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NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally sound and economical use of nuclear energy for peaceful purposes;
- to provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD analyses in areas such as energy and the sustainable development of low-carbon economies.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management, 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: The Sturgis, the world's first floating nuclear power plant (Public Domain); BWRX-300 Plant Cutaway (General Electric Hitachi Nuclear Energy).

Foreword

This edition marks the 55th anniversary of the first publication of the *Nuclear Law Bulletin* (NLB) in 1968. The idea to create a law journal dedicated to the study of nuclear law was conceived by Mr Pierre Strohl, former Deputy Director-General of the OECD Nuclear Energy Agency (NEA).

The NEA Community was saddened to learn of Mr Strohl's passing in November 2022. An official since 1948, Mr Strohl joined the European Nuclear Energy Agency (ENEA) in 1956 and was heavily involved in the foundation of the present NEA. In his role as Head of the ENEA/NEA Legal and External Relations Division from 1966 to 1974, Mr Strohl led the NEA's work on the exclusion of small quantities from existing conventions and the establishment of the Convention on Civil Liability for Maritime Carriage of Nuclear Material. As Deputy Director of Security and Regulation of Nuclear Activities and later Deputy Director-General, Mr Strohl was with the NEA until his retirement in 1991. After his retirement he remained active in academia, participating in such diverse bodies as the section de langue française du Centre d'Étude et de Recherche en droit international et relations internationales [French language section of the Centre for Studies and Research in International Law and International Relations]part of The Hague Academy of International Law, among others.

As told by Mr Strohl in the 100th edition of the Nuclear Law Bulletin (Strohl, P. [2018], "Reflections on the Nuclear Law Bulletin", *Nuclear Law Bulletin*, No. 100, OECD Publishing, Paris, p. 22.):

> [T]he original idea for the NLB first arose from an already longstanding observation that the use of nuclear energy made it highly desirable to have a special legal regime for scientific and industrial activities in the nuclear field. The purpose of this regime would be to supplement, if not to a large extent replace, the common law in force. Provisions on major issues such as radiological protection, the safety of installations, and liability for damage caused would be derived from conventions and international recommendations, regardless of the fact that laws and regulations directly applicable in individual countries were in any case published in their official journals and in consequence readily accessible.
>
> There was another reason behind my idea of launching a joint publication about nuclear law, namely to facilitate efforts to harmonise national legislations, as stated in the Foreword to the first issue. This initiative was linked to the Nuclear Energy Agency's mission of fostering the harmonisation of national measures for the development of nuclear energy, and in particular the legislation of participating countries. It was with this in mind that the Nuclear Law Bulletin was designed to serve as a source of information, which could be particularly useful when determining and changing national laws.

The NEA is proud to continue carrying out Mr Strohl's work in the development, strengthening and harmonisation of nuclear legislation and regulation, as well as to continue publishing the Nuclear Law Bulletin for over 55 years.

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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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Applicability of the existing nuclear liability conventions to different types of small modular reactors currently under development

*by Vincent Jérôme H. Roland**

1. Introduction

The commercial development of nuclear electricity production has been marked through the years by a steady increase in the electrical power output of the reactors, progressing from a few tens of MWe[1] in the late 1950s to approximately 1 600 MWe nowadays. From an economic point of view, this impressive increase in the power output of such installations has been accompanied, at least in nuclear power generating member countries of the OECD Nuclear Energy Agency (NEA),[2] by an equally impressive increase in the cost of building these installations.[3] Several econometric studies have documented this cost increase phenomenon. These studies show that the development of industrial nuclear energy through the years has been marked by an inability to take advantage of the economies of scale[4] and learning effects[5] that should have intuitively accompanied this development.[6] Recent examples of reactor construction in Finland, France and the United States also tend to demonstrate that this escalation in costs has yet to be addressed. In nuclear power generating NEA member countries, the main factors driving this escalation have historically been technological upgrades of power plant equipment, defences and safety systems to comply with strengthened regulations, vendor monopoly, construction delays and increases in the prices of materials and equipment.[7] Hence, the question of whether there is a way to stop these cost increases must be asked. In this regard, the development of small modular reactors (SMRs) is attracting considerable attention. SMRs are alleged to provide a solution to the major drawbacks of current nuclear power plants that are driving their ever-increasing construction costs. Many SMRs are designed with passive safety features that eliminate the need for complex and costly active safety systems. They will also be more compact, with less equipment and simplified operations. They offer new ways of harnessing nuclear energy that produce not only electricity but

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1. MWe stands for megawatt electric, the electric output of the generator of a specific installation that is connected to the grid.
2. At the time of this writing, the Russian Federation's membership in the NEA is suspended.
3. Lévêque, F. (2013), *Nucléaire On/Off, analyse économique d'un pari*, Dunod, Paris, pp. 32-47.
4. Cantor, R. and J. Hewlett (1998), "The economics of nuclear power: further evidence on learning, economies of scale and regulatory effects", *The Bell Journal of Economics,* No. 13, pp. 297-310.
5. Zimmerman, M.B. (1982), "Learning effects and the commercialization of new technologies: The case of nuclear power", *The Bell Journal of Economics,* No. 13, pp. 297-310.
6. Lévêque, F. (2013), *supra* note 3, p. 3.
7. See e.g. NEA (2020), *Unlocking Reductions in the Construction Costs of Nuclear: A Practical Guide for Stakeholders*, NEA, Paris, pp 13-15, 45-47. Little data are available that could help us observe similar trends in the Eastern world. In particular, data about nuclear plant building costs in China, India and the Russian Federation are very scarce.

also decarbonised industrial heat. These advantages, along with their potential to complement intermittent renewable means of electricity production in order to mitigate climate change, have recently earned them global political support. Finally, due to their smaller size, lower complexity and modularity, they can be more rapidly delivered than traditional plants. In this way, they also promise less financial risk for investors wanting to enter the nuclear energy market and reduced financing needs for states willing to embark on nuclear energy programmes.

Many SMR concepts are currently being developed. Some are based on well-known technologies, and some on more exotic systems. Some are in the process of being licensed, and some are already under construction.[8] However, although SMRs may appear attractive on paper, many challenges must be resolved before their global deployment becomes a reality. From licensing issues to the harmonisation of the international legal framework[9] and proof of the economic viability of the new proposed technologies, there is plenty of work to be done before SMRs become an important part of the energy mix. If SMRs succeed, they will open a completely new chapter in the deployment and use on earth and in space of nuclear energy for peaceful and military purposes.

One of the many aspects that may be involved in the paradigmatic shift to SMRs is investigated in this article: the applicability of the existing nuclear liability conventions to these reactors. Indeed, in comparison to current nuclear power plants, SMRs have many new attributes and characteristics that may have implications for the interpretation and application of the existing conventions. First, SMRs have a broad deployment potential: they can be land-based, above or below ground, floating on the sea, or powering a space station or a spaceship. Second, as previously mentioned, SMRs possess an intrinsic characteristic: their modularity. SMRs will be built as modules in factories or shipyards and then sent, shipped or towed, domestically or internationally, fuelled or not, to their destination. Once at their destination, SMRs may be installed as standalones with other SMRs or alongside existing nuclear units. They may also be returned to their supplier state for decommissioning once their lifetime has passed or even for refuelling. Third, for SMRs to be economically viable they will need to be produced in series. Indeed, due to their smaller size, they will not benefit from economies of scale.[10] Fourth, SMRs are generally considered to be safer than current operating nuclear reactors,[11] which, in combination with their broad deployment potential, is likely to have significant implications for siting: SMRs could be operated either in very remote locations or near densely populated areas.

This article examines these different characteristics derived from two SMR types and reviews them with regard to the current liability conventions. A number of relevant conventions exist, and they do not always offer identical definitions and coverage, which might directly affect their applicability to certain SMR types. Consequently, this article seeks to answer two important questions. First, are the different types of SMRs covered by the existing liability conventions? And second, do different types of SMRs pose challenges to the existing liability conventions? Section 2 of this article gives an overview of the SMRs that are under development today and defines the two SMR types examined in this article. Section 3 discusses the applicability of the relevant definitions and stipulations of the conventions to provide an answer to the research questions above. Finally, section 4 offers concluding remarks.

8. NEA (2021), *Small Modular Reactors: Challenges and Opportunities*, OECD Publishing, Paris, p. 18.
9. See Nick, K.S. "The future of nuclear energy and the role of nuclear law", *Nuclear Law Bulletin*, No. 108/109, OECD Publishing, Paris, pp. 7-25.
10. NEA (2021), *supra* note 8, p. 9.
11. See e.g. *ibid.*, p. 29, "The design features of small reactor cores … also result in inherent safety features that improve the overall safety case of small modular reactors".

2. Overview of the small modular reactors under development

2.1 Basic considerations

SMRs are commonly defined as "advanced nuclear reactors that have a power capacity of up to 300 MWe per unit",[12] whereas current nuclear power plants are up to five times more powerful. The upper limit of 300 MWe is not very far from the lower-end electrical power produced by nuclear power plants of the second generation (Gen II),[13] which were put into operation from the mid-1960s until the mid-1990s. For example, the Swiss nuclear reactor Beznau 1, which began producing electricity in 1969 and is now the oldest nuclear reactor in operation in the world, has a capacity of 365 MWe.[14] The BWRX-300 is a boiling water SMR design currently being developed by GE Hitachi Nuclear Energy that will produce 300 MWe. This is a similar capacity to that of the 373 MWe produced by Switzerland's Mühleberg plant, which was built in the 1970s and removed from the grid in 2019. Therefore, in some respects, the power capacity of some SMR designs is not new.

2.2 Classification

SMRs are very diverse: numerous designs are being developed that use technologies from different generations of nuclear reactors. As of September 2022, according to the IAEA,[15] there were 83 commercial SMR designs being developed around the globe, which can be categorised as follows:[16]

- land-based water-cooled SMRs;
- marine-based water-cooled SMRs;
- high temperature gas-cooled SMRs;
- liquid metal-cooled fast neutron spectrum SMRs;
- molten salt SMRs; and
- micro SMRs.

SMRs are often simplified versions of designs that already exist. Approximately 50% of the SMRs in development today are more compact or integral reactor versions[17] of Generation II and III light water reactors (LWRs) and heavy water reactors (CANDU).[18] They rely on well-understood and widely commercially used technologies. The other 50% consist of more exotic reactors derived from the diverse fourth-generation family (Gen IV) of salt, gas and liquid metal-cooled reactors for which few commercial applications can be

12. Liou, J. (2021), "What are Small Modular Reactors (SMRs)?", International Atomic Energy Agency (IAEA), www.iaea.org/newscenter/news/what-are-small-modular-reactors-smrs (accessed 4 July 2023).
13. Nuclear power plants are classified according to their generation (Gen I to Gen V). Generations of nuclear reactors differentiate themselves by safety characteristics and reactor construction features that lead over time to ever-increasing safety. Most of Gen I to Gen III reactors are water-cooled reactors. Gen IV reactors present much more diversity in the materials used for cooling and moderation. Today's SMRs are mostly based on Gen II to Gen IV nuclear power plant technologies.
14. The Beznau nuclear power plant consists of two pressurised water reactors of 365 MWe each, Beznau I and II, that were put into operation in 1969 and 1972, respectively.
15. IAEA (2022), *Advances in Small Modular Reactor Technology Developments, A Supplement to: IAEA Advanced Reactors Information System (ARIS)*, IAEA, Vienna.
16. *Ibid.*
17. The water recirculation, reactivity control, vapour generation and pressurisation function are incorporated in the reactor vessel, reducing the risk of loss of coolant accidents, control rod ejection accidents and nozzle cracking.
18. NEA (2021), *supra* note 8, p. 9.

found in nuclear power generating NEA member countries.[19,20] However, as previously stated, the concepts themselves are not new. Those reactors rely on decades-long R&D efforts, mainly in France, Russia and the United States, to support their industrial development. For this reason, the following sections investigate the ways in which SMRs are new.

2.3 Modularity aspects

One of the newest concepts concerning the large-scale deployment of SMRs is their modularity. When researching the different SMR designs in development and surfing through the various vendors' websites, one could be confused by the use of the words "module" and "modularity" because they may imply different meanings. A conventional nuclear LWR "unit" is usually comprised of a "reactor island," which houses the nuclear steam supply system, the fuel pool and several safety and reactor protection systems in a special containment, as well as a "conventional island" housing the turbine, condenser and generator.[21] Several units are often grouped together to form a nuclear "site", within which the units can share systems and features (e.g. shared control rooms). With respect to SMRs, a "module" can refer to the nuclear reactor, the "nuclear island" or a complete "unit."[22] Modules can also relate to the different parts of the SMR itself, that is, the parts that are shipped independently from the factory and assembled.

In a conventional "multi-unit" site, several nuclear units work alongside each other on the same site. In the case of the SMR, the arrangement can be much more complicated. For example, several "reactor modules" could be housed in the same containment, sharing safety systems as well as a common "turbine island", final heat sinks, control rooms, AC power or balance of plant equipment, thus building a "multi-module" unit. SMR units could also be added to the same site alongside an already existing "conventional unit." It should be noted that different operators might be present on the same site. The SMR Regulators' Forum made it clear that "'multi-modules' could not be considered as equivalent to 'multi-units'"[23] and "acknowledged that 'the list of potential safety issues for multi-modules facilities remains open and cannot be completed until more detailed SMR design information is available'".[24]

2.4 Safety aspects

The economic and human environment in which SMRs are established plays a key role for the insurance and re-insurance industry. SMR vendors claim that because of their considerable simplification, passive safety features and smaller inventory, their designs will be much safer than the existing nuclear power plants and that, in turn, the corresponding

19. *Ibid*.
20. The sodium-cooled fast breeder reactors BN-600 and BN-800 are in operation in Russia. China is currently running a high-temperature gas-cooled reactor pebble-bed module with a declared thermal output of 250 MW in China's Shandong province that achieved first criticality in 2021. World Nuclear News (2021), "China's HTR-PM reactor achieves first criticality", www.world-nuclear-news.org/Articles/Chinas-HTR-PM-reactor-achieves-first-criticality (accessed 4 July 2023). Projects for scaling up these technologies are also on their way both in China and Russia.
21. The reality is often more complicated as auxiliary buildings are almost always present on a nuclear site.
22. This diverse use of the word "module" is in part due to the varying individual circumstances of the vendors. Indeed, some of them aim at designing and constructing full operational "units", while others only sell/design a nuclear reactor technology that they do not build themselves. In addition, the technologies as well as the size and configuration of the reactors themselves vary greatly.
23. Small Modular Reactors Regulators' Forum (2019), "Design and Safety Analysis Working Group Report on Multi-unit/multi-module aspects specific to SMRs, interim report", www.iaea.org/sites/default/files/19/12/smr_rf_dsa_interim_report.pdf.
24. *Ibid*.

emergency planning zone[25] (EPZ) could be reduced.[26] SMR vendors are urging regulators to take steps to allow for such reductions, which could make it possible to site SMRs close to densely populated areas. Indeed, the current plume exposure pathway EPZ for nuclear power plants in the United States is generally 10 miles[27] (approximately 16 km), which greatly limits the establishment of nuclear power plants near urban centres. From a third party liability point of view, it makes a significant difference if a site has an EPZ that is limited to the site fences. The "nuclear damages" to people, property and environment that a severe nuclear incident in such an installation would imply are therefore expected to be smaller than for a traditional nuclear power plant. Smaller potential damages can lead to reductions in the minimum liability amounts for which the operators are liable according to the different nuclear liability conventions in case of an incident.

Reducing the EPZ is a question for the national regulatory framework. The recent evaluation by the US Nuclear Regulatory Commission's (US NRC) Advisory Committee on Reactor Safeguards (ACRS) of NuScale's methodology for establishing the technical basis for plume exposure EPZ at NuScale plant sites[28] could pave the way for the review of similar SMR-specific EPZ sizing methodologies in other countries. Such methodologies,[29] if accepted, might have the potential to deliver on the EPZ size reduction promises SMR designers are advertising.[30] One of the limitations to such methodologies is the possible complex interconnections that may exist between modules and/or units and the threat they potentially represent to the concept of defence in depth.[31] The possible consequences

25. The IAEA defines EPZ as "The precautionary action zone (PAZ) and the urgent protective action planning zone (UPZ)." IAEA (2015), *Preparedness and Response for a Nuclear or Radiological Emergency*, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna, p. 82. Further definitions of PAZ and UPZ are provided in *ibid*., p. 91 (PAZ) and 96 (UPZ).
26. This is because the expected radioactive plumes and released radioactive inventory would be much smaller than those of a conventional nuclear power plant.
27. 10 *Code of Federal Regulations* (CFR) 50.47(c)(2), "Generally, the plume exposure pathway EPZ for nuclear power plants shall consist of an area about 10 miles (16 km) in radius and the ingestion pathway EPZ shall consist of an area about 50 miles (80 km) in radius. The exact size and configuration of the EPZs surrounding a particular nuclear power reactor shall be determined in relation to local emergency response needs and capabilities as they are affected by such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries. The size of the EPZs also may be determined on a case-by-case basis for gas-cooled nuclear reactors and for reactors with an authorized power level less than 250 MW thermal. The plans for the ingestion pathway shall focus on such actions as are appropriate to protect the food ingestion pathway."
28. Letter to D. Dorman (US NRC Executive Director for Operations) from J.L. Rempe (Chairman, US NRC ACRS) (19 Oct. 2022), re: "Safety Evaluation for NuScale Topical Report, TR-0915-17772, 'Methodology for Establishing the Technical Basis For Plume Exposure Emergency Planning Zones At NuScale Small Modular Reactor Plant Sites,' Revision 3" (ADAMS Accession No. ML22287A155). ADAMS stands for Agencywide Documents Access and Management System, which is the NRC's official system for accessing publicly available documents. The documents referenced 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.
29. NuScale Power, LLC (2022), "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites", TR-0915-17772-NP, Rev. 3 (ADAMS Accession No. ML22161B010).
30. Kraev, K. (2022), "NuScale/US Regulator Approves Methodology For Smaller Emergency Zones Around Voygr SMR", NucNet, www.nucnet.org/news/us-regulator-approves-methodology-for-smaller-emergency-zones-around-voygr-smr-11-5-2022 (accessed 4 July 2023).
31. The IAEA defines defence in depth as "A hierarchical deployment of different levels of diverse equipment and *procedures* to prevent the escalation of *anticipated operational occurrences* and to maintain the effectiveness of physical *barriers* placed between a *radiation source* or *radioactive material* and *workers*, *members of the public* or the *environment*, in *operational states* and, for some *barriers*, in *accident conditions*." IAEA (2022), *IAEA Nuclear Safety and Security Glossary*, Interim Edition, IAEA, Vienna, p. 51. See also IAEA (2006), *Fundamental Safety Principles*, IAEA Safety Standards Series No. SF-1, IAEA, Vienna, pp. 13-14.

of such interconnections on accident development will have to be considered during licensing. The case of the interconnections between the different units at the Fukushima Daiichi Nuclear Power Plant is a good example of accident development in "multi-unit" sites where the interconnections between the units play a key role. Regulators around the world are now focusing on these considerations. Evidently, this can only be achieved based on a specific design as initiating events specific to each design play a vital role in such an analysis. In addition, the consideration of external events may be decisive. In the case of the NuScale VOYGR SMR, all the modules are to be placed in a joint pool and housed in a joint containment vessel. Under certain circumstances, it might be difficult to argue that 12 modules of 50 MW will lead to a smaller release than one reactor of 600 MW. This is also true for SMRs being sent to or built in remote areas of the world to provide energy to remote communities or resource extraction projects, for which the "siting" will essentially be determined by where the energy is needed, and which may be increasingly exposed to natural hazards and extreme meteorological conditions. In addition, due to their versatile uses, SMRs might be subject to external industrial incidents originating from the facilities they provide with electricity or industrial heat.

2.5 Types of small modular reactors under consideration

Two types of SMRs are likely to face similar challenges under the current nuclear liability framework. These two types of SMRs are evaluated against the definitions and provisions of existing nuclear liability conventions. The classification is dictated by life cycle factors rather than technical considerations concerning the SMR technologies. Although technical considerations surrounding the SMR technologies are important to understand the risk that SMRs might represent, they are of little relevance when considering the applicability of the liability conventions to different types of technologies. Concepts that seem quite distinct from each other on paper are addressed identically in the conventions, and in most cases pose little to no challenge to them compared to current nuclear power plants. The following classifications are not exhaustive and do not capture the full spectrum of possible use cases that might emerge for SMRs. Notably they do not consider the use of SMRs in space or for non-peaceful purposes according to Article 2(4) of the United Nations (UN) Charter.[32]

2.5.1 Type 1

Type 1 SMRs are land-based SMRs that do not differ significantly from current nuclear power plants in terms of their treatment by the conventions. This type could potentially apply to all the SMR categories previously listed. They are produced in one or several supplier states, assembled in a host state, receive their first batch of fuel and are subsequently refuelled onsite until the end of their lifetimes, when they are finally defueled and decommissioned in the host state. The most important characteristic of this use case is that a factory-fuelled reactor is never transported. In this case, the fresh fuel production and delivery (front end) – irrespective of the fuel's physical form – as well as the spent nuclear fuel management (back-end) aspects of the fuel cycle are not relevant, as they do not differ conceptually from what currently occurs with existing nuclear power plants. Depending on their final form, possible SMR concepts[33] that might conform to this type are, among others, GE Hitachi's BWRX-300, the Westinghouse AP300, the Rolls-Royce UK SMR[34] and the mPower from BWX Technologies. Although most of these SMRs will be used to produce electricity, some of them might be used to produce process heat. Some other SMRs of lower capacity might also be used in direct combination with an industrial site. They could be used as a single-module or in a multi-module unit.

32. Charter of the United Nations (1945), 1 UNTS XVI, entered into force 24 Oct. 1945, "All Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the Purposes of the United Nations."
33. The referenced concepts are described in detail in: IAEA (2022), *supra* note 15.
34. Although this concept has an installed capacity of 470 MWe, it is considered an SMR.

2.5.2 *Type 2*

The significant difference between type 1 and type 2 SMRs is that type 2 includes the following:

(i) factory-fuelled reactor modules to be used;

(ii) reactor modules and any constitutive module to be sent to a decommissioning facility at the end of reactor lifetime; and

(iii) reactor module to be sent to a dedicated facility to be replenished/refuelled.

A use case for such an SMR may be the following: (1) a supplier state produces and fuels the reactor; (2) the reactor is shipped to the host state where it is installed on-site and/or assembled with the rest of its modules, if any; (3) the SMR is operated in the host state; and (4) the SMR is transported back to the supplier state for defueling and decommissioning at the end of its life. When referring to type 2 SMRs, this example will be used as the benchmark. The conclusions will extend to cases in which SMR refuelling occurs in the supplier state and the involvement of several vendors/supplier states is envisaged. It should also be noted that these steps could also all take place in the same state, implying a homogeneous nuclear liability regime. Nonetheless, this use case attempts to highlight certain issues that might arise under the current nuclear liability framework with cross-boundary movement of SMR modules containing nuclear material. Although many different concepts might apply to type 2, they are likely to involve the following:

- land-based, small to very small SMRs designed to deliver power output up to 10 MWe, factory-fabricated SMRs for decentralised power and heat applications in civilian, industrial and defence sectors similar to the one supported by the US Department of Energy Microreactor Program.[35] Depending on their final forms, possible SMR concepts that might be classified within this type are the Westinghouse eVinci, Idaho National Laboratory's Microreactor Applications Research Validation and Evaluation Project (MARVEL), HolosGen's HOLOS-QUAD and Jimmy Energy's SMR. These SMRs may or may not involve, or be comprised in, a means of transport.
- marine-based SMRs, intended to be used for electricity production in remote areas of the globe on the seabed or the surface of the sea. These SMRs are transportable by nature and often contained within what can be regarded as a means of transport, which can sometimes be juridically attached to a vessel or ship, e.g. a floating reactor (anchored to the sea bed or not). They could also be installed as fixed platforms at sea or as immersed capsules anchored to the seabed. In this case, they represent an intersection between the nuclear liability and international sea conventions frameworks. For the moment, marine-based SMRs are almost exclusively being developed in China and Russia. The case of the "Akademik Lomonosov", a marine-based SMR that is comprised of a non-self-propelled barge and is already in operation in Russia, constitutes a perfect example.

2.6 Spent fuel strategies and back-end liabilities

The spent fuel strategies of SMRs are diverse and will have to adapt to states' national strategies. This may place limitations on the design of the reactor and the definition of the fuel vendors' front- and back-end use cases when trying to accommodate several fuel cycle strategies at once. Although radioactive waste management strategies for SMRs fitting type 1 are likely to be very close to current strategies, the introduction of more exotic designs, fitting type 2, might well require changes in national legislation that allow, for example, the treatment of nationally produced high- and low-level wastes in foreign supplier states and the redefinition of back-end liabilities. However, this topic will not be discussed within this article. Section 3 examines how the existing nuclear liability conventions can be applied to SMRs of types 1 and 2.

35. IAEA (2022), *supra* note 15, p. 351.

3. A study of existing nuclear liability conventions

3.1 Basic considerations

The international nuclear third party liability framework consists of a set of legally binding conventions and protocols under the auspices of two international institutions: the IAEA and the OECD.[36] Although the need for a harmonised and global liability framework is evidenced by the possible extent of the transboundary damages provoked by catastrophes such as Chernobyl, the global liability framework currently remains heterogeneous, with many states, even important nuclear states, not party to any conventions. These binding legal instruments, when transposed or incorporated into the national legal framework of the state parties, ensure that victims will be compensated for incurred losses and damages to their health and property in the unlikely case of a nuclear incident. Post-Chernobyl conventions also ensure that funds will be available to reinstate the environment if it suffers damage and allow for compensation of certain economic losses. These conventions follow the five basic principles of nuclear liability: "strict liability of the operator, that is, liability without fault; exclusive liability of the operator; establishing a minimum amount of liability for the operator; limitation upon the operator's liability in time; an obligation on the operator to cover its liability by insurance or other financial security."[37] Of these five basic principles, the most important is that the conventions establish minimum requirements in terms of the sum for which operators should be liable in the case of an incident and the obligation for operators to maintain insurance or financial securities to ensure that they will be able to meet the amount of their prescribed liability to ensure that "adequate and equitable compensation for persons who suffer damage caused by nuclear incidents"[38] is received. However, limiting the amount of the operator's liability is often seen by detractors of nuclear power as a hidden form of subsidy.[39] Indeed, when comparing the liability amounts of the conventions and the costs of potential nuclear incidents, which can amount to extraordinarily high sums,[40] one might think that external costs[41] are not accounted for, which will result in the costs of a major accident being borne by taxpayers. However, this view needs to be carefully considered as confusion regarding the risk and the cost of a severe accident often arises. Indeed, under the current liability framework, operators must ensure that the liability amounts defined by the conventions are covered by insurance or other financial security that is available in the event of a nuclear incident, for example, by

36. With the exception of the Brussels Convention Supplementary to the Paris Convention for which the Belgian Government acts as the depositary.
37. 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 (*Exposé des Motifs*), p. 3.
38. *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 (Paris Convention or PC), preamble.
39. The conventions considered here only specify minimum liability amounts, but countries can impose unlimited liability for the operator. Austria, Germany, Japan and Luxembourg are examples of states that have chosen that path.
40. The latest compensation amounts payable (as of 30 June 2023) are available at TEPCO (2023), "Records of Applications and Payouts for compensation of Nuclear Damage", www.tepco.co.jp/en/hd/responsibility/revitalization/pdf/comp_result-e.pdf (accessed 4 July 2023). The main TEPCO website on compensation for nuclear damage is available at TEPCO (n.d.), "Compensation for Nuclear Damages", www.tepco.co.jp/en/hd/responsibility/revitalization/compensation-e.html (accessed 24 June 2023).
41. Lévêque, F. (2013), *supra* note 3, pp. 122-125. In this book Lévêque goes into great depth about the concept of internalisation of risk and the idea of a possible hidden subsidy in favour of nuclear operators. Although this discussion takes place within the framework of the late revision of the nuclear liability regime, it is still relevant today.

paying yearly fees to a nuclear insurance pool or mutual assurance company. Hence, the conventions indirectly oblige operators to internalise some part of the risk of a potential severe accident in their operating costs. As previously stated, it is the risk of such an accident that is partly internalised, not the cost – the internalisation of which would either be impossible or render nuclear electricity production unprofitable. One might argue that the only real subsidy to the nuclear industry under the conventions with regard to a severe accident is the subsidy that exists when measuring the difference between the cost of the insurance needed to fully cover the risk and the cost of the insurance covering only the prescribed liability amount.[42] Although the risk itself might be difficult to define and measure, the liability amount set in the conventions provides an opportunity to find the right equilibrium to reduce that subsidy as much as possible. Undeniably, "Nuclear-related activities … create risks of a specific character" with potentially catastrophic consequences, and a certain internalisation of that risk is essential to the social acceptability of nuclear energy.[43] This internalisation of the risk, although not perfect, along with the liability principles incorporated in the conventions, is very specific to nuclear energy and remains mostly unmatched by practices in other energy sectors. Due to the extraordinary energy density of the nuclear fuel, this internalisation only has a marginal effect on the price of the nuclear MWh.

Evaluating nuclear risks throughout the history of nuclear liability has always been a difficult task. This difficulty, combined with the willingness to ensure that "the development of the production and uses of nuclear energy for peaceful purposes is not … hindered"[44] by economically burdening nuclear operators, has obliged the drafters of the conventions to increase the prescribed liability amounts over the years. In recent history, the Fukushima Daiichi incident demonstrated the inadequacy[45] of the minimum amounts specified in the conventions at the time and prompted a revision of these amounts. A significant step towards the modernisation of the international nuclear liability regime has been taken with the 2022 entry into force of the 2004 Protocol to Amend the Paris Convention on Third Party Liability as well as the Brussels Convention Supplementary to the Paris Convention. It sets the operator's minimum liability amount at no less than EUR 700 million and the maximum amount at disposal through supplementary funding at EUR 1.5 billion, an amount unmatched by other conventions. The next section examines the definitions and fundamental provisions of the conventions that might influence their applicability to the previously defined SMR types.

3.2 Overview of the different conventions

The convention framework is composed of the following conventions and protocol:

- Paris Convention;[46]
- Brussels Supplementary Convention;[47]

42. *Ibid*., p. 123. Note: The author is paraphrasing the original sentence in French in Lévêque's book.
43. Tonhauser, W. et al. (2022), "International legal framework on nuclear safety: Developments, challenges and opportunities", in NEA (ed.), *Principles and Practice of International Nuclear Law*, OECD Publishing, Paris, p. 137.
44. Paris Convention, *supra* note 38, preamble.
45. McIntosh, S. (2022), "Nuclear Liability and Post-Fukushima Developments", in IAEA (ed.), *Nuclear Law: The Global Debate*, IAEA, Vienna, p. 252.
46. Paris Convention, *supra* note 38.
47. 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 (Brussels Supplementary Convention or BSC).

- Vienna Convention;[48]
- Revised Vienna Convention;[49]
- Joint Protocol;[50] and
- Convention on Supplementary Compensation.[51]

The PC, which is under the auspices of the OECD, covers most Western European countries. The Vienna Conventions[52], under the auspices of the IAEA, have an international spread and cover most Eastern European countries. The JP forms a bridge between the PC and the Vienna Conventions. Among other things, it specifies which of the Paris Convention or the Vienna Conventions applies, and which state jurisdiction applies, in the case where damages are suffered in a country other than the installation state when both states involved are not party to the same convention but party to the JP. The BSC relates to and complements the amounts to be made available for indemnification under the PC. Finally, the CSC provides a supplementary system of compensation pursuant to the national laws of Vienna Conventions states, PC states or states with national laws deemed compliant with the prescriptions of the Annex of the CSC, referred to as "Annex states", provided that such a state, when possessing a nuclear installation as defined in the Convention on Nuclear Safety[53] on its territory, is a party to the CNS.[54] Like the Vienna Conventions, the CSC has an international spread.

3.2.1 Nuclear reactor

The VC and RVC both state the following: "'Nuclear reactor' means any structure containing nuclear fuel in such an arrangement that a self-sustaining chain process of nuclear fission can occur therein without an additional source of neutrons."[55] This definition of a nuclear reactor is very broad and potentially covers all the previously presented types with the exception of reactors that would be subcritical during operation, for example accelerator-driven systems (ADS). Notably, research on lead-bismuth-eutectic subcritical reactors is ongoing in Belgium (MYRRHA project), China and Switzerland.[56] Because ADS are capable of transmuting elements, they are often seen as waste burners and a solution to reducing the final activity of radioactive waste. They are also deemed

48. Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977 (Vienna Convention or VC).
49. Vienna Convention on Civil Liability for Nuclear Damage of 21 May 1963, as amended by 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 4 Oct. 2003 (Revised Vienna Convention or RVC).
50. 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 or JP).
51. Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 Apr. 2015 (CSC).
52. The expression "Vienna Conventions" stands for VC and RVC.
53. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996 (CNS).
54. CSC, *supra* note 51, Article 18(1). This condition in the CSC regarding the CNS might need clarification with regard to SMR deployment. Indeed, clarification is needed on whether a state party to the CSC that does not possess, on its territory, a nuclear installation as defined by the CNS, but rather an SMR which does not fit the definition of "nuclear installation" in the CNS (a marine based SMR for example) would be allowed to continue to be party to the CSC without being party to the CNS.
55. Vienna Convention, *supra* note 48, Article I(1)(i) and Revised Vienna Convention, *supra* note 49, Article I(1)(i).
56. A Geneva-based startup called Transmutex is looking at this technology with the ambitious target to build a 10 MW demonstration ADS within the next 10 years.

safer than critical reactors[57] because they are *per se* subcritical and generally operate at atmospheric pressure.

In contrast to the Vienna Conventions, there is no standalone definition of a "nuclear reactor" in the PC. However, the words "nuclear reactor" are a direct part, as may be subsequently observed in the next section, of the definition of "nuclear installation". This does not change the conclusion just drawn regarding the Vienna Conventions as the PC also makes a clear distinction between critical and subcritical reactors. The *Exposé des Motifs* mentions an interpretation adopted by the Steering Committee for Nuclear Energy on 8 June 1967 "according to which the term 'reactors' in the sense of the Article 1(a)(ii) … does not include sub-critical assemblies, that … are not capable of maintaining a self-sustaining chain process of nuclear fission."[58] The text also mentions that "[t]his interpretation will remain valid after the Protocol to amend the Paris Convention of 12 February 2004 comes into force for all Contracting Parties."[59] Although their deployment as SMRs is not discussed in this work, it would be desirable to include subcritical reactors in the convention's definitions of a "nuclear reactor" to avoid ambiguity. Finally, the CSC provides a definition of a "nuclear reactor" that resembles that of the Vienna Conventions.

In short, SMRs of types 1 and 2 are explicitly considered to be nuclear reactors under all the previously cited conventions. Further, no specific challenges await the two SMR types concerning the definition of nuclear reactor. If sub-critical installations are to be used more widely in the future, an explicit mention of their existence could be useful to avoid ambiguity.[60]

3.2.2 Nuclear installation

According to the conventions, all nuclear reactors are part of a "nuclear installation". The Vienna Conventions and the PC all provide a definition for "nuclear installation". The PC states that a "nuclear installation" refers to the following:

- reactors other than those comprised in any means of transport;
- factories for the manufacture or processing of nuclear substances;
- factories for the separation of isotopes of nuclear fuel;
- factories for the reprocessing of irradiated nuclear fuel;
- facilities for the storage of nuclear substances other than storage incidental to the carriage of such substances;
- installations for the disposal of nuclear substances;
- any such reactor, factory, facility or installation that is in the course of being decommissioned; and
- such other installations in which there are nuclear fuel or radioactive products or waste as the Steering Committee for Nuclear Energy of the Organisation … shall from time to time determine.[61]

57. Subcritical reactors are not without risk. Some fuel cycle concepts require onsite online reprocessing capacity, the implementation of which could be challenging from a safety point of view. It is also worth noting that although these reactors are deemed to always stay subcritical, the current nuclear safety framework will *de facto* force them at least to possess a failsafe SCRAM system like any other conventional critical installation.
58. See *Exposé des Motifs, supra* note 37, p. 7, n. 4.
59. *Ibid*.
60. The next section, with the help of the definition of a nuclear installation, shows that sub-critical SMRs might as well be covered by the conventions.
61. Paris Convention, *supra* note 38, Article 1(a)(ii).

The same definition also states that "any Contracting Party may determine that two or more nuclear installations of one operator which are located on the same site shall, together with any other premises on that site where nuclear fuel or radioactive products or waste are held, be treated as a single nuclear installation."[62]

Under the VC, a "nuclear installation" is defined as the following:

> (i) any nuclear reactor other than one with which a means of sea or air transport is equipped for use as a source of power, whether for propulsion thereof or for any other purpose; (ii) any factory using nuclear fuel for the production of nuclear material, or any factory for the processing of nuclear material, including any factory for the reprocessing of irradiated nuclear fuel; and (iii) any facility where nuclear material is stored, other than storage incidental to the carriage of such material; provided that the Installation State may determine that several nuclear installations of one operator which are located at the same site shall be considered as a single nuclear installation.[63]

The RVC adds the following to the previous definition: "(iv) such other installations in which there are nuclear fuel or radioactive products or waste as the Board of Governors of the International Atomic Energy Agency shall from time to time determine".[64]

In addition, the JP accommodates the definition of the Paris and Vienna Conventions without providing its own definition. The BSC does the same in the framework of the PC. Finally, in the CSC, which is open to accession by states party to either the Paris and Vienna Conventions[65] or "Annex states," the definition of "nuclear installation" will be the Vienna Conventions definition, the PC definition or one of the two definitions provided in the Annex. The first definition of the Annex[66] is identical to that of the VC and the second definition, which still resembles that of the VC, specifically addresses civil nuclear reactors and facilities, while making it possible to exclude "any other civil facility" under certain conditions similar to the RVC in Article I(2), without referring to criteria that should be established for this purpose by the IAEA Board of Governors.[67]

It can first be concluded that the definitions provided for "nuclear installation" under the Paris and Vienna Conventions, including the CSC, are quite similar and cover all land-based critical[68] SMRs of type 1. Indeed, in this case there are no particular differences

62. *Ibid*.
63. Vienna Convention, *supra* note 48, Article I(1)(j).
64. Revised Vienna Convention, *supra* note 49, Article I(1)(j)(iv).
65. Article I of the CSC states: "'Vienna Convention' means the Vienna Convention on Civil Liability for Nuclear Damage of 21 May 1963 and any amendment thereto which is in force for a contracting Party to this convention." *Supra* note 51. Although the VC and RVC are two separate conventions, the RVC is to be considered as an amendment to the VC in the framework of this paragraph.
66. *Ibid*., Annex, Article 1(1)(b).
67. *Ibid*., Annex, Article 2(3).
68. Although ADS fuel could be assimilated to what the PC defines as "Nuclear Substances" (see Paris Convention, *supra* note 38, Article I(a)(v)) or to what the Vienna Conventions define as "Radioactive products or waste" (see Vienna Convention, *supra* note 48, Article I(1)(g) and Revised Vienna Convention, *supra* note 49, Article I(1)(g)), they do not fit well into the definitions for "nuclear installation". The Vienna Conventions, for example, qualify any facility where "nuclear material" ("radioactive product and waste", as probable ADS fuel, are part of "nuclear material" under the Vienna Conventions) is stored as a "nuclear installation". The PC classifies a "facility for the storage of nuclear substances" and "factories for the reprocessing of irradiated nuclear fuel" as a "nuclear installation". In both cases, the definitions in the conventions only cover activities incidental to ADS operation, which are in their primary essence neither storage facilities nor factories. Article 1(a)(iii) of the PC provides for the possibility to recognise nuclear material composed of "radioactive products or waste" as being "nuclear fuel", which would answer the question of whether an ADS is a "nuclear installation" under the PC. Finally, both the Vienna Conventions and the PC provide the possibility to broaden the definition of "nuclear installation".

between SMRs and the current nuclear power plants. However, complications arise in the case of SMRs that are comprised in a means of transport or in any structure that might be assimilated to a means of transport, which may occur with type 2. Are such SMRs excluded from the definition of a nuclear installation under the Vienna and Paris conventions? The PC excludes "reactors other than those comprised in any means of transport",[69] which encompasses trucks, trains, barges and ships that might appear in type 2. The *Exposé des Motifs* further states that "Nuclear installations are defined as reactors, other than those which are used or incorporated for use in a means of transport as a source of power for any purpose". The Vienna Conventions might seem less restrictive by only excluding means of sea and air transport. Similar to the PC, they specify that cases in which the nuclear reactor is used as a source of power, whether for the propulsion of the means of transport or for any other purpose, are not covered by the convention, an exclusion, that, as will be shown in the next paragraphs, also applies to means of rail and road transports. Accordingly, it can be directly concluded that all SMRs used for the propulsion of a means of transport or to produce energy for any purpose related to their transport are excluded by both the Paris and the Vienna Conventions.

The question of whether SMRs comprised of a means of transport might be covered by the conventions has yet to be addressed. For type 2, factory-fuelled SMRs comprised in a means of transport, energy production takes place after the installation is complete and at no time is energy provided for the propulsion of the means of transport or for any other purpose related to transport. A good example of such an SMR is the Akademik Lomonosov, which was towed from its shipyard to its installation site, where it remains fixed and produces electricity for land-based uses only. It is likely that the exclusion of these SMRs through the mere fact that they are comprised in a means of transport was not intended by the convention's drafters.

This view is supported by Mr Steven MacIntosh, former Chairman of the IAEA's International Expert Group on Nuclear Liability (INLEX), in his article "Nuclear Liability and Post-Fukushima Developments" in which he discusses the applicability of the conventions to "transportable nuclear power plants" and reports the work of INLEX on this issue.[70] With regard to INLEX's work on the framework of the Vienna Conventions, he writes: "INLEX considered that the term 'as a source of power' necessarily implied that the power was used in connection with the operation of the means of sea or air transport."[71] MacIntosh's work also references the official records of the International Conference on Civil Liability for Nuclear Damage held in Vienna from 29 April to 19 May 1963 concerning the drafting of the 1963 Vienna Convention to strengthen his thesis.[72] In these records, one can read the US delegation's argument aimed at promoting an amendment to the original draft of the convention concerning paragraph 1(j)(i), which proposed to replace "any nuclear reactor other than one with which a means of transport is equipped for use as a source of power" with the words "any nuclear reactor other than one with which a means of sea or air transport is equipped for use as a source of power" in the draft version.[73] The motivation for this clarification relates to the fact that the United States was testing trailer-mounted mobile reactors at the time with the intention of making "them available for disaster relief in the United States and foreign countries".[74] The rationale presented by the United States was that "[t]he reactors would be mobile solely for purposes of transport and would operate only in a stationary condition[, therefore, t]he fact that they could be transported should not exclude them from the Convention."[75] To this argument, Mr Lytkin for the USSR responded that "[he] preferred the clearer definition of the Drafting Committee's text. There were at present no such mobile reactors. In any case they would begin to operate only when they reached the intended site and could therefore be considered as stationary

69. Paris Convention, *supra* note 38, Article 1(a)(ii).
70. McIntosh, S. (2022), *supra* note 45, pp. 250-268.
71. *Ibid.*, p. 260.
72. IAEA (1964), *Civil Liability for Nuclear Damage: Official Records*, Legal Series No. 2, IAEA Vienna.
73. *Ibid.*, p. 119-120.
74. *Ibid.*, p. 119.
75. *Ibid.*, p. 119-120.

reactors, like any other reactor covered by the Convention."[76] Further on in the minutes, Mr Spingarn of the US delegation stated "that the purpose of his amendment was to bring the Convention into line with modern developments".[77] He continues on to note that "[l]ow- and medium-power mobile plants were now in use in the United States [and that this] amendment would bring such plants within the scope of the Convention while excluding reactors used to propel means of transport by sea or air or in outer space."[78] He further explained that the reactors "he [has] in mind [are] trailer-mounted mobile plants which are transported by truck or railroad[, and he considers] it desirable that such reactors should come within the scope of the Convention."[79]

This causes McIntosh to conclude that this is consistent with the "clear intention of the original drafters of the Vienna Convention to include in the definition of 'nuclear installation' 'low and medium power mobile power plants' transported by truck or railroad (while excluding reactors used to propel means of transport by sea or air or in outer space) while the mobile reactors were in a stationary position and operation."[80] Although SMRs comprised in a means of road or rail transport are not explicitly excluded under the Vienna Conventions, the aforementioned statement implies that they would also only be covered by the convention if they operated in a stationary position.

Finally, the explanatory text of the VC states that "at its eighteenth meeting (15-17 May 2018), INLEX concluded that the exclusion does not apply to transportable nuclear power plants",[81] while reaffirming the conclusion that such transportable nuclear power plants in a fixed position would be covered by the convention. This conclusion also applies for SMRs of type 2 "that are floating reactors, anchored to the seabed or the shore, and attached to the shore by power lines",[82] but not to reactors not anchored to the seabed. Such reactor would not be "fixable" and fall outside the scope of the conventions. Marine-based SMRs of type 2 that are installed as floating reactors anchored to the seabed, fixed platforms at sea or as immersed capsules anchored to the seabed might bring new challenges to the conventions (see next section). They are also transportable nuclear power plants, but they might not be "attached to the shore by power lines",[83] especially in the case of platforms and floating reactors. Their status under the conventions might require clarification. Additional factors should also be considered, such as the concept of transport of nuclear substances and the geographic scope of the conventions (see *infra*).

The PC, for its part, excludes all reactors "comprised in any means of transport", but the arguments presented by INLEX in the framework of the Vienna Conventions are again relevant. Hence, it can be assumed that type 2 SMRs that are not producing any energy for whatever purposes within the means of transport in which they are comprised, and provided that their transport has stopped, might well be covered by the conventions and not be considered "nuclear installations" when being transported, but rather viewed as "nuclear substances" (in the framework of the PC) or "nuclear material" (in the framework of the VC, RVC and CSC) under transport (see next section).

Concerning type 2 marine-based SMRs, it is also worth noting that at least one nuclear liability convention addresses nuclear ships of any kind – namely the Convention on the Liability of Operators of Nuclear Ships,[84] which was adopted in Brussels on 25 May 1962

76. *Ibid*., p. 120.
77. *Ibid*., p. 170.
78. *Ibid*.
79. *Ibid*., p. 170-171.
80. McIntosh, S. (2022), *supra* note 45, p. 260.
81. 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. 26 n. 85 (*Explanatory Texts*).
82. IAEA (2019), "Nuclear and Radiation Safety, Report by the Director General", IAEA Doc. GOV/2019/27-GC(63)/4, p. 28.
83. *Ibid*.
84. Convention on the Liability of Operators of Nuclear Ships (1962), 57 *American Journal of International Law* 268 (not in force).

and never entered into force. In fact, this Convention led to the original exclusion from the Paris and Vienna Conventions of reactors "comprised in means of transport", because it was expected that such reactors, existing or planned at the time of the drafting of those conventions, would be covered by the said convention once entered into force rather than by the Paris or Vienna Conventions.[85] This "convention was intended to apply to nuclear damage caused by a nuclear incident occurring in any part of the world and involving the nuclear fuel of, or radioactive products or waste produced in, a nuclear ship flying the flag of a contracting party."[86] It defines a "nuclear ship" as "any ship equipped with a nuclear power plant" and a "nuclear power plant" as "any power plant in which a nuclear reactor is, or is to be used as, the source of power, whether for propulsion of the ship or for any other purpose."[87] In terms of its structure, definitions and liability principle, this Convention is very similar to the PC and VC. Its entry into force would have seamlessly complemented the conventions for SMR marine-based applications for cases in which the source of nuclear energy is used in conjunction with the energy supply of a ship, such as an SMR powering an icebreaker. This Convention did not come into force mainly because of the reduced number of commercial "nuclear ships" at the time of its drafting and because, as previously stated, it also covers military purposes and "states with major military nuclear fleets have not been interested in becoming contracting parties to this convention."[88] However, the number of commercial nuclear-powered ships could soon increase rapidly, mainly because of the volatility of hydrocarbon prices and the opening of new sea routes in the Artic. This Convention could provide a good basis for harmonising the nuclear liability framework concerning marine-based SMRs of type 2 as well as SMRs used for the propulsion of ships or vessel. Indeed, this harmonisation could prove to be crucial for the development of type 2 marine-based SMRs. In this respect, it should be noted that the low number of nuclear-powered ships to date may well be partly due to the difficulty, in the absence of a harmonised liability framework for such ships, of negotiating the bilateral agreements necessary to secure financial guarantees in the event of an accident involving a vessel operating abroad in foreign territorial waters and ports.[89] Such an unfavourable development could be expected in particular for the development of type 2 marine SMRs, especially those for which the existence as "nuclear installations" within the meaning of the conventions is not certain.

In short:

- All SMRs used for the propulsion of a means of transport or to produce energy for any purpose related to their transport are excluded by both the PC and the Vienna Conventions.
- Type 1 SMRs and land-based type 2 SMRs that are not comprised in a means of transport are generally covered by the definition of "nuclear installation".
- Land-based and marine-based type 2 SMRs that are comprised in a means of transport are challenging the current nuclear liability framework. They would probably be covered by the definition of "nuclear installation" once fixed in the host state, in which case an interpretation of the conventions' text is needed. In the framework of the Vienna Convention, this interpretation is provided by INLEX. Similar clarifications in the framework of the PC may lead to the same conclusion. The case of marine-based type 2 SMRs that are installed as a platform at sea or as immersed capsules anchored to the seabed will be discussed further in the next section, after an examination of the definition of an "operator" and its

85. See Reye, S. (1992), "Extension of the technical scope of the Paris and Vienna conventions: fusion reactors and reactors in means of transport", in NEA (ed.), Proceedings of the Helsinki Symposium, OECD Publishing, Paris, pp. 256-257.
86. Handrlica, J. (2009), "Facing Plans for Multiplying Nuclear-Powered Vessels: Lessons Gained from the Brussels Convention on the Liability of Operators of Nuclear Ships of 1962", *International Journal of Nuclear Law*, Vol. 2, No. 4, Inderscience, pp. 313-333.
87. Convention on the Liability of Operators of Nuclear Ships, *supra* note 84, Articles I(1) and I(9).
88. Handrlica, J. (2009), *supra* note 86.
89. Reye, S. (1992), *supra* note 85, p. 258.

liability under the conventions. However, more detailed analysis is needed before a decision can be made on whether to definitively classify marine-based type 2 SMRs as "nuclear installations".

- The case of factory-fuelled SMRs during transport will be discussed more generally in the next section. They fall under the concept of transport of nuclear substances already covered by the conventions.

3.2.3 The operator and their liability

One of the primary roles of the conventions is to prescribe who will be liable for nuclear damage and to ensure that some party, usually the "operator of a nuclear installation", will always be liable for any nuclear damage suffered within their geographic scope. The latter, in turn, identifies where damage is covered under a certain convention. When several countries adopt the same conventions, they automatically spread this liability principle further, ensuring that potential victims across borders will enjoy the same basic rights and establish reciprocity regarding how possible transboundary damages originating from the territory of one state will be treated in the other. In the case of transboundary transports, they also ensure that the chain of liability related to the transportation of nuclear substances will not be broken. The fact that, as previously stated, the current international liability framework resembles a patchwork is thus challenging for SMRs, especially with regard to type 2, whereby factory-fuelled reactors are shipped around the globe. Indeed, with the transfer of liability from one operator to another which might be party to different conventions, the possibility arises of damages being inadequately covered and reciprocally managed by the state involved. This is not only a problem for victims in the case of an accident but could also have a significant impact on the effective deployment of SMRs. For example, the legal channelling of all claims to the operator offers all implicated subcontractors/suppliers the juridical certainty that they will not be confronted with claims brought against them by victims in different states and jurisdictions, which makes their participation in such projects possible. If victims of uncovered damage in the host state can bring claims against the supplier of an SMR in the supplier state, the latter might reconsider becoming involved in the first place. Accordingly, the definition of an operator and their liability considering the different SMR types will be examined and new challenges that these types might generate for nuclear liability will be identified.

The PC and Vienna Conventions define what an operator is in relation to a nuclear installation. The PC defines the operator as "the person designated or recognised by the competent public authority as the operator of that installation",[90] while the Vienna Conventions (including the CSC) define the operator as "the person designated or recognized by the Installation State as the operator of that installation."[91] The installation state is defined in the framework of the Vienna Conventions as "the Contracting Party within whose territory that installation is situated or, if it is not situated within the territory of any State, the Contracting Party by which or under the authority of which the nuclear installation is operated."[92] As previously stated, liability is considered in terms of the liability of an operator of a nuclear installation. The Vienna Conventions,[93] the PC[94] and the CSC[95] further state that the operator of a nuclear installation shall be held liable for nuclear damage "upon proof that such damage has been caused by a nuclear incident in its installation or involving nuclear substances coming from or going to such

90. Paris Convention, *supra* note 38, Article 1(a)(vi).
91. Vienna Convention, *supra* note 48, Article I(1)(c); Revised Vienna Convention, *supra* note 49, Article I(1)(c) and CSC, *supra* note 51, Annex, Article I(1)(d).
92. Vienna Convention, *supra* note 48, Article I(1)(d); Revised Vienna Convention, *supra* note 49, Article I(1)(d) and CSC, *supra* note 51 Article I(e).
93. Vienna Convention, *supra* note 48, Article II(1) and Revised Vienna Convention, *supra* note 49, Article II(1).
94. Paris Convention, *supra* note 38, Article 3 and 4.
95. CSC, *supra* note 51, Annex, Article 3.

installation."[96] In addition, the operator is not synonymous with "owner" and, in theory, could be separate entities. It is also noted that the operator of a nuclear installation under a specific convention is the operator designated by the "competent public authority" or the installation state, which excludes cases in which an operator of the supplier state might operate SMRs in the host state while not regulated by the nuclear authorities of the host state. A foreign supplier company that wishes to retain ownership and operate an SMR in the host state would have to create a juridical entity in the host state and become the operator of the SMR under the authority of the host state (as in the framework of the build-own-operate project delivery mechanism already in use in the nuclear industry today). However, possible ownership transfer schemes will not be discussed here. Henceforth, only the operator and liability transfer are discussed while hypothesising that such an operator exists under the respective state authority and that the transfer of authority between supplier and host state authorities takes place. Furthermore, in the case of factory-fuelled SMRs, the person that is putting the fuel into the reactor and performing the hot testing will have to obtain some sort of licence to "operate" the reactor. This obligation might also fall on the carrier. The discussion of such a licence is outside the scope of this study. However, it is worth noting that this might pose a challenge for existing liability conventions. Indeed, an "operator of a nuclear installation" might receive a licence to operate a reactor, that has, according to the meaning of the conventions, not yet become a "nuclear installation". The implications of the definition of "operators" and their liability are now analysed for the two types of SMRs.

Type 1 SMR modules are produced in supplier states and conventionally transported to the host state to be assembled at a specific location. Though module commissioning could take place with the involvement of the host state's nuclear authorities in the supplier state, the nuclear fuel would be loaded in the SMR once it is in the host state, and a licence to operate the reactor would only be required there after it became a nuclear installation. In the host state, the person operating the installation once it is fully commissioned and fuelled will be its operator under the conventions, and the host state, if party to one of the Vienna Conventions, will be the "installation state". With regard to the conventions, type 1 SMRs in matter of liability and the definition of "operator" do not really differ from existing nuclear power plants.

In the case of type 2 SMRs, multiple operators, possibly under different conventions, will subsequently be liable for any damage through the SMR's lifetime. The conventions' applicability to the earlier defined steps – (1) a supplier state produces and fuels the reactor, which is then (2) shipped to the host state where it is assembled with the rest of its modules, if any, and (3) is operated in the host state and (4) transported back to the supplier state for defueling and decommissioning – is examined here.

The Vienna Conventions,[97] the PC[98] and the CSC[99] address the liability of the different operators when involved in transport between "nuclear installations". For example, analysing the SMR's transport from the supplier state to the host state, the vendor who puts the fuel in the reactor, performs a hot test on it and initiates its transport is the operator of a "nuclear installation"[100] in their state. They will thus remain liable for accidents involving nuclear substances comprised in the transported SMR, until their liability with regard to nuclear incidents has been transferred to the operator of the host state, either by contract or when the latter has effectively taken charge of the nuclear substances.[101] The

96. Exclusions exist that are not relevant to the purpose of this paragraph and are hence omitted.
97. Vienna Convention, *supra* note 48, Articles II(1)(b) and (c) and Revised Vienna Convention, *supra* note 49, Articles II(1)(b) and (c).
98. See Paris Convention, *supra* note 38, Article 4(a) and (b).
99. CSC, *supra* note 51, Annex, Article 3.
100. This installation produces fuelled SMRs and would qualify as "nuclear installation" under the conventions.
101. Vienna Convention, *supra* note 48, Articles II(1)(b)(i) and (ii); Revised Vienna Convention, *supra* note 49, Articles II(1)(b)(i) and (ii); Paris Convention, *supra* note 38, Articles 4(a)(i) and (ii); CSC, *supra* note 51, Annex, Articles 3(1)(b)(i) and (ii).

conventions also allow the operator to transfer their liability to the carrier of the SMR, who can be recognised as an operator with the consent of the first operator,[102] in which quality they are considered to be the operator of a nuclear installation situated within the territory of the supplier state. Similar considerations apply to the SMR on its way back to the supplier state. As observed in the conventions, the transport of fuelled SMRs between different states and nuclear installations, although other licensing issues might appear,[103] is comparable to the transboundary transport of fresh or spent nuclear fuel as well as the transport of activated parts to be decommissioned, which already currently occur at the international level between "nuclear installations". Therefore, in this respect, such transports do not really challenge the current nuclear liability framework.

The conventions also deal with cases where a reactor comprised in a means of transport is transported. For example, this would occur in the case of a standalone factory-fuelled transportable SMR being delivered by the supplier state to the host state or sent back to the supplier state for refuelling or decommissioning after having been used in a remote location.[104] In this case, the Vienna Conventions[105] state that the liability of the operator in the supplier state for nuclear damage related to the sending of nuclear material

> intended to be used in a nuclear reactor with which a means of transport is equipped for use as a source of power, whether for propulsion thereof or for any other purpose, [runs until] the person duly authorized to operate such reactor has taken charge of the nuclear material … but where the nuclear material has been sent to a person within the territory of a non-Contracting State, before it has been unloaded from the means of transport by which it has arrived in the territory of that non-Contracting State.[106]

When countries involved are not contracting states to the same conventions, the liability of the operator in the supplier state would continue to run indefinitely if there is no unloading of the nuclear material from the "means of transport by which it has arrived in the territory of that non-Contracting State".[107] Such case where the SMR is destined to remain in the means of transport would require more scrutiny and probably a clarification.

When the SMR is subsequently returned for reloading or decommissioning to a nuclear installation in the supplier state, the Vienna Conventions[108] prescribe that liability for nuclear damage related to the receipt of nuclear material takes place

102. Vienna Convention, *supra* note 48, Article II(2); Revised Vienna Convention, *supra* note 49, Article II(2); Paris Convention, *supra* note 38, Article 4(e); CSC, *supra* note 51, Annex, Article 3(2).
103. Indeed, aside from the technical questions that will have to be dealt with for the transport itself (for example, the design and licensing of an overpack that leads to the receipt of a transport license that can be recognised by the collaborating parties' authorities), new technical proofs will have to be brought that show, for example, that the reactor will behave in a certain way so that the safety goals are met during transport. One might consider here the reactor protection and reactivity control system's behaviour under transport conditions.
104. On the way to the host state, the question arises whether a receiving "nuclear installation" or "operator of a nuclear installation" is always present in the host state before the delivery of the SMR. Similarly, on the way back, the question arises whether a "nuclear installation" or "operator of a nuclear installation" is always present after its departure. For example, the perimeter where a floating SMR is anchored onshore only becomes a nuclear installation when the SMR arrives. Will it stay a nuclear installation when it leaves? Will there then be an operator of a nuclear installation in the host state? The same questions are relevant in the case where such SMR would not be comprised in the means of transport.
105. Similar provisions are provided in Article 4(b)(iii-iv) of the Paris Convention, *supra* note 38.
106. Vienna Convention, *supra* note 48, Articles II(1)(b)(iii) and (iv) and Revised Vienna Convention, *supra* note 49, Articles II(1)(b)(iii) and (iv).
107. Vienna Convention, *supra* note 48, Article II(1)(b)(iv) and Revised Vienna Convention, *supra* note 49, Article II(1)(b)(iv).
108. Similar provisions are provided in Article 4(b)(iii-iv) of the Paris Convention, *supra* note 38.

> after [the operator] has taken charge of the nuclear material from a person operating a nuclear reactor with which a means of transport is equipped for use as a source of power, whether for propulsion thereof or for any other purpose…but where the nuclear material has, with the written consent of the operator, been sent from a person within the territory of a non-Contracting State, only after it has been loaded on the means of transport by which it is to be carried from the territory of that State.[109]

In this case, the operator would be the one of the "nuclear installation" in the supplier state to which the SMR is heading and the transfer of liability from the "person duly authorised" would start after the operator has taken charge of the SMR or, in cases in which the countries involved are not contracting parties to the same conventions, once it has been loaded on the means of transport. In this case, the nuclear material would already be loaded on the means of transport, the SMR itself, and the provision would apply. This, in turn, implies that the liability for the SMR during transport will have to be assumed, depending on the geographic configurations, on the territory of the host state by an operator of a foreign nuclear installation (the one to which the SMR is heading).

On the way to the host state and on the way back to the supplier state, the contract/agreement between the persons/countries involved will generally establish the modalities for the transfer of liability between the operator of the nuclear installation from which the SMR comes or to which it comes back and the "person duly authorized"/"person operating a nuclear reactor". Such arrangement might be impossible if the countries involved are not party to the same conventions. The PC as well as the CSC contain similar provisions from which the same conclusion can be drawn.[110]

The previous section discussed the case of marine-based type 2 SMRs that are installed as fixed platforms at sea, as immersed capsules or as floating reactors anchored to the seabed, concluding that their status under the conventions might need some clarification. The next paragraphs look at them once more in the light of the definition of "nuclear installation". Indeed, an area where the PC and the Vienna Conventions might conceptually differ arises in the case of nuclear installations installed outside of the territory of a contracting party, which might happen for these SMRs. The Vienna Conventions explicitly mention the eventuality of an installation not being "situated within the territory of any State" in their definition of "installation state".[111] Furthermore, as will be discussed later, the RVC explicitly foresees the possibility for a non-contracting state to possess a nuclear installation in "any maritime zones established by it in accordance with the international law of the sea",[112] which eventually implies having a nuclear installation outside of its territory. Although the PC also foresees this possibility while framing its geographical scope as applicable to non-contracting states having no nuclear installation,[113] it does not contain a similar definition of an "installation state" and refers, throughout its text, to nuclear installations situated within the territory of a contracting party. The author's interpretation is that, in cases where a factory-fuelled SMR is operated at a fixed place outside the territory of any states, for example on the surface or the bottom of the sea in international waters, although no transport is physically taking place during the SMR's operation, the transport as defined in the PC would have not stopped and liability would have remained with the liable operator during transport and suffered nuclear damages would be subject to compensation according to the geographical scope of application of the PC provided in its

109. Vienna Convention, *supra* note 48, Articles II(1)(c)(iii) and (iv) and Revised Vienna Convention, *supra* note 49, Articles II(1)(c)(iii) and (iv).
110. See Paris Convention, *supra* note 38, Article 4(a) to (b) and CSC, *supra* note 51, Annex, Article 3(1)(b) to (c).
111. From Vienna Convention, *supra* note 48, Article I(1)(d) and Revised Vienna Convention, *supra* note 49, Article I(1)(d): "'Installation State', in relation to a nuclear installation, means the Contracting Party within whose territory that installation is situated or, if it is not situated within the territory of any State, the Contracting Party by which or under the authority of which the nuclear installation is operated."
112. Revised Vienna Convention, *supra* note 49, Article I A(3)(a).
113. Paris Convention, *supra* note 38, Article 2(a)(iii).

Article 2. The operation of such an SMR, once fixed, contradicts the conclusion presented earlier in this article regarding nuclear installations that energy production during transport is excluded.[114] The question thus arises whether this SMR can be considered as a nuclear installation under the PC and deserves further analysis.

Nonetheless, the Vienna Conventions could apparently, in a similar scheme, allow the mentioned marine-based SMR to become a "nuclear installation"[115] once fixed, and hence would render a liability transfer possible. Considering the SMR as being in "transport" in this case (under the Vienna Conventions) would raise the same contradiction as in the case of the PC. Such use cases might become relevant if marine-based SMRs are to be used in relation to the exploitation of natural resources in a contracting party's exclusive economic zone (EEZ) or on its continental shelf and would deserve more detailed scrutiny.

In short, although some clarification might be needed considering the status of platforms at sea and immersed capsules or floating reactors anchored to the seabed, the designation of the liable operator does not pose a new problem under the conventions once the installation is fixed. For type 2 SMRs, the transports between a supplier state and a host state can be compared to transboundary transports of "nuclear substances" or "nuclear material", which are already performed today. When the national nuclear laws provide for this possibility, inter-state agreements might be needed to organise the transfer of liability during transport and definitions should be agreed on in cases where different conventions are involved. Finally, challenges might arise when type 2 SMRs comprised in a means of transport are transported between states not party to the same conventions. This scenario might call for innovative technical solutions (unloading of the SMR from the means of transport) or a clarification of the conventions.

It should be noted that marine-based SMRs, such as non-self-propelled barges and capsules at sea or anchored to the seabed, are also regulated by maritime conventions, such as the United Nations Convention on the Law of the Sea (UNCLOS).[116] Depending on their legal status under these conventions, which have not yet been defined, other issues might arise concerning, for example, navigational rights and the liability of the states in case of accident, which may further complicate the deployment of marine-based SMRs.[117]

In a real-world case, each involved state, even if party to the same conventions, will have a different national nuclear liability framework prescribing different liability amount limits. Bilateral or multilateral agreements between involved countries will be inevitable to settling, among other aspects, the applicable national law and liability amount. These provisions will then in turn be reflected in the contracts and agreements signed between the private or state-owned stakeholders and the liability amount secured by the involved company. The supplier states, the traversed third-party states and the host state may not be party to the same conventions or party to any conventions at all.[118] Examining such

114. Indeed, as already mentioned, although no transport physically takes place, the SMR would be in a "transport" state.
115. This would, according to INLEX, generally be true for "floating reactors, anchored to the seabed or the shore, and attached to the shore by power lines". *Explanatory Texts*, *supra* note 81. A clarification might be needed for type 2 SMRs that are installed as fixed platforms at sea or as immersed capsules anchored to the seabed, or floating reactors anchored to the seabed but not attached to the shore by power lines.
116. United Nations Convention on the Law of the Sea (1982), 1833 UNTS 397, entered into force 16 Nov. 1994 (UNCLOS).
117. Bernini, E. (2022), "Small Modular Reactors and Transportable Nuclear Power Plants", in Kraska, J. and Park, Y. (Eds.), *Emerging Technology and the Law of the Sea*, Cambridge University Press, Cambridge, pp. 108-140.
118. One might imagine that countries that enter such deals will want to harmonise their respective nuclear liability frameworks (especially if they are geographically close) so that equal and reciprocal treatment of victims is secured in case of transboundary damage between their respective countries. This is of course also true for the commerce of normal nuclear power plants but might become even more important in the future where a small number of SMR vendors will possibly service a great number of clients across the world.

transports through the perspective of the conventions is useful to obtaining a sense of the challenges that such countries will face while drafting such agreements.

Finally, it should be noted that to make such transports possible, all the implicated countries – the supplier states, all the third-party states involved in the transport and the host state – will have to work together and sign bilateral or multilateral agreements on subjects extending far beyond nuclear liability, for example on subjects related to the use of certain maritime routes, safeguards, safety and nuclear export control. The next section presents the geographic scope of the conventions, which details where damage must take place so that an operator of a nuclear installation can be held liable thereof under a specific convention.

3.2.4 The geographical scope of the conventions

- 3.2.4.1 The Paris Convention

  The Paris Convention applies not only to nuclear damage suffered in the territory of a contracting party to the Convention (including its maritime zones or on board a ship or aircraft registered by such party[119]), but also to nuclear damage suffered in a non-Paris Convention state (including its territories and maritime zones or on board a ship or aircraft registered by such state) if: it is a party to the Vienna Convention and the 1988 Joint Protocol; or it has no nuclear installations; or its nuclear liability legislation affords equivalent reciprocal benefits[120] and is based on principles identical to those contained in the Paris Convention.

Non-contracting states not mentioned under Article 2(ii)-(iv) are termed "excluded" below. With respect to maritime zones, the explanatory text of the PC clarifies that "[t]he term 'maritime zones' as used in the Convention means maritime zones that are established in accordance with international law. Such zones are understood to include the territorial sea, a contiguous zone, an exclusive economic zone and the continental shelf".[121]

The geographic scope of the PC is broad. The next paragraphs examine its application to the two SMR-types.

Under the PC, Type 1 SMRs display no real differences to conventional nuclear power plants. Similarly, transports of nuclear substances related to the life cycles of land- and marine-based SMRs display no real differences to nuclear transports between nuclear power plants. While SMR projects are being developed, the PC exceptions related to "excluded" non-contracting states will have to be considered to minimise the occurrence of uncovered damages under the PC. In the unlikely case where one involved state is an "excluded" non-contracting party to the PC, an agreement should be reached between states (in addition to the agreement addressing the liability issue in the previous section) to determine the compensation mechanism and the applicable jurisdiction in the case of an SMR accident leading to damage that might be suffered in both states. An agreement with any "traversed third party" might also be required.

Once installed, marine-based type 2 SMRs, due to their nature, might produce use cases that should be examined in more detail. Indeed, once the transport has stopped, such SMRs might be fixed in the territorial waters of the host state. Damage suffered there, as well as in its EEZ or on its continental shelf would be covered under Article 2 of the Paris

119. In the *Exposé des Motifs* it is remarked that "damage suffered on board a ship or aircraft" is to be understood as to include damage suffered by a ship or aircraft other than that which is transporting the nuclear substances that are involved in the nuclear incident. *Supra* note 37.
120. There is, concerning Article 2(a)(iv) of the PC, no certainty regarding the exact meaning of the term "equivalent reciprocal benefits". *Supra* note 38. Moreover, the list of principles identical to those of the PC is not exhaustive. Paragraph 10 of the *Exposé des Motifs* provides in this regard that it is up to the competent court to determine whether a particular non-Contracting State meets the requirements of Article 2(a)(iv) of the PC. *Supra* note 37.
121. See *Exposé des Motifs, supra* note 37, para. 12, pp. 5-6.

Convention (without prejudice to the exceptions/exclusions of this article). Furthermore, when an accident occurs in the EEZ of a contracting party (for example upon transport), or in an area that could be recognised as such, jurisdiction under the PC belongs to this contracting party, provided that such zones had been declared to the Secretary-General of the OECD before the accident occurred.[122] In the unlikely case that the exact place of an accident involving a mobile SMR is undefinable, or takes place in the territory of a non-contracting state or in no state's territory, jurisdiction will belong to the state in whose territory the installation of the liable operator is situated according to Article 13 of the Paris Convention. Claims made in other states in cases where damage is suffered outside of the territory of the PC state are outside the scope of the present text.[123]

Hypothetical examples of damage explicitly covered under the Paris Convention include:

1. Damage suffered on the high seas[124] by a French ship due to nuclear substances emanating from a British SMR operating in British territorial waters off the coast of Scotland (both countries are PC states).
2. Damage originating from the same British SMR, and suffered in the territorial sea, a contiguous zone, an EEZ, on the continental shelf or on the high seas by a ship flying the flag of a state not party to the PC but mentioned under points (ii), (iii) and (iv) of Article 2(a) of the PC.

In both cases, as the incident occurs in the territorial sea of the United Kingdom, the United Kingdom should have jurisdiction according to the Article 13(a) of the PC.

Examples of damage that would explicitly not be covered under the PC include those arising from the following:

1. A marine-based SMR in use in the territorial waters of a contracting party to the PC causing damage to/on a ship or aircraft present on the territory of an "excluded" non-contracting state, independent of the state they are registered in.
2. A marine-based SMR in use in an overseas territory, over which a PC state has jurisdiction and which has decided, according to the Paris Convention, Article 23(b), that it should be treated as a PC state territory, causing damage to/on a ship or aircraft present on the territory of an "excluded" non-contracting state, independent of the state they are registered in.

These damages, unless otherwise decided by the PC state according to Article 2(b) of the Paris Convention, would not be covered under the PC and potential victims and owners of vessels in these zones, including vessels flying the flag of a PC state, would have the option to lodge claims in the supplier state, if it is not party to the PC and does not apply similar liability principles against, for example, the vendor of the SMR.

▪ 3.2.4.2 The Brussels Supplementary Convention

The BSC is a complementary convention defining supplementary funding for compensation for "nuclear damage for which an operator of a nuclear installation, used for peaceful purposes, situated in the territory of a Contracting Party to this Convention … is liable under the Paris Convention".[125] The geographic scope of application of the BSC is more restricted

122. Paris Convention, *supra* note 38, Article 13.
123. For damage suffered outside of the territory of a contracting party, for example in its EEZ or on its continental shelf outside its territorial waters, there will be a way for victims to claim reparation against the supplier of the SMR concerned in the supplier-state if, for example, this state is not party to the PC. Such cases might be dismissed on the argument that adequate compensation might have been received by the victims in the jurisdiction of the state party to the PC.
124. See *Exposé des Motifs, supra* note 37, para. 7.(a).
125. See BSC, *supra* note 47, Article 2.

than that of the PC. It applies only to damage suffered within the territory of a contracting party to the BSC as well as:

> in or above maritime areas beyond the territorial sea of a Contracting Party … on board or by a ship flying the flag of a Contracting Party, or on board or by an aircraft registered in the territory of a Contracting Party, or on or by an artificial island, installation or structure under the jurisdiction of a Contracting Party, or … by a national of a Contracting Party.[126]

Nonetheless, the BSC covers damage "in or above the [EEZ] … or on the continental shelf of a Contracting Party [when suffered] in connection with the exploitation or the exploration of the natural resources of that [EEZ] or continental shelf",[127] for example, by ships, regardless of the flag they are flying.[128]

The absence of cover for nuclear damage originating from a marine-based SMR, present in the territorial waters of a contracting party, to/or aboard ships flying the flag of a non-party state outside of the territory of a BSC state might become an issue if such SMRs were to become widely used in the vicinity of highly populated marine routes. In the case of factory-fuelled SMRs, provided that their transport routes back and forth between the supplier and host states span a large geographical area and involve remote sites where nuclear liability convention penetration is low, most of the nuclear damage coming from such mobile SMRs will not be covered by the BSC.

▪ 3.2.4.3 The Vienna Convention

The major difference between the VC and the PC is that the VC does not explicitly make exceptions for non-contracting parties, and nothing in its text limits the territorial scope concerning the place where the damage can be suffered. The *Explanatory Texts* of the 1997 Vienna Convention documents the ongoing debate through the years.[129] The *Explanatory Texts* specifically recalls the view expressed by the Standing Committee in 1964 that "nuclear damage suffered within the territory of a non-contracting State would not be nuclear damage covered by the Convention even if the nuclear incident causing such damage occurred within the territory of a Contracting Party or on or over the high seas."[130]

The case of the Akademik Lomonosov might be of interest here. One might conjecture whether damage caused by such an SMR and suffered on the territory of a non-contracting state to the VC would be covered under the Vienna Conventions. Such a situation might occur in the Baltic Sea between VC and PC states if the two are non-contracting parties to the JP. Nonetheless, the VC provides that in such cases where the exact position of the accident involving a mobile SMR cannot be defined or if the accident occurred in the territory of a non-contracting state or in no state's territory, jurisdiction of the case would generally belong to the installation state.[131] This implies that the VC can be interpreted as "allowing the applicable national law to also cover damage suffered in non-contracting States",[132] in this case Russian national law. The question of the limits of the territorial scope within which damage can be suffered has been clarified in the RVC.[133]

126. *Ibid*.
127. *Ibid*., Article 2(a)(iii).
128. See e.g. NEA (2020), "Exposé des Motifs of the Brussels Supplementary Convention as amended by the Protocols of 1964, 1982 and 2004", adopted by the Contracting Parties to the Brussels Supplementary Convention on 23 Dec. 2010, NEA Doc. NEA/NLC/DOC(2017)4/FINAL (*Exposé des Motifs of the BSC*), p. 5, n. 8.
129. See *Explanatory Texts*, *supra* note 81, pp. 27-28.
130. See *Ibid*., p. 30.
131. Vienna Convention, *supra* note 48, Article XI.
132. See *Explanatory Texts*, *supra* note 81, p. 30.
133. Revised Vienna Convention, *supra* note 49, Article I A.

▪ 3.2.4.4 The 1997 Vienna Convention

As previously mentioned, the 1997 VC clarifies the limits of the territorial scope within which damage can be suffered while stating that the RVC applies to nuclear damage wherever it is suffered.[134] However, an exception to this principle is possible. Indeed, the Convention allows a contracting state to exclude at the national level "damage suffered … in the territory of a non-Contracting State; or … in any maritime zones established by [it] in accordance with the international law of the sea."[135] Nonetheless, exclusion is only possible if the non-contracting state "has a nuclear installation on its territory or in any maritime zones established by it in accordance with the international law of the sea; and does not afford equivalent reciprocal benefits" while omitting "damage on board or to a ship or an aircraft" from the exclusion concerning damage suffered within any maritime zones established by it in accordance with the international law of the sea.[136] A contracting party that uses this possibility would be in a similar position to a PC contracting state in the face of a non-contracting state, but ships or aircrafts of a non-contracting party that suffered nuclear damage for which an operator is liable under the RVC would be in a stronger position in this case, since they cannot be completely excluded from cover.

Finally, if the accident occurs in the EEZ of a contracting party (or an area that could be recognised as such if not declared), jurisdiction belongs to the contracting party to which it belongs.[137] In this respect, both the RVC and the PC are similar.

▪ 3.2.4.5 The CSC

The CSC is conceived as a supplement to the compensation system established by the PC, the VC and the RVC, as well as the national compensation system of states that are compliant with the Annex of the CSC. The CSC applies "to nuclear damage for which an operator of a nuclear installation used for peaceful purposes situated in the territory of a Contracting Party is liable under either the [PC, the VC or the RVC] or national law [compliant with the CSC Annex]".[138] In this way, it "provides a two-tier compensation system: the first tier is provided by the operator and, if necessary, the state where its installation is situated; the second tier is provided by the CSC states."[139] The first tier is distributed according to the law of the installation state,[140] and the second tier[141] is distributed for compensation of nuclear damage "in the territory of a Contracting Party; or … in or above maritime areas beyond the territorial sea of a Contracting Party"[142] pursuant to Article V(1)(b)(i) to (ii) of the CSC in terms very similar to the BSC, excluding compensation with the means of the second tier of damage suffered in the territory of non-contracting parties. The CSC also includes damage "in or above the [EEZ] of a Contracting Party or on the continental shelf of a Contracting Party in connection with the exploitation or the exploration of the natural resources of that [EEZ] or continental shelf".[143]

▪ 3.2.4.6 The JP

The JP states that "[t]he operator of a nuclear installation situated in the territory of a Party to the Vienna Convention shall be liable in accordance with that Convention for nuclear damage suffered in the territory of a Party to both the Paris Convention and [the JP]" and that "[t]he operator of a nuclear installation situated in the territory of a Party to the Paris

134. *Ibid.*, Article I A(1).
135. *Ibid.*, Article I A(2).
136. *Ibid.*, Article I A(3) and I A(4).
137. *Ibid.*, Article XI.
138. CSC, *supra* note 51, Article II(2).
139. Burns, S. (2022), "The impact of the major nuclear power plant accidents on the international legal framework for nuclear power", in NEA (ed.), *Principles and Practice of International Nuclear Law*, OECD Publishing, Paris, p. 95.
140. CSC, *supra* note 51, Article III(2)(a).
141. From CSC states.
142. CSC, *supra* note 51, Article V(1).
143. *Ibid.*, Article V(1)(c).

Convention shall be liable in accordance with that Convention for nuclear damage suffered in the territory of a Party to both the [Vienna Conventions] and the [the JP]".[144] Furthermore, "[e]ither the Vienna Convention or the Paris Convention shall apply to a nuclear incident to the exclusion of the other."[145]

This arrangement provides certainty concerning the compensation of nuclear damage that would otherwise be subject to the non-contracting party "treatment" in the case of the "Baltic Sea" example given in section 3.2.4.3, provided that the marine-based SMR would be fixed in Russian territorial waters since Russia is not a party to the JP.

The JP also specifies the convention that will be applicable, namely the convention to which the state where the nuclear installation involved is situated is a party. If the incident happens during transport, the applicable convention is the one to which the state where the nuclear installation of the liable operator under the Vienna Conventions or the PC is situated is a party.[146]

Nonetheless, the JP does not specifically address the situation in which a "nuclear installation" is fixed outside of the territory of a contracting party to either the Vienna Conventions or the PC. Would the same damage as above be covered under the JP if the Russian SMR were to be anchored in the Russian EEZ, outside of its territorial waters? Ambiguity arises once again about incidents that take place outside the territory of a contracting party and not during transport in the framework of the Vienna Conventions. This is an area that requires clarification.

In short, the geographic scope of the conventions is generally very broad and for the PC and the RVC, very similar. Two challenges will probably have to be overcome for SMRs to become widely used: first, the absence of a harmonised international liability framework; and second, the fact that damages remain uncovered in some areas and situations due to the geographic scope of the conventions. This implies that participants in SMR projects might still be subject to claims outside the nuclear liability framework, even if they are not the operator. In addition, some clarifications are needed in the framework of the conventions concerning possible exclusions related to non-contracting parties. These two hurdles create uncertainty and unforeseeable risks, which may reduce the attractiveness of SMR projects.

In addition, as observed in the case of SMR transports, many details of a specific project – the supplier state, transport routes, third parties involved, the host state and the location of the installation within its territory (or even possibly outside of its territory), and the geography of the neighbouring states – are key to understanding how damages will be covered and which agreements should be in place for a specific scheme to work. As export projects develop and initial co-operation agreements are signed internationally, timely, thorough and transparent reviews of their implications for nuclear liability will be required. Over time, best practices should be derived and disseminated internationally to ensure that SMR deployment takes place according to the fundamental objectives of the conventions, while encouraging states that are not party to any conventions to join them. The next section explores the possibility for a state to reduce the minimum liability amounts prescribed in the conventions and how the modularity and safety concepts introduced in sections 1.3 and 1.4 might have a role to play in this reduction.

3.2.5 Reduced liability amount

Under the PC, RVC and the Annex of the CSC, provisions are present that give states the possibility of reducing the liability amounts within certain limits.[147] The idea of these provisions is to maintain a graded approach to risk with "the aim … to avoid burdening the

144. JP, *supra* note 50, Article II(a) and (b). As explained earlier, the JP applies to both the VC and the RVC.
145. *Ibid.*, Article III(1).
146. *Ibid.*, Article III(2) and (3).
147. Paris Convention, supra note 38, Article 7(b); Revised Vienna Convention, *supra* note 48, Article V(2) and CSC, *supra* note 51, Article 4(2).

nuclear operators concerned with unjustified insurance or financial security costs".[148] In such case, an obligation is imposed on the state to make public funds available for compensation for nuclear damage arising from a nuclear incident that would exceed the reduced liability amounts up to the prescribed minimum (non-reduced) liability amounts.[149] The reduced liability amount provided by the conventions for low-risk activities and installation is 5 million International Monetary Fund special drawing rights (SDR) in the case of the RVC and the Annex of CSC, and EUR 70 million for the PC, which also provides a lower limit for transport of EUR 80 million.

With regard to SMRs, it will be up to the states to decide where they want to place the bar between the reduced liability amount and the minimum liability amount. This exercise contains several difficulties:

- the multi-module/multi-unit/multi-operator aspects of certain SMR concepts: Specific bands of power for individual modules might be defined, within which liability amounts are relaxed up to a certain aggregate power, per operator, per site;
- SMRs are not only expected to produce electricity. Defined bands might also be expressed in terms of the thermal output of a reactor;
- environmental boundary conditions for different SMRs might be extremely diverse. The direct environment of the nuclear installation in terms of population[150] as well as the extent of its EPZ might be considered while defining the liability amount.

Regulators will have to consider these parameters when defining the minimum liability amount for different types of SMRs so as not to favour one type or one design over another or certain power/number combinations of modules that would lead to inconsistent liability obligations between designs or situations that are otherwise equivalent from a safety point of view. The establishment of technology-neutral performance or risk-informed guidance for states under the PC and the Vienna Conventions would be very useful and help harmonise how states set the bar when establishing reduced liability amounts. Considering the important differences in the levels of the liability amounts between conventions, for example between the PC and the Vienna Conventions, one can readily understand that such recommendations only make sense in the framework of a specific convention or for states that are party to conventions offering similar minimum and reduced amounts of liability.

The possible deployment of SMRs in industrial environments is also likely to produce new challenges in terms of insurance. Aside from the fact that industrial heat or electricity production in combination with industrial installation will revolutionise the vision we have of today's nuclear operators (every industrial company seeking to replace its conventional energy source with SMRs may potentially become an operator of a nuclear installation), the possible presence of high-value assets in the vicinity of SMRs with reduced liability limits could lead to either inadequate third-party liability cover or prohibitive increases in premiums. Such questions might necessitate reliable in-depth studies as part of the evidence for the economic feasibility of such concepts.

Finally, one might want to point out that, especially for type 2 SMRs, damage to the means of transport under the conventions may become a subject of interest. Indeed, if fuelled SMRs are to be transported around the world and, *a fortiori*, if new technologies and dedicated vessels are to be developed, owners of such vessels will require certainty concerning indemnification in the case of accidents. There is no implicit mention of the minimum liability amount towards damage to the means of transport in the conventions. For example, the VC provides that operators should not be liable for such costs and gives states the possibility of legislating on the matter provided that the operator's minimum liability amount for nuclear damage remains untouched.[151] The PC includes this possibility

148. See *Exposé des Motifs*, *supra* note 37, para. 68.
149. Paris Convention, *supra* note 38, Article 10(c) and Revised Vienna Convention, *supra* note 49, Article 5(2).
150. For example, where SMRs are used for district heating.
151. Vienna Convention, *supra* note 48, Article IV(5) and (6).

provided that the "liability of the operator in respect of other nuclear damage"[152] is not reduced below EUR 80 million (the minimum liability amount for transport). In this regard, the RVC is more generous because it provides for a possible reduction of the minimum liability amount for damages other than transport of up to SDR 150 million, which would represent half of the highest minimum amount for which the operator can be held liable.[153] Care will be taken by transporters to check that the liability amounts offered in the different countries traversed, as well as the amounts contractually agreed with their clients, are adequate. If technologies required for fuelled SMR transport become much costlier than the actual technologies, some steps may need to be taken to reflect this new situation in the conventions.

3.2.6 Inclusion of other installations and exclusions from the conventions

The RVC complements the VC's definition of "nuclear installation" and adds "such other installations in which there are nuclear fuel or radioactive products or waste as the Board of Governors of the International Atomic Energy Agency shall from time to time determine."[154] The PC definition of "nuclear installation" also contains a similar wording: "… and such other installations in which there are nuclear fuel or radioactive products or waste as the Steering Committee for Nuclear Energy of the Organisation … shall from time to time determine."[155]

As previously discussed, the definition of "nuclear fuel or radioactive products or waste" potentially covers everything that is likely to enter into the production of nuclear fuel for SMRs.[156] Hence, the definition of "nuclear installation" in the RVC and PC offers the possibility to cover SMRs more explicitly. Indeed, a look at the conventions' respective explanatory texts is today needed to decide, for example, the extent to which SMRs comprised of a means of transport are covered. A clarification of the situation would provide more legal certainty for the development of SMRs. The situation might be different for VC states and CSC Annex states, as in this case the definitions of "nuclear installation" contained in the CSC Annex and the VC do not provide the possibility to include other installations.

The conventions also contain exclusion provisions that give national legislators or, in the case of the PC, the Steering Committee[157] the option of excluding some "nuclear installations",[158] "small quantities of nuclear material" or – in the case of the PC – "nuclear installations", "nuclear substances" as well as "nuclear fuel" from the conventions.[159] Articles 1(b) and 16[160] of the Paris Convention address this possibility. Article 1(b) states that "the Steering Committee may, if in its review the small extent of the risks involved so warrants, exclude any nuclear installation, nuclear fuel, or nuclear substances from the application of this Convention." Similar provisions exist in the RVC[161] and in the CSC[162] that address both the "small quantities of nuclear material" and "nuclear installation." The formulation "small quantities of nuclear material" might seem narrower than "nuclear substances" (from the PC), but both are based on the same principle according to which

152. Paris Convention, *supra* note 38, Article 7(c).
153. Revised Vienna Convention, *supra* note 49, Article 5(1)(a).
154. *Ibid.*, Article I(1)(j)(iv).
155. Paris Convention, *supra* note 38, Article 1(a)(ii).
156. The PC also provides in Article 1(a)(iii) for the possibility to include other fissionable material in the definition of "nuclear fuel". *Supra* note 38.
157. For the PC, this possibility is given to the Steering Committee, not to the national legislators. Decisions adopted by the Steering Committee are binding upon all contracting parties to the PC.
158. The VC's exclusion clause only relates to "small quantities of nuclear material" and not to "nuclear installation".
159. The PC, the Vienna Conventions and the CSC all exclude "radioisotopes which have reached the final stage of fabrication" and "natural and depleted uranium" as well.
160. Decisions taken by the Steering Committee under Articles 1(a)(ii), 1(a)(iii) and 1(b) of the Paris Convention shall be adopted by mutual agreement of the members representing the contracting parties.
161. Revised Vienna Convention, *supra* note 49, Article I(2).
162. CSC, *supra* note 51, Annex, Article 1(2).

the conventions provide an exceptional regime limited to risks of an exceptional character for which common law rules and practice are not suitable. Whenever risks, even those associated with nuclear activities, can properly be dealt with through existing legal processes, they are left outside the scope of the conventions.[163] To date, decisions related to Article 1(b) of the PC have been made on the following matters:[164]

- exclusion of certain kinds of nuclear substances (1977);
- nuclear installations in the process of being decommissioned (2014);[165]
- the exclusion of small quantities of nuclear substances outside a nuclear installation (2016);[166] and
- nuclear installations for the disposal of certain types of low-level radioactive waste (2016).

Additionally, decisions have been taken on the establishment of maximum limits for the exclusion of small quantities of nuclear material (2014)[167] in the framework of the Vienna Conventions. The decisions of the IAEA Board and of the Steering Committee concerning "small quantities of nuclear substances" provide exclusion criteria for "[n]uclear material … consigned by an operator to a recipient for use … for the period it is outside a nuclear installation,"[168] that is, during transport. In both the Paris and Vienna Convention cases, exclusion criteria are based on dose level and radioactivity inventory that could be of use for the transport of low activated SMR components or modules to their decommissioning plants if they meet the aforementioned criteria.

To date, there has been no decision concerning the exclusion of "nuclear installation" for energy production while in operation and such a decision might never transpire. In addition, the current exclusions regarding small quantities are to the author's knowledge of no practical use for the operation of the vast majority of the SMRs currently in development.

3.2.7 Peaceful applications

Some SMRs, especially marine-based SMRs, could be operated by the military for peaceful or military purposes. Once again, the Akademik Lomonosov provides a good example of such an SMR that could be put to use along the Northern Sea Route or in the South China Sea for military power projection or to deliver energy to remote areas in which other sources are unavailable or uneconomical.[169] The use of truck-mounted SMRs operated by the military for catastrophe relief might also be considered. Are they excluded by the conventions? Both the PC and the VC address "peaceful purposes" in their preambles, but they do not explicitly exclude reactors that would be operated by the military. The explanatory text of the PC states that "[t]he Convention contains no specific provision regarding its application to nuclear installations used for military purposes, apart from a reference in the preamble to the Convention to the development of the production and uses of nuclear energy for peaceful purposes."[170] Nothing in the PC's definition of "nuclear installation" excludes reactors operated by the military. As previously stated, the VC also

163. See *Exposé des Motifs*, *supra* note 37, para. 13, p. 6.
164. NEA (2022), "Compilation of the Decisions, Recommendations and Interpretations applicable to the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964, by the Protocol of 16 November 1982 and by the Protocol of 12 February 2004", OECD Publishing, Paris, p. 5.
165. Repealing a similar decision taken in 1990.
166. Repealing a similar decision taken in 2007.
167. Repealing a similar decision taken in 2007.
168. IAEA (2014), "The Establishment of Maximum Limits for the Exclusion of Small Quantities of Nuclear Material from the Application of the Vienna Conventions on Nuclear Liability, Resolution adopted by the Board of Governors on 20 November 2014", IAEA Doc. GOV/2014/63, p. 2.
169. Bernini, E. (2022), *supra* note 117, pp. 108-140.
170. See *Exposé des Motifs*, *supra* note 37, para. 18.(d), pp. 8-9.

contains a reference to "peaceful uses of nuclear energy" in its preamble. However, although reading the IAEA Statute, especially Articles II ("… to further any military purpose") and III ("atomic energy for peaceful purposes") together, might lead to the exclusion of "any military application or purpose" from the VC, the same ambiguity that exists in the PC also exists here. Article I B of the RVC clarifies the situation a little with respect to installations used for "military purposes" in that it states that the "[c]onvention shall not apply to nuclear installations used for non-peaceful purposes."[171] This is so despite the fact that, "[s]ince military installations may cause as much damage as civilian ones, [some] States strongly [advocated the explicit inclusion of] military installations in the revised *Vienna Convention* regime".[172] The *Explanatory Texts* of the RVC states that "… it was eventually decided to insert in the amending Protocol a provision whereby the Vienna Convention does not apply to nuclear installations used for non-peaceful purposes; thus, the supposed ambiguity in the 1963 Vienna Convention is at least dispelled. This provision appears as Article I B of the 1997 Vienna Convention."[173] Although the provision does not exclude the peaceful operation of a nuclear installation by the military, "[i]t differs in this respect from the Paris Convention which, in the absence of any express exemption, can be taken to apply to military installations where these installations fulfil the criteria in the definition".[174]

Both the PC and the Vienna Conventions (including the CSC Annex) ensure that no operator will be made liable for nuclear damage caused by a nuclear incident that "is directly due to an act of armed conflict, hostilities, civil war or insurrection".[175] While it is then clear that nuclear damage arising from a military nuclear installation due to an act of war would not be covered by the conventions, here, also, nuclear damage arising from military nuclear installations is not explicitly excluded either. Indeed, incidents could occur that involve SMRs operated by the military and not used in relation to "threat or use of force against the territorial integrity or political independence of any state".[176]

Under the PC, the Contracting Party within whose territory the nuclear installation of the liable operator is situated, and under the Vienna Conventions, the installations state of the operator liable, are required to step in and cover the gap between the reduced amount of liability and the general amount of liability should the insurance or other financial security not be available or sufficient to satisfy claims for compensation.[177] In a case in which a state or state-owned entity is the operator of an SMR, it would have to provide compensation at least up to the minimum liability amounts – though there is no obligation on any state to secure these amounts – without the option to call on state immunity according to the PC[178] and Vienna Conventions,[179] which might hold in the case when the military is the operator.[180] On the other side, the Annex of the BSC,[181] which is, according to its Article 20, a part of the BSC, contains a declaration on "compensation for nuclear damage caused by a nuclear incident not covered by the Supplementary Convention solely by reason of the fact that the relevant nuclear installation, on account

171. Revised Vienna Convention, *supra* note 49, Article I B.
172. NEA (1994), *Liability and compensation for nuclear damage: An International Overview*, OECD Publishing, Paris, p. 125.
173. See *Explanatory Texts*, *supra* note 81, p. 29.
174. See Dussart-Desart, R. "The reform of the Paris Convention on Third Party Liability in the Field of Nuclear Energy and of the Brussels Supplementary Convention: An overview of the main features of the modernisation of the two Conventions", *Nuclear Law Bulletin*, No. 75, OECD Publishing, Paris, p. 13.
175. Vienna Convention, *supra* note 48, Article IV(3)(a); Revised Vienna Convention, *supra* note 49, Article IV(3); Paris Convention, *supra* note 37, Article 9.
176. UN Charter, *supra* note 32, Art. 2(4).
177. Vienna Convention, *supra* note 47, Article VII(1); Revised Vienna Convention, *supra* note 49, Article VII(1)(a); Paris Convention, *supra* note 38, Article 10(c).
178. Paris Convention, *supra* note 38, Article 13(j).
179. Vienna Convention, *supra* note 48, Article XIV and Revised Vienna Convention, *supra* note 49, Article XIV.
180. The question as to whether peaceful uses by the military can be considered as covered by the PC/BSC is subject to interpretation, with the competent court having the final say.
181. See BSC, *supra* note 47, p. 22.

of its utilisation, is not on the list referred to in Article 13 of the Supplementary Convention (including the case where such installation, which is not on the list, is considered by one or more but not all of the Governments to be outside the Paris Convention) […]".[182] In addition, paragraph 8 of the *Exposé des motifs of the BSC,* which provides more explanations as regards the declaration, does explicitly mention installations that are not used for peaceful purposes and states that "where nuclear damage is caused by a nuclear incident that is not covered by the Convention solely because the relevant nuclear installation is not used for peaceful purposes and is thus not on the list referred to in Article 13(a), the Contracting Parties declare that compensation shall, in any event, be provided without discrimination among nationals of the Convention's Contracting Parties, up to not less than EUR 1500 million". Most PC states are also BSC states. Therefore, their contracting party in whose territory such a nuclear installation would be situated would be obliged to pay compensation of no less than EUR 1.5 billion.[183]

Finally, it is worth noting that the Convention on the Liability of Operators of Nuclear Ships is not limited to peaceful usages. The word "peaceful" does not appear in the text.

In conclusion, although the conventions generally do not cover non-peaceful applications, military uses of SMRs might not be treated homogeneously across the conventions and even if states endeavour to compensate damages, other factors such as "state immunity" and the interpretation of the conventions might threaten victims' access to compensation.

4. Conclusion

Two research questions were formulated in the introduction. This article tried to answer these questions by examining the complex corpus of articles of each nuclear liability convention.

First, the analysis demonstrates that all SMRs, including SMRs comprised in a means of transport once installed in the host state, are likely to be covered under the conventions. Second, it appears that factory-fuelled SMRs, independent of the used technology, while in transport would be covered by the conventions as nuclear transports for which the liability of the operator of a nuclear installation is suitably prescribed. Interpretation of the conventions is required to address ambiguities in topics such as subcritical reactors, reactors comprised in a means of transport, the status of certain marine-based SMRs, the coverage of damage in the territory of a non-contracting party to the VC and the coverage of non-peaceful uses. In this respect, it might be necessary to clarify certain definitions, in particular that of "nuclear installation". However, the author identified no critical issues necessitating a revision of the conventions, which would impair the development of SMRs, as the conventions already sufficiently secure the liability chains that SMR deployment implies.

182. See *Exposé des Motifs of the BSC*, *supra* note 128, para. 8(b) and the preamble of the Annex of the BSC *supra* note 47.
183. See *Exposé des Motifs of the BSC*, *supra* note 128, para. 8(a).

Responding to the call: Assessing international legal frameworks for response to incidents involving floating nuclear power plants

*by Jason Karcz**

1. Introduction

The 2021 United Nations Climate Change Conference of Parties (COP26) brought together countries from around the world to address the impact of climate change and establish actions to combat it.[1] One of the outcomes of COP26 was the "mitigation" goal, where 153 states established new emissions objectives for the year 2030 to accelerate net zero climate goals.[2] During this conference, the International Atomic Energy Agency (IAEA) held a side event to discuss the role of nuclear energy in providing clean energy to help meet net zero goals.[3] During this event, IAEA Director General Rafael Mariano Grossi said "[p]eople are approaching the issue of nuclear's contribution to climate change from a more objective perspective, with a much better disposition… The voice of nuclear had to be heard, is being heard and will continue to be heard".[4]

Even before COP26, 53 states had already indicated interest in developing their energy infrastructures (including physical and regulatory infrastructure) to accommodate nuclear energy based on state energy needs.[5] The COP26 and a renewed interest in advanced nuclear technologies that are more flexible to states' needs have combined to revitalise the application of nuclear power as a suitable form of energy to combat climate change. Transportable nuclear power plants (TNPPs) and floating nuclear power plants (FNPPs), a subset of TNPPs, are attractive options for nuclear power delivery because of their ability to generate electricity, heat and desalinated water while in operation, as well as for their portability, which makes it possible to deliver energy to areas in need of energy.[6] The IAEA defines a TNPP as "a factory manufactured, transportable and/or relocatable nuclear power

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1. UK Government (2021), "COP26 The Glasgow Climate Pact", The Glasgow Climate Pact, https://ukcop26.wpenginepowered.com/wp-content/uploads/2021/11/COP26-Presidency-Outcomes-The-Climate-Pact.pdf, p. 3.
2. *Ibid*., p. 5.
3. IAEA (2021), "Countries Detail Nuclear Power Climate Change in COP26 Event with IAEA Director General", www.iaea.org/newscenter/news/countries-detail-nuclear-power-climate-change-plans-in-cop26-event-with-iaea-director-general (accessed 10 July 2023).
4. *Ibid*.
5. Locatelli, G., C. Bingham, and M. Mancini (2014), "Small Modular Reactors: A Comprehensive Overview of their Economics and Strategic Aspects", *Progress in Nuclear Energy*, Vol. 73, Elsevier, p.4.
6. IAEA (2013), *Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study*, IAEA Nuclear Energy Series, No. NG-T-3.5, IAEA, Vienna, p. 7.

plant which, when fuelled, is capable of producing final energy products such as electricity, heat and desalinated water."[7] Many TNPPs are expected to come already fabricated for their operation, including the reactor (and possibly fuel, if factory-fuelled) and associated components (such as the turbine and generator), to help expedite deployment.[8] Small modular reactors (SMRs) are attractive options for use in the deployment of TNPPs and FNPPs to meet varying energy needs.

With the development and future deployment of emerging nuclear technologies such as SMRs and TNPPs to address climate change, the threat of theft and sabotage by malicious actors increases. The number of existing nuclear reactors and the expected construction of new SMRs around the world provide more opportunities for malicious actors to trigger nuclear security events, regardless of the strength of a state's regulatory or physical infrastructure. A radiological release through an act of sabotage of an operating nuclear reactor would have devastating effects both domestically and internationally. Mass casualties, economic impacts and damage to critical infrastructure are just a few of the consequences that may arise from the malicious use of nuclear material.[9]

Emerging nuclear technologies such as FNPPs generate unique and complex challenges and legal requirements for FNPP deployment, particularly in planning for the response to a nuclear security event. First, jurisdictional considerations may arise among a host state and supplier state. The regulatory frameworks implemented by the host state and supplier state may differ depending on which law is applied and which state ultimately governs the FNPP. Extraterritorial considerations also raise questions as to how a response to a nuclear security event is to be conducted and co-ordinated if the supplier state's jurisdiction extends to the operation and regulation of the FNPP in the host state based on arrangements between the two states.[10]

Second, safety and security issues, especially with respect to the emergency planning zone (EPZ) and maritime security zone (MSZ), respectively, may conflict within the area in which an FNPP is deployed. These may create uncertainties within response co-ordination and mechanisms, such as new stakeholders and applicable response frameworks, and questions may arise regarding who has ultimate jurisdiction for response during a nuclear accident or nuclear security event. Additionally, response measures to such an event could depend on whether an FNPP is classified as a facility, vessel or platform, because different classifications have different requirements within the international nuclear and maritime frameworks. Existing response requirements and mechanisms for a nuclear accident or nuclear security event involving an FNPP are either limited, vague or non-existent within the Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment (ACPPNM), the International Ship and Port Facility Security (ISPS) Code, the International Maritime Dangerous Goods (IMDG) Code, and other international instruments within nuclear and maritime law.[11] Safety and security response scenarios are important to consider and analyse and the law must be strongly established to allow for the creation of efficient and legal mechanisms for response to any type of event.

7. *Ibid*.
8. *Ibid*.
9. Buddemeier, B. and N. Suski (2011), "Improvised Nuclear Device Case Study: An Analytical Framework for Disaster Management", conference paper at the 2011 IEEE International Conference on Technologies for Homeland Security, IEEE, Waltham, MA, 15-17 November, p.1.
10. Scott, J. (2014), "Extraterritoriality and Territorial Extension in EU Law", *The American Journal of Comparative Law*, Vol. 62, No. 1, Oxford Academic, p. 90.
11. Convention on the Physical Protection of Nuclear Material (1980), IAEA Doc. INFCIRC/274 Rev. 1, 1456 UNTS 125, entered into force 8 Feb. 1987 (CPPNM), Art. 5.1; Amendment to the Convention on the Physical Protection of Nuclear Material (2005), IAEA Doc. INFCIRC/274/Rev.1/Mod.1, entered into force 8 May 2016 (ACPPNM), Art. 5; International Ship and Port Facility Security Code, Chapter XI-2 of the International Convention for Safety of Life at Sea, entered into force 1 July 2004 (ISPS Code); International Maritime Dangerous Goods Code (2020 edition), Amendment 40-20, updated regularly (IMDG Code).

This article provides a brief description of the history of FNPPs and existing work that has been done in nuclear law and maritime law related to FNPP deployment and response, with an aim to identify possible gaps related to work in response and emergency planning for FNPPs. In furtherance of this goal, the article analyses and discusses the existing international legal frameworks, other international recommendations, and previous FNPP studies for both nuclear law and maritime law specifically for nuclear and maritime security and response. These two fields incorporate different frameworks, stakeholders, and even geographies for activities conducted within the two domains. As more FNPPs are deployed in the future, the legal requirements based on their classification must be fully ascertained to keep them safe and secure. The article also discusses existing frameworks and the interface between nuclear safety and security, especially maritime security in the case of a nuclear security event involving sabotage with radioactive release at an operating FNPP docked at a seaport.

Applying the aforementioned analysis, this article frames and develops a nuclear security event scenario to analyse the applicability of the existing nuclear and maritime frameworks as they relate to the response to such an event. The scenario and subsequent analysis consider the applicability of the frameworks based on a defined classification of the FNPP and other feasible parameters associated with an FNPP docked and operating at a seaport. Ultimately, this article assesses the sufficiency of international nuclear and maritime law with a focus on safety and security responses to events occurring on FNPPs.

2. Background and existing studies

The following section provides a brief history of FNPPs and a discussion of some existing studies conducted on FNPPs related to the responses and roles of the host state and supplier state. According to the IAEA, the host state is defined as "the State in which the TNPP is operated" and the supplier state is "the State in which the TNPP is designed and fabricated."[12] The section describes the history and features of the FNPP and highlights previous work that has paved the way for analysis of these emerging nuclear technologies.

A. History of FNPPs

i. The Sturgis

The FNPP is not a new concept, but rather has been revisited as a viable option for generating power and heat.[13] The first FNPP to be deployed, the Sturgis, appeared in the 1960s after repurposing the SS Charles H. Cugle into a barge with a 45 MWt pressurised water reactor to generate power.[14] The Sturgis began operation in 1967 by supplying power to a military base in Fort Belvoir, in the state of Virginia in the United States (US). It was towed to other areas, such as the Panama Canal Zone, to provide power generation to varying locations and finally was towed back to Fort Belvoir for decommissioning in 1977.[15]

One of the unique aspects of the Sturgis was the timing of its deployment and operation, because it was designed before international physical protection requirements were adopted.[16] As a result, its physical protection system was not designed around modern international requirements, but rather would have had to meet domestic regulations in existence at the time. Although information on response protocols related to the Sturgis may not be available, it is possible that its operation helped pave the way for new regulations around the operation of nuclear reactors within the maritime domain.

12. IAEA (2013), *supra* note 6, p. 8.
13. *Ibid.*, p. 7.
14. Marcus, G.H. and S.M. Mirsky (2021), "The History and Future of Civilian Nuclear Power Afloat", *NuclearNews*, December 2021 Issue, American Nuclear Society, p. 37.
15. *Ibid.*
16. *Ibid.*

ii. *Akademik Lomonosov*

Over four decades passed since the Sturgis before another FNPP was constructed in early 2018 by the Russian Federation – the Akademik Lomonosov.[17] Later that year, on 2 November 2018, the reactor started up and subsequent testing ended on 28 June 2019.[18] Finally, from 23 August 2019 to 9 September 2019, the Akademik Lomonosov was towed from Murmansk to Pevek, where it began commercial operation on 22 May 2020.[19] Critical aspects of the Akademik Lomonosov (and similarly the Sturgis) were that it was towed from its origin to its destination and that the nuclear reactor on board did not generate power to propel the FNPP.[20] These important characteristics are further discussed in section 3 of this article.

The design of the KLT-40S nuclear power reactor used on the Akademik Lomonosov is meant to be inherently safe through innovative technologies and passive safety systems.[21] New core configurations and designs, passive emergency cooling systems, fuel reloading and storage compartments, and other technical characteristics were all carefully designed and implemented in deploying the KLT-40S on the Akademik Lomonosov.[22] Various layers of steel, concrete and water are used as radiation protection, with the hull of the FNPP as the final safety layer to contain radiation from the reactors.[23] Through these technological innovations and designs, the KLT-40S reactors on board the Akademik Lomonosov are meant to be inherently safe and "guarantee a significant margin of time during which personnel can control accidents".[24] Bylov states that, with its safety characteristics, the Akademik Lomonosov has an EPZ of 1 kilometre (km) around it, compared with traditional EPZs that may extend for up to tens of kilometres; however, it is unclear how this value was determined and further research should be conducted to help standardise the design of EPZs around FNPPs for future deployments.[25]

Unlike the Sturgis, the Akademik Lomonosov was designed and constructed after the CPPNM and its Amendment were established and entered into force.[26] Nikitin and Andreyev began identifying scenarios against which the CPPNM and its Amendment protect, including the hijacking of an FNPP to steal nuclear material, malicious use of radioactive material obtained from the FNPP, and attacks on vital components of the FNPP, such as the reactor or supporting systems and facilities, that result in a radiological release.[27] The authors also note that in Russia, military forces are used to protect nuclear waste and nuclear material in transit.[28] In the case of the Akademik Lomonosov, these forces would likely be responsible for the primary response to nuclear security events; however, when the Akademik Lomonosov is docked at a seaport, it is unclear what role any port security response forces will play in combination with the military forces that may be present with the FNPP.

17. Belyaev, V.M. et al. (2020), "The World's First Floating NPP: Origination and Direction of Future Development", *Atomic Energy*, Vol. 129, No. 1, Springer Link p. 30.
18. *Ibid*.
19. *Ibid*.
20. *Ibid*.
21. *Ibid*., pp. 27-28.
22. *Ibid*.
23. *Ibid*.
24. *Ibid*., p. 29.
25. Bylov, I.A. (2013), "Safety Provisions for the KLT-40S Reactor Plant Floating Power Unit", slideshow presented at the 6th INPRO Dialogue Forum on Global Nuclear Energy Sustainability: Licensing and Safety Issues for Small and Medium-Sized Nuclear Power Reactors slide 11, Vienna, 29 July – 3 August 2013, p. 11; IAEA (2007), *Arrangements for Preparedness for a Nuclear or Radiological* Emergency, IAEA Safety Standard Series, Safety Guide, No. GS-G-2.1, IAEA, Vienna, p. 76.
26. Nikitin, A. and Andreyev, L. (2011), "Floating Nuclear Power Plants", Bellona, https://network.bellona.org/content/uploads/sites/3/Floating-nuclear-power-plants.pdf.
27. *Ibid*., p. 30.
28. *Ibid*., p. 31.

iii. The Offshore Floating Nuclear Plant

In 1982, the US Nuclear Regulatory Commission licensed the Offshore Power System to manufacture eight FNPPs at a facility near Jacksonville, Florida, as an alternative to land-based nuclear power plants.[29] It was anticipated that this FNPP design would be operated approximately 3 miles offshore to provide power to the local areas.[30] More recently, another FNPP concept was developed by the Massachusetts Institute of Technology (MIT) that is referred to as the "Offshore Floating Nuclear Plant" (OFNP).[31] The OFNP is meant to be analogous to an offshore oil rig but utilises nuclear energy to generate power that is supplied to the grid using underwater cables.[32] The concept would initially be built as a platform and then transported within a state's territorial waters (within 12 nautical miles (NM) of a state's coast).[33] MIT claims that the cylindrical design and placement within territorial seas as the "ultimate" heat sink creates intrinsic safety and security benefits against external operational interference such as natural disasters or terrorist attacks.[34] The safety and security measures and systems that were conceptualised by MIT as they relate to response are compared with those of the Akademik Lomonosov and further discussed later in this section.

B. Existing studies on FNPPs

Several studies have recently been conducted on the safety and security of FNPPs. The list of reports discussed in this section is not exhaustive but provides relevant studies that can help frame what is currently known regarding FNPP response mechanisms to nuclear accidents and nuclear security events that occur within the maritime domain.

In 2020, Fialkoff identified significant gaps within the legal frameworks that classify an FNPP. Additionally, the author highlighted that the FNPP classification would influence security requirements and obligations based on how the FNPP is legally defined. The study considers existing international nuclear and maritime frameworks that would be used to classify the FNPP as a facility, a transport, or a vessel and indicates the gaps that FNPPs present in the current nuclear security and maritime security regimes.[35] The FNPP classification presented in the analysis is a crucial first step in determining both safety and security response requirements. Different response authorities, mechanisms, and forces will apply to different FNPP classifications based on existing international frameworks and instruments, such as the CPPNM and its Amendment, the ISPS Code, and the IMDG Code. The article concluded that existing frameworks may be sufficient for the security of FNPPs regardless of classification, but that the adequacy of the frameworks for FNPPs is still in question because of their silence regarding requirements specific to nuclear operations in

29. US NRC, Offshore Power Systems, Docket No. STN 50-437, Floating Nuclear Power Plants 1-8, Manufacturing License No. ML-1, issued 17 Dec. 1982 (ADAMS Accession No. ML20070J215). See also US NRC (1982), Offshore Power Systems, Docket No. STN 50-437, Floating Nuclear Power Plants 1-8, Notice of Issuance of Manufacturing License (ADAMS Accession No. ML20070J219). ADAMS stands for Agencywide Documents Access and Management System, which is the NRC's official system for accessing publicly available documents. The documents referenced 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.
30. US NRC (1978), "Environmental Statement related to the manufacture of Floating Nuclear Power Plants by Offshore Power Systems", Part III, NUREG-0502, p. v (ADAMS Accession No. ML19274D088).
31. Buongiorno, J. et al. (2016), "The Offshore Floating Nuclear Plant Concept", *Nuclear Technology*, Vol. 194, p. 2.
32. *Ibid*.
33. *Ibid*.
34. *Ibid*.
35. Fialkoff, M.R. (2020), "The Floating Chameleon: Floating Nuclear Power Plants and the Nexus of Maritime and Nuclear Security Law", *Journal of Maritime Law and Commerce*, Vol. 51, No. 2, p. 3.

the maritime domain.[36] The following paragraphs provide a brief overview of security considerations that Fialkoff discussed and an explanation of response implications based on the different possible classifications of the FNPP.

Fialkoff begins to untangle the knot created by FNPPs on a broader level for nuclear and maritime security and for subsequent requirements for responding to a nuclear security event. The findings were based on the classification of the FNPP as a facility, as a vessel, or nuclear material in transport. The impact of each of these classifications on response and the associated legal instruments is discussed in more detail in section 3 of this article.

Fialkoff explains the different areas an FNPP would include if classified as a facility, the limited access area, protected area, inner area, and vital area, and how more stringent security measures are applied for each.[37] More specifically, the IAEA defines a vital area as the "[a]rea inside a protected area containing equipment, systems or devices, or nuclear material, the sabotage of which could directly or indirectly lead to high radiological consequences".[38] If an FNPP is classified as a nuclear facility, the vital area would be the most heavily secured; however, what security looks like in existing practice is unclear at this time. For response purposes, the vital area may be one of the first areas where first responders (for safety incidents) and response forces (for security incidents) arrive to mitigate the consequences or identify the source of a nuclear security event or nuclear accident. Additionally, response to a nuclear facility would likely involve multiple nuclear stakeholders within the state where the event and subsequent response occur, such as the regulatory body, local law enforcement or transport ministry.[39]

If an FNPP is classified as a facility, Fialkoff states that maritime security would follow the ISPS Code security designations: security level 1 (lowest security measures) through security level 3 (most stringent security measures).[40] Additionally, response would be incorporated into a port facility security plan developed at the port facility, which would include specific "procedures for responding to security threats or breaches of security".[41] For response to a security event at a maritime facility, the co-ordination may be less complex and involve fewer authorities and response forces because the port authority within a state would have competency over maritime infrastructure, where the FNPP could fall if classified in this manner. Response forces may come directly from the state's port authority in the case where the FNPP falls directly under its jurisdiction. This situation could allow for more readily trained and available forces who are more familiar with protocols at a port during a security event. However, owing to the complexities of an FNPP and its interdependencies with other areas of infrastructure, the security plan at a maritime facility may need additional response procedures to more effectively mitigate the consequences of the nuclear security event or nuclear accident. This type of guidance may not be readily available in the frameworks discussed in section 3 of this article.

If the FNPP is classified as nuclear material in transport (i.e. as cargo), Fialkoff suggests the CPPNM and ACPPNM do not provide sufficient guidance for ensuring nuclear security during transport because of the lack of information within the conventions that speaks to actually developing the physical protection requirements at the national level.[42] This lack of requirements by default extends to ensuring proper response protocols and procedures, which is not present in the CPPNM and ACPPNM. This issue will be further analysed and discussed in section 3 of this article.

36. *Ibid.*, pp. 44-45.
37. *Ibid.*, p. 35.
38. *Ibid.*, p. 36; IAEA (2011), *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)*, IAEA Nuclear Security Series, Recommendations, No. 13, p. 55.
39. IAEA (2019), *Developing a National Framework for Managing the Response to Nuclear Security Events*, IAEA Nuclear Security Series, Implementing Guide, No. 37-G, p. 18.
40. Fialkoff, M.R. (2020), *supra* note 35, p. 37; ISPS Code, *supra* note 11, sections 14.2-14.4.
41. Fialkoff, M.R. (2020), *supra* note 35, p. 38; ISPS Code, *supra* note 11, sections 16.3.1-16.3.5.
42. Fialkoff, M.R. (2020), *supra* note 35, p. 40.

If the FNPP is classified as a vessel, it would follow the ISPS Code, similar to a facility, but with different nuances required for vessel security.[43] Specifically, a vessel security plan would be developed, as opposed to the facility security plan previously mentioned.[44] Similarly, response would be handled by developing "procedures for responding to security threats or breaches of security, including maintaining critical operations of the ship…".[45] To this point, how are critical operations maintained when responding to a security event involving the nuclear reactor on board? Crew members and other personnel on the vessel would need specialised, possibly new, training to carry out their duties during an event to properly maintain these operations. Additionally, a vessel security officer would be responsible for ensuring vessel security.[46] The vessel security officer would need considerable knowledge of response procedures and of how to maintain operation of the vessel during a security event. Also, it would be vital for the vessel security officer to understand each component of an FNPP to uphold their responsibility for ensuring that the security systems and reactor are operating as normal and that there are no indications of sabotage occurring while on duty.

In a separate paper, Fialkoff et al. bring attention to other response challenges associated with FNPPs. Most notably, use of force is identified as a regulatory challenge because of different protocols and other jurisdictional considerations based on the location of the FNPP – whether it is in the original state, in a transit state or at its destination.[47] The possibility of insider sabotage is acknowledged, but the paper notes the difficulty of simulating this circumstance owing to the training, knowledge and qualification of response forces.[48] This lack of understanding of qualifications, roles and responsibilities of response forces could indicate a regulatory gap related to FNPPs within current frameworks or guidance documents.

MIT begins to delineate some of the threats, as well as the competent authorities with response oversight associated with those threats.[49] The two authorities listed are the host state's military and the FNPP's security forces (organised through the FNPP operator). The military forces would have oversight for threats such as military aircraft, military surface vessels and large tankers; the FNPP security forces would respond to threats such as drones, non-military boats or divers with explosives.[50] While two different authorities are introduced by MIT, the Akademik Lomonosov likely uses a single authority (i.e. its military units responsible for guarding the FNPP) to initially respond to any threat posed to the FNPP.[51] These different authorities and response forces are important to note for jurisdictional considerations in developing response mechanisms based on where the FNPP is located and what triggers the nuclear security event. The different roles and responsibilities of all response forces involved in a nuclear security event must be clearly defined to understand relevant mechanisms, such as chain of command, based on the event that is occurring. Additionally, MIT notes the challenge of responding to an incident due to the isolated nature of the FNPP if it is not operating at a port and suggests a stand-off time of 30 minutes.[52] Conversely, the Akademik Lomonosov, operating at a seaport, would have a much shorter stand-off distance, which would likely result in a much quicker response time owing to its proximity to land.

43. *Ibid.*, p. 42.
44. *Ibid.*; ISPS Code, *supra* note 11, section 9.
45. Fialkoff, M.R. (2020), *supra* note 35 p. 42; ISPS Code, *supra* note 11, section 9.4.4.
46. Fialkoff, M.R. (2020), *supra* note 35, p. 42; ISPS Code, *supra* note 11, section 12.
47. Fialkoff, M.R. et al. (2020), "Harmonizing Maritime and Nuclear Security for the Physical Protection of Floating Nuclear Power Plants", conference paper at the INMM 61st Annual Meeting, Baltimore, 12-16 July 2020, p. 5.
48. *Ibid.*, p. 6.
49. Buongiorno, J. et al. (2016), *supra* note 31, p. 9.
50. *Ibid.*
51. Nikitin, A. and Andreyev, L. (2011), *supra* note 26, p. 31.
52. *Ibid.*

One of the emerging challenges for FNPP deployment is the establishment of the EPZ and MSZ. These two zones are critical features of the safety and security interface and may differ in size based on the location of an FNPP and how they are established in different states' national legislation and jurisdiction. The EPZ is the area based on which arrangements and actions are made in the event of a nuclear accident or radiological emergency to minimise dose off site.[53] In the US 33 *Code of Federal Regulations* (CFR) 165.30, the security zone is defined by the United States Coast Guard as:

> an area of land, water, or land and water which is so designated by the Captain of the Port or District Commander for such time as is necessary to prevent damage or injury to any vessel or waterfront facility, to safeguard ports, harbors, territories, or waters of the United States or to secure the observance of the rights and obligations of the United States.[54]

The purpose of the MSZ is further described in 33 CFR 165.30(b) to "safeguard from destruction, loss, or injury from sabotage or other subversive acts, accidents, or other causes of a similar nature: (1) Vessels, (2) Harbors, (3) Ports, and (4) Waterfront facilities".[55]

In practice, MSZs are used for a wide variety of dangerous goods to protect them against acts of sabotage or other acts of terrorism. In the United States, four nuclear power plants utilise security zones that extend various distances around the plant.[56] These distances vary from 250 yards into the waterside area in proximity to the nuclear power plant, to a 2 000 yard radius from a predetermined point near the nuclear power plant.[57] Regardless of the size, the MSZ around an FNPP may have significant impacts on commercial port operations (if an FNPP is deployed there), especially if vessels are not permitted to travel within a certain distance of the FNPP. Establishing an MSZ might be easier to accomplish for an FNPP deployed 12 NM offshore than for an FNPP at a seaport, but this would depend on the FNPP's location and conditions for vessel traffic separation within the area. The impacts of an MSZ on different FNPP deployment scenarios should be further investigated, not only through a technical lens but also from a regulatory perspective, to understand if MSZ sizes for FNPPs can be uniformly defined within a state's legislation and whether such regulatory requirements can be effectively implemented into a state's existing regulatory framework. This approach would allow for more consistent planning for MSZs, as it would not depend on where the FNPP is located.

During the MIT study of its conceptual FNPP, a form of MSZ was proposed and analysed for an FNPP deployed within territorial waters. The study assumed a circular configuration of the FNPP with four zones: the monitored area (8 NM), large ship exclusion area (6 NM), controlled access area (1 NM) and protected area.[58] The monitored area monitors all traffic within its zone, the large ship exclusion area would "trigger prompt intervention by the host nation coast guard or military forces", the controlled access area is monitored with sonar technology and is meant to prevent unauthorised access and the protected area is the most heavily protected area.[59] These areas could be analogous to traditional areas associated with land-based nuclear facilities but expanded in size owing to the nature of an FNPP's environment.

The existing studies presented are a few of the analyses that discuss response-related information for FNPPs. It is especially vital that an MSZ be clearly defined specifically to the FNPP within a state's regulatory framework to establish appropriate protective measures within the zone and to develop appropriate protocols should the zone be breached through unauthorised access. This approach will also help clarify what responsibility an authority bears around the FNPP and what procedures will be followed in a variety of scenarios defined

53. IAEA (2007), *supra* note 25, p. 137.
54. 33 CFR 165.30.
55. *Ibid.*
56. 33 CFR 165.106; 33 CFR 165.115; 33 CFR 165.505; 33 CFR 165.1155.
57. 33 CFR 165.106; 33 CFR 165.1155.
58. Buongiorno, J. et al. (2016), *supra* note 31, p. 10.
59. *Ibid.*, p. 9-10.

by a state. Prior examples in this section demonstrated one possible approach to establishing a security zone within a specific nuclear power plant's waters through various regulations; a uniform approach could be explored to establish a single size of security zone regardless of where an FNPP is located in a state's waters.[60] If MIT's layered concept is accepted, a clear but high-level response procedure is established even at the level of a large ship exclusion area.[61] Whether an FNPP is docked at a seaport or deployed in territorial waters will have tremendous impacts on the layout of the MSZ, which may subsequently shift how ports operate while the FNPP is deployed.

3. Legal and supporting frameworks governing FNPP response

There are various international conventions and IAEA publications that govern and describe response frameworks for nuclear security events. This section looks at these frameworks and recommendations for nuclear security and maritime security to understand existing requirements and guidance and it examines the interplay between the nuclear field and maritime domain to identify possible gaps related to the response to an FNPP. Additionally, nuclear safety and maritime safety instruments are included and analysed because of the safety and security overlap during FNPP operation (regardless of its location or classification) and its subsequent response to an event.

A. Nuclear security

According to the IAEA, a nuclear security event is "[a]n event that has potential or actual implications for nuclear security that must be addressed."[62] This section analyses the international legal frameworks that protect against nuclear security events related to FNPPs, especially theft and sabotage of nuclear material by malicious actors.

i. *Convention on the Physical Protection of Nuclear Material*

The CPPNM is the cornerstone international convention for physically protecting nuclear material during international transport.[63] In the CPPNM, specific response requirements are few in number, with only Article 5 describing a response mechanism for unauthorised removal of nuclear material.[64] More specifically, states are required to designate a "central authority and point of contact having responsibility for physical protection of nuclear material and for co-ordinating recovery and response operations in the event of any unauthorised removal, use or alteration of nuclear material or in the event of credible threat thereof."[65] Article 5 of the CPPNM also describes requirements for states to inform other states, co-ordinate efforts for responding to events involving theft or unauthorised removal of nuclear material, and provide assistance when requested based on national legislation.[66]

If the FNPP is classified as nuclear material transport and is operating within the maritime domain with applicability of the CPPNM, the central point of contact may have shared or overlapping jurisdiction with a state's port or maritime authority in the case of an event. The designated nuclear security contact may have to develop response mechanisms that abide by the port or maritime authority's response requirements, which may differ from the state's nuclear security response requirements and mechanisms to develop an effective response mechanism that meets both nuclear and maritime requirements for an incident involving an FNPP. Additionally, if an FNPP is transiting through a state's jurisdiction, the transit state will be responsible for ensuring physical protection of the

60. 33 CFR 165.106; 33 CFR 165.115; 33 CFR 165.505; 33 CFR 165.1155.
61. Buongiorno, J. et al. (2016), *supra* note 31, p. 10.
62. IAEA (2022), *IAEA Nuclear Safety and Security Glossary,* Interim Edition, IAEA, Vienna, p. 141.
63. CPPNM, *supra* note 11, Art. 2.
64. *Ibid.*, Art. 5.
65. *Ibid.*, Art 5.1.
66. *Ibid.*

nuclear material under Article 3 and Annex I of the CPPNM.[67] Annex I of the CPPNM describes security requirements based on the category of nuclear material being transported.[68] The CPPNM is silent on response requirements for Category II and Category III nuclear material; but Category I nuclear material is "under surveillance by guards who are in close communication with appropriate response forces."[69] This requirement creates several challenges for responding to a security event within the transit state. The states involved during the transport of the FNPP must determine the authority that guard forces have as the FNPP transits through multiple states with varying jurisdictions. Also, depending on how the MSZ is established around the FNPP, the MSZ may not apply in the transit state's jurisdiction, especially if the MSZ was established for the FNPP while it was in the supplier state's jurisdiction (e.g. 33 CFR 165.106, specific to the Seabrook nuclear power plant).[70] Finally, the response capabilities of the transit state may not be adequate to mitigate an event occurring within its territory. This is possible especially if a physical protection system was designed around the supplier state's national threat assessment, as the transit state's threat assessment would be different from the supplier state's.[71] This is one of the shortcomings of the CPPNM: it lists requirements for protecting and responding to nuclear security events, but it does not describe how to ensure that these response measures are adequate for any given scenario or how to appropriately co-ordinate the specific details of the response as an incident evolves.[72] This limitation can introduce multiple entities and jurisdictions that may play a role in response, with different mechanisms governing each state's response to an event involving an FNPP.

ii. *Amendment to the CPPNM*

The ACPPNM further strengthened nuclear security regimes and the physical protection of nuclear material by expanding the scope of the CPPNM from solely the international transport of nuclear material to its domestic use, storage and transport; and it includes requirements for protecting against sabotage.[73] The ACPPNM also adds 12 Fundamental Principles, one of which, Fundamental Principle K, requires states to develop contingency plans that are used "to respond to unauthorized removal of nuclear material or sabotage of nuclear facilities or nuclear material, or attempts thereof … and appropriately exercised by all license holders and authorities concerned."[74] Under the ACPPNM, a nuclear facility is defined as a facility (including associated buildings and equipment) in which nuclear material is produced, processed, used, handled, stored or disposed of, if damage to or interference with such a facility could lead to the release of significant amounts of radiation or radioactive material.[75] Additionally, the ACPPNM modified Article 5 of the CPPNM to consider sabotage and state co-operation (within national legislation) by requiring that:

> in the case of sabotage of nuclear material or a nuclear facility in a State Party and if in its view other States are likely to be radiologically affected, the former, without prejudice to its other obligations under international law, shall take appropriate steps to inform as soon as possible the State or the States which are likely to be radiologically affected and to inform, where appropriate, the International Atomic Energy Agency and other relevant international organizations, with a view to minimizing or mitigating the radiological consequences thereof.[76]

67. *Ibid.*, Art. 3.
68. *Ibid.*, Annex I (2).
69. *Ibid.*, Annex I (2).
70. 33 CFR 165.106.
71. IAEA (2015), *Security of Nuclear Material in Transport,* Nuclear Security Series, Implementing Guide, No. 26-G, p. 17, section 3.43.
72. CPPNM, *supra* note 11, Annex I (2).
73. ACPPNM, *supra* note 11, Art. 2.1.
74. *Ibid.*, Art. 3.
75. *Ibid.*, Art. 1(d).
76. *Ibid.*, Art. 5.

Within the ACPPNM, sabotage is defined as "any deliberate act directed against a nuclear facility or nuclear material in use, storage or transport which could directly or indirectly endanger the health and safety of personnel, the public or the environment by exposure to radiation or release of radioactive substances."[77] The ACPPNM also added several offences involving use, storage and transport of nuclear material to be punishable within states' national laws.[78] These offences include theft of nuclear material, malicious acts directed towards nuclear facilities with the intention of causing harm or death to a person or environmental damage due to release of radiological material, and threats to use nuclear material to cause harm or death to a person or radiological release.[79] Finally, Article 8 of the ACPPNM requires states parties to establish jurisdiction over the aforementioned offences when the events occur within the state or the person committing the offence is a national of the state.[80]

In the absence of a formal convention focused solely on notification and response to a nuclear security event (analogous to nuclear safety conventions described later in this section), the ACPPNM aims to create response mechanisms among states during events involving theft or sabotage of nuclear material.[81] One of the challenges with the deployment of FNPPs may come with extraterritoriality, "the application of a measure triggered by something other than a territorial connection with the regulating state."[82] In this sense, the supplier state would have full governance and ownership of the FNPP in the host state. If the supplier state has the responsibility of physical protection (including response) of the FNPP in this case, the current requirements in the ACPPNM do not explicitly address what response may look like. Further, it is unclear whether the host state's or supplier state's laws and response frameworks would apply. An FNPP might have guards from the supplier state, but the validity of the MSZ and the response mechanism might nonetheless be unclear because of the lack of international requirements, guidance or best practices for the guards' response to an event within an MSZ of an FNPP in another state's territory. If the supplier state exerts extraterritoriality over the FNPP and an event occurs, but the FNPP has not made response agreements with the host state, how can an effective response be ensured, especially as the secondary response from the supplier state could be thousands of kilometres away?

While the ACPPNM requires a contingency plan for use, storage or transport of nuclear material, it does not lay out the requirements such a plan should include for responding to a nuclear security event.[83] Similar to the CPPNM, the ACPPNM has no legal mechanism to ensure the quality and sufficiency of the implementation of the convention, such as the content included within a state's contingency plan. In the end, the development of these plans is dependent on non-binding instruments such as the IAEA's Nuclear Security Series (NSS) No. 13, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities*, NSS No. 26-G, *Security of Nuclear Material in Transport*, NSS No. 27-G, *Physical Protection of Nuclear Material and Nuclear Facilities*, NSS No. 37-G, *Developing a National Framework for Managing the Response to Nuclear Security Events*, and NSS No. 39-T, *Developing a Nuclear Security Contingency Plan for Nuclear Facilities*. All of these instruments aim to implement the provisions within the CPPNM.[84]

Each of the publications provides some level of guidance for contingency plan content, but unless the elements are international legal requirements, the different mechanisms and protocols in practice could vary widely state by state. In cases of FNPPs involving a supplier state and a host state, the lack of harmonisation of contingency plans between

77. *Ibid.*, Art. 1(e).
78. *Ibid.*, Art. 7.
79. *Ibid.*
80. *Ibid.*, Art. 8.
81. *Ibid.*, Art. 5.
82. Scott, J. (2014), *supra* note 10, p. 90.
83. ACPPNM, *supra* note 11, Art. 3.
84. IAEA (2018), *Physical Protection of Nuclear Material and Nuclear Facilities (Implementation of INFCIRC/225/Revision 5)*, Nuclear Security Series, Implementing Guide, No. 27-G, IAEA, Vienna; IAEA (2019), *supra* note 39.

the two states may pose challenges for implementing response mechanisms to nuclear security events, depending on which regulatory framework is implemented during the FNPP's deployment. The IAEA publications cited are also silent on response to nuclear security events in the maritime domain; they depend instead on various International Maritime Organization (IMO) instruments discussed later in this section.[85] The content and implementation of contingency plans will largely depend on how an FNPP is classified, but with no explicit requirements within the international frameworks, these requirements and associated mechanisms would vary from state to state.

Although not legally binding, NSS No. 37-G provides guidance on response frameworks for nuclear security events.[86] The guidance does not speak to events within the maritime domain; however, it provides a general overview for what a national framework should include for states' emergency management.[87] NSS 37-G recommends incorporating response to a nuclear security event into a state's overall emergency management system but acknowledges that there may be interagency overlap.[88] Having all response resources in one place may make it convenient to find state requirements or guidance during an event, but conflicting responsibilities and overlapping resources may cause confusion and inefficiency during a nuclear safety or nuclear security event. The two types of events are separately defined by the IAEA; and the separation could allow states to mount a more fluid response during a safety or security event, with roles and responsibilities more clearly defined for the response forces deployed.[89] NSS 37-G also discusses the challenges for response forces lacking appropriate training or equipment for incidents involving nuclear material.[90] Not only may this be the case for traditional nuclear safety or nuclear security events, but also the forces responding to an event may lack adequate training to handle a situation occurring at a port or in a state's territorial waters and may conflict with maritime response forces.

iii. International Convention for the Suppression of Acts of Nuclear Terrorism

For security, response includes "nuclear forensics and related actions in the context of investigation into the circumstances surrounding a nuclear security event".[91] As a result, consideration should be given to measures taken to establish relevant jurisdictions and investigate offences that eventually lead to prosecution actions.

Through Article 8 of the ACPPNM, states are required to establish jurisdiction over various offences laid out in the convention through different measures as appropriate within their laws. The malicious acts discussed in this section may be triggering events for the response co-ordination described in Article 5 of the ACPPNM. The following paragraphs discuss the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT) and how it relates to response to nuclear security events for FNPPs.

Once the response is successful and the security event is resolved, the acts that were committed must be investigated and punished based on their severity according to the national laws of the state that has jurisdiction. ICSANT entered into force in 2007 and lays out offences involving possession of radioactive material with the intent to cause damage to property or the environment and/or bodily harm, use of radioactive material with the same malicious intentions, threatening to use radioactive material (which includes nuclear material) with malicious intent, or unlawfully demanding radioactive material by threat or use of force.[92] Not only are committed acts punishable, but attempts at any of those acts or threats are considered offences as stated in Article 2 of ICSANT.[93] Article 5 of ICSANT

85. IAEA (2015), *supra* note 71, section 6.90.
86. IAEA (2019), *supra* note 39, section 1.3.
87. *Ibid.*
88. *Ibid.*, section 1.4.
89. IAEA (2022), *supra* note 62, pp. 10 and 141.
90. IAEA (2019), *supra* note 39, section 1.4.
91. IAEA (2022), *supra* note 62, p. 182.
92. International Convention for the Suppression of Acts of Nuclear Terrorism (2005), 2445 UNTS 137, entered into force 7 July 2007 (ICSANT), Art. 2; *Ibid.*, Art. 1.1.
93. *Ibid.*, Art. 2.

also requires states parties to adopt the above intentions as punishable under national law.[94] The level of punishment for those acts described in ICSANT will depend upon states' judicial systems and subsequent criminal codes. Measures for the detection, delay, response and investigation of the acts described in Article 2 of ICSANT are also required by Article 7 of this Convention.[95] This requirement in Article 7 helps to bridge response to criminal prosecution by providing a link at the convention level between security response and penalising the criminal acts listed within ICSANT.

One key aspect of ICSANT as it relates to the relationship between the host state and supplier state for FNPPs is Article 9, which pertains to the jurisdiction that states parties establish over the offences within Article 2 of ICSANT.[96] When a supplier state agrees to lease an FNPP to a host state, ownership of the FNPP may create some conflict over the criminal jurisdiction during a nuclear security event. In many cases, the event (and therefore offences under Article 2 of ICSANT) might occur in a transit state or host state that received the FNPP from the supplier state (especially when the reactor is operating rather than being transported). If there is a contractual agreement for the host state to assume full jurisdiction over the FNPP until the moment it begins transit back to the supplier state, ICSANT and relevant punishments within the host state's legislation may apply. The subsequent criminal proceedings based on the established jurisdictions over the FNPP would need to be carefully considered when punishing such acts under ICSANT.

If extraterritoriality is established for an FNPP deployment, it is unclear how ICSANT would apply. A nuclear security event with intent of harm occurring at an FNPP in a host state would trigger Article 2 of ICSANT. This act would be punishable by law per Article 5, but which law? The supplier state would have full jurisdiction over the FNPP, but the act would have been committed within a separate host state's territory. Such a situation might fall within the supplier state's criminal law, but the conditions of extraterritoriality would need to be closely analysed because the supplier state's territory would be within a host state's territory.

B. Nuclear safety

Although the focus of this article is response to an event from a security perspective, obligations related to emergency response must also be considered because of the safety and security interface that is ever present during the operation of any nuclear reactor. The following subsections provide a brief overview of states' safety obligations related to response to a nuclear accident or radiological emergency.

i. Convention on Nuclear Safety

The application of the Convention on Nuclear Safety to FNPPs is questionable, is likely inapplicable at this time, and presents a significant legal gap because a nuclear installation is defined as "any land based civilian nuclear power plant under its jurisdiction" within the convention.[97] The term "land based" is likely to raise questions regarding the applicability of safety requirements (and subsequent emergency response requirements) within the CNS to the development of FNPPs.

The "land based" nuance within the CNS scope probably makes it inapplicable to FNPPs as the CNS currently reads. However, although states would not be legally obligated to implement it, the CNS has several provisions that states may consider adopting within their safety regimes that provide for response to an emergency at a nuclear installation.[98] Article 16 provides requirements for emergency plans, including information sharing

94. *Ibid.*, Art. 5.
95. *Ibid.*, Art. 7(b).
96. *Ibid.*, Art. 9.
97. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996 (CNS), Art. 2(i).
98. *Ibid.*, Art. 16(1).

among neighbouring states during a radiological emergency.[99] Something to note in these plans is the safety and security interface alongside the contingency plans required by the ACPPNM.[100] The response mechanisms for both safety and security could overlap in certain cases (i.e. sabotage with radiological release); and all roles, responsibilities and objectives would need to be clearly defined within each to prevent any confusion among responding parties. Close co-ordination would also be needed among the state's competent authorities for nuclear security, emergency preparedness, response and management, and the state's maritime authorities involved with port operations. These details would need to be included within the state's emergency plan for a radiological emergency.

ii. Convention on Early Notification of a Nuclear Accident

In September 1986, the Convention on Early Notification of a Nuclear Accident (Early Notification Convention) brought together states to agree upon prompt and efficient notification and communication between the IAEA and affected states during a nuclear accident.[101] The IAEA defines a nuclear accident as "[a]ny accident involving facilities or activities from which a release of radioactive material occurs or is likely to occur and which has resulted or may result in an international significant transboundary release that could be of radiological safety significance for another State."[102] The broad scope of the Early Notification Convention allows for its applicability to FNPP response through Article 1, which states the convention applies to "any nuclear reactor wherever located" in addition to "any nuclear fuel cycle facility" and "the transport and storage of nuclear fuels and radioactive wastes".[103] Article 1 also explicitly states that the Convention applies to the above activities "from which a release of radioactive material occurs or is likely to occur" and may subsequently result in a transboundary release.[104].

A nuclear accident may occur from a loss of coolant or some other failed or deficient safety measure that triggers the accident, without any involvement of a malicious actor.[105] From a security perspective, though, sabotage of a reactor could result in the release of radiological material as well, triggering response mechanisms required by the ACPPNM and now the Early Notification Convention. However, the safety and security interface of a sabotage event with radiological release incorporates two separately defined incidents, each having different associated communications and response mechanisms.[106] States that are parties to both the ACPPNM and the Early Notification Convention must effectively communicate both safety and security response to states that may be impacted. But does response to a sabotage event with radiological release overlap with a response to a nuclear accident, or vice versa? Is there an inflection point at which sabotage transitions to accident response and safety considerations take over? For an FNPP, especially during transit, because of the possible transboundary impacts on other states during an act of sabotage or nuclear accident, these mechanisms must be clearly developed. They must consider how an effective response would look in this case and who the competent authorities would be in terms of a chain of command and associated responsibilities. In current international nuclear law frameworks, these response mechanisms would vary from state to state based on appropriate competent authorities, international obligations (based on signatory status to the Early Notification Convention and other conventions) and relevant national law related to emergency preparedness and response.

99. *Ibid.*
100. ACPPNM, *supra* note 11, Art. 3.
101. 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), Preamble; *Ibid.,* Art. 1.
102. IAEA (2022), *supra* note 62, p. 10.
103. Early Notification Convention, *supra* note 101, Art. 1.
104. *Ibid.*
105. IAEA (2022), *supra* note 62, p. 169.
106. *Ibid.,* pp. 12 and 23.

iii. 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) was also adopted in September 1986 as a way to create a mechanism among states to co-operate with and assist one another in the case of a nuclear accident or radiological emergency.[107] Coupled with the Early Notification Convention, this formal assistance agreement aims to create a framework for states' notification and assistance to responses during a nuclear accident or radiological emergency. Article 2 of the Assistance Convention describes the assistance states parties may request from other states, including an agreeable scope of assistance, relevant information, and/or assistance facilitated through the IAEA, which includes available experts, equipment or other assistance methods.[108] This Article also explicitly states that the nuclear accident or radiological emergency does not need to occur within the territory of the requesting state.[109] Additionally, Article 3 of the Assistance Convention states that the "overall direction, control, co-ordination, and supervision of the assistance shall be the responsibility within its territory of the requesting State."[110]

For FNPP deployment, the Assistance Convention will apply in a similar manner as the Early Notification Convention because of its applicability during nuclear accidents and radiological emergencies. Regardless of where an event involving a radiological release originating from an FNPP occurs, states may request assistance during an event.[111] This approach would help alleviate any confusion about whether the host state or supplier state can or should request assistance during an emergency, as Article 3 allows for any state to request assistance and facilitate appropriate co-ordination of the assistance within its limitations as stated within Article 3. In the case of extraterritorial deployment, the Assistance Convention could be triggered by a host state even if it has no jurisdictional control over an FNPP; however, the extent of this assistance may be limited, depending on whether the supplier state allows for external assistance and access to the nuclear reactor under its control. Assistance may instead be accomplished through prior arrangements between the supplier state and host state. However, ultimately, the level of assistance from the host state may depend on the supplier state's jurisdictional control of the FNPP, even if the accident occurs within the host state's territorial boundaries. Extraterritoriality may not permit the host state to exercise jurisdiction over a supplier state's FNPP within the host state's territory, so assistance mechanisms must be clearly laid out should an FNPP be deployed in such a scenario.

The provisions in the Assistance Convention are also a continuation of the safety/security response analogy previously introduced for security in Article 5 of the ACPPNM, which states may co-ordinate assistance with one another in the event of, or threat of, sabotage.[112] While both the Assistance Convention and the ACPPNM provide high-level mechanisms for states to assist with responding to radiological emergencies and sabotage, some legal challenges may arise during the actual response. First, some states may not be parties to both the Assistance Convention and the ACPPNM. That situation may create challenges in harmonisation with international requirements for co-ordinating assistance in case of a radiological emergency or sabotage event, because some states may not have the requirements found in the Assistance Convention and the ACPPNM in their national laws and regulations. There may be intergovernmental agreements in place between states that are not parties to the conventions. However, if there are no requirements for co-ordinating assistance, an FNPP deployed by a supplier state within a host state may not have the response mechanisms listed within the Assistance Convention and the ACPPNM within either state's national law to appropriately respond to an event with radiological release.

107. Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1986), IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987 (Assistance Convention), Art. 1.
108. *Ibid.*, Art. 2.1-2.4.
109. *Ibid.*
110. *Ibid.*, Art. 3.
111. *Ibid.*, Art. 2.1.
112. ACPPNM, *supra* note 11, Art. 5.

C. *Maritime security*

This section provides an overview of international maritime security frameworks and their roles in responding to a nuclear security event. The interfaces with the nuclear security frameworks previously discussed are also introduced in this section.

i. International Shipping and Port Facilities Code

In 1974, the International Convention for the Safety of Life at Sea (SOLAS) was ratified under the IMO to develop a set of uniform principles for ships under contracting governments.[113] The SOLAS Convention also includes a definition of a nuclear ship as "a ship provided with a nuclear power plant", which may apply to FNPPs if classified as a vessel.[114] In this case, if the design and classification of the FNPP is determined to be that of a ship, it would fall directly in line with the definition of a nuclear ship under the SOLAS Convention and would be governed through the requirements within SOLAS and other maritime instruments. An amendment to the SOLAS Convention, the ISPS Code, was created as an international framework to define security requirements for "security incidents affecting ships and port facilities used in international trade". It includes three security levels, "security level 1" through "security level 3", with "security level 3" implementing the most protective security measures.[115] However, one shortcoming of the ISPS Code for FNPPs is that it does not speak to required security measures specific to dangerous goods.[116] With nuclear material as fresh or irradiated at any given time on the FNPP, the ISPS Code does not specify response requirements in the case of a security event involving the theft or sabotage of such material.[117]

The ISPS Code is divided into two parts: Part A, which provides mandatory requirements for contracting governments, and Part B, which is guidance for implementing the ISPS Code requirements in Part A.[118] Although it is used as a basis for the maritime security of FNPPs in previous studies, the applicability of the ISPS Code to FNPPs is unlikely at this time. The scope of Part A is listed in section 3.1.1 and section 3.1.2 of the Code, which state that it "applies to the following types of ships engaged on international voyages: passenger ships ... cargo ships ... and mobile offshore drilling units" and "port facilities serving such ships engaged on international voyages", respectively.[119] The specific scope of section 3.1.1 does not include nuclear ships as defined in the SOLAS Convention, thus rendering the section inapplicable to FNPPs. Section 3.2 of the ISPS Code allows contracting governments to determine the applicability of the ISPS Code "to those port facilities within their territory which, although used primarily by ships not engaged on international voyages, are required, occasionally, to serve ships arriving or departing on an international voyage."[120] The argument could be made that the ISPS Code would apply if an FNPP made international voyages from supplier state to host state and used the appropriate port facilities. However, there is no international classification of an FNPP at the time of this article; and until it is defined, the classification and implementation will largely depend on the state that has jurisdiction over the FNPP, whether this is the host state or supplier state. Deployment of more FNPPs (in addition to the Akademik Lomonosov) before FNPPs are formally classified at the international level would create significant inconsistencies in how FNPPs are protected, especially if they are treated solely as nuclear facilities with few to no maritime security requirements.

The response provisions within Part A of the ISPS Code are largely laid out in section 9 of the Code, about the requirements for ship security plans, and section 16, about the

113. International Convention for the Safety of Life at Sea (1974), 1184 UNTS 2, entered into force 25 May 1980 (SOLAS), Preamble; *Ibid.,* Art. 2.
114. *Ibid.,* Annex Chapter II Regulation 2(j).
115. ISPS Code, *supra* note 11, Part A, section 1.2.1; *Ibid.,* section 7.4.
116. *Ibid.*, Part A.
117. *Ibid.*
118. *Ibid.*
119. *Ibid.,* Part A, sections 3.1.1-3.1.2.
120. *Ibid.*

requirements for port facility security plans.[121] The ship security plan requirements listed in sections 9.4.4, 9.4.5 and 9.4.10 include, respectively, "procedures for responding to security threats or breaches of security, including provisions for maintaining critical operations of the ship or ship/port interface", "procedures for responding to any security instructions Contracting Governments may give at security level 3" and "procedures for interfacing with port facility security activities".[122] Separately, the port facility security plan response requirements within sections 16.3.3, 16.3.4 and 16.3.7 are equivalent to the ship security plan requirements in sections 9.4.4, 9.4.5 and 9.4.10, respectively; but they are applicable to port facilities rather than to ships.[123] Section 16.3.14 provides an extra requirement for the port facility security plan to address "procedures for responding in case the ship security alert system of a ship at the port facility has been activated."[124]

Although Contracting Parties are not legally required to follow Part B of the ISPS Code, they may find it useful as a starting point for implementing maritime security response of FNPPs because of the broad scope defined in section 3.2 of Part B. Section 3.2 of Part B states "it should be recognized that the extent to which the guidance on ships applies will depend on the type of ship, its cargoes and/or passengers, its trading pattern, and the characteristics of the port facilities visited by the ship."[125] The scope in section 3.2 of Part B would give states more flexibility for implementing the provisions found in Part B compared with the more limited scope of Part A of the ISPS Code.

Part B provides more specific response guidance (compared with Part A) for the ship security plan at security level 2 that recommends "establishing a restricted area on the shore side of the ship" in section 9.16.4 and "granting access only to those responding to the security incident or threat thereof" in section 9.17.2 at security level 3.[126] The restricted area recommended in section 9.16.4 could be considered as a partial MSZ for the FNPP for the shore side of the FNPP, depending on how it is implemented in a state. Such a partial MSZ could be similar to that seen in 33 CFR 165.106, which specifies a zone extending a set distance on one side of the nuclear power plant. Especially for an FNPP docked at a seaport, this area may be a starting point for the development of the MSZ within international guidance for maritime security. Section 9.18.3 also recommends that the ship security plan designate certain restricted areas on the ship.[127] It would be vital to share these areas listed in the ship security plan with response forces because, for the FNPP, they would likely include areas such as the reactor room or material storage locations. Section 13.1.9 recommends that the company security officer and ship security officer be trained in "emergency preparedness and response and contingency planning" and "security drills and exercises" under section 13.1.19.[128] Given the nature of an FNPP and the interface between nuclear and maritime law, the training within the ISPS Code, although not required under Part B, would need to be closely aligned with any nuclear safety and security response training requirements established by a state's competent authority for nuclear safety and nuclear security. Additionally, the drills and exercises expressed in section 13.1.19 are expanded in section 13.7.3 to include "search and rescue or emergency response exercises".[129] Again, these drills would be in co-ordination with the state's competent authority for nuclear safety and nuclear security because they would involve an operating nuclear reactor existing within the maritime domain.

For port facilities, Part B provides some guidance for response, including increased patrol use for security level 2 and security level 3.[130] One key recommendation within the ISPS Code Part B is in section 16.25.1, which recommends a restricted area of the port

121. *Ibid.*, Part A, section 9; *Ibid.*, Part A, section 16.
122. *Ibid.*, Part A, section 9.4.4-9.4.5; *Ibid.*, Part A, section 9.4.10.
123. *Ibid.*, Part A, section 16.3.3-16.3.4; *Ibid.*, Part A, section 16.3.7.
124. *Ibid.*, Part A, section 16.3.14.
125. *Ibid.*, Part B, section 3.2.
126. *Ibid.*, Part B, section 9.16.4; *Ibid.*, Part B, section 9.17.2.
127. *Ibid.*, Part B, section 9.18.3.
128. *Ibid.*, Part B, section 13.1.9; *Ibid.*, Part B, section 13.1.19.
129. *Ibid.*, Part B, section 13.7.3.
130. *Ibid.*, Part B, section 16.19.6; *Ibid.*, Part B, section 16.20.4.

facility to include "shore- and water-side areas immediately adjacent to the ship".[131] The language of the guidance may allude to some form of an MSZ; however, because it is within Part B of the ISPS Code and specific distances are not included, it could further increase international inconsistencies in how states implement this guidance for FNPPs. Additionally, the protocols for response within these designated restricted areas are not specified and would vary from state to state. If supplier states apply some or full jurisdiction over response to incidents involving the FNPP, this jurisdiction could create legal conflicts with how far these restricted areas extend and what authority the supplier state may have over the restricted areas, because Part B of the ISPS Code is guidance rather than requirements for ships and port facilities.

ii. *International Maritime Dangerous Goods Code*

Chapter VII of the SOLAS Convention provides requirements for states during the carriage of dangerous goods.[132] The IMDG Code extends the requirements in the SOLAS Convention and applies them to "all ships, irrespective of type and size, carrying substances, materials, or articles identified in this Code…".[133] Chapter 1.4 of the IMDG Code describes requirements for response training and for security plans to include "response to higher threat conditions".[134] However, in general, the IMDG Code refers to the ISPS Code for general security (as discussed previously in this section) and the CPPNM and NSS No. 13 for radioactive material.[135]

Although the IMDG Code's primary focus is on safety and packaging of dangerous goods, it does contain some relevant security provisions for response to security threats; however, the security provisions within the IMDG Code are generic and do not speak specifically to security response to any class of material, including Class 7.[136] Although states can meet the security requirements by applying the CPPNM and NSS No. 13, the maritime element of FNPP deployment applies a complexity that the CPPNM and NSS No. 13 do not explicitly address. This complexity presents a significant challenge within the law because different entities have different competencies and requirements based on their respective oversight. For FNPPs, establishing competencies for different stakeholders responsible for the security of FNPPs is critical to understanding state response mechanisms during a security event, especially for chain of command and general responsibility for decisions related to response. The IMDG Code is silent on this point, but it does contain some provisions for responding to nuclear and radiological emergencies. However, these requirements are only that response arrangements should be made and may be interpreted and implemented differently based on the structures of state governments and authorities.[137] Additionally, the IMDG Code mostly defers to IAEA guidance such as *Preparedness and Response for a Nuclear or Radiological Emergency* and other IAEA Safety Standards Series publications for emergency response arrangements, which are not legally binding.[138]

131. *Ibid.*, Part B, section 16.25.1.
132. SOLAS, *supra* note 113, Preamble; *Ibid.*, Chapter VII.
133. IMDG Code, *supra* note 11, Vol. 1, Art. 1.1.1.3.
134. *Ibid.*, Vol. 1, Art. 1.4.2.3.2; *Ibid.*, Vol. 1, Art. 1.4.3.2.2.2.4.
135. *Ibid.*, Vol. 1, Art. 1.4.3.2.3.
136. *Ibid.*, Vol. 1, Chapter 1.5.
137. *Ibid.*, Vol. 1, Art. 7.8.4.3.
138. *Ibid.*, Vol. 1, Art. 7.8.4.5.

4. Discussion of scenario involving an act of sabotage with radiological release

With the international requirements for response to a nuclear accident and/or nuclear security event identified and discussed, the next step of this analysis is to present a practical scenario using predefined parameters to understand which international instruments would be triggered, and the interplay between the international instruments and the state response based on the scenario. The parameters for this scenario are as follows:

- The supplier state provides an FNPP to the host state, which has full regulatory control over the FNPP through an independent, fully functional competent authority capable of carrying out its basic regulatory functions such as inspections and enforcement.
- The FNPP is docked at a seaport and is therefore within the host state's territorial waters.[139]
- The host state is a party to all Conventions and Codes listed in section 3 of this article.
- Through the definition of "nuclear facility" under the ACPPNM and the applicability of the Early Notification Convention and the Assistance Convention for "any nuclear reactor wherever located" and "any nuclear fuel cycle facility", the FNPP is classified as a nuclear facility. Thus, it falls under the oversight of the host state's competent authority for nuclear safety and nuclear security with respective response forces designated for nuclear accidents and radiological emergencies.[140]
- The FNPP has begun fully operating and is connected to the grid through the necessary shoreside infrastructure.
- The EPZ for this FNPP has been established, similar to that of the Akademik Lomonosov, at 1 km with an equivalent MSZ distance for its waterside area.[141]
- During its operation, an adversary commits an act of sabotage on the FNPP, resulting in a radiological release.

During a scenario such as that described, the ACPPNM, the Early Notification Convention and the Assistance Convention would be triggered immediately. However, since there is no precedent for the order in which the provisions are triggered, it would fall on the host state to determine how designated response forces are sent to the event site. The specific agencies would vary from state to state, but these response forces may include law enforcement agencies, a state's coast guard, fire and medical response, and other organisations involved with emergency response. Different response forces would have different roles and responsibilities depending on whether they respond to a nuclear accident, radiological emergency or a nuclear security event.[142] Additionally, because the FNPP is considered a nuclear facility at a seaport, the provisions within Part A of the ISPS Code would not apply because of the scope of Part A.[143] The state operating the FNPP may still include guidance provisions within Part B of the ISPS Code within its framework, because Part B allows for a state to determine whether or not these provisions will be applicable to a given port facility.[144]

139. United Nations Convention on the Law of the Sea (1982), 1833 UNTS 397, entered into force 16 Nov. 1994 (UNCLOS), section 2, Art. 3.
140. ACPPNM, *supra* note 11, Art. 1(e); Early Notification Convention, *supra* note 101, Art. 1.2(a); *Ibid.*, Art. 1.2(b).
141. Bylov, I.A. (2013), *supra* note 25; IAEA (2007), *supra* note 25.
142. IAEA (2019), *supra* note 39, section 1.4.
143. ISPS Code, *supra* note 11, Part A.
144. *Ibid.*, Part B, section 3.2-3.3.

The response mechanisms in Article 5 of the ACPPNM would trigger when a malicious actor commits an act of sabotage with radioactive release.[145] Initially, a state may invoke its contingency plan according to the requirements within Fundamental Principle K of the ACPPNM.[146] The contingency plan may include measures to incorporate Article 5 of the ACPPNM, such as the manner in which information is initially communicated and to whom it is communicated (i.e. the IAEA and any surrounding states that may be impacted by the radiological release).[147] Although not explicitly required within the ACPPNM, states may have agreements in place for assisting in certain security situations, in addition to assisting with mitigating radiological consequences; however, this assistance is not defined within the existing international nuclear security frameworks and may vary from state to state.

With radiological release, the Early Notification Convention would be activated through the host (or other) state contacting the proper authorities at the IAEA and/or other states to notify them of the release.[148] Even if this scenario occurred under extraterritorial conditions, Article 3 of the Early Notification Convention allows for other states also to notify the IAEA of a radiological emergency that is occurring.[149] Under the Early Notification Convention, the IAEA would then be obligated to share relevant information about the release to other states that may be impacted to help mitigate the consequences of such a radiological release.[150] During such an event, there may be limitations on what information can be shared with states by the IAEA, especially if the information may be sensitive to the state.

The Assistance Convention would also trigger assistance with the radiological release upon request by the host state or other state.[151] As in the Early Notification Convention, the requesting state does not have to be the host state; if that is the case, some impacts of extraterritoriality that the supplier state may impose in deploying the FNPP may be offset. However, the limitations of the assistance may include access to the FNPP or other physical forms of assistance, depending on whether the supplier state chooses to accept the assistance.[152] Although the Assistance Convention describes co-ordination and facilitation of assistance provided by the IAEA or other states, it does not detail what form this process would take, and the extent of the assistance would be left up to the states.[153] This process may depend upon how states implement IAEA or other guidance for emergency response into their national frameworks. The amount of assistance that can be provided by states may also be driven by these frameworks, as the states would have to provide assistance within the boundaries of their national laws and regulations.

During an act of sabotage resulting in a radiological release, national safety and security response mechanisms will be triggered to respond to the incident to mitigate the safety and security consequences. At the national level, these mechanisms may be within a single emergency response plan; but they must be clearly separated to avoid any confusion of roles and responsibilities during an event such as the one described.[154] Also, response mechanisms for overlap in a nuclear security event with radiological release would need to be carefully defined within the state's contingency and emergency plans to clarify the roles and responsibilities of all response forces involved. Additionally, the maritime instruments do not specifically speak to response to nuclear security events in the maritime domain because of the extent of their scope.[155]

Because of the lack of international requirements, the EPZ and MSZ zones would be determined and established by the state. Since the FNPP in this scenario is classified as a

145. ACPPNM, *supra* note 11, Art. 2.
146. *Ibid.*, Art. 3.
147. *Ibid.*, Art. 5.
148. Early Notification Convention, *supra* note 101, Art. 2.
149. *Ibid.*, Art. 3.
150. *Ibid.*, Art 4.
151. Assistance Convention, *supra* note 107, Art. 2.1.
152. *Ibid.*
153. *Ibid.*
154. IAEA (2019), *supra* note 39, section 1.4.
155. ISPS Code, *supra* note 11, Part A; IMDG Code, *supra* note 11, Vol. 1.

nuclear facility, the competent authority for nuclear safety and nuclear security (competent authority) would need oversight of the space designated for the EPZ and MSZ. Because of the maritime characteristic presented by the FNPP in this case, the competent authority may not have immediate jurisdiction to establish zones that extend beyond the boundaries of the FNPP; rather, this authority may fall under the state's coast guard. Without this authority, the competent authority may need to arrange a memorandum of understanding, or a similar understanding, with a state's coast guard to effectively establish the EPZ and MSZ while the FNPP is operating. Whereas the EPZ may be determined by reactor design, geographic location and nearby population, the MSZ may be impacted by different parameters when an FNPP is deployed, such as port traffic, threat or other security risks assessed by the state.[156] In this scenario, the host state would implement protocols and security response procedures, such as chain of command, use of force and other measures in the MSZ within its national laws and regulations.

Overall, the notable response challenges within international frameworks during an act of sabotage with radiological release stem from the lack of specificity for maritime requirements within international nuclear frameworks and the lack of specific nuclear requirements within existing international maritime frameworks. Even if response provisions within the ISPS Code or IMDG Code are in place within a state, if the FNPP is classified as a nuclear facility as described above, these provisions may not be legally applicable in response mechanisms that would unfold in the case of an incident. Additionally, the oversight of the competent authority may be different from that provided by a port authority, and so the various personnel trained for nuclear safety and nuclear security response may not be trained to respond to an incident within the maritime domain involving an operating nuclear reactor.[157] States may have agreements among authorities to allow for maritime forces to respond to a nuclear safety or security event involving an FNPP at a port, rather than traditional response forces for land-based nuclear safety or security events. Without international legal requirements established by the IAEA or IMO for responding to operating nuclear reactors at a port, the form of these mechanisms at the state level will vary based on different competencies, jurisdictions or other factors for authorities involved in the deployment of an FNPP at a seaport.

5. Conclusion

The lack of international requirements and guidance for FNPP deployment indicates that at this time, response mechanisms will largely be determined by the state. Although state determination of response mechanisms is a vital step towards effective deployment of FNPPs and subsequent response preparations, the lack of international legal instruments may prevent harmonisation of response mechanisms among states that supply and operate FNPPs. For supplier states and host states where the host state does not have full jurisdiction or has some form of shared jurisdiction over the FNPP, this may conflate response mechanisms that are developed by either state. Should this be the case, response to a safety or security event may not be carried out as efficiently as needed and create further complications as the event progresses.

The lack of nuclear safety or nuclear security guidance within the international maritime instruments may be a starting point for closing the response gaps and facilitating future harmonisation efforts. Pursuing solutions to the lack of guidance early on will maximise response training for associated personnel. It will also enable states to begin untangling the competencies and oversight of different authorities involved in both FNPP operation and response to safety and security events related to these emerging reactors operating in the maritime domain.

156. US Nuclear Regulatory Commission (2020), "Emergency Planning Zones", www.nrc.gov/about-nrc/emerg-preparedness/about-emerg-preparedness/planning-zones.html (accessed 10 July 2023).
157. IAEA (2019), *supra* note 39, section 1.4.

It is possible that legal mechanisms will be established to allow an FNPP to be considered an extension to a land-based maritime facility while being classified as a civilian nuclear power plant. A highly detailed analysis would be needed to clarify this process for the deployment of FNPPs. If analysed and determined from a legal perspective, such a designation might strengthen nuclear and maritime safety and security measures. Depending on what sort of determination was made, it could provide a mechanism for applying international instruments such as the ISPS Code and CNS. This area should be further explored, as it would aid in the classification of FNPPs at the international level, and the results of the FNPP classification could strengthen state response requirements.

Another area that should be further investigated for FNPP response is environmental law and its interplay with nuclear and maritime law. For response, legal mechanisms within environmental law might overlap or conflict with mechanisms for nuclear safety and security presented in this article. Additionally, environmental law may play a role in determining where an FNPP can be sited, which may impact response mechanisms through different geographies and regional jurisdictions.

Should an FNPP be docked and operate at a seaport, it is important to note that maritime traffic and commerce will coexist with the FNPP throughout the duration of its operation. A nuclear safety or nuclear security event would have devastating impacts on commerce, as it would shut down a port for an extended period of time. Although a proper response might not entirely prevent a nuclear safety or security event, appropriate response mechanisms can mitigate the consequences, minimising the economic impacts of a port that shuts down.

FNPPs are an emerging nuclear technology that is gaining interest for future use by nuclear energy newcomers or other states to combat climate change and meet COP26 goals. Thus, it is critical that the international frameworks that govern the use of FNPPs be developed or amended precisely and carefully to prevent their misuse or involvement in catastrophic incidents. The law is typically slow and reactive in nature, but the level of interest in FNPPs and the gaps present in existing frameworks – not only for event response but also for general nuclear safety and security – provides an opportunity to conduct research in this field. Research may not ever allow the law to keep up with the growth of emerging nuclear technologies, but it presents the opportunity to at least keep pace with the development of innovative nuclear power plants. Legal research into FNPP deployment would provide a promising model or methodology not only to govern FNPPs but also to establish international frameworks for the fast-paced, ever-evolving nuclear technologies of the future.

CASE LAW

France

State Council (Conseil d'État), 15 March 2023, No. 456871[1]

In a case related to the disclosure of a redacted version of the safety case of a centralised spent fuel storage pool, the State Council (*Conseil d'État* – France's highest administrative jurisdiction) clarified the scope of the right of access to environmental information.

The association Réseau "Sortir du nucléaire" ["Nuclear Phase-out" network] (the Association) appealed to the State Council a 20 July 2021 decision of the Administrative Court of Lyon (Tribunal administratif de Lyon), which rejected its request that Electricité de France (EDF) release information concerning a project for a centralised spent fuel storage pool. EDF had previously only released a version that redacted information related to the monitoring tools used, the water temperature and the installation of the cooling and water supply system.

Relying on provisions of both the Environmental Code and of the Code for Relations between the Public and the Administration, the State Council first explained that public security and commercial confidentiality are among the motives that entitle the Government to refuse, after a case-by-case assessment of the utility of the disclosure of environmental information. The State Council specified that commercial confidentiality includes proprietary information, economic and financial information, and commercial or industrial strategies.

The State Council then explained that commercial confidentiality cannot be invoked to dismiss an application for information relating to the release of substances into the environment. The State Council also defined the scope of this regime. Drawing from European case law that requires the kind of information at issue to concern effective or foreseeable release in normal or realistic conditions of use, the State Council inferred that information concerning purely hypothetical release, as that resulting from a possible accident, for example, does not fall within the scope of the provisions of the Environmental Code and thus is not subject to a disclosure obligation, as well as information that, albeit presenting a link with the release at issue, does not concern said release.

Therefore, the State Council found that the Administrative Court of Lyon provided sufficient reasoning to support its decision to reject the Association's request for information with respect to the monitoring tools and the water temperature. Regarding the request for information about EDF's installation of the cooling and water supply system, the State Council considered that the disclosure of this information would cause harm to public security due to the sensitive features of the system for both the safety of the nuclear installation and public protection. However, the State Council found that the Administrative Court of Lyon did not provide motivating reasons to reject the Association's request with respect to the installation of the cooling and water supply system and therefore that portion of the order is annulled.

1. ECLI:FR:CECHR:2023:456871.20230315.

Japan

Court decision on a request to stop the Tomari Power Station, to remove spent nuclear fuel from the reactor buildings and to decommission the nuclear reactor (Tomari 1-3)[2]

I. Background and summary of this case

To operate a nuclear power plant in Japan, a nuclear operator must undergo a safety review conducted by the Nuclear Regulation Authority of Japan (NRA) and obtain a licence to operate. However, since the Fukushima Daiichi Nuclear Power Plant accident, some civil lawsuits have been filed against nuclear power plant operators by plaintiffs, requesting to stop the operation of the plants before the NRA's safety review has been completed.[3] Furthermore, in some of these civil lawsuits, plaintiffs have demanded not only to stop the operation of the plants but also to remove the spent nuclear fuel that currently exists in the reactor buildings from the reactor buildings and to decommission the reactor.[4]

The civil lawsuit concerning the Tomari Power Station (Tomari Plant), reported herein, is a good example of such lawsuits. In the case, 1 201 people living in Japan (from Hokkaido prefecture to Okinawa prefecture), the United Kingdom and the United Sates filed a civil lawsuit against Hokkaido Electric Power Company (HEPCO) on 11 November 2011 and 12 November 2012, claiming it was highly probable that their personal rights to life and health would be infringed due to a lack of safety against earthquakes, tsunamis, volcanic events, etc. In this case, the Plaintiffs requested the following:

- a halt to the operation of units 1, 2 and 3 of the Tomari Plant;
- removal of the spent nuclear fuel from the reactor buildings; and
- decommissioning of the reactors.

The issues in this case are: (i) whether the Plaintiffs' personal rights are likely to be infringed due to the operation of the reactors, (ii) whether the Plaintiff's personal rights are likely to be infringed due to the presence of spent nuclear fuel in the reactor buildings, (iii) whether it is necessary to decommission the Tomari Plant, and (iv) how extensive the damage would be from the postulated accident at the Tomari Plant. Furthermore, there are five issues relating to the risk of infringement of the Plaintiffs' personal rights due to the operation of the Tomari Plant: on-site safety, safety of the seabed, safety against tsunamis, safety against volcanic events and the suitability of the local disaster prevention plan.

The NRA began its safety review of the Tomari Plant in 2013, but it had not yet been completed as of the date of conclusion of oral arguments (18 January 2022). Also, because HEPCO, the Defendant, planned to argue its case and prove the safety of this plant based

2. Judgment of the Sapporo District Court of 31 May 2022 (Case number: 平成23(ワ)3265 [Heisei23(Wa)3265]), available in original Japanese at: www.courts.go.jp/app/hanrei_jp/detail4?id=91246.
3. In Japan, when plaintiffs file litigation seeking an injunction against the operation of a nuclear power plant, they frequently bring a civil lawsuit rather than an administrative lawsuit. One of the reasons for this is that the standard of review is different between administrative litigation and civil litigation. In administrative litigation, the standard of review is whether or not there is unreasonableness in the administrative decision making. On the other hand, in civil litigation the standard of review is whether or not there is a specific risk that is likely to infringe on the claimant's personal rights, and, as personal rights are abstract rights, the plaintiffs' claims are more likely to be recognised in civil litigation.
4. For example, in a civil litigation regarding the Hamaoka nuclear power plant filed in July 2011 plaintiffs sought an injunction against the plant's operation, and they also demanded the safe storage of nuclear fuel in the reactor buildings and the implementation of decommissioning measures.

on the safety review by the NRA, HEPCO had not yet finished arguing and proving the safety of the Tomari Plant to the Court in the more than 10 years since the Plaintiffs filed the case.

On 31 May 2022, the Sapporo District Court accepted the claims by 44 Plaintiffs living within a radius of 30 kilometres from the Tomari Plant and dismissed the claims by the rest of the Plaintiffs living in Japan, the United Kingdom and the United States living outside a radius of 30 kilometres from the nuclear power plant in question. To protect the 44 Plaintiffs' personal rights, the Court issued a decision granting an injunction against the operation of the Tomari Plant because it was not safe from tsunamis, but the Court did not accept the Plaintiffs' claims regarding the removal of spent nuclear fuel and decommissioning of the reactors. This decision is the fourth injunctive decision[5] in Japan stopping the operation of a nuclear reactor. Furthermore, this decision is significant as it is the first court decision on a request to remove spent nuclear fuel from a reactor building and start the decommissioning process.

II. Court's decision

The Sapporo District Court held as follows in response to the Residents' claims:

- (1) Premise of ruling (whether the case was ripe for decision)

Generally, in lawsuits concerning whether to operate a nuclear power plant, careful consideration should be given to scientific and technical expertise. This often results in the need for reasonable time for review and consideration of safety, especially because nuclear power plants have certain risks that need to be controlled based on scientific and technical expertise. In addition, nuclear power plant operation relates closely to social and economic activities of citizens. Based on the purpose of the Code of Civil Procedure, the court should ensure reasonable time for each party to prepare their argument and evidence.

Since the Tomari Plant is still under the NRA's safety review, the safety measures at the nuclear power plant may change after the conclusion of the oral arguments. Therefore, where the NRA has not yet finished its safety review of the nuclear power plant at issue, a court decision stating that the nuclear power plant does not have the necessary safety features may not lead to an effective resolution of the dispute.

In this case, however, more than ten years have passed since the lawsuit was filed and there is still no prospect that HEPCO will be able to prove its claim since the NRA's review is still ongoing. If the hearing continues under these circumstances, the Plaintiffs will be forced to endlessly respond to HEPCO's arguments and evidence, which may change depending on the status of the NRA's conformity assessment. There is, however, another method for HEPCO to settle the dispute, such as an "action to oppose execution", even if the circumstances regarding the safety of the Tomari Plant change after the conclusion of the oral argument in this case.[6] Since the Plaintiffs' claims are to protect rights currently being infringed, not to protect future rights, the Court considers that out of fairness to the Plaintiffs, this situation cannot continue.

5. As for other civil litigation in which injunctions against the operation of nuclear power plants were decided, see Kanazawa District Court decision in the Shika Nuclear Power Station Unit 2 Operation Injunction Case, Judgment of 24 March 2006, *Hanrei jiho*, Vol. 1930, p. 25; Fukui District Court decision in the Ohi Power Station Unit 3 and 4 Operation Injunction, Judgment of 21 May 2014, *Hanrei jiho*, Vol. 2228, p. 72; Mito District Court decision in the Tokai No. 2 Power Station Operation Injunction Case , Judgment of 18 March 2021, *Hanrei jiho* Vols. 2524/2525, p. 40.
6. Code of Civil Execution, Article 35(1), "An obligor who opposes the presence or contents of the claim pertaining to a title of obligation […] may file an action to oppose execution in order to seek non-permission of compulsory execution based on such title of obligation. The same applies to an obligor who opposes establishment of a title of obligation other than a judicial decision". (English translation), available at: www.japaneselawtranslation.go.jp/ja/laws/view/4272#je_ch2sc1at14.

Considering the above circumstances, it is not reasonable to continue the oral arguments while waiting for HEPCO's further argument; therefore, the Court found that the lawsuit "ripe for making a judicial decision".[7]

- (2) Claim for stopping the operation of Tomari Plant

a. Framework for the court's judgment on the specific risk of infringement of personal rights by the operation of the Tomari Plant

For a claim to be successful, a claimant must assert and prove that a nuclear power plant lacks safety and that operation of the nuclear power plant carries a risk that is likely to infringe of personal rights. However, HEPCO has the scientific and technical knowledge on the safety of nuclear power plants and the Defendant has the documents on the safety of facility design and structure, etc. Therefore, regardless of who has the burden of proof, HEPCO must first assert and prove that the Tomari Plant meets the NRA's safety standards and that there is no risk of infringement of personal rights if an accident happens. If HEPCO cannot prove its claim on this point, it is effectively presumed that the Tomari Plant lacks safety against natural phenomena and that there is a concrete risk of infringement of Plaintiffs' personal rights, which may be harmed in the event of an accident.

As regards the five issues of infringement of personal rights due to the operation of the Tomari Plant (on-site ground safety, safety against earthquakes, safety against tsunamis, safety against volcanic events and suitability of the regional disaster prevention plan), the NRA's safety standards must be met and, if any one of these standards is not satisfied, a specific risk of infringement of personal rights is found by the court.

b. Safety against tsunamis

In this case, it is found that the maximum water level of the expected tsunami exceeds the height of Tomari Plant site. Therefore, for the Tomari Plant to meet the NRA's safety standards it is necessary to install tsunami protection facilities that could protect the nuclear power plant in question from anticipated earthquakes and tsunamis.

Although the Tomari Plant has a seawall with a support base made of backfilled soil (the Existing Seawall), the NRA pointed out in the safety review that there was a possibility of ground liquefaction in the Existing Seawall due to an earthquake. In response to the NRA's comment, HEPCO initially stated that ground liquefaction and shaking subsidence were unlikely to occur and it would conduct further investigations to explain that there was no such possibility. However, based the fact that, in the review of other nuclear power plants, the NRA expressed its opinion to other power companies that it would take more time to examine the seawalls without bedrock support, HEPCO changed its policy and decided to construct new seawalls with bedrock support rather than denying the possibility of ground liquefaction in the Existing Seawall.

Therefore, it is found that HEPCO has not proven that there is no possibility of ground liquefaction concerning the Existing Seawall by showing concrete evidence, with substantial data, that the Existing Seawall has the safety required as a tsunami protection facility. In addition, it is found that the specific structure of the new seawalls that HEPCO plans to construct has not yet been determined.

Based on the above facts, the Tomari Plant does not satisfy the NRA's safety standards because it has no tsunami protection facility that can protect the plant from anticipated earthquakes and tsunamis at the conclusion of this oral argument.

c. Extent of infringement of personal rights caused by an accident at the Tomari Plant

The Plaintiffs claimed that there was a risk of an infringement of their personal rights, at least for residents living within 250 kilometres of the Tomari Plant, if an accident occured

7. Code of Civil Procedure, Article 243(1): "The court, when the suit is ripe for making a judicial decision, shall make a final judgment". (English translation), available at: www.japaneselawtranslation.go.jp/ja/laws/view/4421#je_pt2ch5at1.

at the Tomari Plant. However, the Court found that the evidence, which Plaintiff submitted, does not show that damage caused by a nuclear accident would extend as far as 250 kilometres from the Tomari Plant.

On the other hand, according to the national disaster prevention basic plan for nuclear power plants and the Hokkaido regional disaster prevention plan for the Tomari Plant, it is assumed that there is a probability that residents living within a radius of at least 30 kilometres from the Tomari Plant would be exposed to health risks from radioactive materials in the event of an accident. In addition, as a factual matter, following the Fukushima Daiichi accident, areas within 20 kilometres of the plant were designated as "evacuation zones" regardless of radiation levels, and areas between 20 and 30 kilometres were designated as "emergency evacuation preparation zones", requiring preparations to enable indoor evacuation and evacuation at all times.

Therefore, the Court found that the 44 Plaintiffs living within at least 30 kilometres of the Tomari Plant are at risk of infringement of their personal rights caused by a potential accident at the Tomari Plant.

- (3) Claim for removal of spent nuclear fuel present in the reactor building

As explained above, the Court found that the Existing Seawall does not have the appropriate level of safety against tsunamis to protect facilities of the Tomari Plant, which leads to the conclusion that the Tomari Plant itself lacks the required safety.

HEPCO claimed that the danger of the spent fuel stored in the spent fuel storage facility had decreased because the spent fuel has been cooled for a sufficiently long period after the plant ceased operation, showing decommissioning plans of other nuclear power plants approved by the NRA. However, the Court pointed out that the situation of the Tomari Plant is different from the case of other nuclear power plants because the operators of other nuclear power plants applied for the approval of the decommissioning plans with actual data and examinations, however HEPCO has not provided any evidence of safety based on specific studies or any substantial data proving that there is no danger due to the presence of spent nuclear fuel. Therefore, the Court found that there is the possibility of infringement of personal rights due to the presence of spent nuclear fuel for residents living within 30 kilometres of the Tomari Plant.

In a civil lawsuit, when a plaintiff asks a court to order a defendant to do a certain act, a plaintiff's claim should be specified to the extent that a compulsory execution can be implemented to realise a plaintiff's claim. However, in the Plaintiff's claim for removal of the spent nuclear fuel existing in the reactor building, the destination for removed fuel is not specified by the Plaintiffs, and so their claim is considered to be the removal of the spent fuel from the reactor building to any area. It was found that the Plaintiffs do not claim that the spent fuel should be stored in safe areas that meet certain conditions. In addition, the Court found that, if the conditions for appropriate removal and storage of spent nuclear fuel are not met, there is a possibility that the personal rights of the residents in the surrounding area of the relocation site will be infringed.

Therefore, the Court found that the Plaintiffs' claim for the removal of spent fuel is not admissible.

- (4) Claim for decommissioning of the reactors

Based on the Plaintiffs' claims and evidence provided, the Court found that there are no specific circumstances in this case that necessitate the decommissioning of the reactors.

III. Features of this decision

Two features of this decision can be noted. First, the Court granted the request to stop the operation of units 1, 2 and 3 of the Tomari Plant even though the nuclear power reactors in question are still under safety review by the NRA and, as a result of the safety review, there

is a possibility of change in the situation regarding the safety of the Tomari Plant.[8] In addition, this case is the first instance of a court deciding on a claim for the removal of the spent fuel present in the reactor building and the decommissioning of the reactor.

Following this decision, on 2 June 2022, HEPCO appealed to the Sapporo High Court, and as of April 2023 the Sapporo High Court was hearing the appeal. In addition to this case, other civil litigation on different nuclear power plants has been filed requesting the safe storage of spent nuclear fuel in the reactor building and the decommissioning of the reactor, as well as stopping the operation of the reactor, based on the infringement of the personal rights as in this case. Therefore, attention should be paid to this potential future trend.

United States

Ohio Nuclear-Free Network v. US Nuclear Regulatory Commission

Ohio Nuclear-Free Network v. US Nuclear Regulatory Commission[9] arose in the context of the issuance of a licence amendment by the United States (US) Nuclear Regulatory Commission (NRC) to American Centrifuge Operating, LLC (ACO). The amendment permitted the company to produce high-assay low-enriched uranium (HALEU) (i.e. uranium enriched between 5 and 20%) at a facility near Piketon, Ohio, owned by the US Department of Energy (DOE). ACO's predecessor, the United States Enrichment Corporation (now Centrus Energy Corp.) had previously obtained a licence from the NRC in 2007 to construct and operate a commercial scale uranium enrichment facility at this location. That facility was never constructed, but ACO still possessed the licence, which authorised the enrichment of uranium up to 10%. In 2019, ACO entered into a three-year contract with the DOE to demonstrate its ability to produce HALEU enriched to 19.75%. ACO thus sought a licence amendment from the NRC to produce and possess this HALEU at the Piketon facility.

While the NRC was considering the licence amendment application, multiple organisations submitted a letter to the Agency requesting that the NRC prepare a programmatic environmental impact statement (EIS) addressing non-proliferation concerns and the potential impacts the HALEU demonstration project may have on domestic uranium mining.[10] Prior to approving the licence amendment, the NRC published an environmental assessment, concluding that ACO's HALEU demonstration project – which would produce a maximum of 600 kilograms of HALEU over a three-year period, at the same location where an extensive environmental review for a much larger enrichment facility had previously been prepared – would not have a significant environmental impact.

The organisations challenged the NRC's decision not to prepare an EIS in the US Court of Appeals for the District of Columbia Circuit (DC Circuit). However, the Court dismissed the petition for review because the organisations had not properly raised their concerns before the NRC prior to seeking judicial review. The US Atomic Energy Act provides that any person "whose interest may be affected" by a licensing proceeding may obtain a hearing before the agency.[11] The NRC's regulations implementing this hearing requirement state that the person must submit at least one admissible contention.[12] Only a "party

8. This can be problematic from the perspective of the legal doctrine of ripeness. See Uchiyama, H. (2023), "*Tomari Gensiryoku Hatsudensyo Unten Teisitou Seikyu Jiken ni okeru Funsou no Seijukusei ni tuite*" [Ripeness of the dispute in the case of the request for the injunction of operation of the Tomari Nuclear Power Plant], in Japan Energy Law Institute (ed.), Japan Energy Law Institute Quarterly Bulletin 280, Japan Energy Law Institute, Tokyo, pp. 5-11.
9. 53 F.4th 236 (DC Cir. 2022).
10. Under the US National Environmental Policy Act (NEPA), federal agencies must prepare a detailed environmental impact statement before taking any "major federal action significantly affecting the quality of the human environment." 42 *United States Code* (USC) 4332.
11. 42 USC 2239(a)(1)(A).
12. 10 *Code of Federal Regulations* (CFR) 2.309(f) (contention admissibility).

aggrieved" by the final order of such a proceeding may seek judicial review of the Agency's decision.[13] The DC Circuit Court held that because the organisations challenging the decision never sought a hearing per the agency's established procedures, they were not "parties aggrieved" by the NRC's decision, and the letter they submitted to the NRC staff was not an adequate substitute for a hearing request.

Spent fuel storage litigation

Multiple parties have filed petitions for judicial review in federal courts of appeals throughout the United States concerning the NRC's decision to issue a licence to Interim Storage Partners, LLC (ISP), to construct and operate a consolidated interim spent fuel storage facility in Andrews, Texas. The NRC issued the licence on 13 September 2021, authorising the company to receive, possess and store up to 5 000 metric tons of spent fuel in dry-cask storage systems for a licence term of 40 years. Prior to issuing the licence, several organisations and environmental groups sought to intervene in the NRC's licensing proceeding by submitting "contentions" seeking a hearing before the NRC's Atomic Safety and Licensing Board (ASLB). These contentions alleged either that there were deficiencies with ISP's application or that the NRC's issuance of the licence violated the Nuclear Waste Policy Act (NWPA), or both. In a series of adjudicatory decisions beginning in 2019, the ASLB denied each of these hearing requests for failure to submit an admissible contention.[14] These denials were appealed to the Commission, which issued four orders affirming the ASLB's determinations.[15] Various petitioners then sought judicial review of the Agency's actions in three federal circuit courts of appeals across the United States. As of this writing, two of the three have been dismissed.

The first case to be dismissed, Don't Waste Michigan v. US Nuclear Regulatory Commission,[16] was brought in the US Court of Appeals for the District of Columbia Circuit by multiple organisations that had previously sought to participate in the licensing proceeding. Several of these organisations challenged not only the NRC's decision to deny their contentions seeking an administrative hearing but also the NRC's decision to issue the licence to ISP. With respect to the NRC's denial of the organisations' hearing requests, the Court determined that the NRC had acted reasonably in determining that the contentions proffered by the petitioners did not raise any genuine dispute of law or fact and that the NRC had taken an adequate "hard look" at the environmental impacts of the proposed action. The Court also determined (citing the Ohio Nuclear-Free Network decision summarised above) that it did not have jurisdiction to consider the organisations' separate challenges to the NRC's decision to issue the licence because their hearing requests were denied.

The second case to be dismissed, Balderas v. US Nuclear Regulatory Commission,[17] was brought by the state of New Mexico in the US Court of Appeals for the Tenth Circuit. Unlike the petitioners in the Don't Waste Michigan case, New Mexico did not seek a hearing in the ISP licensing proceeding. Instead, the state submitted a comment on the NRC's draft EIS, to which the NRC responded in its final EIS published prior to issuing the licence. Citing the Ohio Nuclear-Free Network decision, the Court held that New Mexico was not a "party aggrieved" by the NRC's issuance of the licence to ISP because the state never submitted

13. 28 USC 2342, 2344.
14. Interim Storage Partners LLC (WCS Consolidated Interim Storage Facility), LBP-19-07, 90 NRC 31 (23 Aug. 2019); Interim Storage Partners LLC (WCS Consolidated Interim Storage Facility), LBP-19-09, 90 NRC 181 (18 Nov. 2019); Interim Storage Partners LLC (WCS Consolidated Interim Storage Facility), LBP-19-11, 90 NRC 358 (13 Dec. 2019); Interim Storage Partners LLC (WCS Consolidated Interim Storage Facility), LBP-21-02, 93 NRC 104 (29 Jan. 2021).
15. Interim Storage Partners LLC (WCS Consolidated Interim Storage Facility), CLI-20-13, 92 NRC 457 (4 Dec. 2020); Interim Storage Partners LLC (WCS Consolidated Interim Storage Facility), CLI-20-14, 92 NRC 463 (20 Dec. 2020); Interim Storage Partners LLC (WCS Consolidated Interim Storage Facility), CLI-20-15, 92 NRC 491 (17 Dec. 2020); Interim Storage Partners LLC (WCS Consolidated Interim Storage Facility), CLI-21-09, 93 NRC 244 (22 June 2021).
16. DC Cir. No. 21-1048 (2023).
17. 59 F.4th 1112 (10th Cir. 2023).

contentions or requested a hearing as required per the agency's rules of procedure. The Court held that the state could have raised its environmental objections by submitting contentions alleging deficiencies with ISP's application, or it similarly could have raised its arguments before the Agency that the Commission lacked the authority to license the ISP facility. The Court held that by choosing only to submit comments on the EIS the state bypassed its chance to participate as a "party" in the licensing proceeding and thus could not seek judicial review of the licence. New Mexico also invoked the NWPA as support for its challenge to the NRC's issuance of the licence to ISP, which provides federal appellate jurisdiction over, among other things, challenges to an EIS prepared for the siting, construction and operation of a permanent federal repository for spent nuclear fuel.[18] The Court further held that this provision of the NWPA did not provide jurisdiction in the instant case because the ISP facility was neither a federal facility nor a permanent repository.

Lastly, there remains pending a petition for review in the US Court of Appeals for the Fifth Circuit filed by the state of Texas (consolidated with a petition submitted by two of the same organisations who also sought review in the DC Circuit Court).[19] Texas primarily argues that the NRC lacks authority under the US Atomic Energy Act to license the private storage of spent fuel nuclear fuel. The NRC moved to dismiss the case, arguing (consistent with the Ohio Nuclear-Free Network and Balderas cases) that the state of Texas cannot seek judicial review of the NRC's licensing decision because it did not first raise its claims before the Agency by seeking a hearing. The NRC further asserted that the US Atomic Energy Act confers upon it the authority to issue licences for the possession of the constituent elements of spent nuclear fuel – namely, source, byproduct and special nuclear material – and therefore permits it to issue licences to private parties to operate spent fuel storage facilities. Oral argument took place in August 2022, and as of this writing a decision has not been issued.

18. 42 USC 10139(a)(1)(D).
19. Texas v. US Nuclear Regulatory Commission, 5th Cir. No. 21-60743 (filed 7 Feb. 2022).

NATIONAL LEGISLATIVE AND REGULATORY ACTIVITIES

Algeria

Nuclear safety

Decree of 8 Ramadhan 1442, corresponding to 20 April 2021, establishing the organisation and operation of the National Nuclear Safety and Security Authority

On 1 January 2023, Algeria established the National Nuclear Safety and Security Authority (NNSSA) according to the Law No. 19-05 of 14 Dhou El Kaâda 1440, corresponding to 17 July 2019, on Nuclear activities. The NNSSA has the power and independence required to ensure regulatory control of nuclear activities.

Pursuant to Law No. 19-05, the organisation of the NNSSA is set by the provisions of Decree No. 21-148 of 20 April 2021 so that the NNSSA can fulfil its duties and functions in an effective and reasonable manner, taking into account the nature of the installations and activities it regulates and supervises.

The NNSSA consists of, *inter alia*:

- the Authority Council;
- the Nuclear Regulation Directorate;
- the Inspections Directorate;
- the Directorate for Nuclear Safety, Radiological Protection and Radioactive Waste; and
- the Directorate for Nuclear Security and Nuclear Non-Proliferation Safeguards.

The organisational structure of the NNSSA reflects the collective nature of its decision-making process and the prerogatives of the Authority Council.

Belarus

General legislation, regulation and instruments

Presidential Decree to abolish the Department for the Elimination of the Consequences of the Chernobyl Disaster

Presidential Decree No. 405, "On the Ministry of Emergency Situations of the Republic of Belarus", signed by the President of Belarus on 14 November 2022, abolishes the Department for the Elimination of the Consequences of the Chernobyl Disaster and transfers the tasks and functions of the department and its structural divisions to the Nuclear and Radiation Safety Department of the Belarusian Emergencies Ministry (Gosatomnadzor) of the Ministry on Emergency Situations (MES). Additionally, the Decree eliminates the administration of exclusion and resettlement zones and reassigns the responsibility for the following from MES to other entities:

- Polessky State Radiation and Ecological Reserve, a state environmental research institution, now the responsibility of the Ministry of Natural Resources and Environmental Protection;

- Polesie, a state enterprise, now the responsibility of the Gomel Regional Executive Committee; and
- Radon, a state enterprise, now the responsibility of the Mogilev Regional Executive Committee.

The Decree also approves new powers for MES and its departments.

International co-operation

An agreement on co-operation in the field of spent nuclear fuel management between Belarus and the Russian Federation (Agreement) was signed on 21 November 2022 in Sochi, Russia. The Agreement concerns the export of irradiated fuel assemblies from Belarusian nuclear reactors to Russia for temporary storage and subsequent processing, as well as the return of radioactive waste from Russia to Belarus. Transportation of irradiated fuel assemblies and radioactive waste across the territories of Belarus and Russia, their movement across the state border, and physical protection of irradiated fuel assemblies and radioactive waste will be carried out in accordance with the Agreement. The Agreement also provides for measures on civil liability for nuclear damage.

The Ministry of Energy of Belarus and the State Atomic Energy Corporation Rosatom of Russia are designated as the competent authorities to implement the Agreement. Any additional issues related to the Agreement will be agreed upon by the parties' competent authorities before the first export of irradiated fuel assemblies from Belarusian nuclear reactors to Russia. Belarus appoints an authorised organisation for receiving radioactive waste in Belarus.

Radioactive waste management

Developments in the strategy for radioactive waste management in Belarus

Belarus adopted Resolution No. 460, "On approval of the Strategy for Radioactive Waste Management of the Belarusian Nuclear Power Plant", dated 2 June 2015.

During the lifetime of the Belarusian nuclear power plant (60 years), the formation of 9 360 cubic metres of solid radioactive waste of various categories and 60 cubic metres of highly radioactive waste is predicted. According to preliminary estimates, the projected volume of low-level and intermediate-level solid radioactive waste generated as a result of decommissioning of a similar nuclear power plant is 2 050 cubic metres per unit of a nuclear power plant. For high-level solid waste, the projected volume is 85 cubic metres. Taking into account the expected volumes of radioactive waste, there is an objective need to create a disposal site to ensure the safe storage of very low-level, low-level and intermediate-level radioactive waste after the decommissioning of a nuclear power plant. The project developed for radioactive waste produced by the Belarusian nuclear power plant will provide for the use of modern technical solutions. The amount of financial resources for the construction of a disposal site for radioactive waste, estimated based on the cost of constructing a similar facility in Lithuania (the disposal site for radioactive waste from the Ignalina nuclear power plant), is about USD 60 million. The estimated cost of construction of the first stage of facilities for the Belarusian radioactive waste disposal facility is USD 10 million. The actual cost of the construction of these facilities will be determined based on the results of the development of the corresponding Ignalina radioactive waste disposal project.

The implementation of a radioactive waste management strategy for the Belarusian nuclear power plant is expected to contribute to the improvement of the waste management system, minimising the amount of radioactive waste generated during the operation of the nuclear power plant and reducing the operating costs for the maintenance of the radioactive waste management system. In the future, the strategy should contribute to reducing the financial burden associated with maintaining the safety of similar radioactive waste management system facilities for future generations.

Developments in the strategy for spent fuel management in Belarus

Resolution No. 558, dated 22 August 2019, approved the Strategy for the Management of Spent Nuclear Fuel from the Belarusian nuclear power plant and entrusted the Ministry of Energy with the co-ordination of work on its implementation. The strategy provides for key organisational aspects for the creation and implementation of a national system for the management of spent nuclear fuel, including detailing the main tasks of scientific, technical and practical activities of the participants involved in the treatment process, and a phased, adaptive approach based on the consent of the participants involved in the treatment process to the final stage of the nuclear fuel cycle.

As a result of the implementation of this strategy:

- the basic elements and organisational legal mechanisms of state management in the field of SNF management will be formed;
- effective protection of people, society as a whole and the environment from the potential effects of spent nuclear fuel radionuclides and ionising radiation generated during all stages of SNF management will be ensured;
- a socially-acceptable level of safety will be maintained;
- basic safety principles within the framework of Belarus's international obligations will be consistently implemented;
- mechanisms for personnel and financial support for the safe handling of the Belarusian nuclear power plant's spent nuclear fuel and the resulting raw materials will be developed and implemented; and
- maintenance of a non-proliferation regime and the physical protection of nuclear materials will be ensured.

Belarus focuses on the use of Russian technology and expertise as the supplier of nuclear technology to Belarus. The strategy notes that the preferred option for handling spent nuclear fuel from the Belarusian nuclear power plant is its processing in Russia with the return to Belarus of waste in a glass-like matrix containing radionuclides of the cesium-strontium fraction, with the exception of long-lived radionuclides. The strategy states that financial mechanisms are being developed to ensure that the Belarusian nuclear power plant has adequate funding in place by the end of its commercial operation to handle spent nuclear fuel and radioactive waste produced by the nuclear power plant. By the time spent nuclear fuel processing waste is returned to Belarus (by approximately 2050), the strategy requires confirmation of the presence of facilities for handling such waste within the territory of Belarus. Processing should be carried out after intermediate storage of SNF in the territories of Belarus and/or the Russian Federation.

The strategy notes that it is advisable to consider the possibility of waste disposal from the processing of both spent nuclear fuel and radioactive waste generated during the operation of the Belarusian nuclear power plant at the same disposal site. In accordance with the strategy, the total costs for various options for spent nuclear fuel management with existing technologies are estimated to be between USD 2.5 billion and USD 3.5 billion for the expected period of operation of the Belarusian nuclear power plant (up to 100 years). No later than 2028, a storage site should be created with the potential to be expanded to accommodate intermediate (long-term) spent fuel storage.

Development in the strategy for radioactive waste management in Belarus

Presidential Decree No. 101 "On organizing a radioactive waste management system" was signed by the President of Belarus on 12 April 2023 to enable the operation of a system of long-term storage and disposal of radioactive waste. The decree defines the sources of financing for the activities of a specially authorised organisation, the national operator for radioactive waste management, Belarusian Organization for Radioactive Waste Management, as well as the general design organisations, Belnipienergoprom and the Joint Institute for Power and Nuclear Research – Sosny, for scientific support of radioactive waste work and for the design and construction of radioactive waste management facilities, respectively.

Resolution No. 128, dated 15 February 2023, approved the Strategy for Radioactive Waste Management. The strategy is a comprehensive policy document that establishes the main areas of activity for the safe and cost-effective management of radioactive waste.

The strategy highlights several main principles for ensuring radiation safety in Belarus when handling radioactive waste, including:

- ensuring an acceptable level of protection of workers (personnel) and the public from the radiation effects of radioactive waste in accordance with the principles of justification, rationing and optimisation;
- ensuring an acceptable level of environmental protection from the harmful radiation effects of radioactive waste;
- consideration of the interdependence between different stages of radioactive waste management;
- protection of future generations, which consists in the fact that the predicted levels of exposure of future generations caused by the disposal of radioactive waste should not exceed the permissible levels of exposure of the population established by law;
- non-imposition of an unreasonable burden on future generations to solve problems in ensuring safety in the management of radioactive waste;
- control over the formation and accumulation of radioactive waste (limiting the formation and accumulation of radioactive waste at a minimum level);
- prevention of accidents with radiation consequences and mitigation of possible consequences in case of their occurrence.

The document is designed to address a number of priority tasks, including improving the regulatory framework in the field of radioactive waste management, developing an integrated infrastructure in the field of radioactive waste management, and providing for the collection, transportation, processing, long-term storage and disposal of radioactive waste of all categories and classes. These tasks will be accomplished, in part, by:

- creating and ensuring the functioning of a specialised organisation, a national operator for radioactive waste management;
- planning the volume of radioactive waste generation;
- creating a system for training qualified specialists in the relevant field; and
- expanding international co-operation in the field of radioactive waste management.

The implementation of measures under the strategy will be carried out in three stages:

2022-2030

- creating a national operator for the management of radioactive waste and the organisation of related activities;
- conducting survey work on the selection of a site for the construction of a radioactive waste disposal facility;
- determining expected radioactive waste volumes and methods of radioactive waste management, including biological waste, which can potentially be formed in an emergency situation;
- developing design documentation for the first stage of the construction of a radioactive waste disposal facility, including for the placement of potential emergency waste;
- summarising the accumulated experience of maintaining decontamination waste disposal sites, taking into account international practices, on the basis of which a programme will be formed that develops approaches for the eventual withdrawal

of decontamination waste disposal sites from regulatory control, once the sites do not pose a danger to the environment or the population; and

- training personnel and maintaining the qualifications of specialists within public administration bodies, and scientific, design, and operating organisations in the field of radioactive waste management.

2030-2050

- ensuring on a permanent basis the packaging and transfer of very low, low, and intermediate-level radioactive waste from the Belarusian nuclear power plant to the disposal point for processing (if necessary), as well as storage or burial;
- carrying out scientific research for the formation of a radiation and environmental monitoring system of decontamination waste disposal sites; and
- optimising the disposal system of waste from the Chernobyl site on the basis of the developed approaches for the removal of decontamination waste disposal sites from regulatory control.

2050 and beyond

- safely managing radioactive waste, including radioactive waste generated during decommissioning of Belarusian nuclear power plant units, and transferring the radioactive waste to the disposal site;
- further optimising the disposal system of Chernobyl waste on the basis of developed approaches for the removal of decontamination waste disposal sites from regulatory control; and
- scientific and practical activities within the programme for the subsequent removal from regulatory control of decontamination waste disposal sites that over time will not pose a danger to the environment and the population.

France

Radioactive waste management

Decree No. 2022-1547 of 9 December 2022 pursuant to Article L. 542-1-2 of the Environmental Code setting out the requirements for the National Radioactive Material and Waste Management Plan[1]

Order of 9 December 2022 in accordance with Decree No. 2022-1547 of 9 December 2022 pursuant to Article L. 542-1-2 of the Environmental Code setting out the requirements for the National Radioactive Material and Waste Management Plan[2]

1. Decree No. 2022-1547 of 9 December 2022 pursuant to Article L. 542-1-2 of the Environmental Code setting out the requirements for the National Radioactive Material and Waste Management Plan, *Journal Officiel de la République française* (JORF) No. 286, 10 Dec. 2022, Text No. 30.
2. Order of 9 December 2022 in accordance with Decree No. 2022-1547 of 9 December 2022 pursuant to Article L. 542-1-2 of the Environmental Code setting out the requirements for the National Radioactive Material and Waste Management Plan, JORF No. 286, 10 Dec. 2022, Text No. 34.

Opinion No. 2022-AV-0403 of the Nuclear Safety Authority of 23 June 2022 regarding the draft Decree and Order setting out the requirements for the National Radioactive Material and Waste Management Plan[3]

The National Radioactive Material and Waste Management Plan (NRMWMP) is a planning tool for the transparent and sustainable management of radioactive material and waste in accordance with the safety and security of people and the environment. The Decree and Order implement the main recommendations of the NRMWMP, as well as deadlines and stepping stones with respect to the management of radioactive material and waste by setting out formal requirements. Both texts were reviewed by the French Nuclear Safety Authority (Autorité de Sûreté Nucléaire – ASN), which issued a formal opinion.

The Decree amends the Environmental Code (Code de l'Environnement) and sets out the regulatory requirements applicable to the NRMWMP for the period 2022-2026. The Order details the requirements with regards to:

- co-ordination of energy and radioactive material and waste policies;
- radioactive material: strengthened control of radioactive material recycling, continuation of the work related to material management solutions when such material is requalified as waste;
- storage of radioactive material and waste: fine-tuning of the capacity forecasts of existing storage, definition of a storage strategy for spent fuel, ongoing deployment of new wet storage capacities, storage of radioactive material and waste;
- very-low-level waste (VLLW) management: development of new centralised and decentralised disposal capacities, definition of VLLW management scenarios in view of the establishment of an overall management strategy, recycling of VLLW metal and study of possible optimisation strategies for the management of all VLLW, and accurate assessment of VLLW generated by the decommissioning of nuclear installations;
- management of long-lived low-level waste (LL-LLW): ensuring more accurate inventory of LL-LLW and continuation of studies and work on the definition of technical specifications in view of future disposal, definition of scenarios for the management of LL-LLW to devise an overall management strategy, finalising the characterisation of safety issues related to the Vendeuvre-Soulaines site;
- management of long-lived intermediate- and high-level waste (LL-IHLW): conditions for the implementation of the CIGEO deep geological repository, continuation of the work around LL-IHLW;
- management of specific waste categories: ongoing work on the definition of a management strategy for legacy waste, definition of management strategies for waste that require specific work; and
- general provisions for better consideration of radioactive material and waste management crosscutting issues: development of a multi-actors and multi-criteria method for the analysis of possible management options, and of environmental, health and economic challenges related to transport.

3. Opinion No. 2022-AV-0403 of the Nuclear Safety Authority of 23 June 2022 regarding the draft Decree and Order setting out the requirements for the National Radioactive Material and Waste Management Plan, *Bulletin officiel de l'ASN*, 28 Dec. 2022.

Radioactive materials (including physical protection)

Order of 27 December 2022 relating to physical monitoring, accounting and accounting declaration modalities for nuclear material, pursuant to Articles R. 1333-3-2 and R. 1333-11 of the Defence Code for activities that are not subject to authorisation under Article 1333-4 of said Code[4]

This Order specifies requirements applicable to physical monitoring, accounting and accounting declaration modalities related to nuclear material (plutonium, uranium, thorium, tritium and lithium-6). It applies to fabrication, detention, transfer and use of said nuclear material when those activities are not subject to authorisation.

Order of 27 December 2022 relating to activities subject to authorisation pursuant to Article 1333-4 of the Defence Code concerning the use of Category IV nuclear material inside installations or being imported or exported, outside of a vital importance area of the energy sector (peaceful use of nuclear energy subsector)[5]

This Order specifies requirements applicable to physical monitoring, accounting and accounting declaration modalities related to nuclear material used for fabrication, detention, transfer, use, import or export of nuclear material in quantities falling within the scope of category IV of Article 1333-70 of the Defence Code.

Order of 28 February 2023 relating to activities subject to authorisation pursuant to Article R. 1333-4 or the Defence Code concerning the use of Category III nuclear material inside installations or being imported or exported, outside of an area of vital importance with regards to the national directive on the security of the energy sector (peaceful use of nuclear energy subsector)[6]

This Order applies to fabrication, detention, transfer, use, import or export of certain nuclear material subject to authorisation and requiring quantities of nuclear material falling within the scope of Category III of Article R. 1333-70 of the Defence Code. This Order sets the control and protection rules against wrongful acts for this type of nuclear material.

Order of 28 February 2023 relating to the security of nuclear material in transport pursuant to Articles R. 1333-4 and R. 1333-17 to R. 1333.19 of the Defence Code[7]

This Order sets out the requirements relating to the security of nuclear material in transport subject to authorisation, including:

- the responsibilities of the operator of the authorised transport and sending and receiving organisations;

4. Order of 27 December 2022 related to physical monitoring, accounting and accounting declaration modalities for nuclear material, pursuant to Articles R. 1333-3-2 and R. 1333-11 of the Defence Code for activities that are not subject to authorisation under Article 1333-4 of said Code, JORF No. 11, 13 Jan. 2023, Text No. 18.
5. Order of 27 December 2022 related to activities subject to authorisation pursuant to Article 1333-4 of the Defence Code concerning the use of Category IV nuclear material inside installations or being imported or exported, outside of a vital importance area of the energy sector (peaceful use of nuclear energy subsector), JORF No. 12, 14 Jan. 2023, Text No. 18.
6. Order of 28 February 2023 relating to activities subject to authorisation pursuant to Article R. 1333-4 or the Defence Code concerning the use of Category III nuclear material inside installations or being imported or exported, outside of an area of vital importance with regards to the national directive on the security of the energy sector (peaceful use of nuclear energy subsector), JORF No. 72, 25 Mar. 2023, Text No. 28.
7. Order of 28 February 2023 relating to the security of nuclear material in transport pursuant to Articles R. 1333-4 and R. 1333-17 to R. 1333.19 of the Defence Code, JORF No. 71, 24 Mar. 2023, Text No. 31.

- the conditions applicable to applications for execution agreement for any and all transport; and
- the security of transport obligations, with provisions applicable to all modes of transport and specific provisions for road, railway, sea and air transport.

Organisation and structure

Decree No. 2022-1411 of 7 November 2022 establishing an interministerial programme delegation for nuclear new build[8]

This Decree establishes an interministerial programme delegation for nuclear new build placed under the authority of the Prime Minister. This delegation is in charge of supervising the implementation of industrial nuclear new build programmes in France in relation to and in compliance with central administration and national services as well as with the Prefects in charge of the areas of the future nuclear reactors sites. Its missions are to:

- contribute to the definition of objectives in terms of costs, quality and deadlines, and ensure the project owner complies with these objectives, including by performing regular reviews of progress and audits of the procurement process;
- ensure the project owner implements actions to manage industrial, contractual and financial risks, and ensure secure procurement for the programme;
- ensure the project owner duly takes into account the nuclear safety and environmental aspects of the programme;
- ensure the project owner's internal organisation is efficient and monitor effective mobilisation of the nuclear sector and ability of said sector to contribute to the implementation of the programme;
- contribute to the definition of the programme funding and economic regulation framework, and ensure the programme is implemented according to European Union rules and regulation;
- conduct, subject to the authority of the ASN and the National Commission for Public Debate, the public participation process and co-ordinate licensing procedures related to the programme;
- co-ordinate, with regards to all aspects of the programme, the relations between the French Government and the project owner, the nuclear industry, the electricity transport network operator, the ASN, the Energy Regulation Commission and local authorities where new nuclear reactors will be built; and
- contribute to public information on the major aspects of the French nuclear new build programme.

Greece

Radioactive waste management

Joint Ministerial Decision No. 35225/2023

Joint Ministerial Decision No. 35225/2023, "Legislative, regulatory and organizational framework for the responsible and safe management of spent fuel and radioactive waste – Adaptation of Greek legislation to 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 199/02.08.2011) – National program for spent fuel and

8. Decree No. 2022-1411 of 7 November 2022 establishing an interministerial programme delegation for nuclear new build, JORF No. 259, 8 Nov. 2022, Text No. 30.

radioactive waste management"[9] (JMD) makes improvements and clarifications based on the experience of implementing the framework to date. The JMD also updates the existing provisions for reasons of compatibility and removes overlaps with Presidential Decree 101/2018, A' 194. Radiation Protection Regulations.

Furthermore, the JMD provides the methodology for the implementation, through specific objectives, of the national policy for the responsible and safe management of spent fuel and radioactive waste, in compliance with the corresponding requirements 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.

Article 25 and the attached Annex to the JMD set the new national programme. The national programme has a reference period of 20 years (2023-2042), and it includes the dismantling of the research reactor and appropriate performance indicators. It covers the entire process of safe and responsible management of radioactive waste, from production to disposal, and is a key reference for the bodies involved in the practical implementation of the national policy. Part of the national programme shall receive financing from the Recovery and Resilience Fund, amounting to more than EUR 3 million.

According to Article 26 of the JMD, upon its publication, the following legislation ceases to be valid and any reference made to it is considered as reference to the JMD:

- Presidential Decree 122/2013 (OGG No. 177/A/2013);
- Joint Ministerial Decision No. 97529/18.9.2020 on the National Program for the management of spent fuel and radioactive waste (OGG No. 4317/B/2020); and
- Joint Ministerial Decision No. 131207/I3/27.8.2015 on definition of the national policy for the management of spent fuel and radioactive waste (OGG No. 1858/B/2015).

Slovak Republic

International co-operation

IRRS and ARTEMIS missions

Following the International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service (IRRS) mission in the Slovak Republic in September 2022, the Nuclear Regulatory Authority of the Slovak Republic (ÚJD SR) has continued with the preparation of the action plan to address findings of the mission. The document will be submitted for the approval of the Government of the Slovak Republic in Q2 2023. Further, the Slovak Republic also hosted its first-of-a-kind IAEA Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) mission in February 2023, in a back-to-back format with the IRRS mission. The mission reviewed the national framework (policy and programme) for the area of decommissioning, radioactive waste and spent nuclear fuel management, as well as environmental remediation. The findings from the mission will similarly be implemented in the action plan. Both follow-up missions are expected to be invited to the Slovak Republic in 2026.

RIC-25

The Slovak Republic, together with the Provisional Technical Secretariat (PTS) of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), will host the 25th On-Site Inspection (OSI) Regional Introductory Course (RIC-25) from 24 to 30 April 2023 in the Bratislava Region for participants from the state signatories to the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The course is being organised by the ÚJD SR as the designated government authority and will be conducted at the premises

9. *Official Government Gazette* (OGG) No. 2638/B/21.04.2023.

of the častá-Papiernička facility and its surrounding forest areas. The key objectives of the RIC-25 are to acquaint national technical experts and personnel from the states signatories to the CTBT of the region with the OSI regime, to broaden the pool of experts from the geographical region for participation in OSI related activities and to identify potential candidates for the PTS roster of OSI surrogate inspectors. The event should also serve as an entry point for national technical experts with expertise in the OSI techniques into the new Linear Training Programme (LTP) and will serve as the In-Field Operations Support Training Course for current LTP trainees. Hosting of the RIC-25 will be conducted in accordance with the provisions of the Agreement between the Government of Slovak Republic and the CTBTO Preparatory Commission on Mutual Cooperation for Training and Exercise Activities of the Commission related to OSI.

Bilateral meeting between the Slovak Republic and Czechia

A bilateral meeting took place in Smolenice (Slovak Republic) on 27-28 February 2023 between the ÚJD SR and the State Office for Nuclear Safety (SÚJB) (Czechia). The meeting was organised according to the agreement between the Government of the Slovak Republic and the Government of Czechia on Cooperation in the Field of State Regulation of Nuclear Safety of Nuclear Installations and of State Regulation of Nuclear Materials. Participants discussed issues of mutual interest within the past year, such as institutional issues of their regulatory bodies, relevant regulatory aspects and issues related to the operation of nuclear power plants, radiation protection-related matters in the territories of both states, as well as international activities and involvement. These meetings play an important role in acquiring knowledge and sharing information that both sides may use in the decision-making process as well as in their future activities. The next bilateral meeting will take place in 2024 in Czechia.

Slovenia

Radioactive waste management

Resolution on the national programme on radioactive waste and spent fuel management for the period 2023-2032

At its session, held on 27 January 2023, the National Assembly of Slovenia adopted the "Resolution on the national programme on radioactive waste and spent fuel management for the period 2023-2032".

The Resolution is a continuation and update of the "Resolution on the national programme on radioactive waste and spent fuel management for the period 2016-2025" to remedy instances of alleged non-compliance with Council Directive 2011/70/Euratom,[10] pursuant to the 2017 Ionising Radiation Protection and Nuclear Safety Act (ZVISJV-1), No. 76/2017, as well as all the adopted regulations and revised documents dealing with the handling of radioactive waste and spent fuel and the decommissioning of facilities.

The key novelties in the new Resolution are more specific timelines in the national programme, more precise key performance indicators, and more precise definitions regarding the financing of research and development in the field of radioactive waste and spent fuel. To monitor the progress and implementation of the planned measures more effectively, key indicators for achieving the main objectives and strategies are introduced in Chapter 4 of the Resolution. All the above mentioned was also the subject of the reasoned opinion of the Radioactive Waste Management Agency's (Agencija za radioaktivne odpadke – ARAO) management board.

10. 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 337 (5 Dec. 2006).

Further, the Resolution includes the improvement of the radioactive waste and spent fuel inventory assessment, updating the radioactive waste and spent fuel management programmes, plans and costs of decommissioning, and management of radioactive waste and spent fuel, as well as other important decisions, milestones and advanced projects for the decommissioning of nuclear facilities. It also includes an estimate of costs for implementing measures to achieve the goals of the national programme. For the implementation of the entire programme, an amount of EUR 129 740 000 must be secured over the next decade from the Krško Nuclear Power Plant Decommissioning Fund and the state budget.

The new Resolution is published in the *Official Gazette of the Republic of Slovenia*, No. 14/23, and it entered into force on 18 February 2023.

Switzerland

Liability and compensation

Revision of the Ordinance of 25 March 2015 on third-party liability in the field of nuclear energy

The revision of the Ordinance on third-party liability in the field of nuclear energy (ORCN, RS 732.441) allows for an increase of the private insurance share. According to Swiss nuclear liability law,[11] the liability of a nuclear operator for nuclear damage is unlimited and an operator must have insurance cover up to EUR 1.2 billion (plus 10% of that amount to cover interest and costs allocated by a judicial authority). Until the end of 2022, private insurers offered cover up to CHF 1 billion (EUR 1.02 billion), with the Swiss Confederation ensuring cover for the difference in amounts and for a number of risks that private insurers could partially or fully exclude from insurance cover. Since 1 January 2023, private insurers can offer cover for the entirety of the EUR 1.2 billion amount and for a bigger share of some of the risks that can be excluded (e.g. nuclear damage caused by acts of terrorism or extraordinary natural phenomena). With this modification, the insurance cover provided by the Swiss Confederation (federal cover, financed by premiums paid by operators) is reduced. The revised version of the ORCN entered into force on 1 January 2023.

Nuclear installations

Revision of the Ordinance on the qualification of staff working in nuclear installations and of the Ordinance on security guards at nuclear installations

The Ordinance of 9 June 2006 on the qualification of staff working in nuclear installations (OQPN, RS 732.143.1) sets out the qualifications, training and skills required of nuclear installations staff whose work is relevant to nuclear safety, as well as the conditions for staff that must obtain clearance. The Ordinance of 9 June 2006 on security guards at nuclear installations (OESN, RS 732.143.2) defines the tasks and skills of the nuclear installation security surveillance teams, their equipment, weapons and organisation, as well as the organisation of the security surveillance teams and external guards and the qualifications and skills required of the members of such teams.

In November 2022, both Ordinances were amended to reflect the practice in place since 2016 regarding annual health examinations required for nuclear installations staff and members of surveillance teams. As of 2016, the Swiss National Accident Insurance company (SUVA) stopped organising exams because, under the law on accident insurance, preventive exams are only authorised for the prevention of occupational illnesses and accidents. In contrast, the main purpose of the health examinations prescribed by both the

11. Law of 13 June 2008 on third-party liability in the field of nuclear energy (LRCN, RS 732.44).

OQPN and the OESN is not to prevent occupational illness but rather to ensure the operational security of nuclear installations. Because the Fund stopped conducting such examinations, nuclear installations' practice is to have such exams performed by external physicians or a company doctor as part of the annual health examination of nuclear installation staff, nuclear installation security surveillance teams and external guards.

The revisions of the OQPN and OESN entered into force on 1 January 2023.

United States

Licensing and regulatory infrastructure

Publication of proposed rule for the environmental review for operating licence renewal

On 3 March 2023, the United States (US) Nuclear Regulatory Commission (NRC) published a proposed rule that would amend its environmental protection regulations by updating the Commission's 2013 findings on the environmental effects of renewing the operating licence of a nuclear power plant.[12] The proposed rule addresses previous direction from the Commission to, among other things, conduct a thorough analysis of the environmental impacts of "subsequent" licence renewal (i.e. a second 20-year licence term renewal, following an "initial" 20-year licence renewal term).

NRC regulations require the preparation of an environmental impact statement (EIS) before the Agency can issue the renewal of a nuclear power plant operating licence.[13] To support the preparation of the EIS, the NRC has maintained since 1996 a "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (LR GEIS), in which the Agency has determined which environmental impacts would essentially be the same for all nuclear power plants or a subset of plants ("Category 1" issues) and which impacts could be different at different plants and would require a site-specific analysis to determine the impacts ("Category 2" issues). The LR GEIS is intended to streamline the NRC's environmental review for licence renewal by documenting a systematic approach that the NRC uses to evaluate these environmental impacts, which are then codified in 10 CFR Part 51. For each licence renewal application, Category 2 issues must be analysed by the applicant seeking renewal in the environmental report accompanying its application as well as by the NRC in a site-specific EIS that supplements the findings in the LR GEIS. The LR GEIS was last updated in 2013.

The proposed rule redefines the number and scope of the environmental issues that must be addressed during the review of each application for licence renewal. These changes in the proposed rule are based primarily on the lessons learnt and knowledge gained from initial licence renewal and subsequent licence renewal reviews performed by the NRC since the development of the last LR GEIS revision in 2013. New scientific research, public comments, changes in environmental regulations and impacts methodology, and other new information were considered in evaluating the significance of impacts associated with licence renewal. Additionally, the proposal would expand the scope of the LR GEIS to apply to subsequent licence renewals. The NRC is accepting public comments on the proposed rule through 2 May 2023.

12. Renewing Nuclear Power Plant Operating Licenses – Environmental Review, 88 *Federal Register* 13,329 (3 Mar. 2023).
13. 10 *Code of Federal Regulations* (CFR) 51.95(c). US NRC regulations allow for the renewal of nuclear power plant operating licences for up to an additional 20 years for each renewal term, with no restriction on the number of times a licence may be renewed. 10 CFR 54.31.

Update on NRC Part 53 proposed rule for risk-informed, technology-inclusive regulatory framework for advanced reactors

On 14 January 2019, the President signed the Nuclear Energy Innovation and Modernization Act (NEIMA) into law.[14] NEIMA requires the NRC to prepare the regulatory infrastructure to support the development and commercialisation of advanced nuclear reactors. Consistent with NEIMA, the NRC staff provided a proposed approach to the Commission on 13 April 2020. The Commission approved the overall approach and further directed the NRC staff to prepare and release preliminary draft rule language, followed by public outreach and dialogue, and then to further revise the language until the NRC staff established the proposed rule for Commission consideration.

On 1 March 2023, the NRC staff provided to the Commission a draft proposed rule that would establish a new 10 CFR Part 53, "Risk-Informed, Technology-Inclusive Regulatory Framework for Commercial Nuclear Plants".[15] This draft proposed rule provides two optional technology-inclusive regulatory frameworks for use by applicants for new commercial advanced nuclear reactors. The regulatory requirements developed in this rulemaking would use methods of evaluation, including risk-informed and performance-based methods, that are flexible and practicable for application to a variety of advanced reactor technologies. The draft proposed rule accommodates all reactor technologies and includes two distinct and self-contained licensing frameworks (Framework A and Framework B). The frameworks offer flexibility for the roles of risk assessment techniques and design approaches in establishing licensing basis information.

The NRC staff is seeking Commission approval to publish the draft proposed rule in the *Federal Register* for public comment. Pending Commission approval and after seeking public comment, the NRC staff plans to provide the final rule package to the Commission by December 2024 and would expect to issue the final rule by July 2025.

Update on NRC efforts towards licensing and regulating fusion energy systems

Consistent with NEIMA, the NRC is supporting the development of a regulatory framework for fusion reactors, which the NRC staff refers to as fusion energy systems, by 2027. On 3 January 2023, the NRC staff presented, for Commission approval, three options for the regulation of fusion energy systems: (1) a "utilization facility" framework, which would effectively result in fusion energy systems being regulated under the same regulatory framework as fission reactors; (2) a "byproduct material" framework, where fusion energy systems would be regulated under the Agency's existing process for regulating byproduct materials, such as tritium or material made radioactive by use of a particle accelerator; and (3) a hybrid approach, which would introduce decision criteria to license and regulate fusion energy systems under either a byproduct material or "utilization facility" regulatory approach based on an assessment of potential hazards.[16] On 13 April 2023, the Commission approved option 2 and directed the NRC staff to undertake a limited-scope rulemaking to license and regulate fusion energy systems under the NRC's byproduct material framework contained in 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," and associated regulations.[17] The Commission also directed the NRC

14. Public Law 115-439.
15. Memorandum for the Commissioners from D.H. Dorman, EDO (1 Mar. 2023), "Proposed Rule: Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors (RIN 3150-AK31)", SECY-23-0021 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML21162A093).
16. Memorandum for the Commissioners from D.H. Dorman, EDO (3 Jan. 2023), "Options for Licensing and Regulating Fusion Energy Systems", SECY-23-0001, (ADAMS Accession No. ML22273A163).
17. Memorandum to D.H. Dorman from B.P. Clark (13 Apr. 2023), "Staff Requirements – SECY-23-0001 – Options for Licensing and Regulating Fusion Energy Systems" (ADAMS Accession No. ML23103A449).

staff to develop a new volume of NUREG-1556, "Consolidated Guidance About Materials Licenses", dedicated to fusion energy systems and instructed the staff to notify the Commission and make recommendations if, in the future, anticipated fusion designs present hazards sufficiently beyond those of near-term fusion technologies.

INTERGOVERNMENTAL ORGANISATION ACTIVITY

Euratom Atomic Energy Community (Euratom)

Euratom Community activities

Adoption of the fourth report on the implementation of the Council Directive 2006/117/Euratom

On 16 February 2023, the European Commission adopted the fourth report[1] on the implementation of Council Directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste and spent fuel.[2] The report covers a three-year period and is based on the national reports submitted by the European Union (EU) member states to the Commission.[3]

The fourth report and its accompanying staff working document provide an overview of the import, export and transit authorisations for shipments of spent fuel and radioactive waste in the Community during 2018-2020, highlighting the relevant developments on implementation of the Directive as well as identifying difficulties encountered by EU member states and proposed solutions.

The report shows that in the fourth reporting period no non-authorised shipments or shipment failures were reported by EU member states. Only four cases of refusal to grant consent took place: two because of the temporary inaccessibility of the final treatment facilities and the other two because the to-be-shipped contaminated scrap metal was not considered radioactive waste by a transited EU member state. However, these materials still reached their destination under the applicable local legislation.

The most common purpose of shipments was the processing of radioactive waste – such as treatment for volume reduction or conditioning – in dedicated facilities, as well as returns of processed radioactive waste or spent fuel to the country of origin. The highest number of authorisations were issued by Sweden and Germany, both as country of origin and country of destination.

The report's main conclusions are that supervision and control of shipments of radioactive waste and spent nuclear fuel was guaranteed throughout the Community and that the current Euratom legal framework ensured the highest safety levels with respect to the risks of ionising radiation in the territory of the EU in the context of transboundary shipments.

1. Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel, *Official Journal of the European Union* (OJ) L 337 (5 Dec. 2016), pp. 21-32.
2. Report from the Commission to the European Parliament, the Council and the European Economic and Social Committee on Member States implementation of the Council Directive 2006/117/EURATOM on the supervision and control of shipments of radioactive waste and spent fuel, Fourth Report, COM(2023) 77 final (16 Feb. 2023).
3. Previously the Commission presented the first, second and third reports in 2013, 2018 and 2019 providing for the periods 2008-2011, 2012-2014 and 2015-2017, respectively.

The Commission will start preparing the fifth progress report after EU member states have submitted their national reports for the current, 2021-2023 cycle. EU member states must submit their national reports by 25 December 2023.

International Atomic Energy Agency

Nuclear safety

The Agency facilitated the second meeting of the working group (WG) established at the Organizational Meeting of the Joint Eighth and Ninth Review Meeting (Joint Review Meeting) of the Contracting Parties to the Convention on Nuclear Safety (CNS). The second meeting of the WG was held in Vienna, Austria, from 29 November to 1 December 2022. There, the WG continued its work and further discussed proposals that focused on contingency planning and business continuity, as well as proposals aimed at improving the peer review process.

An Officers' Meeting was held on 1-2 February 2023, at which the Officers of the Joint Review Meeting discussed and agreed on the final arrangements for the Joint Review Meeting.

The Agency facilitated the Joint Review Meeting of the CNS, held on 20-31 March 2023. The Joint Review Meeting had the highest level of participation by contracting parties to date, with 81 of the 89 contracting parties in attendance. At the meeting, the contracting parties reviewed and discussed the National Reports that had been submitted. Two topical sessions were held, one on ageing management and one on safety culture. The contracting parties also agreed, *inter alia*, on: the progress made since the Seventh Review Meeting; several Good Practices and Areas of Good Performances, Major Common Issues and recommendations; and the dates for the Tenth Review Meeting from 13-24 April 2026.

Code of Conduct

The Open-ended Meeting of Technical and Legal Experts for Sharing Information of States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources was held from 29 May to 2 June 2023 at IAEA Headquarters. This meeting, which also celebrated the 20th anniversary of the approval of the Code of Conduct by the IAEA Board of Governors, was attended by 276 participants from 128 states and 4 non-governmental organisations. The meeting provided an opportunity for states to share best practices and challenges related to the implementation of the Code of Conduct and to recognise the progress that the Code of Conduct has made over the last 20 years in enhancing the safety and security of radioactive sources globally. Experts attending the meeting suggested that the IAEA Director-General submit the Co-chair Report of the meeting to the Agency's policymaking organs.

Nuclear security

Outreach on the CPPNM and its Amendment

The Agency continued to promote further adherence to, and full implementation of, the Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment. It conducted regional workshops for Latin America and the Caribbean in Paraguay in November 2022 and for Africa in Zimbabwe in March 2023. It also conducted a sub-regional workshop for the Caribbean in the Dominican Republic in May 2023. In addition, the Agency continued to provide support, through national workshops, to member states in their efforts to join and fully implement the CPPNM and its Amendment.

Nuclear liability

The 23rd regular meeting of the International Expert Group on Nuclear Liability (INLEX) took place at IAEA Headquarters on 18-20 July 2023. The Group welcomed three new members and, for the first time since its establishment in 2003, a new Chair. At the meeting, the Group discussed, *inter alia*, the geographical scope of the 2004 Paris Convention, the 1997 Vienna Convention and the Convention on Supplementary Compensation for Nuclear Damage (CSC). The Group also discussed the understanding of the term "for use" provided in the 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"[4] and the related 2016 OECD Nuclear Energy Agency Steering Committee decision. In addition, the Group discussed the operator's right of recourse under the conventions and liability issues during the transport of nuclear material and those related to outer space activities, small modular reactors and nuclear fusion.

On 21 July 2023, a Workshop on Civil Liability for Nuclear Damage for diplomats from member states was held at the IAEA with the assistance of members of INLEX. The purpose of the workshop was to provide participants with an overview of the international legal regime on nuclear liability.

The Bureau of the Third Meeting of the Contracting Parties and Signatories to the CSC convened several virtual meetings since the Second Meeting of the Contracting Parties and Signatories of the CSC was held at IAEA Headquarters from 31 May to 2 June 2022. These virtual meetings were convened to discuss the arrangements of the Third Meeting, which was held in person on 6-8 June 2023 in Tokyo, Japan, followed by a visit to the Fukushima Daiichi Nuclear Power Plant and the surrounding area on 9 June 2023. The Third Meeting provided an opportunity for the Contracting Parties and Signatories of the CSC to build on the momentum created by the Second Meeting and to identify further enhanced strategies and activities aimed at promoting increased participation in the CSC worldwide. Issues related to the implementation of the CSC, including national nuclear liability frameworks, were considered during the Third Meeting. Regarding the operationalisation of the CSC's international funds, mechanisms for the collection and distribution of such funds were discussed. The Third Meeting also considered the relationship of the CSC with the Paris and Brussels Supplementary Conventions. The Meeting elected the new Bureau of the Fourth Meeting, which is planned to be held in an in-person format at IAEA Headquarters in the second fiscal quarter of 2024. The Agency once again acted as the Secretariat to support the Third CSC Meeting.

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 also provided to several member states through written comments and advice on the preparation of national nuclear legislation.

The Agency also delivered two regional workshops on nuclear law. The first workshop was held for member states in the Asia and the Pacific region in December 2022. The second workshop was held for member states in the Europe and Central Asia region in March 2023.

The Agency also held an interregional training course on nuclear law and legislative assistance in Vienna, Austria, in April 2023. The purpose of this training was to further expand the pool of experts who may be invited to assist the Office of Legal Affairs in conducting legislative assistance activities.

4. IAEA Doc. GOV/2014/63, adopted on 20 Nov. 2014.

OECD Nuclear Energy Agency

Meeting of the NEA Nuclear Law Committee (NLC)

The NLC met in person and online on 14-15 June 2023 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 59 participants representing 25 NEA member countries, the European Commission (EC), the International Atomic Energy Agency (IAEA) and the insurance industry.

The meeting featured a special session that looked at ways to evolve the NLC and its working parties to meet member country needs in the years to come. In addition, a topical session on the reciprocity principle under the nuclear liability conventions was organised to examine the reciprocity requirements provided in the conventions and national legislation. The meeting agenda also included reports by Canada, France and Poland 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, and by the EC and the IAEA on their latest activities. Finally, the Committee was also provided updates on the work undertaken by the Contracting Parties to the Paris Convention (CPPCs).

Meeting of the NEA Working Party on Nuclear Liability and Transport (WPNLT)

The NEA Working Party on Nuclear Liability and Transport (WPNLT) met in person and online on 13 June 2023 to discuss and review its ongoing work on the practical challenges related to the nuclear liability regimes applicable to transport and transit of nuclear substances. The meeting was attended by 30 participants from 14 NEA member countries, the EC, the IAEA and representatives from the nuclear insurance industry. Representatives of the International Nuclear Law Association and the World Nuclear Association also participated by reporting on their activities related to nuclear transport.

The working party continued discussing the challenges related to the qualification of nuclear substances to be transported. The agenda featured a topical session on geographical overlap of the nuclear liability conventions in case of international transport. Participants also exchanged on the considerations for the deployment of floating nuclear power plants relevant to nuclear transport. The Secretariat provided a status update on country sheets on national legislation and rules applicable to nuclear transport and transit and the results of WPNLT case studies.

Meeting of the Contracting Parties to the Paris Convention

The CPPCs met in person and online on 14 June 2023. The CPPCs provided an update on their respective national legislative and administrative processes and the status of financial securities a year and a half after the entry into force of the 2004 Protocols (1 January 2022), with a particular focus on the remaining actions to be undertaken. The meeting also featured a presentation on national developments regarding nuclear liability in the United Kingdom. In addition, the CPPCs discussed several nuclear liability-related matters that touch upon the operation and interpretation of the Paris and Brussels Supplementary Conventions.

2023 International Nuclear Law Essentials (INLE)

The tenth edition of the International Nuclear Law Essentials (INLE) course was held in Paris, France from 27 February to 3 March 2023 with a diverse group of 45 professionals from 20 countries. Renowned specialists in nuclear law from international organisations, governments, academia and private industry delivered the INLE's intensive programme, which consisted of a series of lectures, case studies and panel discussions. The classes, designed for participants of different backgrounds and career levels, touched on all aspects

of nuclear law, including: nuclear safety; management of spent fuel and radioactive waste; environmental protection; transport; nuclear security; non-proliferation; safeguards; nuclear liability; and international trade.

Recommendation of the [OECD] Council on Improving the Gender Balance in the Nuclear Sector

On 8 June 2023, the Council of the OECD, at the Ministerial level, adopted a new OECD Recommendation to help governments attract more women into the nuclear sector and develop more female leaders, ensuring its sustainability and contribution to net zero (Recommendation of the Council on Improving the Gender Balance in the Nuclear Sector, OECD/LEGAL/0496). The Recommendation aims to establish a single, comprehensive set of principles and policy recommendations to assist governments, other public authorities, and relevant stakeholders in their efforts to design and implement policies that increase the representation of women in the nuclear sector and enhance their contributions, especially in science, technology, engineering and mathematics (STEM) roles and leadership positions.

NEA forms Women in Nuclear (WiN) Global Chapter

The NEA has formed a WiN NEA Chapter to help advance the contributions of women in the international nuclear sector. This newly formed Chapter will work to establish and maintain a network for women working at the NEA, in addition to other OECD-based organisations, enabling them to exchange knowledge and experience towards advancing their role in the nuclear field. The NEA has built a strong partnership with the WiN Global network, regularly co-organising mentoring workshops for female students in addition to signing a Memorandum of Understanding in September 2022 with WiN to continue to support and encourage gender balance in the nuclear sector.

Women in Nuclear Law Initiative (WiNLI)

The Women in Nuclear Law Initiative (WiNLI) was launched in March 2023 under the framework of the partnership between WiN Global and the NEA. Until now, WiN Global has largely focused on the technical aspects of nuclear energy, but this new "Group of Expertise" presents a unique opportunity for WiN and the nuclear law community to work together. The main objective of WiNLI is to create a multidisciplinary group of nuclear law experts within the membership of WiN Global and to integrate nuclear lawyers into WiN. WiNLI aims to promote and strengthen the involvement of women in nuclear law and to enhance the attractiveness of nuclear law as an exciting and dynamic practice area. Its mission is to promote and strengthen the involvement of women in nuclear law by attracting, retaining and promoting current and future talents in this interesting and unique field. The management committee will be formed soon with initial meetings taking place shortly thereafter.

New NEA Global Forum working group on nuclear law education

The NEA Global Forum on Nuclear Education, Science, Technology and Policy was established in 2021 in partnership with academia to provide a platform for sustained co-operation among academic institutions, policymakers and key stakeholders in the nuclear energy sector and civil society. At the outset, the Global Forum established four working groups comprised of experts from primarily academic institutions and other relevant stakeholders from NEA member and non-member countries that are interested in studies and analyses in work areas related to the future of the nuclear sector, with a particular focus on educational and human capital issues. In March 2023, the Council of Advisors approved the creation of a fifth working group: Re-establishing Nuclear Law Education Programmes.

It was decided this working group was necessary because, although there are some university-level energy and environmental law programmes that offer nuclear law modules as part of wider energy and environmental law master's courses and some universities

provide an occasional course in nuclear law, the vast majority of university programmes only tangentially address nuclear energy. This is insufficient to provide the legal academic infrastructure required for the development and adaptation of nuclear law to meet the demands of the future, whether it is for new nuclear-based technologies, continued operation of current technologies, or safe spent fuel and radioactive waste management, among other topics. The call for higher educational opportunities, particularly at master's and doctoral levels, is linked to the future need for applied research capability in the nuclear law field.

The membership of this new working group will be established in the fall with its first meeting to follow soon after.

NEA publications of interest

Since the publication of *Nuclear Law Bulletin* No. 108/109, the NEA has issued a number of publications of interest.

The disposal of long-lived radioactive waste in a deep geological repository (DGR) is a scientifically and technically credible solution that meets the need for long-term safety without reliance on active monitoring and management. Nevertheless, it is important to assess the potential risks that may be associated with such a nuclear installation and to ensure that an appropriate regime is in place to adequately compensate third parties in case they suffer nuclear damage caused by a DGR. Therefore, countries developing or intending to develop DGRs must take into account nuclear third party liability regime(s) as long as they apply to the disposal facilities. Those regimes establish a specific legal system that deviates from general tort law principles, including strict and exclusive liability of the operator of a nuclear installation, which will have to maintain a compulsory financial security to cover its liability.

Given the unusually long life cycles of such installations, the report *Deep Geological Repositories and Nuclear Liability* discusses issues that concern future generations against the background of the currently applicable legal frameworks for the operation of nuclear installations, and existing technical knowledge, conscious that both will evolve. Nevertheless, it is important to identify and address potential issues regarding nuclear liability with the nuclear liability regime(s) during the different phases of operation of the DGR.

Female scientists and engineers pioneered the nuclear and radiological fields, establishing the foundation of modern nuclear science and technology. Women continue to make vital contributions to the sector, but their visibility and overall numbers in the sector remain limited, especially in STEM, and leadership roles. The lack of diversity in the sector represents a loss of potential innovation and growth and a critical threat to the viability of the field.

The report *Gender Balance in the Nuclear Sector* features the first publicly available international data on gender balance in the nuclear sector. The data was collected from over 8 000 women in the nuclear workforce in 32 countries, as well as human resources data from 96 nuclear organisations in 17 countries. Based on the findings, a comprehensive, evidence-driven policy framework is proposed with practical recommendations.

All low-carbon solutions will be required to achieve the world's net zero targets. Nuclear energy has a role to play in meeting this need. A wave of innovation in small modular reactors (SMRs) is advancing quickly with the potential to help decarbonise hard-to-abate sectors. Progress is real and is positioned to accelerate pathways to net zero. SMRs could replace coal on-grid, fossil fuel cogeneration of heat and power for heavy industry and diesel at off-grid mines, as well as produce hydrogen and synthetic fuels. Looking beyond technical feasibility, the report *The NEA Small Modular Dashboard* defines new criteria for assessing real progress in six additional dimensions of readiness: licensing, siting, financing, supply chain, engagement and fuel. This first edition tracks the progress of 21 SMRs around the world.

TÜRKİYE

NUCLEAR REGULATION LAW

Law No: 7381

Date of Publication in the Official Gazette: 8/3/2022 and No: 31772

PART ONE

Objective, Scope and Definitions

Objective and scope

ARTICLE 1- (1) The objective of this Law is to determine, based on the peaceful use principle, the fundamental principles and rules to be applied for the protection of workers, public, environment and future generations from possible harmful effects of radiation during activities regarding utilisation of nuclear energy and ionizing radiation; and to determine the responsibilities of the parties; and to define the organisation, duties and authorities of the Nuclear Regulatory Authority having regulatory control over these activities; and to define the principles regarding personal rights of the personnel of Nuclear Regulatory Authority.

(2) Activities related to nuclear energy and ionizing radiation and persons, facilities, devices and substances related to these activities are within the scope of this Law.

Definitions

ARTICLE 2- (1) In the implementation of this Law the terms used herein shall have the following meaning:

a) Ministry: the Ministry of Energy and Natural Resources,

b) President: the President of Nuclear Regulatory Authority,

c) Disposal: final storage of radioactive waste without any intention of retrieval,

ç) Regulatory control: implementation of the regulation, authorisation, evaluation and inspection activities and enforcements carried out by the Authority,

d) Release from regulatory control: the decision of the Authority stating that, within the framework of the terms and conditions set by the Authority, implementation of regulatory control is no longer required,

e) Security: taking necessary measures to prevent, detect and, when required, interfere to any theft, sabotage, any kinds of unauthorised access and other malicious attempts which target facilities and radioactive substances and maintaining the effectiveness of these measures,

f) Safety: establishing and maintaining appropriate conditions, preventing accidents or mitigating the consequences of accidents to ensure protection of workers, public, environment and future generations against radiation in the course of carrying out the activities regarding nuclear energy and ionizing radiation,

g) Decommissioning: the integrated activities for release from the regulatory control of the all or part of the facility after the decision of no further operation,

ğ) Commission: Nuclear Damage Assessment Commission,

h) Spent fuel: Fuel irradiated in the reactor that has been removed from the reactor and cannot be reused as fuel in its current state,

ı) Board: the Nuclear Regulatory Board,

i) Authority: the Nuclear Regulatory Authority,

j) Nuclear safeguards: national and international obligations intended for non-proliferation of nuclear weapons,

k) Nuclear material: isotopes and physical and chemical forms, determined by the Authority, of uranium, thorium, plutonium and other fissile materials,

l) Nuclear installation: A facility being established or operated for the purpose of extracting, producing, processing, using, holding, reprocessing or storing nuclear material,

m) NUTED JSC.: NUTED Nuclear Technical Support Joint Stock Company,

n) Paris Convention: Convention on Legal Liability in the Field of Nuclear Energy dated 29/7/1960 and the protocols amending this Convention to which the Republic of Türkiye is a party,

o) Radiation: ionizing radiation,

ö) Radiation source: Radioactive sources and devices that generate or emit radiation,

p) Radiation facility: Specially designed facility for the production, use, possession, maintenance or repair of radiation sources,

r) Radiation applications: Production, use, possession, maintenance and repair of radiation sources and export, import and transportation activities of radioactive sources,

s) Radioactive waste: Radioactive materials with radioactivity above the release limits determined by the Authority, which are decided not to be used again, or any material contaminated with radioactive material or which has become radioactive,

ş) Radioactive waste facility: a facility where radioactive waste is processed, stored or disposed,

t) Radioactive waste management: all administrative and technical activities related to collection, handling, processing, transport on site, storage or disposal of radioactive waste,

u) Radioactive source: unsealed or sealed sources produced for radiation applications by utilizing their radioactive material content,

ü) Radioactive material: the substances containing an isotope or isotopes which emit radiation by spontaneous decay of their nuclei, including nuclear material, radioactive sources and radioactive waste,

v) TENMAK: Turkish Energy, Nuclear and Mineral Research Agency,

y) Facility: Nuclear facility, radiation facility or radioactive waste facility,

z) Authorised person: a natural or legal person who has been granted license, permit, approval or certificate by the Authority for the implementation of an activity within the scope of this Law.

(2) In the implementation of Chapter Five, for definitions that are included in the Paris Convention but not in this Law and nuclear material in subparagraph (k) of the first paragraph, nuclear facility in subparagraph (1); the definitions in the Paris Convention are valid.

PART TWO

General Principles

General Principles

ARTICLE 3- (1) The natural or legal persons, who carry out any activity regarding nuclear energy, are obliged to comply with international treaties and agreements regarding nuclear safeguards that Republic of Türkiye is a party of.

(2) The following principles shall apply to any activity involving the risk of radiation exposure of workers, public, environment and future generations:

a) The activity shall be beneficial for the individuals or the society,

b) Radiation doses that may be exposed to due to the activity shall be kept at as low as reasonably achievable levels,

c) Radiation doses that may be exposed to due to the activity shall not exceed the dose limits established by the Authority.

(3) Activities related to nuclear energy and radiation and persons, facilities, devices and materials related to these activities are subject to regulatory control in terms of safety, security and nuclear safeguards. The exemptions to be granted regarding regulatory control and the limits and conditions of these exemptions are determined by the regulation by the Authority on the basis of the graded approach, so as to meet the security and safety requirements.

(4) For the activities within the scope of this Law, prioritising the provision of safety and security is essential.

(5) It is essential to inform the people who may be affected by this risk regarding all kinds of activities that will cause the risk of radiation exposure to the workers, the public, the environment and future generations.

(6) Administrative actions and actions of other public institutions and organisations regulating or supervising activities which are within the scope of this Law in the fields which are not within the scope of this Law, shall not be established in a way that impairs safety, security and nuclear safeguards.

(7) Provisions of other legislation that fail to meet the safety, security and nuclear safeguards requirements are not applicable to the activities within the scope of this Law. In this case, the Authority may make additional arrangements to ensure safety, security, and nuclear safeguards.

PART THREE

Authorisation and Inspection

Authorisation

ARTICLE 4- (1) Activities within the scope of this Law shall not be implemented without authorisation from the Authority. The natural or legal persons who want to carry out an activity are obliged to apply to the Authority. The Authority determines the activities that require notification or authorisation on the basis of safety and security principles.

(2) It is obligatory to obtain a license from the Authority to operate a nuclear facility, radiation facility, radioactive waste facility and to carry out radiation applications. Only the citizens of the Republic of Türkiye or legal persons established in accordance with the legislation of Republic of Türkiye may obtain licenses from the Authority.

(3) The activities that require permission from the Authority are as follows:

a) For the nuclear facility preparation of the site, manufacturing the equipment determined by the Authority, constructing the facility, commissioning, decommissioning, re-start of operation, and modifications related to safety and security of the installation,

b) Commissioning and decommissioning of radiation facility and modifications related to safety and security of the facility,

c) Construction, commissioning, decommissioning, closure of the radioactive waste facility, and making changes concerning safety and security in the facility,

ç) Export, import, transportation, transit of radioactive materials,

d) Within the scope of nuclear safeguards, the export of substances, materials, equipment, systems, components and related technology and nuclear dual-use substances, materials, equipment, systems, components and related technology specially designed or prepared for use in the nuclear field,

e) Import of substances, materials, equipment, systems, components or related technology determined by the Authority within the scope of nuclear safeguards,

f) Other activities determined by the Authority taking into account safety security, and nuclear safeguards.

Regarding the permits to be granted within the scope of subparagraphs (d) and (e) of this paragraph, the comments of the relevant ministries is received by the Authority.

(4) The activities within the scope of this Law that require certificate from the Authority are as follows:

a) Legal persons that provide training on radiation protection to the personnel who will take part in the activities,

b) Persons who will provide services for radiation protection,

c) Personnel to take part in the activities,

ç) Persons manufacturing equipment,

d) Companies performing third party surveillance.

The Authority may impose an obligation to obtain certificates on persons for their services provided to authorised persons which may affect safety, security, and nuclear safeguards.

(5) The Authority determines the necessary authorisation conditions for an activity it has authorised, including the conditions to be complied with regarding safety, security and nuclear safeguards.

(6) The license, permit and authorisation certificate issued by the Authority must not be transferred.

(7) The applicants for authorisation are obliged to provide all the information and documents requested by the Authority for authorisation in the required format and content and pay the determined fees.

(8) Processes regarding notifications and authorisations, authorisation conditions, application, scope and validity periods of authorisations, as well as issues regarding renewal, restriction, suspension, cancellation or authorisation of another person for a previously authorised activity are determined by the Authority by taking the opinion of the relevant ministries.

Responsibilities of the authorised person

ARTICLE 5- (1) Authorised legal persons shall, within the framework of the conditions of the authorisation granted and bearing all responsibilities;

a) Provide radiation protection, safety and security during the activity,

b) Ensure that the activity is carried out by sufficient number of competent personnel with a safety and security culture,

c) Provide the necessary organisational structure, equipment and financial resources to carry out the activity in a safe and secure manner,

ç) Ensure that the necessary training is given to the personnel,

d) Perform safety and security assessments at the frequency determined by the Authority,

e) Carry out its activities with an appropriate management system,

f) Keep the records, make notifications and reporting as defined in legislation and its management system,

g) Submit to the Authority all information and documents required by the Authority in the required form, content and scope,

ğ) Conduct research and investigation required by the Authority regarding safety and security or have them conducted,

h) Fulfil its obligations concerning nuclear safeguards,

ı) Within the scope of inspections conducted by the Authority, perform required corrective and preventive activities within the period of time,

i) Carry out on-site management of radiation emergencies, co-operate with the Disaster and Emergency Management Presidency and other relevant institutions and organisations in the management of off-site emergencies,

j) As a result of the assessments, fulfil additional obligations related to safety, security and nuclear safeguards as determined by the Authority,

k) Provide the conditions for releasing from regulatory control.

(2) Authorised real persons carry out the activities for which they are authorised, in accordance with the relevant legislation and authorisation conditions, giving utmost importance and priority to safety and security.

(3) The authorised person has the prime responsibility to ensure safety and security in an activity or at a facility. To comply with the terms and conditions of a granted authorisation and related legislation or to be under regulatory control or delegation or contracting to outsource its responsibilities, shall not reduce or remove the responsibility of the authorised person.

(4) The authorised person must not abandon the site of operation or facility, nuclear material, radioactive source or radioactive waste unless their obligations related to the activity ends.

(5) The authorised persons must fulfil the financial obligations under this Law.

(6) The authorised person's responsibilities end with the release from regulatory control. Dismissal of the authorised person, restriction, suspension or cancellation of his/her authority and similar situations shall not relieve him/her of his/her responsibility. In such cases, if the Authority evaluates that there is a weakness in terms of security, safety and nuclear safeguards, all kinds of measures to ensure security, safety and nuclear safeguards may be taken by the Authority, provided that the legal and financial responsibility belongs to the authorised person.

Approval

ARTICLE 6- (1) The site where nuclear facilities, radiation facilities or radioactive waste facilities will be established is subject to the approval of the Authority. The Authority may determine other matters subject to approval, taking into account radiation protection, safety, security and nuclear safeguards regarding its activities.

(2) The Authority may enforce approval and determine the compliance criteria for activities that may affect the protection of workers, the public, the environment and future generations from radiation.

Inspection and on-site examination

ARTICLE 7- (1) The activities and authorised persons within the scope of this Law are subject to the inspection of the Authority. Within the scope of the authorisation, the Authority may also inspect the activities of the contractors, subcontractors, suppliers and sub-suppliers of the authorised persons. Inspections may be conducted, scheduled or unscheduled, announced or unannounced, at any day of the year and at any time of the day, including public holidays.

(2) Within the scope of inspection and on-site examination, the Authority may receive technical support services from specialised public institutions and organisations, authorised private legal entities and natural persons to investigate, research, detect and report, in such a way that the results are not binding for the Authority.

(3) The provisions of the Law on Construction Inspection dated 29/6/2001 and numbered 4708 and Provisions of the Zoning Law dated 3/5/1985 and numbered 3194 on technical liability do not apply to the structures to be built on the sites of the licensed nuclear facilities and radioactive waste facilities. All responsibility for these structures belongs to the authorised person. The control of these structures is carried out by the Authority. This situation does not remove the responsibility of the authorised person partially or completely. Inspections can also be carried out together with public institutions and organisations that are specialised in this field. The demands of the Authority within this scope are met by specialised public institutions and organisations without delay.

(4) In addition to the supervision of the Authority; authorised legal entities receive services from authorised companies for third party surveillance of activities determined by the Authority, including the inspection of structures related to nuclear facility or radioactive waste facility. The activities, authorities and responsibilities of these companies and the procedures and principles regarding service procurement are determined by the Authority by regulation.

(5) The persons, who are subject to inspections shall be obliged to provide all necessary conditions and take all safety measures in order for the inspectors of the Authority and the persons appointed by the Authority to perform their duties freely and on time.

(6) Those subject to nuclear safeguards inspections, shall comply with their obligations indicated in the relevant legislation during the inspections performed under the international obligations related to nuclear safeguards inspections by the inspectors of International Atomic Energy Agency, who are approved by the Republic of Türkiye. These inspections are accompanied by the Authority representative.

(7) Authorised persons pay the fees determined by the Authority for the inspections of the Authority.

(8) The works and procedures related to the inspection and on-site examination the type and scope of the inspection and the issues related to the Authority's inspectors are determined by the Authority by a regulation.

Inspectors of the Authority

ARTICLE 8- (1) **Inspectors** of the Authority are authorised by the Board from among Authority personnel who have the qualifications determined by the Authority. **Inspectors** of the Authority and other Authority personnel assigned to accompany the inspection, has the authority to enter relevant places or facilities for inspection purposes; to supervise the activities and inspect them on the spot; to meet with the people they deem necessary and to conduct examinations, research and investigations on the issues they deem necessary; requesting, examining, retaining or taking copies of all kinds of information, documents and records; to take, remove, retain, properly dispose of or have any material or sample; to make or have measurement, analysis, inspection and testing using any device; to keep visual, audio or written records.

(2) Personnel assigned by the Authority to accompany the inspection or to carry out on-site examinations, and those who receive service in accordance with the second paragraph of Article 7 or their personnel have the authority to enter the relevant places or facilities, meet with the people they deem necessary; has the authority to examine and copy all kinds of information, documents and records, to take any material or sample, to measure, analyse, examine and test using any device, and to keep visual, audio or written records.

(3) In cases where safety or security is endangered or may be compromised and delay of the intervention is inconvenient, the inspector of Authority shall immediately notify the Authority and the authorised person. In this case, the Authority may take the necessary measures, including the suspension or limitation of all or part of the authorised activity.

(4) The inspector of the Authority may request law enforcement from the local authorities during the inspection, when necessary. In this case, local administrators and law enforcement officers provide the necessary support to the inspectors of the Authority without delay.

PART FOUR

Radioactive Wastes, Used Fuels and Special Accounts

Radioactive waste and spent fuels

ARTICLE 9- (1) Radioactive waste generated by an activity implemented outside the area of jurisdiction of the Republic of Türkiye must not be brought into the territory of the Republic of Türkiye.

(2) The provision of the first paragraph shall not apply to radiation sources produced within the borders of the Republic of Türkiye and exported with the condition of being returned to the country of origin when their usage period expires and the transit passage of radioactive wastes and the importation of materials contaminated with natural radioactive materials.

(3) Radioactive waste must not be released or left to the environment.

(4) Regarding the activities implemented;

a) All responsibility for the management of the spent fuels or radioactive wastes excluding their disposal belongs to the person authorised for the activity,

b) Radioactive wastes produced as a result of any activity carried out in the facilities are stored at the facility until they are transferred to another authorised person,

c)The spent fuels generated in nuclear power plants are stored at the nuclear power plant site throughout the operational life,

ç) Authorised person who produces spent fuel or radioactive waste as a result of his activities; is responsible for all kinds of transportation of them inside or outside the facility. All kinds of responsibility for the radioactive wastes that will arise during the decommissioning activities belong to the authorised person,

d) Radioactive wastes generated as a result of activities carried out in the sovereignty area of the Republic of Türkiye are disposed of by TENMAK,

e) If an orphan radioactive material is detected, TENMAK co-operates with the relevant institutions and organisations and takes the necessary measures, and carries out the necessary work and procedures, including disposal,

f) Work and procedures related to the radioactive materials used during an activity carried out without a valid authorisation or the management of the radioactive wastes produced are carried out by TENMAK, at the expense of the relevant person, upon the notification of the Authority. TENMAK informs the relevant person in writing that the expense incurred in this context must be paid within one month's payment period. In case the said expenses are not paid by the relevant person on time, they are followed up and collected by TENMAK in accordance with the Law on Collection Procedure of Public Receivables dated 21/7/1953 and numbered 6183,

g) Authorised person; carries out the necessary decommissioning works without delay so that the nuclear facility, radiation facility and radioactive waste processing and storage facility areas can be released from regulatory control in accordance with the re-use conditions. Radioactive waste disposal facilities are closed after safety and security measures are taken and cannot be released from regulatory control except for limited use of the site.

(5) When the authorised person exports the radioactive waste in accordance with the relevant legislation or delivers it to another authorised person for processing, storage or disposal, the responsibility of the authorised person for the radioactive waste within the scope of this Law ends.

(6) The procedures and principles regarding the safe management of radioactive wastes and spent fuels, their release, and the issues related to orphan radioactive materials shall be determined by the Authority by a regulation.

(7) TENMAK, taking the opinions of the authorised persons, prepares the National Radioactive Waste Management Plan Draft, which is the basis for determining the national radioactive waste policy and strategy regarding the management of radioactive wastes and spent fuels, until the end of the years ending with (0) and (5) and submits it to the Ministry. The Ministry determines the National Radioactive Waste Management Plan by taking the opinion of the Authority.

(8) Works and procedures regarding the environmental improvement of areas exposed to radioactive pollution as a result of an activity carried out outside the scope of this Law are carried out by the Ministry of Environment, Urbanization and Climate Change in co-operation with the Authority. The management of radioactive wastes generated in these areas is done by TENMAK. All costs within the scope of this paragraph shall be borne by the polluter.

Special Accounts

ARTICLE 10- (1) Persons who produce radioactive waste during an activity subject to authorisation make a contribution payment to the special account of radioactive waste management in the amount to be determined in accordance with the second paragraph. Persons authorised to operate nuclear facility, radiation facility and radioactive waste facilities make a contribution payment to the special accounts for decommissioning, in the amount to be determined in accordance with the second paragraph. Radioactive waste management special account and decommissioning special accounts are opened at the central accounting unit of the Ministry. Revenues collected on behalf of special accounts cannot be used for any other purpose.

(2) The Accounts Management Board determines the contributions to be paid to special accounts for nuclear power plants per unit of electricity produced (kilowatt hour), and the amount of guarantees per installed power (megawatt). For other facilities and applications, the contributions to be paid to special accounts and the amount of guarantees; are determined by the Accounts Management Board, taking into account the type of facility and application, the class, amount and activity of the waste. Contributions to be paid to special accounts and the amount of guarantees are reviewed every year and updated to cover the foreseen expenses. However, the provisions governing the matters covered by this paragraph in international agreements are reserved.

(3) Revenues of radioactive waste management special account and decommissioning special account consist of contributions and guarantees to be paid, revenues obtained from the evaluation of special account revenues, donations and other revenues.

(4) Payment is made to TENMAK from the radioactive waste management special account to perform these transactions:

a) Determination of the areas where a radioactive waste disposal facility can be established and related field studies,

b) The design, authorisation, construction, operation, maintenance, closure and releasing the radioactive waste disposal facility from regulatory control,

c) Research and development activities for the purposes specified in this paragraph.

(5) Payment is made to authorised person from the decommissioning special account to perform these transactions:

a) Decommissioning of nuclear facilities, radiation facilities and radioactive waste facilities, including the costs of disposal of radioactive wastes generated during decommissioning,

b) Bringing the facility site into compliance with the re-use conditions.

(6) Payments to be made to the chairman and members of the Accounts Management Board, as well as payments to be made within the scope of independent auditing and consultancy services regarding the operation of special accounts, administrative expenses and litigation expenses are covered from special accounts, according to their interests.

(7) In case the amount in the special account for radioactive waste and decommissioning is insufficient due to expenses that may be incurred during decommissioning or related to radioactive waste management, or due to early decommissioning of the facility, the costs shall be covered by the guarantee provided by the authorised person. If the guarantee is insufficient, the remaining amount is collected from the authorised person. Taking into account the amount accumulated in the special account, the amount of financial guarantee in question is determined again upon the request of the authorised person.

(8) Persons who apply for authorisation to operate the facilities submit the cost plan for decommissioning to the Ministry. The decommissioning special account is followed for each plant separately.

(9) Revenues collected in special accounts are outside the scope of the Law No. 4749 dated 28/3/2002 on the Regulating Public Finance and Debt Management.

(10) Contributions not paid on time are followed up and collected in accordance with the Law No. 6183, upon notification to be made by the Ministry to the tax office to which the debtor is affiliated. The amounts collected by the tax office are transferred to special accounts until the end of the month following the collection date.

(11) Issues regarding the acquisition, follow-up, collection, remuneration, expense, accounting, auditing of special account revenues, operation of special accounts, cost plan for decommissioning, preparation and submission of cost plan for radioactive waste management shall be determined by the Ministry by regulation.

Accounts Management Board

ARTICLE 11- (1) An Accounts Management Board shall be established to manage the revenue of special accounts and to approve payments from special accounts. The Accounts Management Board shall consist of two representatives each from the Ministry and the Ministry of Treasury and Finance, a representative from TENMAK and a representative of legal entities operating nuclear power plants within the borders of the Republic of Türkiye, not exceeding three of these institutions and one member representing other facilities and applications. In order to be elected as a representative, it is necessary to fulfil the general conditions of being appointed to the civil service as specified in the Civil Servants Law No. 657 dated 14/7/1965, to complete at least four years of higher education and to have worked in the public and/or private sector for at least five years. One of the representatives of the Ministry acts as the chairman. The meeting and decision quorum is five.

(2) The term of office of the members of the Accounts Management Board is three years. Members whose term of office has expired can be reappointed. Members of the Accounts Management Board, whose term of office is completed, continue to serve until new ones take office.

(3) If the members have lost the necessary conditions for their appointment, other than not having a conviction, or that they misused the income collected on behalf of special accounts, or that they did not attend three consecutive meetings of the Accounts Board of Directors without permission and excuse, or that they did not attend five Accounts Board of Directors meetings in a calendar year and this is determined by decision of the Board, their duties shall end at the time of such determination. The duties of the members whose conviction decision has been finalised due to the crimes they have committed in relation to special accounts or in a way that hinders their assignment shall end as soon as the decision is finalised.

(4) Memberships vacant for any reason before the expiration of their term of office, excluding renewal, are assigned within fifteen days. Those who are appointed in this way complete the remaining term of office of the member to whom they are appointed.

(5) The works and procedures related to the special account for radioactive waste management and the special account for decommissioning and the secretariat of the Accounts Management Board are carried out by the Ministry.

(6) An attendance fee shall be paid to the chairman and members of the Accounts Management Board at the amount of multiplication of civil servant salary coefficient with the indicator number of 20 000.

(7) No authorisation can be made for the operation of the facility without the adequacy of the guarantee that the necessary costs for radioactive waste management and decommissioning can be covered against the possibility of early decommissioning of the facility being reported to the Authority by the Accounts Management Board.

(8) Members of Accounts Management Board are punished as if they were public officials for the crimes they committed in relation to their duties.

(9) Matters regarding the working procedures and principles of the Accounts Management Board and the procedures and principles regarding the election of representatives other than public representatives shall be determined by the Ministry by regulation.

PART FIVE

Legal Liability for Nuclear Damage

Operator's responsibility

ARTICLE 12- (1) In cases where there is no provision in this Law on nuclear damage caused by nuclear incidents, the provisions of the Paris Convention shall apply.

(2) Damages arising from radioisotopes used or to be used outside a nuclear facility and for industrial, commercial, agricultural, medical, scientific or educational purposes that have reached the final stage of production or damage caused by nuclear materials in quantity and activity below the limits set by the Paris Convention are outside the scope of this Section.

(3) On nuclear damage caused by nuclear incidents; Legal person authorised to operate a nuclear facility by the Authority or by the authorities in its country, legal person who established a nuclear facility in the period before the license to operate a nuclear facility is obtained, in the period until a new operator is determined after the cancellation of the license granted to operate the nuclear facility, the legal entity whose license is cancelled is considered as the operator.

(4) The operator is responsible for nuclear damages and payment of indemnities, regardless of whether he, his personnel and the technology, goods and service providers of the facility have any fault in the occurrence of the nuclear incident.

(5) The operator shall not be liable for nuclear damage resulting from a nuclear incident directly caused by an armed conflict, hostile acts, civil war or insurrection.

(6) The operator is solely responsible for compensation for nuclear damage caused by a nuclear incident under the provisions of the Paris Convention and this Chapter.

(7) The cancellation, suspension or restriction of the operator’s authorisation from the Authority does not relieve the operator of its responsibilities under this Section.

(8) In case the operator proves that the nuclear incident causing nuclear damage is caused by the will or gross negligence of the nuclear damaged person; operator, may be relieved of responsibility in whole or in part only against this person who suffered nuclear damage by the decision of the competent court.

(9) In the application of this Section, more than one nuclear facility operated by an operator at the same site is considered a single facility.

Limits of the operator's liability

ARTICLE 13- (1) The liability of the operator for each nuclear incident under this Section is limited to the amounts;

a) 700 million Euros for nuclear reactors with a thermal power of more than ten megawatts and other nuclear facilities to be determined by the assessment to be made before the license to be given by the Authority to operate a nuclear facility,

b) 70 million Euros for nuclear facilities not covered by subparagraph (a),

c) 80 million Euros for the transport of nuclear materials,

ç) 700 million Euros for the transit passage of nuclear materials within the borders of the Republic of Türkiye.

(2) The liability amounts specified in the first paragraph are applied in relation to the damages occurred in other countries, within the framework of the reciprocity principle, limited to the amount of liability applied for the nuclear damages arising from the nuclear incident in that country.

Obligation of the operator to take out insurance or provide financial guarantee

ARTICLE 14- (1) Operators are obliged to take out an insurance or show another guarantee for each nuclear facility or transport activity, in the amount of the upper limit determined in Article 13, at the time and in accordance with the conditions determined by the Authority.

(2) The operator is obliged to take out an insurance or provide a guarantee in the amount of eighty million Euros for the transit passages of nuclear materials to be made in the sovereignty area of the Republic of Türkiye.

(3) The operator must not start the related activities until the insurance contracts or the documents submitted regarding the guarantee are approved by the Authority.

(4) The operator shall take out a new insurance or renew the guarantee before the expiry date of this insurance or financial guarantee, instead of the expiring insurance or guarantee. The renewed insurance or financial guarantee is notified to the Authority. The conditions regarding the termination of the obligations of the Operator in this context are determined by the Authority.

(5) The insurance or financial guarantee specified in the first and second paragraphs must not be suspended or cancelled without giving a written notice to the Authority at least two months in advance by the insurance company or the nuclear insurance pool or the guarantee giver. In case the said insurance or financial guarantee is related to the transportation of nuclear materials, the insurance or financial guarantee must not be suspended or cancelled during transportation.

(6) The insurance or the guarantee provided is only used for the compensation of nuclear damage in the event of a nuclear incident.

(7) In the event that the operator is a public administration within the scope of the central government in accordance with the Public Financial Management and Control Law No. 5018 dated 10/12/2003 or is fully owned by the public, the operator may be exempted from the obligation to take out insurance or provide financial guarantee. In this case, the procedures and principles regarding how the nuclear damage caused by the nuclear incident will be committed by the State shall be determined by the President's decision.

(8) The procedures and principles regarding the implementation of this article shall be determined by a regulation to be prepared jointly by the Authority and the Insurance and Private Pension Regulation and Supervision Agency.

Nuclear insurance pool

ARTICLE 15- (1) A nuclear insurance pool is established to provide insurance for the Operator's obligations set out in this Section. The procedures and principles regarding the functioning of the nuclear insurance pool shall be determined by the Insurance and Private Pension Regulation and Supervision Agency by taking the opinion of the Ministry and the Agency.

(2) The operator may partially or fully obtain the insurance or guarantee obligations specified in this Section from domestic or international markets, or may request insurance from the nuclear insurance pool.

(3) In case the operator cannot find insurance or guarantee or the insurance or guarantee offered by the operator is less than the amounts specified in Article 13, the missing amount shall be covered in accordance with the procedures and principles to be determined by the President.

(4) In the event that the existing insurance or coverage does not meet the amounts specified in Article 13 after a nuclear incident, the missing amount is covered in accordance with the procedures and principles to be determined by the President of the Republic and is revoked to the operator.

Compensation for nuclear damage

ARTICLE 16- (1) The form and amount of compensation for nuclear damage are determined in accordance with the Turkish Code of Obligations dated 11/1/2011 and numbered 6098, based on the principle of flawless and exclusive responsibility.

(2) Separate payments shall be made to the nuclear damaged person pursuant to the legislation on social insurance, private insurance and general health insurance shall be deducted from the compensation amount to be received by the nuclear damaged person in accordance with the provisions of this Chapter.

(3) Recourse provisions of the legislation on social insurance, private insurance and general health insurance are reserved.

Direct claim or right of action

ARTICLE 17- (1) Subject to the provisions of the second paragraph of Article 18, persons who have suffered nuclear damage may demand the compensation of their damages directly from the operator, within the limits of their liability, as well as from the insurer, nuclear insurance pool and other collateral providers.

(2) Reserving the applicable provisions to the second paragraph of Article 18, a lawsuit may also be filed directly against the persons specified in the first paragraph with a claim for compensation

(3) Persons who acquire rights under this Section by subrogation or transfer of claim may exercise the rights in the first and second paragraphs.

Nuclear Damage Assessment Commission

ARTICLE 18- (1) In cases where the nuclear damage is expected to exceed the limits of liability amount specified in Article 13, within two months at the latest from the date of the nuclear incident, Nuclear Damage Assessment Commission shall be established by The President of Republic of Türkiye to evaluate and decide on the applications made by the victims of nuclear damage for compensation for the nuclear damage caused by the nuclear incident and this matter shall be announced in the Official Gazette and other appropriate means. The expenses of the commission are covered from the budget of the Ministry.

(2) In the event that a Commission is established pursuant to the first paragraph, the nuclear damage caused by the nuclear incident shall be compensated by the Commission. The amount that falls within the liability limit of the operator is collected by the Ministry of Treasury and Finance from the operator or its insurer or by converting the guarantee shown by the operator into cash.

(3) With the announcements it will make, the Commission, by giving a period of at least one year and determining the expiry date, requests the persons suffering from nuclear damage to apply to the Commission or other authorities to be determined. In cases brought by persons who suffered nuclear damage for the purpose of determination or compensation of nuclear damage before the establishment of the Commission, it is decided that there is no need for a court decision and that the expenses incurred by the parties be left on them, based on the file, no attorney's fee is awarded. These case files should be sent to the Commission for examination without seeking a new application requirement.

(4) In cases where the total amount of compensation to be paid to the applicants who are duly exceeds the liability amount limit, the Commission makes a payment plan to allocate the amount constituting the liability amount limit. In the payment plan, loss of life or damage to people's health is primarily compensated. For the part where the limit of liability is exceeded, the President takes the measures he deems appropriate.

(5) A lawsuit is filed in Ankara administrative courts against the decisions taken by the Commission.

(6) The commission consists of seven members. Members are determined by the President from among public officials. The commission elects a President and a deputy chairman, by election from among its members. The meeting and decision quorum of the commission is four. Members are deemed to be on paid leave from their Authorities during their duties in the Commission. Members continue to receive their financial and social rights from their Authorities. Attendance fee is paid to the members of the commission over the amount to be found by multiplying the indicator number (30.000) with the monthly coefficient of the civil servants for each month. The qualification, working procedures and principles, secretariat, announcement and application procedure of the members of the commission, determination of nuclear damage, determination of priority in the compensation of nuclear damage, payment of compensation, procedures and principles regarding urgent economic measures to be taken by the President of the Republic of Türkiye and other matters related to the implementation of this article shall be determined by the Presidency by regulation.

Right of recourse and statute of limitations

ARTICLE 19- (1) The operator, the insurer, the nuclear insurance pool, other guarantees and the State have the right of recourse against the natural person who deliberately caused the nuclear incident that caused the nuclear damage.

(2) The operator has the right of recourse against the person with whom he has made the contract, in the scope and manner specified in the contract, if it is expressly stated in the contract between them.

(3) Except for the cases where nuclear damages are covered, claims for damages regarding the liability specified in this Chapter are time-barred by the expiration of three years, if the statute of limitations specified in the fourth paragraph has not yet been completed, from the date the person who suffered the nuclear damage learns about the damage and its responsible.

(4) Claims for compensation for loss of life and damage to health of persons become time-barred, in any case, after thirty years from the date of the nuclear incident, and claims for compensation for other nuclear damage ten years from the date of the nuclear incident.

(5) The right of recourse becomes time-barred after three years from the person having the right to recourse learns of the person to whom the recourse will be made and from the payment of the compensation, and in any case ten years from the date of payment of the full compensation.

Authorised court

ARTICLE 20- (1) Regarding a nuclear incident that took place in the sovereignty of the Republic of Türkiye or in accordance with the Paris Convention and the Joint Protocol on the Implementation of the Vienna and Paris Conventions dated 21/9/1988 to which the

Republic of Türkiye is a party, in cases where Turkish courts have jurisdiction, only the Republic of Türkiye courts are competent.

(2) In case the courts of the Republic of Türkiye are authorised pursuant to the first paragraph, the Ankara courts are definitively authorised.

(3) In the event that the Commission is not established pursuant to Article 18, the court may decide to make a temporary payment to the persons who suffered nuclear damage in accordance with Article 76 of the Law No. 6098, not exceeding the liability limit determined under this Section.

PART SIX

Nuclear Regulatory Authority

Authority

ARTICLE 21- (1) The Authority cannot be given obligations that will weaken its regulatory activities, contradict these activities or prevent it from carrying out its activities effectively. The property and assets of the Authority are considered State property. The property, assets, rights and receivables of the Authority must not be seized or pledged.

(2) In case the income of the Authority does not cover its expenses, the difference is covered from the general budget. Authority receivables that are not paid in due time are followed up and collected in accordance with the general provisions, together with the interest calculated at the rate of late fee determined in Article 51 of the Law No. 6183. Matters regarding the transaction and service fees to be implemented by the Authority shall be determined by the Authority in a regulation.

(3) The Authority may make contracts up to five years with the decision of the Board. The accounting year of the Authority is the fiscal year.

Personnel

ARTICLE 22- (1) Nuclear Regulatory Specialist and Nuclear Regulatory Assistant Specialist are employed in the Authority within the framework of the additional provisions of Article 41 of Law No. 657.

(2) The procedures and principles regarding the qualifications, recruitment, training and training of the personnel to be employed in the Authority, the issues regarding the examination to be held for those who will be appointed to positions other than the administrative positions and positions subject to the additional Article 41 of the Law No. 657, as well as the professional and ethical principles to be followed by the personnel of the Authority while fulfilling their duties are determined by the Authority by regulation.

(3) Faculty members whose expertise is needed in relation to the main duties of the Authority may be temporarily assigned to the Authority upon the request of the President, without considering the time requirement specified in the relevant legislation, provided that it does not exceed ten percent of the number of staff of the Authority. Those who are appointed in this way can be paid in the amount determined by the President of the Republic, without being subject to the regulations and restrictions in other laws, provided that it does not exceed five times the monthly amount stipulated in the fourth paragraph of Article 38 of the Higher Education Law dated 4/11/1981 and numbered 2547.

(4) Regarding the issues requiring special knowledge and expertise in relation to the field of responsibility of the Authority, domestic and foreign experts may be employed as contracted personnel for the execution of the duties assigned in this Law, notwithstanding the provisions of Law No. 657 and other laws regarding the employment of contracted personnel. These are deemed to be under coverage of social security in accordance with the subparagraph (a) of the first paragraph of Article 4 of Social Security and General Health Insurance Law No. 5510 dated 31/5/2006. The amount of the salary, including all kinds of payments to be made to foreign experts to be employed as contract personnel and to domestic experts who have actually worked in the field of nuclear energy

abroad for at least five years, must not exceed fourteen times the contract salary ceiling applied for those employed in accordance with subparagraph (B) of Article 4 of the Law No. 657, determined by the President of Republic of Türkiye. The total number of contracted personnel that can be employed cannot exceed twenty percent of the number of personnel positions of the Authority. The issues concerning the persons to be employed in this way shall be determined by the President of the Republic of Türkiye.

(5) To the Chairman and members of the Board and the personnel of the Authority working in the Authority subject to the Law No. 657; Payments made within the scope of financial and social rights to peer personnel determined in accordance with the additional Article 11 of the Decree-Law dated 27/6/1989 and numbered 375 are paid within the framework of the same procedures and principles Those payments being made to the equivalent personnel and not being subject to taxes and other deductions shall also not be subject to taxes and other deductions for the personnel of the Authority, in accordance with this Law. The Chairman and members of the Board and the personnel of the Authority are considered equivalent to the personnel determined as a precedent in terms of retirement rights. Those appointed to the Chairman and membership of the Board and the personnel working in the Authority subject to Law No. 657 are subject to the provisions of subparagraph (c) of the first paragraph of Article 4 of the Law No. 5510. For those who are appointed as Board members while under the coverage of social security in accordance with the subparagraph (c) of first paragraph of Article 4 of the Law No. 5510, the service period on these positions shall be taken into consideration while determining tier and level of acquired right salary when their term of appointment ended. For those who are appointed as Board members while under the coverage of social security in accordance with the subparagraph (c) of first paragraph of Article 4 of the Law No. 5510, the service period on these positions shall be taken into consideration while determining tier and level of acquired right salary when their term of appointment ended. Amongst these, for those who are in the scope of temporary Article 4 of the Law No. 5510 the period of time spent in these assignments shall be regarded as the period for which the special position allowance and representation allowance must be paid. Those who are appointed as Board members and Chairman while they are under social security coverage in a public institution or organisation within the scope of subparagraph (a) of first paragraph of Article 4 of Law No. 5510 are not required to be discharged from their previous institutions or organisations, or it is not required to make severance payment or termination compensation to them. For those who are in this situation The service periods for which the severance payment or termination compensation are to be paid are combined with their service periods as the Board members and Chairman, and this period shall be accounted for the time of retirement bonus payment.

(6) Chairman and Members of the Board are subject to the provisions of Law No. 2531 dated 2/10/1981 on the Works that must not be Conducted by Former Public Employees.

(7) Chairman and Members of the Board take an oath in front of the Board of First Presidency of the Court of Cassation on performing their duties with full attention, honesty and impartiality; not violating the provisions of the law and not letting them be violated in duration of their term of appointment. The application for the oath shall be regarded as an urgent work by the Court of Cassation. Chairman and Members of the Board shall not be regarded to take office until they have taken the oath.

(8) For alleged offenses committed in connection with their duties by the Board members and Chairman or Authority's personnel, minister is entitled to allow investigations for the Board members, and President is entitled to allow investigations for the Authority's personnel. For alleged offenses collectively committed in connection with their duties by the Board members and the Authority's personnel, the associated minister is entitled to allow investigations for Authority's personnel. The investigations and prosecutions against the Chairman, Board members and the personnel of the Authority due to the alleged offenses in relation to their duties shall be followed by an attorney to be assigned by the Authority if requested by the relevant member or the personnel even if they have left their positions. The expenses of the relevant lawsuit and the attorney's fee shall not exceed 15 times of the attorney's fee defined in the minimum fee tariffs stated by the Union of Turkish Bar Associations, is compensated from the budget of the Authority. If a verdict of conviction is reached for Chairman, a board member or a personnel of the

Authority as a result of prosecution and if this verdict is definite, the attorney fee paid from the Authority's budget shall be collected from that board member or personnel in accordance with the general provisions.

PART SEVEN

NÜTED Nuclear Technical Support Joint-Stock Company

NÜTED Nuclear Technical Support Joint-Stock Company

ARTICLE 23- (1) In order to provide technical support services such as all kinds of analysis, consultancy, surveillance, examination, research, inspection, testing, control, training and certification that the Authority may need while performing its duties, excluding the provisions regarding establishment and registration, 13/1/2011 A joint stock company with private law legal personality under the title of NÜTED Nuclear Technical Support Joint Stock Company, subject to the provisions of the Turkish Commercial Code No. 6102 and private law, with an initial capital of one million Turkish Liras, paid by the Authority, at least fifty percent of the shares belong to the Authority was established.

(2) NÜTED JSC may provide services to third parties in the country and abroad, if the Authority deems it appropriate.

(3) Personnel subject to the Labour Law dated 22/5/2003 and numbered 4857 are employed at NÜTED JSC Upon the request of NÜTED JSC, expert and competent personnel from specialised public Authorities and organisations can be employed at NÜTED JSC Their relations with their Authorities end with the conclusion of the employment contract. The wages to be paid to them and other financial and social rights are determined by the employment contract. Those who are employed in this way return to their former positions or positions, excluding the managerial staff and duties in the Authorities or organisations they previously worked, upon their application within six months following the end of their duties at NÜTED JSC. Pursuant to this paragraph, the services of persons who have returned to their previous Authorities at NÜTED JSC. are evaluated according to their status, in their monthly degrees and levels. In this case, severance payments are not paid due to their work at NÜTED JSC. and these periods are taken into account in the calculation of the retirement bonus.

(4) NÜTED JSC may sign an employment contract to regulate the rights, powers and obligations regarding the execution of the works and services to be provided to the Authority.

(5) NÜTED JSC, regardless of the proportion of public share in its capital, has the force of law on the amendment of the legislation on the general staff and procedure, and some Laws and Decrees Regarding Civil Servants and Other Public Officials No. 527 dated 18/5/1994. Decree-Law No. 657, with the exception of Article 12, Decree-Law on Regulations on the Financial and Social Rights of Civil Servants and Other Public Officials and No. 631, dated 4/7/2001. In accordance with the provisions of the Public Procurement Law dated 22/1/2002 and numbered 4734, the Public Procurement Contracts Law dated 5/1/2002 and numbered 4735, the Allowance Law No. 6245 dated 10/2/1954 and the Vehicle Law No. 237 dated 5/1/1961. is not subject to. NÜTED JSC Contracts to be drawn up between the Authority and the Authority are exempt from stamp tax. Provisions of the relevant legislation regarding the recruitment of personnel to public Authorities and organisations NÜTED JSC It does not apply to personnel to be employed by the Company. However, the provisions of Article 9 of the Law on the Regulation of the Audit of State Economic Enterprises and Funds by the Turkish Grand National Assembly, dated 2/4/1987 and numbered 3346, regarding the audit of the Turkish Grand National Assembly shall apply.

(6) Without prejudice to the duties and authorities of the Authority, the execution of the works and services specified in this article, other administrative and commercial services related to them are provided by NÜTED JSC. The President of the Republic of Türkiye is authorised to make arrangements regarding the procedures and principles regarding the conduct of the company, establishing a company at home and abroad, becoming a partner in established companies or acquiring shares.

PART EIGHT

Criminal Provisions and Administrative Sanctions

Criminal provisions

ARTICLE 24- (1) The following penalties shall apply to those who have committed the acts listed in this paragraph:

a) Persons who operate a nuclear facility, radiation facility or radioactive waste facility without a valid license are subject to imprisonment from four to eight years and a judicial fine of 5 000 days; persons who carry out radiation practices without a valid license are subject to imprisonment from one year to four years and a judicial fine of 1 000 days; persons who carry out activities related to nuclear facilities, radiation facilities or radioactive waste facilities that require permission from the Authority, without a valid permit, are subject to imprisonment from two to five years and a judicial fine of 3 000 days,

b) Persons who leave the place or facility where the activity is carried out, nuclear material, radioactive source or radioactive waste without an owner, before their obligations regarding the activity expire, are subject to imprisonment from three years to eight years and a judicial fine of 5 000 days,

c) Nuclear material, radioactive source and radioactive wastes; Persons who obtain it by force, threat, cheating or any other unlawful act are punished with imprisonment from five years to fifteen years and a judicial fine of 10 000 days, unless the act does not constitute a crime requiring a heavier penalty,

ç) Persons who cause nuclear material, radioactive source or radioactive wastes to be lost, stolen or to reach the hands of unauthorised persons, by negligence or in violation of the duty of care and attention, shall be subject to imprisonment from two years to five years,

d) Apart from the exceptions specified in the second paragraph of Article 9, persons who deliberately bring radioactive wastes or spent fuel into the borders of the Republic of Türkiye are subject to imprisonment from five years to ten years and a judicial fine of 5 000 days,

e) Persons who interfere with, attack, damage or sabotage nuclear facilities, radiation facilities, radioactive waste facilities and nuclear materials, radioactive sources or radioactive wastes are subject to imprisonment from five to fifteen years and a judicial fine of 10 000 days,

f) Persons who interfere with, attack, damage or sabotage nuclear facilities, radiation facilities, radioactive waste facilities and software related to nuclear materials, radioactive sources or radioactive wastes are punished with imprisonment from three years to ten years and a judicial fine up to 10 000 days,

g) Persons who seize, seize or control a nuclear facility, radiation facility or radioactive waste facility by using force or threat or by any other unlawful act are subject to imprisonment from twelve years to twenty years,

ğ) Persons who manufacture nuclear or radiological weapons, possess radioactive materials for this purpose, use them, promote their use or trade them are subject to imprisonment from twenty-five years to thirty years.

(2) In case the acts listed in the first paragraph are carried out with the aim of forcing a natural or legal person, an international organisation or a state to do or refrain from doing an act, the penalty to be imposed is increased from half to two times according to the gravity of the act.

(3) In case the acts listed in the first paragraph are committed within the framework of an organisational activity, the penalty to be imposed is increased from half to one fold according to the gravity of the act.

Administrative sanctions

ARTICLE 25- (1) In the case of detection of existence of the acts indicated in this paragraph, the following administrative fines shall be imposed by the Authority:

a) In case of operation of a nuclear installation without a valid license; from 2 733 000 to 136 623 000 Turkish Liras, in case of operation of a radioactive waste facilities and radiation facilities without a valid license from 1 367 000 to 13 663 000 Turkish Liras, in case of conduct of radiation practices without a valid license from 28 000 to 274 000 Turkish Liras,

b) In case of implementation of the activities requiring permits related to the facilities without acquiring a permit, from 137 000 to 638 000 Turkish Liras; in case of implementation of the activities requiring permits related to others without acquiring a permit, from 10 000 to 45 000 Turkish Liras; in case of conducting the activities requiring certificate without acquiring the certificate, 5 000 to 200 000 Turkish Liras,

c) In case of determination of violation of the legislation or authorisation conditions regarding nuclear facilities, the decisions and instructions of the Authority, from 274 000 to 2 733 000 Turkish Liras; in case of determination of violation of the legislation or authorisation conditions regarding radioactive waste facilities and radiation facilities, the decisions and instructions of the Authority, from 137 000 to 638 000 Turkish Liras; in case of determination violation of the legislation or authorisation conditions regarding other activities, the decisions and instructions of the Authority, from 4 000 to 28 000 Turkish Liras,

ç) In the applications made for authorisation or after the authorisation is made, in the event that the authorised person submits an untrue document to the Authority or gives misleading information or does not notify the changes in the authorisation conditions that will affect the authorisation, without prejudice to the penalty provisions, from 2 733 000 to 136 623 000 Turkish Liras for nuclear facilities, from 1 367 000 to 13 663 000 Turkish Liras for radioactive waste facilities and radiation facilities, from 28 000 to 270 000 Turkish Liras for other activities.

(2) In addition to the administrative fines applied pursuant to the first paragraph, an appropriate time is given to the person concerned by the Authority to rectify the violations. If the violations are not remedied within the given time, administrative fines are applied in the amount of twice the previous penalty each time. If it is determined that the false document, misleading information or the change in the authorisation conditions are the basis for the authorisation and it is determined that it is not possible to correct it, the authorisation is suspended, restricted or cancelled in addition to the administrative fine.

(3) In case it is determined that the acts listed in the first paragraph cause destruction in a way that poses a threat to the health and safety of the public or the environment, the administrative fine to be imposed is increased by one fold. In addition to the administrative fine, the Authority may restrict or suspend the license or permit for the duration of the risk posed by the actions on the public and the environment. The Authority may revoke the license or permit depending on the severity of the risk to the public and the environment.

(4) The operators who fail to fulfil the obligation to take out insurance or provide collateral specified in Article 14 are subject to an administrative fine of three-thousandths of the liability limit.

(5) In case of determination of violation of the provisions in Article 14, the licenses and permits required for the execution of the relevant nuclear activity are suspended by the Authority until the obligation to take out insurance or provide collateral or renew the expired insurance policy or guarantee. Licenses and permits are revoked within one year from the date of suspension, if the said obligation is not fulfilled within three years, provided that it is justified by the authorised person and the justification is approved by the Authority.

(6) In case of cancellation of an authorisation, starting from the date of cancellation;

a) Three months for activities that require a certificate of authorisation,

b) Six months for activities requiring a permit,

c) One year for activities requiring a license.

No re-authorisation application can be made by the same person for the activity subject to the authorisation cancelled for a period of time, and these persons are not authorised by the Authority.

(7) Administrative fines are paid within one month from the date of notification. A lawsuit can be filed against administrative fines in administrative courts within thirty days. Applying to the judiciary against the administrative fines applied does not stop the collection procedures, except in the case of issuing a bank letter of guarantee regarding the administrative fine to the relevant tax office. The amount and type of the letter of guarantee, the conditions under which it will be converted into money and other issues are determined by the Authority.

(8) In case the act constituting the violation is committed again by the same person within two years from the date of committing, the administrative fine is applied by increasing one fold each time. In case same act that requires an administrative fine is not committed again within two years from the date of these penalties, the previous penalties will not be taken as basis.

(9) The implementation of administrative sanctions does not remove the obligation of the authorised persons to take safety and security measures.

(10) In case the Authority evaluates that the safety and security of radioactive materials cannot be ensured and this situation may threaten the protection of the public, workers, environment and future generations from radiation, the Authority may take or have the necessary measures taken, including detention, transportation and disposal. The requests of the Authority within this scope are met by the relevant public Authorities and organisations without delay. Expenses incurred in this context are collected from the person concerned.

(11) The implementation of administrative sanctions according to this Law shall not prevent the implementation of other provisions of this Law. Penalties and measures taken pursuant to this Law shall not prevent actions to be taken pursuant to other laws. Implementation of the penalties in Article 24 shall not prevent the implementation of administrative sanctions.

(12) Implementation principles regarding the administrative sanctions to be applied within the scope of this article; The degree of fault, the weight of the violated interest, and the economic situation of the violator are determined by the Authority by a regulation. Administrative sanctions to be applied and the amount of administrative fine; The type and characteristics of the facility and activity, the possibility of exposure to radiation, the magnitude of the radiation to be exposed, the presence and magnitude of the damage are determined with a graded approach.

(13) The Board is authorised to decide on administrative sanctions. Board; Administrative fine, restriction, suspension or cancellation of authority may apply administrative sanctions together or separately.

(14) In cases where there is no provision in this Law regarding the administrative sanctions to be applied pursuant to this article, the provisions of the Misdemeanour Law No. 5326 of 30/3/2005 shall apply.

PART NINE

Miscellaneous and Final Provisions

Miscellaneous Provisions

ARTICLE 26- (1) In the implementation of this Law, the special provisions in international agreements on co-operation on the establishment and operation of nuclear power plants are reserved.

(2) References made to the Turkish Atomic Energy Authority, which is closed in the legislation regarding the regulatory control of activities involving the use of nuclear energy and radiation, shall be deemed to have been made to the Authority.

(3) References to the Legislative Decree on the Organization and Duties of the Nuclear Regulatory Authority and No. 702, dated 2/7/2018 and amended in the legislation, shall be deemed to have been made to this Law.

Changed and repealed provisions

ARTICLE 27- (1) (It is related to the Law No. 657 of 14/7/1965 and has been replaced.)

(2) (It is related to the Law on Exemptions and Some Regulations of the Turkish Atomic Energy Authority dated 9/7/1982 and numbered 2690 and has been replaced.)

(3) (It is related to the Public Procurement Law No. 4734 dated 1/1/2002 and has been replaced.)

(4) (It is related to the Law on Establishment and Operation of Nuclear Power Plants and Energy Sales dated 9/11/2007 and numbered 5710 and has been replaced.)

(5) (It is related to the Law on Irrigation Unions No. 6172 dated 8/3/2011 and has been replaced.)

(6) (It is related to the Electricity Market Law No. 6446 dated 14/3/2013 and has been replaced.)

(7) The Decree-Law on the Organization and Duties of the Nuclear Regulatory Authority and Amending Some Laws, dated 2/7/2018 and numbered 702, has been repealed.

Transition Provisions

PROVISIONAL ARTICLE 1- (1) The personnel subject to the Law No. 657, who were the personnel of the Authority on the date of enter into force of this Law, shall be deemed to have been appointed to the positions of the Authority in accordance with their acquis, while protecting all their financial and social rights. Those who benefit from the provision of the provisional article 16 of the Law No. 375, among the personnel of the Authority, continue to have these rights as long as they are in the said positions.

(2) Until the regulations specified in this Law enter into force, the current regulations shall continue to be implemented. Undecided current authorisation applications are concluded in accordance with the provisions of the legislation in force before the effective date of this Law. In order to comply with this Law, the Authority may impose new conditions for authorisation, with a Board decision, and may grant an additional period of up to three years for the fulfilment of these conditions. References made to the closed Turkish Atomic Energy Authority regarding the duties, powers and fields of activity of the Authority in the legislation that is still in effect are deemed to have been made to the Authority.

(3) All authorisations made until the date of entry into force of this Law continue to be valid and the obligations of authorised persons continue to the Authority. The Authority may impose additional obligations on authorised persons with a Board decision in order to comply with this Law, and may grant an additional period of up to three years for the fulfilment of these obligations.

(4) Financial resources may be transferred to the special account of radioactive waste management as a debt from the appropriation allocated for this purpose, up to five years from the date of entry into force of this Law, until the income is sufficient to cover its expenses. This transferred resource shall be deposited in the Ministry's central accounting unit account to be recorded as revenue in the general budget, by applying legal interest, starting from the year following the year in which the revenues of the special account reach 30 percent of its expenses.

(5) From the date of publication of this Law until the commissioning of all units of the first nuclear power plant, in case the revenues of the Authority are more than its expenses, the difference is transferred to the next year's budget.

(6) In order to comply with the provisions of Article 23, the current articles of association of NÜTED JSC are amended and announced by making necessary changes.

(7) The implementation of the existing regulations and transactions regarding NÜTED JSC. that are not contrary to the provisions of this Law shall continue until new regulations and transactions are established.

(8) As of the date of publication of this Law, to be employed in the Authority on behalf and on behalf of the Authority, Persons who are entitled to be sent abroad within the scope of the Law on Requests to be Sent to Foreign Countries dated 8/4/1929 and numbered 1416 and amongst those whom have been sent abroad and continue their education, those who completed their postgraduate studies shall be appointed to Nuclear Regulatory Assistant Specialists positions and those who completed their doctorate studies shall be appointed to the Nuclear Regulatory Specialists positions after returning home, from the country they were sent, to fulfil their compulsory service obligations.

(9) As of the effective date of this Law, the provision of subparagraph (f) of the fourth paragraph of Article 9 shall apply to the goods containing radioactive material that are kept in customs areas and cannot be returned to their origin.

Enforcement

ARTICLE 28- (1) This Law enters into force on the date of its publication.

Execution

ARTICLE 29- (1) The provisions of this Law shall be executed by the President.

PRESIDENTIAL DECREE ON ORGANISATION AND DUTIES OF THE NUCLEAR REGULATORY AUTHORITY

Presidential Decree No: 95

Date of Publication in the Official Gazette: 8/3/2022 - No: 31772

PART ONE

Initial Provisions

Purpose

ARTICLE 1- (1) The purpose of this Presidential Decree is to regulate the procedures and principles regarding the establishment, functioning, duties, powers and responsibilities of the Nuclear Regulatory Authority, its organisation and personnel.

(2) Activities related to nuclear energy and ionizing radiation and persons, facilities, devices and substances related to these activities are within the scope of this Law.

Definitions

ARTICLE 2- (1) In the implementation of this Presidential Decree the terms used herein shall have the following meaning:

a) Ministry: the Ministry of Energy and Natural Resources,

b) President: the President of Nuclear Regulatory Authority,

c) Presidency: Presidency of the Nuclear Regulatory Authority,

ç) Regulatory Control: Within the scope of the Nuclear Regulatory Law dated 5/3/2022 and numbered 7381, the regulation, evaluation, authorisation and inspection activities carried out by the Nuclear Regulatory Authority and the implementation of sanctions,

d) Board: the Nuclear Regulatory Board,

e) Authority: the Nuclear Regulatory Authority,

f) Authorised person: Real or legal person, to whom a license, permit or authorisation certificate has been given by the Authority for the execution of an activity within the scope of Law No. 7381.

PART TWO

Organisation, Duties and Authorities

Organisation

ARTICLE 3- (1) In order to protect workers, the public, the environment and future generations from the possible harmful effects of radiation during the conduct of activities related to nuclear energy and radiation, and to fulfil the duties given by the Law No. 7381, this Presidential Decree and other relevant legislation, the Nuclear Regulatory Authority, whose short name is "NDK", has been established as a public legal and administrative entity. The headquarters of the Authority is in Ankara. The ministry with which the Authority is associated is the Ministry of Energy and Natural Resources.

(2) The Authority consists of the Board and the Presidency.

(3) The Authority independently fulfils and uses the duties and powers given to it by Law No. 7381, this Presidential Decree and other relevant legislation. Authority decisions must not be subject to expediency control. No organ, authority or person can give orders or instructions to influence the decisions of the Authority.

(4) The Authority freely uses its financial resources allocated to it within the framework of the procedures and principles specified in the relevant legislation.

Activities, topics and areas to be regulated by the Authority

ARTICLE 4- (1) The Authority shall regulate the following activities, topics and areas:

a) Radiation protection of workers, public, environment and future generations,

b) Safety, security and nuclear safeguards in the activities regarding nuclear energy and radiation,

c) All activities related to the building, operation, decommissioning and closure of nuclear installations, radiation facilities and radioactive waste facilities,

ç) Extraction, production, transportation, storage, export, import, trade, possession, transfer, processing, reprocessing and use of nuclear materials,

d) Production, transportation, storage, export, import, trade, possession, transfer, use, installation, modification, dismantling, maintenance and repair of radiation sources,

e) The possession, transfer, processing, transportation, storage, export, import and disposal of radioactive wastes,

f) Export and import of substances, materials, equipment, systems, components or related technology determined by the Authority within the scope of nuclear safeguards,

g) Radiation emergency management,

ğ) The qualifications and training of the personnel related to the activities within the scope of its duties and authorities,

h) Other issues, areas and activities that fall under the scope of its duties and authorities and to be determined by the Board.

The Duties and Authorities of the Authority

ARTICLE 5- (1) The duties and authorities of the Authority are:

a) To determine the strategy, goals and working principles of the Authority,

b) To carry out regulatory operations regarding issues within the scope of its duties and authorities,

c) To grant authorisations; to define and modify the technical, legal, administrative and financial scope and conditions of the authorisations; to restrict, suspend, end, revoke the granted authorisations; to determine and modify the term of the authorisations; to review and assess the information and documents submitted to the Authority for or after the authorisation; to define and modify the conditions of the granted authorisation in view of the concluded evaluations,

ç) To inspect or examine on-site of the activities or authorised persons before and after the authorisation,

d) To request and evaluate all kinds of required information and documents from the persons who apply to the Authority for authorisation and are authorised, to use this information and documents in compliance with the confidentiality requirements,

e) To determine the issues that require approval within the scope of safety, security, nuclear safeguards and radiation protection, to give approval and to bring compliance criteria when necessary,

f) To request the authorised person to carry out an assessment on safety, security, and nuclear safeguards and to request from the authorised person, under the condition of having financial responsibility and legal liability, to take additional measures according to the results of the assessment,

g) To carry out works and procedures related to administrative sanctions within the scope of Law No. 7381,

ğ) To determine whether the authorised persons have fulfilled their obligations related to the insurance or financial guarantee for nuclear liability and related to the special accounts of radioactive waste and decommissioning,

h) To establish and operate the national radiation sources recording system, national dose registry system, national nuclear material accounting and control system,

ı) To conduct the national radiation monitoring activity or to have it conducted,

i) To co-operate with the institutions and organisations of other countries and international organisations, to participate in joint activities or to co-ordinate the activities carried out with these organisations within the scope of its duties and authorities,

j) To inform relevant national or international organisations about extraordinary events,

k) To have carried out research and development activities in the field of safety and security necessary to support its regulatory activities,

l) To exchange information, co-operate and communicate directly with public and private institutions and organisations, non-governmental organisations and the public,

m) To determine regulatory activities, decisions and opinions to be sent to national and international institutions and organisations, and to be disclosed to the public,

n) To request all kinds of necessary information and documents related to a subject from all natural and legal persons including public institutions and organisations and/or to examine them,

o) To determine the training programs for radiation protection for the personnel who take part in the activities of the authorised persons and determined by the Authority, to ensure that training is given, to carry out the works and procedures related to examination and certification,

ö) To co-operate with the Disaster and Emergency Management Authority and relevant institutions and organisations in the management of radiation emergencies that may occur as a result of activities not under regulatory control.

(2) The Authority co-operates with other authorised institutions and organisations in terms of emergency planning and response, the health of the public and employees, protection of the environment, legal responsibility in the nuclear field, water use and food consumption, land use and planning, transportation of dangerous goods and other areas of which it is a stakeholder, in terms of safety and security, and gives advice to institutions and organisations.

PART THREE

Duties and Responsibilities Regarding Co-ordination

Duties and Responsibilities Regarding Co-ordination

ARTICLE 6- (1) The following duties and responsibilities for ensuring safety and security during the execution of activities within the scope of Law No. 7381, this Presidential Decree and other relevant legislation are fulfilled by relevant institutions and organisations:

a) Necessary co-operation and support regarding the security of nuclear facilities, radioactive waste facilities and radioactive materials are provided by the Ministry of Foreign Affairs, the Ministry of Interior, the Ministry of National Defense, the Presidency of the National Intelligence Organization and other relevant institutions

and organisations. For nuclear power plants and radioactive waste facilities, the co-ordination within this scope is carried out by the Ministry,

b) Off-site security of nuclear facilities and nuclear materials is carried out by the Ministry of Interior with the support of authorised persons and relevant public institutions and organisations. In case of unexpected inadequacies regarding the on-site safety of the nuclear facility and nuclear materials, whose responsibility belongs to the authorised person, and upon the request of the authorised person or the Authority, the Ministry of Interior takes the necessary temporary measures to ensure on-site security,

c) The minimum requirements for radiation sources and equipment used for medical purposes, quality, market surveillance and inspection, and the issues related to the protection of patients and their companions from radiation are regulated by the Ministry of Health, with the approval of the Authority,

ç) The format of the radiological effects sections of the environmental impact assessment report is determined by the Ministry of Environment, Urbanization and Climate Change, with the approval of the Authority,

d) Issues regarding on-site management of radiation emergencies are regulated by the Authority, and issues regarding off-site management are arranged by the Disaster and Emergency Management Presidency, with the approval of the Authority. Authorised persons and relevant public institutions and organisations act in co-operation in the management of off-site emergencies to be carried out under the co-ordination of the Disaster and Emergency Management Presidency,

e) In the transport of radioactive materials, safety and security issues are regulated by the Authority, and other issues are regulated by the Ministry of Transport and Infrastructure, with the approval of the Authority,

f) Matters related to radiation controls at the entry points of the country. It is regulated by the Ministry of Commerce with the approval of the Authority. The authority provides technical evaluation support for radioactive materials detected in radiation controls,

g) Disaster and Emergency Management Presidency, Turkish Energy, Nuclear and Mineral Research Agency and related institutions and organisations act in co-operation with the Authority within the scope of fulfilling obligations arising from international agreements and contracts regarding radiation emergencies,

ğ) Radon accumulation in buildings, radioactivity in building materials and drinking and utility water, radiation that may be exposed due to activities carried out in underground and aboveground workplaces such as hot springs, caves, mines, natural radiation exposure situations such as radiation to which flight personnel are exposed, related public institutions and It is arranged by the institution by taking the appropriate opinion of the Authority. The authority has power to determine special conditions in terms of radiation protection related to these situations and to inspect compliance with these conditions.

PART FOUR

Nuclear Regulatory Board

Nuclear Regulatory Board

ARTICLE 7- (1) The Board is the decision making body of the Authority and consists of five members appointed by the President, one of whom is the President and the other the Second-Chairman. The President appoints the President and the Vice President along with the appointment.

(2) In case the membership becomes vacant for any reason, an appointment is made to the vacant membership within two months at the latest, within the framework of the principles set forth in this article. Persons appointed in this way complete the term of office of the member they are appointed to replace. Those who are unable to perform their

duties for more than six months due to serious illness, accident or any other reason, who do not attend three consecutive Board meetings or five Board meetings in a calendar year without any excuse, excluding valid excuses such as duty, leave or illness, meet the requirements for their appointment. Members of the Board, whose disappearance is determined by the Board or whose conviction for the crimes they have committed in connection with their duties has become final, shall be deemed to have withdrawn from their duties. The Board notifies this situation to the Ministry.

Prohibitions

ARTICLE 8- (1) Members of the Board may publish for scientific purposes, give lectures and conferences, and receive the royalties arising from these, as well as the tuition and conference fees, in a way that does not hinder their essential duties. However, unless it is based on a special law, he must not take on any official or private duty other than the execution of his official duties at the Authority, must not be a manager in associations, foundations, co-operatives and similar places, must not engage in trade, engage in self-employment activities, must not work in partnerships or organisations in the sector and field that the Authority is authorised to regulate and supervise, must not be a shareholder, must not act as an arbitrator or expert.

(2) Members of the Board are obliged to assure and declare that their spouses, adopted children, relatives up to the third degree, and relatives up to the second degree are not shareholders in the organisations that the Authority is responsible for organizing and supervising, starting from the date they take office. A member who does not act in accordance with this paragraph within thirty days from the date of taking office shall be deemed to have withdrawn from membership.

(3) The members of the Board and the personnel of the Authority must not disclose the confidential information they have learned during their duties to anyone other than those authorised in accordance with this Presidential Decree and special laws, and must not use them for their own benefit or for the benefit of others. This obligation continues even after leaving office. Persons and organisations from whom the Authority purchases goods, services and consultancy services and their employees are also subject to the provision of this paragraph.

(4) Those who make a contract with the Authority to carry out services such as consultancy or advocacy through the purchase of services are obliged to notify the Authority of this situation in case they do other work related to the field of activity of the Authority during the contract period. If the Authority decides that these works will cause inconvenience, it terminates the service or mandate contract.

The duties and authorities of the Board

ARTICLE 9- (1) The duties and authorities of the Board are:

a) To issue regulations regarding activities covered by Law No. 7381, this Presidential Decree and other relevant legislation, and to take decisions regarding other regulatory transactions, authorisations and approvals,

b) To determine strategy on subjects related to the field of duty of the Authority and to accept the strategic plan of the Authority,

c) To decide on the personnel policy of the Authority,

ç) To approve the annual activity report and annual budget of the Authority and to decide on transferring between budget items when deemed necessary,

d) To decide on the subjects of participation in international organisations related to the duty field of the Authority, payments to these organisations, and to contribute to the projects about the duty field of the Authority performed by these institutions and the international organisations that are members of the Republic of Türkiye,

e) To decide on the co-operation to be made with the institutions and organisations of other countries related to the duty and jurisdiction of the Authority,

f) Determining process and service fees,

g) To decide on transactions related to the receivables, rights and debts of the Authority with third parties, when necessary, to decide on compromise, acquittal, cancellation and arbitration,

ğ) To decide to abandon the litigation and enforcement proceedings that are not deemed beneficial in the follow-up or transfer to the higher judicial authorities,

h) To decide on the purchase, acquisition, sale and lease of immovable property to the Authority,

ı) To perform other duties assigned by Law No. 7381.

(2) The Board; Among the duties, authorities and authorisations given to the Board by Law No. 7381, it may delegate its powers to the President, except for the authorisation of nuclear facility, radiation facility and radioactive waste facilities and the approval of the site where these facilities will be established.

Working principles of the board

ARTICLE 10- (1) The Board shall conduct meetings at least once a week with an agenda. The meeting agenda determined by the President shall be delivered to the members at least two working days before the meeting. The issues that are not included in the agenda of the meeting may be raised by the President. The President calls the Board to convene in urgent cases. The Board convenes with at least three members and makes decisions with at least three members' votes in the same direction. Members shall not cast abstaining vote. The Board may invite the personnel of the Authority or other persons who are not assigned in the Authority, that participations to meeting are considered to be useful by the Board, to receive opinions on subjects that require expertise in case of need in the meetings.

(2) Board members must not participate in the meeting and voting on matters related to themselves, their spouse, their adopted children and their relatives by blood, including third degree, and in-laws, including second degree.

(3) The working procedures and principles of the Board are determined by the Authority with a regulation.

PART FIVE

Presidency Organisation

Presidency

ARTICLE 11- (1) The Presidency consists of the President, two vice presidents and the service units.

President

ARTICLE 12- (1) The President is responsible for the general management and representation of the Authority. The Chairman of the Board is also the President of the Authority. The duties and powers of the President are:

a) To determine the agenda, day and time of the meetings of the Board, to manage the meetings, to give the final form to the suggestions from the service units, and to submit these suggestions to the Board,

b) To ensure the preparation of the strategic plan, annual activity report, annual budget, financial statements and other related reports of the Authority, and to submit the related documents to the Board,

c) To make distribution of tasks among the vice-presidents, to ensure the efficient and harmonious operation of service units, to solve the duty and authority issues between the service units of the Authority, to assign additional duties, authorities and responsibilities to the service units, when necessary, within the scope of Law No. 7381 and other relevant legislation,

ç) To determine the performance criteria of the personnel of the Authority, excluding the member of the Board and to evaluate the performance of the personnel of the Authority according to these criteria,

d) To make assignments of personnel,

e) To ensure that the decisions of the Board are fulfilled and to follow-up its implementation,

f) To provide public access to reports on the activities of the Authority, without prejudice to national security, safety, trade secret and protection of the personal data,

g) To give information or statement to the press and media organs on behalf of the Authority,

ğ) To ensure the implementation of the Authority's budget,

h) To carry out relations with other institutions and organisations,

ı) To ensure the fulfilment of the obligations under the international agreements within the field of duty of the Authority,

i) To take necessary measures, including the temporary suspension or restriction of all or part of the authorised activity, in cases where the safety or security gets into danger or may be at risk, and where the delay of intervention is regarded as inconvenient,

j) To perform other duties related to the management and operation of the Authority.

(2) In the absence of the President for any reason, the Second-chairman shall act as the President. In the absence of the President and the Second-chairman, a member of the Board determined by the Board to fulfil the duties of the Board, and the Vice President designated by the President to perform the duties of the President, shall deputize to the President.

Vice-Presidents

ARTICLE 13- (1) Two Vice-Presidents may be appointed to assist the President in his duties related to the Presidency. The units that the vice presidents will be responsible for are determined by the President.

Service Units

ARTICLE 14- (1) The Authority consists of the following service units:

a) Department of Nuclear Facilities,

b) Department of Radiation Applications,

c) Department of Security and Safeguards,

ç) Department of Radiation Protection,

d) Department of Inspection,

e) Department of External Relations,

f) Department of Legal Services,

g) Department of Strategy Development,

ğ) Department of Support Services,

h) Media and Public Relations Consultancy,

ı) Board Services Directorate.

(2) In order to fulfil the duties assigned to the service units, group presidencies may be established, the number and distribution of which is determined by the decision of the Board.

(3) Where deemed necessary, units affiliated with the centre may be established by the decision of the Board regarding the activities falling within the scope of the Authority's duty and authority.

Department of Nuclear Facilities

ARTICLE 15- (1) The duties and powers of the Department of Nuclear Installations are as follows:

a) To carry out the necessary works and procedures regarding notification, authorisation and approval for the implementation of regulatory control in order to ensure safety in nuclear installations,

b) To determine the procedures and principles of the service to be purchased from private law legal entities for the third party surveillance of the activities determined by the Authority, including the inspection of structures, by legal entities authorised for nuclear facilities, and to determine the activities, powers and responsibilities of these persons and to carry out the works and procedures related to the authorisation of the persons who will provide services in this field,

c) To carry out the work and procedures regarding the authorisation of the manufacturers of the equipment determined by the Authority and other persons who will serve the authorised persons,

ç) To carry out the works and procedures regarding the authorisation of the personnel to work in the duties determined by the Authority, in the matters falling within its scope of duty and authority,

d) To follow up the fulfilment of the obligations related to insurance or guarantee regarding legal liability and special accounts in the nuclear field,

e) To carry out the works and procedures related to the removal of regulatory control in matters falling within its scope of duty and authority,

f) To carry out a safety assessment regarding the findings that are not positively closed by the Department of Inspection in matters falling within its scope of duty and authority, to identify the non-conformities and to carry out the works and procedures related to these,

g) To determine the issues that may require administrative sanctions in matters falling within its scope of duty and authority, to carry out the works and procedures related to administrative sanctions in co-ordination with the Department of Legal Services,

ğ) To perform other duties assigned by the President.

Department of Radiation Applications

ARTICLE 16- (1) The duties and powers of the Department of Radiation Applications are as follows:

a) To carry out the necessary works and procedures regarding notification and authorisation for the implementation of regulatory control in order to ensure safety and security related to the production, use, possession, maintenance and repair activities of radiation sources,

b) To carry out the necessary works and procedures regarding notification, authorisation and approval for the implementation of regulatory control in order to ensure safety in radiation facilities,

c) To follow up the fulfilment of the obligations regarding special accounts,

ç) To carry out the works and procedures regarding the authorisation of the personnel to work in the duties determined by the Authority, in the matters falling within its scope of duty and authority,

d) To establish, operate and develop the national radiation sources registration system, to keep and maintain records related to radiation sources in co-ordination with the relevant service units,

e) To carry out the works and procedures related to the removal of regulatory control in matters falling within its scope of duty and authority,

f) To carry out a safety assessment regarding the findings that are not positively closed by the Department of Inspection in matters falling within its scope of duty and authority, to identify the non-conformities and to carry out the works and procedures related to these,

g) To determine the issues that may require administrative sanctions in matters falling within its scope of duty and authority, to carry out the works and procedures related to administrative sanctions in co-ordination with the Department of Legal Services,

ğ) To perform other duties assigned by the President.

Department of Security and Safeguards

ARTICLE 17- (1) The duties and powers of the Department of Security and Safeguards are as follows:

a) To carry out the necessary works and procedures regarding notification and authorisation for the implementation of regulatory control in order to ensure safety and security regarding the export, import, transportation and transit activities of radioactive materials,

b) To carry out the necessary works and procedures regarding notification and authorisation for the implementation of the regulatory control regarding the import and export of the substance, material, equipment, system, component or related technology determined by the Authority within the scope of nuclear safeguards,

c) To carry out the works and procedures related to the implementation of regulatory control in order to ensure safety in nuclear facilities, radiation facilities and radioactive waste facilities,

ç) To carry out nuclear safeguards activities at nuclear facilities and other relevant places, to establish, operate and develop the national nuclear material counting and control system,

d) To carry out the works and procedures related to the authorisation of the personnel to work in the duties determined by the Authority, in the matters falling within its scope of duty and authority,

e) To inspect or examine on-site activities and authorised persons in the field of security and nuclear safeguards,

f) To accompany the International Atomic Energy Agency in nuclear assurance inspections, to co-ordinate the inspections in question,

g) To carry out the works and procedures related to the removal of regulatory control in matters falling within its scope of duty and authority,

ğ) To carry out a safety assessment regarding the findings that are not positively closed by the Department of Inspection in matters falling within its scope of duty and authority, to identify the non-conformities and to carry out the works and procedures related to these,

h) To determine the issues that may require administrative sanctions in matters falling within its scope of duty and authority, to carry out the works and procedures related to administrative sanctions in co-ordination with the Department of Legal Services,

ı) To perform other duties assigned by the President.

Department of Radiation Protection

ARTICLE 18- (1) The duties and powers of the Department of Radiation Protection are as follows:

a) To carry out the necessary works and procedures regarding notification, authorisation and approval for the implementation of regulatory control in order to ensure safety in radioactive waste facilities,

b) To determine the procedures and principles of the service to be purchased from private law legal entities for the third party surveillance of the activities determined by the Authority, including the inspection of structures, by legal entities authorised for radioactive waste facilities, and to determine the activities, powers and responsibilities of these persons and to carry out the works and procedures related to the authorisation of the persons who will provide services in this field,

c) To carry out the works and procedures regarding the authorisation of legal persons determined by the Authority, who will provide training on radiation protection to the personnel who will take part in the activities, and natural and legal persons who will provide services for radiation protection,

ç) To determine compliance criteria for activities that may affect the protection of employees, the public, the environment and future generations from radiation, and to carry out work and procedures related to approval,

d) To determine the radiation dose limits that can be exposed due to all kinds of activities that involve the risk of exposure of employees, the public, the environment and future generations to radiation,

e) To determine the training programs for radiation protection, to provide training, to carry out or have the work and procedures related to examination and certification,

f) To carry out or ensure the execution of the national radiation monitoring activity and to co-operate with the relevant institutions and organisations for the conduct of radiation control activities,

g) To inform relevant national or international organisations about extraordinary events,

ğ) To establish, operate and develop the national central dose registration system, to follow the dose records in the system, to examine and inspect the institutions where radiation workers work in co-ordination with the relevant service units when necessary,

h) To issue opinions to the relevant service units on the clearance and release of radioactive materials and to monitor,

ı) To carry out the works and procedures related to the authorisation of the personnel to work in the duties determined by the Authority, in matters falling within its scope of duty and authority,

i) To carry out the works and procedures related to the removal of regulatory control in matters falling within its scope of duty and authority,

j) To co-operate with the Disaster and Emergency Management Presidency and relevant institutions and organisations in co-ordination with the relevant service units in the management of radiation emergencies,

k) To carry out a safety assessment regarding the findings that are not positively closed by the Department of Inspection in matters falling within its scope of duty and authority, to identify the non-conformities and to carry out the works and procedures related to these,

l) To determine the issues that may require administrative sanctions in matters falling within its scope of duty and authority, to carry out the works and procedures related to administrative sanctions in co-ordination with the Department of Legal Services,

m) To perform other duties assigned by the President.

Department of Inspection

ARTICLE 19- (1) The duties and powers of the Department of Inspection are as follows:

a) To inspect or examine on-site of the activities and authorised persons before or after the authorisation,

b) To prepare annual inspection programs regarding inspection activities in co-ordination with the relevant departments,

c) To carry out the works and procedures related to the implementation of administrative sanctions in matters falling within its scope of duty and authority, in co-ordination with the relevant service units. To carry out the works and procedures related to administrative sanctions in matters that do not require co-ordination with the relevant service units, in co-ordination with the Department of Legal Services,

ç) To receive technical support services from specialised public institutions and organisations, private law legal entities and real persons, within the scope of the inspection and on-site examination, in order to conduct the examination, research, determination and reporting in a way that will not be binding on the Authority in terms of results,

d) To inform the authorised person about the findings determined as a result of the inspection activities, to follow up the works and procedures of the authorised person regarding the findings, to report the findings that are not closed positively to the relevant service units and to carry out the works and procedures stipulated in the relevant legislation in co-ordination,

e) To carry out the works and procedures for the authorisation of the inspector of the Authority,

f) To perform other duties assigned by the President.

Department of External Relations

ARTICLE 20- (1) The duties and powers of the Department of Nuclear External Relations are as follows:

a) To carry out the works and procedures related to co-operation with the institutions and organisations of other countries and international organisations on the matters falling within the scope of duty and authority of the Authority, and to ensure internal co-ordination in the meetings to be held with these organisations,

b) To organize, support or participate in scientific meetings such as national and international congresses and seminars, to co-operate with relevant domestic and foreign institutions, to participate in joint studies or to co-ordinate the activities carried out with these organisations,

c) To provide or have the translation and interpreting services required by the Authority made,

ç) To carry out the works and procedures related to the bilateral and multilateral agreements and contracts to which the Authority is a party,

d) To follow up and co-ordinate the implementation of bilateral co-operation agreements signed with regulatory agencies of other countries,

e) Carrying out the works and procedures regarding the signing of co-operation protocols with other institutions and organisations in order to co-operate on the issues falling within the scope of duty and authority of the Authority, to follow the protocols signed with other public institutions and organisations and to co-ordinate their implementation,

f) To follow up the works and procedures related to membership to international organisations, dues and similar payments to be made to these organisations in matters falling within the scope of the duty and authority,

g) To carry out the works and procedures related to the overseas assignments of the personnel of the Authority and the transportation and accommodation of the personnel assigned abroad,

ğ) To perform other duties assigned by the President.

Department of Legal Services

ARTICLE 21- (1) The duties and powers of the Department of Legal Services are as follows:

a) To represent the Authority in order to follow up, defend and resolve transactions to which the Authority is a party or any dispute regarding the Authority in judicial and administrative authorities, internal and external arbitration proceedings and enforcement offices,

b) To co-ordinate, monitor and supervise the proceedings related to litigation and enforcement proceedings and arbitration that the Authority will represent through service procurement,

c) To carry out the works and procedures regarding the application of legal remedies such as filing a lawsuit and filing a criminal complaint, if assigned by the President,

ç) To submit a proposal to the Board regarding the abandonment of litigation and enforcement proceedings, which are not deemed beneficial in their follow-up or transfer to higher-level judicial authorities,

d) To monitor the cases according to their hearings and to inform the President and the Board about their progress, if requested,

e) To carry out the works and procedures regarding the receivables, rights and debts of the Authority with third parties,

f) To examine the compliance of the regulatory transactions of the Authority and their compliance with the legislation, to participate in the preparation of the drafting of the regulatory act,

g) To give an opinion on the needed issues and regulatory action drafts,

ğ) To carry out the works and procedures related to the implementation of administrative sanctions under the co-ordination of the relevant service units,

h) To perform other duties assigned by the President.

Department of Strategy Development

ARTICLE 22- (1) The duties and powers of the Department of Strategy Development are as follows:

a) To carry out the work and procedures related to the determination of the strategy, target and working principles of the Authority,

b) To co-ordinate the processes regarding the medium and long-term strategic goals and objectives of the Authority in co-ordination with the relevant service units

within the scope of the strategic plan studies and to prepare the strategic plan of the Authority,

c) Establishing a performance and efficiency-based management system in the Authority, determining job descriptions and work and procedures flows, carrying out or getting work done for the development and improvement of business processes,

ç) To draft the personnel policy of the Authority, to make the workforce planning,

d) To prepare the budget proposal in accordance with the strategic plan of the Authority,

e) To prepare reports on the performance, financial situation, annual activities and needed issues of the Authority,

f) To prepare the financial reports and final account of the Authority,

g) To carry out the procedures regarding the budget, annual business plan, income-expenditure final accounts, annual activity report and other reports of the Authority, and to carry out the works and procedures regarding transferring between the budget items when necessary,

ğ) To prepare the annual report of the previous financial year, containing consolidated income statements, balance sheets and comprehensive financial statements based on annual activities, and to send it to the relevant places for information until the end of April of the next year at the latest, and to carry out the procedures related to the release of the budget,

h) To carry out procedures regarding the collection and follow-up of the Authority's revenues, to manage and preserve the cash assets of the Authority,

ı) To carry out works and procedures related to the determination of service and transaction costs in co-ordination with the relevant service units,

i) To ensure that the expenditures of the Authority are carried out within the framework of the approved budget and in accordance with the expenditure procedures and principles,

j) To carry out the procedures regarding the chart of accounts, accounting records and other accounting services of the Authority,

k) To keep and publish statistical information about the works falling within the scope of the Authority's duties,

l) To ensure the implementation of the legislation on financial issues,

m) To carry out works and procedures regarding the follow-up and collection of administrative fines,

n) To establish or have the IT infrastructure installed so that the service units of the Authority can operate effectively, and to carry out the necessary works and procedures for the establishment and operation of information systems,

o) To carry out the works and procedures related to the internet activities of the Authority in co-ordination with the relevant service units,

ö) To carry out the procedures regarding information requests from public institutions in co-ordination with the relevant service units,

p) Public Financial Management and Control Law No. 5018 dated 10/12/2003 and Article 15 of the Law on Amendments to the Public Financial Management and Control Law No. 5436 of 22/12/2005 and Some Laws and Decrees, and other legislation to perform other duties assigned to strategy development and financial services units within the scope of the project,

r) To perform other duties assigned by the President.

Department of Support Services

ARTICLE 23- (1) The duties and powers of the Department of Support Services are as follows:

a) To carry out the appointment, transfer, discipline, performance, promotion, retirement and similar transactions of the personnel,

b) To prepare and implement career and training plans for in-service training, training, productivity improvement and preparation of the personnel of the Authority for higher positions,

c) To prepare the necessary plans for training, training, increasing knowledge and experience, internship, training and specialisation of the personnel at home and abroad in services related to the Authority's field of duty, to ensure their implementation and to carry out the procedures related to their follow-up,

ç) To carry out the necessary works and procedures regarding the higher education students sent abroad in order to provide trained human resources to the Authority,

d) To make temporary assignments of the personnel outside the scope of duty of the service units,

e) To ensure that the financial resources of the Authority are used effectively and efficiently,

f) To carry out the works and procedures related to the purchase and leasing transactions within the framework of the technical specifications established for the purchases of all kinds of goods, services and consultancy requested by the service units, provided that the payments are made by the relevant service units,

g) To carry out the services related to the purchase, acquisition and rental of movable and immovable property and services needed for the services of the Authority,

ğ) To carry out the procedures related to taking and executing the security measures related to the service places of the Authority and arranging the entrances and exits to these places,

h) To plan and carry out the civil defense and mobilisation services of the Authority,

ı) To keep the records of the movable and immovable properties of the Authority,

i) To prepare the legislation regarding the communication, general documents, printing and publication and archive activities of the Authority, to carry out these activities and to ensure that other documents that must be kept in accordance with the legislation are protected in a regular filing system,

j) To carry out all kinds of maintenance, repair, construction, archive, health, social and similar services that the Authority needs,

k) To perform other duties assigned by the President.

Press and Public Relations Consultancy

ARTICLE 24- (1) The duties and powers of the Press and Public Relations Consultancy are as follows:

a) To monitor, compile and evaluate the publications of the press related to the activities of the Authority, to respond to what the President deems necessary,

b) To carry out the relations of the Authority with the press and broadcasting organisations,

c) To inform the public on matters related to the field of activity of the Authority,

ç) To take the necessary actions within the framework of the Law No. 4982 on the Right to Information dated 9/10/2003,

d) To carry out the public relations activities of the Authority in co-ordination with the relevant service units,

e) To ensure the preparation of visual, written and similar materials for the promotion of the Authority in co-ordination with the relevant service units,

f) To perform other duties assigned by the President.

Board Services Directorate

ARTICLE 25- (1) The duties and powers of the Board Services Directorate are as follows:

a) To prepare the agenda of the Board meeting, to complete the memorandum and annexes on the agenda items in co-operation with the relevant units and to distribute them to the members of the Board,

b) To prepare the texts of the Board resolutions, to file and keep the resolutions, to approve the originality of the decision samples and to send them to the relevant units, to carry out the works and procedures regarding the decisions to be published in the Official Gazette,

c) To make all kinds of correspondence belonging to the Board, to keep the archive, to ensure the relations of the Board members with the Authority's service units, to carry out administrative works and procedures and protocol services,

ç) To perform other duties assigned by the President.

PART SIX

Personnel

Personnel

ARTICLE 26- (1) The main tasks and services required by the duties and authorities given to the Authority by this Presidential Decree and other legislation are carried out by the Professional staff consisting of the Nuclear Regulatory Specialists, the Nuclear Regulatory Assistant Specialists and other personnel. The personnel of the Authority are subject to the Civil Servants Law No. 657, dated 14/7/1965, except for the issues regulated in this Presidential Decree and other relevant legislation.

Positions

ARTICLE 27- (1) The personnel positions of the Authority are shown in the attached tables of positions (1) and (2). Providing that it does not exceed the total number of the positions in the mentioned table and it is limited to the already present titles of the positions or to the titles of the positions included in the tables of the Presidential Decree on General Personnel Positions and Procedures, the Board is authorised in matters pertaining to the changing of the classes, titles, tiers of the positions and the use of positions except the creation of presidency consultant position.

PART SEVEN

Miscellaneous, Provisional and Final Provisions

Revenues of the Authority

ARTICLE 28- (1) It is essential that the revenues of the Authority meet its expenses.

(2) The revenues of the Authority are as follows:

a) Process and service fees,

b) Publication and other revenues,

c) Donations to be submitted to the Authority,

ç) Revenues of movable or immovable properties of the Authority,

d) Treasury grants from the general budget.

(3) The Authority must not accept donations in any way from persons subject to regulatory control.

Delegation of authority

ARTICLE 29- (1) The President and the director of the Presidency at all levels may delegate some of their powers to lower levels, provided that the limits are clearly defined and in writing. The delegation of authority does not remove the responsibility of the transferor.

Repealed provisions

ARTICLE 30- (1) Part fifty-four of the Presidential Decree On Organization Of Affiliated, Related, Associated Institutions And Organizations With Ministries And Other Institutions And Organizations No: 4 and the articles 785, 786, 787, 788, 789, 790, 791 and 792 in this part have been repealed.

Transition Provisions

PROVISIONAL ARTICLE 1- (1) The current duties of the Chairman and members of the Board, who were in office on the effective date of this Presidential Decree, continue. The Chairman and members complete their remaining terms.

(2) Pursuant to this Presidential Decree, the provisions of the existing regulations and other regulatory acts that are not contrary to this Presidential Decree shall continue to be applied until a new regulation is made.

Enforcement

ARTICLE 31- (1) This Presidential Decree shall enter into force on the date of its publication.

Execution

ARTICLE 32- (1) The provisions of this Presidential Decree shall be executed by the President.

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Feature articles in this issue include "Applicability of the existing nuclear liability conventions to different types of small modular reactors currently under development" by Vincent Jérôme H. Roland; and "Responding to the call: Assessing international legal frameworks for response to incidents involving floating nuclear power plants" by Jason Karcz.

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