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A New Vessel on the Block - How the Law of the Sea Applies to Floating Nuclear Power Plants

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1 Introduction

As energy production adjusts to the sunsetting fossil fuel era, new technologies have the potential to challenge existing international legal regimes. One of the latest challenges to this system are projections of floating nuclear power plants (hereinafter FNPP) being deployed worldwide.[1] So far, the only operational FNPP is the Russian built *Akademik* Lomonosov, currently operating in *Pevek*, Russia. The potential of these new floating plants makes speculations of wide employment in the near future quite believable. Introduction of these vessels at the international level raises numerous questions such as what environmental impact these might have? Are FNPPs ships[2] according to international law? Does the Law of the Sea provide a regime that protects navigation of FNPPs while appropriately balancing the rights of the coastal States in their maritime zones? Does the International Maritime Organization fill the gaps in the Law of the Sea? On top of answering these questions the principal objective of this research is to evaluate how the Law of the Sea applies to FNPPs during navigation. In order to achieve that, the following sections will be divided according to the specific legal instrument analyzed; starting with United Nations Law of the Sea Convention (hereinafter UNCLOS) and then proceeding with applicable International Maritime Organization (hereinafter IMO) instruments. Once the legal doctrinal analysis is completed, a concluding discussion will provide a thorough assessment of the information found.

1.1 Scope of the research

The regulatory legal regime that can apply to these vessels comes from two major sources, the Law of the Sea Convention and its related International Maritime Organization instruments and sources of nuclear law, deriving principally from the International Atomic Energy Agency (hereinafter IAEA). Although the main subject of this thesis are nuclear power plants, the nature of these facilities poses unique questions, particularly related to the Law of the Sea, such as classification and the balance between coastal and flag State jurisdiction. Since this research is based around the Law of the Sea, IAEA instruments will not be addressed in detail but referred to, where necessary. Lastly, this research aims at assessing the general international regime that would apply to FNPPs, and although the *Akademik Lomonosov* will

[1] Dowdall, Mark, and William JF Standring. *Floating nuclear power plants and associated technologies in the northern areas*. No. NRPA--2008: 15. Statens Straalevern, 2008. (p.6).

[2] The terms vessels and ship will be used interchangeably throughout this thesis.

be used as a specific example, there will be no assessment of Russian domestic legislation related to FNPPs, as this author does not speak Russian.

1.2 Sources and methodology

In order to provide an evaluation of the instruments available to coastal States and to determine their rights and duties related to FNPP this thesis will principally use a legal doctrinal analysis of sources of international law that are relevant to the analysis. Article 38 of the ICJ statute, which is generally accepted as an authoritative list of sources of international law, indicated the latter as being treaties, customary law, general principles of law, judicial decisions.[3] In light of the aforementioned, this thesis will focus primarily on the UNCLOS and IMO instruments, while including as secondary sources case law and opinion of renowned scholars. Case law will be also considered to determine how ultra-hazardous radioactive material at sea is perceived and how it relates to international law and specifically the Law of the Sea. All of the existing law analyzed in this document will be interpreted in accordance to the Article 31 and Article 32 of the Vienna Convention of Laws and Treaties (hereinafter VCLT).[4]

2 Background

The construction of the first FNPP began on in 1963 when the United States began adjusting the WWII ship *Charles H. Cugl*.[5] The ship got its propulsion system removed and other necessary modifications to safely install the reactors. Unfortunately, the vessel had to be decommissioned after its first trip due to the damage endured while crossing the Atlantic.[6] During the making of the Sturgis, FNPPs was addressed for the first time at the United Nations Conference of the Law of the Sea in Caracas in 1974.[7] Some of the topics touched during this conference included the balance between the right of a coastal State to construct FNPPs and in its territorial waters and the right of neighboring States to prevent the

[3] For the non-paraphrased version of Article 38 please visit https://www.icj-cij.org/en/statute.
[4] 1969 Vienna Convention on the Law of Treaties, OS – 23rd May 1969, EIF – 27th January 1989, 1155 UNTS (hereinafter VCLT).
[5] Dowdall, Mark, and William JF Standring. *Floating nuclear power plants and associated technologies in the northern areas*. No. NRPA--2008: 15. Statens Straalevern, 2008. (p.9-10).
[6] *Ibid.*
[7] Von Welck S. Third United Nations conference on the law of the sea and the use of nuclear energy. Nuclear Law Bulletin 1975 (15): 62-72. in Dowdall, Mark, and William JF Standring (p. 39).

construction of installations that may pose an environmental threat.[8] On top of that, other States' rights should also be considered when choosing the location where these installations are positioned, especially in regards to freedom of shipping and fishing.[9]

Since FNPP are a new and relatively unknown technology, the following section of this paper will provide appropriate background for a well-rounded understanding. Although FNPPs are new to the international community, they nevertheless fall within the well-established field of the transportation of ultra-hazardous materials. This will help gain prospective on the possible environmental impact of FNPP and the risks that these vessels may pose to the areas they navigate through or operate in. However, there are also environmental advantages that come with the increased use of these vessels, which will also be included. Lastly, the *Background* section will outline the current status of FNPPs, future prospects, and the risks known so far.

2.1 The Akademik Lomonosov: technical aspects

Although there are several designs of FNPPs[10], there is only one fully operational, the Russian KLT-40S floating reactor unit, named the *Akademik Lomonosov*.[11] Described as a barge with low capacity nuclear power plants (LCNPP), this specific model has the capacity to provide power, heat and fresh waters through desalination.[12] As outlined on the official page of *Rosatom*, the Russian owned company that produced the *Akademik Lomonosov*, this FNPP is designed to support rural northern communities and remote offshore resource extraction operations. Because this specific plant is expected, but not restricted, to operate in secluded areas, it has the appropriate on-board facilities to hold enough fuel and store enough spent nuclear fuel (SNF) and other radioactive waste.[13] This specific design allows the *Akademik Lomonosov* to be operational for a about 12 to 15 years, after which it would have to spend a year in a designated facility for maintenance, restoration of fuel and removal of

[8] Dowdall, n. 5, (p.39).
[9] *Ibid*
[10] The Long Operating Cycle Simplified BWR (LSBWR) design of Toshiba Corp., Japan (100-300 MW(e)); The CNEA/INV AP CAREM-25 design from Argentina (27 MW(e)); The SMART (System-Integrated Modular Advanced Reactor) of the Republic of South Korea (90 MW(e)); Mitsubishi's (Japan) Integrated Modular water Reactor (IMR) (300 MW(e)); Russia's KLT-40S heat and power floating reactor unit (75 MW(e)).
[11] *Akademik Lomonosov, a Floating Nuclear Power Plant*, www.fnpp.info/.
[12] Lee, Kang-Heon, et al. "Recent advances in ocean nuclear power plants." *Energies* 8.10 (2015): 11470-11492. (p.11472).
[13] Dowdall, n 5, (p.16).

SNF.[14] Although this research is not specifically on the *Akademik Lomonosov* it is an appropriate example of a towable, non-self-propelled FNPP. In regard to the reactors present on board of this FNPP, the KLT-40 has long been employed in Russian nuclear-powered vessels.[15] In fact, for the past 20 years Russia has been using different versions of the same reactor on its nuclear-powered submarines and icebreakers.[16] Nonetheless, the lack of self-propulsion is a considerable aspect of the *Akademik Lomonosov* that should be addressed.[17] From a safety of navigation standpoint, towing of any kind is not a safe mode of navigation when compared to a self-propelled vessel. Without providing a reference to situations in which towing barges created safety issues, this mode of operation was enough of a concern for the IMO to produce guidelines to prevent accidents.[18] With calm weather, towage of a FNPP following regulations and safety standards should not present any issues. However, as mentioned in the first page of the IMO resolution A.765 (18), there have been situations in which towage has presented risks to navigation and the environment. The lack of self-propulsion, low resistance to wind and no steering capability indicate that the *Akademik Lomonosov* would most likely require the presence of appropriate towing vessels at all times.[19] Before reaching destination, the FNPP is expected to sail long distances, since it appears that interests in *Rosatom*'s floating energy producing plant come from Middle East, North Africa and South-East Asia.[20] Traversing such distances can result in the barge encountering different weather conditions and increase the chance for critical accidents to arise. Towing in critical weather conditions, and possibly in Arctic waters is incredibly dangerous, which would require technical and practical experience, trained decision making and at least three or four tow vessels.[21] *Rosatom*, in defense of the FNPP, ensures that the *Akademik Lomonosov* is build following the "Rules for the Classification of Seagoing Ships"

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[14] Dowdall, n 5, (p.16).
[15] Dowdall, n 5, (p. 24).
[16] *Ibid.*
[17] On top of the navigational risks tied to the lack of self-propulsion discussed in this section of the thesis, the same feature may bear relevance further ahead when discussing the classification of FNPPs.
[18] Resolution A.765(18), IMO, adopted on 4 November 1993. Guidelines on THE Safety of Towed Ships and Other Floating Objects Including Installations, Structures and Platforms at Sea, Retrieved August 21, 2020, from http://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Assembly/Documents/A.760(18).pdf
[19] Nikitin, Alexander, and Leonid Andreyev. "Floating nuclear power plants." *Oslo: Bellona Foundation* (2011). (p.22)
[20] *Rosatom Reports Power Start-up of the World's Only Floating Nuclear Power Unit*. https://rosatom.ru/en/press-centre/news/rosatom-reports-power-start-up-of-the-world-s-only-floating-nuclear-power-unit/
[21] Nikitin and Andreyev, n 19 (p.23).

and the "Rules for the Classification of the Construction of Atomic Ships and Floating Structures"; nonetheless, the company was unable to answer questions in a reporting when asked the ice-classification.[22] Particularly worrying since the same piece points out the FNPP is expected to be moored in the East Siberian Sea while the project mentions only ice-resistant paint.[23] The same experts criticizing the FNPP's navigation capabilities in dire weather conditions also point out that project designers ensure that the *Akademik Lomonosov* is capable to withstand winds of 25 meters per second.[24] That speed equals to about 48 knots, which according to the Beaufort Wind Scale can result in waves of between seven and 10 meters high.[25] Such claims will be confirmed with time, however, the towage of a FNPP in such extreme weather with four other vessels cannot be an easy operation.

2.2 Transportation of ultra-hazardous radioactive material

Transportation of radioactive material at the international level, although separate from FNPPs, is a useful starting point to assess the general state of international nuclear shipping. Major shipments of radioactive material are of a different magnitude compared to FNPPs because of the quality and radioactivity. It is estimated that 18-38 million radioactive packages are shipped worldwide; however, majority of the (about 60%) are low level radioactivity.[26] Nonetheless, if FNPPs do become a popular alternative to conventional sources of energy, it is plausible that maritime transport of highly radioactive cargo will remain largely unavoidable because of higher demand for these energy sources.[27] Of course, this will be depending on whether an increase in production of FNPPs would increase low or high level radioactivity shipments. This is a key issue since it has occurred in the past that certain shipments posed unique risks because of the high radioactivity of their cargoes. The *Pacific Teal, Pacific Pintail* and *Pacific Swan* attracted plenty of attention and worried numerous countries during their navigation. For example, the *Pacific Swan* alone carried 96,000,000 m curies of radioactivity while travelling around Cape Horn in 2001, sufficient to

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[22] *Rosatom Reports Power Start-up of the World's Only Floating Nuclear Power Unit*. https://rosatom.ru/en/press-centre/news/rosatom-reports-power-start-up-of-the-world-s-only-floating-nuclear-power-unit/.
[23] *Ibid.*
[24] Nikitin and Andreyev, n 19, (p.23).
[25] *Beaufort Wind Scale*, www.spc.noaa.gov/faq/tornado/beaufort.html.
[26] Nadelson, Robert. "After MOX: the contemporary shipment of radioactive substances in the law of the sea." *The International Journal of Marine and Coastal Law* 15.2 (2000): 193-244. (p.198).
[27] Nadelson, n 26, (p. 200).

build dozens of nuclear weapons.[28] Obviously, environmental impact of radioactive contamination should not be condoned regardless of the level of radioactivity, and it should not be underestimated, despite the smaller size of the reactors on FNPPs, or of the smaller quantity of nuclear waste they carry on board. Nevertheless, with bigger and international shipments come different risks such as terrorist attacks, increased naval traffic of highly radioactive material and more challenging if not impossible retrieval in case of sinking.[29]

Majority of controversies with the shipment of radioactive material occurs between the countries directly benefiting from the economic potential and the ones that see these ships as a potential threat to their wellbeing. Van Dyke points out that the necessity for a comprehensive regime for the transportation of ultra-hazardous materials is to make sure that risks are not transferred from those who benefit from these activities to the ones that have nothing to gain from them.[30] The struggle between countries protecting their navigational rights and coastal States trying to prevent irreversible damage in their territorial waters is a contemporary and prominent debate stemming from regular shipments of ultra-hazardous radioactive material. Reasonableness of Van Dyke's position is challenged by some of the existing regimes of navigation, which will be discussed later in this thesis. Nonetheless, unlike navigation of regular cargo ships, FNPPs are not dictated by schedules for just-in-time delivery, because of that, the necessity to use the fastest route available is unnecessary.

2.3 Environmental Risks

Although there are obvious examples that come to mind when thinking about environmental damage caused by the nuclear industry,[31] issues tied to this emerging industry are multifaceted. It appears that most of the issues come from refueling and disposal of spent nuclear fuel (hereinafter SNF). Handling and storage of SNF is in fact one of the major issues with the nuclear industry.[32] As mentioned before, responsibility for repairs and refueling will most likely be in the hands of the country supplying the FNPPs, and expectations are that

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[28] Dyke, Jon M. Van. "The legal regime governing sea transport of ultrahazardous radioactive materials." *Ocean Development &International Law* 33.1 (2002): 77-108. (p.78).
[29] Nadelson, n 26, (p. 203).
[30] Dyke, n 28, (p. 79).
[31] Accidents such as Chernobyl and Fukushima are well known to the public.
[32] Additional information available at: Options for Management of Spent Fuel and Radioactive Waste for Countries Developing New Nuclear Power Programmes. (2018, December 19). Retrieved July 08, 2020, from https://www.iaea.org/publications/12255/options-for-management-of-spent-fuel-and-radioactive-waste-for-countries-developing-new-nuclear-power-programmes.

ultimately these vessels will be decommissioned and disposed in specialized facilities by the supplier.[33] Obviously, this raises questions as to how these facility will be established, and reliability ensured. Developing countries being used as dumping grounds for hazardous waste is also a recurring issue that may worsen with more FNPPs.[34] Some issues are already arising from the single Russian facility, home of the *Akademik Lomonosov*, *Rosatom*. It appears that operations could pose risks of contamination, including gas release from reactors on vessels and from stored SNF during the initial month of storage.[35] However, there are some examples of how *Rosatom* handles these operations because of the Russian fleet of nuclear icebreakers. SNF from their reactors is handled at a *Rosatom* site and apparently there has not been any significant contamination of the nearby bay.[36]

Some skepticism does exist nonetheless, as Tscherning points out, risks arise during initial fueling, during transportation, during day-to-day operations and during the refueling.[37] Nevertheless, Tscherning also admits that these vessels do have the potential to reduce traditional costly maritime supply routes of fuel which need to be kept open by nuclear powered icebreakers.[38] On top of that, their versatility seems to be a possible solution to modern energy demands. As mentioned in the introduction, large scale desalination is one of the services that these vessels can provide on top of heat and energy. As demand for fresh water is predicted to increase, FNPPs hold a considerable advantage since costs of nuclear desalination can be 30-60% lower than the most economical fossil fuel-based systems.[39] Importantly, there are considerable risks to take into consideration due to the locations that FNPPs will be deployed to. Since one of the advantages is in fact that these vessels can be deployed in remote areas where resource extraction occurs, especially in northern areas, risks do accumulate in such circumstances. Naval accidents in normal circumstances create challenging search and rescue operations, depending on location, weather and number of

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[33] Dowdall, n 5, (p.12).
[34] Abrams, David J. "Regulating the International Hazardous Waste Trade: A Proposed Global Solution." Columbia Journal of Transnational Law, vol. 28, no. 3, 1990, p. 801-846. (p. 804).
[35] Dowdall, n 5, (p. 19-20).
[36] Additional information available at: Arctic Monitoring and Assessment Programme (AMAP). Arctic pollution issues: Radioactive contamination. Østerås: Norwegian Radiation Protection Authority, 1997. https://oaarchive.arctic-council.org/handle/11374/924,
[37] Tscherning, Rüdiger. "Transportable Nuclear Power Plants–An Update on Regulatory Responses in International Nuclear Law." *Nuclear Law in the EU and Beyond*. Nomos Verlagsgesellschaft mbH & Co. KG, 2014. (p. 181).
[38] Tscherning, n, 37 (p. 176).
[39] Dowdall, n 5, (p.11-12).

passengers. It is considerably different when the passengers that need to be rescued are in polar waters, with challenging weather conditions and the vessel sinking has the potential to release radioactive material in the water for an indefinite period of time.[40] Plutonium and other isotopes such as americium do not dissolve in water, meaning that they can become part of the sediment and that they may move and contaminate surrounding areas every time the ocean floor is disturbed.[41] Contrarily, other isotopes such as strontium-90 and caesium-137 are water soluble but equally dangerous as they can be absorbed by fish or other organisms.[42] This has the potential to directly affect consumers through popular fish, especially predators such as tuna, through a process known as bioaccumulation.[43]

There are competing views on the risks that FNPPs pose to the environment and to populations close to areas of operation. On their principal web page, *Rosatom* uses terms such as green energy, environmentally friendly and sustainable to describe what the *Akademik Lomonosov* can provide.[44] Critiques of this new technology come from different fields, with obvious ones such as Greenpeace, which released a peace entitled "*32 years after Chernobyl, next up, a Chernobyl on ice?*".[45] The title of this article is controversial to say the least, as the size and potential damage of the reactors is a forced comparison with a land-based nuclear power plant.[46] Experts in the nuclear energy field, while providing more insight than Greenpeace on what their critiques are based upon, seem to be on a wait-and-see approach.[47] Nonetheless, since these are not operational yet, it is impossible to be certain on the impact that they may have. Some studies have reached competing conclusions to some of these questions. Worst case scenario would be a situation in which a large amount of energy

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[40] For a detailed report on search and rescue in the Arctic: Solberg, Knut Espen, Ove Tobias Gudmestad, and Bjarte Odin Kvamme. "SARex Spitzbergen: Search and rescue exercise conducted off North Spitzbergen: Exercise report." (2016). http://hdl.handle.net/11250/2414815.
[41] Nadelson, n 26, (p. 204).
[42] *Ibid.*
[43] Bioaccumulation: the accumulation over time of a substance and especially a contaminant (such as a pesticide or heavy metal) in a living organism https://www.merriam-webster.com/dictionary/bioaccumulation.
[44] *Reactor Plants for Small- and Medium-Sized Nuclear Power Stations*. www.okbm.nnov.ru/en/business-directions/reactors-plants-for-small-and-medium-sized-npps/.
[45] Alimov, Jan Haverkamp and Rashid. "32 Years after Chernobyl, next up, a Chernobyl on Ice?" *Greenpeace International*, 26 Apr. 2018, www.greenpeace.org/international/story/16149/32-years-on-chernobyl-on-ice/.
[46] The two KLT reactors on board of the Akademik Lomonosov have each a 35 MWe capacity (www.fnpp.info/.) wheras the four RBMK reactors of the Chernobyl Power Complex had the capacity to produce 1000 MWe each (https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx).
[47] Nikitin and Andreyev, n 19, (p.23).

reaches supercritical conditions and becomes impossible to control.[48] Risk of such an event occurring is higher during refueling operations, which occur every 3-4 years.[49] Of course, probability of an accident does increase with the frequency operations are carried out, however, risk remains low overall.[50]

Despite the fact that there is only one FNPP, critiques concerning the *Akademik Lomonosov* should not be overlooked. The construction of the *Akademik Lomonosov* and other units like it should follow what are known as Normative Documents, a collection of rules and standards ensuring quality and safety.[51] According to Kuznetsov, certain elements of the reactor do not correspond or outright violate these Normative Documents[52] The same author is also skeptical of some of the developers' claims that despite FNPPs being new, they can rely on in-service experience with the KLT-40C reactor installed on submarines and ice-breakers.[53] As a matter of fact, although it is true that these reactors have long been used on different vessels, there is a long list of accidents with reported contamination.[54] Of the 47 accidents documented by Kuznetsov, only fifteen had any impact on human beings, nine of which resulted in contamination.[55] Of the nine times people were contaminated, seven were accidents in which only the crew operating the vessel were affected. Thus, of the 47 accidents, only six resulted in death of either civilians or crew member.[56] As a matter of fact, one of the worst accidents documented was the sinking of the submarine the *Kursk*, when 118 people died. The tragedy of accidents with so many casualties is undeniable; nonetheless, research on the environmental impact of this misfortune reveals a less dire situation. Through two expeditions done by a Norwegian company with Norwegian and British deep-water divers,[57] reports showed there were no indications of leakage.[58] Although military secrecy limited the

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[48] Dowdall, n 5, (p.47).
[49] *Ibid* (p.26).
[50] *Ibid* (p.48).
[51] Kuznetsov, V. M. *Floating Nuclear Power Plants in Russia: A Threat to the Arctic, World Oceans and Non-Proliferation Treaty*. Agency Rackurs Production, 2004. (p.18).
[52] Kuznetsov, n 51, (p.18).
[53] *Ibid.*
[54] *Ibid* (p. 66-69).
[55] *Ibid.*
[56] *Ibid.*
[57] Amundsen, I., et al. "The accidental sinking of the nuclear submarine, the Kursk: monitoring of radioactivity and the preliminary assessment of the potential impact of radioactive releases." *Marine pollution bulletin* 44.6 (2002): 459-468. (p.459).
[58] *Ibid* (p.467).

availability of details pertaining the structure and condition of the *Kursk*,[59] the report concluded that there would not be any considerable impact.[60] A similar conclusion came from a report on the environmental impact of the sunken submarine *Komsomolets*. The study undertaken by the Norwegian Defense Research Establishment determined through a worst-case scenario study that there would not be any significant hazard today or in the future.[61]

To conclude, the information provided in this section, excluded past accidents of different types of vessels, is mostly based on speculation. Although concerns regarding safety standards are not surprising, especially around a novelty such as FNPPs; the reality is that these are based on the first and only FNPP currently available in Russia. Risks and other concerns, although understandable, are based on limited information.

2.4 Current International Legal Context

Since FNPPs are relatively new to the global legal stage, it is necessary to establish a preliminary legal context that may apply to these vessels. The objective of this section is to outline some of the legal difficulties that arise for the regulation of FNPPs. As the framework convention for the regulation of the seas and navigation, the LOSC is natural starting point, for which will dedicate a considerable part of this thesis. Consecutively, one of the first issues appear for the regulation of transboundary movement of the waste from these floating plants. The Basel Convention[62] is designed to ensure the correct disposal of hazardous waste through collaboration between producer, receiver and whoever stands in between. Unfortunately, the scope of this Convention is limited to hazardous wastes other than radioactive ones; as specifically mentioned in Article 1(3).[63] Excluding therefore its application to FNPPs. On the other hand, the International Atomic Energy Agency (hereinafter IAEA) attempted to fill this legal void through the "Code of Practice on the International Transboundary Movement of Radioactive Waste".[64] However, this code is more so a set of recommendations and best

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[59] Amundsen et. al, n 57 (p.467).
[60] *Ibid* (p.468).
[61] Høibråten, Steinar, Per E. Thoresen, and Are Haugan. "The sunken nuclear submarine Komsomolets and its effects on the environment." *Science of the total environment* 202.1-3 (1997): 67-78. (p.77).
[62] 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, OS—22 March 1989, EIF—5 May 1992, 1673 UNTS.
[63] *Ibid*.
[64] International Atomic Energy Agency, Code of Practice on the International Transboundary Movement of Radioactive Waste, IAEA, Vienna (1990) https://www.iaea.org/publications/documents/infcircs/code-practice-international-transboundary-movement-radioactive-waste.

practice, not legally binding. Despite the non-binding character of IAEA documents, their utility and information help clarifying some ambiguities. As a matter of fact, the IAEA's "Regulations for the Safe Transport of Radioactive Material" offers another definition of "vessels" (Any seagoing vessel or inland waterway craft used for carrying cargo), which Tscherning believes could include FNPPs.[65] However, in this author's opinion, Tscherning is particularly liberal with his interpretation. Although some definitions of "cargo"[66] could theoretically include FNPPs in this latter definition of vessel. However, what this would mean is that when considering the regulation of cargo ships, FNPPs would also be included. It is obvious from the *Technical Aspects* of the *Akademik Lomonosov* previously discussed that its design is considerably different from the ones of cargo ships built for long voyages. The creation of this two-tier system would most likely result in shortcomings because of the considerable difference between cargo ships and FNPPs.

In principle, transportation of dangerous goods is governed by Chapter VII of the International Convention for Safety of Life at Sea (hereinafter SOLAS) and the International Dangerous Code Goods Code (hereinafter IMDG Code).[67] The IMDG Code was made mandatory through amendments to the SOLAS Convention in 2004. Because of the absence of specific reference to radioactive material, the IMO published the "Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-level Radioactive Wastes on Board Ships" (hereinafter INF Code).[68] One of the issues arising from this is whether FNPPs do classify as an INF ship. Since the fuel in the reactor core is not designed to be removed at destination, it is not certain it would classify as cargo.[69] Such unclarity regarding the classification of FNPPs creates challenges when attempting to determine the legal regime that applies to such vessels. As a matter of fact, because of its unique characteristics, it is not completely certain vessels such as the *Akademik Lomonosov* are subject to the regime governing the seas in its entirety.

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[65] Tscherning, n 37, (p. 182).
[66] "Cargo: Meaning in the Cambridge English Dictionary." *Cambridge Dictionary*, https://dictionary.cambridge.org/dictionary/english/cargo.
[67] 1974 International Convention for the Safety of Life at Sea, OS—1 November 1974, EIF—25 May 1980, 1184 UNTS (hereinafter SOLAS)
[68] International Maritime Organization, Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board of Ships, IMO, London (1993)
[69] Tscherning, n 37, (pp.181-182)

3 Classification of FNPPs

There are some questions in regard to what FNPPs such as the *Akademik Lomonosov* classify as. The lack of self-propulsion and the mode of operation at destination create a distinct regime for FNPPs. Classification of these floating plants is a key component to better understanding which legal instruments may or may not apply. The following sources will provide mere examples on how different classification can be from one legal instrument to the other. Although UNCLOS does not provide a definition of what classifies as a "ship", there are several other sources that provide one. According to the International Convention for the Prevention of Pollution from Ships (hereinafter MARPOL), a ship is "any vessel whatsoever operating in the marine environment and includes… floating crafts and fixed or floating platforms".[70] On the other hand, the United Nations Convention on Conditions for Registration of Ships (hereinafter UNCCRS), ship is described as "any self-propelled sea-going vessel used in international seaborne trade for the transport of goods, passengers, or both".[71] The International Convention on Salvage (hereinafter London Salvage Convention) defines vessel as "any ship or craft, or structure capable of navigation".[72] Lastly, the International Convention for the Prevention of Pollution of the Sea by Oil (hereinafter OILPOL) gives this definition "ship means any sea-going vessel of any type whatsoever, including floating craft, whether self-propelled or towed by another vessel, making a sea voyage".[73] As it is clear in the definitions put forward, self-propulsion is the major number one factor to determine a classification for FNPPs. Although of the four definitions given half of them would exclude FNPPs from other ships, the source of these is important. Notably, the conventions that aim for a more inclusive application are more liberal on what is included as ship. On the other hand, it would be counterintuitive if for example the UNCCRS included offshore installations and barges. Therefore, the unavailability of one single definition points to the fact that "ship" must be interpreted on a case-to-case, or better convention-to-convention basis. Classification of FNPPs is one of the most important aspects, if not the most important, in order to determine the applicability of existing international law. In particular,

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[70] 1978 International Convention for the Prevention of Pollution from Ships, OS – 2nd November 1973, EIF – 12 September 1983, 1340 UNTS.
[71] 1986 United Nations Convention on Conditions for Registration of Ships, OS – 7th February 1986, not yet into force.
[72] 1989 International Convention on Salvage, OS – 28th April 1989, EIF – 14th July 1996, 1953 UNTS.
[73] 1954 International Convention for the Prevention of Pollution of the Sea by Oil, OS, 12 May 1954, EIF – 26th July 1958, 4714 UNTS.

when addressing IMO instruments, it will be possible to observe how classification is a vital element for determining the potential relevance of said instruments.

4 Law of the Sea Convention

As a framework convention the UNCLOS relies on the development of new regulations aimed at the evolutive nature of international law, specifically the one concerning the sea and its uses. International treaties negotiations can pose challenges and may even not be successful at reaching the objective desired. Lengthy negotiations and unnecessary diplomatic tug-of-wars can and should be averted when international law can adapt and evolve with the introduction of new variables. Certain legal instruments, such as the United Nations Convention on the Law of the Sea were intended to have an evolutive character.[74] Although UNCLOS was enacted in 1982, by referring to GAIRAS it relies on institutions such as the International Maritime Organization (hereinafter IMO) to produce legal instruments for the management of activities related to navigation without the need for amendments. Although the scope of this research is to evaluate how the Law of the Sea Convention applies to FNPP, subsequent sections will address other instruments that may apply.

The Convention applies a functional approach to the different maritime zones, generally measured from the coast, in order to establish rights and duties of coastal and flag States. The distance from the coast of any activity determines the balance between coastal State jurisdiction and flag State freedoms. This balance of rights and duties applies to any activity from navigation to scientific research, and the further away from the coast it occurs the weaker coastal State jurisdiction is. Nonetheless, discussing the whole balance between coastal and flag State jurisdiction goes beyond the scope of this research. There are specific regimes for navigation established by the Convention, innocent passage in the territorial sea, freedom of navigation in the exclusive economic zone (EEZ), and transit passage through straits used for international navigation.

The following section will address navigation of FNPP under each regime in order to determine the starting point and legal status of FNPP before addressing IMO instruments.

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[74] As a framework convention UNCLOS relies on other instruments through rules of reference in areas the drafters deemed necessary. This is done through explicit reference in specific provision to “generally accepted international rules and/or standards” or GAIRAS.

Each maritime zone will be analyzed separately by identifying relevant provisions in the UNCLOS in order to evaluate under what conditions FNPP can navigate in the different maritime zones and under what conditions coastal States may regulate such navigation.

As it was addressed in the *Classification of FNPPs* section the lack of a definition in the UNCLOS allows for a more inclusive application of this specific convention. Therefore, self-propelled or not FNPPs do classify as ships according to the UNCLOS. However, since the UNCLOS does regulate ships and offshore installations, during their normal mode of operation,[75] FNPPs should be understood as offshore installations under UNCLOS Article 60(1(b)).[76]

4.1 Internal Waters

coastal States hold full sovereignty in their internal waters,[77] delimited by the use of baselines, either normal or straight. The only exception is when the straight baseline method is employed. In this case, other States enjoy the right of innocent passage when the straight baselines close off "areas which had not previously been considered as such".[78] Therefore, because the use of straight baselines may create difficulties for international navigation, Article 8(2) of the Convention curtails the remanence of *mare liberum.*

Navigational rights for FNPPs in the internal waters of another State are therefore strictly dependent on authorization of that State. Nothing in the UNCLOS except to Article 8(2) provides any information as to what rights other vessels have in the internal waters of a coastal State. However, since Article 8(2) specifies the only circumstances in which FNPPs would have the right of innocent passage through these waters, and Section 3 of the UNCLOS is dedicated to innocent passage in the territorial sea, it is safe to assume that coastal States have full jurisdiction over their internal waters. This is also mentioned in Article 2 of the UNCLOS, which states that coastal State jurisdiction extends beyond land territory and internal waters. It is deducible from the wording of Article 2 that according to UNCLOS, coastal State jurisdiction over internal waters is equivalent to land territory.

[75] By normal mode of operation is intended at a semi-permanent location, producing energy.
[76] Legal aspects of this will be addressed in the following sections of this research.
[77] UNCLOS Art. 2.
[78] *Ibid,* Art. 8(2).

4.2 Navigation of FNPPs in the Territorial Sea and Coastal State Jurisdiction

4.2.1 FNPPs in the Territorial Sea

As it was explained in the opening segments of this research, the UNCLOS does not provide an explicit definition of ships or vessels. This allows new and unique vessels such as FNPPs to be included in its provisions. Out of Section 3, only two Articles expressly address nuclear-powered ships, Article 22 and Article 23. Nonetheless, when strictly looking at UNCLOS, there is no reason why FNPPs should not enjoy rights as other ships.

Innocent passage is the principal limitation to coastal State sovereignty in the territorial sea and a contested area of debate for different reasons. As of today, arguments come from two groups of countries both trying to defend their interests. These two groups are not necessarily divided according to their interests in nuclear-related activities since there have been occasions where States with such interests opposed navigation of vessels carrying ultra-hazardous materials in their maritime zones. A prime example of this is the case of Argentina. Although the country holds interests in nuclear development and energy production, in 2004 a national court decision banned the passage of ships carrying nuclear cargo within the 200 nm of the Argentinian EEZ.[79] The decision was done by citing the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; which according to Argentina's court decision would authorize such restrictions. On top of that, in order to counter opposition to such decision by Countries invoking their right of innocent passage under UNSLOC, Argentina declared that such implementations were allowed by the declaration made upon ratification of the UNCLOS, which allowed Argentina to regulate the transport of radioactive substances through their maritime zones.[80]

In most circumstances, however not strictly, States that oppose the navigation of vessels carrying nuclear material are archipelagic States with an economy directly related to their appeal as touristic destinations. This sparks an interesting debate over the first sentence of Article 19 of the 1982 Convention. The 1982 Convention does not offer any definition of

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[79] Currie, Duncan EJ, and Jon M. Van Dyke. "Recent Developments in the International Law Governing Shipments of Nuclear Materials and Wastes and their Implications for SIDS." *Rev. Eur. Comp. & Int'l Envtl. L.* 14 (2005): 117. (p.120).

[80] *Ibid.*

peace, good order or security. Due to the generality of such terms the interpretation can vary depending on national interests. Some countries seem to argue that the mere passage of ships carrying radioactive material is a threat to their peace, good order and security, therefore rendering passage non-innocent.[81] The cornerstone of this argument lays in the interpretation of Article 19. Although reference to peace, good order or security is broad enough to allow coastal States to make a case-to-case interpretation of what that entails, the rest of Article 19 poses some challenges to that interpretation. In spite of the fact that a definition is not provided, the same provision does deliver a list of what is considered prejudicial to peace.[82] Ships navigating through the territorial sea enjoy the right of innocent passage as default, as long as navigation is in conformity with the Convention and other international rules and standards. Article 19(2) outlines a list of actions which would strip vessels of this right. None of the activities listed seem to bridge the right of innocent passage with what is contained inside the vessel as cargo. It would be counterintuitive to assume that simply the type of cargo present on a ship would deprive it of such a basic right of navigation.

Out of the list provided in Article 19, particular attention should be given to 19(2(h) as it is the only one with particular reference to pollution. Since innocent passage is a pillar of navigational rights, the UNCLOS increases the threshold for the type of pollution that would result in a vessel losing its right of innocent passage. A definition of "pollution" is available in Article 1 of the UNCLOS, which encompasses a wide range of activities.[83] If Article 19(2(h) did not specify "willful" and "serious" the right of innocent passage would be greatly affected. According to Roscini, "willfulness must be understood in a different sense and refer not to the consequence of the conduct, but to the conduct itself."[84] Roscini holds that ships carrying ultra-hazardous material through high-risk area cannot be considered "innocent"[85] Although this author agrees with Roscini's view that a modern concept of "security" should

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[81] See Iran's Note No. 641/1206 of 3 May 1995 addressed to the Embassy of the French Republic at Theeran in *UN Law of the Sea Bulletin,* 221 (1996) p. 37.
[82] UNCLOS Art 19(2).
[83] "pollution of the marine environment" means the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities. UNCLOS, Art 1(4).
[84] Roscini, Marco. "The navigational rights of nuclear ships." Leiden Journal of International Law 15.1 (2002): 251-265. p.259.
[85] Roscini, n 84, (p.259).

be ecological and not strictly politico-military;[86] there are some risks connected to such a shift in the regime of innocent passage, especially when it comes to the transportation of ultra-hazardous nuclear material. The UNCLOS clearly adjudicates the right of innocent passage at the discretion of the flag State, meaning that it is solely dependent on the conduct of foreign vessels. This new interpretation that Rossini puts forward would shift it at the discretion of the coastal State, which may very well be abused to negate innocent passage to vessels depending on what they are transporting. To what extent coastal States can regulate navigation of FNPPs in their territorial sea will be analyzed below. Nonetheless, it should not take more than a superficial evaluation of Article 19 to conclude that Roscini's interpretation would result in creeping coastal State jurisdiction.

Out of section 3, two specific provisions expressly address nuclear powered ships and ships carrying nuclear material. Article 22 and 23 point to the fact that during the drafting of the Convention, specific thought was dedicated specifically to this special class of vessels; thus, vessels carrying dangerous material need to observe some additional requirements. Nonetheless, if FNPP are to be given the same navigational rights as ships carrying ultra-hazardous radioactive material, Article 22 and 23 give them the right of Innocent Passage. When looking solely at provisions in the Convention that expressly address nuclear-powered ships and other similar vessels, it is challenging to argue otherwise; in fact, this author agrees with Roscini and Treves in regards to the clarity of Article 23.[87] As it will be addressed in the following section, some believe that the presence of radioactive cargo on a ship could allow coastal States to prevent passage in the territorial sea. Although the requirements set upon ships carrying radioactive material[88] are entirely dependent on the legitimacy of the documents released and the process prior the release of such documents, Article 23 of the Convention does give coastal States the right to request this additional documentation. On top of that, Article 23 does make reference to international agreements, requiring ships in question to follow "precautionary measures established".[89] The Convention does not specify which international agreements, nonetheless, the International Maritime Organization (IMO)

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[86] Roscini, n 84, (pp.257-258).
[87] *Ibid,* (p.252); Treves, Tullio. "Navigation of Ships with Nuclear Cargoes: Dialogue between Flag and coastal States as a Method for Managing the Dispute." (2009): 217-235. (p.217)
[88] Article 23 of UNCLOS requires ships carrying nuclear substances to carry documents and observe special precautionary measures established for such ships by international agreements.
[89] LOSC Art. 23.

released a list of instruments that would fall within the scope of Article 23.[90] Of particular interest for this research is the reference to the International Convention for the Safety of Life at Sea of 1974, more specifically chapter VIII in respect of nuclear ships and chapter VII in respect of dangerous goods.[91] Most notably, as mentioned earlier, Article 23 does set a different standard for ships that fall within its scope, and the right of Innocent Passage should be considered lifted if Article 23 is breached.[92]

Intuitively, the same vessels that fall under Article 23 must observe Article 22 as mentioned in sub-paragraph 2 of the provision. Molenaar points out that there is some debate over the wording of Article 22 as to what "safety of navigation" entails.[93] Debate may arise in the eventuality Article 22 is used to steer ships away from particularly sensitive areas affected by operational discharges. When considering ships carrying ultra-hazardous cargoes, the major concern should be ensuring that navigation is safe and risk at a minimum. Therefore, when it comes to ships carrying radioactive material, the first and foremost use of Article 22 should be to require foreign ships to use sea lanes exactly for the reason of safety of navigation. This author believes there are two modes of navigation that should interest coastal States when considering these vessels. One is the regular route of navigation through the territorial sea enjoying innocent passage, direct and expeditious. When this route poses some challenges to navigation then Article 22 can be used to impose a safer route.[94]

As previously mentioned, Article 22 and 23 are the only provisions of the 1982 Convention that specifically mention ships carrying nuclear material. As it was already addressed at the beginning of the section on the Law of the Sea Convention FNPPs do classify as ships and therefore during navigation, self-propelled or not, Article 22 and 23 do indeed apply. Nonetheless, there is space for discussion as to whether the towage of such a unique and new technology requires a revision of what we understand as safety of navigation. As mentioned

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[90] Secretariat, I. M. O. "Implications of the United Nations Convention on the Law of the Sea for the International Maritime Organization." *Study by the Secretariat of the International Maritime Organization (IMO, LEG/MISC* 6.10 (2008). (p. 33)

[91] SOLAS will be addressed in following sections of this research.

[92] Barnes Art. 23 in Proells (ed) "United Nations Convention on the Law of the Sea: A Commentary". (2017) (p. 217).

[93] Erik J. Molenaar, coastal State Jurisdiction over Vessel Source Pollution (1998), 203.

[94] Debate over what extent Article 22 can be used to impose sea lanes for environmental purposes goes beyond the scope of this research as the main way to avoid environmental damage from ships carrying radioactive material is to ensure the vessel navigates safely through the territorial sea.

above, Article 22 allows the coastal State to designate sea lanes for safety of navigation. However, does this concept of "safety of navigation" differ according to what it applies to? A ship carrying radioactive material inherently raises more concerns than a ship carrying non-radioactive material. Hence the specification of Article 22(2) stating that especially certain types of vessels must follow the sea lanes prescribed. On top of that, FNPPs need to be towed by other vessels, increasing chances for accidents to occur. Safety standards for FNPPs should therefore be different, more stringent if you will, compared to self-propelled vessels, giving coastal States more leverage to force them to prescribe and require following sea lanes.

4.2.2 Coastal State Jurisdiction in the Territorial Sea

coastal State sovereignty is the principal regime regulating, *inter alia*, navigation in the territorial sea. Limiting sovereignty is the right of innocent passage that other states enjoy, outlined in Section 3 of Part II of the UNCLOS. Normally, as clearly explained in Article 17 of the Convention, ships of all States enjoy this right and so long as ships do not render their passage non-innocent, coastal States do not have the right to hamper their passage.[95] Nevertheless the UNCLOS does provide coastal States with some degree of power to regulate navigation in their territorial sea. The following section will evaluate under what conditions and to what extent coastal States can regulate the passage of FNPP in their territorial sea.

In the same subsection of the UNCLOS where the right of innocent passage is found, there are also provisions giving the coastal State prescriptive powers to regulate vessels in innocent passage. Although the overarching duty not to hamper innocent passage does limit the extent to which coastal States may impose certain rules and regulations, it would be counterintuitive if this could override every other provision in subsection A. Article 21 of the UNCLOS provides a list of where the coastal State may adopt rules and regulations, with explicit reference to the relation between these activities and innocent passage. Therefore, simply by the wording of Article 21(1) of UNCLOS, it is understood that this provision attempts to strike a balance between coastal States' prescriptive power and other States' right of innocent passage. Out of the list provided in Article 21, two sub-sections of it are of direct interest to the coastal State for the management of FNPPs. The first one is the one allowing the coastal State to adopt laws and regulation for safety of navigation.[96] This should be read in

[95] UNCLOS Art. 24.
[96] UNCLOS Art. 21(1(a).

conjunction with Article 22(2), which gives coastal States more authority over certain types of vessels, FNPPs included.[97] Nonetheless, the same provision leaves a fair amount un unclarity as to under what pretexts the coastal State may impose schemes to regulate maritime traffic. As a matter of fact, "safety of navigation" does not necessarily entail physical challenges such as rocks or shallow areas, but rather the orderly transit of particularly dangerous vessels. On top of that, since Article 21 is specifically dedicated to the laws and regulations of the coastal State, shouldn't "safety" be understood as perceived by the coastal State rather that from a purely navigational perspective? Since the ambiguity in the provisions of the UNCLOS do not allow for a clear-cut answer, a middle-of-the-way approach seems to be a more reasonable outcome for what is the arm-wrestle between coastal and flag States. In fact, Barnes points out that "hamper" is not as straightforward as "deny",[98] and in the same document, agrees with Brian Smith who puts forward a theme of proportionality and reasonableness.[99]

In order to find where the UNCLOS allows to strike this balance of proportionality and reasonableness it is first necessary to uncover all of coastal States' rights in the Territorial sea, which expand beyond the Part II into Part XII, particularly Article 211 and 220. Article 211 is specific to vessel-source pollution, which includes accidental, intentional and operational pollution.[100] According to Article 211, all States have an obligation to adopt laws and regulations for the prevention, reduction and control of pollution from vessels flying their flag.[101] The minimum standard for those regulations are generally accepted international rules and standards.[102] Interestingly, in the same provision allows coastal States to exercise their sovereignty and adopt rules and regulations in the Territorial Sea for the same purpose, with the only limit being the hampering of other States' innocent passage.[103] Article 211(4), just as Article 21 explicitly state that such rules and regulations allowed under these two provisions

[97] Barnes Art. 22 in Proells (ed) "United Nations Convention on the Law of the Sea: A Commentary". (2017).
[98] *Ibid.*
[99] *Ibid.*
[100] Bartenstein Art 211 in Proells (ed) "United Nations Convention on the Law of the Sea: A Commentary". (2017) p.1422.
[101] UNCLOS Art. 211(2).
[102] *Ibid.*
[103] UNCLOS Art. 211(4).

are to be in direct relation with other States' right of innocent passage, showing that innocent passage is not an absolute and unmodifiable right.

In regard to enforcement, the coastal State holds enforcement power to prevent passage that is non-innocent.[104] As it was discussed in the previous section, there could be the possibility to construct an argument that the mere navigation of FNPPs or other vessels carrying radioactive cargo is indeed prejudicial to the peace of the coastal State.[105] Nonetheless, the prevention of passage that is non-innocent is just a portion of Article 25. The temporary suspension of innocent passage in a specific area of the Territorial Sea could be used as enforcement power, only if the interpretation of "security" goes beyond military security. Churchill and Lowe point out that since "weapons exercises" was explicitly added in the same provision then "security" should have a broader range rather than just military security.[106] Churchill and Lowe do also point to the fact that is should be more limited than "peace, good order, or security" of Article 19(1).[107] The scope of it should be determined on a case-by-case basis, with its limitations to be determined by State practice. Nonetheless, "security" in this specific provision should be interpreted as not strictly military security since it expressly applies to ships and not warships. The limitations of Article 25 are, of course, the ambiguity of some of its wording, and the requirement to publish the areas in which innocent passage is suspended.[108] In fact, the necessity to duly publish which parts of the Territorial Sea are not accessible may interfere with the ultimate objective of protecting coastal State security. Lastly, one of the major issues with Article 25 is the area it can apply to. Despite the fact that there is no maximum limit on how much Territorial Sea can be closed off, it seems counterintuitive it would allow coastal States to prevent navigation in the Territorial Sea altogether.

There have been instances in which coastal States have used other venues than Article 25 to protect their coasts. As of 1996, already a considerable number or States[109] voiced concerns

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[104] UNCLOS Art. 25 (1).
[105] UNCLOS Art 19.
[106] Churchill and Lowe in Barnes Art. 25 Proells (ed) "United Nations Convention on the Law of the Sea: A Commentary". (2017) p.226.
[107] *Ibid.*
[108] UNCLOS Art. 25 (3).
[109] They include: Uraguay, Colombia, Argentina, Brazil, Indonesia,Portugal,Equador,**Fiji,** Dutch Antilles, Jamaica, Philippines, Chile, Spain, Puerto Rico, Martinique, Commonwealth **of** Dominica, Dominican Republic,

and opposition to the navigation of certain vessels through their maritime zones. Of particular interest to this thesis is the case of Chile, whom invoked the right to self-defense and the precautionary principle to ban the navigation of ships carrying nuclear cargoes from its EEZ. In itself, according to the UN Charter, the right to self-defense is only allowed in response to an attack.[110] Therefore, if Chile did invoke Article 51 of the UN Charter to justify action against nuclear vessels in its maritime zones it would most likely not hold in an international court.[111] However, there is room for discussion by looking at the UNCLOS and the Rio Declaration. According to Principle 15 of the Rio Declaration,[112] which is widely considered customary international law,[113] the precautionary principles should be applied in order to protect the marine environment. As it was just mentioned above, Article 25 of the UNCLOS is not simply for military security; thus, paired with Principle 15 of the Rio Declaration, Chile's stance against vessels carrying radioactive material is not so unthinkable anymore. As it is proven throughout this thesis, both coastal States and flag States have a duty to protect and preserve the marine environment, whether under their jurisdiction or not.[114] On top of that, although this section of the thesis is dedicated to the territorial sea, it is important to point out that coastal States also have jurisdiction over the protection and preservation of the marine environment in the EEZ.[115] Since the coastal State holds this type of jurisdiction in the EEZ, it should have even stronger rights in the territorial sea, where it enjoys full sovereignty.[116] That said, if precaution is to be applied to navigation of FNPPs in maritime zones of other States, it should be both a right of the coastal State and a duty of the flag State to maintain navigation out of sensitive areas. However, since coastal States should not have to rely on other States adopting precaution when considering navigation of FNPPs, Article 25

Federated States of Micronesia, British and **US** Virgin Islands,Honduras,Aruba, Hawaii,Ethiopia,South Africa, Republic of Nauru, Mauritius, Antigua and Barbuda and Chile. Currie, Duncan EJ. "The Right to Control Passage of Nuclear Transport Vessels Under International Law." *Glob. Envtl. L. Ann.* (1996): (p.54).

[110] 1945 Charter of the United Nations and Statute of the International Court of Justice, OS – 26th June 1945, EIF – 24th October 1945, 1 UNTS

[111] This conclusion is supported by the ICJ Corfu Channel Case (Merits 34-35), in which the ICJ rejected both claims for self-defence.

[112] Agenda 21, Rio Declaration, Forest Principles. New York: United Nations, 1992.

[113] For further discussion on the status of the precautionary principle: Gillespie, Alexander. "The precautionary principle in the twenty-first century: a case study of noise pollution in the ocean." *The international journal of marine and coastal law*22.1 (2007): 61-87. (p. 66).

[114] General obligation under Art. 192; Measures to prevent pollution, reduce and control pollution of the marine environment under Art. 194; Pollution from vessels under Art. 211

[115] UNCLOS Art. 56(b(iii).

[116] UNCLOS Art. 2.

paired with Principle 15 of the Rio Declaration could be adopted to close off part of the territorial sea. Nonetheless, still remains the question of how much of the territorial sea can be closed off.

coastal State enforcement power does seem to have more vigor when it comes to Part XII of UNCLOS. As mentioned above, the coastal State does hold prescriptive powers under Article 21 and 211. However, what enforcement powers do coastal States have in their Territorial Sea when it comes to FNPPs? Ideally, Article 2 of UNCLOS does give enforcement power to the coastal State since its sovereignty extends to the Territorial Sea. However, the lack of a provision explicitly outlining what this jurisdiction entails leaves much up for debate. First of all, innocent passage must be respected and upheld for all ships that follow the guidelines of Article 19. Nonetheless, Article 21 does specifically state that "coastal States may adopt laws and regulations […] relating to innocent passage".[117] However, other States are only required to comply with laws and regulations relating the prevention of collision at sea,[118] leaving some ambiguity as to what weight other areas of Article 21 have compared to the ones related to prevention of collision at sea. Although prevention of collision as tea is fairly broad for the coastal State to implement meaningful laws and regulations to ensure the safe passage of FNPPs through their Territorial Sea. On top of that, Article 21 should be read in conjunction with Article 220 (2), which gives to the coastal State explicit power to inspect and institute proceedings when there are clear grounds for believing that a vessel violated coastal State's regulations for the prevention, reduction and control of pollution from vessels.[119] Nonetheless, when a vessel is inspected for a breach of regulations related to the prevention and control of pollution, coastal States' enforcement powers are limited by Article 226 (1(b)

In light of all of this then the question remains as to what extent can the coastal State interfere with the right of innocent passage. The existence of Articles such as 21 and 211 point to the conclusion that there is some sort of balance that can be achieved. Although Article 18(2) does state that passage should be continuous and expeditious, such requirement applies solely to foreign ships in order to retain their right of innocent passage. coastal States do not have any requirement to ensure passage is continuous and expeditious. Article 24 does set a duty

[117] UNCLOS Art. 21(1).
[118] UNCLOS Art. 21(4).
[119] UNCLOS Art. 220 (2).

not to impose rules and regulations that can deny or impair innocent passage.[120] However, if a coastal State can impose sea lanes and traffic separation schemes without that being an impairment of innocent passage, there should be a considerable range or requirements that coastal States can impose of FNPPs without it being an impairment.

Inter alia, ship reporting systems or prior notification have been a lively area of discussion, especially in regard to ship carrying radioactive cargo.

Notification without consent is not a new practice and it is already present in some internationally recognized legal instruments such as the Basel Convention,[121] the IAEA Joint Convention on Safety of Spent Fuel Management and on Safety of Radioactive Waste Management.[122] Although these legal instruments go beyond the scope of this research, they can still be indication of a recognition of State practice and emergence of a new understanding of navigational freedom and reciprocal due regard. A similar approach can be observed in the regime governing navigation of warships.

4.3 Navigation of FNPPs Through Straits Used for International Navigation and Coastal State Jurisdiction

4.3.1 FNPPs in Straits Used for International Navigation

Part III of UNCLOS is dedicated to the regime of straits used for international navigation, governed by the regime of transit passage. Similar to the regime of innocent passage, right of transit is restricted to continuous and expeditious navigation through the strait.[123] Since there are neither any specific provision in this part that mentions ships carrying radioactive cargo, nor any explicit exclusion of them, it is assumed that FNPPs would fall within "all ships and aircraft" mentioned in Article 38.[124] Just as for the regime of innocent passage, Part III gives FNPPs freedom of navigation through the strait and limits sovereignty of States bordering the area in question, regardless this overlapping with the Territorial Sea.[125] Nonetheless, there is a

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[120] UNCLOS Art. 24 (1(a).
[121] 1989 Basel Convention on the Control of Transboundary Movements of Hazardous wastes and Their Disposal, OS – 22nd March 1989, EIF – 5th May 1992 1673 UNTS.
[122] Doc. IAEA INFCIRC/546 of December 24, 1997. See Art. 27 (1(i) requirement of authorization of the State of destination; 27(1(ii) weaker provision for States of transit; 27(3(i) saving clause *inter alia* for a maritime rights and freedoms as provided by international law..
[123] UNCLOS Art. 38 (2).
[124] UNCLOS Art. 38 (1).
[125] UNCLOS Art. 38 (2).

set of rules that must be complied with during transit, outlined under Article 39. Of particular interest is subparagraph 2 of Article 39, according to which FNPPs, just as other vessels, would have to follow a broader set of regulations compared to the regime of innocent passage. As a matter of fact, not only FNPP would have to obey internationally accepted rules and standards but also a broader set of recommendations and voluntary code of practice.[126] Once traffic separation schemes or sea lanes, where properly imposed by the coastal State, are followed, nothing in UNCLOS would prevent FNPPs from navigating through straits used for international navigation.

Despite this broader set of regulations, there is an issue with enforcement rights by the coastal State when foreign ships are in transit passage. On the one hand, solely from Part III of UNCLOS it would seem that coastal States do not have any type of enforcement power. On the other hand, there are plenty of straits used for international navigation that overlap with the Territorial Sea of these strait States. In the next section it will be addressed how this may give some enforcement powers to the coastal State for the prevention, reduction and control of pollution from ships.

4.3.2 Coastal State Jurisdiction in Straits Used for International Navigation

As previously addressed in the International Straits section dedicated to rights and duties of FNPPs, the international straits regime gives coastal States bordering the strait little to no enforcement power. Although the set of rules and regulations that vessels are required to follow are broader than the ones in the Territorial Sea during in innocent passage,[127] the coastal State has limited enforcement power to ensure these are followed. As a matter of fact, even coastal State prescriptive power is quite limited. For example, navigational safety is limited to sea lanes and traffic separation schemes;[128] and the prevention, reduction and control of pollution is restricted to applicable regulation for the discharge of oil, oily waste and other noxious substances.[129] On top of that, coastal States are also limited by Article 233 of UNCLOS, which allows “appropriate enforcement measures” only when there is major damage or a threat thereof. Clearly allowing the coastal State a reactive rather than proactive

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[126] UNCLOS Art. 39 (2(a and b)); Nadelson, Robert. "After MOX: the contemporary shipment of radioactive substances in the law of the sea." *The International Journal of Marine and Coastal Law* 15.2 (2000): 193-244. (P.210)
[127] UNCLOS Art. 39 (2(a-b).
[128] UNCLOS Art. 42 (1(a).
[129] UNCLOS Art. 42 (1(b).

array of options. Therefore, when a FNPP does approach a strait used for international navigation, the coastal State is allowed to prescribe rules and regulations for safety of navigation and possible discharges while also knowing that some enforcement is allowed under Article 233. Nonetheless, this is limited to reactive actions only once the vessel in question is creating a dangerous environment by not following sea lanes or TSSs. In majority of cases, FNPPs will most likely be able to use straits for international navigation undisturbed. One possible way for coastal States to regulate or prevent their passage would be if where there is an overlap of international strait and Territorial Sea, customary competence to take action when their peace and good order is threatened.[130] However, from the conclusion drawn from the section on Territorial Sea, peace and good order is a threshold that the mere passage of a FNPP does not break for a coastal State to have the power to interfere with its navigation.

4.4 Navigation of FNPPs in the Exclusive Economic Zone and Coastal State Jurisdiction

4.4.1 FNPPs in the EEZ

Rights and duties of other States in the EEZ are found under Article 58 of Part V of UNCLOS. Navigation through this maritime zone is governed by the same freedom of navigation that vessels hold in the high seas through specific reference to Article 87.[131] Freedom of navigation is limited by giving due regard[132] to the rights and duties of the coastal State,[133] which will be further discussed in the latter section on coastal State rights and duties in the EEZ. Naturally, since not even in the high seas States enjoy complete and absolute freedom,[134] in the EEZ other States have an obligation to follow laws and regulations adopted by the coastal State.[135] As it can be concluded by the name Exclusive Economic Zone, the main purpose of this area is to give coastal States prioritized access to the resources within the 200 nm from the baseline. Therefore, coastal State legislative power is aimed at regulating living and non-living resources within the 200 nm limit. This is deducible by the wording of

[130] Nadelson, n 26, (p. 211).
[131] UNCLOS Art. 58 (2).
[132] The concept of *due regard* will be further address below in the section regarding navigation in the high seas.
[133] *UNCLOS* Art. 58 (3).
[134] *Ibid* Art. 87 (2).
[135] *Ibid* Art. 87 (3).

Article 56,[136] and particularly on what is omitted from the same provision. While the UNCLOS does recognize priority to the coastal State on certain matters,[137] it does not hold extensive rights for the regulation of navigation. Since the coastal State does not have the power to prescribe any sea lanes or TSSs, navigation through the EEZ should be undisturbed as long as it is done following laws and regulations adopted by the coastal State in relation to Article 56.

One element of Article 58 that may raise some ambiguities is the reference to "other internationally lawful uses of the sea" that other States enjoy in the EEZ on top of freedom of navigation.[138] Weinstein points out that in the eventuality that a State institutes a ban on importation of hazardous waste or in this case radioactive cargo, navigation of vessels carrying such cargoes could arguable be unlawful.[139] Although this argument may find some strength by the fact that due regard for the rights of other States should not be accorded higher priority than environmental protection;[140] and this could be an alternative path for coastal States to manage the navigation of certain vessels in their EEZs, it would be tough to uphold if challenged legally. First of all, since other States have the right to lay submarine cables in the EEZ of a coastal State, one of the internationally lawful activities that are allowed in this area is maintenance operations.[141] Secondly, the transportation of radioactive material is an internationally lawful activity and compatible with the provisions of UNCLOS,[142] which would not become internationally unlawful through a national ban. Therefore, the mere navigation of nuclear cargo through the EEZ would not be in breach of any national ban. Just as in the case of innocent passage in the Territorial Sea, the nature of the cargo does not affect a vessels' right of innocent passage. If foreign vessels hold such a right in the Territorial Sea, it would be counterintuitive if the coastal State could have such power in the EEZ. Lastly, the

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[136] Thorough explanation in the next section *coastal State Jurisdiction in the EEZ.*
[137] UNCLOS Art 56.
A) sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources […];
B) jurisdiction as provided for in the relevant provisions of this Convention with regard to: […]
C) other rights and duties provided for in this Convention.
[138] UNCLOS Art. 58 (1).
[139] Weinstein, Elaine B. "The impact of regulation of transport of hazardous waste on freedom of navigation." *The International Journal of Marine and Coastal Law* 9.2 (1994): 135-172. (p.143)
[140] *Ibid* (p.142)
[141] Proelss Art. 58 in Proells (ed) "United Nations Convention on the Law of the Sea: A Commentary". (2017) (p.452)
[142] UNCLOS Art. 58 (1)

UNCLOS does not provide extensive prescriptive powers to the State allowing it to adopt legislation banning vessels from navigating in their EEZ waters. In the territorial sea the State can temporarily close off its waters and suspend innocent passage. That is not possible in straits and certainly not in the EEZ. Even when trying to protect the environment the coastal State must refrain from unjustifiable interference with activities carried out by other States in the exercise of their rights.[143]

4.4.2 Coastal State Jurisdiction in the EEZ

As mentioned in the section of this research regarding the rights and duties of FNPPs in the EEZ, the coastal States' jurisdiction over this area is mainly resource oriented. Article 56 gives the coastal States' sovereign rights for the purpose of, inter alia, managing and conserving natural resources. There is an argument to be made when it comes to living natural resources. If a naval accident was to occur in the EEZ and radioactive substances polluted the waters, those living resources and with them the economic activity connected to them would be affected. In order to prevent pollution from vessels the coastal State has limited prescriptive powers, meaning that the legislation that it adopts must conform to and give effect to generally accepted international rules and standards.[144] In other words, in the EEZ coastal States can only ensure other vessels do not break the minimum standards set by international law, which other flag States should already be following. Among the rules and standards, the coastal State can legislate to prevent pollution from vessels are the prescription of sea lanes and TSSs, since these are done through IMO instruments,[145] some of which fall within the generally accepted rules and standards and require approval of the IMO.[146] Through Article 211 coastal States have also the power to designate special areas when international rules and standards are inadequate.[147] This, however, is dependent on an extensive process where coastal States must collect and provide evidence to justify why the area in question requires more stringent regulations; all of which is reliant on IMO approval.[148]

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[143] UNCLOS Art. 194 (4)
[144] UNCLOS Art. 211(5).
[145] This will be further discussed in the following section on SOLAS.
[146] Bartenstein Art 211 in Proelss (ed) "United Nations Convention on the Law of the Sea: A Commentary". (2017) (p.1434).
[147] UNCLOS Art. 211(6).
[148] UNCLOS Art. 211(6(a to c).

coastal State enforcement powers of the abovementioned rules and regulations are outlined in Article 220 of UNCLOS. The UNCLOS does provide the coastal State with enforcement powers.[149] Article 220 outlines the normal process when such violations occur, which is first to request information, following with an investigation, then take stricter enforcement measures such as arrest. On top of that, the coastal State does hold the right of hot pursuit in accordance with Article 111 (2), which can continue in the high seas as well. Although the coastal State does have the possibility to pursue other enforcement measures such as inspections and institute proceedings, these are only available to it under certain conditions. Inspections are only allowed if the initial information requested is not given or tampered with.[150] Therefore, if a FNPP navigating through the EEZ is by no means a threat and provides all information the coastal State requires, the coastal State has no grounds for enforcing their jurisdiction.

Lastly, Article 221 gives coastal States the possibility to proportionate measures in the eventuality of marine casualties. "Beyond the territorial sea" allows coastal States to take measures in the EEZ and the high seas as well, just as long as the threat in question has the potential for harmful consequences. Importantly, Article 221 is not supposed to give coastal States more power than it is allowed by international law, a concerned voiced by the Soviet delegation, stating that Article 221:

> 'should not be held to give the coastal State more extensive rights of intervention in cases of maritime casualty than the rights of intervention it already enjoyed under the terms of the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, signed in Brussels in 1969,'[151]

Article 221 would nonetheless give coastal States the right to intervene in accordance to the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties even when the State is not a party to it. Lastly, the safeguards outlined in Section 7 of the UNCLOS still apply even when Article 221 is being enforced, therefore imposing limitations on the exercise of the powers of enforcement.[152]

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[149] UNCLOS Art. 220.
[150] UNCLOS Art. 220(5).
[151] Third Committee UNCLOS III, 38th Meeting found in Bartenstein Art 221 in Proelss (ed) "United Nations Convention on the Law of the Sea: A Commentary". (2017) (p.1518).
[152] Bartenstein Art 221 in Proelss (ed) "United Nations Convention on the Law of the Sea: A Commentary". (2017) (p.1519).

4.5 Navigation of FNPPs in the High Seas

When FNPPs sail in the high seas, unlike the previous sections on the *Law of the Sea*, there is a primacy of flag State jurisdiction.[153] However, as it was discussed above flag State jurisdiction in the high seas is not absolute, such as in the case of hot pursuit.[154] Duties of the flag State are listed in Article 94 of the UNCLOS, centered around administrative, technical and social matters. On top of that, general obligations to protect and preserve the marine environment apply to the high seas and therefore to the flag State as well.[155]

In order to balance competing interests of different States in the high seas, the LOSC applies the concept of due regard, just as in the EEZ. The LOSC does not provide any specific duty or any particular criteria to help define what due regard entails. Nonetheless, the International Law Commission recognized it to be customary international law, therefore applying also to non-parties and entailing that "States are bound to refrain from act which might adversely affect the use of the high seas by nationals of other States"[156] In other words, States enjoy considerable freedom in the high seas, but that freedom ends where another State's freedom starts. In light of that, due regard does not only impose an obligation on vessels not to interfere, but also a due diligence obligation to ensure that its vessels are not infringing the rights of the coastal State.[157]

The concept of due regards was addressed in two separate occasions by international tribunals. First in the *Chagos Marine Protected Area Arbitration,* where the tribunal outlined that:

> "the ordinary meaning of 'due regard' calls for the [first State] to have such regard for the rights of [the second State] as is called for by the circumstances and by the nature of those rights. The Tribunal declines to find in this formulation any universal rule of conduct. The Convention does not impose a uniform obligation to avoid any

[153] UNCLOS Art. 92(1).
[154] UNCLOS Art. 111.
[155] UNCLOS Art. 192.
[156] ILC Law of the Sea Article with Commentaries (note 60), Art. 24 (Art. 27); in Guilfoyle Art.87 n Proells (ed) "United Nations Convention on the Law of the Sea: A Commentary". (2017) (p.681).
[157] This applies to the high seas but also to the EEZ as it is clear from the adjudication in the South China Sea Arbitration: "China has, through the operation of its marine surveillance vessels in tolerating and failing to exercise due diligence to prevent fishing by Chinese flagged vessels at Mischief Reef and Second Thomas Shoal in May 2013, failed to exhibit due regard for the Philippines' sovereign rights with respect to fisheries in its exclusive economic zone. Accordingly, China has breached its obligations under Article 58(3) of LOSC" (At para 757); South China Sea Arbitration, Philippines v China, Award, PCA Case No 2013-19, ICGJ 495 (PCA 2016), 12th July 2016, Permanent Court of Arbitration.

> impairment of [the second State's] rights; nor does tit uniformly permit the [first State] to proceed as it wishes, merely noting such rights. Rather, the extent of the regard required by the Convention will depend upon the nature of the rights held by [the second State], their importance, the extent of the anticipated impairment, the nature and importance of the activities contemplated by the [first State], and the availability of alternative approaches.[158]

According to the tribunal, due regard is purposely left without a specific definition or outline of what it entails so that it can be applied proportionately to different circumstances. The legitimacy of this interpretation of due regard was strengthened when it was cited once again in the *South China Sea Arbitration.*[159]

Since the flag State has full and sole jurisdiction over FNPPs navigating in the high sea, it is in fact under flag State responsibility to ensure that the design, construction, equipment, operation and manning of the plant are up to par. Of course, the LOSC does not provide standards but just an obligation to do so; and for the case of FNPPs, flag States shall ensure that the vessel is up to standard for both navigation and during operation as an offshore installation.[160] Obligation to ensure that vessels flying their flag are seaworthy is also repeated in Article 217 of the UNCLOS, while also imposing an obligation to ensure international laws and regulations are enforced. On top of that, the same provision also sets an obligation for the flag State to investigate violations committed by vessels flying their flag.[161] There is no specification of where violations need to occur, which allows the conclusion that if violations are made in the high seas, other vessels can submit a written request demanding the flag State to investigate.

That being said, since the *Akademik Lomonosov* is the only FNPP currently operating, it is to see if current standards are enough to ensure safe navigation. Although it is not the first time the KLT reactors present on the *Akademik Lomonosov* are found at sea,[162] the uniqueness of

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[158] *Chagos Marine Protected Area Arbitration (Mauritius v. United Kingdom),* Award of 18 March 2015, para. 519.
[159] *South China Sea Arbitration (The Republic of Philippines v. The People's Republic of China)*, Award of 12 July 2016, para. 742.
[160] UNCLOS Art. 194(3(b and d).
[161] UNCLOS Art. 217(6).
[162] As mentioned above, the KLT reactors on the FNPP are similar to the ones found on the Russian nuclear-powered ice breaker fleet and submarines.

this vessel[163] poses certain concerns as to whether the existing standards flag States have an obligation to enforce are enough to ensure safe navigation in the high seas.

5 IMO Instruments

As it is mentioned in Article 2 of Annex VIII of the UNCLOS, the IMO is in charge of regulating navigation. Although that is the only provision in which the IMO is mentioned explicitly, the UNCLOS makes reference to it as the "competent international organization", and it is the principal instrument designed to maintain and improve collaboration between States in regard to navigation.[164] For the purpose of this thesis, not all IMO instruments will be analyzed but only the ones related to navigation. Beginning with the SOLAS Convention, and the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel (hereinafter INF Code) and the International Maritime Dangerous Goods Code (hereinafter IMDG Code), both of which are made mandatory under SOLAS. The Polar Code, as an Arctic and Antarctic specific instrument will also be included, especially since one of the advantages of FNPPs would be to deliver energy to remote areas, including the Arctic. The Polar Code will be addressed under the SOLAS Convention as it is incorporated through Chapter XIV. On top of that, the IMO instruments that will be addressed also apply to polar regions as well, whereas the Polar Code is limited polar regions. On top of that, also MARPOL and the London Convention will be covered in the following section of the thesis. The scope of this following section is to evaluate whether or not the relevant instruments apply to FNPPs or not. The purpose is to determine if there is a gap in the existing international law that regulates navigation.

5.1 SOLAS Convention

5.1.1 Chapter I General Provisions

The SOLAS Convention provides a general application provision in Chapter I, under Regulation 1. According to this first general provision, SOLAS applies to "ships engaged on international voyages,[165] which is fairly inclusive. However, question arises when considering

[163] See *Technical Aspects* in this thesis for more info.
[164] 1948 Convention of the International Maritime Organization, OS – 6th March 1948, EIF – 17th March 1958, 1520 UNTS, Art. 1.
[165] 1974 International Convention for the Safety of Life at Sea, OS—1 November 1974, EIF—25 May 1980, 1184 UNTS Chapter I Regulation 1.

the example of Russia, which so far is the first to deploy a FNPP. As a matter of fact, if the *Akademik Lomonosov* does not leave Russian maritime zones but operates in proximity to other States, Russia is not legally obligated to follow the SOLAS Convention. Being one of the principal instruments for the safety of life at sea and prevention of pollution from ships, this limitation in its applicability may result in possible threats to neighboring States.

From the multiple definitions of ship in the *Classification of FNPP* section of this thesis, it is evident that SOLAS Convention is quite restrictive compared to other IMO conventions such as MARPOL. As a matter of fact, it would appear to be a deliberate choice during the negotiations not to have an all-inclusive definition, since in each single Chapter it is specified to what type of ships it applies. However, Regulation 3 provides a list of exceptions, which raise some questions as to whether these exclude FNPPs such as the *Akademik Lomonosov*.[166] In fact, the lack of self-propulsion may allow some to challenge the SOLAS Convention's applicability to non-self-propelled FNPPs since Regulation 3 states that the present Regulations do not apply to "ships not propelled by mechanical means".[167] First of all, it is unclear as to whether "the present regulations"[168] refers to all regulation of the SOLAS Convention or Regulations of that specific Chapter since the SOLAS Convention is composed of particularly specific Annexes that expressly provide their scope of application. However, it is presumable that Regulation 3 of Chapter I provides overarching exceptions that apply to the entire SOLAS Convention. Most importantly, question remains as to whether Regulation 3(i) excludes non-self-propelled FNPPs from the SOLAS Convention. As it is mentioned in the *Background* section of this thesis, interpretation of treaties is done in accordance to the VCLT. According to Article 31 of the VCLT, interpretation shall be done "in good faith" and "in accordance to the ordinary meaning to be given to the terms of the treaty in their context and in the light of its objective and purpose.[169] One of the possible interpretations of Regulation 3 (i) is that FNPPs such as the *Akademik Lomonosov*, although not self-propelled by mechanical means, they are propelled by mechanical means, in the form of multiple tugboats. However, this interpretation has two major flaws. First of all, for the FNPP to have a "propulsion" it requires the presence of other vessels. Without tugboats, the *Akademik Lomonosov* is in fact without means of propulsion, less capable of navigating than a rowboat.

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[166] SOLAS Chapter I Regulation 3.
[167] *Ibid.*
[168] SOLAS Chapter I Regulation 3(a).
[169] VCLT Art. 31(1).

On top of that, the VCLT requires to interpret provisions with the ordinary meaning of terms. According to the Cambridge online dictionary, "propulsion" means "a force that pushes something forward".[170] Contrarily, "towing" is the action of pulling as described by the Cambridge dictionary.[171] However, according to the IAEA, the SOLAS Convention does apply during transport of FNPPs.[172] Nonetheless, during a workshop in Tromsø (Norway), during which the legal ambiguities surrounding FNPPs were addressed, Jan Engel de Boer, an IMO's Senior Legal Officer, stated that according to the IMO, the SOLAS Convention does not apply to FNPPs without independent mechanical means of propulsion.[173] In reality, if the utilization of towboats fulfilled the requirements set under Regulation 3(i) it would mean that all of the vessels that the same regulation aimed at excluding from the SOLAS Convention would automatically be included as soon as the vessel in question required towing. That being said, since there is a fair amount ambiguity surrounding the applicability of the SOLAS Convention to FNPPs such as the *Akademik Lomonosov*, the following section will address how Chapter VII and VIII of the same convention would apply to FNPPs in case future FNPPs do have a means of mechanical propulsion that would undoubtedly fall under SOLAS.

5.1.2 Chapter VII Carriage of Dangerous Goods

Chapter VII of the SOLAS Convention provides regulation on the carriage of dangerous goods, and through amendments to this Chapter that the INF and the IMDG Code were made mandatory. As a matter of fact, both the IMDG and the INF Code have become an intrinsic part of Chapter VII of the SOLAS Convention. Under Regulation 1 of Chapter VII, the SOLAS Convention relies on the IMDG Code for the definition of dangerous goods, which for the purpose of this thesis are under the Class 7 Radioactive Material.[174] Whereas the INF Code appears under Regulation 14 of Chapter VII, making reference to it for the definition of

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[170] Propulsion*:* Meaning in the Cambridge English Dictionary. *Cambridge Dictionary,* https://dictionary.cambridge.org/dictionary/english/propulsion.
[171] Tow: Meaning in the Cambridge English Dictionary *Cambridge Dictionary,* https://dictionary.cambridge.org/dictionary/english/tow?q=towing.
[172] "Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study." *IAEA*, IAEA, 6 Sept. 2016, www.iaea.org/publications/10516/legal-and-institutional-issues-of-transportable-nuclear-power-plants-a-preliminary-study (p. 63).
[173] Important to specify that the IMO has not yet started any official work on FNPPs.
[174] 2008 International Maritime Dangerous Goods Code: Incorporating Amendment 34-08. London: International Maritime Organization.

INF cargo. To begin with, this section will address Chapter VII as a whole, in order to determine if it applies to FNPPs. The IMDG Code and INF Code will be analyzed separately.

Applicability of Chapter VII is specified under Regulation 2 of the same Chapter, which it encompasses a broad range of possible vessels carrying dangerous goods, or in this case, IMDG Class 7 goods. However, the provision specifies that the dangerous goods are to be in packaged form, suggesting that the provisions of Chapter VII are more so meant for cargo ships. However, as it was explained it the *Akademik Lomonosov: technical aspects* section of this thesis, the Russian FNPP is designed to operate on site for several years. In order to ensure that kind of autonomy, SNF is stored on the FNPP. The fact that SNF is stored for a considerable amount of time on the same vessel as the rest of the crew operating the FNPP, points to the fact that the SNF must be stored properly. Whether or not this means that the SNF is in packaged form is uncertain. Although FNPPs such as the *Akademik Lomonosov* may not have any dangerous goods in packaged form at the beginning of its operations, it would end up with stored SNF throughout the course of the operation. Nonetheless, in order to be in "packaged form", according to Regulation 1(3) of the IMDG Code, the SNF should be a "form of containment specified in the IMDG Code"[175] It is beyond the scope of this research to determine if the *Akademik Lomonosov* does fulfill these requirements, since this thesis is not specific to the Russian FNPP only and *Rosatom* does not provide such information. The conclusion that can be drawn from this is that if FNPPs without self-propulsion somehow do fall under the scope of SOLAS and store SNF on board in packaged form, then it will be mandatory that the storage of SNF is done by following IMDG regulations on packaging.

Transportation of dangerous goods in packaged form is collected under Part A of Chapter VII. Part A-1 of the same Chapter addresses the transportation of dangerous goods in bulk. Whereas Part A might leave some uncertainty as to whether it applies to FNPPs, Part A-1 is clearer. In order to determine if Part A-1 applies to FNPPs it is not necessary to mention Regulation 7-1, which covers applicability, but rather, concentrate on the Regulation 7. Regulation 7 provides the definition of dangerous goods in solid form in bulk; which excludes FNPPs by specifying that the material in question is loaded into cargo spaces of a whip without any intermediate form of containment. There are two elements in this definition that

[175] IMDG Code, Regulation 1(3).

exclude FNPPs from Part A-1. First of all, as far as this research uncovered, FNPPs do not necessarily have any cargo space. The only part of the FNPP that could in some resemble cargo space is the section for the storage of SNF. Secondly, even in the case SNF storage units on FNPPs are considered cargo space, nothing would be "loaded directly" into them, as it is specified under Regulation 7 of Part -1. As a matter of fact, SNF would be loaded into these storage units from its "intermediate form of containment", the reactors on board of the FNPP.

The second instrument made mandatory through amendments to Chapter VII of SOLAS is the INF Code. Part D of Chapter VII on requirements for the transport of packaged irradiated nuclear fuel outlines under *Definitions* in Regulation 14 that INF means "packaged irradiated nuclear fuel. As mentioned above, it is uncertain whether or not the SNF stored on board of FNPPs will be in packaged form. However, the most important factor is that FNPPs such as the *Akademik Lomonosov* are not meant to carry any INF as cargo but only SNF. Because of this, the INF Code does not apply to FNPPs. In the eventuality of future FNPPs with on-board storage of INF for possible on-site refueling, Part D of Chapter VII could possibly apply.

In regard to the INF and IMDG Codes, there is an important aspect of their scope of application that must be addressed. Both Parts state that they apply to "all ships" covered by the present regulations, including cargo ships of less than 500 gross tonnage. The question is, by saying that they apply to "all ships", does this include ships without mechanical propulsion? Some could argue yes since it says, "all ships". However, by observing Regulation 3, cargo ships of less than 500 tons gross tonnage are mentioned as one of the exceptions, right before ships not propelled by mechanical means. Exceptions of SOLAS apply to the different Chapters, unless expressly provided otherwise.[176] Throughout Chapter VII, cargo ships of less than 500 500 tons gross tonnage are explicitly included in the scope of application. Therefore, if ships without mechanical propulsion were supposed to be included in the INF and IMDG Codes they would have expressly been mentioned.

5.1.3 Chapter VIII Nuclear Ships

While Chapter VII is for the transportation of nuclear cargoes of different types, Chapter VIII is more so structured for nuclear ships such as nuclear-powered icebreakers. The lack of a

[176] SOLAS Chapter I Regulation 3(a).

definition of ship leaves quite some ambiguity as to whether this Chapter applies to FNPPs. As it was clarified in the *Classification of FNPPs* section of this thesis, the classification of ship may vary according to the legal instrument in question. According to some of the definitions of ships provided in this thesis it is clear that non-self-propelled FNPPs can classify as ship. In UNCLOS, because of the lack of such definition in the framework convention, brought this author to conclude that the omission is for the purpose of inclusivity. Instead, SOLAS provides what is *not* included, hence, any vessel without mechanical propulsion. Therefore, applicability of Chapter VIII just as for Chapter VII, relies on the interpretation of Regulation 3 of Chapter I. It is worth nothing that the wording in this Chapter is peculiar, in the sense that in Chapter VII it was concluded that if the intention was to include vessels without mechanical propulsion, it would have been specifically stated. The fact that the definition of nuclear ship is not "a ship powered by a nuclear power plant" but rather a "ship provided with a nuclear power plant" may point to a more open-ended scope of application.

5.1.4 Chapter XIV on Safety Measures for Ships Operating in Polar Waters

The Polar Code, just as the IMDG and the INF Code is also referred to in the SOLAS Convention through Chapter XIV. There should be little debate as to whether the Polar Code applies to FNPPs after the information provided in the former section regarding Chapter VII. Applicability is outlined under Regulation 2 of Chapter XIV. Regulation 2 clearly states that the Polar Code applies to all ships operating in polar waters, therefore Arctic and Antarctic region. However, it also states that it applies to ships certified in accordance to Chapter I of SOLAS, meaning that ships without mechanical means of propulsion are not included.[177] FNPPs without self-propulsion are therefore not included in the mandatory parts of the Polar Code.

5.2 MARPOL Convention

MARPOL also has an initial provision that establishes its applicability under Article 3. On top of that, Annex III of MARPOL is of particular interest for this thesis, as it provides "Regulations for the prevention of pollution by harmful substances carried by sea in packaged

[177] SOLAS Chapter I Regulation 3.

form". General applicability will be discussed first, once determined whether or not FNPPs fall within MARPOL's scope, Annex III will be evaluated as well.

As it was already mentioned in the *Classification of FNPPs,* unlike the SOLAS Convention, MARPOL provides a definition of ship in Article 2 (4), which states "Ship" means a vessel of any type whatsoever operating in the maritime environment and includes hydrofoil boats, air-cushion vehicles, submarines, floating craft and fixed platforms. It would be challenging to argue that FNPPs do not fall under such definition, therefore settling this part of the discussion. Applicability is fairly straightforward as well, and according to Article 3 MARPOL applies to ships entitled to fly the flag of a Party to MARPOL.[178] In light of that, if the FNPP in question flies the flag of a Party to MARPOL then MARPOL applies. On top of that, Article 2 offers a definition of ship that would not only include FNPPs during navigation but also once it arrives at destination in its semi-permanent position.

Annex III on the other hand has other standards for its applicability, outlined under Regulation 1. Here, just as in the SOLAS Convention, it makes reference to the IMDG Code to provide the definition of "harmful substances" and "packaged form". Also in this case, "harmful substances" are the ones listed as IMDG Class 7 goods. Question remains as to whether the SNF that will accumulate on the FNPP will be stored in a manner which classifies as "packaged form".

5.3 1972 London Convention, SUA Convention and SUA Protocol

These three legal instruments and their applicability are fairly straightforward and do not require extensive analysis as MARPOL and especially SOLAS.

Article III (2) of the London Convention[179] is particularly inclusive, which clarifies the meaning of "vessels and crafts" as any waterborne craft, self-propelled or not. Out of most of the definitions provided in this thesis this is one that does not require any clarification, FNPPs are as a matter of fact waterborne, hence "floating". Similarly, the SUA Convention has an inclusive definition of ship under Article 1(a) which includes vessels of "any type whatsoever

[178] MARPOL Article 3.
[179] 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, OS – 29 December 1972, EIF – 30 August 1975, 1046 UNTS.

not permanently attached to the sea-bed".[180] FNPPs such as the *Akademik Lomonosov* would most likely fall within this definition. From the information found on the technical aspects of the FNPP, during its normal mode of operation it will remain floating and not fixed to the seabed. Whether or not the FNPP will be permanently attached to the seabed will determine of the SUA Convention will apply. It is in fact the SUA Protocol that applies to installations permanently attached to the seabed.[181] However, neither the SUA Convention nor the SUA Protocol are in force.

6 Conclusion

Although the information provided in this thesis related to the technical aspects of FNPPs is relatively limited, it is still possible to understand their potential. Importantly, the *Akademik Lomonosov*, being the only operating FNPP at the moment, was used as principal example throughout this analysis. Since there are several of these vessels being developed in different countries, it is more than likely that there will be new FNPPs with features completely different from the Russian version. The *Akademik Lomonosov* has been such a controversial topic for discussion because of its uniqueness. The lack of self-propulsion placed the FNPP in a "grey area" of international law, creating uncertainty as to how it would be regulated and by which legal instruments. This specific detail added to the already existing challenges that surround the transport of nuclear material.

Transportation of nuclear material, whether under the form of cargo or used as a method of propulsion raises concerns related to the environmental impact in case of an accident. The *Akademik Lomonosov*, equipped with a similar reactor of nuclear-powered icebreakers and submarines, has attracted attention of groups such as Greenpeace. Prospects of an accident resulting in the release of radiations is definitely a scenario that must be considered. However, as it was addressed in the *Environmental Risks* section, risk assessments and environmental impact of FNPPs will be speculative until there is more information available.

[180] 2005 Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation, OS – 14th October 2005, EIF – not yet in force, 1678 UNTS.
[181] 2005 Protocol for the Suppression of Unlawful Acts against the Safety of Fixed Platforms Located on the Continental Shelf, OS – 14th October 2005, EIF – not yet in force, 1678 UNTS.

Classification of FNPPs should be one of the most pressing issues that need clarification in the near future. Although there is no overarching definition of what a ship is, it is clear that the lack of self-propulsion limits the legal instruments that apply to FNPPs.

The UNCLOS applies to FNPPs without ambiguity applying the same long-lasting balance between coastal and flag States. It might be worth to reevaluate how some of the provisions of the UNCLOS are interpreted. Such as how innocent passage should be conducted and the inclusion of environmental protection in the definition of "security". It appears that the concept of "due regard" is at times overlooked to curtail navigational rights. It appears that, especially passed the territorial sea, the coastal State does not have much leverage to regulate navigation. Schemes such as sea lanes and TSS are already fairly controversial but could be a useful tool if made mandatory for FNPPs.

On top of that, the UNCLOs, as a framework convention was never intended to be the single source of law for navigation. IMO instruments are an indispensable part of the regulative system that governs the oceans. Out of the legal instruments analyzed in this thesis, the SOLAS Convention is one of the most pertinent ones for the regulation of FNPPs. Debate over the applicability of SOLAS creates a level of uncertainty that should not be tolerated in the absence of a specific set of regulations strictly for FNPPs. In the eventuality that SOLAS does not apply to FNPPs, neither would the INF Code, IMDG Code and the mandatory parts of the Polar Code. These three documents were mentioned repeatedly by several of the sources used in this thesis as the principal instrument for the regulation of ships carrying radioactive material. Without them, FNPPs would not have to follow an extensive and rather necessary set of safety standards.

Although MARPOL does apply to FNPPs, it most definitely does not suffice as an appropriate instrument for the regulation of such vessels. Prevention of pollution from ships is without a doubt an important aspect of international law and indispensable for the protection of the marine environment. A similar conclusion can be made about the SUA Convention and SUA Protocol. Although necessary and useful, these instruments leave a considerable gap when it comes to safety standards that should be imposed on FNPPs.

In light of the information provided in this thesis, it is fairly clear that although UNCLOS is applicable to FNPPs, it will most likely not suffice, and the likelihood of amending the UNCLOS is not a realistic solution to this issue. On top of that, debate over the interpretation

of its provisions creates a level of uncertainty that should be avoided when considering FNPPs. Overall, it can be concluded that the lack of self-propulsion is a major issue that should be addressed, not only for a question of security but also in regard to classification. Debate over the applicability of SOLAS is also an issue that needs urgent clarification since with UNCLOS, it is the most important set of regulations. In this authors opinion, after a thorough assessment of the existing legal instruments, the creation of a new convention specific to FNPPs would seem to be the most appropriate solution to most issues. It is important to point out that the lacunes in international law outlined in this thesis have arisen after the deployment of the *Akademik Lomonosov*. Since there are several countries developing their own version of FNPPs, the deployment of these new vessels and structures will challenge the existing law. A new convention would hopefully fill the gaps in international law but also involve the expertise of the IAEA to the IMO to expand the framework around the UNCLOS.

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