



RISKS AND REGULATIONS IN THE TRANSPORT OF NUCLEAR MATERIAL BY SEA

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ABSTRACT

The technical regulations for the safe carriage of nuclear material by sea, having been developed over a number of years, are comprehensive and well thought out. The chief regulations in relation to shipping include the International Maritime Dangerous Goods Code (IMDG Code) and the “INF Code”, which has become the mandatory International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Waste on Board Ships.

But such technical codes do not deal with serious practical issues that have arisen recently and which must be addressed if the carriage by sea of such material is to increase in line with the international demand for enriched material and reprocessing. The proliferation of piracy, terrorism and obstructive protest in the first years of the 21st century and the apparent inability to effectively combat these on the high seas gives rise to serious questions as to whether the international law of the sea is ready for this challenge.

Defence of ships in ports and harbours was, after the New York 9/11 attacks, addressed in the International Ship and Port Security Code (ISPS Code) but only limited measures were taken to deal with perceived threat of attack on the high seas. These include the use of Global Maritime Distress Safety Systems (GMDSS), Automatic Identification Systems (AIS) and bilateral international agreements permitting warships of one nation (usually the US) rights to stop and search ships flying certain foreign flags. In effect, the steps put in place were not so much to defend the ship from attack but were designed to give authorities notice that a ship had been attacked and hijacked so it could not be used as a terrorist weapon delivery system.

The vulnerability of ships on the high seas and in roadsteads, particularly to piracy and terrorism, has been demonstrated by such incidents as the *Limburg* and *USS Cole* attacks and by the success of Somali piracy which has become a lucrative business model. The international community has struggled to deal effectively with such attacks both legally and practically despite the deployment of extensive naval forces. The increasing boldness and effectiveness of pirates and terrorists and even peaceful protestors on the high seas outside the jurisdiction of any state raise difficult questions of self defence and reasonable force in the already dangerous environment of the sea.

There are other issues related to the international law of the sea which must be considered if the carriage of nuclear material is to safely increase: the rights of nuclear ships to innocent passage through sea lanes within territorial seas; the right to a safe haven or port of refuge where a vessel suffers a breakdown or is overwhelmed by the elements; and where, despite all technical and practical measures, a ship becomes a casualty, how the question of salvage would be dealt with and the liability issues that may arise. This paper considers whether the law as it stands is sufficient or



whether perhaps, a new convention dealing with nuclear transport by sea is necessary and practicable.

INTRODUCTION

According to the World Nuclear Association, around twenty million consignments of all sizes containing radioactive materials are routinely transported worldwide annually on public roads, railways and ships [FN1]. As the international demand for enriched material and reprocessing continues to increase, so too will the volume of nuclear material requiring transportation. The regulatory framework covering all aspects of the nuclear industry has developed both nationally and internationally and has been developing for over forty years, largely driven by political agendas and public concern. Although the framework of international nuclear regulations currently in place all relate to the same general topic, being the protection and security of nuclear material, it is arguable that, because of the way in which it has developed, it fails to provide comprehensive and unified international legal regime covering all liabilities and issues, including those which arise from the transport of nuclear material by sea.

The gaps in the regulatory framework expose vulnerabilities of ships transporting nuclear material on the high seas and raise difficult questions regarding how to deal with them. This paper considers the following issues: (i) how to respond to the increasing threats of piracy or terrorist attacks; (ii) interference with the right of innocent passage; (iii) the ability of vessels to enter safe havens and ports of refuge; and (iv) how to deal with salvage and civil liability for nuclear damage; and the paper questions whether the regulatory framework currently in place provides us with sufficient guidance on how such issues should be dealt with.

THE EXISTING MATRIX OF REGULATIONS

As early as 1961, the International Atomic Energy Agency (IAEA) published its Regulations for the Safe Transport of Radioactive Material (the IAEA Regulations). Although the IAEA Regulations are recommendatory in nature, they have been adopted or used as a basis for regulations in many Member States and, at an international level, they form part of the UN Recommendations on the Transport of Dangerous Goods and the IMDG Code. The IAEA Regulations are based on the fundamental principle that radioactive material being transported should be packaged adequately to provide protection against the various hazards of the material under both normal and potential accident conditions.

The IAEA is also responsible for the Convention on the Physical Protection of Nuclear Material, which has been ratified by 144 countries to date [FN2]. The contracting states to the Convention agree to ensure, during international nuclear transport, the protection of nuclear material within their territory or on board their ships or aircraft. The IAEA's guidance set out in The Physical Protection of Nuclear Material and Nuclear Facilities is intended to supplement the international conventions, industry standards and national requirements in order to establish a consistent basis for protecting people and the environment.

The International Maritime Organisation (IMO) has also been very active in this area. To supplement the transport of dangerous goods provisions of Chapter VII of the Convention on the



Safety of Life at Sea (SOLAS) 1974 and the IMDG Code, in 1993 the IMO developed and adopted the Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Waste in Flasks on Board Ships (INF Code). The INF Code, which is mandatory in its application, contains additional recommendations for the design of the vessels transporting radioactive material. Prior to the introduction of the INF Code there were no special considerations or equipment requirements, of an advisory or mandatory nature, for ships carrying radioactive materials.

Following the tragic events of 11 September 2001, there has been increased scrutiny of the regulatory framework for sea transport generally and, in particular, for the transport of radioactive material. It had previously been recognised that nuclear material was vulnerable to theft or sabotage, however the lengths to which extreme terrorists may be prepared to go to had not been fully appreciated or considered prior to 9/11. The IMO therefore developed and introduced the ISPS Code, which contains a comprehensive set of measures to enhance the security of ships and port facilities. The ISPS Code is implemented through Chapter XI-2 (Special Measures to Enhance Maritime Security) in SOLAS, so compliance is mandatory for the 159 contracting parties to SOLAS. In essence, the ISPS Code takes the approach that ensuring the security of ships and port facilities is a risk management activity and that, in order to determine what security measures are appropriate, an assessment of the risks must be made in each particular case. However, the burden of physical security provision lies mostly with the port facility; the ship's role is to cooperate and take very basic precautions. The ISPS Code requires very little in the way of positive security, for example guards and defensive measures.

Developments since 9/11 have also included a shift towards increased focus on the security and protection of information pertaining to nuclear cargoes (for example, provisions of international law dealing with the confidentiality of information and the requirement for hi-tech intelligence and communication equipment on board vessels), rather than just concern about safety and sustainability of the packages of nuclear material.

In addition to the regulatory framework in respect of the security and protection of nuclear cargoes during transport, there is also a myriad of regulations covering the area of nuclear civil liability during transport, both at a national and an international level, including the Paris Convention, the Brussels Supplementary Convention, the Vienna Convention, the Joint Protocol linking the Paris and the Vienna Conventions and the Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material 1971. The main principle of these conventions is the channelling of civil liability into a single nuclear operator, as well as dealing with mandatory insurance, caps on liability, time limits and jurisdiction.

GAPS IN THE MATRIX

In an ideal world, all risks associated with the transport of radioactive and nuclear materials by sea would be addressed in a comprehensive and easy to follow manner in a closely related set of international conventions or regulations. However, the way in which the regulations have developed means that no single international instrument deals with nuclear security and safeguards in a complete manner. Inevitably, there are gaps in the matrix.

Some of the risks associated with the transport of nuclear material by sea require consideration of complex and difficult questions of international law and public policy. Unfortunately, in some



circumstances, the international legal community appears to have neglected to consider such issues, therefore leaving some difficult questions left unanswered.

Security of nuclear material - protection against pirates and terrorists

(i) Terrorism

The risk of terrorists seeking nuclear weapons or material and committing malicious acts involving nuclear or radioactive material is a global one. The IAEA acknowledge that the “*transport of nuclear material is probably the operation most vulnerable to an attempted act of unauthorized removal of nuclear material or sabotage*” [FN3]. This risk has been long recognised within the industry, however it is has significantly increased in recent years. For example, the *USS Cole* bombing and the 9/11 attacks demonstrated the lengths to which terrorists were prepared to go.

Although the ISPS Code went some way towards increasing both physical and organisational security on ships and in port facilities and the INF Code ensures that vessels transporting nuclear material are fitted out with additional security protections, it should not be assumed that these measures can prevent terrorist acts. The ISPS Code does not go far enough in his regard, in fact it may be properly be regarded, from the ship’s point of view, as the equivalent of a “neighbourhood watch” scheme. Nevertheless, even the highest security precautions can be defeated by determined terrorists.

(ii) Piracy

Acts of piracy and armed robbery against ships are of tremendous concern to the shipping industry. Although piracy is not prevalent on the most common routes (for example, from the UK to Japan via the Panama Canal, around the Cape Horn or around the Cape of Good Hope and Australia [FN4]) used by vessels transporting nuclear material [FN5], it still presents a risk. In the waters around Somalia, Nigeria and Malacca, piracy is a very serious and a very real problem and if shipments of nuclear material are to increase, it is something to which the transport of nuclear material cannot afford to fall victim to.

The risk of piracy is generally considered to be of less concern than that posed by terrorists, given that most pirates would not be in a position to take on an armed vessel built to transport nuclear material due to precautions in place and self defence capabilities. The route planning system and communication channels operate to minimise this risk. On the other hand, a ship with nuclear material onboard would be regarded as a particularly special prize by Somali pirates. They would expect the ransom to be paid would be much higher than usual payments. Given the sophistication of the pirates, they would probably be able to identify the nuclear carrier and may make an extra effort to board it. The boarding of the *Pacific Swan* in 1998 by Greenpeace members in the Panama Canal demonstrates that it is possible for persons to get on board such vessels, despite the high levels of security employed and without resorting to lethal force.

In circumstances involving nuclear material, it is apparent that the distinction between piracy and terrorism may therefore become blurred. In either scenario the bargaining power of the material and the potential risks if it were released are significant.



Sufficiency of the regulations in dealing with the risks of piracy and terrorism

Some commentators argue that the threat posed to nuclear shipments by piracy and terrorist attacks is small because the perceived success rate of such attacks is low [FN6], largely as a result of the protective security measures already in place under the existing regulations and the fact that there is an exemplary safety record in this field to date. However, as discussed above, previous incidents and the events of 11 September 2001 demonstrate that there is no room for complacency, particularly given that the volume of shipments may increase.

It is not always possible to entirely eliminate risk, but ideally international regulations should provide effective mechanisms not only to deal with the threat or potential risk, but also how to address any issues arising out of the risk becoming reality. It is questionable whether the regulatory framework currently in place, which is largely preventative in nature, goes far enough to achieve this.

There is no doubt that vessels carrying nuclear material are as safe as they can be by present standards and that the preventative measures contained in the regulations effectively minimise the risks to a level that is acceptable to society. However, the regulations are silent regarding the issue of how to effectively and legally deal with an attack by pirates or terrorists and the use of lethal force.

Piracy or terrorist attacks may take place either in territorial waters or on the high seas outside the jurisdiction of any state. This is likely to bring issues of self defence and reasonable force to the fore, particularly in a situation where the vessel under attack is armed, which is likely where there is a shipment of, for example, MOX fuel or plutonium dioxide [FN7]. The existing regulations do not go as far as prescribing the measures which should be taken in such a situation, and they neither prohibit, nor permit, the carriage, or use, of firearms for self-defence, therefore this remains a grey area. In such circumstances, seafarers may find themselves facing unforeseen penal consequences under foreign laws. Although many nations do reduce or absolve criminal liability where a criminal act is committed in self-defence, the existence and application of any self-defence rule cannot be guaranteed, as this would depend on the specific circumstances.

The exercise of fundamental rights at sea

Coastal states exercise sovereignty over their territorial waters, which covers the area up to 12 nautical miles from the coast of the state in question, and a vessel transiting through such waters may be subject to the laws and regulations of that country. This is particularly relevant in respect of vessels transporting nuclear material because in recent years the international sea transport of nuclear materials has been the subject of opposition from coastal states and anti-nuclear groups seeking to constrain the nuclear industry's operations by disrupting the transport chain.

(i) Innocent passage

According to the fundamental right of freedom of navigation (as laid down by UNCLOS and international law) [FN8], vessels on the high seas and within the exclusive economic zone of a coastal state (which is an area beyond and adjacent to a coastal state's territorial sea which may extend up to 200 nautical miles) have exclusive jurisdiction over their vessel and crew and their



passage can not be suspended. Furthermore, a vessel is entitled to innocent passage through the territorial sea of a coastal state [FN9]. Passage is innocent, as long as it is not prejudicial to the peace, good order or security of the coastal state.

Despite this, the trans-national shipment of nuclear materials by sea has encountered resistance from both coastal states and environmental organizations. A significant number of coastal and island countries have publicly prohibited ships carrying nuclear materials from taking a route through their waters, including Argentina, Brazil, Chile, Portugal, South Africa, Malaysia and several Caribbean Islands, with the effect that the vessels have had to avoid such waters. For example, in 1995 the Chilean Navy threatened the *Pacific Pintail*, which was carrying 28 logs of high-level vitrified nuclear waste in glass blocks from France to Japan, with military action if it did not leave their waters immediately and change course. The Master of the *Pacific Pintail* conceded to the Chilean's demands and returned to the high seas, despite the grave risks posed by rough waters. This raises a fundamental question: are coastal states legally entitled to impede vessels carrying nuclear material from exercising their right to innocent passage?

Unfortunately, the law in this area is unclear. The challenge of such actions have yet to be brought before a court of law, therefore it is not possible to say with certainty whether such action taken by coastal states is legal. However, it has been argued by some academics that concerned coastal and island nations have the right to prior notification and consultation before a vessel carrying nuclear material can pass through their exclusive economic zones, and that they may be legally entitled to block the passage of such vessels transiting through their territorial waters [FN10]. This argument highlights a potential conflict between principles of international law. On the one hand UNCLOS contains strong environmental protection provisions and on the other it contains a clear right to innocent passage. This conflict is not definitively addressed in any of the international legislation relating to the transport of nuclear material by sea.

Given that affected coastal and island states have taken unilateral action in the past, and are likely to continue doing so until the international legal community addresses the issue, it appears that there is a need to bridge the gap between these conflicting principles of international law if the shipment of nuclear material is to increase.

(ii) Effect of weapons

As discussed above, generally vessels transporting nuclear material are designed with enhanced self defence measures including heavy armaments, sophisticated surveillance and early warning equipment, passive defence systems and crew trained in self defence and evasive procedures. For example, in the UK on board PNTL ships transporting shipments of MOX fuel and plutonium, armed officers of the Civil Nuclear Constabulary (CNC) provide on-board protection from departure to arrival [FN11].

Port state law is likely to regulate the kinds of weapon which may be carried on board when a vessel calls at port. Even though a ship flies to flag of another state, a visiting ship is subject to the domestic laws of the port state just as much as anyone else. Certain kinds of weapon are likely to be banned altogether (heavy machine guns, for instance), while others will need to be declared to customs, and may need to be subject to stringent storage requirements. For example, in the UK, in most cases, so long as the firearms are declared and secured and remain secured while the vessel is



in UK waters, there will be no need for the authorities to board the ship for firearms control purposes. However, some port states will not allow vessels to call if there are weapons or firearms at all on board, and others only if such weapons can be classified as sporting, for example shotguns. Vessels carrying firearms therefore need to seek clearance with port authorities that they are not breaking any local laws by bringing weapons of the type they carry on board into the port in question. It is therefore possible that in an emergency situation a vessel transporting nuclear material may face difficulties in gaining access to a port of refuge or safe haven and detention once it has arrived.

(iii) Safe havens and ports of refuge

Even the most well maintained ship can get into difficulties due to the violence of the seas, including suffering from breakdown and damage meaning she needs to seek shelter in order to be repaired. In international law, coastal states have customarily allowed ships to take shelter. However, in recent times, where the risk posed by that ship is high, the consequences of agreeing to do so are weighed up.

Ships in distress have been turned away when they have sought a sheltered anchorage or port, and in some cases this has led to disastrous consequences, for example in the cases of the *Erika* and the *Prestige*. The custom that no deserving case of a damaged or needful ship would be rejected is at risk, and recent years have seen some vessels becoming rather less welcome. The reason for this is that the port or haven would rather certain vessels went somewhere else, something BIMCO has recognised as “Not In My Back Yard” syndrome. The EU has had to legislate to oblige EU coastal states to live up to their customary obligations [FN12].

Individual ports are often reluctant to admit certain vessels because of the risk of pollution within the port and the subsequent disruption and loss of business, this is very likely to be the case where there is potential for pollution or damage resulting from nuclear material. Local politics often become a more important consideration than the safety of the ship and the greater good to the environment. However, to send the vessels back out to sea could seriously increase the likelihood of an accident and with it the risk of more widespread pollution that could cause more environmental damage than might otherwise have been the case. If this devastating scenario were to occur it would raise difficult questions regarding where liability should fall.

Nuclear Civil Liability

Where a nuclear incident occurs which involves states that are party to the same nuclear civil liability convention the liability issues are fairly well covered. If, however, an incident occurs on the high seas or involves states which are not party to a nuclear civil liability regime or where they are party to geographically distinct regimes, this may give rise to difficult, and as yet unanswered, questions.

The main conventions in this area are the Paris Convention, the Brussels Supplementary Convention, the Vienna Convention, the Joint Protocol linking the Paris and the Vienna Conventions and the Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material 1971.



In accordance with the existing matrix of nuclear civil liability conventions, where a nuclear incident occurs during the transportation of nuclear material, liability would generally fall either upon the carrier or upon the operator of a nuclear installation in connection with which the material is carried. Under the common law of torts, the carrier would most probably be held liable, but in the case of carriage of nuclear material very special considerations are involved. The special rules of nuclear liability law, as laid down in all the existing international conventions, impose exclusive liability on the operator of the nuclear installation in connection with which the material is carried.

An almost inevitable result of having several overlapping conventions which address the same issues is that there are inconsistencies or gaps. For example, in a transport of nuclear material which starts in a country with its own comprehensive legislation governing civil nuclear liability, which travels by sea through the territorial waters of countries which do not have any nuclear legislation, and which ends up in a country which is a party to the Paris Convention, it is possible that victims of nuclear damage may seek recourse against carriers pursuant to specific local laws, if available.

One practical solution to this problem is for parties to stipulate in contracts how nuclear civil liability is allocated between the parties involved in the transport. For example, an important concern for carriers is to clearly determine in the transport contract which entity will be held liable in case of nuclear incident during the transport, and with reference to a reliable legislation on nuclear liability. Nevertheless, it is not generally considered to be satisfactory to resolve inconsistencies between nuclear civil liability regimes by contractual provisions. The ultimate solution to bring confidence and predictability would be the introduction of a harmonised international regime.

CONCLUSIONS

Closing the gaps - time for a new convention?

Although the safety record in the field of transport of radioactive and nuclear materials is excellent, there should be no room for complacency regarding any risk, particularly given the potential size and scale and the possibility of devastating consequences should nuclear material fall into the wrong hands or be unwittingly released.

From the discussion above it is clear that there are several gaps and therefore several difficult unanswered questions regarding the regulations governing the transport of nuclear material by sea. An ideal solution would be for the international legal community to revisit the law in this area and address all of the issues relating to the transport of nuclear material by sea in a single convention. However, it is unrealistic that such a neat solution could be readily achieved given the myriad of issues which would need to be addressed. Therefore perhaps a compromise would be a convention to link the existing conventions together more comprehensively. However, given the political difficulty of achieving this, which has, for example, been demonstrated by the relatively low uptake of the Joint Protocol linking the Paris and the Vienna Conventions and the Convention on Supplementary Compensation, this may be also be an unrealistic ideal.

Moreover, it may be that because of the potential scale and ramifications and the political sensitivity of a nuclear incident the questions are too complex to comprehensively answer. Therefore, perhaps



an achievable compromise would be for the IMO or the IAEA to publish additional guidelines would to assist carriers of nuclear material in dealing with the difficult issues discussed above.

It is important to at least raise awareness of the difficult legal issues regarding transport of nuclear material by sea. The overriding message to the international community should be that there is no room for complacency given the nature of the risks involved in the transport of nuclear material and the fact that the volume of shipments may increase.

REFERENCES

[FN1] Transport of Radioactive Materials (www.world-nuclear.org/info/inf20.html)

[FN2] http://www.iaea.org/Publications/Documents/Conventions/cppnm_status.pdf

[FN3] Paragraph 8.1.1 of The Physical Protection of Nuclear Materials and Nuclear Facilities (INFCIRC/225/Rev.4)

[FN4] See, for example, <http://www.nci.org/nci-wm-sea.htm>

[FN5] See <http://www.nci.org/nci-wm-sea.htm>

[FN6] For example, Dr Ron Smith in his report "Terrorism and the Maritime Shipment of Nuclear Material

[FN7] For example, in PNTL's fleet the Pacific Teal and Pacific Pintail have been fitted with additional security features, including fixed naval guns, that enable them to transport MOX fuel and plutonium dioxide. Also, for shipments of MOX fuel and plutonium, armed officers of the Civil Nuclear Constabulary provide on-board protection from departure to arrival.

[FN8] Article 87 of United Nations Convention on the Law of the Sea

[FN9] Article 17 of United Nations Convention on the Law of the Sea

[FN10] See, for example, Professor Jon M. Van Dyke in "The Legitimacy of Unilateral Actions to Protest the Ocean Shipment of Ultrahazardous Radioactive Materials"

[FN11] See <http://www.pntl.co.uk/safety/security.asp> and <http://www.cnc.police.uk/>

[FN12] Third EU Maritime Safety Package (known more commonly as "Erika III"), see <http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2009:131:SOM:EN:HTML>