*" means nuclear fuel that has been irradiated in and permanently removed from a reactor core.

- Council Directive 2011/70/EURATOM

The Council Directive 2011/70/EURATOM[11] provides definitions of "radioactive waste" and "spent fuel" that are similar to the ones provided in the Joint Convention:

> 'radioactive waste' means radioactive material in gaseous, liquid or solid form for which no further use is foreseen or considered by the Member State or by a legal or natural person whose decision is accepted by the Member State, and which is regulated as radioactive waste by a competent regulatory authority under the legislative and regulatory framework of the Member State.
>
> 'spent fuel' means nuclear fuel that has been irradiated in and permanently removed from a reactor core; spent fuel may either be considered as a usable resource that can be reprocessed or be destined for disposal if regarded as radioactive waste.

2. Nuclear transport

- IAEA *Regulations for the Safe Transport of Radioactive Material* SSR-6 (Rev.1)

The following definition of "radioactive material" is provided in paragraph 236 of the SSR-6 Regulations:

> *Radioactive material* shall mean any material containing radionuclides where both the activity concentration and the total activity in the *consignment* exceed the values specified in paras 402–407.[12]

9. *Ibid*., p.169; IAEA (2018), *Regulations for the Safe Transport of Radioactive Material*, IAEA Safety Standards Series, Specific Safety Requirements, No. SSR-6 (Rev. 1), IAEA, Vienna (SSR-6 Regulations).
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 on 18 June 2001 (Joint Convention).
11. 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, *Official Journal of the European Union* (OJ) L 199 (2 Aug. 2011), Art. 3, "Definitions", paras. 7 and 11 (Waste Directive).
12. SSR-6 Regulations, *supra* note 9, p. 11. The list of those radionuclides is provided in Section IV of SSR-6.

It is worth mentioning that a 2014 IAEA Board of Governors Resolution on "The Establishment of Maximum Limits for the Exclusion of Small Quantities of Nuclear Material from the Application of the Vienna Conventions on Nuclear Liability" [13] as well as the NEA's Decision of the Steering Committee for Nuclear Energy of 27 October 1977 on the Exclusion of Certain Kinds of Nuclear Substances (the "1977 NEA Steering Committee Decision")[14] and the 2016 Decision of the Steering Committee for Nuclear Energy on the Exclusion of Small Quantities of Nuclear Substances outside a Nuclear Installation from the Application of the Convention on Third Party Liability in the Field of Nuclear Energy [NEA/NE(2016)8/FINAL] (the "2016 NEA Steering Committee Decision")[15] expressly refer to the SSR-6 Regulations while determining the scope of the relevant exclusions. These exclusions will be further analysed in Section II.

- UN *Recommendations on the Transport of Dangerous Goods, Model Regulations*

The UN *Recommendations on the Transport of Dangerous Goods, Model Regulations* (the "Orange Book") provide the following definition of "radioactive material", which is very similar to the one used in the SSR-6 Regulations:

> *Radioactive material* means any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in 2.7.2.2.1 to 2.7.2.2.6 [of Chapter 2.7: Class 7 – Radioactive Material].[16]

- The International Maritime Dangerous Goods Code

The "International Maritime Dangerous Goods Code (IMDG Code)" issued under the auspices of the International Maritime Organization (IMO)[17] deals with maritime transport of dangerous goods and applies the same definition of "radioactive material" as the one provided in the Orange Book.

- Other instruments

Several other binding and non-binding instruments at the international and regional levels provide definitions and/or classification of substances or material to be transported: e.g. the European Agreement concerning the International Carriage of Dangerous Goods by Road,[18] the Convention concerning International Carriage by Rail and the Regulations concerning the

13. IAEA Doc. GOV/2014/63, adopted on 20 Nov. 2014. See also *infra* note 30.
14. An extract of this Decision is provided in NEA (1990), *Paris Convention: Decisions, Recommendations, Interpretations*, OECD Publishing, Paris, p. 7.
15. NEA Doc. NEA/NE(2016)8/FINAL, available at: www.oecd-nea.org/jcms/pl_20242/decision-on-the-exclusion-of-small-quantities-of-nuclear-substances-outside-a-nuclear-installation-from-the-application-of-the-convention-on-third-party-liability-in-the-field-of-nuclear-energy-nea/ne-2016-8/final (accessed 29 Dec. 2022). Pursuant to Article 1(b) of the Paris Convention, the Steering Committee for Nuclear Energy may, if in its view the small extent of the risks involved so warrants, exclude any "nuclear installation", "nuclear fuel" or "nuclear substances" from the application of the convention. The initial version of the Decision was adopted in 1964. It was subsequently revised in 1977, in 2007 and then in 2016.
16. United Nations (2021), *Recommendations on the Transport of Dangerous Goods, Model Regulations*, 22d revised edition, United Nations, New York, p. 135.
17. For more information, see IMO (n.d.), "The International Maritime Dangerous Goods (IMDG) Code", www.imo.org/en/OurWork/Safety/Pages/DangerousGoods-default.aspx (accessed 29 Dec. 2022). The 2022 edition of the IMDG Code (including Amendment 41-22) comes into force on 1 June 2023 and may be applied voluntarily as from 1 January 2023.
18. Entered into force 29 Jan. 1968 (ADR). For more information on the ADR, see United Nations Economic Commission for Europe (n.d.), "About the ADR", https://unece.org/about-adr (accessed 29 Dec. 2022).

International Carriage of Dangerous Goods by Rail,[19] Technical Instructions For The Safe Transport of Dangerous Goods by Air,[20] the International Air Transport Association (IATA) Dangerous Goods Regulations (DGR).[21] Finally, each country may implement those instruments into its national legislation according to its own legal system.

Based on the analysis of definitions provided in different sources mentioned above, the following conclusions can be drawn:

(i) There are similarities among definitions provided in several international and regional documents in the area of nuclear safety (e.g. the definitions of "radioactive waste" and "spent fuel" provided in the Joint Convention and the EU Directive 2011/70/Euratom; the definition of "radioactive waste" provided in the *IAEA Nuclear Safety and Security Glossary* [for regulatory purposes], the Joint Convention and the EU Directive 2011/70/Euratom);

(ii) A specific definition of "radioactive material" using the thresholds of the activity concentration and the total activity of material in the consignment is given in nuclear transport regulations (e.g. the SSR-6 Regulations, the Orange Book, IMDG Code). Moreover, a reference to the SSR-6 Regulations is expressly provided in certain instruments applied in the process of qualifying substances or material as being excluded from the nuclear liability conventions (i.e. the 2014 IAEA Board of Governors Resolution, and the 1977 and 2016 NEA Steering Committee Decisions);

(iii) With the exception of the SSR-6 Regulations, and based on the analysis of documents provided in this study, there is no link between the definitions of "radioactive products or waste", "nuclear substances" or "nuclear fuel" used in the nuclear liability conventions and the definitions provided in other instruments that may apply to nuclear safety or transport of relevant substances or material. This can lead to a discrepancy between the classification of material under the relevant technical regulations (e.g. as "exempted material") and their qualification as "nuclear substances" or "nuclear material" according to the applicable nuclear liability convention. Consequently, it may further complicate the process of providing an appropriate financial security to cover transport of relevant substances or material.

19. Regulations concerning the International Carriage of Dangerous Goods by Rail), Appendix C to the Convention concerning International Carriage by Rail (RID), with effect from 1 Jan. 2023. For more information on the RID, see Intergovernmental Organisation for International Carriage by Rail (n.d.), "RID 2023", https://otif.org/en/?page_id=1105 (accessed 29 Dec. 2022).
20. International Civil Aviation Organization (ICAO) (2022), *Technical Instructions For The Safe Transport of Dangerous Goods by Air, 2023-2024*, ICAO Doc. No. 9284. For more information on the ICAO Technical Instructions, see www.icao.int/safety/DangerousGoods/Pages/Doc9284-Technical-Instructions.aspx (accessed 29 Dec. 2022).
21. IATA (2022), *Dangerous Goods Regulations*, Edition 64 (effective 1 Jan. 2023) (DGR). For more information on the DGR, see IATA (n.d.), "Dangerous Goods", www.iata.org/en/programs/cargo/dgr (accessed 29 Dec. 2022).

II. Exclusions from the nuclear liability conventions

A. Exclusions common to all nuclear liability conventions

As mentioned in Section I of this study, the nuclear liability conventions expressly exclude from their scope of application certain types of nuclear substances or material. Other exclusions are allowed in certain legal instruments adopted under the auspices of the relevant conventions.

1. Natural and depleted uranium

Natural and depleted uranium are excluded from the definitions of "nuclear substances" or "nuclear material" provided in all nuclear liability conventions.[22] The reason behind this exclusion lies in the low level of radioactivity and the absence of criticality risks of natural or depleted uranium.[23]

The low level of risk as a ground for exclusion can in turn be explained by the rationale behind the establishment of the specific nuclear liability regime, which was designed to govern risks of an exceptional character for which common law rules and practice are not suitable. Consequently, "[w]henever risks, even those associated with nuclear activities, can properly be dealt with through existing legal processes, they are left outside the scope of the Convention."[24]

It is worth mentioning that, unlike the IAEA conventions, the Paris Convention expressly includes natural uranium in its definition of "nuclear fuel". Consequently, natural uranium used as fuel in certain types of reactors (e.g. the CANDU reactors) is covered by the Paris Convention.[25]

2. Radioisotopes outside a nuclear installation which have reached the final stage of fabrication

All nuclear liability conventions exclude radioisotopes which have reached the final stage of fabrication from their respective definitions of "radioactive products or waste". Except for certain slight differences in the relevant provisions (i.e. unlike the IAEA conventions, the Paris Convention specifies that radioisotopes shall be "outside a nuclear installation"

22. See Article 1(a)(v) of the Paris Convention ("nuclear substance"), Article I.1(h) of the Vienna Convention and the revised Vienna Convention, Article 1.1(c) of the CSC Annex ("nuclear material").
23. The *Exposé des Motifs* of the Paris Convention further specifies in its paragraph 18(f) that:
    > Factories for the manufacture or processing of natural or depleted uranium, facilities for the storage of natural or depleted uranium, and the transport of natural or depleted uranium are also excluded *since the level of radioactivity is low and there are no criticality risks*. Under Article 1(a)(v) of the Convention, natural uranium and depleted uranium are excluded from the definition of 'nuclear substances'. Installations where small amounts of fissionable materials are found, such as research laboratories, are likewise outside the Convention, and particle accelerators are also excluded. Finally, where materials such as uranium salts are used incidentally in various industrial activities not related to the nuclear industry, such usage does not bring the plant concerned within the scope of the Convention.

    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 (PC Exposé des Motifs) (emphasis added).
24. *Ibid*., para. 13.
25. With regard to depleted uranium, it is used in the mixed oxide (MOX) fuel blend, even though it is not used yet on its own as nuclear fuel. In this regard, paragraph 19 of the Exposé des motifs of the Paris Convention further specifies that "Depleted uranium means uranium which contains a smaller proportion of the isotope U-235 than is contained in natural uranium." *Ibid*., para. 19.

[26] and also provides that they can be usable for "educational purposes"), the conventions use the same language for this exclusion.[27]

However, applying those provisions in practice may be a challenge due to discrepancies in the interpretation of the term "final stage of fabrication" by different countries (e.g. do radioisotopes reach their final stage of fabrication as soon as they are usable for any intended purpose, or is the classification of the "final stage" independent of their potential use? What are the temporal effects of the exclusion, provided that radioisotopes usually undergo several successive transports throughout their lifecycle?). Moreover, difficulties in the interpretation of those provisions may also affect the organisation of an appropriate insurance cover and create uncertainty as to whether a specific transport of radioisotopes should be subject to the nuclear liability regime.

To remedy this situation, the Steering Committee for Nuclear Energy adopted a Recommendation clarifying that:

> radioisotopes reach the final stage of fabrication, under Article 1(a)(iv) of the Paris Convention, when they may be used for any industrial, commercial, agricultural, medical, scientific or educational purpose. The radioisotopes which have reached the final stage of fabrication are excluded from the scope of application of the Paris Convention and shall not be made subject to it at a later stage.[28]

However, it is important to note that this instrument is not binding on the Contracting Parties to the Paris Convention.

3. Small quantities of nuclear substances or material outside a nuclear installation

All nuclear liability conventions allow the exclusion of small quantities of nuclear substances or material from their scope of application. Indeed, it was recognised that within certain defined limits, nuclear substances in use outside a nuclear installation should be excluded from the application of the conventions, given the small extent of risk involved.

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26. Art. 1(a)(iv) of the Paris Convention. In this regard, and concerning the IAEA conventions, footnote 24 to the *Explanatory Texts*, *supra* note 5, p. 9, further specifies that
> The definition of "nuclear material", which is relevant for nuclear incidents occurring in the course of transport under Article II.1(b) of the Convention, clearly excludes the operator's liability for damage caused by transport incidents involving "radioisotopes which have reached the final stage of fabrication so as to be usable for any scientific, medical, agricultural, commercial or industrial purpose". As for damage caused by an emission of radiation involving such radioisotopes when within a "nuclear installation", as defined, the definition of "nuclear damage" referred to above only covers damage caused by a source of radiation other than "nuclear fuel" or "radioactive products or waste", as defined, if the law of the Installation State so provides. In the absence of such a determination by the law of the Installation State, damage caused by such a source of radiation within a nuclear installation is to be considered as conventional damage: as such it is only covered, under Article IV.4 of the Convention, if it occurs together with "nuclear damage" caused by a "nuclear incident" and if it is not reasonably separable therefrom. As is pointed out in Section 2.3 of these explanatory texts, the 1997 Protocol amends the Vienna Convention in order to include damage caused by any other source of radiation within a nuclear installation, irrespective of a determination to this effect by the law of the Installation State.
27. Compare Article 1(a)(iv) of the Paris Convention, Article of I.1(g) of the Vienna Convention and the revised Vienna Convention, and Article 1.1(e) of the CSC Annex.
28. 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, adopted on 5 March 2020, p. 2 (the 2018 NEA Steering Committee Recommendation), available at: www.oecd-nea.org/jcms/pl_24762/definition-of-radioisotopes-which-have-reached-the-final-stage-of-fabrication-nea/ne-2018-3/final (accessed 29 Dec. 2022).

This possibility is expressly provided in Article I.2 of the Vienna Conventions and Article 1.2(b) of the CSC Annex, with the technical criteria being set out in the 2014 IAEA Board of Governors Resolution. As regards the Paris Convention, the Steering Committee for Nuclear Energy adopted a similar instrument in the 2016 NEA Steering Committee Decision, which, unlike the 2014 IAEA Board of Governors Resolution, is binding on all Contracting Parties to the Paris Convention. The criteria for the exclusion are established by reference to the SSR-6 Regulations.

Specifically, the 2014 IAEA Board of Governors Resolution provides that:

> Nuclear material which is consigned by an operator to a recipient for use may be excluded from the application of the Vienna conventions on nuclear liability for the period it is outside a nuclear installation, provided that the consignment, when leaving a nuclear installation, complies with the provisions set forth in the Annex hereto and with the other relevant requirements of the Transport Regulations. [29]

The 2016 NEA Steering Committee Decision mirrors those provisions by stating:

> Nuclear substances which are consigned by an operator to a recipient for use shall be excluded from the application of the Paris Convention for the period during which they are outside a nuclear installation provided that the consignment, when leaving a nuclear installation, complies with the provisions set forth in the Annex to this Decision and with other relevant requirements of the Regulations for the Safe Transport of Radioactive Material of the International Atomic Energy Agency. [30]

It is worth mentioning that there is no common understanding regarding the meaning of the term "for use" provided in the above instruments. One may consider that these instruments do not apply to radioactive waste, as "waste" is usually regarded as material for which no further use is foreseen.[31] Consequently, different countries may interpret this term according to their own national legislation, which may not allow the application of the exclusion to radioactive waste.

B. Exclusion specific to the Paris Convention: Certain kinds of nuclear substances

In 1977, the Steering Committee for Nuclear Energy adopted a Decision on the Exclusion of Certain Kinds of Nuclear Substances.[32] This decision intends to exclude substances consisting substantially of uranium, which, for all practical purposes, present no greater risk than natural uranium, from being considered nuclear substances for the purposes of the Paris Convention, subject to certain conditions and criteria described in the decision being met. More specifically, the Steering Committee agreed that the limits for residual contamination should be set so that any uranium excluded would: (i) meet the appropriate contamination limits specified in the current fuel reprocessing specifications; and (ii) be acceptable for transport as "low specific activity material" as defined in paragraph 121 of the 1973 edition of the IAEA Transport Regulations.[33] Moreover, it was also agreed that it was technically acceptable to treat (for the purposes of the Paris Convention) all uranium,

29. IAEA Doc. GOV/2014/63, *supra* note 14, p. 2, para. 1(a). The initial version of the Resolution was adopted in 1964, and further revised in 1978, 2007 and 2014.
30. NEA Doc. NEA/NE(2016)8/FINAL, *supra* note 16, p. 2, para. 1. See references in *supra* notes 15 and 16.
31. The *IAEA Nuclear Safety and Security Glossary*, *supra* note 6, p. 225, defines waste as "Material for which no further use is foreseen." For other definitions of "radioactive waste", see Section I of this study.
32. See NEA (1990), *Paris Convention: Decisions, Recommendations, Interpretations*, *supra* note 15, p. 7.
33. IAEA (1973), *Regulations for the Safe Transport of Radioactive Materials – 1973 Revised Version*, IAEA Safety Standards, Safety Series, No. 6, IAEA, Vienna, p. 5. These regulations have been revised several times since 1973. The latest revision was made in 2018. See SSR-6 Regulations, *supra* note 9.

including reprocessed uranium, having a uranium-235 content not exceeding 1%, in a similar manner to natural uranium.

Unlike the Paris Convention, the IAEA conventions do not provide for the possibility to exclude certain kinds of "nuclear material".

In light of the preceding, the following can be concluded regarding the exclusions of substances or material from the nuclear liability conventions:

(i) All nuclear liability conventions exclude from their scope of application certain categories of nuclear substances or material due to their low level of risks (e.g. natural or depleted uranium, radioisotopes which have reached their final stage of fabrication, small quantities of nuclear substances or material outside a nuclear installation);

(ii) Application of those exclusions in practice may be a challenge due to the differences in the interpretation of certain terms provided in the relevant exclusions (e.g. the term "final stage of fabrication" for radioisotopes; the term "for use" regarding the small quantities exclusion);

(iii) The non-binding character of certain instruments governing the exclusions (e.g. the 2004 IAEA Board of Governors Resolution, the 2018 NEA Steering Committee Recommendation) contributes to creating a patchwork in their implementation and application by different stakeholders in different countries. However, the implementation of binding instruments is also dependent on the specificities of the national legal system of each concerned country and is therefore left to the discretion of its legislators and competent courts;

(iv) There is no complete consistency between the exclusions applicable according to different nuclear liability conventions (e.g. the exclusion of certain kinds of nuclear substances is applicable to the Contracting Parties to the Paris Convention only). This may further exacerbate the organisation of transboundary movement of nuclear substances or material and impact the preparation of an appropriate insurance cover.

III. Practical challenges

An accurate qualification, from the nuclear liability perspective, of substances or material being transported is paramount to the proper organisation of their carriage. Depending on the qualification, the specific nuclear liability regime or general tort law would apply to the consequences of an accident during transport.

On one hand, nuclear liability insurance is required for substances qualified as "nuclear substances" or "nuclear material" under the nuclear liability conventions. It plays a key part in terms of covering risks of transport. On the other hand, transport of material not covered by the specific nuclear liability regime triggers the application of different rules regarding their insurance, if any, depending on the applicable national legislation. All those requirements and rules need to be taken into account while organising the carriage.

As mentioned in Section I of this study, definitions of "nuclear substances" or "nuclear material" provided in the nuclear liability conventions are broad and not linked to the relevant technical regulations that may apply to each specific transport. This situation is partially remedied by certain exclusions from the conventions, which expressly refer to specific technical criteria provided in the IAEA transport regulations (e.g. the exclusion of small quantities of nuclear substances or material provided under all nuclear liability conventions and the exclusion of certain kinds of nuclear substances provided under the Paris Convention).

As highlighted above, the implementation or application of those exclusions is left to the national legislation and the competent courts of each concerned country. As a result, there may be discrepancies in the qualification of substances or material being transported even between the countries party to the same nuclear liability convention. A lack of treaty

relations between countries and the territories that the transport may cross add an additional layer of complexity to the organisation of the carriage. Moreover, the organisation of transport is also affected by potential changes in the qualification of substances or material throughout their lifecycle (e.g. radioisotopes which have reached their final stage of fabrication) and by the application of a patchwork of regulatory regimes that may or may not allow for the exemption of the same substances from the nuclear liability regime.

The lack of detailed definitions and the absence of a common understanding and harmonised application of concepts used in the nuclear liability conventions leave significant room for interpretation and contribute to creating legal uncertainty, which may result in errors in the qualification of substances or material being transported and lead to delays or cancellation of transport, with all the consequences that this may entail, including financial loss. Moreover, differences in the qualification of substances or material being transported heavily affect the organisation of an appropriate financial cover for their transboundary movement.

IV. Recommendations

In light of the preceding, there is a clear need to achieve a common understanding of which nuclear substances are covered by, or excluded from, the nuclear liability conventions and the applicable national nuclear liability regimes.

The process of qualification of nuclear substances or material can be facilitated by clarifying the interpretation of key definitions and terms provided in the nuclear liability conventions in order to achieve a certain harmonisation of the national legislations and regulations. This can be done, for example, via adoption of recommendations or interpretations for the Paris Convention[34] or similar instruments for the IAEA conventions. In addition, the language of such instruments adopted under the auspices of different nuclear liability conventions should be harmonised to the extent possible to avoid any discrepancies in their implementation and application to transboundary movements of nuclear substances or material.

The current instruments governing the exclusions under the nuclear liability conventions may need to be revised or further clarified to reduce the risk of inconsistency in their practical application (e.g. the clarification of the term "for use" in the exclusion of small quantities; the clarification of the term "final stage of fabrication" regarding the exclusion of radioisotopes for the IAEA Conventions; the need to update the reference to obsolete technical criteria provided in the 1977 NEA Steering Committee Decision). Moreover, countries party to the same nuclear liability conventions should be encouraged to apply those exclusions in the same manner.

It would be beneficial if the results of the qualification of substances or material made according to the applicable nuclear liability regime and the classification of the same substances or material according to the relevant technical regulations match. This would help to avoid a situation in which a specific transport of substances or material is considered as being exempted based on the applicable technical regulations, but remains subject to the nuclear liability regime, including the requirements to have and maintain a compulsory financial security. To achieve this, a risk-based approach in the qualification already used in certain exclusions from the nuclear liability conventions may be considered (e.g. application of thresholds provided in the SSR-6 Regulations, below which substances or material should not fall within the scope of application of the relevant nuclear liability regime because of the

34. Since the entry into force of the Paris Convention, various decisions, recommendations and interpretations have been adopted, either by the OECD Council or by the Steering Committee for Nuclear Energy, to further specify the scope of application of the convention or assist the contracting parties and the public in general in its implementation. For more information, see NEA (n.d.), "Paris Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention or PC)", www.oecd-nea.org/jcms/pl_20196/paris-convention-on-third-party-liability-in-the-field-of-nuclear-energy-paris-convention-or-pc (accessed 29 Dec. 2022).

low level of risk they present). There are limits to this approach, as national legal and regulatory frameworks vary significantly, especially regarding classification of certain material (e.g. radioactive waste) and implementation of different technical regulations. However, development of international guidelines providing a harmonised legal and technical framework for the qualification of all categories of nuclear substances or material can only be encouraged.

To avoid a situation in which the same substances or material are qualified differently based on the applicable legislation of each transit country (which may, in turn, affect the availability of an appropriate financial security cover), countries should be encouraged to adopt in their national legislation the principle according to which the qualification, once done (e.g. by the sending operator), should be recognised throughout the whole itinerary.

Finally, there is a real need to raise and increase awareness among all the stakeholders involved in international transport and transit of nuclear substances or material of the application of the nuclear liability conventions and national nuclear liability regimes, including the exclusions that apply to nuclear transport. Moreover, co-ordination and communication among the different stakeholders involved in the organisation of such transport, and especially among nuclear operators, financial security providers and the relevant public authorities, are key to ensuring that the substances or material to be transported are properly qualified and insured. Such steps would facilitate the understanding of the applicable qualification process in the different countries that the international carriage may cross, and would improve visibility on the relevant financial security and insurance requirements.

CASE LAW

Canada

Citizens Against Radioactive Neighbourhoods (CARN) v. BWXT Nuclear Energy Canada Inc.

On 9 June 2022, the Federal Court of Canada released a decision dismissing a judicial review application brought by a community-based organisation to challenge a licensing decision of the Canadian Nuclear Safety Commission.[1] The applicant, CARN, had argued that the Commission's decision to renew BWXT Nuclear Energy Canada Inc.'s licence to operate two nuclear fuel fabrication facilities in Toronto and Peterborough, Ontario, was unlawful and unreasonable.

Background

CARN is an unincorporated non-profit organisation based in Peterborough, Ontario. It was established in spring 2019 in response to BWXT's intention to apply to the Commission for a ten-year licence renewal which would include seeking authorisation to produce uranium dioxide fuel pellets at the Peterborough facility.

BWXT owns and operates the two nuclear fuel manufacturing facilities in Toronto and Peterborough. Both facilities are, under the Nuclear Safety and Control Act and its Class I Nuclear Facilities Regulations, defined as "Class IB nuclear facilities".[2] Prior to 2016, these facilities were operated by GE-Hitachi Nuclear Energy Canada Inc. The Commission transferred the operating licence for these facilities to BWXT following its acquisition of that company in 2016.

On 2 November 2018, BWXT applied for a ten-year renewal of its operating licence for the two Class IB facilities. It sought authorisation to conduct "pelleting operations", previously authorised only at the Toronto facility, at the Peterborough facility, for potential future business reasons. Pelleting operations consist of the production of natural and depleted uranium dioxide (UO_2) pellets, which are then used together with zircalloy tubes to assemble fuel bundles for nuclear power reactors. The Peterborough facility is in a residential area of downtown Peterborough and is adjacent to an elementary school.

The Commission decision

In March 2020, the Commission held a five-day public hearing to consider BWXT's application. Over two days in Toronto and three days in Peterborough, it heard from BWXT, from its own staff and from 248 intervenors, including CARN.

1. Citizens Against Radioactive Neighbourhoods (CARN) v. BWXT Nuclear Energy Canada Inc., 2022 FC 849 (June 2022).
2. Nuclear Safety and Control Act, S.C. 1997, c.9 (NSCA). Class I Nuclear Facilities Regulations, SOR/2000-204.

In its decision dated 18 December 2020,[3] the Commission renewed the licence for a period of ten years pursuant to section 24 of the *NSCA* and severed the single licence into two facility-specific licences for the Toronto and Peterborough facilities. The renewed facility-specific licences were validated from 1 January 2021 until 31 December 2030.

By majority decision, the Commission authorised commercial fuel pellet production by BWXT at the Peterborough facility, subject to three licence conditions, the first two commonly termed "hold points":

- Licence Condition 15.1 required BWXT to submit and implement an updated environmental monitoring programme at the Peterborough facility prior to the commencement of fuel pellet production;[4]
- Licence Condition 15.2 required BWXT to submit a final commissioning report related to production of fuel pellets that is acceptable to the Commission, prior to the commencement of commercial fuel pellet production at the Peterborough facility;[5] and
- Licence Condition 15.3 stipulated that fuel pellet production could be conducted at either the Toronto facility or at the Peterborough facility, but not at both facilities.[6]

The minority Commission decision (dissent) would not have authorised fuel pellet production at the Peterborough facility. The Commission majority was satisfied that pelleting operations would be adequately safe at either location, since the public effective dose, the air uranium dioxide releases and the effluent uranium dioxide releases would remain well below regulatory and licence limits. The majority found that BWXT was "entitled to determine how best to conduct its business, and that the Commission's role is to ensure it does so safely in accordance with the NSCA and related regulations".[7] The minority, on the other hand, was of the view that even if the safety case were met for either location, the "question is not whether pelleting is safe in Peterborough, but rather, at what location is it 'safer' to pellet".[8]

The minority was satisfied that the matter had to be viewed through the "As Low As Reasonably Achievable" (ALARA) principle, the justification principle, the precautionary principle and considering the relative risk of pelleting operations at either location. Through these lenses, the minority would not have authorised pelleting at the Peterborough facility; the proximity of the elementary school and the concerns of residents were predominant factors for not allowing pelleting in Peterborough. The minority found:

> […] BWXT has not provided justification that would override the need to protect the more vulnerable population of Peterborough, and that it is therefore more justifiable to conduct pelleting in Toronto than in Peterborough.[9]

3. BWXT Nuclear Energy Canada Inc., Record of Decision, DEC 20-H2 (18 Dec. 2020).
4. *Ibid.*, para. 470. Condition 15.1 states: "The licensee shall submit and implement an updated environmental monitoring program at the Peterborough facility prior to the commencement of production of fuel pellets as described in paragraph (i) (a) and (iii) of Part IV of this licence."
5. *Ibid.*, para. 471. Condition 15.2 states: "The licensee shall submit a final commissioning report related to production of fuel pellets as described in paragraph (i)(a), (iii) of Part IV of this licence that is acceptable to the Commission prior to commencement of commercial production of fuel pellets at the Peterborough facility."
6. *Ibid.*, para. 472. Condition 15.3 states: "The commercial production of fuel pellets shall be conducted at either the Toronto facility or at the Peterborough facility, but not at both facilities."
7. *Ibid.*, para. 449.
8. *Ibid.*, para. 443.
9. *Ibid.*, para. 450.

Respecting the "precautionary principle", the minority reasoned that:

> […] even if it would be difficult to argue that there is potential for "serious or irreversible damages" with moving the pelleting operations, adding radiation doses and UO2 air and effluent emissions in a site which has an adjacent vulnerable population, is not acting in an abundance of precaution.[10]

The Commission majority was of the view that:

> […] the very low levels of environmental releases and doses to the public would not have an impact on the health of persons and the environment, in accordance with subsection 24(4) of the NSCA. It is the licensee which has the responsibility to assess and document the rationale for its proposal, and the Commission is satisfied that BWXT will comply with the ALARA principle and aim at minimizing doses at either location. In addition, the majority is of the view that there is no reasonable basis on which to deny the request for flexibility to be built into the licence, which is conditional on further confirmation of these low levels via a final commissioning report and an updated safety analysis, should BWXT opt to transfer its pelleting operations.[11]

The Commission reasoned as follows with respect to the adequate protection of the health and safety of persons and "relative risk" of pelleting operations at either facility:

> […] the transfer of the pelleting operations would increase the environmental emissions of UO2 in air and water and the resulting dose to the public in Peterborough. However, it is the view of the majority that these doses would be so negligible that they would have no health and safety impact to persons and the environment, including to the most vulnerable population such as the students at the Prince of Wales Public School. Releases would be a very small fraction of the regulatory limits.[12]

The decision of the Federal Court of Canada on the judicial review application

Justice Mosley on behalf of the Federal Court began the judgment and reasoning in this matter as follows:

> This is a case where community interests are in conflict with those of a business subject to a regulatory regime designed to protect the public. The question before the Court is whether the regulatory body responsible for administering the regime failed to discharge its duties properly in rendering a decision about the operations of the company. The test the Court must apply is not whether the Court agrees with the decision but whether it met the legal standard of reasonableness.[13]

The Court concluded that the decision was lawful and reasonable, and dismissed the application seeking to have the licence decision quashed. There were four major issues in the application that the Court addressed:

- the appropriate standard of review, or level of deference to be given to the decision-maker;
- the sufficiency of the licence renewal application materials and information provided for hearing;
- the legality of the use of "hold point" licence conditions; and
- how the principles of ALARA, justification and precaution fit within the statutory scheme of the NSCA and domestic law, to assess the legality of the Commission majority decision.

10. *Ibid.*, para. 451.
11. *Ibid.*, para. 447.
12. *Ibid.*, para. 448.
13. CARN v. BWXT Nuclear Energy Canada Inc., *supra* note 1, para 1.

- Standard of review:

The parties before the Court agreed that the appropriate standard through which the Court ought to review the Commission decision was *reasonableness*. The Court explained this standard as follows:

> A reasonable decision is "based on an internally coherent and rational chain of analysis" and is "justified in relation to the facts and law that constrain the decision maker". It must encompass the characteristics of a reasonable decision, namely, justification, transparency and intelligibility. The reviewing court must adopt a deferential approach and intervene only "where it is truly necessary to do so in order to safeguard the legality, rationality and fairness of the administrative process".[14]

The Court cited as "directly relevant to the case at bar", the following guidance of the Federal Court of Appeal in a 2016 decision respecting the review of another CNSC decision:

> Where, as here, the issues at play involve detailed factual findings and discretionary decisions within the heartland of the tribunal's expertise, the reasonableness standard requires that considerable deference be given to the tribunal's determinations. *This is particularly so when the issues under review concern nuclear safety and the tribunal is the nuclear safety regulator*. In short, the CNSC is much better placed than a reviewing court to factually assess and determine what types of possible accidents are likely to occur at a nuclear power plant and how to conduct the assessment of the environmental impacts of potential accidents. It is therefore inappropriate for a reviewing court to second-guess these determinations through a detailed re-examination of the evidence as the appellants would have us do in the instant case.[15]

- Sufficiency of the licence application material

In its judicial review application, CARN argued that BWXT's licence application lacked information that was required by the statute and the applicable regulations, violating the statutory scheme and resulting in an unreasonable decision on the part of the Commission. CARN submitted that since this alleged lack of sufficient information failed to satisfy the statutory and regulatory information requirements, the Commission therefore had no authority to license the activities.

The Court was not persuaded by this submission, finding that the sufficiency of an application received by the CNSC under the NSCA and its regulations was:

> […] *a subjective standard left to the Commission to enforce, as the Regulations provide broad, general standards, and terms defined without scientific precision.* These broadly defined standards leave room for the Commission's judgment. It is worth noting that the Commission itself wrote the *Class I Regulations … Calibration of the precise level of specificity required by these broad terms is a matter Parliament left for the Commission, not for the Applicant or the Court.*[16]

The Court was satisfied that there was no reviewable error respecting this issue.

- "Hold point" licence conditions

In its challenge to the Commission's decision, CARN argued that the licence conditions 15.1 and 15.2 imposed by the Commission unlawfully deferred key elements of the Commission's decision making and relieved the licensee of mandatory licence application requirements. The conditions require that, before commencing pelleting operations in the Peterborough facility, the licensee must first provide updated information to be verified.

14. *Ibid.*, para. 41 (citations omitted).
15. Greenpeace Canada v. Canada (Attorney General), 2016 FCA 114, para. 60 (emphasis added).
16. CARN v. BWXT Nuclear Energy Canada Inc., *supra* note 1, para. 73 (emphasis added).

From the perspective of CARN, this is information that the Commission must have for evaluation before being in a position to authorise any activity. For its part, the respondent, BWXT, noted that the imposition of hold points was not an unusual practice for the Commission, and forward-looking hold points existed in many CNSC licences and remain an important part of ongoing regulatory oversight.

The Court noted that the NSCA confers a broad discretion on the Commission respecting the power to impose licence conditions. Subsection 24(5) of the NSCA provides that:

> A licence may contain any term or condition that the Commission considers necessary for the purposes of this Act, including a condition that the applicant provide a financial guarantee in a form that is acceptable to the Commission.

Finding this wording to reflect Parliament's intention that the Commission have flexibility in its interpretation of its enabling authority, the Court found the Commission's imposition of "hold point" licence conditions to be a valid exercise of its discretionary power:

> This is but one of the several "broad powers" the legislature has conferred on the Commission with regard to granting licences, pursuant to ss 24 and 25 of the NSCA.… Thus, the intention was that the Commission is to have significant leeway in interpreting the meaning of s 24(5) of the *NSCA*.
>
> [59] The broad and open language of s 24(5) is, in the Court's view, a complete response to the question of whether the license conditions were lawful, as the enactment provides the Commission with statutory authority to issue licence conditions in the form of hold points that must be satisfied prospectively. The attachment of conditions in the form of hold points is not a deferral of a decision, but rather an integral part of the decision that the Commission made. Thus, the Commission's decision was fully compliant with its enabling statute.[17]

The Court was also satisfied that there was no reviewable error on the part of the Commission in requiring additional information from a licensee in the future. The Court noted that "[c]hanges to a licensed facility or activity are expected. The Commission's authority to attach any condition it considers necessary would have little or no purpose if licence applications must fully account for every contingency during the licence period."[18]

- The principles of ALARA, justification and precaution: Customary international law and the NSCA

It is in relation to these issues – the issues in respect of which there was disagreement between the Commission members deciding the matter – that the Court's analysis in this case is most instructive. The reasoning of the Court turns on how international law is made into domestic law in Canada, and also reflects a focus on what Parliament has specifically tasked the Commission with doing – preventing unreasonable risk and implementing Canada's international obligations when discharging its regulatory function under the NSCA.

CARN submitted that the Commission exercised its statutory discretion unreasonably in light of three principles: (i) the ALARA principle; (ii) the justification principle; and (iii) the precautionary principle. These principles, CARN argued, have been entrenched in international law, and sections 3, 9 and 24(4) of the *NSCA* required that they be applied by the Commission.

With respect to the ALARA principle, the Court found that the Commission "did not unreasonably fail to implement the ALARA principle as there was no obligation for it to do so in its decision. The Commission properly found that the Respondent complied with the ALARA principle by monitoring radiation doses, implementing "action levels" and establishing an ALARA Committee."[19] The Court was satisfied that "[n]one of the regulations or regulatory documents cited by the Applicant create an obligation for the Commission's

17. *Ibid.*, paras. 58-59 (citation omitted).
18. *Ibid.*, para. 78.
19. *Ibid.*, para. 95.

decisions to comply with the ALARA principle, nor for its decisions to take into account social considerations in applying that principle."[20]

With respect to justification, it is important to note that, according to the applicant, CARN, the justification principle dictates that the Commission could not authorise pelleting operations in the Peterborough facility without finding that the advantage or benefit posed by exposure to additional levels of ionising radiation outweighed any risks. The Court rejected this reasoning, accepting the argument of the respondent BWXT that in Canada, under the NSCA, justification is a matter of "preventing unreasonable risk" under sections 3, 9 and 24 of the Act. Importantly, the Court found:

> In its response to the International Atomic Energy Agency declining its request to expressly incorporate the justification principle, the Commission noted that its licensing process "embodies" the justification principle of international law; however, it drew a distinction between the exercise of justification under s 24(4) of the *NSCA*, which requires that decisions be justified on the basis that there is no unreasonable risk, and the justification principle as understood under international law, which requires an assessment of whether the benefits outweigh the harm. Therefore, it cannot be said that the justification principle, as understood under international law, is believed to amount to a legal obligation in Canada. As such, it does not satisfy the criterion of *opinio juris* and does not constitute a norm of customary international law.[21]

As a result, the Commission's determination that the licensee would adequately provide for the protection of the health and safety of persons, the protection of the environment, national security and Canada's international obligations, satisfied the test for preventing unreasonable risk under the NSCA.

With respect to the application of the precautionary principle, the Court was satisfied that it was not engaged here, since there was, as had been established to the satisfaction of all of the Commission members, no potential for serious or irreversible damages:

> The Court agrees with the Respondent that […] the precautionary principle was not engaged in this instance. The Commission majority expressly found that "there would not be serious or irreversible damages" resulting from the transfer of pelleting operations to Peterborough. The dissenting Commission Member conceded "it would be difficult to argue that there is potential for 'serious or irreversible damages' with moving the pelleting operations". *The test is not, as the dissenting Member suggested, that the principle was breached because the transfer to Peterborough would not amount to "acting in an abundance of caution"*. Thus it was reasonable for the Commission majority to determine that the precautionary principle was not engaged.[22]

In its conclusion, the Court noted, in relation to the local concerns and societal considerations that were engaged in this matter, that while "[r]easonable people can disagree about whether expanding an industrial operation involving nuclear materials in a residential district and adjacent to a primary school is wise", the technical evidence was clear and the Commission majority had acted reasonably and in accordance with the NSCA.[23] The Court found that while it "may consider that the wisdom of expanding an industrial operation involving nuclear materials in the immediate vicinity of a primary school is dubious, that is not the question before it to determine."[24] In applying a standard of review of reasonableness, the Court was satisfied that the Commission majority decision was reasonable, and did not suffer from any error that would justify quashing the decision.

20. *Ibid.*, para. 93.
21. *Ibid.*, para. 99.
22. *Ibid.*, para. 102 (emphasis added).
23. *Ibid.*, para. 103.
24. *Ibid.*

- Significance

There are several ways in which this decision may be considered instructive, from the perspective of the interpretation of the NSCA as well as the interpretation of the scope of the Commission's discretion under its enabling statute. First, it is of note that in 2022, the Commission continues to receive deference from reviewing courts on its factual findings, its interpretation of its authorities under the NSCA and its discretionary exercise of those authorities, so long as Commission decisions are both within the scope of the Commission's statutory mandate and expertise in nuclear safety, as well as being fully explained and justified with reasons that are intelligible and clear.

This extends to the Court's recognition of a certain "flexibility" that the Commission has to interpret its enabling statute and its own regulations. This flexibility that Parliament intended means that "hold point" licence conditions imposed by the Commission are well within its statutory power under section 24 of the NSCA. In this respect, the Court recognised the reasonableness of imposing prospective requirements under a licence, as a function of regulatory oversight over time and in light of changes that would be likely over time.

Importantly, the Court in this matter found that neither the "prevention of unreasonable risk" under the NSCA nor the ALARA principle would require a specific analysis in this case that "benefits must outweigh harm". One may conclude that Parliament, in enacting the NSCA, has expressed the policy determination that nuclear activities are justified in Canada, and that it falls to the CNSC, in regulating those activities, to ensure they are done safely. The NSCA may be seen as the manifestation of a general policy decision that the benefits of nuclear can outweigh its risks and are justified, so long as the CNSC performs its regulatory oversight to prevent risks that would be unreasonable. Were it otherwise, if the benefits of nuclear activities did not outweigh their risks, the statutory scheme would be one of prohibition, not of regulation and risk minimisation.

Finally, the decision is also an important reminder that principles and tenets of international law, in order to be applicable in Canada, must be made into domestic law, and it is domestic law that applies to the regulated community. When the Commission weighs the evidence before it, it is the NSCA mandate that must guide its decisions.

Japan

Judgment framework of the court on the provisional disposition against the operation of the Ikata Nuclear Power Plant

There are three main types of litigation concerning the legality of the operation of nuclear power plants in Japan. The first is administrative litigation against the state to revoke the administrative disposition of the proposed Reactor Installation Permit. The second is civil litigation seeking an injunction against the operator concerning nuclear power plants in operation or under construction. The third is provisional disposition to preserve residents' rights temporarily against the operator.

Before the Fukushima Daiichi accident, residents who were against the operation of nuclear power plants had often filed litigation of the first and second types. The Supreme Court decision on the Ikata Nuclear Power Plant, Unit 1 in 1992 is the leading case of administrative litigation over the safety reviews of nuclear power plants in Japan. In the case, the court said that the administrative decision to grant a permit should be considered illegal when: (a) the requirements for Reactor Installation Permits formulated by the administrative agency are unreasonable, or (b) the process of examining and deciding that the nuclear power plants have complied with the requirements is unreasonable, and the administrative agency needs to prove that there is no unreasonableness in its requirements or process and the agency has all the documents concerning Reactor Installation Permits. Many regional courts have adopted this decision framework (hereinafter referred to as "the Ikata decision framework") regardless of the type of litigation. After the Fukushima Daiichi accident, however, residents have filed the third type of legal challenge more often. The volume of civil litigation, including for provisional dispositions, has been increasing, but many regional

courts tend to follow the Ikata decision framework. Some scholars suggest that courts' adoption of the Ikata decision framework has resulted in an increased number of decisions to grant injunctions against the operation of nuclear power plants because the framework lowers the burden of proof for the residents who challenge plant operation and imposes a heavier burden on the administrative agency and the nuclear operators in defending continued operation.

1. Overview of the case

The residents living near the Ikata Nuclear Power Plant, Unit 3 filed a petition for a provisional disposition order of an injunction against plant operation by Shikoku Electric Power Company (SEPCO), based on the specific risk that such operation might infringe on their personal rights for life and health because the nuclear power plant lacks safety against earthquakes.

On 4 November 2021, the Hiroshima District Court decided not to grant a provisional injunction against the operation of SEPCO's Ikata Unit 3. The Hiroshima District Court did not follow the Ikata decision framework. In doing so, it said that: (a) if the court decides whether the requirements and process of granting administrative disposition (in this case, amendments to a Reactor Installation Permit) are reasonable or not, the court's decision is practically equivalent to the court redoing the expert reviews done by the Nuclear Regulation Authority (NRA); (b) it is not appropriate for SEPCO, to which the administrative disposition is granted, to prove whether the administrative disposition is reasonable; and (c) the Ikata decision framework should be applied to administrative litigation and not to civil provisional remedies. The District Court ruled that the residents are responsible for making a prima facie showing of the specific risk against which it is necessary to preserve their interests and that a lower burden of proof for the residents was not warranted. As a result, the court dismissed the residents' petition because they did not make a prima facie showing of the specific risk of an earthquake exceeding the Standard Seismic Motion (SSM) established by SEPCO.

2. The District Court's decision

In dismissing the petition for the provisional disposition order, the Hiroshima District Court covered the following matters in its holding:

- 2.1 Framework of judicial review

The residents had claimed that the Ikata decision framework should apply to civil litigation where an injunction against the operation of nuclear power plants is sought based on the infringement of personal rights. In addition, they argued that SEPCO should bear the burden of making a prima facie showing of the reasonableness of administrative requirements and the NRA's review. In response, SEPCO asserted that, as a general principle of seeking an injunction based on personal rights, the residents should bear the burden of a prima facie showing of the existence of a specific risk infringing on such rights. SEPCO also claimed that, even if the operator bears the burden of proving the safety of nuclear power plants, it is enough to show that it had obtained the appropriate authorisations under the Reactor Installation Permit from the NRA, which demonstrates that its nuclear power plants are installed and operated under current safety regulations.

The District Court decided that the specific risk that the residents could claim would be the occurrence of an earthquake exceeding the SSM at Ikata Unit 3, because the residents did not argue that the failure of the seismic safety at Ikata Unit 3 might result in damage to the plant as a result of an earthquake lower than the SSM. The Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (hereinafter referred to as the "Reactor Regulation Act"), which was amended after the Fukushima Daiichi accident, gives the NRA the authority to formulate and review regulatory requirements for nuclear safety, including the assessment of the occurrence of an earthquake exceeding the SSM. Thus, adopting the residents' assertion practically means that the District Court would itself undertake a review of the NRA's assessment, which is based on highly scientific and expert knowledge that the court does not have, an outcome that does not comport with the purpose of the Reactor Regulation Act.

Moreover, this provisional disposition case is different from an administrative litigation in which the administrative agency is the defendant, and thus adopting the Ikata decision framework was not appropriate for this case. The NRA formulated the regulatory requirements and examined the Ikata Nuclear Power Plant, and it is not reasonable for SEPCO as the recipient of the administrative disposition to have to prove the rationality of the administrative disposition. On the contrary, the court held, the residents should make a prima facie showing of the risk of an earthquake exceeding the SSM, because they would benefit from the legal effect of the injunction based on their personal rights.

- 2.2 Safety against earthquakes

The residents claimed that the new requirements of the Reactor Regulation Act are unreasonable because of the records of observation of earthquakes in Japan and the cases of earthquakes exceeding the relevant SSM recorded at nuclear power plants other than the Ikata Nuclear Power Plant. However, they only cited the earthquake motion values observed all over Japan without making any correction of the ground motion values for the Ikata Nuclear Power Plant. Hence, the court decided that the residents did not make a prima facie showing of the specific risk of an earthquake exceeding the SSM occurring at the Ikata Nuclear Power Plant.

- 2.3 Necessity of preservation

Courts can order provisional disposition of an injunction against the operation of a nuclear power plant when there is a risk of significant detriment or imminent danger to the plaintiff, which is called the necessity of preservation. Therefore, when affirming the necessity of preservation, the residents must make a prima facie showing of the following facts: that the operation of the nuclear power plant is currently infringing their legal interests, or that the occurrence of an earthquake exceeding the SSM is so imminent that there is no time to wait for final resolution of the litigation. However, the residents failed to make a prima facie showing on either ground in this case. Therefore, the District Court dismissed their petition.

3. *Significance of the case*

The Hiroshima District Court allowed the parties to argue on an equal footing as to whether or not there was a specific risk posed by the nuclear power plants' operation. The court reverted to the principle that the plaintiffs (the residents) should bear the burden of making a prima facie showing and did not adopt the Ikata decision framework. Incidentally, the residents' burden of proof is mitigated in other environmental civil litigation involving, for example pollution. In such cases, they may have a more difficult challenge to prove their cases due to the uneven availability of evidence and highly technical issues. Similarly, nuclear operators have been responsible for bearing a higher degree of proof as the Ikata decision framework shows. With this background, it can be said that the Ikata decision framework has functioned in a situation where neither the residents nor the courts have substantial knowledge of the administrative review process.

The Hiroshima District Court case is noteworthy in view of the ruling that the Ikata decision framework may be adopted in administrative litigation but is not appropriate in provisional disposition cases. Therefore, the District Court seems to consider that the Ikata decision framework is appropriate when courts examine the reasonableness of the administrative agency's decision process.

In addition, adopting the framework would make SEPCO indirectly responsible for making a prima facie showing of the reasonableness of the administrative agency's decision in effect. Thus, the court determined that adopting the framework in this circumstance is against the purpose of the Reactor Regulation Act. This case is meaningful because the District Court provided a way of making a prima facie showing without being bound by the Ikata decision framework. In other words, the court considered judicial review and the parties' burdens in light of five perspectives: (a) the nature of the litigation, (b) the proportion of proof corresponding to the type of litigation, (c) the degree of proof, (d) the nature of the parties, and (e) the peculiarity of litigation involving nuclear facilities that may focus on the

technical findings of the regulator. As a result, in civil litigation, including provisional dispositions concerning the legality of the nuclear power plants' operation, the burden of proof might change. Therefore, future decisions of the courts will warrant examination.

United States

DC Circuit decision involving Powertech uranium extraction licence

On 9 August 2022, the US Court of Appeals for the District of Columbia Circuit (DC Circuit) issued a decision denying a petition for review of the US Nuclear Regulatory Commission's (NRC) decision to issue a licence to Powertech, Inc., for a proposed *in situ* uranium recovery facility in South Dakota.[25] The petition for review was brought by the Oglala Sioux Tribe and a non-profit association named Aligning for Responsible Mining (Petitioners), alleging that the NRC had failed to meet its obligations under two federal laws before issuing the licence – the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA). NEPA requires all federal agencies to prepare a detailed environmental impact statement (EIS) prior to taking any major action "significantly affecting the quality of the human environment".[26] The NHPA requires federal agencies, prior to the issuance of any licence, to "take into account the effect of the undertaking on any historic property," and further requires agencies to consult with any Indian tribe that "attaches religious and cultural significance to historic properties that may be affected" and provide them a "reasonable opportunity" to identify concerns.[27]

The DC Circuit's decision upheld the results of the NRC's licensing proceeding, which began in 2009 when Powertech applied for an NRC license and the Petitioners intervened in the proceeding and asserted various challenges under NEPA and the NHPA.[28] The NRC's Atomic Safety and Licensing Board (Board) held a hearing in 2014, after the NRC staff completed its safety review and issued its final EIS. Although the Board ruled against the Petitioners on most of their contentions, it did find that the NRC staff did not engage in adequate consultation with the Tribe or sufficiently consider the potential impacts of the project on the Tribe's cultural resources in its EIS.[29] As a result, the NRC staff engaged in renewed efforts to consult with the Tribe and arrange for additional cultural-resource site surveys with the Tribe's participation. The NRC staff and the Tribe could not, however, successfully reach agreement on the survey's methodology. The NRC staff eventually determined that further consultations would not be fruitful and discontinued their consultation efforts, and the Board determined the staff had reasonably satisfied its legal obligations. Petitioners challenged in the DC Circuit the Commission's affirmation of the Board's decision.

In its August 2022 decision, a panel of DC Circuit judges held that the NRC did not violate NEPA, nor was further supplementation of the agency's EIS required, because the agency made reasonable efforts to gather information concerning the Tribe's cultural resources and had already explained, in the agency's hearing record, why the additional cultural resource

25. Oglala Sioux Tribe v. NRC, 45 F.4th 291 (DC Cir. 2022).
26. 42 USC 4332.
27. 54 USC 306108; 36 CFR 800.2.
28. Section 189a of the Atomic Energy Act of 1954, as amended, entitles "any person whose interest may be affected" by an NRC licensing proceeding to seek a hearing and be made a party to that proceeding. 42 USC 2239(a).
29. On appeal, the Commission upheld these determinations. Powertech (USA), Inc. (Dewey-Burdock In Situ Uranium Recovery Facility), CLI-16-20, 84 NRC 219 (2016). The Petitioners challenged the NRC's decision to leave the licence in effect while these deficiencies were resolved. See Oglala Sioux Tribe v. NRC, 896 F.3d 520 (DC Cir. 2018), which resulted in the Commission ordering Powertech to provide notice well in advance of any licenced activities at the site, allowing the Board to take any necessary action during the pendency of the adjudication. Powertech (USA), Inc. (Dewey-Burdock In Situ Uranium Recovery Facility), CLI-19-1, 89 NRC 1 (2019).

information was "effectively unavailable" to the agency.[30] The court also held that the NRC had satisfied its obligations under the NHPA, because the NRC had offered the statutorily required opportunities to the Tribe to provide input regarding cultural resources.[31] Additionally, the court upheld the NRC's dismissal of environmental contentions relating to the NRC staff's analysis of groundwater impacts, disposal of byproduct material generated from uranium extraction, and potential measures to mitigate environmental impacts.[32]

On 23 September 2022, the petitioners sought rehearing *en banc* before the full DC Circuit. The court declined to grant *en banc* review on 14 December 2022.

Update of GEIS for Subsequent Licence Renewal of Nuclear Plants

Section 103 of the Atomic Energy Act (AEA) of 1954 authorises the NRC to issue initial licences for nuclear power reactors for terms of up to 40 years, and to issue renewed licences that are effective upon completion of the initial licence term.[33] NRC regulations permit the renewal of power reactor licences for up to 20 years beyond the previous licence term and do not limit the number of times a licence can be renewed.[34] The NRC's generic environmental impact statement for licence renewal at nuclear power plants (LR GEIS) evaluates environmental impacts considered to be generic to all nuclear power plants and identifies issues that need to be addressed in site-specific environmental reviews for nuclear power plant licence renewals.[35] Licence renewal applicants are not required to conduct site-specific analyses of environmental impacts classified as generic in the LR GEIS when submitting licence renewal applications, and the NRC staff likewise relies on the conclusions in the LR GEIS when preparing a site-specific EIS for a power reactor licence renewal.[36] In previous decisions, the Commission has held that the LR GEIS can be relied upon in both initial and subsequent licence renewal proceedings.

On 24 February 2022, in a series of adjudicatory decisions, the Commission reversed its earlier rulings and held that the LR GEIS only applied to the *initial* licence renewal proceedings and not *subsequent* licence renewal (SLR) proceedings.[37] The Commission stated that the LR GEIS only applied to initial license renewal and it would not issue any licences for subsequent renewal terms until an adequate site-specific environmental review for each application was conducted. The Commission, separately, directed the staff to provide a rulemaking plan to update the LR GEIS to clearly include evaluation of the environmental impacts of SLR.[38]

30. 45 F.4th at 300-01.
31. *Ibid.*, at 306.
32. *Ibid.*, at 303-05.
33. 42 USC 2133(c).
34. 10 CFR 4.31.
35. 10 CFR 51.53(c)(3).
36. The NRC prepares EISs in connection with licence renewal proceedings to comply with the requirements under the National Environmental Policy Act (NEPA).
37. Florida Power & Light Co. (Turkey Point Nuclear Generating Units 3 and 4), CLI-22-2, 95 NRC __ (24 Feb. 2022) (slip op.); Duke Energy Carolinas, LLC (Oconee Nuclear Station, Units 1, 2, and 3), CLI-22-3, 95 NRC __ (24 Feb. 2022) (slip op.); Exelon Generation Co., LLC (Peach Bottom Atomic Power Station, Units 2 and 3), CLI-22-4, 95 NRC __ (24 Feb. 2022) (slip op.). "Subsequent licence renewal" refers to a licensee's application for renewal of their operating licence after an initial licence renewal period (i.e. for the period of 60-80 years after the original licence was issued).
38. Memorandum to D.H. Dorman, Executive Director of Operations (EDO) from A.L. Vietti-Cook, Secretary of the Commission (24 Feb. 2022), "Staff Requirements – SECY-21-0066 – Rulemaking Plan for Renewing Nuclear Power Plant Operating Licenses – Environmental Review (RIN 3150 AK32; NRC 2018 0296)" (ADAMS Accession No. ML22053A308). ADAMS stands for Agencywide Documents Access and Management System, which is the NRC's official system for accessing publicly available documents. The documents referenced in this article with an ADAMS number can be accessed with the "Advanced Search" option and searching the "Accession Number" on the NRC's ADAMS website, at: https://adams.nrc.gov/wba.

Currently, the NRC is evaluating a number of SLR applications. As a result of these rulings, licensees applying for SLR cannot complete the licence renewal process without site-specific analysis of environmental impacts previously listed as generic in the LR GEIS, until the NRC staff issues an updated LR GEIS that explicitly covers SLR applications.[39] Contentions in the currently pending SLR proceedings have been dismissed and can be refiled once the NRC staff completes the update to the LR GEIS or an applicant elects to provide a site-specific analysis of the issues previously resolved generically in the LR GEIS.[40] The Commission also directed staff to shorten the licence terms of the two SLRs that have already been issued at Peach Bottom Atomic Power Station in York County, Pennsylvania and Turkey Point Nuclear Generating Station in Homestead, Florida, until completion of the NEPA analysis.[41]

On 5 April 2022, the Commission approved the NRC staff's recommendation to pursue a 24-month schedule to, among other things, update the LR GEIS to clearly include evaluation of the environmental impacts of SLR and to amend NRC regulations codifying the conclusions of the LR GEIS.[42]

39. The Commission noted that some licensees may continue to perform SLR-adjacent safety evaluations while the update to the LR GEIS is pending.
40. See Oconee, *supra* note 40, slip op. at 3.
41. See Peach Bottom, *supra* note 40, slip op. at 3; Turkey Point, *supra* note 40, slip op. at 14.
42. Memorandum to D.H. Dorman, EDO from B.P. Clark, Secretary of the Commission (5 Apr. 2022), "Staff Requirements – SECY-22-0024 – Rulemaking Plan for Renewing Nuclear Power Plant Operating Licenses – Environmental Review (RIN 3150-AK32; NRC-2018-0296)" (ADAMS Accession No. ML22096A035).

NATIONAL LEGISLATIVE AND REGULATORY ACTIVITIES

Belarus

General legislation, regulations and instruments

The new Law of the Republic of Belarus of 10 October 2022, No. 208-Z, "On Safety Regulation in the Use of Atomic Energy", has been officially published in the National Register, No. 2/2928. This legal act was developed taking into account current international requirements, as well as the experience gained in the country and law enforcement practice during the implementation of the first nuclear energy programme. The law was adopted to strengthen and maintain the proper level of nuclear and radiation safety in the use of atomic energy. In particular, the law:

- comprehensively regulates safety in the use of atomic energy at all stages of the life cycle of nuclear energy facilities;
- defines and strengthens the responsibility of authorised public administrative bodies involved in the decision-making process for the management and regulation of the safe use of atomic energy; and
- establishes provisions on safety assessments and licensing of activities in the field of nuclear energy.

The law establishes the principles of safety regulation in the use of atomic energy. These include:

- the priority of ensuring nuclear and radiation safety and protecting the life and health of the population and the environment over other aspects of activities in the field of nuclear energy use, including economics;
- provision of complete, reliable and timely information related to the regulation of safety in the use of atomic energy, if this information does not relate to information that has restrictions against dissemination or provision;
- independence of state regulatory bodies in the field of safety in the use of atomic energy in their decision-making and the exercise of their powers;
- development of nuclear energy for peaceful purposes, including a ban on the production of nuclear weapons and other nuclear explosive devices;
- participation of legal entities and individuals in public hearings at the decision-making stage on the regulation of activities in the field of safety in the use of atomic energy;
- protecting the life and health of the population and the environment from the negative effects of radioactive waste at present and in the future by not imposing an excessive burden on future generations.

The law also:

- clarifies the powers of state authorities and regulatory bodies in the field of nuclear energy use;
- clarifies the powers of officials in the conduct of state supervisory activities;
- forms a system of scientific and technical support for regulation, i.e. by establishing the National Commission for the Safe Use of Atomic Energy under the Government of the Republic of Belarus;
- forms the state system for ensuring nuclear security;
- addresses the issues of International Atomic Energy Agency (IAEA) safeguards and the state system of accounting and control of nuclear materials, as well as state regulation in the field of export control in relation to nuclear materials, equipment and technologies.

The legal act provides for the amendment or repeal of the following earlier laws:

- amends Law No. 340-Z of 7 January 2012, "On the sanitary and epidemiological welfare of the population";
- amends Law No. 198-Z of 18 June 2019, "On Radiation Safety"; and
- repeals Law No. 426-Z of 30 July 2008, "On the Use of Atomic Energy".[1]

The main provisions of Law No. 208-Z come into force on 14 October 2023, one year after its official publication.

France

Radioactive waste management

Decree No. 2021-897 of 6 July 2021 on the modification and codification of Decree 2008-209 of 3 March 2008 on procedures applicable to the reprocessing of foreign spent fuel and radioactive waste and several provisions regarding deconcentrated decisions[2]

The Decree amends the provisions of Decree 2008-209 of 3 March 2008 on procedures applicable to the reprocessing of foreign spent fuel and radioactive waste as well as the distribution of this waste *vis-à-vis* the waste that will remain on national territory. The Decree also codifies the new provisions at Sections R. 542-33 and following of the Environmental Code (Code de l'Environnement). As such, the modalities of the use of the "equivalent" of radioactive waste of foreign origin and of radioactive waste produced from the reprocessing of spent fuel and radioactive waste of foreign origin sent abroad due to the prohibition of their disposal in France are now established. The "equivalent" is determined taking into account the toxicity of the waste in question with regards, on the one hand, to the protection of public health, safety and the environment, assessed on the basis of a representative indicator of its radiotoxicity to persons over the long term and, on the other hand, to the mass of said waste. In this manner, the use of the "equivalent" of such waste can be authorised in order to speed up shipping of waste out of national territory.

1. See NEA (2008), "National Legislative and Regulatory Activities" and "Texts", *Nuclear Law Bulletin*, No. 82, OECD Publishing, Paris, pp. 119-120, 135-159.
2. *Journal Officiel Lois et Décrets* (JOLD), Text No. 9 (7 July 2021).

Decree No. 2022_992 of 7 July 2022 registering the Deep Geological Repository for Long-lived High- and Intermediate-level Radioactive Waste (Cigéo) on the list of National Interest Operations mentioned in Section R. 102-3 of the Urban Code[3]

Decree No. 2022_993 of 7 July 2022 declaring the Deep Geological Repository for Long-lived High- and Intermediate-level Radioactive Waste (Cigéo) a public interest operation and amending the Territorial Consistency Plan of Pays Barrois (Meuse), the Local Intercommunity Development Plan for Haute-Saulx (Meuse) and the Local Development Plan of Gondrecourt-le-Château (Meuse) for compliance purposes[4]

The two Decrees pertain to the Deep Geological Repository for Long-lived High- and Intermediate-level Radioactive Waste (Cigéo). Cigéo is now a public interest operation. Under the Urban Code, national interest operations are land development operations related to matters of such importance that they require the engagement of the national community and for which the government implements specific means and measures. Moreover, structures and associated works associated with Cigéo are declared to be of public interest for the benefit of the National Agency for Radioactive Waste Management (ANDRA), to allow for the purchase of land necessary to build the facility.

Radioactive materials (including physical protection)

Decree No. 2021-713 of 3 June 2021 to adapt Part I, Book III, Title III, Chapter III of the Defence Code[5]

The Decree amends the Defence Code's provisions applicable to the protection and control of nuclear material that are not assigned to the necessary means to the implementation of the nuclear deterrence policy.

A new cross-cutting obligation is established, consisting in "Nuclear Security" meant as "the protection and control of nuclear material and associated activities against malevolent acts and losses". Although the Decree makes clear that this definition only applies to the implementation of requirements concerning nuclear material not assigned to nuclear deterrence, it is, however, important to note that this definition differs from the legal definition of nuclear security codified at Section L 591.1 of the Environmental Code, which includes more broadly "nuclear safety, radiation protection, prevention of and countermeasures against malevolent acts as well as civil security actions in case of an accident".

The Decree reinforces applicable procedures, especially the ones related to authorisation. Authorisation thresholds are lowered, leading to a *de facto* suppression of the declaratory regime. In exchange for this, case-by-case exemptions are now possible for material that does not pose a risk in terms of proliferation and for which, in case of a malevolent act, potential consequences to public health and security and on environmental protection are reduced. The procedural framework is also clarified; for example, timelines for application review are detailed, as well as the content of the authorisation decision. The procedure to amend an existing authorisation is also supplemented with the new notion of "substantial amendment", which allows the Minister in charge to request the submission of a new authorisation application.

The control over nuclear material is also reinforced. Requirements related to centralised accounting of nuclear material are extended; all persons that carry out activities associated with nuclear material, except nuclear transport, shall henceforth submit an accounting statement to the Minister in charge. Authorisation control modalities have also been extended, with the High Commissioner for Atomic Energy (*Haut-commissaire à l'énergie*

3. *Journal Officiel de la République française* (JORF), Text No. 12 (8 July 2022).
4. JORF, Text No. 13 (8 July 2022).
5. JOLD, Text No. 4 (5 June 2021).

atomique) now having authority to designate and give clearance to staff in charge of controlling development, detention, transfer, use, transport, import and export of nuclear material within the remit of the Minister for Defence.

Nuclear safety and radiological protection (including nuclear emergency planning)

Order of 28 June 2021 concerning skill hubs in radioprotection[6]

The Order, issued in accordance with Section R. 4451-126 of the Labour Code, establishes the terms and conditions for the creation of skill hubs in radiological protection as referenced in Section R. 4451-113 of the Labour Code and at Section R. 593-112 of the Environmental Code. Skills hubs must be established in companies having at least one basic nuclear facility (installation nucléaire de base – INB) in order to provide advice in radiological protection matters to the employer and operator in their respective fields of expertise.

Skills hubs were to be formed by January 2022 and approved by the relevant authority.

Decree No. 2021-1091 of 18 August 2021 concerning the protection of labourers against ionising and non-ionising radiation hazards[7]

The Decree extends the deadline for the implementation of the new radiological protection organisation as well as for obtaining certification and clearance from relevant organisations. The Decree also amends several provisions for improved consistency as related to electromagnetic fields and clarifies the provisions that apply to labourers subject to long term exposure as a result of a radiological emergency.

Liability and compensation

2022 Finance Law No. 2021-1900 of 30 December 2021[8]*; Constitutional Council, 28 December 2021, No. 2021-833 DC*

Section 156 of the 2022 Finance Law amends the provisions of the Insurance Code pertaining to the state financial guarantee offered to the Central Reinsurance Office (*Caisse centrale de réassurance*) for the reinsurance of nuclear risks covered under the third party nuclear liability regime established by the Environmental Code in accordance with the Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy (Paris Convention).[9] As of the date of entry into force of the 2004 Protocol amending the Paris Convention,[10] Section L. 413-5 of the Insurance Codes provides as follows:

- the state financial guarantee amounts to EUR 700 million maximum per nuclear installation and per nuclear accident;

6. JOLD, Text No. 6 (1 July 2021).
7. JOLD, Text No. 32 (20 Aug. 2021).
8. JOLD, Text No. 1 (31 Dec. 2021).
9. 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 (Paris Convention).
10. 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).

- as regards nuclear substances transport in France, the amount of the state financial guarantee is EUR 80 million per nuclear accident; and
- as regards international transport of nuclear substances, the amount is set by the sending state, the receiving state or the transit state, with a maximum amount of EUR 700 million per nuclear accident.

Decree No. 2022-37 of 17 January 2022 publishing the Protocol Amending the 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, and the Protocol Amending 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, concluded in Paris on 12 February 2004[11]

The Protocols of 12 February 2004 amending the Paris Convention on Third Party Liability in the Field of Nuclear Energy and the Brussels Supplementary Convention[12] entered into force on 1 January 2022. This Decree allows for their publication. The main modifications brought by the 2004 Paris and Brussels Protocols are as follows:

- extension of the geographical scope of application of the Paris Convention to nuclear damage suffered on the territory or in the maritime zone of several non-contracting states;
- new types of damage can be compensated, like economic loss, costs of preventive measures and costs of measures of reinstatement of impaired environment; and
- increase of the amount of compensation for nuclear damage, now set at a total amount of EUR 1.5 billion distributed in three tiers: EUR 700 million minimum for the operator liable for the damage, EUR 500 million maximum for the state on whose territory the accident occurred and EUR 300 million maximum for the public international fund financed by the Contracting Parties to the Brussels Supplementary Convention.

Order of 15 June 2022 granting the Central Reinsurance Fund a State guarantee for third-party liability in the field of nuclear energy

Finance Act No. 2021-1900 of 30 December 2021 for 2022 amended the provision of the Insurance Code pertaining to the state guarantee granted to the Central Reinsurance Fund for the reinsurance of nuclear risk covered pursuant to the nuclear third-party liability regime set by the Environmental Code in accordance with the Paris Convention.

Since the entry into force of the 2004 Paris Protocol, Section L. 431-5 of the Insurance Code specifies that the state guarantee can be granted via an Order of the Minister of Economy within a limit of EUR 700 million per nuclear installation and per nuclear accident. The amount of the guarantee is up to EUR 80 million per nuclear accident of nuclear material transport in France and, in the case of international transport, matches the amount set by the expedition, destination or transit state of said material, within a limit of EUR 700 million per nuclear accident.

This Order grants the state guarantee to the Central Reinsurance Fund.

11. JOLD, Text No. 5 (19 Jan. 2022).
12. 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).

Decree No. 2022-1186 of 25 August 2022 implementing Section L. 597-4 of the Environmental Code pertaining to third-party liability in the field of nuclear energy and codifying the provisions pertaining to low-risk installations sites

Order of 25 August 2022 setting the list of low-risk sites and entitling their operators to a reduced liability amount pursuant to Section R. 597-3 of the Environment Code

Section L. 597-4 of the Environment Code sets the liability amount for operators of a nuclear installation at EUR 700 million for a single nuclear accident. That amount can be lowered to EUR 70 million for a single accident when the installations on a specific site are all low-risk installations.

This Decree defines the characteristics of low-risk installations. To be entitled to this regime, an operator must send to the Ministers in charge of nuclear energy and safety a case file demonstrating that any and all installations on the site match the defined characteristics.

Pursuant to these provisions, the Order of 25 August 2022 sets the list of sites for which operators are entitled to a reduced liability amount.

General legislation, regulation and instruments

Order of 15 February 2022 setting general rules regarding defence nuclear activities and facilities[13]

The Order applies to all activities and facilities falling within the category of defence nuclear activities and facilities (IANID – *Installations et activités nucléaires intéressant la défense*), except for the transport of fissile or radioactive material linked to nuclear weapons-related activities and nuclear propelled vessels as provided in Section L 1333-15(5) of the Defence Code (Code de la Défense). The general rules established therein apply to each of the life cycle phases of said facilities: design, construction, operation or realisation, maintenance, permanent shutdown and decommissioning.

The Order specifies the nuclear safety requirements with which operators must comply in order to prevent nuclear and radiological hazards in their facilities. The nuclear safety and radiological protection approach that operators must implement takes into account the specificities of national defence and complies with the requirements set by the supervising body, the Delegate for Nuclear Safety and Radioprotection for Defence-Related Nuclear Installations and Activities (DSND).

The Order goes on to set the rules concerning the safety and radiological protection organisation that needs to be set up by the operator. It defines the responsibilities of operators: e.g. implementation of internal control in order to ensure that activities important for safety are carried out, the obligation to report significant events in terms of nuclear safety or radiological protection to the DSND, among others.

Order of 4 March 2021 certifying Decision 2021-DC-0703 of the Nuclear Safety Authority of 4 February 2021 listing nuclear activities using sources of ionising radiations for industrial, veterinary or research (except research involving humans) purposes subject to formal registration and the requirements applicable to said activities[14]

The Public Health Code establishes the main administrative regime for nuclear activities, except for nuclear substances transport and, within this framework, sets out a declaration, registration and authorisation regime. Taken in accordance with Sections R. 1333-113 to

13. JORF, Text No. 14 (22 Feb. 2022).
14. JOLD, Text No. 6 (24 Mar. 2021).

R. 1333-117 of the Public Health Code, the Order certifies the Nuclear Safety Authority Decision of 4 February 2021 that contains, *inter alia*:

- the list of nuclear activities categories henceforth subject, in accordance with Section R. 1333-113 (I) of the Public Health Code, to the registration regime set up according to Section L. 1333-8 of said Code (Annex 1);
- clarifications on the duration of registration;
- practical modalities to submit an initial registration application or a modification or renewal application, as well as the list of information and documents to submit when applying for registration (Annex 2);
- the list of general requirements applicable to the respective categories of nuclear activities that persons responsible for nuclear activities have to follow and the infringement of which can be punished (Annex 3);
- the transitory provisions applicable to authorised activities previously subject to the authorisation regime and now subject to the registration regime.

Decree No. 2022-174 of 14 February 2022 regarding the implementation of recovery measures of low-activity substances[15]

Decree No. 2022-175 of 14 February 2022 regarding radioactive substances eligible to recovery operations mentioned at Section R. 1333-6-1 of the Public Health Code[16]

Order of 14 February 2022 defining the content of the case file mentioned at Section R. 1333-6-1 of the Public Health Code[17]

Section R. 1333-2 of the Public Health Code forbids in the manufacturing of consumer goods, food or animal feed: (1) any addition of radionuclides to those already naturally present, including by activation; (2) any use of radioactive substances of natural origin; (3) any use of substances originating from nuclear activity when these substances have been contaminated, activated or may be contaminated or activated by radionuclides used in or generated by nuclear activity. Furthermore, the following are forbidden: import from a non-European Union (EU) country; export outside of the EU; and distribution or use of consumer goods, food or animal feed that do not comply with these prohibitions (Section R. 1333-3 of the Public Health Code).

The above-mentioned Decrees and Order establish the framework that authorises, by exemption to the above-mentioned prohibitions, the recovery of the substances mentioned in (3) above.

Decree No. 2022-174 sets the framework for this exemption, which is granted by Ministerial Order after public consultation and opinion from the Nuclear Safety Authority (ASN). The Decree states that the substances subject to exemption must beforehand be submitted to recovery in a facility specially authorised to perform such recovery operation.

Decree No. 2022-175 gives the list of substances concerned. Those substances are metallic substances that, before they were used for nuclear activities, did not warrant radiological protection control.

Finally, the Order of 14 February 2022 defines the content of the exemption application file.

15. JORF, Text No. 4 (15 Feb. 2022).
16. JORF, Text No. 5 (15 Feb. 2022).
17. JORF, Text No. 8 (15 Feb. 2022).

Hungary

Organisation and structure

Change in the legal status of the Hungarian Atomic Energy Agency

The Hungarian Atomic Energy Authority (HAEA) is responsible for the regulatory tasks in connection with the use of atomic energy exclusively for peaceful purposes, the safety of nuclear facilities and transport containers, as well as with the security of nuclear and other radioactive materials and associated facilities in Hungary. Act CXIV of 2021 amending several laws established the necessary framework for the change of the legal status of the HAEA and laid down the general rules for the independent regulatory body. As a result, the provisions of the Act CVII of 2019 on organisations with special status apply to the HAEA as of 1 January 2022. In addition, Act CXVI of 1996 on Atomic Energy (Atomic Energy Act) includes detailed provisions on the nuclear regulatory authority. The purpose of the recent change in the HAEA's legal status is to strengthen its independence, which is in line with international expectations and standards.

The HAEA is now an independent regulatory organisation with special legal status, supervised by Parliament. The new amendment transfers to the Atomic Energy Act all the responsibilities of the HAEA related to the European Union and international obligations in the field of nuclear energy, which were previously regulated by Government Decree 112/2011. The HAEA shall not be instructed by other governmental entities in carrying out the scope of its authority, and it shall perform its task independently from other organisations and be free of their influence. It is a central budgetary body with an independent heading in the annual budget act, and it has full autonomy on decisions related to its organisation (staffing, structure, salaries, etc.) within its annual budget, based on its tasks. According to the Hungarian Fundamental Law, an independent regulatory body also has the power to issue regulations; therefore, the amendment gives the HAEA the power to issue regulations (Presidential Decrees) in a number of cases.

The amendments were effective from 1 January 2022.

Furthermore, the following HAEA Decrees entered into force on 1 May 2022, with their content remaining unchanged compared to the repealed relevant regulations:

- 1/2022 HAEA Decree on the nuclear safety requirements of nuclear facilities and on related regulatory activities;
- 2/2022 HAEA Decree on the protection against ionising radiation and the corresponding licensing, reporting (notification) and inspection system;
- 3/2022 HAEA Decree on the rules of accountancy for and control of radioactive materials, and on the corresponding data provisions;
- 4/2022 HAEA Decree on the rules of accountancy and control of nuclear materials;
- 5/2022 HAEA Decree on the independent technical expert acting in the field of the application of atomic energy;
- 6/2022 HAEA Decree on the administrative fees payable for certain administrative procedures and services of the Hungarian Atomic Energy Authority; and
- 7/2022 HAEA Decree on detailed rules for the certification and registration of competences for working as a technical expert, designer, technical inspector and responsible technical manager in connection with buildings and installations subject to the law on nuclear energy and rules governing the information to be included in the register.

General legislation, regulations and instruments

Amendments of the Atomic Energy Act

Act 1 of 2022, effective from 1 May 2022, contains additional provisions amending the Atomic Energy Act. Amendments stipulate data supply obligations for the ministers in listed cases in the scope of their competence in the use of atomic energy. Further modifications give the power to the President of the HAEA to issue regulations in a number of cases. Nuclear facilities can submit technical documents to the HAEA in Hungarian or in English in certain processes determined by Decree of the President of the HAEA.

Other amendments

Due to the amendment of Act CXXV of 1995, employees of the HAEA shall be subject to the national security vetting process (effective from 1 January 2022).

Amendment of Government Decrees (regulatory oversight of nuclear facilities)

Besides technical and codification clarifications, the amendment of the Government Decree 118/2011 enables applicants to submit certain listed documents in the licensing processes concerning the new nuclear power plant in Hungarian and as well as in English (effective from 14 August 2021).

Due to the amendment of Government Decree 112/2011, the scale of fines that can be imposed by the HAEA has been increased in exercising regulatory oversight of the licensees of a nuclear power plant or other nuclear facility, other licensees, and licensees obliged to supply data in cases within the jurisdiction of the HAEA, as defined in the Act on Atomic Energy (effective from 8 January 2022).

Amendment of Government Decrees (safety supervision of transport packages)

According to the amendment of Government Decree 34/2009, the competent authority can notify a foreign applicant about the authorisation of the shipment of radioactive waste or spent fuel out of the territory of Hungary electronically, which does not qualify as written communication (effective from 29 June 2022).

Slovak Republic

Nuclear installations

Licensing of Mochovce Nuclear Power Plant Unit 3

After verifying compliance with all technical and legal requirements and after consideration of the comments, objections and submissions in the appeal of the first-instance authorisation for commissioning of the Mochovce Nuclear Power Plant Unit 3, the Chairperson of the Nuclear Regulatory Authority of the Slovak Republic (Úrad jadrového dozoru Slovenskej republiky, ÚJD SR) as the second-instance authority issued on 25 August 2022 Decision No. 248/2022 P. The decision dismisses the appeal and upholds Decision No. 156/2021 (13 May 2021), by which ÚJD SR issued the authorisation for commissioning of Unit 3, the authorisation for radioactive waste, spent nuclear fuel and nuclear material handling, and the permit for early use of the building. The administrative proceeding had begun on 12 December 2016 at the request of the intended operator, Slovenske elektrárne, a.s. The second-instance decision was delivered in accordance with section 26 of the Administrative Procedure Code by a public decree, and as such it was posted on 25 August 2022 for a period of 15 days on the Electronic Official Board of the ÚJD SR at www.ujd.gov.sk, on the Official Board of the ÚJD SR located at the entrance to the building of ÚJD SR's headquarters in Bratislava, Slovak Republic, as well as on the Central Official Electronic Board (CUET) on the Central Public Administration Portal at www.slovensko.sk. The last

day of this period is the day of delivery. The second-instance decision entered into force on the day of delivery and took effect on 9 September 2022.

The plant owner and operator has commenced the commissioning process for the plant, starting with the initial nuclear fuel loading and followed by the reactor assembly, which was completed on 20 September 2022. The first criticality was achieved on 22 October 2022.

Subsequently, after completion of remaining aspects and tests within the commissioning process, Unit 3 will move to the power start-up stage. It is estimated that under current conditions the commissioning stage of Unit 3 is expected to be completed on 20 January 2023, when the unit will enter the 144-hour trial run operating at full capacity.

Unit 3, once operating at full capacity, will provide approximately 13% of electricity consumption in the Slovak Republic, thereby further increasing the total share of nuclear power in the national energy mix to 67%. The Slovak Republic will also become self-sufficient in terms of energy supply. The final design includes upgrades to safety and security that were incorporated in the project based on the lessons learnt from the Fukushima Daiichi accident and in line with the IAEA international safety standards as well as EU/Euratom requirements. Detailed information on the administrative process in English is available at: www.ujd.gov.sk/public-information/informacie-k-mo-34/?lang=en.

General legislation, regulations and instruments

The Amendment of the Decree of the Nuclear Regulatory Authority of the Slovak Republic No. 55/2006 Coll. laying down details in emergency planning for the event of an incident or an accident as amended, came into the force on 1 October 2022 under Act No. 310/2022 Coll.

This decree stems from the amendment of the Atomic Act in Act No. 363/2021 Coll., which came into the force on 12 October 2021 and reflects the changes within the Act No. 87/2018 Coll. on radiation protection as amended. It was necessary to update the size of the emergency planning area as well as backup documentation required for siting permission. Guidance in IAEA et al. (2015), *Preparedness and Response for a Nuclear or Radiological Emergency*, Safety Standards Series, General Safety Requirements, No. GSR Part 7, IAEA, Vienna, and IAEA et al. (2007), *Arrangements for Preparedness for a Nuclear or Radiological Emergency*, Safety Standards Series, General Safety Guides, No. GS-G-2.1, IAEA, Vienna, as well as the Western European Nuclear Regulators Association reference levels, were also taken into account.

International co-operation

Two memoranda of understanding were concluded during the 66th IAEA General Conference held in Vienna from 26-30 September 2022:

- Memorandum of Understanding between the Nuclear Regulatory Authority of the Slovak Republic and the Moroccan Agency for Nuclear and Radiological Safety and Security for the Exchange of Technical Information and Cooperation in the Field of Regulation of the Safe Use of Nuclear Energy for Peaceful Purposes (Vienna, 29 Sept. 2022) signed for the Slovak Republic by Ms Marta Žiaková, the Chairperson of the ÚJD SR and for Morocco by Mr Mounji Zniber, Acting Director of the Moroccan Agency for Nuclear and Radiological Safety and Security.

- Memorandum of Understanding between the Nuclear Regulatory Authority of the Slovak Republic and the Nuclear Regulatory Authority of the Republic of Türkiye for Cooperation and Exchange of Information in the Field of Nuclear Safety (Vienna, 26 Sept. 2022) signed for the Slovak Republic by Ms Marta Žiaková, the Chairperson of the ÚJD SR and signed for the Republic of Türkiye by Zafer Demircan, President of the Nuclear Regulatory Authority of the Republic of Türkiye.

Integrated Regulatory Review Service (IRRS) Mission

An (IRRS) Mission under IAEA auspices took place from 5-16 September 2022 in Bratislava. This was the third IRRS Mission in the Slovak Republic. A preparatory meeting was held 21-22 March 2022 in Bratislava with four members of the IRRS Mission team present. In the Slovak Republic, the nuclear field is regulated not only by the Nuclear Regulatory Authority of the Slovak Republic (ÚJD SR), but also by the Public Health Authority, the Labour Inspectorate and others. The co-operation among these bodies had to be ensured in preparation for the mission and the national self-assessment.

The IRRS Mission team found several areas of good performance that demonstrate continuous improvement of the Slovak Republic since the previous IRRS reviews, e.g. the open and transparent approach to the emergency preparedness and response inspection programme. The IRRS Mission team also made several recommendations to the regulatory authorities for further improvements, including: development of a national nuclear emergency plan; increasing the functional independence and resourcing of the Radiation Protection Departments of the Public Health Authority of the Slovak Republic and respective regional public health authorities, and the Ministry of Transport and Construction; improvement in co-operation and co-ordination between the different regulatory authorities; establishing an integrated management system by some of the governmental authorities; and application of a graded approach to the delivery of the regulatory functions.[18]

Liability and compensation

The Nuclear Regulatory Authority of the Slovak Republic prepared a report on the status and development of European and worldwide legislation on civil liability for nuclear accidents through 31 December 2021. The report was submitted to the Government of the Slovak Republic and was subsequently approved by the Resolution of the Government No. 148/2022 on 2 March 2022. The subject matter of the report covered mainly:

- the increase of the limits and timeframe for nuclear accident liability upon the ratification of the 2004 Paris and Brussels Protocols;
- the international workshops on civil liability held in Bratislava (2017) and Lisbon (2019);
- the Convention on Supplementary Compensation for Nuclear Damage;
- the increase of the liability limits for nuclear accidents under the 1997 Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage[19] from the 1963 Vienna Convention;[20] and
- reform of courts in the Slovak Republic.

The report noted that since the last report there had been no nuclear accidents, and thus no liability issues, processed in the Slovak Republic.

18. IAEA (2022), "IAEA Mission Says Slovakia Is Committed to a High Level of Safety, Sees Areas for Further Enhancement", www.iaea.org/newscenter/pressreleases/iaea-mission-says-slovakia-is-committed-to-a-high-level-of-safety-sees-areas-for-further-enhancement (accessed 20 Jan. 2023).
19. 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).
20. Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977 (Vienna Convention).

Slovenia

Nuclear safety and radiological protection (including nuclear emergency planning)

Act Amending the Protection against Ionising Radiation and Nuclear Safety Act

At its session held on 20 October 2021, the National Assembly of the Republic of Slovenia adopted the Act Amending the Protection against Ionising Radiation and Nuclear Safety Act (ZVISJV-1B).

The act was amended because of the letter of formal notice of the European Commission of 30 October 2020, which called on Slovenia to eliminate inconsistencies in the transposition of Council Directive 2013/59/Euratom laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation[21] in Slovenian legislation. Amendments to the Ionising Radiation Protection and Nuclear Safety Act thus include a new definition of the term radiological facility; a new provision on co-operation between authorised radiation protection experts and authorised medical physics experts; a supplemental provision on the database on personal doses of exposed workers; a supplemental provision regarding mandatory data on received radiation doses in the current calendar year and in the last five calendar years, required of the external contractor before starting work in the controlled area; and added content in a permit for the use of a radiation source, which must also contain minimum performance criteria for the source, source container and additional equipment and restrictions on high-activity sealed sources.

Other statutory articles were amended to harmonise the texts in some areas, such as environmental radioactivity monitoring and radon exposure provisions, and a provision was added regarding the inspection of measures undertaken for new construction work or renovations in existing buildings to protect human health from the harmful effects of radon. The amendment to the act also designates a new competent ministry for the supervision of the operations of the provider of the obligatory state public utility service for radioactive waste management.

The amended 2017 Act (ZVISJV-1B) is published in the *Official Gazette of the Republic of Slovenia*, No. 172/21 and entered into force on 13 November 2021.

Decree Amending the Decree on the National Radon Programme

The amendment relates to the introduction of a methodology for the assessment of radon doses by an authorised radiation protection expert, using the methodology defined by the International Commission on Radiological Protection. The amended provision shifts the date of application of the methodology from 2021 to 2023.

The amended Decree was published in the *Official Gazette of the Republic of Slovenia*, No. 152/20 and entered into force on 7 November 2020.

Rules on requirements for new construction and renovation in existing buildings in order to protect human health from the harmful effects of radon

These Rules set out the requirements and ways in which the reduction of radon concentrations below the reference level is achieved in buildings, thereby avoiding endangerment of human health due to the harmful effects of radon. These Rules also transpose into the Slovenian legal system the requirements of Council Directive 2013/59/Euratom. With anti-radon design and radon renovations of existing buildings, new requirements are being introduced into the Slovenian construction industry to ensure the protection of people from the harmful effects of radon.

21. Consolidated version, *Official Journal of the European Union* L 13/1 (17 Jan. 2014).

The Rules stipulate that the Minister responsible for construction will issue a technical guideline regulating radon protection in buildings, which determines recommended design and construction measures and solutions to meet the requirements of the Rules.

The Rules, jointly adopted by the Minister of Environment and Spatial Planning and the Minister for Health, were published in the *Official Gazette of the Republic of Slovenia*, No. 14/22 and entered into force on 18 February 2022 and apply from 30 June 2022.

Radioactive waste management

New Rules on Radioactive Waste and Spent Fuel Management

The new Rules on Radioactive Waste and Spent Fuel Management basically follow the rules with the same title from 2006. The new rules transpose into Slovenian legislation the requirements of the Western European Regulators' Association and the provisions regarding the determination of releases of radioactive substances into the environment in relation to the transposition of Council Directive 2013/59/Euratom. The Rules also prescribe new requirements regarding acceptance criteria for the storage of radioactive waste.

The new Rules were published in the *Official Gazette of the Republic of Slovenia*, No. 125/21 and entered into force on 14 August 2021. On the day the Rules entered into force, the former Rules on Radioactive Waste and Spent Fuel Management (*Official Gazette of the Republic of Slovenia*, No. 49/06 and 76/17 – ZVISJV-1) ceased to apply.

New Decree on the method and subject of and conditions for performing a public utility service of radioactive waste management

This Decree determines the manner and conditions of implementation of the obligatory state public utility service for radioactive waste management, including the organisational form of the public utility service, the sources of financing, the method and methodology of its financing, a list of facilities managed by the public utility service, the criteria for creating a price list for services and other content important for the implementation of all organisational and physical activities performed by the public utility service in the storage, transfer, processing, storage and disposal of radioactive waste.

The Decree was published in the *Official Gazette of the Republic of Slovenia*, No. 8/22 and entered into force on 1 January 2022. On the day the new Decree entered into force, the Decree on the method, subject and conditions of performing the public utility service of radioactive waste management (*Official Gazette of the Republic of Slovenia*, No. 32/99 and 41/04 – ZVO-1 and 76/17 – ZVISJV-1) and the Decree on the manner, subject and conditions of performing the obligatory state public utility service of long-term control and maintenance of mining and hydrometallurgical tailings dumps generated during the extraction and exploitation of nuclear mineral raw materials (*Official Gazette of the Republic of Slovenia*, No. 76/15) ceased to apply.

Ordinance establishing public service for radioactive waste management: Agencija za radioaktivne odpadke

This Ordinance is closely linked to the above-mentioned Decree and regulates the organisation, activity, bodies and their competencies and other issues related to the provision of the obligatory state public utility service for radioactive waste management.

The Ordinance was published in the *Official Gazette of the Republic of Slovenia*, No. 8/22 and entered into force on 1 January 2022. On the day this Ordinance entered into force, the Ordinance on the transformation of the public company Radioactive Waste Agency p.o., Hajdrihova 2, Ljubljana, into a public economic institution (*Official Gazette of the Republic of Slovenia*, No. 45/96, 32/99, 38/01, 41/04 – ZVO-1 and 113/09) ceased to apply.

Switzerland

Radioactive waste management

Geological disposal of radioactive waste: Dealing with uncertainties in safety cases

- Steps toward siting a repository

The National Cooperative for the Disposal of Radioactive Waste (Nagra) is expected to submit a general licence application for a deep geological repository to the Federal Department of the Environment, Transport, Energy and Communications (DETEC) in 2024. The Swiss Federal Nuclear Safety Inspectorate (ENSI) will then review the associated safety report. For ENSI it is essential that all remaining uncertainties in the data and in the understanding of the process be assessed.

Any person who operates or decommissions a nuclear installation is obliged under the Nuclear Energy Act of 21 March 2003, SR 732.1 to safely dispose of the radioactive waste from the installation at their own cost. The obligation to dispose of radioactive waste encompasses the necessary preliminary activities such as research and geological investigations, and the timely provision of a deep geological repository (Nuclear Energy Act, Art. 31). The search for a suitable site for the repository is described in the Deep Geological Repository sectoral plan issued by the Swiss Federal Office of Energy (SFOE).[22] Nagra will most likely submit an application for a general licence for a deep geological repository to the federal government in 2024 under Art. 42 et seq. of the Nuclear Energy Act). The legal requirements[23] and ENSI regulations[24] state that the geological suitability of the site must be demonstrated. ENSI has clarified and added greater detail to the safety requirements for stage 3 of the sectoral plan, both for site comparison and for general licence applications for the selected sites.[25]

The disposal of radioactive waste in a deep geological repository is subject to a multi-stage licensing procedure (general licence, construction licence, operating licence, closure and release from nuclear energy legislation). Compliance with all legal regulations and, in particular, nuclear safety and security requirements must be checked at all stages. The Federal Council (Swiss government) is responsible for issuing the general licence and for establishing that the repository is no longer subject to nuclear energy legislation; DETEC is responsible for the other licences. The SFOE, the authority conducting the procedure, must invite all specialist authorities to submit comments, ENSI in particular. The decision-making authority co-ordinates the various provisions formally and substantively. Any elimination of differences within the Federal Administration is done on the basis of Art. 62b et seq. of the Government and Administration Organisation Act of 21 March 1997, SR 172.010.

Geoscientific investigations must be conducted to confirm the suitability of the site for a deep geological repository and sufficient knowledge of the safety-relevant elements, properties, events and processes must be available for a general licence to be granted. The sectoral plan sets out 13 safety criteria, on the basis of which the suitability of the site is assessed.

22. SFOE (2011), *Sachplan geologische Tiefenlager Ergebnisbericht zu Etappe 1: Festlegungen und Objektblätter* [Sectoral Plan For Deep Geological Repositories, Results Report for Stage 1: Definitions and Object Sheets].
23. Nuclear Energy Act, Art. 13; Nuclear Energy Ordinance (NEO) of 10 December 2004, SR 732.11, Art. 11 and Art. 62 et seq.
24. ENSI (2020), Deep Geological Repositories – Guideline for Swiss Nuclear Installations, Guideline ENSI-G03.
25. ENSI (Nov. 2018), *Präzisierungen der sicherheitstechnischen Vorgaben für Etappe 3 des Sachplans geologische Tiefenlager* [Specification of the Safety-Related Requirements for Stage 3 of the Sectoral Plan for Deep Geological Repositories], ENSI 33/649.

- Minimising uncertainties in repository design

The deep geological repository system must be designed to withstand the impact of uncertainties, including through the choice of a suitable host rock and its surrounding rock formations to ensure that the public is exposed to radiation doses far below the protection criterion for the post-closure phase (0.1mSv a year). The protection objective is in line with the principles governing the use of nuclear energy (see Nuclear Energy Act, Art. 4) and the fundamental safety objective in the IAEA's Fundamental Safety Principles.[26] For the operational phase, the fundamental protection objectives set out in Article 1.d of the DETEC Ordinance of 17 June 2009 on Danger Scenarios and the Assessment of Protection against Incidents in Nuclear Installations, SR 732.112.2, apply.

The design of the repository can minimise the uncertainty of the repository system. For example, increasing the distance between the final storage containers for highly radioactive waste reduces the temperature in the vicinity of the repository, weakening interactions in the host rock.

- Reducing uncertainties by conducting systematic analysis

Oversight involves reviewing decisions regarding the project planning and realisation of the deep geological repository for their safety relevance, taking into account uncertainties in data, processes, modelling and even development scenarios with very low probability. In order to demonstrate the robustness of the effectiveness of the barrier system as provided in NEO, Art. 11.2.b and ENSI's Guideline ENSI-G03, *supra* note 3, developments that are not very likely or even purely hypothetical are also considered.

According to the requirements of the Guideline ENSI-G03 and the requirements for stage 3 of the Sectoral Plan, the safety analyses for site comparison and the safety case for deep geological repositories must include at least the following aspects: first, a systematic analysis of any uncertainties in the data, processes and models, and second, a calculation of the resulting range of variation in radionuclide release or doses. The statements in the site comparison and in the safety case must also be valid, taking into account the existing variability and uncertainties.

- Safety case: Uncertainties to be set out in the safety report

The safety case must also explain how uncertainties are to be dealt with. In particular, the robustness of the repository and its surroundings must be demonstrated, as must resilience to a variety of possible development scenarios. ENSI pays particular attention to this point when assessing applications. The aim is to identify the uncertainties, assess their potential impact on safety and reduce them as far as necessary.

The safety report is the key document for the safety case in the licensing procedures. It provides a basis for the decision on the general licence application. The safety report describes the deep geological repository project and provides evidence of operational and long-term safety. In particular, the safety relevance of existing uncertainties is set out.

The systematic consideration of the impact of uncertainties on long-term safety serves to strengthen the validity of statements on long-term safety, to identify future research needs and to optimise the design of the deep geological repository. Sensitivity and uncertainty analyses provide valuable indications of any further investigations and method developments that may be necessary in order to reduce the existing uncertainties of the input values and models.

- Reducing uncertainties through research

Before a deep geological repository is created, unanswered safety-relevant issues must be comprehensively clarified. Information on the research and data collection that is still

26. IAEA et al. (2006), *Fundamental Safety Principles: Safety Fundamentals*, IAEA Safety Standards Series, Safety Fundamentals, No. SF-1, IAEA, Vienna.

necessary is provided in the report on the research, development and demonstration programme of the parties responsible for nuclear waste disposal. Nagra's Research, Development and Demonstration report is reviewed by ENSI and must be updated at least every five years.

For its part, ENSI conducts and supports regulatory safety research in the area of waste disposal – projects that make it possible to identify potential problem areas, draw up possible improvements, reduce uncertainties and optimise procedures. The research projects provide the basic principles and tools that ENSI needs to fulfil its tasks, such as simulation programmes for safety analyses. ENSI's deep geological repository research projects thus address the properties of the appropriate rock types, the design and oversight of a deep geological repository, and the processes that can affect the safety of a deep geological repository in the long term.

4th revision of the Ordinance on the decommissioning fund and the management fund (OFDG)[27]

Most of the radioactive waste in Switzerland results from electricity generation in the five Swiss nuclear power plants. Other sources are medicine, industry and research (MIR waste). Radioactive waste is managed applying the causality principle: nuclear power plant operators are responsible for the management of spent fuel and radioactive waste resulting from the operation, decommissioning and dismantling of nuclear power plants. The Swiss Confederation is responsible for managing MIR waste.

The guiding principles of decommissioning and management financing are set out in the Nuclear Energy Act,[28] and the details are laid out in the 7 December 2007 Ordinance on the Decommissioning Fund and the Radioactive Waste Management Fund for Nuclear Installations. Both funds are independent and are financed by yearly contributions from nuclear operators.

The purpose of the revision of the OFDG is to apply the findings of the Federal Tribunal decision of 6 February 2020 by removing illegal authority from the Federal Department for Environment, Transport, Energy and Communication (DETEC). Following the revision, the Commission for the Dismantling Fund and the Management Fund (Stenfo) must request a decision from DETEC on cost studies and a control report from the Costs Committee before it can set the foreseeable amount of decommissioning and management costs. Moreover, the revised text makes binding the present method used to calculate the amount for the management costs related to waste that predate the final shutdown of nuclear power plants. The Ordinance also contains provisions on a clearer and streamlined organisation of the different authorities involved in the process. Finally, the members of the Commission and of the different Committees are under the express obligation to aim for adequate financing of the decommissioning fund and of the management fund.

The 4th revision came into force on 1 January 2022.

27. Ordinance of 7 December 2007 on the Decommissioning Fund and the Radioactive Waste Management Fund for Nuclear Installations, *Recueil systématique du droit fédéral* (RS) 732.17 (accessed 21 Jan. 2023). For more information on the revision of the Ordinance, see Federal Department for Environment, Transport, Energy and Communication (DETEC) (2021), *Explanatory Report on the revision of the Ordinance on the Decommissioning Fund and the Radioactive Waste Management Fund for Nuclear Installations: Rapport explicatif concernant la révision de l'ordonnance sur le fonds de désaffectation et sur le fonds de gestion des déchets radioactifs pour les installations nucléaires (OFDG; RS 732.17*).
28. Nuclear Energy Act of 21 March 2003, RS 732.1.

Liability and compensation

Entry into force of the new Law on third-party nuclear liability

The revised versions of the Law of 13 June 2008 on third-party liability in the field of nuclear energy (LRCN, RS 732.44) and of the Ordinance on third-party liability in the field of nuclear energy (ORCN, RS 732.441) entered into force on 1 January 2022. The two texts are based on the revisions under the 2004 Paris and Brussels Protocols that Switzerland ratified in 2009 and that entered into force on 1 January 2022. Switzerland also ratified the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention on 7 January 2022.[29] The operative provisions of the Paris Convention (Articles 1 to 15) are set out so as to be directly applied in a given country. This means that this international treaty does not have to be transposed in a national law to be applicable. Switzerland opted for the self-executing option, which also has the advantage of avoiding misinterpretation of the treaty when transposing it into national legislation.

The main principles and aspects of the new law are as follows:

- Exclusive and unlimited liability. As was the case under the prior Swiss legislation, the operator of a nuclear power plant bears exclusive and unlimited liability for nuclear damage. The operator is liable for damage without fault (objective aggravated liability), including for nuclear damage caused by acts of war or terrorism. The insurance cover obligation also remains unchanged. However, the amount of the cover is raised from CHF 1 billion (approximately EUR 1 billion) to EUR 1.2 billion, plus 10% of that amount for interest and costs. In case of damage, the insurance cover is supplemented by an amount of EUR 300 million allocated by the Contracting Parties to the Brussels Supplementary Convention. Thus, in total, EUR 1.5 billion is available to cover nuclear damage.

- Federal and private coverage. Coverage in a minimum amount of CHF 1 billion must be borne by private insurers. The LRCN sets out the risks that insurers are allowed to exclude partially or totally from coverage (e.g. extraordinary natural phenomena or acts of war). The insurance cover provided at present by the Swiss Confederation covers damage up to EUR 1.2 billion that is not covered by private insurers. To benefit from the federal insurance, operators pay policies that are used to finance the nuclear damage fund. The calculation of these contributions is based on actuarial principles and takes into account the risk associated with the installation or transport concerned.

  If and when economic conditions allow for higher private coverage under acceptable conditions, the Federal Council may increase the minimal amounts for private cover.

- Nuclear substances transport and coverage. The new legislation establishes distinct types of insurance policies for nuclear installations and nuclear substances transport. Under previous legislation, nuclear substances were included in the installations insurance. The total amount of coverage is EUR 1.2 billion (plus 10% for interest and costs) per transport of irradiated nuclear fuel or vitrified fission products originating from the reprocessing of spent fuel elements with a total weight of nuclear substances over 100 kg. For other transports of nuclear substances, the amount of the insurance cover is lowered to EUR 80 million (plus 10% for interests and costs). Transport of certain nuclear substances is excluded

29. 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).

based on decisions of the OECD Nuclear Energy Agency's Steering Committee for Nuclear Energy.[30]

- Coverage for certain nuclear facilities. The insurance cover for nuclear research facilities, federal interim repositories and decay storage facilities is lowered to EUR 70 million plus 10% for interest and costs.

- The notion of damage. Nuclear damage is meant to include damage to persons and goods as well as the environment. For example, the costs of measures of reinstatement of the impaired environment or any loss of income in relation with the use of the environment must now be covered.

- One court. One single court now has jurisdiction for all victims of an accident that occurred in a state that is party to the Convention, whatever their residence and nationality. The compensation procedure is greatly simplified and the protection of victims is increased in case an accident occurring abroad should cause damage in Switzerland.

- Major damage. If the amount of the third-party liability insurance and the total financial means of the operator with unlimited liability are not sufficient to cover the cost of damage, a regulation applicable to major damage comes into play, as was the case under the previous legislation. This regulation also applies in case the normal procedures are incapable of being carried out due to the large number of victims. The Federal Assembly can adopt a compensation regulation that provides that the Swiss Confederation will make supplementary contributions for the compensation of damage that is not covered.

United Arab Emirates

Nuclear installations

Operating licence for Unit 3 of Barakah Nuclear Power Plant

On 17 June 2022, the Federal Authority for Nuclear Regulation (FANR) of the United Arab Emirates (UAE) granted a licence to Nawah Energy Company (Nawah), a subsidiary of Emirates Nuclear Energy Corporation, for the operation of Unit 3 of the Barakah Nuclear Power Plant (BNPP) located in the Al Dhafra region of Abu Dhabi Emirate in the United Arab Emirates. The licence authorises Nawah to commission and to operate BNPP Unit 3 for 60 years, as well as to conduct a number of ancillary regulated activities related to the operation of Unit 3. The licence also subjects the commissioning and operation of Unit 3 to 17 licence conditions.

The licence to operate Unit 3 follows the issuance of the licences to operate Units 1 and 2 of the BNPP, respectively granted to Nawah in February 2020 and in March 2021. The licences were amended at the time of the issuance of the licence to operate Unit 3 to add and amend some of the existing licence conditions.

BNPP Unit 1 has been in commercial operation since April 2021 and Unit 2 since March 2022. Unit 3 was connected to the grid in October 2022.

30. NEA (2017), "Decision on the Exclusion of Small Quantities of Nuclear Substances outside a Nuclear Installation from the Application of the Convention on Third Party Liability in the Field of Nuclear Energy", adopted by the Steering Committee for Nuclear Energy on 3-4 Nov. 2016, NEA Doc. NEA/NE(2016)8/FINAL; NEA (1977), "Decision on the Exclusion of certain kinds of nuclear substances", adopted by the Steering Committee for Nuclear Energy on 27 Oct. 1977, NEA Doc. NE/M(77)2.

FANR's licences issued for the operation of BNPP Units 1 to 3 are available on the FANR website: www.fanr.gov.ae/en/rules-regulations/licenses-regulatory-approval (accessed 13 Jan. 2023).

Nuclear safety and radiological protection (including nuclear emergency planning)

Regulation for Leadership and Management for Safety in Nuclear Facilities (FANR-REG-01), Version 1

FANR issued a revised Regulation on the Leadership and Management for Safety in Nuclear Facilities (FANR-REG-01 V.1) on 6 October 2022. The regulation was published in the *UAE Official Gazette* No. 738 (31 Oct. 2022) and it will enter into force on 30 April 2023.

This regulation updates FANR's Regulation for Management Systems for Nuclear Facilities, which was issued in 2011, with the objective to expand the scope of the regulation, reflect the enhancements introduced by the IAEA Safety Standards on *Leadership and Management for Safety* published in 2016,[31] and take into account the experience and feedback from the implementation of the existing regulation.

The revised regulation establishes the requirements for the establishment, sustainability and continuous improvement of leadership and management for safety and an effective management system within a nuclear facility, which are to support and sustain a strong safety culture and security culture. It applies to different stages of the nuclear facility cycle including the siting, design, construction, commissioning, operation, closure and decommissioning, as well as any subsequent period of institutional control.

The regulation introduces a specific focus on the responsibility and leadership for safety, with dedicated provisions on the responsibilities of the licensee's board of directors, on the management's leadership for safety and on safety and security culture. In addition, the regulation sets out requirements related, *inter alia*, to the management system, documentation, resources and knowledge management, the control of documents and records, products and services and purchasing. Finally, it addresses the measures for the assessment and continuous improvement of the leadership for safety and the management system.

Regulation on Technical Services related to Radiation Safety (FANR-REG-30), Version 0

FANR issued a new regulation on the Technical Services Related to Radiation Safety (FANR-REG-30 V.0) on 13 October 2022. The regulation was published in the *UAE Official Gazette* No. 738 (31 Oct. 2022) and entered into force on 30 November 2022.

This new regulation establishes the framework to regulate the technical services in the field of radiation safety, such as calibration and testing, measurement and evaluation of doses to a worker or to the public, radiation measurement services, and radiation safety consultancy. The regulation establishes the requirements and criteria to register or obtain a licence from FANR for the provision of technical services relating to radiation safety as well as the requirements applicable to such services, including any modification or termination thereof. It includes a list of the technical services related to radiation safety. The list of the registrants or licensees authorised to provide such technical services along with the list of the technical services related to radiation safety that they are authorised to provide will be published by FANR on its website and will be updated on a regular basis.

The two above-mentioned regulations are available in English and Arabic on the FANR website, www.fanr.gov.ae/en/rules-regulations/regulations-guides/regulations (accessed 13 Jan. 2023).

31. IAEA (2016), *Leadership and Management for Safety*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 2, IAEA, Vienna.

United States

Nuclear installations

NRC authorises Vogtle Unit 3 to load nuclear fuel and begin operation

On 3 August 2022, the United States (US) Nuclear Regulatory Commission (NRC) authorised Southern Nuclear Operating Company, Inc., to load nuclear fuel and begin operation of the company's newly constructed AP1000 reactor (Unit 3) at the Vogtle Electric Generating Plant near Waynesboro, Georgia. This authorisation was provided after the NRC confirmed that all of the inspections, tests, analyses and acceptance criteria (ITAAC) included in the combined licence for Unit 3 had been met. A "combined licence" is an NRC-issued licence that authorises both the construction and the operation of a nuclear power plant (as opposed to two separate authorisations for construction and operation). Section 185b of the Atomic Energy Act of 1954, as amended, and NRC regulations in 10 Code of Federal Regulations (CFR) Part 52, state that the NRC may issue a combined licence after holding a public hearing and determining that there is reasonable assurance that the facility will be constructed and operated in conformance with the licence application and the NRC's requirements.[32] When issuing a combined licence, the Commission must identify the appropriate ITAAC that the licensee must perform to demonstrate that there is reasonable assurance the facility has in fact been constructed and will be operated in conformity with the license and the NRC's requirements. The licensee cannot operate the facility until the Commission makes a finding that all ITAAC have been completed.[33]

This marks the first time that the NRC has authorised the operation of a nuclear reactor licensed under the agency's 10 CFR Part 52 combined licence process. As of October 2022, the licensee has begun loading fuel into Unit 3. Southern Nuclear also has a combined licence for another AP1000 reactor (Unit 4) that is still under construction.

Denial of Oklo combined licence application for lack of information

On 6 January 2022, the NRC denied, without prejudice, Oklo Power, LLC's (Oklo) application to build and operate an advanced micro-reactor at Idaho National Laboratory.[34] The proposed design, "Aurora," uses heat pipes to transport heat from the reactor core to a power conversion system. Oklo submitted its licence application in March 2020, and the NRC staff accepted the application for review in June 2020. The NRC adopted a novel two-step approach to evaluating Aurora's design. In step 1 of the approach, Agency staff obtains additional information from Oklo on key safety and design aspects of the Aurora licensing basis, which is used to develop the schedule for the full technical review. In step 2 of the approach, Agency staff conducts the full technical review.

The NRC staff denied Oklo's application based on Oklo's failure to provide sufficient information in step 1 to establish a schedule to review the key safety and design aspects of the reactor. Missing information included a lack of information on the maximum credible accident[35] for the Aurora design, missing information concerning the safety classification of structures, systems, and components, and other issues. The NRC's denial does not preclude Oklo from submitting a complete application in the future.

32. 42 United States Code (USC) 2235(b); 10 CFR 52.97.
33. 10 CFR 52.103(g).
34. Oklo Power LLC, a subsidiary of Oklo Inc.; Oklo Aurora Combined License Application Idaho National Laboratory, 87 *Federal Register* (Fed. Reg.) 1441 (11 Jan. 2022).
35. The "maximum credible accident" is the worst-case accident scenario that could conceivably occur during the life of the reactor.

NuScale small modular reactor design certification

On 29 July 2022, the Commission directed the NRC staff to issue a final rule to certify NuScale Power, LLC's (NuScale) small modular reactor (SMR) design for use in the United States.[36] The final rule has since been published and will be effective 21 February 2023.[37]

NuScale's design certification application, the first SMR design reviewed by the NRC, was accepted for review by the NRC staff in March 2017. The NRC staff completed its safety evaluation of NuScale's application in August 2020 and determined the design met the applicable requirements to proceed to design certification, which is a rulemaking process that, once completed, approves the design of a nuclear power plant, thereby enabling future applicants to reference the design in applications to construct or operate a plant. An application to construct or operate a nuclear power plant that references a certified design will not need to address any of the issues resolved by the design certification rule.

Acceptance for review of the proposed Kairos Hermes Test Reactor

The NRC staff accepted for review Kairos Power, LLC's (Kairos) proposed "Hermes" Test Reactor design. The proposed reactor is a "low-power test reactor", meaning it will not generate power for the grid. Kairos is a US-based company developing a fluoride salt cooled high temperature reactor (KP-FHR) using tristructural isotropic (TRISO) fuel in pebble form. TRISO fuel utilises a carbon matrix coated fuel particle, like that developed for high temperature gas-cooled reactors, in a pebble-based fuel element. On 23 March 2022, the NRC held a public meeting to gather comments on the proposed design. The purpose of the public meeting was to gather information necessary to prepare an environmental impact statement (EIS) to evaluate the environmental impacts for the construction permit (CP) requested by Kairos. On 29 September 2022, the NRC staff issued a draft EIS for public comment.[38]

The NRC staff is currently engaged in review activities of the Hermes CP application. The safety and environmental review for this test reactor is projected to be completed in September 2023. Kairos expects their reactor to be operational by 2026 in eastern Tennessee.

Licensing and regulatory infrastructure

Proposed Rule for decommissioning nuclear power plants

On 3 March 2022, the NRC solicited public comment on a proposed rule for decommissioning nuclear power plants.[39] Plants undergoing decommissioning often rely on licensing actions, such as licence amendment and exemption requests, to reduce requirements that are no longer necessary to protect public health and safety and the common defence and security for permanently shut down reactors. Permanently shut down and defueled reactors undergoing decommissioning have significantly lower safety hazards than operating plants. The risk of offsite radioactive release is lower, and the types of possible accidents are fewer. Consistent with the reduced risk of these plants, the proposed rule would implement specific regulatory requirements for different phases of the decommissioning process. This rule would incorporate lessons learnt from plants that have recently transitioned to decommissioning and improve the effectiveness of the NRC's regulatory framework. The NRC held six public meetings to promote full understanding of this proposed rule and to facilitate public comments. Currently, there are 21 power reactors undergoing decommissioning in the United States that are overseen by the NRC.

36. Memorandum to D.H. Dorman, EDO from B.P. Clark, Secretary of the Commission (29 July 2022), "Staff Requirements – Affirmation Session, 2:00 p.m., Friday, July 29, 2022, via Public Teleconference" (ADAMS Accession No. ML22210A158), regarding SECY-22-0062 – Final Rule: NuScale Small Modular Reactor Design Certification (RIN 3150-AJ98; NRC-2017-0029).
37. NuScale Small Modular Reactor Design Certification, 88 Fed. Reg. 3287 (19 Jan. 2023).
38. Kairos Power, LLC; Hermes Test Reactor, 87 Fed. Reg. 59124 (29 Sept. 2022).
39. Regulatory Improvements for Production and Utilization Facilities Transitioning to Decommissioning, 87 Fed. Reg. 12254 (3 Mar. 2022).

Update on environmental justice at the US NRC

On 23 April 2021, the Commission directed the NRC staff to conduct a systematic review of how the NRC's programmes, policies and activities address "environmental justice," which refers to identifying and addressing disproportionately high and adverse human health or environmental effects of federal programmes, policies, and activities on minority populations and low-income populations.[40] After several public meetings and providing an opportunity for public comment, the NRC staff provided the results of their review to the Commission on 29 March 2022.[41]

The NRC staff concluded that the NRC's programmes, policies and activities that address environmental justice are consistent with applicable law, but also provided several recommendations to the Commission to enhance the NRC's approach to environmental justice. The staff recommended revising the 2004 NRC Environmental Justice Policy Statement.[42] The staff also recommended updating the Environmental Justice Strategy to account for all the changes to NRC activities, programmes and policies since the strategy was published in 1995. The staff recommended that the agency take various actions to enhance the agency's environmental justice related outreach activities. The staff also recommended the establishment of a Federal Advisory Committee for Environmental Justice and to have Commission meetings with relevant communities and Tribal nations. The report also suggests that the Commission direct the staff to examine whether the agency should pursue legislative changes to the current legal prohibition on funding parties who intervene in NRC regulatory or adjudicatory proceedings. Finally, the staff recommended assessing whether there are enhancements that can be made to address environmental justice concerns in the Agreement State application process and other related activities.

Outreach to stakeholders was a major aspect of the staff's recommendations to the Commission. Particularly, the staff recommended increasing outreach to environmental justice communities and Tribal nations, establishing permanent staff positions for environmental justice outreach, enhancing guidance and training for the NRC staff on environmental justice related outreach and improving access to environmental guidance and procedures. The staff committed to improving communication on specific topics, such as dose and radiation protection, emergency preparedness and the hearing process. Additional commitments included consideration of lessons learnt and knowledge gained during the environmental justice review when updating environmental review guidance documents.

40. See Memorandum to M.H. Doane, EDO and M. Zobler, General Counsel from A.L. Vietti-Cook, Secretary of the Commission (23 Apr. 2021), "Staff Requirements – Briefing on Equal Employment Opportunity, Affirmative Employment, and Small Business" (ADAMS Accession No. ML21113A070).
41. See Memorandum to the Commissioners from D.H. Dorman, EDO and M. Zobler, General Counsel (29 Mar. 2022), "SECY-22-0025 – Systematic Review of How Agency Programs, Policies, and Activities Address Environmental Justice" (ADAMS Accession No. ML22031A065).
42. Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions, 69 Fed. Reg. 52040 (24 Aug. 2004).

INTERGOVERNMENTAL ORGANISATION ACTIVITY

Euratom Atomic Energy Community (Euratom)

Euratom Community activities

Entry into force of the Agreement between the Republic of South Africa and the European Atomic Energy Community for Cooperation in the Peaceful Uses of Nuclear Energy

Over the years, the European Atomic Energy Community (Euratom) has concluded a number of bilateral international agreements under Article 101 of the Euratom Treaty. Those agreements were concluded with the US (1958, then replaced in 1995), Canada (1959), Australia (1982, replaced in 2012), Argentina (1997), Uzbekistan (2004), Japan (2006), Ukraine (2006), Kazakhstan (2008), South Africa (2013) and the United Kingdom (2020). These agreements vary in scope while key elements in most of them are nuclear safeguards clauses.

Although signed in 2013,[1] the Agreement between South Africa and Euratom for Cooperation in the Peaceful Uses of Nuclear Energy (hereinafter, the NCA) only entered into force in September 2021 on the basis of Article XV(1) of the NCA,[2] once formalities were completed by both signatory parties.

This NCA provides for wide-ranging co-operation on safe and peaceful uses of nuclear energy, underpinned by commitments by both sides to comply with international non-proliferation obligations. The co-operation relates to the peaceful uses of nuclear energy and includes, *inter alia*:[3]

- research and development in the field of nuclear energy (including fusion technologies);
- use of nuclear materials and technologies, such as applications in health and agriculture;
- transfers of nuclear materials and equipment;
- nuclear safety, radioactive waste and spent fuel management, decommissioning, and radiation protection, including emergency preparedness and response;
- nuclear safeguards;
- other areas to be agreed by the Parties, insofar as they are covered by the parties' respective programmes.

The co-operation under the NCA may be undertaken in various forms, such as supply of nuclear and non-nuclear materials, equipment and related technologies; provision of nuclear fuel cycle services; establishment of Working Groups, if necessary, to implement specific studies and projects in the area of scientific research and technological development; exchange of experts, scientific and technological information; organisation

1. *Official Journal of the European Union* (OJ) L 204 (31 July 2013), pp. 3-10.
2. According to this Article the NCA shall enter into force on the date of the latter written notification that internal procedures necessary for its entry into force have been completed by the parties.
3. Article III of the NCA.

of scientific seminars and conferences; consultations on research and technological issues; co-operation activities in promoting nuclear safety; and other forms of co-operation as may be determined by the parties in writing.

The NCA contains also nuclear safeguards provisions to ensure that both parties adhere to their non-proliferation commitments[4] and that co-operation serves only peaceful purposes. This includes the exchange of notifications and consents when nuclear items are transferred. The NCA also provides for the establishment, by the competent authorities of both parties, of Administrative Arrangements to ensure the effective implementation of its provisions.[5]

A particularity of this NCA is that technology transfers can be covered by the NCA when a Euratom member state elects to place such transfers within the framework of the NCA.[6]

Recent Euratom activities in relation to the Convention on the Physical Protection of Nuclear Material

On 24 January 2022, Euratom fulfilled its obligation pursuant to Article 14.1 of the Convention on the Physical Protection of Nuclear Material, as amended (A/CPPNM) to inform the International Atomic Energy Agency of its laws and regulations giving effect to the Convention. This was done with an information paper.

The Euratom information paper includes a comprehensive list of all Euratom legal acts in several fields of nuclear law, which cover, at least to some extent, aspects of physical protection, and to which the member states' legislative and regulatory frameworks governing the physical protection of nuclear material and nuclear facilities apply. In addition, it includes information on the international agreements referring to the Convention, the competent authorities, the nuclear security measures during international nuclear transport and the international co-operation.

Subsequently, Euratom participated in the Conference of the Parties to review the A/CPPNM, which took place from 28 March to 1 April 2022 in Vienna. Euratom delivered a statement covering its implementation measures, its views on the adequacy of the Convention and the areas where further progress can be made. Euratom, as well as all of its member states, joined the request that the depositary convene the next conference of parties no later than six years after the first Review Conference.

Second Report of the European Commission on the progress achieved with the implementation of the Nuclear Safety Directive

On 21 April 2022, the European Commission (Commission) adopted its second progress report,[7] accompanied by a detailed staff working document,[8] assessing the progress achieved by EU member states in implementing the Nuclear Safety Directive, as amended in 2014.[9]

4. Article VI of the NCA.
5. Article IX of the NCA.
6. Article IV of the NCA.
7. Report from the Commission to the Council and the European Parliament on the progress made with the implementation of Directive 2009/71/Euratom establishing a Community framework for the safety of nuclear installations amended by Directive 2014/87/Euratom, COM(2022) 173 final (4 Apr. 2022).
8. Commission Staff Working Document, Implementation of Directive 2009/71/Euratom establishing a Community framework for the safety of nuclear installations amended by Directive 2014/87/Euratom, SWD(2022) 107 final (21 Apr. 2022).
9. 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, pp. 18-22, as amended by 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), pp. 42-52. A consolidated version is available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02009L0071-20140814 (accessed 29 Dec. 2022).

The report is based on the national reports submitted by the member states in 2020, but also takes into account findings from the assessment of the Directive's transposition, results of the EU Stress Tests and of the first Topical Peer Review, conclusions of international reviews and issues raised by EU citizens and other EU institutions.

The Commission's reporting offers a comprehensive overview of nuclear safety in the EU. It concludes that there is a good overall level of implementation of the Directive's obligations, and highlights the significant progress made since the Fukushima Daiichi nuclear accident in 2011. However, it notes that there is still room for improvement. In this respect, the report presents a number of observations addressed to the member states on nuclear safety governance and technical aspects, building on the good practices and challenges identified, with due consideration of national specificities.

Furthermore, taking account of these observations, the report highlights several areas where there is scope for future action at the EU level to continuously improve nuclear safety in the EU. These actions would contribute to enhancing the independence of the regulatory authorities, strengthening the capabilities of licence holders, consolidating safety culture and transparency, supporting the application of the nuclear safety objective and making the European peer-reviews more effective.

Progress in these areas will be achieved through a structured exchange of views and experiences between member states, supported and facilitated by the Commission. In this framework, the Commission organised in Luxembourg, on 8-9 November 2022, a workshop reuniting representatives of national authorities, international organisations, industry associations, NGOs and independent experts. This event offered an opportunity for an open and comprehensive debate on key nuclear safety topics, aiming to inform the choice of priority topics with the greatest cross-cutting benefit for safety on which work at the EU level should focus over the next two years.

Signature of a new Memorandum of Understanding between Euratom and the IAEA on nuclear safety co-operation

In September 2022, Euratom and the International Atomic Energy Agency (IAEA) signed a Memorandum of Understanding on nuclear safety co-operation, updating the previous agreement from 2013.

The IAEA and Euratom have developed extensive scientific and technological co-operation over many years. A co-operation agreement between the IAEA and EURATOM has been in force since 1976, providing a formal basis for collaboration. It is on the basis of this agreement that Euratom participates in the IAEA General Conference as an observer. In 2008, a joint statement was issued by which both organisations agreed to examine concrete steps to significantly reinforce the quality and intensity of their co-operation.

Subsequently, the organisations signed a Memorandum of Understanding in 2013 that was renewed twice. While the co-operation on the basis of the 2013 Memorandum of Understanding has been effective and fruitful, both sides saw the need to enlarge the scope of their co-operation to reflect advances in the sector in the new, updated 2022 Memorandum of Understanding.

The updated Memorandum of Understanding extends the scope of the previous Memorandum of Understanding to include emerging areas of common interest between Euratom and the IAEA, such as education and training, small modular reactors, and the safety of fusion installations. The 2022 Memorandum of Understanding also looks to further strengthen co-operation in the areas of radiation safety, waste safety, and emergency preparedness and response.

International Atomic Energy Agency

Nuclear safety

Convention on Nuclear Safety

An Officers' Meeting was held from 18 to 19 July 2022, at which the Officers of the Joint Eighth and Ninth Review Meeting of Contracting Parties (CP) to the Convention on Nuclear Safety (CNS) discussed and agreed, *inter alia*, on the updated templates for the Joint Eighth and Ninth Review Meeting of the CPs to the CNS.

At the Organizational Meeting of the Joint Eighth and Ninth Review Meeting, the CPs agreed on the establishment of a working group to discuss proposals focusing on contingency planning and business continuity and other proposals aiming at improving the peer review process. The first meeting of the working group was held from 20 to 22 July 2022.

Outreach on the Convention on Nuclear Safety

The Agency hosted an Educational Workshop from 19 to 13 May 2022. The workshop addressed Signatory States and those Contracting Parties that recently joined the CNS or have difficulties in fulfilling their obligations under the CNS. The workshop aimed at enhancing the participation in the peer review process and the understanding of the CPs' obligations.

In addition, a workshop for Representatives of Permanent Missions to the IAEA to provide assistance and educational information on the CNS, on its review process and on fulfilling obligations under the CNS was held on 27 October 2022.

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

The Agency hosted and provided secretariat support to the Seventh Review Meeting of the Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) held in Vienna, from 27 June to 8 July 2022, and attended by more than 750 delegates from 76 CPs. At the meeting, CPs reviewed and discussed the National Reports submitted by the CPs and agreed, *inter alia*, on the progress made since the Sixth Review Meeting, several Good Practices and Areas of Good Performances, overarching issues and recommendations as well as the planned dates for the Eight Review Meeting from 17 to 28 March 2025.

Outreach on the Joint Convention

The Agency facilitated an interregional workshop, held from 19 to 23 September 2022 in Vienna, to promote adherence to the Joint Convention. The aim of the workshop was to provide member states with information on the adherence process, a broader understanding of the peer review process and the obligations of CPs under the Joint Convention.

Convention on Early Notification of a Nuclear Accident (Early Notification Convention), the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention)

From 13 to 17 June 2022, the Agency held the Eleventh Meeting of the Representatives of Competent Authorities identified under Early Notification and Assistance Conventions. The main objectives of the meeting were to share information on national emergency preparedness and response arrangements and challenges, and to discuss the implementation of the Conventions.

Technical meetings to create awareness for the need for political commitment to the Code of Conduct on the Safety and Security of Radioactive Sources and its Supplementary Guidance

The Agency continued its efforts to raise awareness among member states of the need and benefits of expressing political commitments to the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance. Technical Meetings to create awareness of the need for such political commitments and to provide comprehensive information on the benefits of providing such commitment were held from 17 to 20 May 2022 for member states in Latin America and the Caribbean region and from 30 August to 2 September 2022 for member states in Africa and Asia and the Pacific regions.

Nuclear security

Outreach on the CPPNM and its Amendment

The Agency continued to promote further adherence to, and full implementation of, the CPPNM and its Amendment, including through national workshops, as well as a regional workshop for Asia and the Pacific in Hanoi, Vietnam, from 4 to 7 October 2022.

Nuclear liability

The Second Meeting of the Contracting Parties and Signatories of the Convention on Supplementary Compensation for Nuclear Damage (CSC) was held at the IAEA from 31 May to 2 June 2022. The aim of the Second Meeting was to encourage dialogue among CSC parties and signatories on CSC implementation matters, and to work together to promote participation in the CSC worldwide. The CSC parties and signatories discussed topics such as the logistics, timing and flow of money between CSC parties in supplementary funding, the interrelationship between supplementary funding under CSC funding and the Brussels Convention Supplementary to the Paris Convention on Third Party Liability in the Field of Nuclear Energy (BSC). The CSC parties and signatories also delivered presentations on their respective domestic nuclear liability regimes.

The 22nd regular meeting of the International Expert Group on Nuclear Liability (INLEX) took place at IAEA Headquarters from 6 to 8 September 2022. At the meeting, the Group discussed, *inter alia*, the operator's right of recourse under the nuclear liability conventions, liability issues concerning small modular reactors, nuclear fusion and the relationship between supplementary funding under the BSC and the CSC. No definitive conclusions were reached on any of these items, and the Group decided to continue to discuss them at their next meeting. At the meeting, INLEX adopted a statement on the "Benefits of Joining the Global Nuclear Liability Regime".

On 9 September 2022, a Workshop on Civil Liability for Nuclear Damage was held at the IAEA with the assistance of the members of INLEX. The purpose of the workshop was to provide officials and experts from member states with an overview of the international legal regime on nuclear liability.

66th regular session of the IAEA General Conference

The 66th regular session of the IAEA General Conference was held in person at IAEA Headquarters in Vienna, Austria, from 26 to 30 September 2022.

Around 2 570 delegates registered to attend the General Conference, coming from 152 of the IAEA's 175 member states and from international organisations, non-governmental organisations and the media. A total of 92 side events took place during the week, highlighting the innovative work underway at the IAEA and in member states using nuclear technology and its applications.

Resolutions of the Conference

A number of resolutions were adopted by the Conference. As in previous years, resolution GC(66)/RES/5 on Nuclear and Radiation Safety and resolution GC(66)/RES/7 on Nuclear Security include sections that are of legal relevance to nuclear safety and security. All resolutions adopted during the 66th regular session of the General Conference are available on the IAEA website.[10]

- Nuclear and Radiation Safety (GC(66)/RES/5)[11]

Regarding the CNS, the General Conference urged "all Member States that have not yet done so, especially those planning, constructing, commissioning or operating nuclear power plants, or considering a nuclear power programme, to become Contracting Parties to the CNS".[12]

The Conference likewise 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".[13]

The Conference stressed "the importance of CNS and Joint Convention Contracting Parties fulfilling their respective obligations stemming from these Conventions and reflecting these in their actions to strengthen nuclear safety and in particular when preparing National Reports, and actively participating in peer reviews for CNS and Joint Convention Review Meetings".[14]

In addition, the Conference requested "the Secretariat to provide full support for the CNS and Joint Convention Review Meetings, and to consider addressing their outcomes in the Agency's activities, as appropriate and in consultation with Member States".[15]

The Conference further urged "all Member States that have not yet done so to become Contracting Parties to the Early Notification Convention and the Assistance Convention", and stressed "the importance of Contracting Parties fulfilling the obligations stemming from these Conventions, and actively participating in regular meetings of the Representatives of Competent Authorities".[16]

In this context, the Conference requested "the Secretariat, in collaboration with regional and international organizations and Member States, to continue its activities to promote the importance of conventions concluded under the auspices of the IAEA and to assist Member States upon request with adherence, participation and implementation as well as strengthening of their related technical and administrative procedures".[17]

With respect to the Code of Conduct on the Safety and Security of Radioactive Sources, its supplementary Guidance on the Import and Export of Radioactive Sources, and its supplementary Guidance on the Management of Disused Radioactive Sources, the General Conference encouraged "all Member States to make political commitments to the non-legally binding Code of Conduct on the Safety and Security of Radioactive Sources, and its Guidance on the Import and Export of Radioactive Sources, and its Guidance on the Management of Disused Radioactive Sources, and to implement these, as appropriate, in order to maintain effective safety and security of radioactive sources throughout their life

10. IAEA (2022), "66th IAEA General Conference (2022) Resolutions and Decisions", www.iaea.org/about/governance/general-conference/gc66/resolutions (accessed 29 Dec. 2022).
11. IAEA (2022), Nuclear and radiation safety, Resolution adopted on 30 September 2022 during the eleventh plenary meeting, IAEA Doc. No. GC(66)/RES/5.
12. *Ibid.*, p. 7, para. 14.
13. *Ibid.*, para. 15.
14. *Ibid.*, para. 16.
15. *Ibid.*, para. 17.
16. *Ibid.*, para. 18.
17. *Ibid.*, para. 19.

cycle". The Conference also requested "the Secretariat to continue supporting Member States in this regard".[18]

Similarly, the Conference encouraged member states "to apply the guidance of the Code of Conduct on the Safety of Research Reactors at all stages in their life, including planning" and "to freely exchange their regulatory and operating information and experience with regard to research reactors". In this context, the Conference requested the Secretariat "to continue to support Member States, upon request, in [the] application of the guidance of the Code of Conduct on the Safety of Research Reactors".[19]

With regard to civil liability for nuclear damage, the General Conference encouraged "Member States to give due consideration to the possibility of joining the international nuclear liability instruments, as appropriate, and to work towards establishing a global nuclear liability regime".[20]

In this context, the Conference requested "the Secretariat, in coordination with the OECD/NEA when appropriate, to assist Member States, upon request, in their efforts to adhere to any international nuclear liability instruments concluded under the auspices of the IAEA or the OECD/NEA, taking into account the recommendations of the INLEX in response to the IAEA Action Plan on Nuclear Safety".[21]

In addition, the Conference recognised "the valuable work of INLEX", took note "of its recommendations and best practices on establishing a global nuclear liability regime, including through the identification of actions to address gaps in and enhance the existing nuclear liability regimes", encouraged "the continuation of INLEX, especially for its support for the IAEA's outreach activities to facilitate the achievement of a global nuclear liability regime" and requested "that INLEX, via the Secretariat informs Member States on a regular and transparent basis about the work of INLEX and its recommendations to the Director General".[22]

- Nuclear Security (GC(65)/RES/9)[23]

In the context of nuclear security, the Conference affirmed "the central role of the Agency in strengthening the nuclear security framework globally and in coordinating international activities in the field of nuclear security, while avoiding duplication and overlap".[24]

The Conference called upon the Secretariat "to continue to organize [the International Conference on Nuclear Security] ICONS every four years" and encouraged "all Member States and the Secretariat to engage actively in the preparation of ICONS 2024".[25]

The Conference also encouraged "all Parties to the CPPNM and its 2005 Amendment to fully implement their obligations thereunder" and encouraged "States that have not yet done so to become party to this Convention and its Amendment". It further encouraged "the Agency to continue efforts to promote further adherence to the Amendment with the aim of its universalization". In this context, the Conference reminded "all Parties to inform the depositary of their laws and regulations which give effect to the Convention without further delay", and requested "the Director General of the IAEA, as the depositary, to continue communicating such information to all Parties".[26]

The Conference welcomed "the successful holding of the 2022 Conference of the Parties to the Amendment to the CPPNM" and noted that "the required number of Parties to the

18. *Ibid.*, para. 20.
19. *Ibid.*, para. 21.
20. *Ibid.*, p. 8, para. 31.
21. *Ibid.*, para. 32.
22. *Ibid.*, para. 33.
23. IAEA (2022), Nuclear Security, Resolution adopted on 30 September 2022 during the eleventh plenary meeting, IAEA Doc. No. GC(66)/RES/7.
24. *Ibid.*, p. 4, para. 1.
25. *Ibid.*, p. 5, para. 7.
26. *Ibid.*, para. 12.

Amendment requested the depositary to convene a follow-on Conference, in line with Article 16.2 of the Convention". In addition, it also requested the Secretariat "to take the Outcome Document of the 2022 Conference into consideration in line with the Member States' respective legal obligations".[27]

IAEA Treaty Event

The twelfth Treaty Event took place during the margins of the 66th regular session of the General Conference. It provided member states with a further opportunity to deposit their instruments of ratification, acceptance or approval of, or accession to, the treaties deposited with the Director General, including those related to nuclear safety, security and civil liability for nuclear damage. At the Treaty Event, Cambodia deposited an instrument of accession to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Mauritania deposited an instrument of acceptance of the African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA), and Mozambique deposited an instrument of ratification of the Amendment to the Convention on the Physical Protection of Nuclear Material.

Side event to mark the 25th anniversary of the 1997 Nuclear Liability Instruments

During the 66th regular session of the General Conference, on 28 September, a side event was held to celebrate the 25th anniversary of the adoption of the Convention on Supplementary Compensation for Nuclear Damage and the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage. The side event provided member states with an opportunity to consider the importance of establishing a modernised and global nuclear liability regime. Representatives from Japan, Morocco, the United Kingdom and the United States gave remarks at the event.

Side event to mark the 25th anniversary of the adoption of the Joint Convention

During the 66th regular session of the General Conference, on 27 September, a side event was held to celebrate the 25th anniversary of the adoption of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (25 Years Joint Convention: A Proven Instrument for Improving Nuclear Safety and Promoting Transparency and Public Confidence in Spent Fuel and Radioactive Waste Management). At the side event, the past 25 years of the Joint Convention was recalled from the perspectives of Canada, Ghana and the Secretariat. The side event also provided member states with an opportunity to discuss and share their experience on the benefits of adhering to the Joint Convention.

Legislative assistance

The Agency continued to provide legislative assistance to member states to support the establishment of an adequate and comprehensive national nuclear legal framework, and to promote adherence to the relevant international legal instruments, through national workshops and awareness raising activities. In addition, specific bilateral legislative assistance was provided to several member states through written comments and advice on drafting national nuclear legislation. Two sub-regional workshops on nuclear law were held, the first for member states in Asia and the Pacific region in August 2022 and the second for member states in Latin America and the Caribbean in September 2022.

The 2022 Nuclear Law Institute (NLI) was held in Vienna, Austria, from 10 to 21 October 2022. The NLI was attended by 57 participants from 54 member states. The Agency also sponsored 15 grantees to attend the Nuclear Energy Agency's International School of Nuclear Law, which was held in Montpellier, France, from 22 August to 2 September 2022, and it sponsored 8 grantees to attend the Nuclear Inter Jura Congress 2022, "INLA and the

27. *Ibid.*, para. 13.

Nuclear Industry: The Next 50 Years", which was held in Washington, DC, United States, from 23 to 27 October 2022.

During the reporting period, the final two webinars of the series of eight topical webinars, which started on 28 October 2021, were held. The webinars covered the Legal Framework for the Management of Transboundary Nuclear Risk and Openness and Transparency in International and National Nuclear Law.

OECD Nuclear Energy Agency

Nuclear law-related meetings

Meeting of the NEA Nuclear Law Committee (NLC)

The NLC met in person and online on 29-30 June 2022 to review the activities of the NEA Division of Nuclear Law (DNL) and the NLC working parties on nuclear liability and transport, deep geological repositories and nuclear liability, and the legal aspects of nuclear safety. The meeting was attended by 68 participants representing 25 NEA member countries, 4 partner countries, the European Commission (EC), the International Atomic Energy Agency (IAEA) and the insurance industry.

Two topical sessions were held during the meeting. The first, on the nuclear liability amounts applicable to small modular reactors (SMRs), was organised to examine this issue from the perspective of the nuclear liability conventions and discuss the relevant provisions of national legislation of countries that are developing SMR projects. Another topical session focused on the legal issues related to nuclear installations in Ukraine, with an update on the status of nuclear facilities and impacts on the operator and the regulatory body. It also included reports on the application of international law to nuclear facilities in Ukraine, liability issues with respect to nuclear installations under military control, and the practical implications for nuclear liability insurance in Ukraine. The meeting agenda also featured reports by Finland and Sweden on the latest national developments in nuclear law in those countries, by Japan on the status of lawsuits for compensation for nuclear damage regarding the Fukushima Daiichi Nuclear Power Plant accident, by the United Arab Emirates updating on their nuclear programme and recent developments in its licensing and regulatory framework, and by the EC and the IAEA on their latest activities. Finally, the Committee was also updated on the work undertaken by the Contracting Parties to the Paris Convention and on the status of the reports for previous NEA events on nuclear liability.

Meeting of the NEA Working Party on the Legal Aspects of Nuclear Safety (WPLANS)

The WPLANS met in person and online on 27-28 June 2022 with 42 participants representing 19 NEA member countries, 2 non-NEA member countries, the EC and the IAEA. The first day of the meeting featured discussions on national developments related to the legal aspects of nuclear safety, legal issues related to long-term operation of nuclear power plants and legal challenges to licensing decisions, with updates from Belgium, Canada, Japan, Sweden and the United States. In addition, a session on the licensing and regulation of small modular and advanced reactors took place, with presentations by representatives of the Czech Republic, Finland, Korea and the United Kingdom. The day ended with the EC's update on matters of special interest to WPLANS. The second day of the meeting focused on updates related to the survey and draft report on legal challenges related to nuclear safety, with presentations by the NEA and group discussions on future actions. A topical session on climate change litigation took place, with presentations by representatives from Australia and Canada. Participants from the IAEA, Ukraine and the United Arab Emirates provided updates on matters of special interest to the WPLANS.

Meeting of the NEA Working Party on Nuclear Liability and Transport (WPNLT)

The NEA Working Party on Nuclear Liability and Transport (WPNLT) organised on 1 December 2022 a remote working meeting of an ad-hoc expert group to address selected outcomes of the workshop on "The Qualification of Nuclear Substances and Nuclear Liability" held on 29-30 March 2021. The meeting was held with a view to preparing practical solutions to facilitate the process of qualification of nuclear substances being transported and the identification of an appropriate insurance or other financial security coverage. The working meeting was attended by 34 legal, technical and insurance experts nominated by 14 NEA member countries, 2 non-NEA member countries (Lithuania and the United Arab Emirates), the EC and the IAEA. Representatives from the nuclear insurance industry, the International Group of P&I Clubs, the International Nuclear Law Association (INLA) and the World Nuclear Association (WNA) also participated in the meeting. The ad-hoc expert group tackled certain practical aspects of the implementation of the exclusion of small quantities of nuclear substances from the scope of the application of international nuclear liability conventions and held a round table on the challenges and the pathway to elaborate practical solutions to facilitate the process to qualify nuclear substances being transported.

Meeting of the Contracting Parties to the Paris Convention and the Brussels Supplementary Convention

As part of the preparation for the entry into force of the 2004 Protocols, the NEA member countries that are party to the Paris Convention and Brussels Supplementary Convention (Contracting Parties) undertook a review of all the Decisions, Recommendations and Interpretations (DRI) applicable to the Paris Convention and the Brussels Supplementary Convention in force. In this context, the Steering Committee for Nuclear Energy and the OECD Council were informed that nine DRI of the Steering Committee regarding the Paris Convention and two Recommendations of the Council regarding the Paris Convention and the Brussels Supplementary Convention (respectively OECD/LEGAL/0197, on fixing a lower liability amount, and OECD/LEGAL/0198, on unit of account) would become obsolete, as their provisions are covered by the 2004 Protocols, and should therefore be abrogated once all Contracting Parties to the Paris Convention and to the Brussels Supplementary Convention have ratified the 2004 Protocols. The Steering Committee approved on 21 April 2022 the proposal to abrogate several DRI related to the application of the Paris Convention on Third Party Liability in the Field of Nuclear Energy and the Brussels Convention Supplementary to the Paris Convention and the Council agreed to the abrogation of the two Recommendations of the Council on 1 June 2022.

The Contracting Parties met in person and online on 1 July 2022. The Contracting Parties provided an update on their respective national legislative and administrative processes and the status of financial securities following the entry into force of the 2004 Protocols, with a particular focus on the remaining actions to be undertaken and the impact of the entry into force of the 2004 Protocols on the insurance market. The meeting featured presentations on national developments regarding nuclear liability in Türkiye and the United Kingdom. The Secretariat also provided updates to the Contracting Parties on nuclear liability-related matters that touch upon the operation and interpretation of the Paris and Brussels Supplementary Conventions.

In addition, the Contracting Parties organised a virtual working meeting on 30 November 2022 to discuss the reciprocity principle provided in the Paris Convention. Following the expansion of its geographic scope of application, the Paris Convention now allows affected persons situated in certain countries that are not parties to the Paris Convention to make claims in case they suffer damage or loss as a result of ionising radiation emitted from an accident in a nuclear installation or the transport of nuclear substances that are under the responsibility of a nuclear operator situated in a Paris Convention State. During the working meeting in November, the Contracting Parties discussed the criteria to be fulfilled by countries with national nuclear liability regimes that are similar to the one set up by the Paris Convention and afford equivalent reciprocal benefits to the Paris Convention State where the accident occurred.

NEA education programmes

2022 Fundamentals of International Nuclear Law (FINL)

The second edition of the Fundamentals of International Nuclear Law (FINL) course was held on 14-18 February 2022 with a diverse group of 42 professionals and graduate students from 25 countries. The FINL was designed to accommodate the needs and interests of professionals working in the nuclear field and graduate students enrolled in an energy or international law-related LLM programme.

The FINL is an online course developed by the NEA to provide a high-level, introductory review of the central aspects of international nuclear law in a condensed programme. Building upon the success of the first edition of the FINL, this year's programme was expanded to five days, three hours a day, and included a welcome and introductory session where the participants and lecturers could interact in an informal atmosphere.

The participants learned about the international nuclear law framework and major issues affecting the peaceful uses of nuclear energy. Renowned specialists in nuclear law from international organisations, governments and private industry delivered lectures on topics related to nuclear safety, security, non-proliferation and liability.

2022 International School of Nuclear Law (ISNL)

The 2022 session of the ISNL was held from 22 August to 2 September at the University of Montpellier. It marked the first time the programme was held in person since the 2019 edition.

Organised by the NEA and the University of Montpellier, the ISNL is a unique educational programme that offers participants from the academic, private and governmental sectors an in-depth look at international nuclear law, focusing on areas such as nuclear safety, environmental law, security, safeguards, and nuclear third party liability. The 2022 session was attended by 56 participants from 38 countries, including non-NEA member countries, many of whom received support to attend the ISNL from the IAEA, which also provided several lecturers.

The participants from different backgrounds and career levels were immersed in the subject through the ISNL's rigorous programme, which consisted of lectures, group assignments and panel discussions. These classes touched on all aspects of nuclear law, including nuclear safety, environmental protection, transport, nuclear security, non-proliferation, safeguards, nuclear liability, international trade and management of spent fuel and radioactive waste. Comprehensive lectures were delivered by 28 specialists in nuclear law from international organisations, governments, academia and private industry. In addition, the ISNL ensured that participants had the opportunity to network with their new classmates and to discover the city of Montpellier and its surroundings with social events, city tours and a graduation ceremony.

After the session's programme concluded, many participants continued their studies by completing an examination and a written dissertation on a topic relevant to international nuclear law, with the intention of applying for the University Diploma (*Diplôme d'université* – D.U.) in International Nuclear Law from the University of Montpellier.

2022 International Radiological Protection School (IRPS)

The IRPS was created in 2018 in partnership with the Swedish Radiation Safety Authority (SSM) and Stockholm University's Centre for Radiation Protection Research (CRPR) to ensure that the depth of knowledge of the radiological protection (RP) system is passed onto future generations of RP professionals and to advance progress in the field. The IRPS aims to underline the nuances and history of international guidance and working experience that will allow the next generation of radiological protection leaders to appropriately apply the radiological protection system consistently with national regulations in place and to address current and future RP challenges.

The fourth edition of the International Radiological Protection School was held on 22-26 August in Stockholm, Sweden, and assembled 52 participants from 26 countries at Stockholm University and online. Over the 5-day programme, 23 renowned teachers and experts in the radiological protection field from around the world delivered a series of lectures. Each lecture addressed a specific issue in the diverse field of radiological protection, providing the participants with a thorough overview of the fundamentals, latest developments and future challenges in the field.

The participants had the opportunity to exchange and build upon their knowledge during these classes in addition to workshops, Q&A sessions, quizzes and practical case studies. The scenarios gave the students the opportunity to propose solutions to hypothetical challenges in radiological protection regulation and implementation and to receive feedback from their mentors. Prior to the IRPS on-campus week, participants were invited to join a dedicated online learning platform that introduced them to some of the lecturers and helped them in their course preparations.

NEA workshops

2022 Workshop on the Management of Spent Fuel, Radioactive Waste and Decommissioning in SMRs or Advanced Reactor Technologies in Canada

The NEA and Natural Resources Canada held an international workshop in Ottawa, Canada, on 7-10 November 2022 on the implementation of radioactive waste management and decommissioning strategies in SMRs and advance reactor technologies.

As many countries are exploring ways to achieve their commitments to meet their decarbonisation targets by 2050, they are focusing their attention on the ongoing development of SMRs and Generation IV reactor technologies as an option to address the effect of climate change and future energy demand. To ensure these new technologies are viable to supplement existing energy sources, careful consideration of the management, storage, transport and disposal of the radioactive waste needs to be closely examined at the early stages of the design process. This topic is at the centre of nuclear and radioactive waste fields, and increasingly in the public domain. This topic has been surfacing in conversation for many months during various events within the international community, including those hosted by the NEA.

The workshop convened participants from various fields of expertise in the areas of radioactive waste management, decommissioning, nuclear science and development, transportation, as well as young professionals, communication experts and researchers.

The Workshop's objectives were to:

- better understand how radioactive waste management and decommissioning should be considered as part of a more comprehensive preparation for these reactors' deployment from the design stage;
- understand unique features of SMR waste and the key questions that need to be answered to ensure a path to final disposal;
- review current challenges in decommissioning and provide lessons learnt to avoid similar challenges in the future;
- better integrate educational institutions and engage with interested communities early in the processes; and
- better understand how the current regulatory framework should be considered in the early development of SMR and advanced reactor technologies.

The goal of the workshop was to devise a guideline document that will serve implementers in understanding key issues in decommissioning and waste management of new reactors from the design perspective, aiding in the licensing process and in future decommissioning and waste management activities.

NEA-serviced bodies

New framework agreement for the Multinational Design Evaluation Programme (MDEP)

MDEP, a unique multinational initiative leveraging the resources and knowledge of national regulators to review new reactor designs, began operation under a new framework agreement in January 2022 with the first meeting of the new Management Board. During its first meeting, the Management Board elected officers and confirmed MDEP's willingness to consider options for wider international co-operation in the future as new reactor technologies are presented to national regulators for assessment.

The Management Board also adopted new Terms of Reference for the Programme and for its design-specific and any future issue-specific groups.[28] This concluded the transition from the previous Framework and will further allow MDEP to continue in its unique role. The two working groups of the programme continue to exchange information and share experience in national regulatory activities, approaches and legal framework related to new designs, with the goal to leverage resources and ensure that the VVER and HPR1000 design reviews remain safety-focused.

MDEP is currently considering plans to hold a conference on its key achievements since 2006, the lessons learnt, its ongoing work and future international co-operation in light of the needs of embarking countries.

NEA publications of interest

Since the publication of *Nuclear Law Bulletin* No. 107, the NEA has issued a number of publications of interest.

Hydrogen is expected to play important roles in decarbonised energy systems, as an energy source for otherwise hard-to-electrify sectors as well as a storage vector to enhance power system flexibility. However, hydrogen is not a primary energy resource and has to be produced using different chemical processes. Water electrolysis, which uses electricity to split water molecules to extract hydrogen, is expected to become a leading solution in this context. Electrolysis will, however, only be a feasible solution if the electricity used as feedstock comes from low-carbon sources. A significant number of countries are therefore considering a role for nuclear energy in their hydrogen strategies.

The Role of Nuclear Power in the Hydrogen Economy: Cost and Competitiveness (2022) provides an assessment of the costs and competitiveness of nuclear-produced hydrogen across the hydrogen value chain and explores the impacts of hydrogen production on the overall costs of integrated electricity and energy systems. It shows, in particular, that nuclear energy can be a competitive source to produce and deliver low-carbon hydrogen for centralised industrial demand. The large scale and dispatchability of nuclear power can also improve the cost-efficiency of hydrogen transport and storage infrastructures, and reduce the overall costs of the energy system.

A five-day workshop entitled "Multi-Sector Workshop on Innovative Regulation: Challenges and benefits of harmonising the licensing process for emerging technologies" was held in December 2020 and jointly sponsored by the NEA and the Canadian Nuclear Safety Commission. The outcomes and conclusions of the event were published in *Harmonising the Nuclear Licensing Process for Emerging Technologies: A Global Path Forward* (2022), providing valuable insights from other sectors that have managed both the regulation of innovative technologies and global harmonisation. The lessons learnt will help the nuclear sector as it adopts advanced, disruptive technologies in the coming years.

Finally, the Working Party on Deep Geological Repositories and Nuclear Liability (WPDGR) report *Deep Geological Repositories and Nuclear Liability* has been finalised and is expected to be published in 2023.

28. Multinational Design Evaluation Programme Terms of Reference (Jan. 2022), www.oecd-nea.org/mdep/documents/MDEPToRapproved_Jan2022.pdf (accessed 29 Dec. 2022).

NUCLEAR REGULATORY LAW

No. 7381

Dated 8 March 2022

SECTION FIVE

Civil Liability Regarding Nuclear Damages

Liability of the operator

ARTICLE 12- (1) Provisions of Paris Convention shall be applied in the event there are no provisions of this Law to nuclear damages resulting from nuclear incidents.

(2) This Section shall not cover to the damage caused by radioisotopes used or to be used outside a nuclear installation and have reached the final stage of fabrication so as to be usable for any industrial, commercial, agricultural, medical, scientific or educational purpose or from nuclear substances which quantity and activity are below the thresholds determined in the frame of Paris Convention.

(3) Regarding nuclear damages resulting from nuclear incidents; legal entity authorized by the Nuclear Regulatory Authority or the authorities in their country to operate a nuclear installation, legal entity who established the nuclear installation in the period before the license of operating the nuclear installation is granted, legal entity whose license is canceled and is operating the nuclear installation still until a new operator is established after the revoking of license shall be deemed as the operator.

(4) The operator shall be liable for nuclear damage and shall pay compensation without regard to whether itself, its personnel and the suppliers of technology, goods and services for the installation contributed to the occurrence of the nuclear incident, or without regard to fault.

(5) The operator shall not be liable for nuclear incidents directly caused by armed conflicts, hostile acts, civil war or insurrection.

(6) The operator shall be liable only within the scope of the provisions of Paris Convention and this Section regarding the compensation of nuclear damages caused by a nuclear incident.

(7) Cancellation, suspension or restriction of the authorization obtained by the operator from the Nuclear Regulatory Authority shall not extinguish the operator's liability under this Section.

(8) If the operator proves that the nuclear incident causing the nuclear damage has occurred due to the intentional acts or gross negligence of the person suffering by nuclear damage, the operator may partially or wholly fully be exempt from responsibility the order of competent court in respect of the damage suffered by such person.

(9) Within the scope of implementation of this Section, more than one nuclear installation being operated at the same site by one operator shall be treated as a single nuclear installation.

The limitations of the operator's liability

ARTICLE 13- (1) For each nuclear incident within the scope of this Section, the liability amounts for the operators shall be limited to the following;

a) Seven hundred million Euros for nuclear reactors that have a thermal power above ten megawatts and other nuclear installations to be determined by the Nuclear Regulatory Authority through an assessment performed before granting a license to operate a nuclear installation,

b) Seventy million Euros for nuclear installations that are not within the scope of subparagraph (a),

c) Eighty million Euros for the transportation of nuclear substances,

d) Seven hundred million Euros for the transit pass of nuclear substances which occurs within the territory of Republic of Türkiye.

(2) Regarding the damages occurring in other countries, the amounts of liability determined in the first paragraph, within the framework of the principle of reciprocity, shall be applied as limited to the amount of liability established for nuclear damages arising from the nuclear incident in that country.

The operator's obligation to have insurance or financial security

ARTICLE 14- (1) The operators shall be obliged to have insurance or financial security in the amount of the upper limit for each nuclear installation or transportation as specified in the Article 13 and in accordance with the time frame and conditions established by the Nuclear Regulatory Authority.

(2) The operator shall have insurance or financial security for the amount of 80 million Euro during the transit of nuclear substances within the sovereignty of Republic of Türkiye.

(3) The operator shall not commence its operations unless the documents they submitted concerning the insurance contracts or financial security have been approved by the Nuclear Regulatory Authority.

(4) The operator shall have a new insurance or renew financial security before the expiry date of this insurance or financial security, instead of the expiring insurance or financial security. The Nuclear Regulatory Authority shall be informed of the renewed insurance or financial security. The conditions regarding the termination of the obligations of the Operator within this context shall be determined by the Nuclear Regulatory Authority.

(5) The insurance or financial security specified in the first and second paragraphs, shall not be suspended or revoked by the means of the insurance company or nuclear insurance pool or the guarantor without notifying the Nuclear Regulatory Authority in written form at least two months ago. If such insurance or other financial security is related with the transportation of nuclear substances, the insurance or financial security shall not be suspended or revoked during the transportation.

(6) The insurance or the financial security provided shall be used only for the compensation of nuclear damage in the event of a nuclear incident.

(7) The operator may be exempt from the obligation of having insurance or financial security if the operator is a public administration under the scope of central administration pursuant to Public Financial Management and Control Law dated 10/12/2003 and numbered 5018 or if his/her capital is wholly-owned by the State. In this situation, procedures and principles relating to how the State will undertake for the nuclear damage resulting from the nuclear incident shall be established by the decision of the President.

(8) The procedures and principles relating to implementation of this Article shall be established by the regulation to be prepared jointly by the Nuclear Regulatory Authority and Insurance and Private Pension Regulatory and Supervision Agency.

Nuclear insurance pool

ARTICLE 15- (1) A nuclear insurance pool shall be established in order to insure the obligations of the operator established in this Section. The procedures and principles relating to the process of the nuclear insurance pool shall be established by the regulation to be prepared by Insurance and Private Pension Regulatory and Supervision Agency, in consultation with the Ministry of Energy and Natural Resource and the Nuclear Regulatory Authority.

(2) The operator may provide the insurance or guarantee obligations established in this Section from the national or international markets partially or fully, or they may demand to be insured with the nuclear insurance pool.

(3) If the operator is not able to find an insurance or a guarantee or the insurance or guarantee provided by the operator is less than the amount specified in the Article 13, the shortage amount shall be covered in accordance with the procedures and principles to be determined by the President.

(4) If the existing insurance or guarantee is not able to cover the amounts specified in the Article 13 after a nuclear incident, the shortage amount shall be covered in accordance with procedures and principles to be determined by the President and shall be recourse to the operator.

Compensation of nuclear damage

ARTICLE 16- (1) The form and amount of the nuclear damage, based on the principles of absolute and exclusive, shall be assessed in accordance with Turkish Code of Obligations numbered 6098 dated 11/1/2011.

(2) The payments made separately to the persons suffering nuclear damages in accordance with the legislation on social insurance, private insurance and general health insurance shall be deducted from the compensation amount to be received by the persons suffering nuclear damages in accordance with the provisions of this Section.

(3) The right of recourse provisions of the social insurances, private insurances and general health insurances shall be reserved.

Right of direct claim or action

ARTICLE 17- (1) Person suffering nuclear damage, without prejudice to the provision of the second paragraph of Article 18, may claim compensation directly from the insurers, nuclear insurance pool and other financial guarantors as well as operator within the limits of liability.

(2) An action for compensation may be filed directly against the persons referred to in the first paragraph, without prejudice to the provisions of the second paragraph of Article 18.

(3) The person who acquire the rights within the scope of this Section by subrogation or assignment of claim may exercise the rights that are under the first and second paragraph.

Nuclear Damage Determination Commission

ARTICLE 18- (1) In the events where nuclear damage is expected to exceed the limits of liability amount specified in the Article 13, within two months at the latest from the date of the nuclear incident occurred, the President shall establish a Nuclear Damage Determination Commission (Commission) to evaluate the applications made by those who suffered nuclear damage for the compensation of the nuclear damage caused by the nuclear incident and to decide on the applications and this matter shall be announced in the Official Gazette and other appropriate instruments. The expenses of the Commission shall be covered from the budget of the Ministry of Energy and Natural Resources.

(2) In the event of the Commission being established pursuant to first paragraph, the nuclear damages arising from the nuclear incident shall be compensated through the Commission. The amount, which is within the liability limit of the operator, shall be collected by the Ministry of Treasury and Finance from the operator or his/her insurer or by converting financial security, which is provided by the operator, into money.

(3) The Commission shall request persons suffering from nuclear damage to apply to the Commission or other authorities to be determined by the Commission, by giving a period of at least one year and determining the expiry date with announcements to be made. In lawsuits brought with the purpose of determination or compensation of the nuclear damage by those who suffered from the nuclear damage before the establishment of the Commission, it shall be awarded that there is no need for a court decision and that the expenses incurred by the parties be left on them based on the lawsuit file, attorney's fee shall not be awarded. These lawsuit files shall be submitted to the Commission to review without a new application requirement.

(4) In the events where the total amount of compensation to be paid to those who made applications duly in accordance with the procedure exceeds the liability amount limit, the Commission shall make a payment schedule that will allocate the amount constituting the liability amount limit. In the payment schedule, the damage suffered due to death or personal injury shall be compensated first. The President shall take the appropriate measures for the part that exceeds the liability amount limit.

(5) A lawsuit can be filed in Ankara administrative courts against the decisions made by the Commission.

(6) The Commission shall consist of seven members. The members shall be designated among public servants by the President. The Commission shall elect a chairman and a deputy chairman amongst themselves. The quorum of meeting and decision of the Commission shall be four. Members continue to receive their financial and social benefits from their institutions. The duty period of the members shall be taken into account when calculating their promotion and retirement and their promotion shall be done within the original time frame without the need for any further action. The commission members shall not be assigned any other duties until the applications are finalized. An attendance fee as much as the result of the indicator number of 30 000 multiplied by the civil servant salary coefficient shall be paid monthly to the Commission members. Issues relating to the qualifications of the Commission members, working procedures and principles, secretariat, announcement and application procedures, the determination of nuclear damage, the determination of prioritization of the compensation of nuclear damages, payment of the compensation, procedures and principles regarding the urgent economic measures to be taken by the President and other matters regarding the implementation of this Article shall be determined by a Presidential regulation.

Right of recourse and prescription

ARTICLE 19- (1) The operator, the insurer, nuclear insurance pool, other financial guarantors and the State has the right of recourse against the real person who intentionally caused the nuclear incident that led to the nuclear damage.

(2) The operator, with the condition that the contract between them explicitly states it, has the right of recourse against the person, with whom they signed a contract, if and to the extent that is so provided in that contract.

(3) Except for cases in which nuclear damages are compensated, if the prescription specified in the fourth paragraph has not yet been expired, the right to claim compensation determined under this Section shall be prescribed after three years from the date when the person suffering nuclear damage has known of both the damage and the person liable.

(4) In any case, the right to claim compensation for the damage resulting from the loss of life and the damage caused to individuals' health, shall be prescribed after thirty years from the date when the nuclear incident occurred, and the right to claim compensation for other nuclear damage shall be prescribed after ten years from the date when the nuclear incident occurred.

(5) The right of recourse shall be prescribed after three years from the date when the person having a right of recourse has knowledge of such right and the compensation is paid, and in any case, after ten years from the date when the full amount of compensation is paid.

Competent Court

ARTICLE 20- (1) In regard to a nuclear incident occurring in the sovereignty of the Republic of Türkiye or in the events where Turkish courts have jurisdiction pursuant to the Paris Convention and Joint Protocol relating to the Application of the Vienna Convention and the Paris Convention of 21 September 1988 to which the Republic of Türkiye is a party, the courts of the Republic of Türkiye shall have exclusive jurisdiction.

(2) In the event that the courts of the Republic of Türkiye have jurisdiction pursuant to the first paragraph, the courts of Ankara shall be the competent court exclusively.

(3) In case the Commission is not established pursuant to Article 18, the court may order temporary payment to the person suffering nuclear damage pursuant to Article 76 of the Law numbered 6098, not exceeding the liability amount established in this Section.

NEWS BRIEFS

2023 International Nuclear Law Essentials (INLE)

The next session of the NEA International Nuclear Law Essentials (INLE) will take place in Paris, France, from 27 February to 3 March 2023. The five-day INLE course is designed to provide participants with a practical and comprehensive understanding of the various interrelated legal issues relating to the safe and peaceful use of nuclear energy. This intensive course in international nuclear law addresses the needs and interests of lawyers working in either the public or the private sector, but will also be of interest to scientists, engineers, policymakers, managers and other professionals working in the nuclear field.

24th International Nuclear Law Association (INLA) Inter Jura Congress in Washington, DC, 2022

After a two-year delay because of the pandemic, the International Nuclear Law Association (INLA) held its Inter Jura Congress 2022 in Washington, DC. The Congress was held on 23-27 October 2022 at the Willard Hotel in downtown Washington, within sight of the United States (US) Capitol building. The theme of the Congress was celebrating the 50th Anniversary of INLA, with a focus in each of the multiple sessions on the next 50 years of INLA and the nuclear industry.

The 2022 Congress was organised by the INLA-US Chapter, and was co-sponsored by the US Nuclear Energy Institute (NEI) and its Legal Advisory Committee. With the pandemic and its impacts in mind, it was viewed as important for this Congress to be in person, and over 160 INLA members came to Washington to attend it. Virtually all presentations were live, with opportunities for the INLA community to interact directly with lively discussions over the course of several days. The attendees were from five continents and reflected the full range of INLA's reach into the global nuclear community, comprising both new and long-time INLA members who hold positions in regulatory agencies, law firms, international nuclear associations, contractors, academic institutions and research organisations.

The full agenda and presentations may be found at https://aidn-inla.be/proceedings.

Overall, the 2022 Congress was organised principally around the structure of the INLA Working Groups. And with each session key players in the international nuclear community shared their perspectives with keynote presentations leading off the sessions. These distinguished guests and participants were:

- Mr William D. Magwood, IV, Director-General, OECD Nuclear Energy Agency (NEA)
- Dr Katherine Huff, Assistant Secretary for the Office of Nuclear Energy, US Department of Energy (DOE)
- Mr Christopher T. Hanson, Chairman, US Nuclear Regulatory Commission (NRC)
- Mr Samuel Walsh, General Counsel, DOE (NEI Legal Advisory Committee Session Keynote)
- Ms Peri Lynn Johnson, Legal Advisor and Director, Office of Legal Affairs, International Atomic Energy Agency
- Ms Kimberly Sexton Nick, Head, Division of Nuclear Law, NEA

- Ms Lisa Thiele, Vice-President, Legal and Commission Affairs, and Senior General Counsel, Canadian Nuclear Safety Commission
- Mr Stephen G. Burns, Former Chair, US NRC, and Former Head of Legal Affairs, NEA
- Mr Jack Edlow, President, Edlow International

These individuals, with their varying global perspectives, set the theme and positive tone of the Congress, as INLA looks forward to the next 50 years of global nuclear power.

For the Congress presentations, each of the morning and afternoon sessions on Monday through Wednesday had multiple speakers (overall, more than 60 speakers and panellists), organised in the first instance around the Working Groups' focal areas and then on other matters of interest to the Congress' theme.

Monday: Working Group 2, Nuclear Liability and Insurance, led off in the morning with three panels with a total of nine speakers, looking at the impact of nuclear liability on project development, liability in a post-accident perspective, and nuclear insurance and claims handling. The second session on Monday morning involved the first portion of Working Group 3's (International Trade/New Build) presentations, with three speakers focusing on new plant licensing in the United States, the US design certification process for new plants and transport liability for floating nuclear plants. Monday afternoon consisted of the US NEI Legal Advisory Committee sessions and featured a number of topics including tax issues, opportunities for regulatory enhancements in licensing, new plant siting issues and the evolving nuclear narrative.

Tuesday: Tuesday morning began with Working Group 1 (Safety and Regulation), with two panels dealing in the first instance with contracting, extended operation and emergency preparedness. The second panel concerned the establishment of new nuclear regulatory programmes in countries entering the nuclear power sphere. A special panel discussion was held Tuesday afternoon, with an overall theme of the global evolution of nuclear power legal frameworks and addressing the global climate change issues. Working Group 3 followed with its second set of presentations dealing with international trade impacts, ranging from transportable nuclear power plants to advanced reactors in the multi-national export control regimes. Working Group 4 (Radiological Protection) then addressed the revision of International Commission on Radiological Protection Recommendations, followed by an analysis of the three blind mice nature of epidemiology and low-dose radiation in the law. The session also recognised Ms Ulrike Feldmann for her notable service to the industry and INLA as she ventured into retirement.

Wednesday: Working Group 5 (Radioactive Waste Management) began Wednesday's programme with a panel discussion springing from presentations on US decommissioning innovations and their translation to international applications, international models for decommissioning, and challenges in removing the decommissioned installation and site release after decommissioning. Nuclear Security and Non-Proliferation (Working Group 6) held the only virtual presentations of the Congress, with a focus on the Working Group's theme and discussion of current related developments, and a panel on the question of nuclear security state responsibility and determining which state is responsible in the advanced reactors realm. Working Group 7 (Transportation) included individual speakers and a panel discussion dealing with the geo-political challenges of transporting nuclear materials, floating nuclear power plants and radioactive wastes. Finally, Working Group 8 (Nuclear Fusion) provided the theme and several panellists addressed topics including nuclear fusion research, project alliancing and harmonising the regulation of fusion for global deployment with lessons from small modular reactor licensing.

Thursday: The General Assembly of INLA was held to conduct INLA business and to elect new officers and board members. Mr Łukasz Młynarkiewicz of Poland was elected as the new President and announced that the next Nuclear Inter Jura Congress will be held in Warsaw in 2024. Mr Marc Beyens was appointed Secretary General, with Ms Godelieve Vanderputte appointed the Deputy to the Secretary General. Mr Patrick Reyners, who has served INLA in various capacities for almost 50 years, most recently as its long-time Secretary General, will continue as the Scientific Advisor.

2022 Meeting of United Kingdom (UK) members of INLA

On 8 September 2022, the UK membership of INLA met in Birmingham, United Kingdom, for a full day meeting. This meeting had been postponed from March 2020 due to the start of the pandemic, so it was much anticipated and had sold out before it was announced.

The papers presented on the day focussed on the busy UK nuclear sector and legal issues arising in six major work streams:

1. nuclear decommissioning;
2. management of the end of life of the advanced gas-cooled reactor (AGR) fleet and their ultimate decommissioning;
3. progress with the geological disposal facility;
4. large scale nuclear new build, in particular at Hinkley C and Sizewell C;
5. small modular reactors (SMRs); and
6. fusion in the United Kingdom and in particular the Spherical Tokamak for Energy Production (STEP) programme.

Speakers provided updates on Hinkley C and Sizewell C; updates on financing large scale nuclear in the United Kingdom, with particular updates on the development of the Regulated Asset Base (RAB) model for investment in new projects; and progress on SMRs with a particular focus on Rolls Royce.

The decommissioning session provided papers explaining the latest developments at the Nuclear Decommissioning Authority (NDA) and its operating models, as well as on nuclear decommissioning in the defence sector and a correlation of the legal issues in common with the civil decommissioning sector.

Nuclear liability was a major topic of discussion but was given additional significance at the event in light of the implementation of the revised Paris Convention as amended by its 2004 Protocol and changes to UK law as of 1 January 2022. Papers also reviewed implications of important new statements on the UK government's plans to adopt the Convention on Supplementary Compensation for Nuclear Damage. There was an in-depth paper on the insurance industry's approach to the entry into force of the revised Paris Convention on 1 January 2022 and the challenges that remain to be resolved.

The closing session focused on the UK fusion industry, with a review of STEP and a paper looking at potential lessons from the ITER project.

The session included speakers from the UK Atomic Energy Authority, UK Government, NDA, Magnox, Fusion for Energy (F4E), Burges Salmon LLP, Gowling LLP, Nuclear Risk Insurers, Stephen Tromans KC, Électricité de France (EDF), the Nuclear Energy Agency and Rolls Royce SMR. The INLA event will also, however, be remembered for the sad news at its close of the death of her Majesty the Queen.

Copies of the papers are available on the INLA UK website, www.INLA-UK.co.uk, in the member's area. If access to the member's area is required by INLA members, please contact Ian Salter for the necessary password at: ian.salter@burges-salmon.com.

RECENT PUBLICATIONS

German Radioactive Waste – Changes in Policy and Law (Routledge, 2022) by Robert Rybski

by Christian Raetzke

The appearance of a monograph in the English language on particular aspects of the national nuclear law of a specific country is always welcome to the international community of nuclear law experts. This is true particularly in this case, when the topical issue – the management of radioactive waste – is an essential challenge common to all countries.

The author of this study on German radioactive waste policy and law, Robert Rybski from Poland, claims in his introduction that the German approach to the nuclear waste issue is a leading one in the world. The author of this review, who is German, would hesitate to agree; other countries have been more effective in developing waste concepts, including repositories for high-level waste. What is true, however – and Mr Rybski rightly points this out – is that law and policy of radioactive waste management in Germany has been from the beginning, in fact since the creation of the German Nuclear Act in 1959, a matter of intensive discussion in politics and in law and has been addressed in many court cases and articles. Thus, there is much material to be presented.

The book is not a comparative study; it deals with the German framework only. It is surprising – and worthy of praise – that a non-German author ventures to write such a book. Having said this, it must be emphasised that Mr Rybski, as he informs us in the acknowledgments at the head of the text, has spent several years studying in Germany. It is also obvious that he has a full command of the German language.

Mr Rybski has consulted an impressive array of sources – books, articles, judgments, explanatory texts to law bills, and others. This becomes apparent by the numerous notes and references listed at the end of each of the three chapters. It must also be said in his praise that there is no German book in existence that deals with the topic of radioactive waste management in such a comprehensive and up-to-date way. Thus, Mr Rybski had to break original ground; there was no easy model at his disposal.

Mr Rybski has organised his book in three substantive chapters. The first covers the nuclear energy sector and its by-products, and mainly offers a discussion of nuclear waste definitions in German law and some analyses concerning the attribution of lawmaker competencies (always a difficult issue in a federal state) The second chapter deals with the storage and disposal of radioactive waste and with the division of obligations and responsibilities (for action and for financing) of the several steps of waste management up to final disposal. The third chapter covers the selection of an appropriate site for final disposal of radioactive waste. A short fourth chapter with concluding remarks emphasises again Germany as a role model, its case law and its legal acts.

The author does not cover all important legal aspects of nuclear waste management law to the same extent and in the same systematic approach; in fact, there are some notable omissions. Thus, the important legislation enacted in 2017 settling the financing of nuclear waste generated in the country's commercial nuclear power plants is not thoroughly covered in the book; the reason may well be that the manuscript was largely completed when this legislation was enacted. The author does discuss the first draft law bills presented in 2015. However, the 2017 package was more than just an implementation of these drafts (as the author briefly notes on p. 69); it introduced a new concept, involving

the creation of a new fund for waste management (*Kerntechnischer Entsorgungsfonds*) to which the operators transferred the money they had earmarked in their accounts for waste management. By paying an additional premium, the operators were relieved of any future obligation to inject additional money into the fund. At the same time, the state took over the task of intermediate storage of nuclear waste generated in nuclear power plants, which entailed the creation of a new state-owned company, the *BGZ Gesellschaft für Zwischenlagerung* (BGZ). Due to this legislation, the German nuclear operators – nuclear subsidiaries of the four large energy utilities – can now concentrate on the dismantling of their nuclear power plants. Once this has been done and all resulting radioactive waste has been handed over to the BGZ, their activity and responsibility will likely be concluded. This might be an option to be considered in other countries as well; it is a possible solution to the obvious conflict between the timeframes linked to site selection and construction of spent fuel repositories, which span several generations, and the limited operational time of commercial entities, without putting into question the polluter-pays principle (after all, the fund fed by money from the utilities should be sufficient if well managed).

It must also be pointed out that the final repository for low-level and intermediate-level waste *Schacht Konrad* is not discussed in the book. According to the current national strategy, the Federation will fulfil its task of providing repositories by developing two separate installations: one for low and intermediate level waste, currently constructed at the site of the ancient iron ore mine *Schacht Konrad*, and one for high-level waste at a site yet to be identified. Mr Rybski focuses only on the latter repository. It is sometimes unclear whether the book intends to cover all radioactive waste issues or only those concerning high-level waste, i.e. spent fuel and waste from reprocessing; the perspective seems to change several times throughout the book.

Having said this, Mr Rybski's remarks about the repository for high-level waste are generally quite pertinent. Site selection for this repository, after having concentrated on the *Gorleben* site for decades, was re-started from scratch in 2013, based on the Act on Site Selection (*Standortauswahlgesetz*) of 2013, and recast in 2017. This Act provides for a framework ensuring that site selection will take place in an open and transparent matter, based on all geological information available in Germany, with a high level of meaningful public participation; however, this means at the same time that the process will last for decades and that an operational repository can reasonably not be expected before the end of this century (pessimists rather point toward the 22nd century). There are many pros and cons to all this, and Mr Rybski addresses many of them. This includes a very lucid discussion about the creation and composition of a specific Commission advising the Bundestag on a revision of the Act on Site Selection. The chapter also contains some enlightening reasoning about the requirement to guarantee long-term safety for one million years, which is rightly said to be arbitrary. Overall, the third chapter is, in this reviewer's view, the best part of the book and it is definitely worth consultation for those interested in their own national repository strategy.

There are some misunderstandings or errors throughout the book. The author mentions that interim storage facilities in Germany follow a concept of "wet storage" and "wet containers" (p. 46). This is somewhat misleading: spent fuel assemblies, after having been stored for some time in spent fuel pools within the nuclear power plants, are placed into dry storage casks that are then transferred to dry storage in dedicated interim storage buildings erected on the sites of the nuclear power plants. Further, the main legal document in the area of radiation protection is the Act on Radiation Protection (*Strahlenschutzgesetz*) of 2017; the Ordinance on Radiation Protection of 2018 (*Strahlenschutzverordnung*), the only text examined by the author (p. 27), is a subsidiary ordinance based on the Act and its basic provisions. In addition, the German term for financial security covering nuclear damage is "Deckungsvorsorge" and not "Schadensvorsorge" (pp. 57 and 58), the latter term denoting the level of nuclear safety required by law to be achieved by nuclear installations.

Nonetheless, the book is the product of scholarly research into German radioactive waste law and policy. As noted above, there are some areas that could benefit from a more comprehensive and up-to-date discussion; however, those issues that are discussed in depth are well worth attention, and the author's goal of fostering discussion in other countries is achieved by presenting the controversial aspects of radioactive waste

management law and history in Germany. Altogether, books such as this one spark constructive international discussion and serve a function that cannot be underestimated. There should be more of them.

The Law of Nuclear Energy, Third Edition (Sweet & Maxwell, 2022) by Helen Cook

by Stephen G. Burns

Building on her earlier work in writing a comprehensive guide to nuclear energy law, Helen Cook has produced an updated third edition of The Law of Nuclear Energy. Ms Cook is a seasoned practitioner of nuclear law with experience in addressing the challenges of new nuclear power deployment. This new edition serves as an excellent guide to the basic principles and issues involved in the peaceful uses of nuclear energy and comes at an important inflection point for nuclear power. When the first edition appeared nearly a decade ago, the accident had recently occurred at the Fukushima Daiichi Nuclear Power Plant in Japan which caused a serious reflection and pause in some countries on the role of nuclear power in the energy mix. In contrast, the third edition comes at a time when nuclear energy is seen as contributing to the reduction of carbon emissions, expansion of energy resources is viewed as critically important, particularly in the context of greater electrification, and new nuclear technologies are presenting themselves for deployment. Moreover, the global legal regime applicable to nuclear energy continues to evolve, as evidenced by the entry into force last year of the 2004 Protocols to the Paris Convention and the Brussels Supplementary Convention related to third party liability in the field of nuclear energy.

Ms Cook's text is a comprehensive, well-organised volume that informs the reader on all aspects of nuclear energy law, from the basic principles of safety, security and safeguards (the "3 S's") that form the basis for peaceful uses of the atom to the considerations that come into play in the context of financing, project development and management, and liability and insurance, among others. Nuclear energy law reflects a complex framework of international legal instruments and guidance ("hard" and "soft" law), national legislation and regulations that reflect the international standards and countries' own policy determinations, and even consensus standards developed by private organisations. Given the complexity and diversity of the legal sources and principles, Ms Cook skilfully guides the reader toward a holistic understanding of the regime.

In Part 1 of the book, Ms Cook leads us through the considerations bearing on selection of energy policy and then walks us through the development of a nuclear power programme with particular reference to the fundamental IAEA "Milestones" approach. In this context, the key international conventions and treaties related to the core principles of safety, security, and safeguards are introduced. The reader is then led through the key components necessary to establish effective national nuclear legislation and nuclear regulation. The reader also benefits from thorough references to important international guidance documents. Ms Cook provides examples of legislative and regulatory approaches in several countries, including those with long-standing nuclear programmes, such as the United Kingdom and the United States, as well as more recent entrants, such as the United Arab Emirates.

Ms Cook examines in Part 2 of the book the practical aspects of undertaking a nuclear project. Close attention is required to understand the roles of various participants and stakeholders in a project as one works through the procurement process and prepares for the challenges that may arise in financing and construction. Because those undertaking a project will also need to consider the nuclear fuel cycle, Part 2 addresses its front and back ends: i.e. obtaining fuel supply and services as well as planning for the management of used fuel and radioactive waste.

In Part 3, Ms Cook reflects on the future of nuclear law and thoughtfully addresses the trends and challenges in the deployment of new nuclear technology. She considers the increasing interest in small modular reactors of varied technical designs and how they may

be deployed within the current international and national frameworks. Objectives for further development in nuclear energy law and policy include adapting transportable designs to the existing framework and focusing on greater harmonisation across regulatory systems. In the final chapter, Ms Cook highlights the future developments to which we should continue to give our attention. These topics include the drivers of and challenges to nuclear power deployment, the continued focus on nuclear safety and security, technological innovation, waste management, green and sustainable finance, and fostering human resources.

The depth and excellence of the exploration of nuclear energy law, as well as the clarity of the author's presentation, alone make this book a valuable reference. Ms Cook should also be complimented for the book's organisation. The reader is able to quickly access specific topics of interest within the book via its detailed table of contents and index. The texts of the major nuclear law treaties and conventions are included for easy reference in the book's appendices, allowing the reader immediate access to these instruments discussed throughout the book.

Helen Cook continues to make an important contribution to the understanding of nuclear law by building on her earlier work in this excellent and comprehensive third edition of The Law of Nuclear Energy. As one who has been a practitioner in the field for over 40 years, I find Ms Cook's text an informative and useful reference to refresh one's understanding of the applicable legal principles as well as to help in evaluating questions that arise in one's practice. Importantly, the intended audience of her book is not solely legal professionals but more broadly policymakers, legislators, regulators, owners, vendors, investors, fuel suppliers and other stakeholders active in the nuclear sector. Given the book's structure, it can certainly be particularly useful for individuals working in or for countries that are contemplating, or are in the process of developing, nuclear power programmes.

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Nuclear Law Bulletin No. 108/109

The *Nuclear Law Bulletin* is a unique international publication for both professionals and academics in the field of nuclear law. It provides readers with authoritative and comprehensive information on nuclear law developments. Published free online twice a year in both English and French, it features topical articles written by renowned legal experts, covers legislative developments worldwide and reports on relevant case law, bilateral and international agreements as well as regulatory activities of international organisations.

Feature articles and studies in this issue include "The future of nuclear energy and the role of nuclear law" by Kimberly Sexton Nick; "The rule of law: A fragile tool for the development of emerging nuclear technologies" by Cyril Pinel and Hugo Lopez; "Legal frameworks for nuclear energy in non-nuclear countries: An Irish case study" by Veronica Smith; "The qualification of nuclear substances and nuclear liability" by Elena de Boissieu.

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