Globalisation of the Nuclear Fuel Cycle and Maritime Carriage of Radioactive Materials: Review of the Legal Regime

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Abstract
The international community and important nuclear stakeholders are making efforts to promote the further globalisation of the nuclear fuel cycle. Consequently, marine shipments of radioactive materials are ever increasing. The history of maritime carriage of these substances has been characterised by disagreements between the various stakeholders with regard to, i.e., concepts such as innocent passage as included in the 1982 UN Convention on the Law of the Sea and implementation and interpretation of the precautionary principle. The international framework governing these shipments is flawed due to its inconsistency and fragmentation, thereby passively allowing coastal nations to take unilateral action, such as blocking the shipments from their Exclusive Economic Zones and territorial waters. On the European level, modern environmental law principles are being put forward more progressively, but are not incorporated into a consistent and clear legal regime in this particular context. Overall, there are many feasible improvements, both in the short- and the long term.

Keywords
multilateral nuclear fuel cycle; precautionary principle; United Nations Convention on the Law of the Sea 1982; environmental impact assessment; prior notification and authorisation; physical security of radioactive materials during marine transport; Exclusive Economic Zone; innocent passage.

Introduction

Background

Marine shipments of nuclear materials have been taking place with an excellent safety record for over 45 years. However, this period was characterised...
by disputes between shipping nations and coastal nations, environmental organisations and the industry. Some of these disputes are still ongoing. Great discrepancies exist with regard to the interpretation of what is meant by ‘innocent passage’, and with regard to the limits of coastal states’ powers to protect their territorial waters and Exclusive Economic Zones (EEZs) from such shipments. Given the renewed interest in nuclear energy and the further globalisation of the nuclear fuel cycle, maritime carriage of radioactive materials will increase. It is therefore clear that sustained unilateral action undertaken by coastal nations will have a negative effect on the regime governing the transboundary movement of these substances. Environmental law in general has evolved greatly since the enactment of the 1982 Law of the Sea Convention (LOSC); the precautionary principle has gained strength and substance over the years. It is timely to review the legal framework in this context and to evaluate how it can be ameliorated to incorporate modern environmental law provisions.

Globalisation of the Nuclear Fuel Cycle: Evolution
Since 2001, due to the combination of increasing demands for energy with concerns over climate change and security of supply, the words ‘nuclear renaissance’ have frequently come up in a global context.2 The International Energy Agency recently issued a report wherein targets were set for nuclear energy to provide 24% of global electricity by 2050.3 China, for example, will increase its nuclear capacity six-fold by 2020, while India issued plans to add 20 to 30 new reactors within the same time frame. In Finland and Sweden, permanent disposal sites for nuclear waste are being built. Furthermore, international cooperation relating to nuclear science is growing rapidly and new technologies are being developed, such as fast-neutron reactors that are able to consume nuclear waste through fission.4

Multilateral approaches to the nuclear fuel cycle are also being put forward, and continuous efforts are being made to enhance non-proliferation initiatives. For example, the United Nations Nuclear Agency has negotiated an agreement with Iran to send its enriched uranium abroad in exchange for nuclear fuel, preventing the former material from being used for atomic

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bombs.\textsuperscript{5} Between 2011 and 2018, large quantities of nuclear materials, currently stored in Canada, will be shipped to the United States. These transfers play a role in the international efforts to consolidate uranium at the fewest possible secure locations.\textsuperscript{6}

Furthermore, mechanisms such as nuclear fuel leasing and take back are being encouraged by the International Atomic Energy Agency (IAEA), and are developing at a fast pace. Through the “fuel leasing—fuel take back model”, the fuel is leased to the customer and, after its use and a cooling period, the supplier takes back the fuel for storage, reprocessing and final disposal.\textsuperscript{7} In response, the industry is investing in new purpose-built ships, such as the \textit{Pacific Egret}, the latest ship built by the transport group Pacific Nuclear Transport Ltd. (PNTL).

\textbf{Lack of Policy and Legal Consistency}

Consistent policies and a legal framework to govern these developments are lacking. In principle, stringent technical regulations govern the shipments. When applied rigorously, these regulations operate to assure safe shipment. However, the overarching legal framework of the maritime carriage of nuclear materials is generally considered to be an inconsistent patchwork of non-binding and binding rules. As a result, companies and countries are either avoiding or abusing the system. For example, shipping companies have been found guilty of falsifying safety records, and coastal states are continuously acting unilaterally and contrary to the LOSC.

Moreover, risks to the shipments are ever increasing due to security threats and intensification of transport. Consequently, the concept of friendly international relations cannot be relied on, but a solid legal framework must be resorted to. An analogy may be drawn from the Canada-US situation with regard to the Northwest Passage: in 1988 the US agreed to request prior authorisation to enter the Northwest Passage. This compromise was reached on the basis of good international relations, and not on an agreement to a legal basis, in the sense that the US would not accept Canada’s claim to designate the waters of the Canadian Archipelago as historic internal waters.\textsuperscript{8} The clarification of the current ambiguities is therefore of paramount importance.

\textsuperscript{8} Suzanne Lalonde and Ronald St. J. Macdonald, ‘Donat Pharand: The Arctic Scholar’ in:
Scope

This study does not cover nuclear-powered ships and their waste. It covers the carriage of nuclear materials by sea, namely irradiated nuclear fuel (INF), plutonium and high-level radioactive wastes carried in accordance with Class 7 of the International Maritime Dangerous Goods Code (the IMDG Code). The present article pertains to shipments of ultra-hazardous radioactive materials that are created by and for the nuclear fuel cycle industry. It will not delve into the routine movements of radioactive materials for, e.g., medical reasons.

International Legal Framework: Navigation

Innocent Passage: General

Chile has stated that the protection of the marine environment takes precedence over the right of innocent passage. Among the ‘hard law’ instruments, the first Treaty that should be consulted is the 1982 LOSC, as it is considered to be the constitution for the oceans. The provisions of the LOSC aim to balance shipping and coastal states’ interests by promulgating provisions ensuring the flag states’ freedom of navigation, while simultaneously providing the coastal states with some leeway of action to protect the marine environment. Certain coastal states have taken unilateral or regional action,
thereby interpreting the LOSC’s provisions on innocent passage and freedom of navigation in a way which is not in line with that envisioned by the initiators of the LOSC proceedings.

In the run-up to the 1982 LOSC, several countries were in favour of coastal state control over shipments of ultra-hazardous materials. To the extent that they would not present a hindrance to innocent passage, such provisions were included in the LOSC. Article 23, the most relevant Article in this context, provides for the unimpeded innocent passage of ships carrying nuclear substances. Indeed, such vessels may exercise their right of innocent passage through the territorial waters of the coastal states, carrying documents and observing precautionary measures established specifically for such ships by international agreements.

Besides the reference to these measures in international agreements, which will be developed further infra, the LOSC also provides coastal states with other tools. For example, Article 22 stipulates that the coastal state may issue rules and regulations relating to innocent passage in the territorial sea.\(^\text{14}\) It may therefore be said that coastal states may control the exercise of innocent passage, but may not interfere with it per se.\(^\text{15}\) In other words, coastal states may prescribe that foreign ships use designated sea-lanes or traffic separation schemes. The LOSC explicitly mentions ships carrying nuclear materials as being suitable for the ‘sea-lane confinement’ requirement.\(^\text{16}\)

The coastal states may not block the innocent passage of foreign ships through their territorial waters.\(^\text{17}\) Moreover, even should the cargo potentially represent an environmental risk, the ship’s passage remains innocent.\(^\text{18}\) Several states attached formal statements to their documents ratifying the LOSC. These statements may be considered as proof that the passage of vessels carrying nuclear cargo as such constitutes innocent passage as foreseen by the LOSC. The ambiguity pertains to the interpretation of the exact meaning of the required precautionary measures to be taken. The Netherlands and the United Kingdom issued declarations pursuant to LOSC Article 287 on the interpretation of innocent passage and coastal states’ powers. Indeed, these

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\(^{14}\) LOSC Article 22.

\(^{15}\) LOSC Article 18 defines passage as navigation through the territorial sea for the purpose of traversing the sea without entering internal waters or calling at a port and proceeding to or from internal waters or a call at such roadstead or port facility. Passage includes stopping and anchoring, but only insofar as these stops are incidental or necessary by force majeure or distress or for the purpose of rendering assistance.

\(^{16}\) LOSC Article 22 § 2.

\(^{17}\) LOSC Article 24.

countries stated that the LOSC allows for innocent passage in the territorial sea for ships carrying nuclear or hazardous waste, without any prior consent or notification.\textsuperscript{19} On the other hand, states such as Egypt and Malaysia interpret the precautionary measures as requiring that flag states obtain their prior authorisation before entering their waters.

**When Does Passage Cease To Be Innocent?**

For passage to cease to be innocent, it must be prejudicial to the peace, good order or security of the coastal state.\textsuperscript{20} In the EEZ, coastal states have less discretion to promulgate rules of conduct than they have in their Territorial Sea.\textsuperscript{21} The LOSC states that any act of wilful and serious pollution removes the innocent character of an otherwise innocent passage. In this case, the coastal state may apply national law.\textsuperscript{22}

Many authors, as well as coastal states, have raised the question whether maritime carriage of nuclear materials \textit{per se} creates a sufficient threat to the marine environment that the innocent character of the passage can be removed merely because of that threat.\textsuperscript{23} It is relevant to explore the track record of nuclear shipments in this context to establish whether this kind of passage should be considered innocent or otherwise. Shipments of nuclear materials have been taking place for over 45 years, and as yet no incident resulting in a significant release of radioactivity has occurred.\textsuperscript{24} So far, the involvement in an

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\textsuperscript{19} See the official webpage pertaining to the Declarations and Reservations made upon ratification, formal confirmation, accession or succession: <http://treaties.un.org/Pages/ViewDetailsIII.aspx?&src=UNTSONLINE&mtds_no=XXI-6&chapter=21&Temp=mtdsgr3&lang=en> accessed 8 March 2011.

\textsuperscript{20} LOSC Article 19 lists the activities that are considered to be prejudicial to peace, good order or security: any use of force, exercise of weapons, any act aimed at collecting information to the prejudice of the defence or security of the coastal state, any act aimed at affecting the defence or security of the coastal state, the launching or landing or taking on board of an aircraft or military device, the loading or unloading of a commodity, currency or person contrary to customs, fiscal, immigration or sanitary law, any act of wilful and serious pollution, fishing activities, research activities, any act aimed at interfering with any systems of communications, and any other activity not having a direct bearing on passage.

\textsuperscript{21} The EEZ is defined as an area beyond and adjacent to the Territorial Sea. It does not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured. See LOSC Articles 55 and 57.

\textsuperscript{22} LOSC Article 19 (2) (h).


\textsuperscript{24} World Nuclear Transport Institute, \textit{Safety Regulations Governing the Transport of Radioactive
accident of the required type of package—a type B transport cask containing radioactive materials—where it leaked or was breached, has not occurred. The LOSC explicitly states that there must be an act of both wilful as well as serious pollution before the passage is no longer deemed to be innocent. Therefore, the nature of the cargo is insufficient to determine the innocent character of the passage. As mentioned above, the vessel carrying nuclear materials must take precautionary measures while in innocent passage. One can hence assume that the LOSC considers ships carrying radioactive materials, which are compliant with precautionary measures established for such ships by international agreements, to be exercising innocent passage as long as there is no intention to cause serious pollution. Coastal states thus act in a discriminatory manner when they deny passage to ships carrying nuclear cargo, merely based on the nature of said cargo.

Suspension of Innocent Passage

Taking this position as a starting point for legal reasoning with regard to the ongoing conflict between shipping and coastal states over the transport by sea of radioactive materials, it is necessary to explore next the options available to coastal states to suspend innocent passage. A coastal state may take such measures in its territorial sea where the suspension is essential for the protection of its security. However, the suspension may only have a temporary character and be applicable to specified areas. The provision does not therefore legitimise unilateral action taken by coastal states to block innocent passage in the entire expanse of their territorial sea.

In 1992, the British-registered Pacific Pintail carrying plutonium from Europe to Japan faced many difficulties along the route. Indeed, the vessel...
first met an extraordinary level of objection and refusal by Latin American and Caribbean States.\textsuperscript{32} As a consequence, the \textit{Pacific Pintail} changed course and sailed towards Cape Horn, where rough seas and wild winds forced the vessel into calmer waters within Chile’s EEZ. However, Chile immediately demanded that the vessel leave its waters, threatening to use military force. The vessel was compelled to sail back into the high seas where it again encountered worse conditions.\textsuperscript{33} Chile cited the precautionary principle to justify its action, but inevitably the question arises whether Chile’s action was consistent with a precautionary approach, as the measures could have had serious consequences.

\textit{Cooperation}

Part XII of the LOSC deals with environmental protection, stating explicitly that states should act through the competent international organisation to establish international rules and standards to prevent vessel-source pollution of the marine environment.\textsuperscript{34} The provision reiterates coastal states’ obligation not to hamper innocent passage of foreign vessels. The latter stipulation, combined with the duty to cooperate, excludes the range of state practice developed over the years, whereby coastal states unilaterally take action to deny innocent passage through their territorial waters of ships carrying nuclear cargo.\textsuperscript{35}

Cooperation through the International Maritime Organization (IMO) is mandated by the LOSC, but the IMO has not been sufficiently proactive in this matter, considering the ongoing conflicting state practice.\textsuperscript{36} In the context of transboundary movement of ultra-hazardous materials, many states and regions have signed regional agreements. For example, the Bamako Convention on the Ban of Imports into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa adopts a precautionary approach and does not exclude radioactive wastes from its scope.

\begin{footnotesize}
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\item[32] Dixon, \textit{op. cit. supra} note 27 at 78.
\item[34] LOSC Article 211 (1).
\item[35] Dixon, \textit{op. cit. supra} note 27 at 94.
\item[36] In the emissions trading sector, the International Civil Aviation Organisation was equally criticised for not being proactive and successful in addressing the impact of aviation on climate change. Malte Petersen, ‘The Legality of the EU’s Stand-Alone Approach to the Climate Impact of Aviation: The Express Role Given to the ICAO by the Kyoto Protocol’ (2008) 17 \textit{RECIEL} 196–204.
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This Convention stipulates that wastes may only be shipped upon written consent by the states of transit and import.\footnote{Article 6 of the Bamako Convention on the Ban of Imports into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, done at Bamako 30 January 1991, in force 22 April 1998, 30 ILM 773.}

However, the IMO has not sufficiently responded to the action taken by worried coastal nations. The IMO does not adopt a truly precautionary approach with regard to the movement of nuclear materials, as it refers to the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board of Ships (INF Code) but not to the IAEA Code of Practice on the International Transboundary Movement of Radioactive Waste.\footnote{International Atomic Energy Agency, \textit{Code of Practice on the International Transboundary Movement of Radioactive Waste}, INFCIRC/386 (13 November 1990).} As will be established \textit{infra}, there are some ambiguities in both the IAEA instruments and in the IMO instruments. As long as these ambiguities are not clarified, coastal states will continue to take unilateral action.

\textit{Dispute Resolution}

The LOSC provides for dispute settlement mechanisms to help clarify possible vague notions and uncertainties in its text. Dispute settlement could turn out to be very helpful in this context, as the exact balance of power between shipping nations and coastal nations with regard to nuclear shipments has been an issue for decades.\footnote{Van Dyke, \textit{op. cit. supra} note 12 at 93.} An interesting evolution may be taking place. Many coastal states deny the right of innocent passage provided for by the LOSC and, more often than not, shipping states did not cause turmoil and avoided the EEZs and territorial waters of the coastal states. The question arises whether this state practice could represent an evolution towards customary international law, whereby the precautionary principle would play an ever stronger role. How ‘holy’ is the concept of innocent passage vis-à-vis coastal states’ duties to protect the marine environment from the mere threat of the carriage of nuclear cargo?

Generally speaking, international jurisprudence has proven to be useful in the clarification of such issues. For example, in the \textit{Southern Bluefin Tuna} cases before the International Tribunal for the Law of the Sea (the Tribunal), Judges Treves and Shearer acknowledged that the Tribunal prudently and implicitly...
took a precautionary approach.\textsuperscript{40} Japan rejected the idea that the precautionary principle had become part of general international law.

However, it is unlikely that the Tribunal would compromise the notion of innocent passage, as it is enshrined in the LOSC. Indeed, the Tribunal has been criticised for undertaking a more diplomatic and academic exercise than an actual judicial one.\textsuperscript{41} In the context of the MOX Plant case, the Tribunal was criticised for not tackling the root of the problem, which was the lack of an adequate environmental impact assessment mechanism.\textsuperscript{42}

**Protection of the Marine Environment**

*Law of the Sea Instruments Available to Coastal States*

**Inspection and Traffic Services**

The LOSC stipulates that, in the case of a threat of significant pollution caused by a vessel navigating in the EEZ, the coastal state may conduct a physical inspection of the vessel for matters relating to the violation, if the vessel has refused to give information requested by the coastal state.\textsuperscript{43} On the other hand, when the vessel is entering the port of a state, that state may initiate proceedings and investigations in response to discharges outside its internal waters.\textsuperscript{44} Thus the LOSC allows port states to take action where coastal states cannot. The port state can act in the public interest; therefore it can be said that a universal jurisdiction is conferred upon it.\textsuperscript{45}

**The LOSC’s Reference to International Agreements**

The reference in LOSC Article 23 with regard to documentary requirements and special precautionary measures in international agreements pertains par-
particularly to the International Convention for the Safety of Life at Sea (SOLAS).46 Chapter VII of SOLAS relates to the carriage of dangerous goods.47

The IMDG Code was made mandatory in 2002 and contains the INF Code, which was developed jointly by the IAEA and the IMO.48 The INF Code includes requirements additional to those provided by the SOLAS Convention, and is equally mandatory and particularly relevant in this context.49 The INF Code requires ships carrying INF cargo to prepare shipboard emergency plans. The INF Code also provides for the requirement of notification in case of an accident. It does not mention issues such as prior environmental impact assessment, prior notification, or authorisation of the shipments.

The IMO has made efforts to align and simplify the regulations on the shipment of dangerous goods by sea. For example, the substances included in Annex III of the International Convention for the Prevention of Pollution from Ships (MARPOL)50 are identified as marine pollutants in the IMDG Code.51 This Code was also aligned with the UN Model Regulations on the Transport of Dangerous Goods.52 The IMDG Code includes IAEA Standards for Class 7 Radioactive Materials and focuses more on package design, whereas the INF Code focuses on ship design.53 The IAEA Regulations for the Safe Transport of Radioactive Materials contain standards which reflect an international consensus on the required level of safety to protect humans and the

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48 The INF Code, op. cit. supra note 9. The INF Code became mandatory on 1 January 2001. Chapter 3.5 IMDG Code, on transport schedules for Class 7 radioactive materials, was one of the deleted chapters. Users were referred to the IAEA Regulations for the Safe Transport of Radioactive Materials. See http://www.imo.org/safety/mainframe.asp?topic_id=158 for an overview of the mandatory and recommendatory chapters in the IMDG Code.
52 Güner-Özbek, op. cit. supra note 49 at 17.
53 Ibid., at 25. Furthermore, the IMDG Code relies on the IAEA requirements as set out in Safety Series No. 6, Regulations for the Safe Transport of Radioactive Material (1985).
The regulations include detailed provisions on the issues of transport and storage in transit, *inter alia* relating to stowage arrangements, and radiation protection programmes.\(^{55}\)

**Areas**

Several tools are available to coastal states to regulate passage within their territorial waters and EEZs without breaching the LOSC. Coastal states may designate certain areas as ‘Special Areas’, where associated measures relating to the prevention of vessel-source pollution apply. LOSC Article 211 (6) provides coastal states with the option to submit a request to the IMO to define a certain area within their EEZ as a ‘Special Area’. The states may then adopt laws and regulations for the prevention, reduction or control of vessel-source pollution, thereby implementing international rules and standards.\(^{56}\) These may include measures foreseen by the MARPOL Convention, as well as measures such as Vessel Traffic Services. In other words, the applicable measures concern all actions which may be taken by the IMO to protect vulnerable areas.\(^{57}\) The LOSC also enables coastal states to adopt additional laws and regulations applicable to that area for the prevention, reduction and control of pollution from vessels. However, the LOSC prohibition on coastal states issuing laws and regulations applying to the design, construction, manning or equipment of foreign vessels that are more stringent than generally accepted international rules or standards still remains valid in this context.\(^{58}\)

Designation of ‘Particularly Sensitive Sea Areas’ (PSSAs) is also possible.\(^{59}\) These are solid legal measures available to states to better protect vulnerable areas against maritime transport.\(^{60}\) The PSSA Guidelines set out several criteria which the area must meet in order to be designated as particularly sensitive. The area must meet one of the following criteria of ecological, social,

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\(^{55}\) *Ibid.*, at 73.

\(^{56}\) LOSC Article 206 (11).


\(^{58}\) LOSC Articles 21 (2) and 211 (6) (c).

\(^{59}\) A PSSA is defined as an area that needs special protection through action by IMO because of its significance for recognized ecological, socio-economic, or scientific attributes where such attributes may be vulnerable to damage by international shipping activities. See International Maritime Organization, Revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas (2005) A 24/Res. 982.

\(^{60}\) Frank, *op. cit. supra* note 57 at 331.
cultural, economic, scientific or educational significance. It must also be established that the area is at risk from international shipping activities. This criterion is particularly relevant in the context of the maritime carriage of ultra-hazardous materials. Indeed, one possible argument in favour of PSSA designation relates to the vessel traffic characteristics. More specifically, it relates to the type of harmful substances the ship is carrying. Coastal states that fear the impact of the navigation of ships transporting nuclear materials on the local economy and tourism and that are currently undertaking unilateral action to deny those shipments contra legem, could benefit from the PSSA option. The coastal states could adopt associated protective measures, such as routeing and reporting systems, as foreseen by the SOLAS Convention. The PSSA may also be designated as an “area to be avoided”. The wider Caribbean region has been designated as a Special Area under the MARPOL Convention, but only in relation to the discharge of garbage, as foreseen by MARPOL Annex V.

The concepts of Special Areas and PSSAs are both developed to combat vessel-source pollution, and are particularly relevant for this study. Identification and designation of both types of ‘Areas’ take place at the international level, thereby excluding the illegitimacy of unilateral action.

Precautionary Principle

General
Countries such as New Zealand are protesting against shipments of ultra-hazardous radioactive materials, using the precautionary principle as their main argument. They claim that the passage of this particular cargo through their EEZs is in breach of the LOSC. More specifically, they declare that the LOSC’s requirements for states to, inter alia, protect the marine environment, establish liability regimes, prepare Environmental Impact Assessments (EIAs), conduct consultations and prepare contingency plans for emergencies, extend to nuclear shipments. Coastal state practice over the years

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62 For an overview of the special areas designated under MARPOL, see <http://www.imo.org/environment/mainframe.asp?topic_id=760> accessed 4 March 2011.
65 Van Dyke, op. cit. supra note 12 at 89.
included requirements of prior notification, prior authorisation, and overall blocking of the passage of these shipments. The latter two initiatives are contrary to the LOSC. Indeed, the LOSC prohibits coastal states from imposing requirements on foreign ships which have the practical effect of denying or impairing their right of innocent passage.66

However, it is conjectured that the idea of prior notification could constitute a revamped interpretation of the LOSC’s provisions.67 This idea, which may be considered characteristic of a precautionary approach, may be said to be justifiable in light of the evolution of environmental law since 1982. The issue of denial of shipment is a relevant example, as this denial is often attributed to a misplaced perception of potential harm, rather than to actual danger.68 Prior notification could mitigate this problem because it would ensure that contingency plans are prepared in time.69 Worries expressed by coastal states relate to incidents such as possible fires, collisions, or sinking. Even though it is clear that the level of safety, in the context of movement of radioactive materials, has so far proven to be high, a more precautionary approach may need to be taken. Indeed, many environmental laws have been created as a reaction to incidents.70

Utilising this interpretation, the international community has the opportunity to enhance the regulatory framework in a preventive manner. Concepts such as prior notification and consultation and EIAs may steer the law of the sea towards a more comprehensive framework. Furthermore, tools such as the International Nuclear Events Scale (INES)—developed by the IAEA and OECD/NEA as a means to communicate the safety levels of incidents at nuclear power stations, to governments, the public, and other actors—may prove to be very useful in the context of transport incidents as well. The INES could go so far as to provide a nuance for existing public perceptions relating to the safety of transport and permit a better understanding of possible incidents.71

66 LOSC Article 24 (1) (a).
69 Van Dyke, op. cit. supra note 12 at 85.
Notification

There is a clear international consensus on notification in the case of an incident during transport of nuclear materials. Indeed, the Convention on Early Notification of a Nuclear Accident requires State parties to notify other States which might be affected by the release of radioactive materials following an incident during the transport of radioactive wastes. However, the issue of prior notification, whereby the shipping State notifies the State of destination and the State of transit in advance, is highly disputed.

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal provides for a mechanism of prior notification and consent. The importing State and the transit States should submit their consent for the transboundary movement of the hazardous wastes before the shipment takes place. However, the Basel Convention stipulates that radioactive wastes, which are subject to international instruments applying specifically to them, are excluded from its scope. Therefore, the Basel Convention is pre-empted by the INF Code as part of the SOLAS Convention. Furthermore, under LOSC Article 210(6), LOSC parties are equally bound by the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. The latter includes the precautionary principle. The 1996 Protocol to the London Convention stipulates that nothing can be dumped except for certain materials, which are explicitly listed.

The question arises whether the exclusion of radioactive wastes from the Basel Convention is justified, when the Conventions governing these wastes do not provide for a level of environmental protection equivalent to the protection foreseen by the Basel Convention. It is quite clear that the patchwork of non-binding and binding rules, flawed with inherent contradictions and inconsistencies, do not provide an equivalent and satisfactory level of environmental protection. Given the track record of accident-free nuclear shipping, the regulations relating to packaging and storage have not been fully tested.

74 Article 1(3) Basel Convention.
75 Dixon, op. cit. supra note 27.
76 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, done at London 13 November 1972, in force 30 August 1975, 11 ILM 1294 (1972). In 1972, the disposal of high-level radioactive waste was banned and in 1994 the disposal of low- and intermediate-level radioactive solid wastes was banned as well.
Regardless of the adequacy of these technical regulations, however, neither shipping nations nor coastal nations are satisfied with the legal regime as it stands today. Many coastal nations demand to be notified prior to the shipment, but cannot truly base this requirement on a binding international Convention, as the Basel Convention does not apply. However, it is interesting that Argentina has previously cited the Basel Convention to prohibit the transport, planned by the United States, of the *San Onofre Nuclear Reactor* through its EEZ. Due to the ban, the United States annulled its shipment plans.

Certain international non-binding codes refer to prior notification, but these are not the instruments that LOSC Article 23 refers to. For example, the IAEA Code of Practice on the International Transboundary Movement of Radioactive Waste incorporates the mechanism of prior notification and consent.\(^78\) This Code represents a precautionary approach to nuclear shipments. However, this Code contains inherent contradictions. It stipulates that it is the sovereign right of each State to prohibit the movement of radioactive waste through its territory, and that every transboundary movement of radioactive waste should take place only with the prior notification and consent of the sending, receiving and transit State(s), in accordance with their laws and regulations.\(^79\) Further on, the Code mandates that nothing in it may prejudice or affect the exercise by ships of all States of maritime navigation rights as established by customary international law and the LOSC. The provisions included in the Code are contradictory, even more so given that the LOSC does not mention prior notification and consent with regard to the movement of radioactive wastes.\(^80\)

Regardless of this unfortunate contradiction, the IMO does not refer to the IAEA Code of Practice, but instead consistently refers to the INF Code, which does not include the precautionary principle.\(^81\) The IMO has urged member states to facilitate the carriage of IMDG Code Class 7 Radioactive Materials when this carriage is found to be in compliance with the INF Code, the IMDG Code and the Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas. Indeed, in this scenario the carriage meets the safety requirements and should not be impeded.

The IAEA Joint Convention on the Safety of Spent Fuel Management and on The Safety of Radioactive Waste Management states that each contracting

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\(^80\) Dixon, *op. cit. supra* note 27 at 89.

\(^81\) *Ibid.*, at 84.
party, when it is a State of origin, must take action to ensure that the transboundary shipment is authorised and that prior notification and consent of the State of destination has taken place. Additionally, the movement through transit States must be in compliance with the applicable international obligations. The IAEA Joint Convention continues to stipulate that none of its provisions may prejudice the exercise by ships of maritime navigation rights as provided for in international law.

Shipping nations claim that EIAs and prior notification would enable persons with malicious intent to intercept the materials. This argument has been rendered obsolete by many actions undertaken by environmental non-governmental organizations (NGOs), who very often have tracked down the vessels and disseminated information on their whereabouts to the public.

**Environmental Impact Assessment (EIA)**

The EIA would be a way to ensure that shipping States undertake prior notification, thereby allowing affected States to consult with them regarding the impact of the planned activity on the marine environment. Principle 17 of the Rio Declaration states that EIAs should be conducted for all activities likely to have a significant adverse impact on the environment. A transboundary EIA implies interstate processes such as notification, information exchange, and consultation.

The LOSC provides that: “in particular, States shall keep under surveillance the effects of any activities which they permit or in which they engage in order to determine whether these activities are likely to pollute the marine environment.” Furthermore, the LOSC states that:

when States have reasonable grounds for believing that planned activities under their jurisdiction or control may cause substantial pollution of or significant and harmful changes to the marine environment, they shall, as far as practicable, assess the potential effects of such activities on the marine environment and shall

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83 Article 27 (3) (i) Joint Convention.
87 LOSC Article 204.
communicate reports of the results of such assessments in the manner provided in article 205.  

The LOSC’s provisions on EIA are rather unclear. For example, it requires States to send reports on the evaluation of the potential impact of their activities on the environment to the competent international organisation. That organisation must then make these reports available to all States. It is unclear how exactly it is ensured that the affected States receive the necessary information in a timely and adequate manner.

One of the disputed issues included in the MOX Plant case related to the marine transport of nuclear materials. Ireland argued that the Environmental Statement, which was prepared in light of the proposed MOX Plant, did not thoroughly take into account the effects of shipping on the marine environment. The Environmental Statement touches lightly upon the issue of transport, but merely with regard to domestic transport. Considering the fact that the MOX pellets were to be transported to Japan through the Irish Sea, the assessment was not adequate from Ireland’s standpoint. The United Kingdom claimed that LOSC Article 23 includes sufficient procedural safeguards by requiring precautionary measures to be taken pursuant to international agreements. However, it is quite clear, in light of the nuclear renaissance and consequent increase in international nuclear shipments, that coastal States consider the procedural requirements included in LOSC Article 23 to be inadequate.

The interpretation of the practical meaning of the precautionary principle has evolved greatly since 1982. Reference to it in the existing international agreements is not satisfactory, as these agreements do not incorporate the precautionary principle as it is interpreted today.

**The Special Case of Ice-Covered Areas**

The Chilean Maritime Authority has used LOSC Article 234 to block the passage of the Pacific Pintail through its waters. This Article was inserted into the LOSC with the special goal of adequately protecting the Arctic, whose particular and exceptional character was acknowledged by many sources. Indeed, the Article pertains to ice-covered areas and grants coastal States the right to adopt laws to control marine pollution in those areas within the limits of their EEZ. The provision does not refer to the designation of sea-lanes or other

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88 LOSC Article 206.
89 Tanaka, op. cit. supra note 84 at 356.
90 LOSC Article 234. The regulations must still have due regard to navigation rights.
options to protect the environment, without interfering all too much with the concept of innocent passage. This Article possibly provides leeway for the coastal state to deny outright innocent passage in the entire ice-covered area within their EEZ.91

**Physical Security of Transport**

The former CIA Director George Tenet has described ship containers as being “the potential Trojan horses of the 21st century”.92 In 1998, members of Greenpeace managed to board the *Pacific Swan*, a British nuclear fuel vessel, in the Panama Canal.93 The vessel was carrying thirty tons of MOX fuel, which contains enough plutonium for sixty nuclear bombs.94 This action clearly demonstrated the vulnerability of these vessels to malicious acts.

Therefore it is necessary to focus not only on environmental protection, but also on respecting international regulations relating to the physical security of transport. The main international instrument in this regard is the Convention on the Physical Protection of Nuclear Material.95 This Convention sets out different levels of physical protection of nuclear materials which should be maintained during international nuclear transport.96 It provides that the State responsible for assuring the protection of the materials must inform States through which the nuclear material is expected to transit, by land or internal waterway, or whose airports or seaports it is expected to enter.97 There is no mention of prior notification to states through whose EEZ the vessel is expected to pass.

The LOSC contains a stipulation relating to the disclosure of information. The provision states that a State Party should not be required to supply information when this would compromise the essential interests of its security.98

With regard to maritime security and anti-terrorism efforts, the SOLAS Convention was also amended to include the International Ship and Port

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91 Dixon, *op. cit. supra* note 27 at 96.
93 Dixon, *op. cit. supra* note 27 at 79.
94 *Ibid*.
96 See CPPNM Annex I.
97 CPPNM Article 4 Paragraph 5.
98 LOSC Article 302.
Facility Security Code (ISPS Code), which aims to enhance cooperation between shipping states and port authorities to identify security issues and prevent them. The ISPS Code requires flag states to approve Ship Security Plans, and port authorities to conduct so-called Port Facility Security Assessments.

**Conclusion and Evaluation of the International Regime**

The international legal framework provides for stringent requirements and technical assistance with regard to the packaging and safety of the materials, sensu stricto. However, on examining the entire framework, including the environmental aspects, the security issues and the diplomatic aspects, it is clear that the regime is fundamentally flawed. Furthermore, the international regime for the transboundary movement of radioactive materials may even be considered a laggard vis-à-vis certain areas of environmental law.

The LOSC Article on the passage of vessels carrying nuclear materials requires compliance with precautionary measures pursuant to international agreements. However, the agreements to which it refers, i.e., the London Convention, the INF Code and the IMDG Code, do not provide for mechanisms relating to prior notification and EIA. Coastal States have consistently objected to these shipments because the international legal framework governing them does not provide sufficient safeguards. When coastal States are adequately consulted and EIAs as required, the notion of prevention would be pursued in an optimal manner. Coastal States’ worries may be mitigated, as prior notification would enhance the trustworthiness of the entities responsible for the shipment.

Therefore, the existing binding Code or Convention should be updated to include such provisions. The SOLAS Convention could be amended to insert a package of precautionary measures into the INF Code. Second, the concepts of innocent passage and suspension thereof in relation to the coastal States’ rights and duties to protect the marine environment should be clarified. However, this would require coastal States to bring a claim before the Tribunal. Third, unilateral action, undertaken by coastal States to deny innocent passage, should be prevented at all cost. The law of the sea in its current form

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provides several tools for coastal States to protect the marine environment in a legitimate way. The concept of Special Areas and PSSAs could prove to be very useful in this regard.

**European Union**

**Background**

Ninety percent of European Union (EU) external trade goes by sea and around 3.7 billion tonnes of freight are unloaded and loaded in EU ports every year. In the nuclear context, Europe has quite a long history of shipping nuclear materials, especially MOX fuel. It is clear now that the question of transboundary movement of nuclear materials is governed by a combination of rules relating to transport and rules relating to marine environmental protection. EU legislation on the transportation of radioactive materials is characterised by complexity, partly because actions are based on the Treaty on the Functioning of the European Union (Lisbon Treaty) and the Euratom Treaty.

In a recent communication on Non-Proliferation Initiatives, the European Commission has urged international cooperation on issues relating to the nuclear fuel cycle, in which transport plays a key role.

**Regime of Transport of Radioactive Materials**

**Legal Basis**

In the EU, the legal basis for actions relating to transport issues is found in Title VI of the Lisbon Treaty and in the Euratom Treaty. Article 33 of the

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102 A typical process would start with Japanese spent nuclear fuel being shipped to Europe. This spent fuel is reprocessed in France and in the UK, and the vitrified residues are shipped back to Japan.


105 Title VI Lisbon Treaty. In the Euratom Treaty, the most relevant provisions are included in Chapter III which has provisions relating to the promulgation of Basic Safety Standards on radiation protection.
Euratom Treaty requires Member States to lay down appropriate provisions to ensure compliance with the Basic Safety Standards and to take measures relating to harmonised implementation. The Euratom Treaty authorises the European Commission to ensure that agreements made by the EU with third states or international organisations are complied with. The EU has concluded cooperation agreements with the USA, Australia and Canada, whereby mechanisms have been established relating to notification and prior consent with regard to transfers of nuclear materials between the EU and these States.

Euratom became a Party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. In the Declaration made by Euratom on the competences in the framework of the Joint Convention, the provisions relating to the transboundary movement of spent fuel or radioactive waste are matters of shared competence between the EU and its Member States.

Framework: Main Instruments and Scope of Application

Council Regulation 93/1493/EURATOM (8 June 1993) on shipments of radioactive substances between Member States was issued to fill the gap between the entry into force and the national implementation processes of Directive 92/3 on the shipments of radioactive wastes. There are two main differences between these two instruments which relate to the material and territorial field of application. First, the 1993 Regulation applies to radioactive substances that exceed the levels of concentration laid down in Directive 80/836/EURATOM, i.e., it does not only apply to radioactive waste. This is in contrast with Directive 92/3. Second, Regulation 93/1493 only applies

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106 Article 77 (b) Euratom Treaty.
108 Euratom met the requirements set by Article 39 (4) of the Joint Convention, op. cit. supra note 82. Euratom’s accession came into effect in January 2006.
to the shipment of radioactive substances between Member States. Directive 92/3 applies also to shipments between Member States and third States.

The Regulation ceased to apply to radioactive waste as of 1 January 1994; from then onwards the Directive applies. Directive 92/3 was then repealed and replaced by Directive 2006/117/Euratom (20 November 2006) on the Supervision and Control of Shipments of Radioactive Waste and Spent Fuel. The 1992 Directive only applied to radioactive waste, which was defined as “any material containing or contaminated by radionuclides and for which no use is foreseen”. The new Directive widened the scope. It now covers nuclear waste as a product and as a waste. The Directive was supposed to be implemented in the Member States by 25 December 2008. The European Commission has referred one Member State to the European Court of Justice, as that State has not taken measures to fully implement the Directive.

A peculiarity in the context of transboundary movement of dangerous goods is that Council Directives exist on the approximation of laws of the Member States relating to the transport of dangerous goods by rail and road, but not for such transport by sea.

**Territorial Field of Application**

Directive 2006/117 applies to transboundary shipments of radioactive waste or spent fuel when the country of origin, or the country of destination, or any country of transit, is a Member State. It is not clear whether the territory of

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114 Ibid.
116 Council framework Directives 94/55/EC and 96/49/CE, both of 21 November 1994, provide for the approximation of laws of the Member States on the transport of Class 7 dangerous goods by road, OJ L 319, and by rail, OJ L 235, respectively.
117 Article 2 (a) Council Directive 2006/117/Euratom, *op. cit. supra* note 114. A Transit State is defined as any country or member state other than the country or the member state of origin or the country of destination, through the territory of which a shipment is planned or takes place.
the Transit State includes the EEZ. In the absence of explicit reference to the possible application to areas adjacent to the territory of the State but under its national jurisdiction, one can assume that the territorial application of the Directive excludes the EEZ. The exact territorial scope should be clarified.\textsuperscript{118}

\textbf{Precautionary Principle}

As stipulated by the Lisbon Treaty, measures taken in the context of environmental protection must be based on the precautionary principle.\textsuperscript{119} In Council Directive 2006/117/Euratom relating to shipments of radioactive wastes, the precautionary approach is applied throughout the instrument. The Directive establishes a standardised system of authorisations for the transboundary movement of radioactive waste and spent fuel, starting from the point of departure up to the point of destination.\textsuperscript{120} It is in line and consistent with the Joint Convention, to which the Community acceded on 2 January 2006. Indeed, the Directive requires Member States of origin to send an application for consent to both the Member State of destination as well as the Member State of transit.\textsuperscript{121} The transit State may refuse to grant consent on the basis of the relevant national, European or international legislation relating to the transport of radioactive materials.\textsuperscript{122} Destination States can also base their rejection on legislation relating to the management of radioactive waste or spent fuel.

In 2005, a process was set up to initiate the third maritime safety package to end substandard shipping and enhance the EU maritime framework by creating a more integrated approach.\textsuperscript{123} The most relevant Directive adopted in the context of the third maritime safety package relates to port state control

\textsuperscript{118} As an example, the Convention for the Protection of the Natural Resources and the Environment of the South Pacific Region specifically includes the 200-nautical-mile zones in the definition of the “Convention Area”. See Article 2 (a) (i) of the Convention for the Protection of the Natural Resources and the Environment of the South Pacific Region, done at Noumea 24 November 1986, in force 22 August 1990, 26 ILM 38 (1987).

\textsuperscript{119} Article 191 (2) Lisbon Treaty.


\textsuperscript{122} Article 9 (3) (a) Council Directive 2006/117/Euratom, \textit{ibid.}

\textsuperscript{123} In 2009, a series of Directives on the quality of flags, classification societies, insurance, liability, port state control and traffic monitoring were adopted. Also relevant in this context is Council Directive 96/98/EC of 20 December 1996 on marine equipment, OJ 1997 L 46.
and traffic monitoring. Article 5 requires that a vessel coming from a port located outside the Community notify the competent authority of the port of destination of the Member State upon departure. The vessel should make use of the Vessel Traffic Service, where it exists. The Directive refers to dangerous goods covered by the IMDG Code.

Directive 93/75/EEC was amended by Directive 2002/84/EC on maritime safety and the prevention of pollution from ships. The latter Directive refers to the INF Code and more specifically to the Regulation establishing a Committee on Safe Seas and the Prevention of Pollution from Ships (COSS). This last reference is important, as it is acknowledged that amendments made to these international instruments can be excluded from the scope of the Directive. Such exclusions may occur upon the initiation of a conformity checking procedure, more specifically in case there is a risk that the international amendment could lower the standard of maritime safety and/or the standard for prevention of vessel-source pollution.

Security during Transport

Through Council Decision 2007/513/Euratom (10 July 2007), Euratom acceded to the Convention on the Physical Protection of Nuclear Material and Nuclear Facilities. The EU may take measures to ensure that nuclear materials are not diverted from their intended purpose by malicious acts. The European Court of Justice also stated that this competence implies

125 Ibid., Article 5 (2).
127 INF Code, op. cit. supra note 9.
measures of physical protection. However, the EU has not adopted measures relating to the assurance of physical protection of nuclear materials during transport.131 A situation which establishes Directives promulgating a system of prior informed consent, but which has no equivalent European regime for the physical protection of nuclear materials during transport, will inevitably raise legal questions.

**Europe as a Model for the International Regime?**

Generally speaking, the EU measures taken in the context of environmental protection are often front-runners in the international arena. The stringent and innovative requirements put forward by the EU with regard to the transition from single-hull to double-hull tankers are prime examples. In the context of transboundary movement of nuclear materials, several regional treaties have incorporated the precautionary principle by requiring prior notification and/or prior authorisation of the shipments. However, there is a degree of complexity and irregularity in the European framework. For example, rules relating to the transportation of dangerous goods by road and rail have been harmonised, but the harmonisation has not been extended to the maritime sector.

Therefore, although the EU has strongly incorporated the precautionary principle, the regime must be ameliorated in terms of consistency. Furthermore, the territorial field of application needs to be clarified and more explicit references to maritime safety must be included in the context of transport of nuclear materials. Finally, an initiative enabling the approximation of laws in this context must be set up.

**Overarching Conclusion and Summary of Recommendations**

After having explored the international and European framework, it may be concluded that there is a legal inadequacy in the regime governing the maritime carriage of nuclear materials. The technical specifications exist, but too many loopholes remain for the framework to meet the current environmental requirements. Looking towards the future, it is clear that both coastal States and shipping States ought to make compromises. These could be in the context

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131 The perpetual international debate on the conflict between the rights of shipping States to maintain a certain degree of secrecy during transport, versus the right and duty of coastal States to protect the marine environment, should be considered here.
of an amendment to the SOLAS Convention, whereby the precautionary principle and its accompanying requirements are incorporated in the INF Code. In this way, coastal States would be provided with the necessary safeguards and the risk of their refusing passage to ships through their waters would be minimized. By providing for prior notification, shipping nations will be in the position to prove that the shipment can be justified in environmental terms. Furthermore, the coastal States would have the guarantee of contingency plans prepared in advance.

The special nature of the cargo should be taken into account, and therefore explicit provisions should be inserted to protect confidentiality and to avoid sensitive information being leaked. On a general level, the ever-continuing debates relating to the precise relationship between the concept of innocent passage and the protection of the marine environment should be brought to an end, preferably with the help of the International Tribunal for the Law of the Sea. Coastal States should also use the tools already available to them in the current legal framework, i.e., the combination of the SOLAS Convention and the LOSC, which provide for many opportunities to, *inter alia*, designate sea-lanes and special areas.

The European framework is strict, but flawed nonetheless, and it would therefore also benefit from clarification. The exact territorial field of application of Directive 2006/117/Euratom is rather vague. Furthermore, efforts to align national legislations and to harmonise the legal instruments on a European level, *i.e.*, “approximation efforts”, have not taken place with regard to marine transportation of nuclear materials.

Therefore, having explored and compared the international regime with the European regime, it is very apparent that the total package contains an enormous amount of conflicting bodies of law. The declarations made by the signatory and ratifying States of the LOSC had already made clear that precautionary measures would be interpreted differently, and these discrepancies have only grown over time. However, the field of environmental law has evolved tremendously since 1982 and therefore it would be only prudent for the framework governing the marine transportation of nuclear materials to evolve as well, by tipping the scale over to the greener side.