
THE RADIOACTIVE NOMAD: THE LIABILITY VACUUM AND JURISDICTIONAL AMBIGUITY OF FLOATING NUCLEAR POWER PLANTS IN THE HIGH SEAS

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ABSTRACT

Floating Nuclear Power Plants (FNPPs) are mobile nuclear reactors placed on ships or offshore platforms and operated on the high seas to supply electricity and Nuclear Energy to remote coastal regions, islands, and energy-deficient areas where land-based nuclear plants are costly, politically sensitive, or geographically impractical. While their offshore location offers advantages such as reduced land use, easier relocation, and proximity to coastal demand, it also creates serious legal and safety concerns because nuclear installations operating beyond national territory are exposed to risks of maritime accidents, radioactive leaks, environmental damage and cross-border harm, and despite these dangers there is no specific international organization or treaty that directly governs FNPPs on the high seas since existing nuclear law Governance like the Nuclear Liability Conventions (Paris and Vienna Conventions Regarding Liabilities Caused by Nuclear Reactors), The Convention on Nuclear Safety 1994 and maritime law frameworks such as The United Nations Conventions on the Law of Sea (UNCLOS) in this aspect Speaks only for land-based reactors or conventional vessels and do not clearly Specify or apply to floating nuclear facilities operating in High Seas, which results in a liability vacuum where responsibility for nuclear damage remains uncertain where no single state has clear legal authority to regulate, license, inspect, or hold operators accountable for accidents on the high seas, thereby making FNPPs a grey zone under public international law and raising urgent questions about environmental protection, state responsibility, nuclear safety, and the need for a dedicated international legal framework to govern the operation of floating nuclear power plants beyond national jurisdiction.

Keywords: Floating Nuclear Power Plants (FNPPs), High Seas, Public International Law, Nuclear Safety, Environmental Protection, State Responsibility, UNCLOS, Grey Zone, Maritime Law, Cross-Border Harm, Beyond National Jurisdiction.

INTRODUCTION:

The issue of cutting carbon emission in the world has pushed the world to create new sources of nuclear energy, such as Floating Nuclear Power Plants (FNPPs). An FNPP is a floating nuclear power plant which is built in a shipyard and then sailed to near the shoreline or offshore facilities to produce electricity and heat. ¹FNPPs are also intended to be either deployed in the territorial waters or possibly in regions beyond the national jurisdiction in contrast to traditional land-based nuclear plants. This mobility generates significant legal concerns regarding the public international law.

The establishment of a legal framework of nuclear power and sea transportation occurred in various historical backgrounds. The Victoria convention and the Paris convention are the international nuclear liability conventions which were being negotiated with various assumptions in place; the nuclear reactors were to be in the territory of any particular state permanently. Simultaneously, the United Nations Convention on the Law of the Sea (UNCLOS) provided a framework to activities carried out in the ocean, such as the freedoms in the high seas as well as jurisdiction related mainly to flag state control. ²Nonetheless, the use of mobile nuclear reactors on non-national territory was not specially envisioned by UNCLOS.

There is thus a fundamental question that arises whether FNPPs are legally and financially responsible in the event of a floating nuclear power plant, which is the source of transboundary environmental damage to the high seas?

The issue is further complicated where ownership, registration, and operation are distributed across multiple states, and are located on the international waters.

This paper discusses the jurisdictional and liability issues that FNPPs raise. It claims that the current maritime and nuclear liability legal frameworks had not been established to govern the mobile nuclear facilities that were in use outside the territorial jurisdiction. Consequently, loopholes might be created in the responsibility of the distribution between the state and the private operators. The paper will examine first the jurisdictional framework of UNCLOS

¹ International Atomic Energy Agency (IAEA), *Legal and Institutional Issues of Transportable Nuclear Power Plants*, IAEA Nuclear Energy Series No. NG-T-3.5 (2013).

² United Nations Convention on the Law of the Sea (UNCLOS), 1982, 1833 U.N.T.S. 397.

followed by the structure of the international nuclear liability regime and finally look into whether reform is necessary in order to have effective compensation and accountability.

TECHNOLOGICAL AND OPERATIONAL BACKGROUND:

Floating Nuclear Power Plants (FNPPs) are nuclear power plants (facilities) that are built upon floating structures that typically have the form of a large ship or a barge. They are usually constructed in shipyards unlike the traditional land-based reactors and then ferried to their locations. Such plants are used to provide electricity, heat, and in a few instances desalinated water to remote coasts or islands, or offshore industries. A popular example was the Akademik Lomonosov, opened in Russia in 2020, which shows that the installations are a workable concept in the real world.³

Technically speaking, there are small or medium-sized reactors that are usually modified to fit a ship. They can be transported anywhere due to their portability hence can be moved in case of power need or business deals. This is a feature that makes them unique as compared to the existing nuclear installations that are fixed firmly on the soil of a given state and evidently under the authority of that state and its regulatory control.

The fact that an FNPP may not be limited to territorial waters is another area of legal complication. According to the international law, the maritime zones are subdivided into territorial sea, the Exclusive Economic Zone (EEZ), and the high seas. Although the coastal countries have sovereignty over the territorial sea and some sovereign rights over the EEZ, the high seas are open to all states and are mainly regulated under flag state jurisdiction of UNCLOS.⁴

In case an FNPP is at sea, it would not be subject to the regulation of the coast state. Instead, it would be, primarily, under the jurisdiction of the state, on the basis of which it is flying its flag. This condition is also a matter of concern since nuclear plants should be highly monitored in terms of safety, emergency response and monetary security arrangements. The current international system of nuclear liability was built under the assumption that a nuclear plant would be being set in a national domain that could be easily identified. A floating and possibly

³ International Atomic Energy Agency (IAEA), *Advances in Small Modular Reactor Technology Developments* (2022 ed.).

⁴ United Nations Convention on the Law of the Sea (UNCLOS), 1982, Arts. 2, 56, 87.

moving reactor disputes that presumption.

Thus, the technical mobility of the FNPPs is not a simple engineering characteristic but the key element causing the blending of the law in jurisdiction and liability issues related to the application of the public international law.

JURISDICTION OF UNCLOS - HIGH SEAS FRAMEWORK:

United Nations Convention on the Law of the Sea (UNCLOS) offers the foundation of the legal regime, which regulates the operations at sea. Under the UNCLOS, the maritime jurisdiction under changes with the type of maritime jurisdiction where an activity occurs. States that are located on the coast have full sovereignty in the territorial sea, and limited sovereignty in the Exclusive Economic Zone (EEZ), and no sovereignty on the high seas. The high seas are free to any states and they are governed largely by the concept of freedom of navigation and other freedoms.⁵

By the definition that a Floating Nuclear Power Plant (FNPP) will be a vessel flying a flag, it would typically be subject to the exclusive jurisdiction of the flag state. This implies that the safety regulation, inspection, and compliance would majorly lie in the hands of that state. UNCLOS was however majorly aimed at regulating the traditional maritime practices like shipping and fishing practices. It did not particularly deal with the functioning of mobile nuclear reactors.

This poses a possible regulatory problem. Nuclear facilities must be tightly monitored, technologically experienced, emergency response mechanisms and funds to compensate in case of an accident. Although Article 94 imposes obligations under the jurisdiction of the flag states, the usefulness of this administrative and technical control is dependent on the administrative and technical power of the respective state. Practically, certain vessels are registered in states which have a mere regulatory infrastructural cover, that is often referred to as flags of convenience. Even though the plain meaning of the UNCLOS is that these states still bear legal responsibility to supervise highly complex nuclear installations, it may also be doubtful whether such states can actually do it.

Thus, UNCLOS offers a jurisdictional regime grounded in flag state control but makes no

⁵ United Nations Convention on the Law of the Sea (UNCLOS), 1982, Arts. 87 and 94.

particular provision of floating nuclear installations with the challenges they present. This is a larger gap even when weighed against the construction of international nuclear liability conventions.

INTERNATIONAL NUCLEAR LIABILITY REGIME:

The international nuclear liability regime was established to provide fast and sufficient reparation in case of nuclear damage. The main two treaties under this area are Vienna Convention on Civil Liability of nuclear damage (1963) and the Paris convention of third-party liability in the field of nuclear energy (1960). Under these conventions special legal framework different to general tort law principles are set.⁶

The given structure is efficient in the situations when nuclear facilities are permanently located within a well-drawn national territory. But Floating Nuclear Power Plant (FNPP) disproves this assumption of territory. When FNPP is working in the high seas it is not situated on the sovereign territory of any state. When this is the case, it becomes more complicated to define the Installation State under which the issue of jurisdiction and liability should be identified.

Moreover, the conventions were developed at the period when it was calculated that the nuclear reactors would be operating on land, controlled by stable national regulation. Privately owned mobile nuclear facilities located in the international waters were not discussed directly. Consequently, some questions are being raised on the question of the jurisdiction of the courts involved, the liabilities would be met by the state, and the question of whether the liability limits that can be imposed are good enough to cover maritime nuclear-related accidents.

Despite the fact that international nuclear liability system is a specialized and organized mechanism, its territorial nature poses some challenges when it is used in application in floating nuclear installations which have been beyond national jurisdiction.

STATE RESPONSIBILITY AND ENVIRONMENTAL OBLIGATIONS:

Along with the regime of nuclear liability conventions, the general principles of the law of the general international law are also applicable when it comes to the damage generated by a Floating Nuclear Power Plant (FNPP). Although the civil liability may be mainly attributed to

⁶ Vienna Convention on Civil Liability for Nuclear Damage (1963), Arts. I-II; Paris Convention on Third Party Liability in the Field of Nuclear Energy (1960), Arts. 3-4

a privately owned operator in the case of nuclear conventions, the states may also be responsible in the general international law in case they do not exercise their international duties.

The duty not to inflict transboundary environmental harm is one of the principles. This has been established as a principle of international jurisprudence and other states must also make sure that actions on their jurisdiction or control do not result in a lot of harm to other states or regions that do not lie within their national jurisdiction.⁷ This duty has been acquired as a duty of due diligence, that is, the states would have to do reasonable and appropriate things and acts to avert injuries, but is not necessarily liable to all mishaps.

When FNPPs are in the high seas, the question that would arise is whether the flag state has played a substantive role of control and supervision. Under Article 94 of UNCLOS, flag states must stand at the point of ensuring flagged vessels and have an effective jurisdiction and control mechanism over flagged vessels. Also, Article 192 and 194 of UNCLOS provide general duties over states to conserve and safeguard the marine environment and to make efforts towards eliminating any form of pollution.⁸ A maritime nuclear accident would obviously be within the context of such environmental protection requirements.

Nevertheless, one should draw a distinction between civil responsibility and the state accountability. Civil liability conventions dwell on providing the compensation to the victim by the operator of the nuclear establishment. State responsibility on the other hand occurs when a state violates an international duty. To illustrate, should one of the states fail to regulate or monitor an FNPP in an appropriate manner, and such failure may be considered a breach of due diligence duties, then it may be held internationally responsible.

Meanwhile, there is no general rule of strict state liability of all ultra-hazardous activities in the international law. Rather, the majority of the jurisprudence upholds due diligence standard and not the automatic liability. Thus, even though the state responsibility can offer an extra point of accountability, it does not eliminate the ambiguity regarding compensation and jurisdiction in the situation of floating nuclear installations active outside the territorial sovereignty.

⁷ Corfu Channel Case (United Kingdom v. Albania) [1949] ICJ Rep 4; Pulp Mills on the River Uruguay (Argentina v. Uruguay) [2010] ICJ Rep 14.

⁸ United Nations Convention on the Law of the Sea (UNCLOS), 1982, Arts. 192, 194 and 94.

This shows that the general principles of environmental protection and the role of the state responsibility can supplement, but not substitute specialized nuclear liability regime.

GAPS AND CHALLENGES IN THE EXISTING FRAMEWORK:

First, UNCLOS mainly governs the maritime jurisdiction and the protection of the environment, and it lacks any particular clauses in response to the nuclear installations that are located on floating platforms. Even though Article 94 obliges that flag states effectively control vessels flying its flag, the article was initially developed to relate to traditional types of maritime activity like navigation and shipping. It fails to give specifications on how to manage intricate nuclear reactors that are used in the sea. Thus, although UNCLOS requires a jurisdictional responsibility, it does not include a specific liability system regarding a nuclear risk.

Second, the nuclear liability conventions had in mind permanently based installations. The theory of the Installation State presupposes strong territoriality between nuclear facility and a sovereign nation. This territorial connection is less direct when an FNPP is working on the deep water. By definition, there can be a situation of uncertainty in identifying the state which qualifies to be the Installation State in terms of jurisdiction where the reactor is mobile, privately owned, and registered on a specific flag state. This is particularly important in a situation where many states are involved, such as where the flag state, home of the operator, and coast state countries are different.

Third, it might have some practical enforcement issues. Although the international law lays the responsibility on the flag states, not every state has the same regulatory ability. The nuclear plants need technical know-how, emergency response and monetary assurances to guarantee reimbursements in case of an accident. In case an FNPP is registered in a state where the administrative capacity is low, the questions of the efficacy of oversight might be raised. Although this does not necessarily mean that the international law is violated in any way, it raises the possible constraints of the sole or only use of flag state control.

These issues do not fully imply that the international law is completely inefficient. Instead, they propose that the legal frameworks came to be formulated in a changed technological and historical environment. Mobile nuclear power installations are also leading to the new factual

conditions which were not clearly foreseen by the existing treaties.⁹

Hence, although the outlines of UNCLOS and the nuclear liability conventions offer a framework to deal with the operations of the FNPP, when used together they might create some gaps namely with the area of jurisdictional clarity and finances in high seas cases.¹⁰

POSSIBLE REFORMS AND CONCLUDING OBSERVATIONS

The discussion above shows that Floating Nuclear Power Stations (FNPPs) bring about new legal issues under the existing international laws. Even though a system of jurisdiction with the flag state control and the sense of environmental protection is established in UNCLOS, floating nuclear installations are not addressed in it very specifically. Equally, nuclear liability conventions are based on the structured regime of compensation but presuppose that nuclear facilities are permanently established in the clearly delimited territorial jurisdiction.

Considering these obstacles, some minor changes or elucidations can be viewed. A potential model would be to clarify in terms of interpretation or further agreements how the concept of the state of Installation applies to floating reactors that are situated outside of the areas of the territorial waters. An example is, the states may agree that a flag state of an FNPP, is to be considered the Installation State in relation to liability and jurisdiction. Clarification of this kind would have the effect of enhancing the legal uncertainty without the need of formally reorganizing the current regime.

The other potential reform option would be to enhance interaction between maritime and nuclear regulators. International institutions like the International Maritime Organization (IMO), the International Atomic Energy Agency (IAEA) may come up with international guidelines or norms exclusively focusing on the safety, emergency preparedness, and financial security of floating nuclear installations.¹¹ This would ascertain that maritime as well as nuclear safety concerns would be taken on board.

Also, states might discuss changing the limits of liability based on the existing conventions in order to evaluate whether they are adequate in case of a possible maritime nuclear attack.

⁹ Vienna Convention on the Law of Treaties (1969), Art. 31 (interpretation in light of object and purpose).

¹⁰ International Law Commission, Draft Articles on Responsibility of States for Internationally Wrongful Acts (2001), Arts. 1–2.

¹¹ International Atomic Energy Agency (IAEA), Handbook on Nuclear Law (2003); International Maritime Organization (IMO), International Convention for the Safety of Life at Sea (SOLAS) (1974).

Considering the fact that accidents in the sea could result in many states affected or environmental damages that look beyond the national borders, the well-developed compensation systems would be required to assure trust in the criminal justice system.

Nevertheless, it should also be noted that the international law develops over time. Numerous treaty regimes have everywhere been modified depending on the technological advances. An example is the Convention on Supplementary Compensation to Nuclear Damage (1997) which has revised and broadened earlier liability systems in response to the emerging realities relating to nuclear power.¹² On the same note, there could be more developments in the field of floating nuclear in future that could result in additional explanation or modification of the current treaties.

CONCLUSION:

Floating Nuclear Power Plants are of significance in the world towards the shift to alternative and low-carbon energy sources. They are designed to produce electricity in isolated coastal locations and on offshore locations whereby standard land-based infrastructure might not be easy to set up. Nevertheless, it is not the mobility of FNPPs that is appealing that raises complicated questions of legal matters in the context of the public international law.

The current legal framework that regulates the operations at sea and liability of nuclear technologies as has been demonstrated in this paper was formulated at different historical and technological times. UNCLOS sets a jurisdictional regime mainly on a maritime zone basis and flag state basis whilst the international nuclear liability conventions assume that nuclear facilities are inherently fixed on a territory of a particular state. In other scenarios where a floating nuclear reactor is powered outside of the territorial waters, the structures overlap in a manner it initially did not intend to do.

Under UNCLOS, the jurisdictional framework is clear in assigning the responsibility to the flag state; and provides some broader duties related to protection and conservation of the marine environment. Meanwhile, the nuclear liability conventions make operators the main providers of compensation and financially stable. However, the utilization of these rules to floating installations can bring about some doubts about identification of the Installation State,

¹² Convention on Supplementary Compensation for Nuclear Damage (1997).

coordination of transboundary claims and insufficiency of oversight in high seas situations.

Notably, in the analysis, I did not indicate that international law could not cause the difficulties in FNPPs. Instead, it emphasizes the fact that technology is typically advanced faster than the law. The international law has traditionally adapted to emerging realities by its interpretative function, by use of supplementary agreements and by the progressive treaty-making. Similarly, the legal problem of floating nuclear power plants can be resolved by shedding more light on jurisdictional regulations, enhanced cooperation in the use of the regulations, and potential enhancement of the current liability systems.

The role of floating nuclear installations must be struck at the end, between the freedom of the high seas, environment protection and efficient compensation of possible damage. Through increasing the level of coordination of maritime and nuclear regulatory regimes and by continuing to see that states have important oversight over the activity, international law can still be able to facilitate some level of accountability and legal predictability in a rapidly changing technological environment. FNPPs should thus not be taken as an indication of an existing vacuum in the law, but it should remain as a reminder to the persistence in the adaptation and responsible government of the international legal order.

Without legal reform, FNPPs risk creating systemic gaps in accountability and compensation under international law.

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