International Law and Ocean Nuclear Power Plants in the Arctic

Martin Ratcovich Leopardi
Stockholm Center for International Law and Justice, Faculty of Law, Stockholm University, Stockholm, Sweden
martin.r.leopardi@hotmail.com

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Abstract

This article addresses the international law of ocean nuclear power plants (ONPPs) with a particular focus on the Arctic. Encompassing norms under the law of the sea, maritime law, environmental law, nuclear energy law and humanitarian law, the article discusses how existing fundamental legal regulations apply to ONPPs in the Arctic. Additionally, the legal role of some relevant institutions, such as the International Atomic Energy Agency, the International Maritime Organization, and the Arctic Council, is considered. While the military nuclearisation of the Arctic has been the subject of much scholarly concern, the civil nuclearisation has not – at least not from an international law perspective. International law provides States with a considerable degree of freedom when it comes to the development and deployment of ONPPs, but there are several challenges and legal gaps, not least regarding special legal regulations for the Arctic.

Keywords

law of the sea – maritime law – new technology – nuclear energy law
Introduction

Until recently, ocean nuclear power plants (ONPPs) seemed mostly a theoretical and futuristic vision. However, technical advances and major economic interests have contributed significantly to the potential of ONPPs. The Arctic, with its vast marine areas, sparsely populated coasts, and rising energy needs, seems a promising region for ONPPs. While the technical challenges are clearly many, States with prior experience with usage of nuclear power at sea are in a lead position.

Russia, with its history of nuclear icebreakers and submarines, was first to place an ONPP in the Arctic. The Akademik Lomonosov was built in Saint Petersburg and towed in 2018 through the Gulf of Finland, across the Baltic Sea and along the Norwegian coast to Murmansk, where it was fully loaded before deployment in the city of Pevek some 5,000 kilometres further to the east. The project was criticised by environmental groups and caused some international concern. However, Russia has stated that the project boosts the power supply in remote areas with dire development needs. For similar reasons, China has expressed an interest in deploying ONPPs in the disputed South China Sea.

1 The author’s research has been funded by Arctic Avenue (a spearhead research project between the University of Helsinki and Stockholm University).
2 See, e.g., VM Kuznetsov et al., Плавучие АЭС России: угроза Арктике, мировому океану и режиму нераспространения (‘Floating Nuclear Power Plants in Russia: A Threat to the Arctic, the Oceans and the Non-Proliferation Regime’) (Bellona, Moscow, 2000) available at https://bellona.ru/publication/floatnp/, all websites accessed on 2 December 2022, unless otherwise mentioned; Greenpeace International, ‘World’s first floating nuclear power plant bound for the Arctic, warns Greenpeace’ (Press Release, 28 April 2018) available at https://www.greenpeace.org/international/press-release/16218/worlds-first-floating-nuclear-power-plant-bound-for-the-arctic-warns-greenpeace/; A Nikitin and L Andreyev, Floating Nuclear Power Plants (Bellona Foundation, Oslo, 2011) available at https://network.bellona.org/content/uploads/sites/3/Floating-nuclear-power-plants.pdf; B Brende, Minister for Foreign Affairs of Norway, ‘Svært kritisk til slep av russisk atomkraftverk’ (Press Statement, 20 June 2017) available at https://www.regjeringen.no/no/dokumentarkiv/regjeringen-solberg/aktuelt-regjeringen-solberg/ud/taler-og-innlegg/bb_taler/2017/bb_nordlys/id2558071/ ‘Regjeringen er svært kritiske till ... det planlagte slepet ... Vi vil også i tiden fremover diskutere saken med andre nordiske land og ta den opp i relevante internasjonale fora’ [‘The Government is highly critical ... to the planned towage ... We will continue to discuss the matter with other Nordic countries and raise it in relevant international forums’].
The concept of ONPPs raises many legal and broader conceptual questions relating to several fields of international law. Compared to land-based nuclear power, many legal issues arising from ONPPs are of specific character and a more transnational nature. The typical need for maritime transport means that more States and communities are affected, for example, the ones along whose coasts the power plant is being transported. The requirement for underwater cables also raises transnational issues. Furthermore, the marine environment is naturally interlinked and unknowing of any borders, making accidents and environmental hazards generally transboundary matters.

In the case of deployment in the Arctic, there is also the special Arctic dimensions – remoteness, harsh weather conditions, sensitive environment, global security issues – which raise special legal questions. For example, the Arctic Sea is the only ocean without a dedicated regional environmental organisation. Even though three binding international agreements have in recent years been concluded within the Arctic Council, it is indisputable that international cooperation concerning the Arctic remains challenging.4

In addition to navigational rights and other salient issues under the law of the sea, more specific maritime law instruments such as the International Convention for the Safety of Life at Sea (SOLAS Convention)5 and the Arctic Council agreements are relevant.6 Moreover, the implications arising from nuclear energy law instruments such as the Convention on Nuclear Safety7 and the Vienna Convention on Civil Liability for Nuclear Damage must be considered.8 Some relevant institutions include the Arctic Council, the International Maritime Organization (IMO) and the International Atomic Energy Agency (IAEA).9 This article aims to identify and discuss a number of international law obligations and concepts of key relevance to the prospect of ONPPs

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4 The Arctic Council is discussed further below, see ‘Institutions’.
9 However, the main focus of the article is legal analysis.
in the Artic. It does not seek to fully resolve every legal problem that may possibly arise with respect to ONPPs. Rather, it is meant to serve as a starting point for a more detailed and thorough analysis.

The legal research presented is based on international legal methodology encompassing international conventions, international custom, general principles of law, judicial decisions, and legal scholarship. Accordingly, the focus is to draw conclusions from already existing and published (legal) sources rather than to seek and compile new data. The main methodological challenge is rather to analyse, interpret, and understand how existing legal regulations interrelate and apply to ONPPs.

The Concept of Ocean Nuclear Power Plants

The concept of ONPPs is recent, and not much has been written about the implications under international law. However, the concept of floating power plants has a notable history. For example, during the winter of 1929–1930, the aircraft carrier USS *Lexington* was used as a temporary emergency power plant for Tacoma, Washington, in the United States. The world’s first power nuclear power barge, the *Sturgis*, was deployed in the Panama Canal Zone from the late 1960s. Several other locations in Latin America have experience with power plant vessels.

However, the *Akademik Lomonsov* is significant because it is the first nuclear power barge intended for serial production. Equipped with two KLT-40S

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11 See, e.g., ‘В Ростатоме предложили установить малые плавучие АЭС ряду зарубежных стран’ Tacc (Tass, 7 December 2020) available at https://tass.ru/ekonomika/10187759, quoting the Deputy Prime Minister of Russia – Plenipotentiary of the President of the Russian Federation in the Far Eastern Federal District Yuri Trutnev: ‘Мы только начали строить атомные блоки. Предложения по установке плавучих блоков “Росатомом” сделаны ряду зарубежных государств. Понятно, что одного блока, чтобы мы продавали такие модули, недостаточно. А их дальнейшее тиражирование создает возможность для России открыть еще одну рыночную нишу, на которой пока еще никого нет’ (‘We have just begun to build nuclear power units. Rosatom has made proposals for the installation of floating units by a number of foreign countries. It is clear that...')
reactor systems (compact icebreaker type, each with a 35 MWe capacity) the vessel is 144 metres long and 30 metres wide and has a displacement of 21,000 tons. It has quarters for a crew of roughly 70 persons. The lifecycle is estimated to be 40 years, with a possible extension by up to 50 years. When in operation, the vessel remains in a fixed position (moored) without any need for assistance by another ship. However, the vessel will be transported to a special facility for planned maintenance several times during its lifecycle. Reactors will be refuelled every third year. Spent reactor fuel will be stored on board. According to Russian State authorities, no spent nuclear fuel or radioactive waste will be left in the Arctic. After decommissioning, the vessel will be towed to a special deconstruction facility and spent fuel taken to special storage facilities.12

The overall cost of the Akademik Lomonosov has not been disclosed and is unknown. Critics say that the project is unreasonably expensive. However, Russian authorities claim that it is cheaper than alternatives. Even though the upfront investment is admittedly larger compared to wind turbines and solar panels, the overall cost is allegedly lower when divided by the number of kilowatt-hours output over the entire life of the plant.13 There are plans to install another ONPP in Vilyuchinsk in Kamchatka.14

During the first leg of its route – from Saint Petersburg to Murmansk – the Akademik Lomonosov passed through both national and international waters. Assuming that the route followed regular shipping lanes (traffic separation schemes, deep-water routes), it seems that the towage at times entered the territorial waters of Russia, Sweden, Denmark, and Norway, as well as the exclusive economic zones of Finland, Estonia, Sweden, Denmark, and Norway.15 Although the towage plans were discussed at the international level, no State openly protested the transit. However, the Norwegian government made it clear that it had serious safety concerns with regard to the transit along the Norwegian coast.16 Following dialogue with Russian authorities, including

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13 Ibid., ‘Get the facts’.
15 The exact route is unknown to the author.
16 See, e.g., B Brende, Foreign Minister of Norway, ‘Svar på skriftlig spørsmål nr. 1295 (2016–2017) om slep av russisk atomkraftverk’ (Reply to Written Question, 23 June 2017)
within the Norwegian-Russian Nuclear Safety Commission, it was announced that there would be no radioactive fuel on board during the first leg of the route. Furthermore, upon completion of loading and final tests in Murmansk, Norwegian authorities would continue to ‘closely monitor the onward transportation to Pevek ... [and] maintain an open dialogue with Russia on operation and maintenance of the power plant in the coming years’.

Navigational Rights

*Registration as Ships?*

While ONPPs are manned during normal operations, they are generally incapable of steering or self-propulsion and remain moored for extended periods of time. This distinguishes them from ordinary ships. However, because there is no uniform definition of ‘ship’ or ‘vessel’ in international law, it is not available at https://www.regjeringen.no/no/dokumentarkiv/regjeringen-solberg/aktuelt-regjeringen-solberg/ud/dialog_stortinget/stortinget_svar/spm-2017/svar_atomkraftverk/id2558709: ‘Regjeringen er svært kritisk til ... det planlagte slepet ... Utenriksdepartementet forventer at Russland kommer med nødvendige forskrifter om alt er gjort for å redusere alle typer risiko’ ['The Government is highly critical ... to the planned towage ... The Ministry for Foreign Affairs expects Russia to provide the necessary assurances that everything has been done to reduce all types of risks'].

17 Russian Atomic Energy Corporation Rosatom, ‘The world’s only floating power unit “Akademik Lomonosov” takes the sea’ (Press Statement, 28 April 2018) available at https://www.rosatom.ru/en/press-centre/news/the-world-s-only-floating-power-unit-akademik-lomonosov-takes-the-sea/: ‘At the first stage, the [Floating Nuclear Power Unit] with no nuclear fuel on board will be towed from ... Baltiyskiy Zavod to ... Murmansk’; IE Søreide, Minister for Foreign Affairs of Norway, ‘Cold Peace in the Arctic?’ (Speech, 14 September 2018) available at https://www.regjeringen.no/no/dokumentarkiv/regjeringen-solberg/aktuelt-regjeringen-solberg/ud/taler-og-innlegg/imes_taler/2018/kald_fred/id2613006/; ‘Thanks to our dialogue with Russian authorities, we were kept well informed, and the haul took place without any nuclear fuel on board. For a general discussion of the differences between transport of a loaded nuclear power plant vis-à-vis transport of an unloaded one, see IAEA (n 10).

18 Ministry for Foreign Affairs of Norway, ‘Miljøovervåking, fjerning av brukt kjernebrensel og flytende kjernekraftverk tema i den norsk-russiske atom sikkerhets-kommisjonen’ (Press Statement, 21 June 2019) available at https://www.regjeringen.no/no/dokumentarkiv/regjeringen-solberg/aktuelt-regjeringen-solberg/ud/nyheter/2019/norskrussisk _kommisjon/id2662620/; ‘Norske myndigheter vil derfor også følge den videre transporten fra Murmansk til Pevek nøye. Vi vil også holde en åpen dialog med Russland om drift og vedlikehold av kraftverket i de kommende årene’ (‘The Norwegian authorities will therefore also closely monitor the further transport from Murmansk to Pevek. We will also hold an open dialogue with Russia about operation and maintenance of the power plant in the coming years’).
straightforward that ONPPs cannot qualify as such. In fact, what is treated as a ship varies widely between different maritime conventions.\footnote{Severance and Sandgren (n 11), at pp.14–19.} For example, the SOLAS Convention applies to ‘ships’ or ‘vessels’, without providing any clear definition, while the International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 (MARPOL),\footnote{Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (London, 2 November 1973, in force 2 October 1983) 1340 UNTS 61, 1341 UNTS 3.} defines ‘ship’ as ‘a vessel of any type whatsoever operating in the marine environment and includes hydrofoil boats, air-cushion vehicles, submersibles, \textit{floating craft and fixed or floating platforms}.\footnote{Emphasis added. On the applicability of maritime conventions to floating turbine units, see Severance and Sandgren (n 11), at pp.14–19. See also IH Anchustegui and VS Radovich, ‘Wind energy on the high seas: Regulatory challenges for a science fiction future’ (2022) 15 Energies 957.} Furthermore, international law leaves States with considerable freedom to determine what qualifies as a ship. Hence, the United Nations Convention on the Law of the Sea (LOSC)\footnote{United Nations Convention on the Law of the Sea (Montego Bay, 10 December 1982, in force 16 November 1994) 1833 UNTS 3 [LOSC].} requires ships to fly a flag without providing a definition of either ‘ship’ or ‘vessel’ and does not explicitly require flag States to adopt any position as to what constitutes such.\footnote{Cf. ibid., Article 91.}

Understandably, the classification of an ONPP as a ship has significant implications for the applicability of international law norms specifically addressing ‘ships’, ‘shipowners’, ‘masters of ships’, and the like. While this is a matter of general significance to the international legal framework applicable to ONPPs, it is most clearly seen in the context of navigational rights, which is discussed below.

**Territorial Waters**

Pursuant to Article 2 of the LOSC, the sovereignty of the coastal State extends beyond its land territory and its internal waters to the territorial sea, including the air space over the territorial sea as well as its bed and subsoil.\footnote{Ibid., Article 2(1).} The sovereignty over the territorial sea is, however, not without exception but ‘is exercised subject to [the LOSC] and to other rules of international law’.\footnote{Ibid., Article 2(3).} The reference to ‘other rules’ makes it clear that the limitations set out in the LOSC are not exhaustive. Other sources of international law may imply additional limitations. However, the most significant limitation of the sovereignty of the
coastal State over the territorial sea is explicitly provided for in the Convention: the right of innocent passage.

The right of innocent passage allows ships of all States to pass through the territorial sea.\textsuperscript{26} The coastal State must not hamper such passage except in certain special circumstances.\textsuperscript{27} Consequently, if a foreign ONPP is classified as a ship under the law of the sea, coastal States have an obligation not to interfere with its passage through the territorial sea.

However, the right of innocent passage is not absolute, there are exceptions, and it only covers navigation that qualifies as ‘passage’. While an ONPP may not have the technical capacity to navigate at the same speed and manner as a conventional ship with a rudder and a distinctly shaped bow, the meaning of ‘passage’ under the LOSC is broad and covers many forms of navigation. Although passage shall be ‘continuous and expeditious’, stopping and anchoring also constitute passage ‘in so far as the same is incidental to ordinary navigation or are rendered necessary by force majeure or distress or for the purpose of providing assistance to persons, ships or aircraft in danger’.\textsuperscript{28}

In line with the general character of the term, there is little reason to doubt that towage cannot count as ‘passage’.\textsuperscript{29} Furthermore, the Convention on the International Regulations for Preventing Collisions at Sea treats a tug and its wet tow as two vessels.\textsuperscript{30} The opposite view – that the navigation of a ship qualifies as passage but that of its (towed) cargo does not – would be absurd. It

\begin{itemize}
\item \textsuperscript{26} Ibid., Article 17.
\item \textsuperscript{27} Ibid., Article 24(1).
\item \textsuperscript{28} Ibid., Article 18(2) (emphasis in original).
\item \textsuperscript{29} For example, in \textit{Passage Through the Great Belt}, the parties seemed to share the view that a need for towage does not disqualify a ship from being under passage. Even though Denmark argued that oil rigs (semi-submersibles, jack-ups) were not ships, and therefore were not entitled to passage, this was for reasons other than need for towage. See, e.g., ‘Application Instituting Proceedings’, \textit{Passage Through the Great Belt (Finland v. Denmark)} (International Court of Justice, General List No 86, 17 May 1991), at p. 14, para 28: ‘The right of free passage must be equally applicable to … rigs that … are towed’; ‘Counter-Memorial submitted by Denmark’, \textit{Passage Through the Great Belt (Finland v. Denmark)} (International Court of Justice, General List No 86, May 1992), at p. 216, para 635: ‘the natural understanding of the term “ship” excludes [oil rigs]. Neither their construction nor their use is comparable to the normal shape and purpose of ships’. The case was eventually withdrawn.
\end{itemize}
would also seem to conflate the navigational purpose of the presence of a ship within the territorial sea (‘passage’) and the activity of the ship (‘innocent’).31

The reference to ‘ordinary navigation’ in Article 18(2) of the LOSC seems particularly important in the context of ONPPs because it allows them to pass through the territorial sea at speeds and along routes that do not endanger the safety of the facility. Accordingly, an ONPP in transit may make necessary stops and anchor within the territorial sea without releasing the coastal State from its obligation not to hamper the passage, as long as the stopping or anchoring is necessary for navigational purposes. While the duration of presence within the territorial sea seems a natural concern for the coastal State, the broad definition of ‘passage’ leaves the coastal State with few other options but to accept that the passage of an ONPP through the territorial sea may take longer than expected. Given the frequently harsh weather and sea conditions in the Arctic this feature of innocent passage seems especially important in relation to Arctic ONPPs.

Pursuant to Article 19(1) of the LOSC, ‘passage is innocent as long as it is not prejudicial to the peace, good order or security of the coastal State’. Article 19(2) includes a list of activities that, if engaged in by a foreign ship during passage in the territorial sea, renders the passage non-innocent. This list encompasses, inter alia, ‘any threat or use of force against the sovereignty, territorial integrity or political independence of the coastal State’, ‘any exercise or practice with weapons of any kind’, ‘the loading or unloading of any commodity, currency or person contrary to the customs, fiscal, immigration or sanitary laws and regulations of the coastal State’, ‘any act of wilful and serious pollution contrary to the [LOS], ‘fishing’, and ‘any other act not having a direct bearing on passage’. However, in the context of ONPPs, the main concern may not be the temporary activity of the ship but the very character of the craft: the fact that it holds nuclear material and nuclear technology thereby implies a risk of a nuclear accident.

Although it must not hamper the innocent passage of foreign ships through its territorial sea, the coastal State remains entitled to adopt certain laws and regulations relating to such passage. Such laws and regulations may concern, inter alia, the safety of navigation and the regulation of maritime traffic, the preservation of the environment, and the prevention of infringement of customs, fiscal, immigration or sanitary laws of the coastal State.32 Foreign ships

31 The distinction between ‘passage’ and ‘innocent passage’ is central to the regime of innocent passage. See, e.g., LOSC Articles 18–19, which deal with the ‘meaning of passage’ and the ‘meaning of innocent passage’ respectively.
32 Ibid., Article 21(2).
exercising the right of innocent passage are expected to comply with such laws and regulations.\textsuperscript{33} Nuclear-powered ships and ships carrying nuclear material are, furthermore, explicitly required to carry documents and observe special precautionary measures established by international agreements when exercising the right of innocent passage.\textsuperscript{34} However, this does not mean that nuclear ships are excluded from the right of innocent passage. Rather, the explicit stipulation of special requirements in respect of documentation and precautionary measures suggests that such ships also enjoy the right of innocent passage.\textsuperscript{35}

Significantly for present purposes, Article 22 of the LOSC allows the coastal State to designate sea lanes and traffic separation schemes in the territorial sea. Like other ships carrying inherently dangerous or noxious substances or materials, the coastal State is allowed to require nuclear-powered ships and ships carrying nuclear material to confine their passage to such sea lanes.\textsuperscript{36} Notwithstanding their rights to adopt and apply certain safety requirements, coastal States have few legal possibilities under the law of the sea to prevent and stop foreign ONPPs passing through their territorial sea. Accordingly, ONPPs enjoy certain navigational rights that coastal States need to respect.\textsuperscript{37}

Naturally, these rights are only relevant when the ONPP is in transit, not when it is in operation and remains fixed in the same position and operates independently. Indeed, the navigational rights flowing from the law of the sea

\begin{itemize}
\item \textsuperscript{33} \textit{Ibid.}, Article 21(4).
\item \textsuperscript{34} \textit{Ibid.}, Article 23. In the \textit{Mox Plant} cases, Ireland requested that the International Tribunal for the Law of the Sea (ITLOS) prescribe interim provisional measures under Article 290 of the LOSC that would, \textit{inter alia}, require the United Kingdom to ensure that there were no movements of any radioactive substances connected with a plant to make mixed oxide fuel (Mox) at Sellafield in northwest England on the cost of the Irish Sea. However, the ITLOS declined to prescribe the provisional measures sought by Ireland because the situation was not deemed sufficiently urgency. Subsequently, an arbitral tribunal established under Annex VII of the LOSC also declined to prescribe provisional measures because Ireland failed to establish that any harm caused to the marine environment by the plant would be serious. See, e.g., RR Churchill, 'Mox Plant arbitration and cases' in \textit{Max Planck Encyclopedia of Public International Law} (Oxford University Press, Oxford, 2018).
\item \textsuperscript{35} See, e.g., T Treves, 'Navigation of ships with nuclear cargoes: Dialogue between flag and coastal States as a Method for managing the dispute' in DD Caron and HN Scheiber (eds), \textit{The Oceans in the Nuclear Age} (Brill Nijhoff, Leiden, 2010) 217–233, at pp. 217–218.
\item \textsuperscript{36} \textit{LOSCL} (n 22), Article 22(2).
\item \textsuperscript{37} See also \textit{IAEA} (n 10), at p. 32: ‘Sea transport ... will be governed by ... international law, including the law of the sea. In recent years, the transport of fuel or radioactive waste has revealed some problems and conflicts between States related to transit or innocent passage on the high seas. However, there is no reason to believe that sea transport of a [transportable nuclear power plant] should give rise to any additional problems or legal requirements’.
\end{itemize}
are not of such character as to establish a right of deployment within the territorial waters of other States. Accordingly, with the common exception of ships under innocent passage, ONPPs are subject to the (full) territorial jurisdiction of the coastal State in territorial waters.

**International Waters**

Although ‘international waters’ is not a term used in the LOSC, it is a useful categorisation of marine areas beyond the sovereign territory of any State, that is, parts of the sea that are not internal waters or territorial sea. Consequently, it has become a common term in the law of the sea and maritime affairs discourse.\(^{38}\) The relevant maritime zones to consider here are the exclusive economic zone (EEZ) and the high seas.\(^{39}\)

In the EEZ, the coastal State enjoys sovereign rights regarding natural resources and related jurisdictional rights and other States enjoy the freedoms of navigation and overflight and of the laying of submarine cables and pipelines.\(^{40}\) The EEZ is an ‘area beyond and adjacent to the territorial sea’\(^{41}\) ranging up to 200 nautical miles from the baselines.\(^{42}\) Because the establishment of artificial islands, installations, and structures in the EEZ is a sovereign right of the coastal State, the lawfulness of the installation of an ONPP in international waters covered by such a zone depends upon authorisation by the coastal State.\(^{43}\) In this sense, there is no difference between the installation of

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\(^{39}\) Archipelagic waters are subject to similar considerations as the territorial sea: cf. LOSC (n 22), Articles 49, 52. The special police rights distinct to the contiguous zone seem of little relevance in the ONPP context (cf. Article 33).

\(^{40}\) Ibid., Articles 56, 58.

\(^{41}\) Ibid., Article 55.

\(^{42}\) Ibid., Article 57.

\(^{43}\) Ibid., Article 60(1). The coastal State also has exclusive jurisdiction over artificial islands, installations and structures (Article 60(2)). Given that energy production qualifies as an economic purpose, there are good reasons to believe that an installed ONPP would be covered by the term ‘installations and structures for the purposes provided for in Article 56 and other economic purposes’ (Article 60(1)(b)). On the broad meaning of this term, see, e.g., G Andreone, ‘The exclusive economic zone’ in D Rothwell et al. (eds), *The Oxford Handbook of the Law of the Sea* (Oxford University Press, Oxford, 2016) 160–180, at p. 172: ‘An almost total exclusivity is accorded to the coastal State to authorize and regulate various kinds of offshore construction, their placement, and their use’. The reference to ‘other economic purposes’ (Article 60(1)(b)) suggests that all purposes comprised in Article 56, including ‘the production of energy from the water, currents and winds’, are
an ONPP and the installation of wave generators or floating wind turbines – the coastal State is equally free to deny the installation of an ONPP in the EEZ as in the territorial sea.\textsuperscript{44}

Navigation rights are different. Notwithstanding the prevalent principle of freedom of navigation in the EEZ, the coastal State not only has rights but also duties in respect of the protection of the marine environment within that zone.\textsuperscript{45} Such protection may take different forms, including the prevention of marine pollution from shipping.\textsuperscript{46} However, such rules and regulations may not amount to stricter requirements than those adopted within IMO, that is, those ‘conforming to and giving effect to generally accepted international rules and standards established through the competent international organization or general diplomatic conference’.\textsuperscript{47} The enforcement powers of the coastal State are even more limited: in brief, the only situation in which a coastal State may board and stop a foreign vessel suspected of pollution within its EEZ is when ‘there are clear grounds for believing that [it] has ... committed a violation ... resulting in a substantial discharge causing or threatening significant pollution’.\textsuperscript{48} The mere suspicion of a violation of a rule or regulation for the prevention of pollution of the marine environment by an ONPP navigating within its EEZ would normally not entitle the coastal State to stop and board it.

Compared to that of the exclusive economic zone, the legal regime of the high seas is more permissive. While the installation of an ONPP on the high seas currently seems rather unrealistic – not least bearing in mind natural factors such as distance, weather, and sea conditions – the law of the sea would not be an obstacle: ‘[the] freedom of the high seas ... comprises ... freedom economic purposes. See also C Nieuwenhout, ‘Offshore hybrid grid infrastructures: The Kriegers Flak combined grid solution’ (20\textsuperscript{18}) 12 European Energy Law Report 95–112, at p. 103: ‘Interconnection between States, as interconnection, with the purpose of electricity exchange, falls under the “other economic purposes”.’ In South China Sea Arbitration (Philippines v. China) (Award of 12 July 20\textsuperscript{16}) PCA Case No 20\textsuperscript{13}–19, the provision of shelter for fishermen was considered an economic purpose (p. 414, para 1036). While it has been argued that the construction of military installations is generally allowed in the exclusive economic zone, despite not being explicitly mentioned in the LOSC, it seems that the typical case of an ONPP is different. On military installations in general, see T Davenport, ‘Island-building in the South China Sea: Legality and limits’ (20\textsuperscript{18}) 8(1) Asian Journal of International Law 76–90, at p. 86 and further references there.

\textsuperscript{44} For the regulation and governance of wind energy turbines on the high seas, see Anchustegui and Radovich (n 21).
\textsuperscript{45} See, e.g., LOSC (n 22), Articles 192, 210(5), 211(5).
\textsuperscript{46} Ibid., Article 211(5). See generally JM Van Dyke, ‘The ocean transport of radioactive fuel and waste’ in Caron and Scheiber (eds) (n 35), 147–167, at pp. 162–167.
\textsuperscript{47} Ibid., Article 211(5).
\textsuperscript{48} Ibid., Article 220(5).
to construct artificial islands and other installations permitted under international law.\textsuperscript{49} The transport of an \textit{ONPP} on the high seas is easier to imagine. Ships on the high seas are, as a rule, subject only to the jurisdiction of the flag State.\textsuperscript{50} Accordingly, States other than the flag State may not interfere with ships on the high seas. However, this does not mean that flag States are free to abdicate their control over ships on the high seas. In addition to the general principle of due regard in the exercise of the freedom of the sea,\textsuperscript{51} Article 94 of the LOSC explicitly requires flag States to exercise ‘jurisdiction and control in administrative, technical and social matters.’\textsuperscript{52} Relatedly, the obligations of States under MARPOL to impose requirements for the prevention of maritime pollution from ships apply also to ships on the high seas. Likewise, neither the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (\textit{INF} Code),\textsuperscript{53} which establishes various safety requirements for carriage of packaged irradiated nuclear fuel, plutonium, and high-level radioactive waste on board ships, nor the International Maritime Dangerous Goods (\textit{IMDG} Code),\textsuperscript{54} which contain provisions governing the carriage of dangerous goods in packaged form, make exceptions for the high seas. Accordingly, like most vessels carrying nuclear fuel or high-level radioactive wastes, \textit{ONPPs} must comply with the requirements of the \textit{INF} and \textit{IMDG} Codes when navigating on the high seas. However, being instruments under the SOLAS Convention, the applicability of the \textit{INF} and \textit{IMDG} Codes ultimately depends on the classification of \textit{ONPPs} as ships.\textsuperscript{55}

\begin{footnotesize}
\begin{enumerate}
\item \textsuperscript{49} \textit{Ibid.}, Article 87(1)(d).
\item \textsuperscript{50} \textit{Ibid.}, Article 92(1).
\item \textsuperscript{51} \textit{Ibid.}, Article 87(2).
\item \textsuperscript{52} \textit{Ibid.}, Article 94(1).
\item \textsuperscript{53} The \textit{INF} Code was first introduced as a voluntary measure to complement the principal IAEA Regulations for the Safe Transport of Radioactive Material. However, in 2001 the \textit{INF} Code was made mandatory under SOLAS Convention chapter VII. Adoption of the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (\textit{INF} Code), \textit{IMO} Doc MSC.88(71) (27 May 1999).
\item \textsuperscript{54} The \textit{IMDG} Code was first adopted as a recommendatory instrument. It became mandatory, under the SOLAS Convention umbrella, through the adoption of a resolution by the \textit{IMO} Assembly in 1991. However, some parts remain recommendatory. The International Maritime Dangerous Goods Code (\textit{IMDG} Code), \textit{IMO} Assembly Res A.716\textsuperscript{17}(17) (3 December 1991).
\item \textsuperscript{55} Cf. \textit{INF} Code (n 53), Regulation 1.2.1: ‘This Code applies to \textit{ships} engaged in the carriage of \textit{INF} cargo’ (emphasis added); \textit{IMDG} Code (n 54), Regulation 1.1.1.1: The provisions contained in this Code are applicable to all \textit{ships} to which ... [SOLAS Convention] applies and which are carrying dangerous goods’ (emphasis added).
\end{enumerate}
\end{footnotesize}
In 2009, IMO adopted non-binding Guidelines for Ships Operating in Polar Waters (Polar Guidelines). The aim of the Polar Guidelines is to promote the safety of navigation and prevent pollution from ship operations in polar waters. Further, in 2014, IMO adopted the International Code of Safety for Ships Operating in Polar Waters (Polar Code). The Polar Code is designed to provide for safe ship operations and the protection of the polar environment by addressing risks present in polar waters. Importantly, the Polar Code confirms that additional demands on ships, their systems, and operation beyond existing global treaties may be necessary in the marine Arctic. However, like the main treaties on pollution by ships (MARPOL, SOLAS Convention), the applicability of the Polar Guidelines and the Polar Code to ONPPs ultimately depends on their classification as ships.

**International Straits**
Pursuant to Part III of the LOSC, straits used for international navigation are subject to special passage rights more permissive than the right of innocent passage through the territorial sea. Except for so-called historic straits and most areas of internal waters within such straits, these rights apply to straits ‘used for international navigation between one [area of international waters] and another [such area]’. In such straits, ships of all States enjoy transit passage, that is, ‘the exercise of ... the freedom of navigation ... for the purpose of continuous and expeditious transit of the strait’. States bordering straits shall not hamper transit passage, and there shall be no suspension of transit passage. Accordingly, there is little room for States bordering straits to deny the passage of an ONPP through such straits. Notwithstanding the right of transit passage, States bordering straits may designate sea lanes and traffic separation schemes, but only to the extent such lanes and schemes conform to generally accepted international regulations and the proposals have been referred to ‘the [IMO] with a view to their adoption’. Under similar condi-

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58 LOSC (n 22), Articles 35(a), 35(c).
59 Ibid., Article 37.
60 Ibid., Article 38(2).
61 Ibid., Article 44.
62 Ibid., Article 41(4).
tions, States bordering straits may prescribe laws and regulations relating to transit passage.\textsuperscript{63}

### The Operational Phase

While the legal categorisation of an ONPP in transit is complex, the situation is even more challenging during the operational phase, that is, when the ONPP is deployed and operates independently. There are good reasons to argue that an ONPP underway constitutes a ship (either because of its own virtues or as part of a tow), while the situation is less clear when the ONPP remains fixed in the same position for extended periods of time. Indeed, the capacity to move/navigate is key to the notion of a 'ship'.\textsuperscript{64}

Even so, the situation under the general law of the sea remains relatively straightforward: territorial waters are subject to the sovereignty of the coastal State, and all activities within them, except for the right of innocent passage, are subject to its (full) territorial jurisdiction. The legality of the installation of an ONPP in the EEZ is dependent upon the authorisation of the coastal State,\textsuperscript{65} while on the high seas it is a right of all States as part of the freedom of the high seas.\textsuperscript{66}

The complexities arise in relation to more specific matters, such as the prevention of maritime pollution or safety on board. MARPOL, for example, applies to ‘ships’ as does the SOLAS Convention. The same goes for the Polar Guidelines and the Polar Code. Accordingly, an ONPP may come within the scope of some maritime law instruments during the transport phase, but not during the operational phase. This means that ONPPs are in a rather different legal situation compared to that of conventional (land-based) nuclear power plants; an ONPP may sometimes (e.g., transport phase) have to comply with various ship-oriented regulations, while at other times (e.g., operational phase) it may be subject to other instruments and standards.\textsuperscript{67}

Another distinct fea-

\textsuperscript{63} Ibid., Article 42(1).

\textsuperscript{64} See, e.g., International Convention on Salvage (London, 28 April 1989, in force 14 July 1996) 1953 \textit{UNTS} 165, Article 1(b): ‘Vessel means any ship or craft or any structure capable of navigation’ (emphasis added). See also R Lagoni, ‘Merchant ships’ in \textit{Max Planck Encyclopedia of Public International Law} (Oxford University Press, Oxford, 2011): ‘A ship is a vessel used or capable of being used as a means of transportation on water’.

\textsuperscript{65} See above (nn 43–44) and accompanying text.

\textsuperscript{66} See above (n 49) and accompanying text.

\textsuperscript{67} See, e.g., below under ‘Nuclear Liability’. 
ture of ONPPs is the need for additional infrastructure, which in turn triggers other legal considerations, such as grid connection, which is considered below.

Submarine Cables

A special feature of ONPPs is that their deployment depends upon connection to the power grid of the area where the electricity produced by the ONPP is to be consumed. While there may in some instances exist other alternatives, a plausible form of such connection is by way of one or several submarine cables. Compared to land-based power cables, submarine cables are relatively easy and cost-effective to install. Indeed, most submarine cables simply rest on the sea floor and do not need to be covered or moored in any specific way. The capacity of submarine cables may also be significantly greater than most land-based ones. The generally low water temperature on the sea floor provides excellent cooling conditions for the myriads of copper threads making up power cables, reducing the risk of melting when high power runs through the cable.

The laying of submarine cables is subject to special regulation in international law. Within territorial waters, the laying of such cables is subject to the sovereignty of the coastal State. Accordingly, the coastal State may simply refuse the laying of such cables within its territorial waters without necessarily having to provide any special reasons. Corresponding to the main legal difference between territorial waters and international waters, where the sovereignty of the coastal State is the main rule for territorial waters and the freedom of the sea the main rule for international waters, the situation is different in the EEZ and on the high seas. Subject to Article 79 of the LOSC, all States are entitled to lay submarine cables on the continental shelf. Accordingly, the coastal State may not impede the laying of such cables. However, the delineation of the course of the laying of pipelines is subject to the consent of the coastal State. Importantly for present purposes, there is no similar provision for submarine cables. Notwithstanding the principal freedom of the State laying the cable to determine its delineation, the coastal State remains free to establish


69 Cf. LOSC (n. 22), Article 2(1) and the non-existence of provisions limiting the sovereignty of the coastal State in this regard.

70 Ibid., Article 79(3).
the conditions for cables that enter its territory or that are constructed or used in connection with the operations of an installation on its continental shelf.\textsuperscript{71}

Accordingly, the necessary connection of an \textit{ONPP} to the land-based power grid through the laying of submarine cables is in most situations subject to the same basic condition of coastal State consent as the very installation of an \textit{ONPP} within territorial waters or the \textit{EEZ}. However, if an \textit{ONPP} is installed within the territorial waters or \textit{EEZ} of one coastal State, and the State receiving the power produced by the \textit{ONPP} is different, the freedom of laying submarine cables on the continental shelf seems a relevant consideration. There is limited opportunity for third States to deny the laying of submarine cables across their continental shelves.\textsuperscript{72}

\textbf{Emergency Preparedness and Response}

Navigation is by nature a risky activity. The gravity of the Earth and the fluidity of water (except for ice) mean that all objects at sea are at risk of sinking. The very purpose of \textit{ONPPs}, to produce energy by nuclear means, brings additional hazards.

The delivery of assistance to those in peril at sea is a central principle of life at sea. It is also an ancient obligation of international law and ‘one of the traditional hallmarks of the law of the sea’.\textsuperscript{73} First and foremost, Article 98 of the \textit{LOS\lowercase{C}} requires every (flag) State to require masters of ships flying their flags ‘to render assistance to any person found at sea in danger of being lost’ and, second, coastal States to ‘promote the establishment, operation and maintenance of an adequate and effective [maritime] search and rescue service’.\textsuperscript{74} Additionally, the \textit{SOLAS} Convention and International Convention on Maritime Search

\begin{footnotes}
\footnote{Ibid., Article 79(5).}
\footnote{But see ibid., Article 79(5), setting forth the increasingly important general obligation to have due regard to cables or pipelines already in position.}
\footnote{\textit{LOS\lowercase{C}} (n 22), Article 98.}
\end{footnotes}
and Rescue set forth the details of coastal States’ obligations concerning maritime search and rescue.\(^{75}\)

Relevantly for the present purposes, the duty to render assistance seems to apply both to ONPPs and in relation to ONPPs in distress. Corresponding to the reference in Article 98 of the LOSC to ‘any person in danger of being lost’,\(^{76}\) the SOLAS Convention makes it explicit that the duty to render assistance ‘applies regardless of the nationality or status of such persons or the circumstances in which they are found’.\(^{77}\) Consequently, masters of ships may, by way of flag State jurisdiction, be required to provide assistance to an ONPP in distress at sea. However, it needs to be noted that this duty of shipmasters to render assistance makes leeway for the safety of the assisting ship. A ship without practical capabilities to assist or that can only do so with great dangers for the safety of the ship itself may thus be exempted from this requirement.\(^{78}\) Because of the special hazards inherent to nuclear facilities, this caveat seems especially relevant in relation to ONPPs.

Coastal States are under stricter requirements. They are simply obliged to establish maritime search and rescue services and conduct search and rescue within their areas of responsibility.\(^{79}\) Accordingly, a coastal State that allows for the installation of an ONPP off its coast within its area of responsibility is expected to have a search and rescue service capable of providing assistance to an ONPP in distress. The same applies to States with areas of responsibility where ONPPs transit; they are similarly required to conduct search and rescue operations. Noting the explicit requirement under Article 98 of the LOSC for the maritime search and rescue service to be ‘adequate and effective’, it is clear that the services must correspond to the risks that may arise within the area of responsibility.\(^{80}\)


\(^{76}\) LOSC (n 22), Article 98(1) (emphasis added).

\(^{77}\) SOLAS (n 5), Chapter V, Regulation 33(1).

\(^{78}\) See, e.g., LOSC (n 22), Article 98(1): ‘Every State shall require the master of a ship flying its flag, in so far as he can do so without serious danger to the ship, the crew or the passengers’ (emphasis added); SOLAS (n 5), Chapter V, Regulation 33(1): ‘The master of a ship at sea which is in a position to be able to provide assistance, on receiving information from any source that persons are in distress at sea, is bound to proceed with all speed to their assistance’ (emphasis added).

\(^{79}\) LOSC (n 22), Article 98(2); SOLAS (n 5), Chapter V, Regulation 7(1).

\(^{80}\) See also SOLAS (n 5), Chapter V, Regulation 7(1): ‘Each Contracting Government undertakes to ensure that necessary arrangements are made for ... the rescue of persons in distress at sea around its coasts. These arrangements shall include ... such search and rescue facilities as are deemed practicable and necessary, having regard to the density of
The need for special resources to deal with nuclear materials, alongside the general cost of and limited availability of such resources, makes cooperation a key factor for the effectiveness of nuclear and radiological emergency preparedness and response. This may be even more so in the case of ONPPs, which are typically intended for deployment in remote areas where infrastructure standards may be exceptionally low. For example, Pevek, the coastal city in northern Russia where the Akademik Lomonosov is deployed, has a population of just a few thousands and development needs far greater than most sites of nuclear power plants. Indeed, before the arrival of the ONPP, a special fire and rescue department was set up and special response resources delivered to Pevek.81

The key instruments of the international legal framework for emergency preparedness and response to nuclear and radiological incidents and emergencies are the Convention on Early Notification of a Nuclear Accident (Early Notification Convention)82 and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention).83

The Early Notification Convention, adopted in 1986 following the Chernobyl accident, establishes a notification system for nuclear accidents. A broad definition of ‘nuclear accident’, including but not limited to accidents from which a release of radioactive material occurs or is likely to occur from ‘any nuclear reactor wherever located’ as well as ‘the transport and storage of nuclear fuels or radioactive wastes’, appears to cover both conventional land-based nuclear power plants and ONPPs.84 Accordingly, a State that runs an ONPP, or that has jurisdiction or control over persons or legal entities so doing, may be obliged the seagoing traffic and the navigational dangers, and shall, so far as possible, provide adequate means of locating and rescuing such persons’ (emphasis added).

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82 Convention on Early Notification of a Nuclear Accident (Vienna, 26 September 1986, in force 27 October 1986) UNTS 1439 [Early Notification Convention].

83 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Vienna, 26 September 1986, in force 26 February 1987) UNTS 293 [Assistance Convention].

84 Early Notification Convention (n 82), Article 1. See, e.g., B Mosner, ‘The IAEA Conventions on Early Notification of a Nuclear Accident and on Assistance in the Case of a Nuclear Accident or Radiological Emergency’ (1982) 44 Nuclear Law Bulletin 10–23, at p. 12: ‘The location of the nuclear reactor and whether it is stationary or mobile is of no importance’; IAEA (n 19), at p. 65: ‘The broad scope of application set forth in Article 1 makes
to notify and provide information to other States following a nuclear accident on an ONPP.\textsuperscript{85}

The Assistance Convention, which was also adopted following the Chernobyl accident, sets out an international framework for cooperation among States Parties and with the IAEA to facilitate prompt assistance and support in the event of nuclear accidents or radiological emergencies. States Parties are required to cooperate with each other, as well as with the IAEA, to minimise the consequences of a nuclear accident or radiological emergency.\textsuperscript{86} Not much is said about the detailed nature of assistance arrangements; they will depend on the requirements of the specific case. The Convention also makes provision for reimbursements of costs and compensation and the direction and control of assistance personnel and the State providing assistance.\textsuperscript{87} Like the Early Notification Convention, the Assistance Convention uses a broad concept of ‘nuclear accident’ and also covers ‘radiological emergency’. ONPPs seem to fall within its scope. While the Assistance Convention establishes the general framework for cooperation in the event of nuclear accidents and radiological emergencies, more detailed provisions are meant to be set out in bilateral or multilateral arrangements.\textsuperscript{88}

With regards to ONPPs in the Arctic, there are two binding agreements on emergency preparedness and response adopted by the Arctic Council that need to be considered, namely, the 2011 Agreement on Cooperation in Aeronautical and Maritime Search and Rescue (2011 Agreement) and the 2013 Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic (2013 Agreement). The 2011 Agreement seeks to strengthen cooperation and coordination on search and rescue activities and establishes an obligation for States to cooperate in this regard. In a similar vein, the 2013 Agreement seeks to strengthen cooperation, coordination, and mutual assistance among the Parties on oil pollution preparedness and response in the Arctic in order to protect the marine environment from pollution by oil. The basic idea of the Arctic regional agreements is to supplement existing global treaties and to strengthen regional cooperation in this regard.

\textsuperscript{85} Early Notification Convention (n 82), Article 2: ‘In the event of ... a “nuclear accident” the State Party ... shall ... notify ... those States which are or may be physically affected ... and ... provide the States ... and the [IAEA] with ... information relevant to minimizing the radiological consequences in those States’.

\textsuperscript{86} Assistance Convention (n 83), Article 1.

\textsuperscript{87} See generally Mosner (n 84), pp. 122–126.

\textsuperscript{88} Assistance Convention (n 83), Article 1(2).
Notwithstanding the fact that neither of the agreements deals specifically with nuclear accidents and radiological emergencies, they may still be of some relevance also in that context. While the 2013 Agreement seems of limited concern to ONPPs, as it deals specifically with oil pollution, the 2011 Agreement seems more relevant as it reinforces the general obligations of States to provide maritime search and rescue services. Importantly, the conduct of maritime search and rescue is not dependent on the classification of ONPPs as ships; the obligations with respect to maritime search and rescue apply regardless of the reason for the distress.89 While the 2011 Agreement mainly reinforces already existing obligations of States Parties under international maritime rescue law, its importance should not be underestimated. Like emergency preparedness and response in general, maritime search and rescue is an inherently practical business where effectiveness is to large extent dependent on professional training, regular exercises, and availability of resources. The 2011 Agreement establishes several obligations concerning joint training and exercises and sharing of information and experience.

In addition to the risks that may arise in the area where the ONPP is deployed, the mobility of ONPPs means risks may arise also in other areas where the ONPP is present temporarily, for example, during transport, maintenance or loading operations. While the existing legal framework requires coastal States to have some preparedness for maritime accidents off their coasts, it seems inevitable that coastal States from time to time may face accidents for which they had not planned. A sensitive issue in the context of ONPPs is whether they have a right to access and seek shelter in ports or other places within internal waters.90 For understandable reasons, coastal States may be reluctant to welcome potential nuclear or radiological emergencies or incidents to their territories.

This raises questions about obligations under international law. Despite the fact that most ports of the world are open to foreign traffic, there is no general duty under international law for States to accept foreign ships into their ports. Conversely, ‘it is ... by virtue of its sovereignty that the coastal State may regulate access to its ports’.91 Coastal States may thus, prima facie, deny ONPPs

89 See above (n 77) and accompanying text.
90 Ports are generally located within internal waters: cf. LOSC (n 22), Articles 7(1) (‘where the coastline is deeply indented and cut into ... the method of straight baselines ... may be employed in drawing the baseline’), 8(1) (‘waters on the landward side of the baseline ... form part of the internal waters’), 11 (‘the outermost permanent harbour works ... are regarded as forming part of the coast’).
seeking shelter in their ports or internal waters. There is, however, at least one important exception to this rule. Historically, ships in distress have had a right of access to a port or another coastal refuge and there is widespread acceptance that a ship that enters a port in distress or because of force majeure is not subject to the full jurisdiction of the coastal State. Even though such ships have in practice often been granted certain immunity, there is also evidence of States having closed their ports to ships in distress that pose a substantial marine pollution risk. How this balance would be struck in the event of a situation where an ONPP is in distress is difficult to determine. However, the very reason for the exceptional right of access for ships in distress is still humanitarian considerations. Accordingly, the legal answer to the question of whether an ONPP in distress has a right of access into ports or another coastal refuge seems to a large extent to depend on factual circumstances and whether the risk to human lives would increase or decrease following entry into port or internal waters. The potential saving of property is not determinative of a coastal State’s humanitarian duty.

While a clearer legal framework for places of refuge for ONPPs might be of practical value, it seems unlikely that such a framework will be established. In essence, it does not seem politically opportune for the responsible minister or government of a coastal State along whose coast foreign ONPPs are being transported (by another State) to welcome potential nuclear accidents or radiological emergencies to its coast, regardless of whether such action would in fact decrease the real risk of such an accident or emergency.

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92 The right to stop during innocent passage of the territorial sea is different; see above (n 28).
95 See, e.g., Chircop (n 94), at p. 140: ‘The coastal State does not have an absolute duty to provide a place of refuge if by doing so, and after saving the crew and others on board, it faces a serious threat to its interests after employing the decision-making standard’.
97 For a description of the current non-progress within IMO for the adoption of a legal instrument for a general framework of places of refuge for ships, see Chircop (n 94).
Nuclear Liability

Nuclear accidents and radiological emergencies easily trigger questions concerning liability. Property may be damaged and costs for environmental restoration arise, for example. The main multilateral instrument concerning nuclear liability is the Vienna Convention on Civil Liability for Nuclear Damage, which aims at ‘establishing some minimum standards to provide financial protection against damage resulting from certain peaceful uses of nuclear energy’. However, the Vienna Convention is in principle not applicable to ONPPs, as the Convention explicitly excludes from its scope ‘nuclear reactor … with which a means of sea or air transport is equipped for use as a source of power, whether for propulsion thereof or for any other purpose’. However, the Vienna Convention covers ‘[facilities] where nuclear material is stored’. Since ONPPs may have such facilities on board, the applicability of the Convention cannot be overlooked. At the same time, it needs to be noted


99 Vienna Convention on Civil Liability for Nuclear Damage (n 8), Preamble, 1st Recital.

100 Ibid., Article 1.1(j)(i) (emphasis added). The Paris Convention (n 98) has an even wider exclusion clause covering reactors ‘comprised in any means of transportation’ (Article 1(a)(ii)).

101 Vienna Convention on Civil Liability for Nuclear Damage (n 8), Article 1.1(j)(iii). It seems reasonable to distinguish between an ONPP, which is designed to produce nuclear energy, and a ship that merely transports a nuclear power plant for installation elsewhere than on board the ship. Cf IAEA (n 10), at pp. 45–46: ‘In the case of a [transportable nuclear power plant], the reactor cannot be considered to be part of the equipment of the vessel and that the vessel merely “transports” a [transportable nuclear power plant] and is built for that purpose’. See also at p. 82: ‘Besides the elimination of nuclear propulsion from the scope … the exclusion of reactors which are otherwise part of such a means of transport could affect the legal status … when … [the nuclear power plant] is integrated in, for
that ‘the entire liability regime of the [Vienna] Convention was adopted under the common understanding that transportable nuclear technologies require a special legal framework’. Consequently, it seems fair to conclude that there is currently a great degree of uncertainty about the international law regulation of civil liability for damages resulting from ONPPs. Still, the argument that the legal status of an ONPP may shift during its operational life raises the question as to whether an installed ONPP, which remains fixed and operates independently, is different from a nuclear-powered submarine or vessel.

Security

While it seems that the main focus of the international discussions about the towage plans of the Akademik Lomonosov was safety and pollution concerns, security is also a natural concern in relation to ONPPs. Energy is essential to the functioning of modern societies, and threats to the energy supply are a common concern for national security. Furthermore, in the context of nuclear power plants, the natural risks associated with nuclear energy also call for special consideration.

In the case of ONPPs, maritime security is an additional dimension of the general international legal framework for nuclear security. The Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation (SUA Convention) is key in this regard. The Convention sets forth a list of

example, a barge (arguably, the case could be made that it is in fact the [nuclear power plant] which is equipped with its own means of transport, not the other way round and, therefore, allow this difficulty to be overcome).

102 Handrliča (n 10), at p. 286.
103 Ibid., at p. 288.
104 See above (nn 15–18) and accompanying text.
105 See generally IAEA (n 10), at p. 43.
offences that its State Parties are required to prevent and suppress,\textsuperscript{108} provided the offences are ‘likely to endanger the safe navigation of the ship’.\textsuperscript{109} The SUA Convention has a rather broad scope and defines ‘ship’ as ‘a vessel of any type whatsoever not permanently attached to the sea-bed, including dynamically supported craft, submersibles, or any other floating craft’.\textsuperscript{110} Accordingly, it seems that an ONPP secured by some way other than permanent anchor mooring or other forms of permanent connection to the seabed, such as shore-based moorings (dock, wharf, quay, etc.), may fall within the definition of ‘ship’ under the SUA Convention. However, the Convention explicitly excludes from its scope of application ‘a ship which has been withdrawn from navigation or laid up’.\textsuperscript{111} Although there may be room for discussion about the precise meaning of these terms, ONPPs in operation would be expected to fall within its scope. An ONPP in operation is clearly not intended for navigation; if not for other reasons, the connection to the electrical grid effectively prevents it from moving/navigating without significant modification. Importantly, ‘the withdrawal from navigation need not be permanent’ for the exception to apply.\textsuperscript{112}

Adopted alongside the SUA Convention, the Protocol to the Convention of 10 March 1988 for the Suppression of Unlawful Acts against the Safety of Fixed Platforms Located on the Continental Shelf broadens the scope of application to ‘fixed platforms located on the continental shelf’.\textsuperscript{113} ‘Fixed platform’ is defined as ‘an artificial island, installation or structure permanently attached to the sea-bed for the purpose of exploration or exploitation of resources or for other economic purposes’.\textsuperscript{114} Unlike conventional oil platforms, ONPPs are not engaged with ‘exploration or exploitation of resources [of the continental shelf]’. Still, ONPPs serve ‘economic purposes’, that is, the production of energy by nuclear means.\textsuperscript{115} Accordingly, it seems that an ONPP that remains fixed by means of permanent anchor moorings or other forms of permanent

\textsuperscript{108} Ibid., Articles 3, 8bis.
\textsuperscript{109} Ibid., Article 3.
\textsuperscript{110} Ibid., Article 1.
\textsuperscript{111} Ibid., Article 2(1)(c).
\textsuperscript{114} Ibid., Article 1(3).
\textsuperscript{115} See above (nn 43–44) and accompanying text.
attachment to the seabed may be outside the scope of the SUA Convention but within the scope of the 1988 SUA Protocol. Conversely, an ONPP in operation secured by shore-based moorings is outside the scope of both instruments.

This somewhat surprising conclusion – which attaches great significance to practical details such as mooring means – is yet another example of an unintended legal consequence that is the result of the fragmented legal framework for ONPPs.116

Institutions

The absence of a designated international legal framework for ONPPs, and the conceivable political will of at least some towards greater legal predictability in this area, begs the question of where such questions may be raised and discussed in a multilateral setting. In the case of the Arctic, at least three institutions can be considered: the IAEA, IMO, and the Arctic Council.

According to its Statute, the objectives of the IAEA are to 'accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world'.117 The IAEA is 'authorized to establish or adopt standards of safety for protection of health and minimization of danger to life and property, and to provide for the application of these standards'.118 Accordingly, efforts to establish a strong, sustainable, and visible global nuclear safety and security regime of ONPPs would seem a neat fit for the IAEA. Furthermore, the Convention on Nuclear Safety, which applies to the safety of land-based civil nuclear power plants, was largely the result of initiatives by the IAEA.119 However, in the light of rising expectations in recent years regarding the role of nuclear power there are many pressing issues for the Agency to consider. Various issues compete for attention and its institutional capacity is limited. Although the mandate of the Agency seems to cover ONPPs, there may be

116  See also IAEA (n 10), at p. 41: ‘While having similarities to both land based [nuclear power plants] and nuclear powered vessels, [transportable nuclear power plants] are ... distinct and may possibly represent a new category for which nuclear security norms, standards or best practices will need to be developed’.
118  Ibid., Article 3.
119  For a brief overview of the process, see D Fischer, History of the International Atomic Energy Agency: The First Forty Years (IAEA, Vienna, 1997) 216–218. Furthermore, the IAEA has adopted safety standards that prima facie are relevant also to ONPPs: IAEA (n 10), at p. 40: ‘Non-binding instruments, such as the IAEA safety standards, will apply to [transportable nuclear power plants] activities’. See also at p. 50.
specific legal challenges that come within the ambit of other institutions. The need for the Agency to engage with these issues may not be obvious, making it easier for it to give priority to other pressing matters.

Given the maritime nature of ONPPs, IMO could be a relevant forum for discussions. Although the purposes of the Organization are broader,\(^{120}\) the specific focus on maritime safety and previous attention of the Organization not only to nuclear matters (nuclear-powered ships, carriage of nuclear materials) but also to Arctic issues (Polar Code) suggest that Arctic ONPPs could be discussed within IMO. Still, it should be noted that the focus of IMO is shipping and that it could easily be argued that ONPPs are something different.

The Arctic Council was established in 2016.\(^{121}\) It is the leading intergovernmental forum for promoting cooperation and coordination between the Arctic States with regard to common Arctic issues, in particular sustainable development and environmental protection in the Arctic. The Arctic Council has six working groups: Arctic Council Action Plan (ACAP); Arctic Monitoring and Assessment Program (AMAP); Conservation of Arctic Flora and Fauna (CAFF); Emergency Prevention, Preparedness and Response (EPPR); Protection of the Arctic Marine Environment (PAME); and Sustainable Development Working Group (SDWG). All eight States with territories within the Arctic Circle are members: Canada, Denmark, Finland, Iceland, Russia, Norway, Sweden, and the United States. The Arctic Council is thus significantly broader than a regional seas forum; for example, its activities include land-based matters and people-to-people cooperation.

While there are indeed challenges to cooperation within the Arctic Council, the development of a framework with regard to ONPPs in the Arctic seems a potential matter for the Council to explore. The clear need for international cooperation in emergency preparedness and response, including pooling of resources, makes political progress in this area seemingly easier compared to other areas. In fact two of the three binding agreements adopted by the Arctic Council concern emergency preparedness and response.\(^{122}\) Furthermore,\(^{120}\) As summarised by the Convention on the International Maritime Organization (Geneva, 6 March 1948, in force 17 March 1958) 289 UNTS 3, Article 1(a), the purposes of IMO are ‘to provide machinery for cooperation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage and facilitate the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and prevention and control of marine pollution from ships’.\(^{121}\)


\(^{122}\) See above (nn 6 and 89) and accompanying text.
in 2019, a new Expert Group on Radiation (RAD EG) was established for the Arctic States to share expertise and experiences on search and rescue operations involving a radiological or nuclear event at sea.123 The work focused on international cooperation including notification, information exchange and situational awareness, resource needs and utilisation, international assistance, protective measures, and possible harmonisation of decisions.124

Without a doubt, there are challenges to effective cooperation within the Arctic Council. Indeed, all official meetings of the Council and its subsidiary bodies were recently paused until further notice. On 3 March 2022, seven Council members (Canada, Denmark, Finland, Iceland, Norway, Sweden, United States) issued a joint statement in which they condemned ‘Russia’s unprovoked invasion of Ukraine’ and announced a pause in their participation in the Arctic Council.125 On 8 June 2022 a further joint statement was issued announcing ‘a limited resumption of [the] work in the Arctic Council, in projects that do not involve the participation of the Russian Federation’126 Russia is the chair of the Arctic Council 2021–2023. It is difficult to predict the future of the Arctic Council.

The Arctic has been identified as a promising region for ONPPs. However, the absence of specific international regulation of Arctic ONPPs, the special governance structure of the Arctic, and rising security tensions make Arctic ONPPs a complicated issue. While some legal challenges may be addressed through the development of a general framework for ONPPs, the need for regional arrangements will likely remain. International cooperation regarding nuclear emergency preparedness and response is an example. The challenges to effective cooperation within the Arctic Council – including the current stalemate in the wake of Russia’s aggression against Ukraine – are reason for serious concern.


125 ‘Joint Statement on Arctic Council Cooperation Following Russia’s Invasion of Ukraine’ (Swedish Ministry for Foreign Affairs, 3 March 2022) available at https://www.government.se/statements/2022/03/joint-statement-on-arctic-council-cooperation-following-russias-invasion-of-ukraine/: ‘In light of Russia's flagrant violation[s] ... our states are temporarily pausing participation in all meetings of the Council and its subsidiary bodies, pending consideration of the necessary modalities that can allow us to continue the Council's important work in view of the current circumstances’.

However, the Arctic Council is not the only relevant international body. For example, IMO and the IAEA could consider the appropriateness of applying relevant maritime law instruments to ONPPs and the possible revision of existing instruments (e.g., SOLAS Convention, MARPOL, INF Code, IMDG Code, Polar Guidelines, Polar Code). Also, the need for the development of a clearer nuclear liability scheme could be considered within the IAEA, possibly in cooperation with IMO.127 By contrast, fundamental law of the sea matters, such as navigational rights, the general duty to render assistance at sea, and the laying of submarine cables, are likely difficult to develop outside of the framework established by the LOSC.

While the Arctic Council has the advantage of a regional focus, IMO and the IAEA may currently be perceived as less politicised and congested with international politics leaving more room for ostensibly neutral discussions about technical safety issues. The larger number of participating States may also contribute to this end. Indeed, both bodies have in the past proved capable of delivering progressive measures in times of great political tension. However, the broad mandates and the large number of participating States in both bodies also means that there are more issues and actors to compete with. Clearly, the concept of ONPP is far from the only issue prompting consideration of development of new legal standards and regulations.

Closing Remarks

The international law of ONPPs with a particular focus on the Arctic has been considered here, albeit briefly. International law provides States with a considerable degree of freedom when it comes to the development and deployment of ONPPs, but there are a number of challenges and legal gaps not least with regard to special legal regulations for the Arctic. A number of issues stands

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out, including the classification of ONPPs as ‘ships’, which affects navigational rights, as well as the applicability of several key maritime law instruments and the obligations of States in relation to nuclear accidents or radiological emergencies involving ONPPs. Furthermore, the ostensible exclusion of ONPPs from the existing nuclear liability regime is a concern. Understandably, uncertainties about the legal status of ONPPs and the rights and obligations of States in relation thereto may affect the willingness of States to adopt such technology and also cause tensions between actors with different interests in ONPPs.128

128 For a similar remark, see IAEA (n 10), at p. 34: ‘The consideration of the current state of international regulation [for transportable nuclear power plants] leads to the conclusion that legal certainty or predictability in the evolution of legal frameworks is not sufficient’.