Regulation of liability and safety in ship transport of CO_2 – a comparative analysis

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Executive Summary

Animosity against onshore CO_2 geological storage by groups of Dutch citizens means that such storage will only be permitted by the Minister of Economic Affairs to take place in suitable geological formations under the North Sea. One of the means of getting the CO_2 to the offshore storage site is ship transport. The purpose of this report is to investigate how ship transport of liquefied CO_2 is regulated through treaties and national legislation, in particular with respect to the safety of the ship and the liability for any damage caused by a loss of containment that may occur in the shipping process. In order to assess how well-developed the existing legal framework is, a comparative analysis is made of the regulation of the ship transport of three other substances which can cause damage: nuclear materials, oil, and liquefied natural gas (LNG).

The report starts off by providing the legal backdrop necessary for understanding the issues properly. The relevant elements of the law of the sea and maritime law are discussed, including the fact that coastal States should in principle tolerate the ship transport of CO_2 through their territorial waters and exclusive economic zone. The following two substantive chapters discuss at length the regulation of safety and liability in the ship transport of respectively nuclear materials and oil. These chapters provide proper comparison material for the following substantive chapter, which deals with safety and liability in ship transport of liquefied gases: LNG and CO_2. Analogies, gaps and uncertainties are subsequently identified. Here we find that the existing safety regulation is ready to accommodate the envisaged large ship transport of CO_2 through the SOLAS Convention and the IGC Code. However, the regulation of liability for a loss of containment of CO_2 during ship transport is another matter. A legal framework in this respect has been set up with the adoption of the HNS Convention, but as this has not entered into force it remains ineffective until it has. There are other loose ends as well. A prime example of this is that the current EU legislation on CCS and greenhouse gas emissions only envisages transport per pipeline. It is thus unclear which party is to hand over emission rights in case of a loss of containment during ship transport. Furthermore, obligations under the HNS Convention could create a significant financial burden on the operator of a permanent storage facility.

At the end of the report, some conclusions are drawn and a list of recommendations is provided. The main recommendations are the following:

At the international level

- Ratification of the amended HNS Convention should be encouraged, to ensure that it enters into force before the large scale ship transport of CO_2 becomes a reality.

- Before ship transport of CO_2 takes place on a large scale, it should be contemplated whether it is wise and desirable to create a new separate account within the HNS Fund for received CO_2, similar to the separate accounts for oil, LNG and LPG.

At the EU level

- Further legislative measures are required to pave the way for the large scale ship transport of CO_2 for permanent storage offshore. To that effect, the EU CCS Directive, the ETS Directive and the Regulation on Monitoring and Reporting of greenhouse gas emissions should be considered for amendment in order to explicitly envisage transport of CO_2 by ship.

- Specifically, it should be clarified if CO_2 transporting ships need to apply for a permit under the EU emissions trading scheme, as is the requirement for CO_2 pipelines. If so, guidelines on an appropriate monitoring and reporting methodology should be outlined, as these already exist for capture, transport and storage components.

- The inclusion, or not, of CO_2 shipping into the EU Emissions Trading Scheme, will establish whether climate liability for a loss of containment of CO_2 during ship transport is applicable.

At the national level

- The RVGZ (*Regeling Vervoer Gevaarlijke Stoffen met Zeeschepen*) should be amended to make the ship transport of CO_2 between Dutch harbours and the sea unequivocally legal.

Distribution List

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Document Change Record

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Version	Nr of pages	Short description of change	Pages

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Abbreviations

CCS	Carbon Capture and Storage
CO_2	Carbon dioxide
EEZ	Exclusive Economic Zone
ETS	Emissions Trading Scheme
EU	European Union
EU ETS	European Union Emissions Trading Scheme
GIIGNL	*Groupe International des Importateurs de Gaz Naturel Liquéfié*
GNR	Gas Not Relevant
GT4	Gas Toxic (cat. 4)
GT5	Gas Toxic (cat. 5)
GT	Gross Tonnage
HNS	Hazardous and Noxious Substances
IAEA	International Atomic Energy Agency
IGC	International Gas Carrier
IGU	International Gas Union
IMDG	International Maritime Dangerous Goods
IMF	International Monetary Fund
IMO	International Maritime Organization
INF	Irradiated Nuclear Fuel
LC	Lethal Concentration
LLMC	Limitation of Liability for Maritime Claims
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MARPOL	Maritime Pollution
MSC	Maritime Safety Committee
NIOSH	National Institute for Occupational Safety and Health
NUMBY	'Not Under My Back Yard'
OECD	Organisation for Economic Co-operation and Development
P&I	Protection and Indemnity
PPM	Parts Per Million
RVGZ	*Regeling Vervoer Gevaarlijke Stoffen met Zeeschepen*
SDR	Special Drawing Right(s)
SOLAS	Safety of Life at Sea
STOPIA	Small Tanker Oil Pollution Indemnification Agreement
TOPIA	Tanker Oil Pollution Indemnification Agreement
UNCLOS	United Nations Convention on the Law of the Sea
WAKO	*Wet houdende regelen inzake aansprakelijkheid voor schade door kernongevallen*
WVGS	*Wet vervoer gevaarlijke stoffen*

Chapter 1 Introduction

1.1 Background

The development of Carbon Capture and Storage (CCS) in the Netherlands is in dire straits. According to the *Volkskrant*, only Minister of Economic Affairs Henk Kamp still believes in the potential of CCS.[1] This is based on the fact that the newly negotiated *Energieakkoord*, which outlines the main goals and policies in the field of energy in the Netherlands negotiated by stakeholders and the government, does not contain any concrete agreements on projects or targets for the storage of CO_2. Furthermore, experts are pessimistic about the future of CCS in Europe because the price of EU ETS emission credits is so low that it causes the energy generating industry to postpone financial investment decisions with respect to CCS demonstration projects.

However, on a European and global scale CCS is still considered by many to be imperative, as models indicate that broad implementation of this technique is necessary in order to reduce greenhouse gas emissions, reach climate goals and thus abate climate change effects such as rising sea-levels.[2] Within CCS projects, transportation of CO_2 via pipelines has been generally assumed to be the method of choice. However, in certain cases, such as in the demonstration phase (smaller CO_2 volumes, shorter project lifecycles), or in projects involving enhanced hydrocarbon recovery (variable CO_2 demand), the use of ships to transport CO_2 may be more cost effective. Furthermore, if CCS is to reach its full potential, smaller and more remote suitable geological formations offshore may need to be utilised whereby pipelines may represent no viable investment.

As with pipelines, however, transport of CO_2 by ship entails risks; a loss of containment during the process cannot be excluded. The high pressure and the cold temperatures under which the CO_2 is transported means that damage could be caused to persons, property, and the environment. Also, since CO_2 is a greenhouse gas, a loss of containment could cause damage to the climate. Regulation is essential to ensure that operators take all reasonable precautions to reduce risk, and therefore it is important to assess whether existing regulation is sufficient to appropriately regulate the bulk transportation of CO_2 for offshore injection.

1.2 Aim of the report

The aim of this report is to investigate how the envisaged large scale ship transport of liquefied CO_2 fits into the existing international and national legal framework with respect to issues of safety of ships and liability for any loss of containment during such ship transport. The findings are viewed in the context of the ship transport regulation regarding three types of dangerous cargo which are already transported on a large scale – nuclear materials, oil, and LNG – to see if such analogies assist in identifying gaps and uncertainties.

1.3 Methodology

In order to investigate the identified issues, the report adopts an analytical approach. Provisions of existing international and national (The Netherlands) legislation on the ship transport of nuclear materials, oil, LNG, and CO_2 are analysed, with a view to clarifying the legal *status quo* in the sea transport of these comparable substances. The primary source of legislation is formed by the relevant treaties and Dutch laws, which will be discussed extensively. A comparison will be made between the regulation of the transport of the abovementioned substances, in order to identify gaps in current regulation relevant to CO_2 transport and to provide ideas for filling these gaps in an effective manner. One of the means of doing so is looking for similarities and patterns, which are transferable to the regulation of ship transport of CO_2. Scenarios will also be provided in boxes throughout the report, to illustrate the discussed theoretical issue with the help of examples.

[1] 'Alleen Kamp gelooft in CO_2-opslag', Volkskrant (16 July 2013), p. 18.
[2] See for example Professor C. Jepma in: 'Groningse hoogleraar: CO2 opslag onontkoombaar en onvermijdelijk voor oplossen klimaatprobleem', Groninger Internet Courant (12 August 2013). URL: www.gic.nl.

Chapter 2 Law of the sea and maritime law

2.1 Introduction

As mentioned in the previous chapter, the goal of this report is to investigate how the large scale transport of liquefied CO_2 fits into the existing international and legal framework with respect to issues of safety of ships and liability for loss of containment. In order to provide proper insight into the regulation of these subjects, it is first important to sketch the legal context within which such shipping operates. To that effect, this chapter will discuss the relevant general issues of the law of the sea and of maritime law, before the following chapters take a closer look at the regulation of the shipping of certain particular hazardous substances.

2.2 Law of the sea: the significance of maritime zones

One of the perceivably feasible scenarios of ship transport of CO_2 for permanent storage offshore is one where CO_2 is captured at a point source in Rotterdam and subsequently shipped to the Danish North Sea for storage in an empty gas field.[3] In order to reach this gas field, the ship will have to transit either the United Kingdom part of the North Sea or, most likely, the German part of the North Sea. Some German *Bundesländer* have shown a negative stance towards the idea of CCS.[4] This brings forth the following question: can a coastal State prevent the ship transport of CO_2 through its maritime zones?

The starting point for any such legal discussion about ship transport should be the law of the sea. The law of the sea refers to the body of law "by which States, coastal, landlocked, and/or international organisations regulate their relations in respect of those areas subject to coastal State jurisdiction and in relation to those areas of the sea and seabed beyond national jurisdiction."[5] One of the primary features of this body of law is that it identifies several maritime zones, which in 1982 have been codified in the UN Convention on the Law of the Sea (UNCLOS).[6] Each maritime zone has its own geographical limits and legal implications. Relevant in the context of this report are in particular the internal waters, the territorial sea and the exclusive economic zone (EEZ).

Not being part of the sea and therefore not a maritime zone as such, the internal waters of a State are comprised of the rivers, lakes, harbours, estuaries and all other waters which lie on the landward side of the so called baseline.[7] The baseline is the low-water line of the coastal State.[8] In principle, the coastal State has full sovereignty and territorial jurisdiction within the confines of its internal waters.[9] Unlike in the territorial sea, there is no right of innocent passage in internal waters and States can and do impose conditions on the entry of ships.[10]

The first maritime zone off the coast is the territorial sea, which consists of the part of the waters outside the baseline up to a distance not exceeding 12 nautical miles.[11] It is part of the territory of the coastal State, meaning that the sovereignty of the coastal State extends to it. This sovereignty

[3] See M.M. Roggenkamp, 'Afvang, transport en -opslag van CO_2 – een analyse van de keten' in *Nederlands Tijdschrift voor Energierecht*, vol. 5/6, 2011, p. 240.
[4] Germany is a federal republic of 16 states. Each state, or *Bundesland*, has functional jurisdiction with respect to the deployment of CCS activities. See: *Gesetz zur Demonstration der dauerhaften Speicherung von Kohlendioxid (Kohlendioxid-Speicherungsgesetz - KSpG*), article 2 (1) and (2).
[5] R. Wallace and O. Martin-Ortega, *International Law*, Sixth edition, Sweet & Maxwell 2009, p. 152.
[6] The European Union itself as well as all States bordering the North sea are parties to this convention. See: <http://www.un.org/Depts/los/reference_files/chronological_lists_of_ratifications.htm> (visited on 14 July 2013).
[7] Article 8 (1), UNCLOS. The Dutch Wadden Sea is thus part of the internal waters of the Netherlands.
[8] Article 5, UNCLOS.
[9] A. Aust, *Handbook of International Law*, Second Edition, CUP Cambridge 2010, p. 279.
[10] A. Aust, *Handbook of International Law*, Second Edition, CUP Cambridge 2010, p. 280.
[11] In the past this used to be 3 nautical miles, a distance which was equal to the maximum range of canons at that time in history and therefore the range of possible enforcement by the coastal State. Cornelius Bynkershoek, a famous Dutch jurist from the 18th century known for his importance in the development of the law of the sea, states in his work *De Dominio Maris Dissertatio* of 1703: "*terrae dominium finitur ubi finitur armorum vis*", *i.e.* the power of the state over territory ends where the range of weapons ends. The current limit of 12 nautical miles is codified in article 3 of UNCLOS, and is now also accepted as customary international law, see R. Wallace and O. Martin-Ortega 2009, p. 155.

of the coastal State is not absolute, however, as it is subject to the rules of UNCLOS, such as those regarding innocent passage, and to other rules of international law.[12] The concept of innocent passage is comprehensively codified in UNCLOS, but for the purpose of this report it suffices to state that it means navigation through the territorial sea for the purpose of traversing it while being non-prejudicial to the peace, good order or security of the coastal state.[13] UNCLOS further provides what kind of laws and regulations a coastal State may adopt relating to the innocent passage through the territorial sea, such as the safety of navigation and maritime traffic. The coastal State may, for instance, require foreign ships to use sea lanes designated or prescribed for passage through its territorial sea, in particular with respect to tankers and ships carrying nuclear or other inherently dangerous or noxious substances.[14] Important to note in this respect is that innocent passage may not be denied by the coastal State merely on the basis of the cargo of the ship.[15] This means that transport of CO_2 by ship should in principle be considered as innocent.

The EEZ is an area beyond and adjacent to the territorial sea, subject to the specific legal regime established in UNCLOS under which the rights and jurisdiction of the coastal State and the rights and freedoms of other States are governed.[16] It extends up to a maximum of 200 nautical miles measured from the baseline.[17] Unlike the territorial sea, the EEZ does not fall under the sovereignty of the coastal State but the coastal State does enjoy certain sovereign rights and/or jurisdiction for certain purposes in it. More specifically, the coastal State has jurisdiction with regard to, among other things, the protection and preservation of the marine environment.[18] However, UNCLOS explicitly states that in the EEZ, all States enjoy, subject to the relevant provisions of UNCLOS, the freedom of navigation.[19] The idea of freedom of navigation stems from Hugo Grotius and his renowned treatise *Mare Liberum*, in which he proclaims that that the oceans are incapable of appropriation by States and that the ships of any State should have the right to navigate freely across the oceans. Freedom of navigation has prevailed ever since, primarily because States needed unhindered access to the seas for trading purposes but also as a means for maritime powers to maintain contact with their overseas colonies.[20]

Finally, it is important to note that in exercising their freedom of navigation, it is required that flag States comply with the laws and regulations adopted by the coastal State in accordance with UNCLOS and other rules of international law.[21] Foreign ships navigating through the EEZ are thus subject to the coastal State's jurisdiction relating to, for example, pollution such as the emission of sulphur oxides and nitrogen oxides.[22] Nonetheless, the main point that should be taken from the law of the sea in the context of this report is thus that coastal States in principle have to tolerate the ship transport of CO_2 in their territorial sea and EEZ. The right of innocent passage and the freedom of navigation, respectively, guarantee this.

2.3 Maritime law: regulation of ships and shipping

Maritime law is not the same as law of the sea. Whereas law of the sea is the body of public international law which deals with the balance of powers and competences between coastal States and flag States in respect of the sea, maritime law refers to the body of law which regulates ships and shipping. This encompasses a broad range of subjects and legal principles, such as the carriage of goods, collisions between ships, and port State control. One of the oldest maritime law principles is the law of general average, also known as the law of jettison, which applies when a ship voluntarily

[12] Article 2 (3), UNCLOS.
[13] Articles 18 and 19, UNCLOS.
[14] Article 22, UNCLOS.
[15] J. Kraska, *Maritime Power and the Law of the Sea*, OUP Oxford 2011, p. 118.
[16] Article 55, UNCLOS.
[17] Article 57, UNCLOS. In practice this may be less, due to opposing EEZs of the neighbouring States. This is particularly relevant in the North Sea, see Annex II indicating the EEZs in the North Sea region.
[18] Article 56 (1), UNCLOS.
[19] Article 58 (1) in conjunction with Article 87 (1), UNCLOS.
[20] A. Hoffmann, 'Navigation, Freedom of', in R Wolfrum (ed), *The Max Planck Encyclopedia of Public International Law*, Oxford University Press, 2008-, online edition, [www.mpepil.com], visited on 22 July 2013.
[21] Article 58 (3), UNCLOS.
[22] A. Hoffmann, 'Navigation, Freedom of', in R Wolfrum (ed), *The Max Planck Encyclopedia of Public International Law*, Oxford University Press, 2008-, online edition, [www.mpepil.com], visited on 22 July 2013.

jettisons part of its cargo in an emergency in order to keep the ship from going under. This principle dictates that in such a situation all parties which profit from the ship reaching its destination share proportionally any losses that were incurred as a result of sacrificing that part of the cargo.[23] The maritime law issues of (limitation of) liability for shipping incidents, the regulation of safety of ships, and the prevention of pollution are particularly relevant for this report and thus deserve a more in depth discussion below.

2.3.1 Limitation of liability for incidents in ship transport: the LLMC Convention

If an incident occurs during ship transport and this leads to damage, there is no general uniform rule which dictates who is to be held liable for compensation of that damage. Depending on the cargo and the extent of the damage, as we will find in the upcoming chapters, this can be the shipowner, the receiver of the cargo, the sender of the cargo, the flag State, or even a collection of flag States. There is, however, a general system for the limitation of liability for maritime claims. The *Convention on Limitation of Liability for Maritime Claims* (LLMC Convention) was drafted in 1976 and significantly amended by the appurtenant Protocol of 1996.[24] It aims to determine uniform rules with respect to the limitation of liability for incidents which can occur in the process of ship transport. It gives shipowners the option of limiting their liability for such incidents to a predetermined amount, depending on the tonnage of the ship. The range of claims which may be subject to limitation under the LLMC Convention is rather extensive, as it may encompass:

> "(a) claims in respect of *loss of life or personal injury or loss of or damage to property* (including damage to harbour works, basins and waterways and aids to navigation), occurring on board or in direct connexion with the operation of the ship or with salvage operations, and consequential loss resulting therefrom;
> (b) claims in respect of *loss resulting from delay in the carriage by sea of cargo*, passengers or their luggage;
> (c) claims in respect of *other loss resulting from infringement of rights other than contractual rights*, occurring in direct connexion with the operation of the ship or salvage operations;
> (d) claims in respect of *the raising, removal, destruction or the rendering harmless of a ship which is sunk, wrecked, stranded or abandoned*, including anything that is or has been on board such ship;
> (e) claims in respect of *the removal, destruction or the rendering harmless of the cargo of the ship*;
> (f) claims of a person other than the person liable in respect of measures taken in order to avert or minimize loss for which the person liable may limit his liability in accordance with this Convention, and further loss caused by such measures."[25]

The LLMC Convention explicitly stipulates that it is not applicable to claims for oil pollution damage, nor to claims for nuclear damage;[26] how the limitation of liability for these claims is regulated will be discussed separately in the following two chapters. However, claims for damage resulting from incidents involving the ship transport of liquefied gases are not excluded by the LLMC Convention. Therefore, as it stands today, shipowners may limit their liability for incidents during the ship transport of LNG and liquefied CO_2 in accordance with the LLMC Convention. Shipowners forfeit their right to limit their liability if it is proved that the damage resulted from their personal act or omission, committed either with the intent to cause such damage or recklessly and with knowledge that such

[23] In Dutch law, this principle is regulated in articles 610 – 613, Book 8, Dutch Civil Code.
[24] The 1976 LLMC Convention has been ratified by 63 States. Several of those States, including the Kingdom of the Netherlands, have withdrawn from the 1976 LLMC Convention after ratifying the 1996 LLMC Protocol. In accordance with article 9 of the Protocol, the LLMC Convention and Protocol are read and interpreted together as one single instrument as between the Parties to the Protocol. A State which is Party to the Protocol but not a Party to the Convention (e.g. the Kingdom of the Netherlands) is bound by the provisions of the Convention as amended by the Protocol in relation to other States Parties hereto, but is not bound by the provisions of the Convention in relation to States Parties only to the Convention. The 1996 Protocol has been ratified by 47 States.
[25] Article 2 (1), LLMC Convention (emphasis added). States which ratify or accede to the LLMC Convention have the right under article 18 of the Convention to exclude the application of paragraph (d) and (e). The Kingdom of the Netherlands has made use of this right and issued a statement upon ratification of the 1976 Convention as well as the 1996 Protocol, stating that it reserves the right to do so. See <http://www.minbuza.nl/producten-en-diensten/verdragen/zoek-in-de-verdragenbank/1996/5/007428.html> (visited on 23 July 2013).
[26] Article 3 (b) and (c), LLMC Convention.

damage would probably result.[27] The general limits set by the LLMC Convention as amended by the 1996 Protocol are the following:

"a) in respect of claims for loss of life or personal injury,
(i) 2 million Units of Account for a ship with a tonnage not exceeding 2,000 tons,
(ii) for a ship with a tonnage in excess thereof, the following amount in addition to that mentioned in (i):
* for each ton from 2,001 to 30,000 tons, 800 Units of Account;
* for each ton from 30,001 to 70,000 tons, 600 Units of Account; and
* for each ton in excess of 70,000 tons, 400 Units of Account,
b) in respect of any other claims,
(i) 1 million Units of Account for a ship with a tonnage not exceeding 2,000 tons,
(ii) for a ship with a tonnage in excess thereof, the following amount in addition to that mentioned in (i):
* for each ton from 2,001 to 30,000 tons, 400 Units of Account;
* for each ton from 30,001 to 70,000 tons, 300 Units of Account; and
* for each ton in excess of 70,000 tons, 200 Units of Account."[28]

The units of account that the Convention uses to calculate the limit of the liability are Special Drawing Rights (SDR), which is a concept created by the International Monetary Fund (IMF). It is not a currency as such, but rather represents a value based on a basket of four key international currencies. SDR can be exchanged for freely usable currencies and at the current exchange rate, one million SDR equates roughly to 1.151 million Euros.[29]

Example
Consider a carrier of liquefied gas with a gross tonnage (GT) of 50,000 tons,[30] which causes personal injury to persons on a boat near the carrier, as well as property damage to that boat. The shipowner may limit his liability with respect to this incident up to the following amounts.

For loss of life and personal injury:
2,000,000 + (28,000 x 800 =) 22,400,000 + (20,000 x 600 =) 12,000,000 = 36.4 million SDR (approximately 41.9 million Euros).

For other claims (including property damage):
1,000,000 + (28,000 x 400 =) 11,200,000 + (20,000 x 300 =) 6,000,000 = 18.2 million SDR (approximately 20.9 million Euros).

An amendment to these limits was adopted by the Legal Committee of the IMO in 2012, which further increases the aforementioned general limits set by the 1996 Protocol to the LLMC Convention.[31] This amendment has not entered into force yet, but in accordance with the rules on the entry into force of amendments of limits it is expected to do so as of 8 June 2015.[32] From that day on, the financial limits of liability will be increased by 51%.[33]

When an incident happens, the shipowner alleged to be liable may constitute a fund in respect of the claims subject to limitation. This fund will need to be constituted in the sum of the amounts applicable under the general limits dependent on the tonnage of the ship, as illustrated by the example above. This fund may be established either by depositing the sum in an account, or by means of a guarantee (e.g. a bank guarantee) which is acceptable under the law of the State where

[27] Article 4, LLMC Convention.
[28] Article 6 (1) in conjunction with article 6 (5), LLMC Convention.
[29] Article 8, LLMC Convention. See also URL: <http://www.imf.org/external/np/exr/facts/sdr.htm> and <http://www.imf.org/external/np/fin/data/rms_five.aspx> (visited on 8 April 2013).
[30] Gross tonnage (GT) is a measure of size of the ship, which indicates the total internal volume. The GT value is calculated by applying a mathematical formula to the volume of the ship, in accordance with the International Convention on Tonnage Measurement of Ships (1969).
[31] Resolution LEG.5(99), *Adoption of amendments of the limitation amounts in the Protocol of 1996 to the Convention on Limitation of Liability for Maritime Claims, 1976*, adopted on 19 April 2012. See *Tractatenblad 2013, 31*.
[32] Article 8 of the 1996 Protocol to the LLMC Convention. See also section (G) of *Tractatenblad 2013, 31*.
[33] Annex of Resolution LEG.5(99), *Adoption of amendments of the limitation amounts in the Protocol of 1996 to the Convention on Limitation of Liability for Maritime Claims, 1976*, adopted on 19 April 2012. See *Tractatenblad 2013, 31*.

the fund is established.[34] If it turns out that the legitimate claims with respect to the incident exceed the limit set, the fund is distributed among the claimants in proportion to their established claims against the fund.[35] The main advantage for the shipowner of setting up such a fund is that any person having made a claim against that fund is subsequently barred from exercising any right in respect of that claim against other assets of the shipowner.[36]

2.3.2 International safety regulation of ships: the SOLAS Convention and IMO Codes

The primary instrument of international law dealing with safety in shipping today is the *International Convention for the Safety of Life at Sea* of 1974 (SOLAS Convention).[37] The first edition of the Convention was drafted already in 1914 in the wake of the sinking of the *Titanic* and has subsequently been replaced and amended several times to keep up with technical developments.[38] The objective of the Convention is to promote safety of life at sea by establishing uniform principles and rules directed thereto in the field of the construction, equipment and operation of ships.[39] The result is a rather technical and vast document, spanning several hundreds of pages of regulations. The range of subjects covered is correspondingly large, so it goes beyond the scope of this report to discuss them all. Instead we will merely delve into those which are particularly relevant for the shipping of the substances discussed in this report, as well as some peculiar ones which show the level of detail to which safety is regulated.

First of all, the SOLAS Convention contains requirements with regard to the design and construction of ships, in order to make them and their operation as safe as possible. This ranges from the presence of double bottoms in cargo ships to the closure-requirements of cargo loading doors on passenger ships.[40] A peculiar issue which illustrates to what level of detail this is regulated is the issue of navigation bridge visibility. The Convention stipulates, for example, that to help avoid reflections, the bridge front window must be placed at an incline from the vertical plane top out, at an angle of between 10° and 25°. Also, the side of the ship must be visible from the bridge wing.[41]

Secondly, the SOLAS Convention provides rules with respect to the equipment on board the ship necessary for safe navigation and emergency situations. An important part of this is the presence of functioning navigational equipment and systems. It stipulates, for example, that all ships, irrespective of their size, should have on board an instrument non-dependent on power to determine the heading of the ship; means of correcting heading at all times; nautical charts to plan and display the ship's route; and a receiver for a navigational system.[42] For larger ships, additional requirements apply depending on the gross tonnage of the ship in question. These range from being fitted with a daylight signalling lamp for ships over 150 GT; a device to measure the available depth of water for ships over 300 GT; an automatic tracking aid for ships over 500 GT; a radar for ships over 3,000 GT; a heading or track control system for ships over 10,000 GT; to finally a rate-of-turn indicator for ships exceeding 50,000 GT.[43] As ship transport of liquefied CO_2 is envisaged to take place on a scale similar to that of LNG, the average carrier of which has a capacity of 155,000 cubic meters,[44] ships involved in the large scale transport of CO_2 by ship will be equipped with a broad range of navigational equipment and systems to ensure safety of navigation and avoid related incidents such as collisions as much as possible. Another substantive safety issue covered by the SOLAS Convention is the presence on board of life saving equipment. This includes the presence of survival craft and rescue boats for emergency situations which require the ship to be abandoned.[45]

[34] Article 11, LLMC Convention.
[35] Article 12 (1), LLMC Convention.
[36] Article 13 (1), LLMC Convention.
[37] The SOLAS Convention has been amended over the years. In this report, use is made of the fourth consolidated edition as published by the International Maritime Organization in 2004.
[38] "History of SOLAS", as found on the website of the International Maritime Organization. URL: <http://www.imo.org/KnowledgeCentre/ReferencesAndArchives/HistoryofSOLAS/Pages/default.aspx> (visited on 15 July 2013)
[39] Preamble, SOLAS Convention.
[40] Regulations II-1/12-1 and 20-1, SOLAS Convention.
[41] Regulations V/22 (1.9) and (1.6), SOLAS Convention.
[42] Regulation V/19 (2.1), SOLAS Convention.
[43] Regulation V/19 (2.2 – 2.9), SOLAS Convention.
[44] 'The LNG Industry in 2012', GIIGNL, p. 11. URL: www.giignl.org (visited on 3 July 2013)
[45] Regulation III/31, SOLAS Convention.

Thirdly, the SOLAS Convention contains rules with regard to the operation of the ship. For instance, before a ship is to set off on its intended voyage, the steering gear needs to be checked and tested by the crew.[46] Also, the master of the ship has to ensure that the intended voyage has been planned using the appropriate nautical charts and publications for the area concerned.[47] Every ship which is engaged in international voyages must further keep a record of all navigational activities and incidents which are of importance to the safety of navigation.

One of the hallmark procedural elements of the Convention is its system of surveys and certificates. Cargo ships are subject to such surveys with respect to their life-saving appliances and equipment, radio installations, and their structure, machinery and equipment.[48] These surveys occur on a regular basis in order for ships to be issued with and to retain the relevant certificates proving that it is in compliance with the relevant requirements. For instance, cargo ships exceeding 500 gross tonnage are subject to surveys with respect to their life-saving appliances and other equipment as follows:

> "(i) an *initial survey* before the ship is put in service;
> (ii) a *renewal survey* at intervals specified by the Administration but not exceeding 5 years, (…);
> (iii) a *periodical survey* within three months before or after the second anniversary date or within three months before or after the third anniversary date of the Cargo Ship Safety Equipment Certificate which shall take the place of one of the annual surveys specified in paragraph (a)(iv);
> (iv) an *annual survey* within 3 months before or after each anniversary date of the Cargo Ship Safety Equipment Certificate;
> (v) an *additional survey* as prescribed for passenger ships in regulation 7(b)(iii)."[49]

The radio installations and the ship's structure, machinery and equipment are subject to the same system of surveys. If the ship is in compliance with the requirements of the survey, it is issued the corresponding certificate of fitness which will have to be kept available for inspection on board.[50] However, if a surveyor finds that that the condition of the ship or its equipment does not correspond substantially with the particulars of the certificate, or if he finds that the condition is such that the ship is not fit to proceed to sea, the surveyor must immediately ensure that corrective action is taken. If corrective action is not taken, the relevant certificate is withdrawn. The government of the port State concerned must, in principle, ensure that the ship does not sail until it is repaired or it can proceed to sea for the purpose of proceeding to the appropriate repair yard, without danger to the ship or persons on board.[51]

Chapter VII of the SOLAS Convention is dedicated specifically to the carriage of dangerous goods, such as liquid chemicals and irradiated nuclear fuel. Part C of that chapter deals specifically with ships carrying liquefied gases in bulk. As we will find in the following chapters, valuable additional regulation can be found especially in regulation adopted under Chapter VII of the SOLAS Convention. These so-called IMO Codes provide more specific requirements for different kinds of ships, such as ships carrying liquefied gas in bulk. The IMO Codes relevant for this report will be discussed in the following chapters.

2.3.3 Maritime pollution: the MARPOL Convention

The *International Convention for the Prevention of Pollution from Ships* (MARPOL Convention) was adopted under the umbrella of the IMO in 1973 and subsequently amended by a protocol in 1978.[52] Its objective is to prevent pollution of the marine environment by ships from both routine operations and accidents. To that end it contains general regulations which apply to any ship entitled to fly the flag of a Party to the Convention operating in the marine environment, except warships and other ships used only on government non-commercial service.[53] More particular rules dedicated to certain kinds of ship are codified in the six Annexes to the Convention. Annex I, for instance, contains

[46] Regulation V/26, SOLAS Convention.
[47] Regulation V/34, SOLAS Convention.
[48] Regulations I/8 to I/10, SOLAS Convention.
[49] Regulation I/8 (a), SOLAS Convention. Emphasis added.
[50] See Regulation I/16 in conjunction with Regulation I/12 (a) of the SOLAS Convention for a complete list of certificates.
[51] Regulation I/6 (c), SOLAS Convention.
[52] The Kingdom of the Netherlands has been a Party to the MARPOL Convention since 1983.
[53] Article 3, MARPOL Convention.

regulations dedicated to the prevention of pollution by oil – irrespective of whether it was on board the ship as cargo or as fuel – which we will discuss in chapter 4 of the report. The other Annexes to the MARPOL Convention deal with pollution by noxious liquid substances in bulk (Annex II), pollution by harmful substances carried by sea in packaged form (Annex III), pollution by sewage from ships (Annex IV), pollution by garbage from ships (Annex V), and air pollution from ships (Annex VI). These six Annexes have some common features. First, they comprise a system of surveys and certificates similar to that in the SOLAS Convention discussed above.[54] Secondly, they contain a number of specific requirements with respect to the construction of ships and the equipment on board ships.[55]

The substantive rules of the Convention are thus codified in the abovementioned annexes; the main body of the text provides merely the framework within which those annexes work. To that effect, it provides some definitions which apply to all of the annexes. Two definitions are of primary importance to establish the scope of the Convention. The first is the definition of "discharge", which reads as follows: "*"Discharge", in relation to harmful substances or effluents containing such substances, means any release howsoever caused from a ship and includes any escape, disposal, spilling, leaking, pumping, emitting or emptying.*"[56] The second is "harmful substances", since this definition dictates what substances fall within the first definition. It states: "*"Harmful substance" means any substance which, if introduced into the sea, is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea, and includes any substance subject to control by the present Convention.*"[57] Considering these broad definitions, it is clear that the MARPOL Convention aims to be a catch-all legal instrument which covers all forms of ship generated maritime pollution.

Annexes III, IV and V of the MARPOL Convention are optional, meaning that a State may at the time of signing, ratifying, accepting, approving or acceding to the Convention declare that it does not accept them.[58] The Kingdom of the Netherlands has made use of this right and does not accept, either for the Kingdom in Europe or for the Netherlands Antilles, Annexes III, IV and V, and the appendices thereto.[59]

2.4 Closing remarks

The Kingdom of the Netherlands is a member of the IMO and is party to the vast majority of the treaties that have been conceived under its umbrella. For them to have legal effect within the confines of the Dutch territory and on ships legitimately flying its flag, the international regulations are implemented into national law. Without looking at that national implementation, we can already draw some conclusions from the international legal framework discussed above. First of all, the rules of the law of the sea regarding maritime zones dictate that coastal States have full sovereignty within their internal waters, which gives them the option of prohibiting the transport of certain hazardous and dangerous substances in that zone if they feel the need to do so. Within their territorial sea and exclusive economic zone, however, coastal States are required in principle to tolerate the ship transport of such substances due to the right of innocent passage and the freedom of navigation respectively. Secondly, there is already a broad range of provisions of maritime law applicable to shipping in general, which includes the shipping of hazardous and dangerous substances. We have found that shipowners may limit their liability in case of an accident to cover claims of several kinds of damage. In addition, there is an extensive body of safety provisions for ships in the form of the SOLAS Convention and the appurtenant IMO Codes. Finally, the MARPOL Convention provides regulations for the prevention of pollution of the marine environment by ships from both routine operations and accidents.

In the following chapters, we will have a more in depth look at the regulation of liability and safety issues in the fields of shipping nuclear materials and oil, before we investigate the regulation of those issues in the field of shipping liquefied gases such as LNG and CO_2.

[54] See, for example, Chapter 2 of Annexes I, IV and VI, and Chapter 3 of Annex II, MARPOL Convention.
[55] See, for example, Chapter 3 of Annex IV and Chapter 4 of Annexes I and II, MARPOL Convention.
[56] Article 2 (3)(a), MARPOL Convention. Deliberate dumping falls outside the scope of this Convention.
[57] Article 2 (2), MARPOL Convention.
[58] Article 14 (1) MARPOL Convention.
[59] See URL: <http://www.minbuza.nl/producten-en-diensten/verdragen/zoek-in-de-verdragenbank/1973/11/002390.html> (visited on 23 July 2013).

Chapter 3 Shipping of nuclear material

3.1 Introduction

The amount of (international) law dealing with the regulation of nuclear material is rather extensive. This can be explained by the enormous potential of nuclear material to cause long-lasting damage, as has regrettably been demonstrated by the nuclear accidents in Chernobyl and, more recently, Fukushima. Section 3.2 of this chapter will discuss the existing regulation on liability for damage caused by (loss of containment of) nuclear materials, with a particular focus on liability for such incidents during transport. The safety of ships carrying such nuclear materials is subsequently discussed in section 3.3. In section 3.4 we will delve into the relevant Dutch legislation in this field, before presenting some conclusions in section 3.5. The aim of this chapter is to create a reference point and source of analogy for the regulation of ship transport of other substances with the potential to cause damage, such as oil,[60] LNG and carbon dioxide.[61]

3.2 International regulation of liability for transport of nuclear material

Liability for damage caused by a loss of containment of nuclear material during the ship transport of such material is covered, depending on ratification by the States involved, by several treaties: (1) the 1960 Paris Convention, (2) the 1963 Brussels Supplementary Convention, (3) the 1963 Vienna Convention and its 1997 Protocol, (4) the 1997 Supplementary Compensation Convention, (5) the 1988 Joint Protocol, and (6) the 1971 Maritime Carriage of Nuclear Material Convention. The content of these six legal instruments and their relationship will be discussed in the following subsections.

3.2.1 Paris Convention (1960)[62]

The first treaty on liability for damage caused by nuclear material was the Paris Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention). It was signed in 1960 and entered into force in 1968.[63] The treaty was drafted within the framework of the Organisation for Economic Co-operation and Development (OECD) and is therefore widely ratified throughout Europe, but not so much beyond.[64] In order to keep it up to date, it has been amended several times over the years.[65] The result is an amended text which has the following main elements.

First of all, the convention stipulates that the liability for nuclear accidents lies with the operator of the nuclear installation,[66] not only when the accident happens in a land-based nuclear installation but also when it happens during the transport of nuclear materials therefrom or thereto.[67] This principle is referred to as the 'channelling of liability to the operator'. When nuclear material is

[60] See chapter 4.
[61] See chapter 5.
[62] *Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982*. See: <http://www.minbuza.nl/producten-en-diensten/verdragen/zoek-in-de-verdragenbank/1960/7/007755.html> (visited on 17 July 2013).
[63] The Kingdom of the Netherlands has been a Party to this Convention since 1979.
[64] The list of States Parties includes direct and indirect neighbouring States of the Netherlands in Europe, *inter alia* Germany, Denmark, Belgium, the United Kingdom, France and Norway. However, major nuclear States like China, the Russian Federation and the United States of America are not. See <http://www.minbuza.nl/producten-en-diensten/verdragen/zoek-in-de-verdragenbank/1960/7/007755.html> (visited on 17 July 2013).
[65] Most recently this was done on 12 February 2004 through the *Protocol to amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982*. See <https://zoek.officielebekendmakingen.nl/trb-2010-26.html> (visited on 17 July 2013).
[66] Note that this is different from the principle applied in liability for maritime oil pollution. The transporter of oil is the primary target when it comes to liability for damage caused by an oil spill on the sea; not the operator of the refinery or other installation where the oil was loaded or will be unloaded. See Chapter 4 of this Deliverable and article III (a) of the International Convention on Civil Liability for Oil Pollution Damage (1992).
[67] Articles 3 (a), 4 (a) and 4 (b), Paris Convention 1960.

transferred between two nuclear installations, the liability with regard to nuclear incidents involving the nuclear material is transferred from the moment when liability has been assumed by the receiving operator, pursuant to the express terms of a contract in writing.[68] In the absence of such express provisions, the liability is transferred to the receiving operator after he has taken charge of the nuclear substances.[69]

The liability of the operator of a nuclear installation under the Paris Convention is strict. This follows from the wording of article 3, which provides that the operator of a nuclear installation will be liable "upon proof that such damage or loss (…) was caused by a nuclear incident in such installation or involving nuclear substances coming from such installation". The operator of the nuclear installation is thus liable for damage caused by the nuclear material, regardless of his fault or negligence, whereas under normal tort law such fault or negligence needs to be established before someone can be held liable for damage.

Nonetheless, the Convention does identify some ways for the operator to escape liability or to at least pass the costs on to another person. The first is provided by a list of exonerations: the operator is not liable for damage caused by a nuclear incident directly due to an act of armed conflict, hostilities, civil war, insurrection or, except in so far as the legislation of the Contracting Party in whose territory his nuclear installation is situated may provide to the contrary, a grave natural disaster of an exceptional character.[70] In the Netherlands, the legislator has indeed decided to provide to the contrary, as we will find below in the section on national law. The second option that the operator may have to prevent having to pay for damages is the right of recourse.[71] The operator has this right of recourse only in one of the following two situations. The first is that the damage caused by a nuclear incident results from an act or omission of a third person with the intent to cause damage. In such a case, the operator is still liable to compensate the victims of a nuclear accident, but he has the right of recourse against that third person who acted or omitted to act with such intent. The second situation is when the right of recourse has expressly been provided by contract.

Another element that stands out is that the concept of damage under the Paris Convention as it is in force today is rather limited in scope; only loss of life or personal injury and loss of or damage to property are covered by it.[72] This means that, for instance, environmental damage and indirect economic losses caused by a nuclear incident are not. The Contracting Parties aimed to mend this lacuna through the adoption of the 2004 Protocol. Upon its entry into force,[73] the updated Paris Convention will cover not only loss of life or personal injury and loss of or damage to property, but also economic loss arising from such loss or damage, the costs of measures of reinstatement of impaired environment, loss of income deriving from a direct economic interest in any use or enjoyment of the environment, and the costs of preventive measures as well as further loss or damage caused by such measures.[74]

Furthermore, the liability under the Paris Convention is limited financially. The Convention dictates that the maximum liability of the operator in respect of damage caused by a nuclear incident is 15 million Special Drawing Rights (SDR[75]).[76] However, Contracting States have the liberty to set a higher maximum in their national legislation.[77] Interestingly, Contracting States may also set a lower maximum liability in their national legislation. This lowered maximum liability may not be less than 5 million SDR, however, and it may only be done if the nature of the nuclear installation or the nuclear substances involved and the likely consequences of an incident originating therefrom warrant this.[78]

[68] Article 4 (b) (i), Paris Convention 1960.
[69] Article 4 (b) (ii), Paris Convention 1960.
[70] Article 9, Paris Convention 1960. In the 2004 Protocol to the Paris Convention, the exoneration for grave natural disasters of an exceptional character is completely omitted. However, the 2004 protocol has not entered into effect yet due to lacking ratifications.
[71] Article 6 (f), Paris Convention 1960.
[72] Article 3 (a), Paris Convention 1960.
[73] Entry into force of the 2004 Protocol requires ratification of two thirds of the Contracting Parties. On 8 April 2013, out of 16 Contracting Parties only one (Switzerland) had ratified the 2004 Protocol.
[74] Article I (B), 2004 Protocol to the Paris Convention.
[75] Special Drawing Rights are an invention of the International Monetary Fund (IMF), see chapter 2 of this report. At the current exchange rate, 15 million SDR equates roughly to € 17,2 million.
[76] Article 7 (b), Paris Convention 1960.
[77] The Netherlands has done this through their national Nuclear Accident Act (WAKO). See below, section 3.4.
[78] Article 7 (b) (ii), Paris Convention 1960.

The Convention further stipulates that the right of compensation is limited in time; it expires if an action is not brought within ten years from the date of the nuclear incident.[79] The adoption of a shorter period would be unfair, since physical injury from radiation may not manifest itself until after several years after the incident. However, the difficulty of proving that long term radiation damage is due to a given source also justifies that the standard period is no longer than ten years. Nonetheless, national legislation may establish an even longer period than ten years under certain conditions.[80] As soon as a person suffering damage has knowledge or should reasonably have known of both the damage and the operator liable, he has at least two years before his right to compensation expires, provided that the abovementioned period of ten years since the occurrence of the accident has not been exceeded.[81]

As a consequence of general treaty law, the geographical scope of the Paris Convention is limited to the territory or jurisdiction of the Contracting States since treaties can only bind States which are Parties to that treaty. This principle works both ways. Not only can a Party to the Convention not file a lawsuit against a liable operator based in a non-Contracting State. It also means that the Convention does in principle not apply to the territory of non-Contracting States or to damage suffered in such territory.[82] A Contracting State can, however, provide otherwise in its national legislation.[83] Nonetheless, in principle a situation could arise under the Paris Convention, where a victim from non-Contracting State ”X” could not apply for damages suffered due to a nuclear accident in or under the jurisdiction of Contracting State “Y”. As we will find below, international efforts have been made to mend this problem and achieve a more comprehensive global coverage.

Another crucial element of the Paris Convention is that the operator is obliged to have insurance or some other form of financial security in order to fulfil his financial liability.[84] Official proof of such financial security needs to be provided to the carrier by the operator of the nuclear installation. The certificate must state the name and address of that operator and the amount, type and duration of the security. Also, the certificate must indicate the nuclear substances and the carriage in respect of which the security applies.[85] By way of exception, a carrier may, at his own request and with consent of the operator, be held liable in place of the operator if national legislation provides this option.[86]

3.2.2 Brussels Supplementary Convention (1963)[87]

Ever since it was adopted, the Paris Convention was criticized for not including any provisions on State liability for compensation for the remaining nuclear damage caused by a nuclear accident.[88] Due to the financial limits of the Paris Convention, some affected persons could be left with uncompensated damages in case of a major nuclear incident. For this reason, the Paris Convention was supplemented by the Brussels Supplementary Convention in 1963.[89] Its main goal is to provide additional compensation for victims of a nuclear accident. The Convention aims to achieve this goal by stipulating that the State where the nuclear installation is located will be liable to provide additional compensation to supplement the liability which the operator of a nuclear installation has under the Paris Convention. This, of course, only becomes relevant either in cases where the required amount of compensation for a nuclear accident is larger than the limit of the operator under the Paris Convention, or in cases where the liable operator fails to pay out the amount that he is liable for.[90]

[79] Article 8 (a), Paris Convention 1960.
[80] Ibid. The Nuclear Accident Act indeed provides a longer period with respect to claims for damage to persons: such claims may be brought within 30 thirty years after the occurrence of the nuclear incident. See article 7 (2), WAKO.
[81] Article 8 (c), Paris Convention 1960. The extent of this period is established by the national law of the Contracting Party.
[82] Article 2, Paris Convention 1960.
[83] This is indeed the case in the Netherlands. See article 15 of the Nuclear Accidents Act as discussed in section 3.4 below.
[84] Article 10, Paris Convention 1960.
[85] Article 4 (c), Paris Convention 1960.
[86] Article 4 (d), Paris Convention 1960. A decision to this effect will need to be taken by the national competent authority.
[87] The Kingdom of the Netherlands is a Party to this Convention since 1979. Other Parties are *inter alia* Germany, Denmark, Belgium, the United Kingdom, France and Norway. See: <http://www.minbuza.nl/producten-en-diensten/verdragen/zoek-in-de-verdragenbank/1963/1/004681.html> (visited on 23 July 2013).
[88] S. M. M. Zeidan, *State Responsibility and Liability for Environmental Damage Caused by Nuclear Accidents*, Tilburg University Press (2012), p. 392 (hereinafter Zeidan 2012).
[89] Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, as amended by the additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (hereinafter "Brussels Supplementary Convention").
[90] Zeidan 2012, p. 393.

The Convention explicitly states that it is not only applicable to nuclear accidents taking place within the territory of a Contracting Party, but equally so to accidents taking place "on or over the high seas on board a ship or aircraft registered in the territory of a Contracting Party."[91] The supplementary liability of the Contracting Parties for such nuclear accidents is set at a maximum of 300 million Special Drawing Rights (SDR).[92] The first 175 million SDR are provided out of funds provided by insurance or other financial security, as well as public funds to be made available by the Contracting State in whose territory the nuclear installation or the liable operator is situated.[93] The amount between 175 and 300 million SDR is provided out of funds to be made available by the Contracting Parties together, according to a formula for contributions defined in the Convention.[94]

Like the Paris Convention, there are temporal limits incorporated in the Brussels Supplementary Convention. For example, it stipulates that in calculating the public funds to be made available pursuant to this Convention, account must be taken only of those rights to compensation exercised within ten years from the date of the nuclear incident.[95]

3.2.3 Vienna Convention (1963)

As we found above, the 1960 Paris Convention has had a geographical scope which was limited primarily to Europe ever since it was conceived. In order to create a more global liability system for nuclear accidents, the Vienna Convention was adopted in 1963.[96] The provisions of the Vienna Convention are similar or identical to those of the Paris Convention, as the principles of liability enshrined in them are the same. A succinct discussion of these principles is therefore sufficient for the purpose of this report.

Like the Paris Convention, liability for nuclear accidents is channelled to the operator of the nuclear installation. In case of a nuclear accident during transport, the operator of either the sending or the receiving nuclear installation will be liable.[97] Also, the liability of the operator is strict and the Convention offers a list of exonerations which is identical to the one in the Paris Convention.[98] The operator further has a right of recourse under the Vienna Convention in case of an act or omission by a third person with the intent to cause damage, or in case a right of recourse is explicitly provided for in a contract in writing.[99] Furthermore, like under the Paris Convention the liability under the Vienna Convention is limited in time; an action for compensation needs to be brought in principle within ten years from the date of the nuclear incident.[100] The types of damage for which an operator is liable are also limited in a similar way to the Paris Convention; merely the loss of life, personal injury or loss of, or damage to, property are covered. The Vienna Convention does, however, leave it up to the legislators of the individual States to add any other loss or damage to this short list.[101] Furthermore, the Vienna Convention dictates that the operator must maintain insurance or another form of financial security to cover his liability for nuclear damage and that he needs to provide the carrier with a certificate as proof of such security.[102] Finally, the Vienna Convention does provide a minimum liability like the Paris Convention but interestingly not a maximum liability of the operator.[103]

Like the Paris Convention, the Vienna Convention was also updated several times to mend flaws and keep up with developments, most recently through adopting a Protocol in 1997. In its amended form, the definition of nuclear damage now also includes environmental damage and

[91] Article 2 (a) (ii), Brussels Supplementary Convention 1963.
[92] At the current exchange rate, 300 million SDR equates roughly to € 345 million.
[93] Article 3 (b) (i) and (ii), Brussels Supplementary Convention 1963.
[94] Article 3 (b) (iii), Brussels Supplementary Convention 1963. The formula is provided by article 12.
[95] Article 6, Brussels Supplementary Convention 1963.
[96] On 29 March 2011, the Vienna Convention had 38 Parties, predominantly from South America, Africa and Eastern Europe, including Ukraine and the Russian Federation. The Netherlands is not a party to this convention, nor are important nuclear States like Japan, the USA, China and the UK. See <http://www.iaea.org/Publications/Documents/Conventions/liability_status.pdf> (visited on 8 April 2013).
[97] Article II (1), Vienna Convention 1963.
[98] Article IV (1) and (3), Vienna Convention 1963.
[99] Article X, Vienna Convention 1963.
[100] Article VI (1), Vienna Convention 1963. Under circumstances this period may be extended under the law of the State where the nuclear installation is located.
[101] Article I (k), Vienna Convention 1963.
[102] Articles III and VII (1), Vienna Convention 1963.
[103] Article V (1), Vienna Convention 1963.

economic loss, and the amount of compensation to be paid by the operator for damage has been increased to not less than 300 million SDR.[104] [105]

3.2.4 Supplementary Compensation Convention (1997)

At the diplomatic conference where the abovementioned 1997 Protocol amending the Vienna Convention was adopted, the Convention on Supplementary Compensation for Nuclear Damage was also adopted. It adds functionality to both the 1963 Vienna Convention and the 1960 Paris Convention. The primary added value of the Supplementary Compensation Convention is that it obliges States Parties to ensure the liability of the operator. To that effect, it provides that the State where the nuclear installation is located must ensure the availability of 300 million SDR or a greater amount that it may have specified at any time prior to the nuclear incident.[106] Secondly, this Convention provides additional compensation to victims of a nuclear accident in a way similar to the Brussels Supplementary Convention. It dictates that the Contracting Parties must make available public funds beyond the amount made available by the liable operator, according to a specified formula.[107] The geographical scope of this latter obligation of the Contracting Parties to make public funds available, is defined more extensively than in other nuclear liability conventions.[108]

In addition, the Convention contains rather extensive provisions on who has jurisdiction over such nuclear accidents. The basic rule is that jurisdiction over actions concerning nuclear damage from a nuclear incident lies only with the courts of the Contracting Party within which the nuclear incident occurs.[109] This includes incidents taking place during carriage within the territorial waters, as they form part of the territory of the coastal State. Where a nuclear accident happens during maritime carriage within the area of the exclusive economic zone of a Contracting Party, jurisdiction over actions concerning nuclear damage from that nuclear incident lies, for the purposes of this Convention, only with the courts of that Party.[110] Where a nuclear incident occurs beyond the EEZ, or where the place of a nuclear incident cannot be determined with certainty, jurisdiction will lie only with the courts of the State where the installation is located.[111]

In order to become a party to the Convention, States are not required to be a party to any of the existing nuclear liability conventions.[112] For States falling into this category, the Supplementary Compensation Convention contains an annex which provides for the liability of the operator of the nuclear installation in accordance with the principles incorporated in the Paris and Vienna Conventions. As a package, then, the Convention provides a rather comprehensive and modern framework on liability for nuclear accidents. Disappointingly, however, it so far lacks a sufficient number of ratifications for it to enter into force.[113]

3.2.5 Joint Protocol (1988)[114]

The major difference between the Paris Convention and the Vienna Convention lies thus not in their content but rather in their geographical scope. Whereas the Paris Convention is widely ratified in Western Europe but not beyond, the Vienna Convention has a geographical scope which extends to large parts of South America, Africa and Eastern Europe. As a result, the geographical scope of these

[104] Article I (1)(k) and article V, Vienna Convention on Civil Liability for Nuclear Damage of 21 May 1963 as amended by the Protocol of 12 September 1997.
[105] On 1 March 2013, the 1997 Protocol to the Vienna Convention had been ratified by only 11 States. See <http://www.iaea.org/Publications/Documents/Conventions/protamend_status.pdf> (visited on 8 April 2013).
[106] Article III (1) (a), Supplementary Compensation Convention 1997.
[107] Article III (1) (b), Supplementary Compensation Convention 1997. The specified formula is defined in article IV, based *inter alia* on the nuclear capacity of the State.
[108] Article V, Supplementary Compensation Convention 1997.
[109] Article XIII (1), Supplementary Compensation Convention 1997.
[110] Article XIII (2), Supplementary Compensation Convention 1997. The exercise of jurisdiction must be done in a manner which is consistent with the international law of the sea, including UNCLOS.
[111] Article XIII (3), Supplementary Compensation Convention 1997.
[112] Article II (2), Supplementary Compensation Convention 1997.
[113] So far only four States have deposited an instrument of ratification, whereas article XX stipulates that 5 Parties with a minimum nuclear capacity of 400.000 MW of thermal power are required for entry into force. See <http://www.iaea.org/Publications/Documents/Conventions/supcomp_status.pdf> (visited on 8 April 2013).
[114] The Kingdom of the Netherlands is a Party to this Protocol since 1992. Other Parties are *inter alia* Germany, Denmark and Norway. The UK, Belgium and France have signed but not ratified the Protocol. See <http://www.minbuza.nl/producten-en-diensten/verdragen/zoek-in-de-verdragenbank/1988/9/003219.html> (visited on 8 April 2013).

nuclear liability regimes remained a non-comprehensive patchwork. To improve the coverage of these two regimes, a Joint Protocol has been established which joins the geographical scopes of the Paris and Vienna Conventions.[115] To that effect, the Protocol dictates that the operator of a nuclear installation situated in the territory of a Party to the Vienna Convention will be liable in accordance with that Convention for nuclear damage suffered in the territory of a Party to both the Paris Convention and the Joint Protocol.[116] Equally, of course, the operator of a nuclear installation situated in the territory of a Party to the Paris Convention will be liable in accordance with that Convention for nuclear damage suffered in the territory of a Party to both the Vienna Convention and the Joint Protocol.[117] The Joint Protocol thus applies the principle of reciprocity in order to extend the benefits of one convention to the other.[118]

The Joint Protocol dictates that the Paris Convention and the Vienna Convention cannot both be applicable to the same nuclear incident. If a nuclear incident occurs in a nuclear installation, the applicable Convention is the one to which the State where that installation is situated is a Party. If a nuclear incident occurs in the course of carriage, the applicable Convention is the one to which the State where the nuclear installation of the liable operator is situated is a Party.[119]

3.2.6 Maritime Carriage of Nuclear Material Convention (1971)[120]

The Paris and Vienna Conventions are mainly geared towards land-based accidents involving nuclear materials. Even though they do clearly stipulate that the operator of a nuclear installation is liable for nuclear accidents which happen during the transport of the nuclear materials to or from the installation,[121] these Conventions also dictate that their provisions do not affect the application of existing treaties in force at the time their conclusion.[122] In order to prevent a conflict between contradicting provisions of international transport legislation, the international community found it desirable to regulate the civil liability for the maritime carriage of nuclear material in a separate treaty. The resulting *Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material* (hereafter the Maritime Carriage of Nuclear Material Convention) was signed in 1971 and entered into force in 1975.

The single objective of the Convention is to reinforce the liability of the operator of the nuclear facility as stipulated by the Paris and Vienna Conventions, and to put this principle above any contradicting provisions in existing international maritime transport law. This follows from the preamble, which states:

> "The High Contracting Parties, (…) [d]esirous of ensuring that the operator of a nuclear installation will be exclusively liable for damage caused by a nuclear incident occurring in the course of maritime carriage of nuclear material, [h]ave agreed as follows (…)"

The operative paragraphs of the Convention subsequently implement this objective in a negative way, providing that any person who might be held liable for damage caused by a nuclear incident must be exonerated from such liability in two cases. First, such a person is exonerated if "the operator of a nuclear installation is liable for such damage under either the Paris or the Vienna Convention".[123] Secondly, a person is exonerated if "the operator of a nuclear installation is liable for such damage under national law (…)".[124] The operator of the nuclear installation thus remains in principle the liable person, even when the nuclear accident causing the damage takes place during maritime transport.

[115] Joint Protocol relating to the application of the Vienna Convention and the Paris Convention, 21-09-1988 (hereinafter referred to as Joint Protocol 1988).
[116] Article II (a), Joint Protocol 1988.
[117] Article II (b), Joint Protocol 1988.
[118] Zeidan 2012, p. 398.
[119] Article III, Joint Protocol 1988.
[120] The list of States Parties to the Maritime Carriage of Nuclear Material Convention includes the Kingdom of the Netherlands (since 1991) and the majority of its direct and indirect neighbouring States in Europe, including Germany, Denmark, Belgium, France and Norway. However, major nuclear States like the United Kingdom, China, the Russian Federation and the United States of America are not a Party. See <http://www.minbuza.nl/producten-en-diensten/verdragen/zoek-in-de-verdragenbank/1971/12/002836.html> (visited on 8 April 2013).
[121] Articles 3 (a), 4 (a) and 4 (b), Paris Convention 1960; Article II (1), Vienna Convention 1963.
[122] Article 6 (b), Paris Convention 1960; Article II (5), Vienna Convention 1963.
[123] Article 1 (a), Maritime Carriage of Nuclear Material Convention 1971.
[124] Article 1 (b), Maritime Carriage of Nuclear Material Convention 1971.

The Convention further clarifies that it supersedes any treaty in the field of maritime transport which existed at the time of its signature, but only to the extent that such treaties would be in conflict with it.[125]

3.3 International safety regulation of ships carrying nuclear materials

3.3.1 Convention on the Physical Protection of Nuclear Material (1980)[126]

The Convention on the Physical Protection of Nuclear Material was drafted within the framework of the International Atomic Energy Agency (IAEA). The main aim of the Convention is to facilitate the safe transfer of nuclear material by establishing effective measures for the physical protection of nuclear material. The Convention applies to nuclear material used for peaceful purposes while in international nuclear transport, which the Convention defines as "the carriage of a consignment of nuclear material by any means of transportation intended to go beyond the territory of the State where the shipment originates beginning with the departure from a facility of the shipper in that State and ending with the arrival at a facility of the receiver within the State of ultimate destination."[127]

The Convention dictates that each State Party must take appropriate steps within the framework of its national law and consistent with international law "to ensure as far as practicable that, during international nuclear transport, nuclear material within its territory or on board a ship (…) under its jurisdiction insofar as such ship (…) is engaged in the transport to or from that State, is protected at the levels described in Annex I."[128] Also, a State Party is not allowed to export or authorize the export of nuclear material unless that State Party has received assurances that the nuclear material will be protected in accordance with Annex I during the transport.[129] This State Party subsequently has the duty to inform in advance the States which the nuclear material is expected to transit by land or internal waterways, or whose seaports it is expected to enter.[130]

Annex I provides the levels of physical protection that need to be applied in international transport of nuclear materials. The Convention identifies three categories of materials, decreasing in level of potential damage.[131] For Category II and III materials, "transportation shall take place under special precautions including prior arrangements among sender, receiver, and carrier, and prior agreement between natural or legal persons subject to the jurisdiction and regulation of exporting and importing States, specifying time, place and procedures for transferring transport responsibility."[132] For Category I materials, the category with the highest potential danger, transportation takes place under the special precautions identified above for Category II and III materials, with the addition of "constant surveillance by escorts and under conditions which assure close communication with appropriate response forces."[133] This latter addition is especially relevant to prevent or stop the theft of nuclear material during transport, which is also regulated through the Convention.[134]

[125] Article 4, Maritime Carriage of Nuclear Material Convention 1971.
[126] The Kingdom of the Netherlands is a Party to this Convention since 1991. Other Parties are *inter alia* Germany, Denmark, Belgium, the United Kingdom, France and Norway, but also States like the Russian Federation, the United States of America and China. See <http://www.minbuza.nl/producten-en-diensten/verdragen/zoek-in-de-verdragenbank/1980/3/000616.html> (visited on 8 April 2013).
[127] Article 2 in conjunction with 1 (c), Convention on the Physical Protection of Nuclear Material 1980.
[128] Article 3, Convention on the Physical Protection of Nuclear Material 1980.
[129] Article 4 (1), Convention on the Physical Protection of Nuclear Material 1980.
[130] Article 4 (5), Convention on the Physical Protection of Nuclear Material 1980. Note that there is no need to inform States that nuclear material will transfer through their territorial sea or Exclusive Economic Zone (EEZ). This is in accordance with the United Nations Convention on the Law of the Sea (UNCLOS) which safeguards the right of innocent passage, the right of transit passage and the freedom of navigation, regardless of the cargo on board the ship (See UNCLOS, articles 17 – 20 and explicitly article 23 on innocent passage, articles 37 – 39 on transit passage, and articles 58 and 87 on freedom of navigation).
[131] Annex II of the Convention on Physical Protection of Nuclear Material 1980 provides a table with the three categories. Categorization depends on the material, the form, and the amount transported. For example, the transportation of 500 grams of plutonium falls within Category III, transportation of 1500 grams of plutonium falls within Category II, and transportation of 2500 grams of plutonium falls within Category I.
[132] Annex I (2) (a), Convention on the Physical Protection of Nuclear Material 1980.
[133] Annex I (2) (b), Convention on the Physical Protection of Nuclear Material 1980.
[134] See article 7 (1) (b), Convention on the Physical Protection of Nuclear Material 1980.

3.3.2 SOLAS Convention

As we found in the previous chapter, the SOLAS Convention provides rules on the design, construction, equipment, and operation of ships. Chapter VII of this Convention deals specifically with the transport of dangerous goods, of which Part D is dedicated to special requirements for the carriage of packaged irradiated nuclear fuel, plutonium and high-level radioactive wastes on board ships. This part of the Convention does not provide any substantive rules, but rather dictates that a ship carrying the aforementioned cargo must comply with the requirements of the *INF Code* in addition to any other applicable requirements of the SOLAS Convention and must be surveyed and certified as provided for in that Code.[135] What the INF Code is and what its requirements are will be discussed in the following subsection.

3.3.3 INF Code[136]

The *Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes in Flasks on Board Ships* (INF Code) was established in 1993. It is part of a broad range of Codes established by the International Maritime Organization (IMO) under the SOLAS Convention, which all deal with the safety of ships carrying specific kinds of cargo.[137] INF cargo stands for packaged irradiated nuclear fuel, plutonium and high level radioactive wastes. The INF Code contains recommendations for the design of vessels which transport such radioactive material, the main features of which are the following.

The Code identifies three classes of ships carrying nuclear material, based on the total amount of radioactivity which the ship is certified to carry on board in the form of INF cargo. The lightest class is Class INF 1 ships, which are certified to carry INF cargo with an aggregate radioactivity of less than 4000 TBq. Class INF 3 ships are the highest class identified by the Code, certified to carry irradiated nuclear fuel or high-level radioactive wastes and plutonium with no restriction of the maximum aggregate activity of the materials.[138] Logically, the higher the class of ship, the more severe and comprehensive the recommended safety precautions are. The Code applies to all ships engaged in carrying INF cargo, regardless of the size of the ship or its date of construction.[139]

Before a ship is taken into service for the carriage of INF cargo, it needs to be subjected to an initial survey which includes a complete examination of its structure, equipment, fittings, arrangements and material.[140] If this survey is completed to the satisfaction of the competent authority, it will issue the ship with an International Certificate of Fitness for the Carriage of INF Cargo.[141] Once certified, the ship will remain subject to inspections and surveys on a regular basis to ensure that it stays in compliance with this Code.[142] If these obligatory surveys are not carried out or if they show that the ship does not comply with the provisions of the INF Code, the aforementioned Certificate of Fitness ceases to be valid.[143]

Ships engaged in the carriage of nuclear materials need to comply with certain standards of damage stability, dependent on which INF Class they belong to.[144] The same goes for the standards of fire safety measures present on board the ship.[145] Furthermore, there are requirements with regard to the temperature control of cargo spaces and the structural strength of deck areas and support arrangements.[146] Also, ships carrying INF cargo will have to carry a shipboard emergency plan

[135] Regulation VII/16 (1), SOLAS Convention.
[136] Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Waste in Flasks on Board Ships, IMO Assembly Resolution A.748(18) (4 Nov. 1993). See article "Transport of Nuclear Cargoes by Sea" by R.A.F. Pedrozo, in *Journal of Maritime Law and Commerce*, Vol. 28, Issue 2, April 1997, p. 207.
[137] Think, for example, of the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), and the International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code).
[138] Section 1.1.1, INF Code.
[139] Section 1.2.1, INF Code in conjunction with Regulation VII/15, SOLAS Convention. The INF Code does not apply to warships and other vessels owned and operated by a State Party and used on government non-commercial service.
[140] Section 1.3.1, INF Code.
[141] Section 1.3.2, INF Code.
[142] Section 1.3.3, INF Code.
[143] Section 1.3.4, INF Code.
[144] Chapter 2, INF Code.
[145] Chapter 3, INF Code.
[146] Chapter 4 and 5, INF Code.

describing the procedures to be followed and actions to be taken in case of an incident involving the INF cargo.[147] Finally, any incident involving the release or probable release of INF cargo needs to be reported to the nearest coastal State as soon as possible.[148]

The content of the INF Code, while originally recommendatory, became mandatory in 2001 due to amendments to the aforementioned chapter VII of the SOLAS Convention.[149] It was then renamed as the *International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Waste on Board Ships* but it is still referred to as the INF Code.[150] Through the amendment, parties to the SOLAS Convention are now obliged to abide by the regulations set forth in the INF Code.

3.3.4 IMDG Code

The INF Code dictates that the provisions of the International Maritime Dangerous Goods Code (IMDG Code) should also apply to the carriage of INF cargo.[151] This Code, adopted in 1965 and updated several times to adapt to technological progress, provides basic principles as well as detailed recommendations for individual dangerous substances and materials. Also, the Code provides a number of recommendations for good operational practice including advice on terminology, packing, labelling, stowage, segregation and handling, and emergency response action.

Since dangerous goods can have very different characteristics and properties meriting specific safety measures, the IMDG Code divides the goods into nine different classes and several subclasses.[152] Radioactive material is one of those classes. Of all the classes of dangerous materials, the class of radioactive material is one of the most extensively regulated in the Code. It contains provisions on, among other things, special packaging requirements,[153] stowage requirements,[154] approval of shipments and notification,[155] and particularly the construction, testing and approval of packages containing the radioactive material.

Similar to the INF Code, the provisions in the IMDG Code were originally recommendatory. As of 2004, however, they have become mandatory due to amendments to chapter VII of the SOLAS Convention which were adopted in 2002.[156]

3.4 National legislation on nuclear incidents

For the sake of comprehensiveness, a short discussion of Dutch National provisions on nuclear incidents is warranted. The 1979 Nuclear Accidents Act (*Wet houdende regelen inzake aansprakelijkheid voor schade door kernongevallen* or *WAKO*) essentially follows the principles set out in the conventions discussed above, but it contains some interesting exceptions and practical solutions.

The Nuclear Accidents Act explicitly provides that the exception with respect to liability for nuclear damage caused by a “grave natural disaster of an exceptional character”, as provided by article 9 of the Paris Convention, does not apply to the liability of the operator of a nuclear installation located in the Netherlands.[157] As a consequence, if a nuclear accident happens due to a grave natural disaster of an exceptional character during the transport of nuclear material stemming from a nuclear installation in the Netherlands, the operator of that installation will be liable.

[147] Chapter 10, INF Code.
[148] Chapter 11, INF Code.
[149] See <http://www.imo.org/OurWork/Safety/Cargoes/Pages/IrradiatedNuclearFuel.aspx> (visited on 8 April 2013)
[150] The International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Waste on Board Ships, IMO Assembly Resolution MSC.88(71) (27 May 1999).
[151] Section 1.2.2, INF Code.
[152] These classes include, *inter alia*, explosives, flammable liquids, corrosive substances and radioactive materials.
[153] Chapter 4.1.9, IMDG Code.
[154] Chapter 7.1.16, IMDG Code.
[155] Chapter 5.1.5, IMDG Code.
[156] However, some part of the IMDG Code remain recommendatory, e.g. some provisions on training of personnel. See <http://www.imo.org/blast/mainframe.asp?topic_id=158> (visited on 30 July 2013).
[157] Article 3, *Wet houdende regelen inzake aansprakelijkheid voor schade door kernongevallen* (hereinafter WAKO). Article 9 of the Paris Convention explicitly provides for this option, stating that an operator is not liable for damage caused by a nuclear accident directly due to a grave natural disaster of an exceptional character “except in so far as the legislation of the Contracting Party in whose territory his nuclear installation is situated may provide to the contrary”.

As we found earlier in this chapter, the 1960 Paris Convention set the maximum liability for nuclear accidents at 15 million SDR but leaves room for a higher limit under national legislation. The Nuclear Accidents Act makes use of this possibility; as of the first of January 1998, this limit was already set at 340,335,162.07 Euro.[158] However, as of the first of January 2013 the liability limit has been almost quadrupled to 1,2 billion Euro.[159] The Act also gives the government the possibility to differentiate between different operators with different levels of risk.[160] To this end, the Minister of Finance can, after consultation with and the consent of the Minister of Justice, lower the maximum amount of liability for a certain operator if this is justified by the nature of the nuclear installation or the nuclear materials, as well as the expected consequences of an accident involving this particular operator.[161]

In addition, the Act provides for an important exception to the general rule under the nuclear conventions discussed above that the liability for the transport of nuclear materials lies with the operator of the nuclear installation on shore. The Act stipulates that, upon request of the transporter and with the consent of the operator of the nuclear installation, the Minister of Finance can decide that, on certain conditions, the transporter will be liable instead of the operator of the nuclear installation.[162]

Another important feature of the Act is related to the financial security that the operator of the nuclear installation must provide under article 10 (a) of the Paris Convention. The Act provides that if the Minister of Finance finds that the operator of the nuclear installation cannot attain a sufficient financial security in the market or if it can only be attained at too high a price, the Minister is empowered, on certain conditions and upon payment of a premium by the operator, to provide the necessary financial security in the name of the State.[163]

Furthermore, the Act provides for a back-up if a nuclear accident happens and the financial security of the operator turns out not to be sufficient to cover the ensuing damages. In such a scenario, the State makes public funds available to the operator up to the maximum amount of his liability.[164] If the insufficiency of the financial security turns out to be the fault of the operator, the State has the right of recourse with respect to the public funds made available to him.[165]

3.5 Closing remarks

In this chapter, we have found that liability for damage resulting from nuclear incidents during the maritime carriage of nuclear materials is extensively regulated, even if only the Contracting States are bound by the relevant conventions.[166] This international liability regime is characterized by the strict liability of the operator of the nuclear facility; the supplementary compensation by the State; the limitation of liability; the obligatory insurance for damage; and a limited scope in time, geographical application, and kinds of damage covered. The international safety regime of shipping nuclear material is quite extensive as well, which can be explained by the large potential for long-lasting damage in case of loss of containment. The Dutch Nuclear Accidents Act provides further rules and conditions within the confines of its jurisdiction, the most notable of which is the 1,2 billion Euro maximum liability for operators of nuclear installations. In the following chapter, we will investigate how liability and safety are regulated in the field of maritime transport of another substance with a large potential for causing damage in case of loss of containment: oil.

[158] Article 5, WAKO.
[159] See *Staatsblad* 2012/398.
[160] This is in line with article 7 (b) (ii), Paris Convention 1960.
[161] Article 5 (3), WAKO.
[162] Article 6, WAKO.
[163] Article 9, WAKO.
[164] Article 10 (1), WAKO.
[165] Article 10 (2), WAKO.
[166] The Kingdom of the Netherlands is party to, and thus covered by, the Paris Convention, The Brussels Supplementary Convention, the Joint Protocol, and the Maritime Carriage of Nuclear Material Convention.

Chapter 4 Shipping of oil

4.1 Introduction

The ship transport of oil in bulk has a history of "legislation by disaster". This refers to the practice of increased legislative activity after the occurrence of a serious incident which exposes the inadequacy of the contemporary legislative framework. The prime example of this can be found in the aftermath to the *Torrey Canyon* incident in 1967. This case of serious oil pollution off the coast of Great Britain led to a Conference in 1969 in Brussels where delegations set out to devise a new liability scheme on oil pollution damage. The resulting liability regime for damage caused by loss of containment of oil during shipping will be discussed at length in section 4.2. In section 4.3, we will delve into the regulation of safety of oil tankers. After discussing the Dutch legislation on oil pollution damage in section 4.4, we will end this chapter by presenting some closing remarks.

4.2 Regulation of liability for ship transport of oil

4.2.1 CLC Convention (1992)

As we found in chapter 2, the Convention on limitation of liability for maritime claims (LLMC Convention) is explicitly not applicable to claims for oil pollution damage.[167] This is because oil pollution damage has a separate liability system. For a comprehensive investigation of this system, we will have to start by looking at the *International Convention on Civil Liability for Oil Pollution Damage* (CLC Convention) of 1992, the original version of which was already adopted in 1969.[168] The 1992 CLC Convention is the first tier in a three tier system of international oil pollution liability regulation. In its current form, the main elements of this Convention are the following.

The first thing that stands out, especially compared to the nuclear pollution liability regime we discussed earlier, is that liability for oil pollution damage during ship transport rests primarily with the shipowner and thus not with the operator of the installation where the oil is transported from or to. This is apparent from the wording of the CLC Convention, which stipulates that in principle "the owner of a ship at the time of an incident, or, where the incident consists of a series of occurrences, at the time of the first such occurrence, shall be liable for any pollution damage caused by the ship as a result of the incident."[169] It follows from this wording that the liability of the shipowner is strict. It is thus not necessary for the victim to prove fault or negligence on the part of the shipowner for liability to be established; proof of a causal relationship between the incident and the damage will be sufficient.

The basic rule in the CLC Convention regarding the liability of the shipowner is balanced by a limited number of exceptions to this rule:

> "2. No liability for pollution damage shall attach to the owner if he proves that the damage:
> (a) resulted from an act of war, hostilities, civil war, insurrection or a natural phenomenon of an exceptional, inevitable and irresistible character, or
> (b) was wholly caused by an act or omission done with intent to cause damage by a third party, or
> (c) was wholly caused by the negligence or other wrongful act of any Government or other authority responsible for the maintenance of lights or other navigational aids in the exercise of that function.
>
> 3. If the owner proves that the pollution damage resulted wholly or partially either from an act or omission done with intent to cause damage by the person who suffered the damage or from the

[167] Article 3 (b), LLMC Convention.
[168] The original CLC Convention dates back to 1969. Like many of the treaties on nuclear liability discussed in the previous chapter, the CLC Convention has been amended several times over the years to keep it up to date. In 1992 it was amended in such a fundamental way that it is now referred to as the 1992 CLC Convention. The 1992 CLC Convention has been in force since 27 November 1992; for the Kingdom of the Netherlands, it entered into force on 30 May 1996. It is widely ratified throughout the world with 130 State Parties at the moment of writing.
[169] Article III (1), CLC Convention 1992.

> negligence of that person, the owner may be exonerated wholly or partially from his liability to such person."[170]

This list of exceptions is, to a large extent, very similar to the exceptions provided in the nuclear liability regime of the 1960 Paris Convention. The main difference is damage which results from an act or omission of a third person with the intent to cause damage. Under the nuclear liability regime, the operator is still liable to compensate the victims of such a nuclear accident, but he has the right of recourse against that third person who acted or omitted to act with such.

Another essential aspect of the CLC Convention is that it sets general financial limits on the liability of the shipowner for oil pollution damage claims. Since the limits set in the original 1969 version of the Convention had become outdated, the 1992 version introduced higher liability limits which were more in line with contemporary cost levels. The actual liability limit depends on the tonnage of the ship, which means that it is not the same for all ships.[171] The owner of a ship which does not exceed 5,000 units of tonnage is entitled to limit his liability to 4,510,000 SDR.[172] For ships with a tonnage which is in excess thereof, each additional unit of tonnage means an additional liability of 631 SDR up to a maximum aggregate liability of 89,770,000 SDR.[173] A graphic illustration of this variable limit is provided by the blue surface in Figure 1 at the end of this chapter.

If a shipowner wants to limit his liability for an incident which involves his ship and which has resulted in oil pollution damage, he will have to constitute a fund for the total sum of his liability. He does this either by depositing the sum or by providing a bank guarantee or some other acceptable guarantee to that amount.[174] If a claim is subsequently brought, the fund will be distributed among the claimants in proportion to the amounts of their established claims.[175] Claims in respect of expenses reasonably incurred or sacrifices reasonably made by the owner voluntarily to prevent or minimize pollution damage rank equally with other claims against the fund.[176] This is an important rule which provides an incentive to the shipowner to take efficient preventive measures in case of an incident, since the costs that he incurs in the process will thus, to a certain extent a least, be deductible from his aggregate liability.

The owner of a ship registered in a Contracting State and carrying more than 2,000 tons of oil in bulk as cargo is required to maintain insurance or another form of financial security, such as a bank guarantee, in the sum of the limit of his liability.[177] After the appropriate authority of a Contracting State has established that he complies with this requirement, his ship is issued a certificate attesting that insurance or some other financial security is in force in accordance with the provisions of this Convention.[178] This certificate needs to be carried on board so that it can be shown in case of an inspection, and a copy is to be kept by the authorities who keep the record of the registry of the ship.[179] Contracting States further have to ensure that insurance or other security is in force in respect of any ship, no matter where it is registered, arriving at or leaving a port in its territory or an offshore facility within its territorial sea, if the ship actually carries more than 2,000 tons of oil as cargo.[180]

As is the case in the nuclear liability regime discussed earlier, the liability for oil pollution damage under the CLC Convention is limited in time; the right to compensation under this Convention

[170] Article III (2) & (3), CLC Convention 1992. The CLC Convention further clarifies in article III (4) that no claims for compensation can be made against other persons involved in the incident, such as crew members, agents, pilots, or even charterers, unless such a person caused the damage and did so with the intent to cause damage.
[171] Article V (1), CLC Convention 1992.
[172] Article V (1)(a) in conjunction with (9)(a), CLC Convention 1992. The CLC Convention refers to 'units of account' where it means Special Drawing Rights (SDR).
[173] Article V (1)(b), CLC Convention 1992.
[174] Article V (3), CLC Convention 1992.
[175] Article V (4), CLC Convention 1992.
[176] Article V (8), CLC Convention 1992.
[177] Article VII (1), CLC Convention 1992.
[178] Article VII (2), CLC Convention 1992: "With respect to a ship registered in a Contracting State such certificate shall be issued or certified by the appropriate authority of the State of the ship's registry; with respect to a ship not registered in a Contracting State it may be issued or certified by the appropriate authority of any Contracting State." This certificate needs to contain the name of ship and the port of registration; the name and principal place of business of the owner; the type of security; the name and principal place of business of the insurer or other person giving security and, where appropriate, place of business where the insurance or security is established; and, finally, the period of validity of the certificate.
[179] Article VII (4), CLC Convention 1992. If the ship is not registered in a Contracting State, the copy is kept by the authorities of the Sate issuing the certificate.
[180] Article VII (11), CLC Convention 1992.

is extinguished when an action is not brought thereunder within three years after the date when the damage occurred.[181] Since significant amounts of time can lapse between the date of the incident and the date of the damage, the Convention further stipulates that an action can in no case be brought after six years from the date of the incident which caused the damage.[182] The rationale for these time constraints is to provide legal security to shipowners.

In addition, the liability for oil pollution damage under the CLC Convention is limited in geographical scope. The Convention applies exclusively to oil pollution damage caused in the territory, the territorial sea, or the exclusive economic zone of a Contracting State.[183] With regard to preventive measures taken to prevent or minimize such damage, the Convention applies also beyond these areas.[184]

Finally, it is important to mention that the liability under the CLC Convention and the additional legislation discussed in paragraphs 4.2.2 and 4.2.3 below is limited to pollution damage caused by so-called 'persistent oils' only. The CLC Convention describes these as "any persistent hydrocarbon mineral oil such as crude oil, fuel oil, heavy diesel oil and lubricating oil, whether carried on board a ship as cargo or in the bunkers of such a ship."[185] Non-persistent oils, on the other hand, are refined oil products which generally are of a volatile nature and are composed of lighter hydrocarbon fractions. These non-persistent oils, such as petrol and kerosene, tend to dissipate through evaporation when there is a loss of containment. Consequently, spills of non-persistent oils require far more limited, if any, clean-up methods than spills of persistent oil.[186] The regulation of damage resulting from non-persistent oils will be discussed in paragraph 4.2.5 below.

4.2.2 Fund Convention (1992)

In the years following the adoption of the original 1969 CLC Convention, States realised that the CLC Convention cannot guarantee full compensation for victims of oil pollution damage in all cases. Therefore, the *International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage* (Fund Convention) was adopted in 1971 and crucially updated in 1992 to ensure adequate compensation for victims of oil pollution damage in cases where the CLC Convention proves inadequate.[187] The Fund Convention is the second tier in the aforementioned three tier system of international oil pollution liability regulation. As the drafters considered that the financial liability for oil pollution damage should not only lie with the shipping industry but also with the oil cargo interests, they established a compensation and indemnification system which reflects this desire: an international fund which is complementary to the CLC Convention, filled with contributions from large receivers of oil.[188]

The contribution system of the Fund is based on the following rule: the Fund is filled with contributions from persons who have received quantities of oil carried by sea exceeding 150,000 tons in total during the preceding calendar year.[189] The term 'person' in the sense of the Fund Convention is very broad and includes corporations as well as the State and its constituent subdivisions. The drafters anticipated that such persons might be split up into smaller subsidiaries which individually stay below the 150,000 ton threshold, who could thusly individually evade the duty to contribute to the

[181] Article VIII, CLC Convention 1992.
[182] Where this incident consists of a series of occurrences, the six years' period runs from the date of the first such occurrence. See CLC Convention, article VIII.
[183] Article II (a), CLC Convention 1992. If a Contracting State has not established an exclusive economic zone, the Convention applies in an area beyond and adjacent to the territorial sea of that State determined by that State in accordance with international law and extending not more than 200 nautical miles from the baselines from which the breadth of its territorial sea is measured.
[184] Article II (b), CLC Convention 1992.
[185] Article I (5), CLC Convention 1992.
[186] 'Persistence of oil', The International Tanker Owners Pollution Federation Limited. URL: <http://www.itopf.com/marine-spills/fate/persistence-of-oil/> (visited on 23 July 2013).
[187] The 1992 Fund Convention has been in force since 27 November 1992; for the Kingdom of the Netherlands, it entered into force on 30 May 1996. It is widely ratified throughout the world with 109 State Parties at the moment of writing.
[188] Preamble, Fund Convention 1992.
[189] Article 10 (1), Fund Convention 1992. Depending on the circumstances, this is the preceding calendar year or the year preceding a certain incident causing oil pollution. See article 12 (2) of the Fund Convention. Also, the oil received should be either received in ports or terminal installations in the territory of the Contracting State, or it should be received in a non-Contracting State and subsequently delivered to installations situated in the territory of the Contracting State. For more details, see article 10 (1) of the Fund Convention.

Fund. To ensure that such persons do not escape their mandatory contribution to the Fund, the Convention stipulates that the oil received in the same Contracting State by any 'associated persons', meaning any subsidiary or commonly controlled entities, should be counted together to ascertain whether the 150,000 ton threshold has been met on aggregate. If so, each associated person pays contributions in respect of the actual contribution received by him notwithstanding that that particular quantity did not exceed 150,000 tons of oil.[190]

The total amount of contributions to be levied per calendar year by the Fund is decided by its Assembly, which consists of all Contracting States to the Fund Convention. The Director of the Fund subsequently calculates the amount of annual contribution for each person or group of associated persons exceeding the 150,000 ton threshold.[191] Contracting States are obligated to communicate to the Director who these persons are, so that the Director can establish and keep up to date a list of persons liable to contribute to the Fund. If a Contracting State fails to inform the Director properly and this results in a financial loss for the Fund, the State in question is liable to compensate the Fund for such a loss.[192]

The maximum amount of compensation to be paid out for oil pollution damage covered by the Fund is currently set at 203 million SDR for any single incident.[193] This is an aggregate amount and thus already includes any funds paid out under the CLC Convention. A graphical illustration of this system is provided by the blue and yellow surfaces in Figure 1 at the end of this chapter.

The Fund pays out compensation for oil pollution damage to a person who was unable to obtain full and adequate compensation under the CLC Convention, but only in the following three situations.[194] The first situation is when no liability arises under the CLC Convention. This could, for example, be the case if an incident occurs as a result of non-functioning lighthouse caused by the negligence of an authority responsible for the maintenance of navigational aids.[195] The second situation is when the liable owner of the ship is incapable of meeting his financial obligations in full and that any insurance or financial security established to that end is insufficient to satisfy the claims for compensation. The third and final situation when the Fund pays out compensation is when the damage exceeds the liability of the owner of the ship as limited under the CLC Convention. At the moment of writing this report, that maximum liability under the CLC Convention was set at 89,77 million SDR.[196] Considering what we found in the previous paragraph, the Fund Convention thus more than doubles the maximum amount of funds available for compensation after an incident causing oil pollution damage. Similar to the CLC Convention, claims under the Fund Convention in respect of expenses reasonably incurred or sacrifices reasonably made by the shipowner voluntarily to prevent or minimize pollution damage rank equally with other claims against the Fund.

Finally, a substantial part of the provisions in the Fund Convention are the same as in the CLC Convention. It has, for example, the same geographical scope and time limitations for bringing a claim as the CLC Convention discussed above.[197] Also, the exceptions to the rule of the obligation of the Fund to pay compensation are identical to the rules in the CLC Convention with respect to the obligation of shipowners.[198]

4.2.3 Supplementary Fund Protocol (2003)

Ten years ago, the *Protocol of 2003 to the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1992* (Supplementary Fund Protocol) was adopted by the Parties to the Fund Convention.[199] The *raison d'être* of this Protocol is that its

[190] Article 10 (2), Fund Convention 1992.
[191] Article 12 (2), Fund Convention 1992.
[192] Article 15, Fund Convention 1992.
[193] Article 4 (4), Fund Convention 1992.
[194] Article 4 (1), Fund Convention 1992.
[195] Article III (2), CLC Convention 1992.
[196] Article V (1), CLC Convention 1992.
[197] See articles 3 and 6, Fund Convention 1992.
[198] See article 4 (2) and (3), Fund Convention 1992. For example, the Fund has no obligation to pay compensation in cases where the oil pollution damage was caused intentionally by the victim.
[199] The 2003 Supplementary Fund Protocol has been in force since 3 March 2005; for the Kingdom of the Netherlands, it entered into force on 16 September 2005. It is not as widely ratified throughout the world as the 1992 Conventions, with only 29 State Parties at the moment of writing. However, it is widely ratified by States bordering the North Sea, as can be seen in Figure 2 at the end of this chapter.

drafters had found that the maximum compensation afforded by the Fund Convention could be insufficient to meet compensation needs in certain instances, such as the oil spills stemming from the *Erika* off the coast of France in 1999 and the *Prestige* off the coast of Spain in 2002. To mend this problem, it was considered necessary by a number of Contracting States to make additional funds available for compensation through the creation of a supplementary scheme "to which States may accede if they so wish".[200] The Supplementary Fund is the third and final tier of the three tier system of international oil pollution liability regulation.

The main element of the Supplementary Fund Protocol is, of course, that it provides a supplementary fund for victims who could not be completely compensated under the CLC Convention, nor under the Fund Convention.[201] The Protocol in fact raises the aggregate amount of compensation payable in respect of any one incident from 203 million SDR to a maximum of 750 million SDR.[202] Where the total amount of compensation claimed exceeds the amount of compensation payable under the Supplementary Fund Protocol, the available funds will be distributed proportionally among the claimants.[203]

Compensation is paid by the Supplementary Fund when the Assembly of the Fund has considered that the total amount of the established claims exceeds – or risks to exceed – the aggregate amount of compensation available under the Fund Convention, and that as a consequence the Assembly of the Fund decided that payments will only be made for a proportion of any established claim. The Assembly of the Supplementary Fund subsequently decides whether and to what extent the Supplementary Fund pays the proportion of any established claim not yet paid under the CLC Convention and the Fund Convention.[204]

For a graphic illustration of this final tier of compensation, see the orange surface in Figure 1. As can clearly be seen from the graphic, the Supplementary Fund more than triples the aggregate amount of compensation. This vast financial burden is carried by the contributions of the same persons who contribute to the Fund: persons receiving in excess of 150,000 tons of oil per calendar year.[205] Identical to the Fund, the total amount of contributions to be levied per calendar year by the Supplementary Fund is decided by its Assembly. The Director of the Supplementary Fund subsequently calculates the amount of annual contribution for each person or group of associated persons exceeding the 150,000 ton threshold.[206] Contracting States communicate to the Director who these persons are, so that the Director can establish and keep up to date a list of persons liable to contribute to the Supplementary Fund. Equal to the Fund, if a Contracting State fails to inform the Director properly and this results in a financial loss for the Supplementary Fund, the State in question is liable to compensate it for such a loss.[207] Finally, the geographical scope and the time limitations for bringing a claim are the same as they are in the CLC Convention and the Fund Convention.[208]

4.2.4 Voluntary burden sharing by shipowners: STOPIA 2006 & TOPIA 2006

Shipowners have acknowledged that the three tier system provided by the CLC Convention, the Fund Convention and the Supplementary Fund Protocol puts the burden of compensating oil pollution damage predominantly on oil receivers in the more costly scenarios. In order to ensure the continuing success of this international system, two agreements have been concluded by the shipowners to share the overall cost of claims more equally with the oil receivers: STOPIA 2006 & TOPIA 2006. These agreements are not treaties since they are not concluded between States but between private parties. They are, however, private international agreements to which shipowners legally bind themselves voluntarily.

[200] Preambular paragraph 5, Supplementary Fund Protocol 2003.
[201] Article 4 (1), Supplementary Fund Protocol 2003.
[202] Article 4 (2) (a), Supplementary Fund Protocol 2003.
[203] Article 4 (3), Supplementary Fund Protocol 2003: "the amount available shall be distributed in such a manner that the proportion between any established claim and the amount of compensation actually recovered by the claimant under this Protocol shall be the same for all claimants."
[204] Article 5, Supplementary Fund Protocol 2003.
[205] Article 10 (1), Supplementary Fund Protocol 2003.
[206] Article 11 (2), Supplementary Fund Protocol 2003.
[207] Article 13, Supplementary Fund Protocol 2003.
[208] Articles 3 and 6, Supplementary Fund Protocol 2003.

Under the *Small Tanker Oil Pollution Indemnification Agreement 2006* (STOPIA 2006), the participating shipowners indemnify the previously discussed International Oil Pollution Compensation Fund (the Fund) for a portion of its liability to pay compensation under the Fund Convention. To this effect, a scheme is established which increases the maximum amount payable by owners of small tankers (29,548 tons or less[209]) to 20 million SDR.[210] The small tankers taking part in the scheme need to be insured by a Protection and Indemnity (P&I) Association and reinsured through the pooling arrangements of the International Group of P&I Clubs.[211] Up until 2012, only one incident occurred involving a ship entered in STOPIA 2006, which was the *SOLAR I* spill in the Philippines in 2006.[212]

The *Tanker Oil Pollution Indemnification Agreement 2006* (TOPIA 2006) is very similar to the STOPIA 2006, the primary difference being that under TOPIA the shipowners indemnify not the Fund but the Supplementary Fund. Shipowners falling under the scheme of TOPIA vow to indemnify the Supplementary Fund for 50% of the amount of compensation claimed for oil pollution damage caused.[213] As is the case under STOPIA 2006, oil tankers under the TOPIA 2006 scheme need to be insured by a P&I Association and reinsured through the pooling arrangements of the International Group of P&I Clubs. However, a minimum tonnage is not required; TOPIA applies to relevant oil tankers of all sizes.[214]

4.2.5 Broader scope: the HNS Convention (2010)

In 1996, the *International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea* (hereinafter HNS Convention) was drafted within the framework of the IMO. Its purpose is to ensure adequate, prompt and effective compensation to persons who suffer damage caused by incidents in connection with the carriage by sea of such substances. The term “hazardous and noxious substances" (HNS) encompasses a vast array of substances which includes oil, as follows from the text of the Convention which states the following:

> ""Hazardous and noxious substances" (HNS) means:
> (a) any substances, materials and articles carried on board a ship as cargo, referred to in (i) to (vii) below:
> (i) oils, carried in bulk, as defined in regulation 1 of annex I to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, as amended;
> (…).“[215]

The definition which the HNS Convention refers to is the one used in the MARPOL Convention, which states that oil means “*petroleum in any form including* crude oil, fuel oil, sludge, oil refuse and *refined products*”.[216] This means that unlike the CLC Convention, Fund Convention, and Supplementary Fund Protocol, the HNS Convention applies not only to damage resulting from spills of persistent oil, but also to spills of non-persistent oil. This makes the scope of the HNS Convention much broader than the previously mentioned agreements.

The second aspect in which the HNS Convention has a broader scope than the abovementioned agreements, is that it will provide for the compensation for other types damage than just pollution damage. It defines damage as follows:

> “(a) *loss of life or personal injury* on board or outside the ship carrying the hazardous and noxious substances caused by those substances;
> (b) *loss of or damage to property* outside the ship carrying the hazardous and noxious substances caused by those substances;

[209] Clause III (B), STOPIA 2006.
[210] Clause IV (C), STOPIA 2006.
[211] Clause III (B), STOPIA 2006.
[212] International Oil Pollution Compensation Funds, Annual Report 2012, p. 7. URL: <http://www.iopcfunds.org/uploads/tx_iopcpublications/AR2012_e.pdf> (visited on 23 July 2013).
[213] Clause XVI (C), TOPIA 2006.
[214] Clause XV (B), TOPIA 2006.
[215] Article 1 (5), HNS Convention 2010.
[216] Regulation 1 (1), Annex I, MARPOL Convention. Emphasis added.

(c) *loss or damage by contamination of the environment* caused by the hazardous and noxious substances, provided that compensation for impairment of the environment other than loss of profit from such impairment shall be limited to costs of reasonable measures of reinstatement actually undertaken or to be undertaken; and
(d) the *costs of preventive measures* and further loss or damage caused by preventive measures."[217]

This definition of damage is clearly much broader than the one used in the International Oil Pollution Compensation system discussed above, and should thus provide victims a better means of getting compensation for their damages. To clarify that pollution damage caused by oil remains covered the three tiered system discussed earlier, the HNS Convention stipulates that it will not apply to "pollution damage as defined in the International Convention on Civil Liability for Oil Pollution Damage, 1969, as amended, whether or not compensation is payable in respect of it under that Convention."[218]

Soon after signature of the 1996 HNS Convention it was found that certain elements of the original text led to practical problems that prevented many States from ratifying the Convention, thus inhibiting its entry into force. To address these practical problems, a Protocol was adopted in 2010. The resulting consolidated text is referred to as the HNS Convention 2010. However, the HNS Convention has not entered into force yet due to an insufficient number of ratifications. Reaching a sufficient number now seems to have become a matter of time, however, since the 2010 Protocol has removed the main reasons for not ratifying. We will discuss the HNS Convention in depth in chapter 5 on the transport of liquefied gases, to which it also applies.

4.3 Regulation of safety of oil tankers

4.3.1 SOLAS Convention

We already touched upon the SOLAS Convention in the previous two chapters. We found that it was drafted to provide rules for all ships, but some of the provisions in the Convention are specifically aimed at specific types of ships. With respect to oil tankers,[219] for instance, it provides that every space within the cargo area must be permanently accessible to enable overall and close-up inspections and thickness measurements of the ship's structures.[220] Also, all ships carrying more than 2,000 tons of oil in bulk as cargo must be issued a "certificate of insurance or other financial security in respect of civil liability for oil pollution damage".[221] This certificate attests that insurance or some other financial security is in force, which should be sufficient to cover the liability in case of an oil spill. The certificate is issued by the appropriate authority of the State where the ship is registered, but not before the authority has determined that the requirements of article VII, paragraph 1, of the CLC Convention have been complied with.[222] More recently, a resolution was adopted which dictates that oil tankers as defined in SOLAS must be subject to an enhanced programme of inspections in accordance with the 'Guidelines on the Enhanced Programme of Inspections During Surveys of Bulk Carriers and Oil Tankers'.[223]

As we found in the previous chapters, there are a number of IMO Codes under the SOLAS Convention, which deal with different kinds of ships. However, none of them is dedicated specifically to oil tankers. Instead, more particular safety regulations with respect to oil pollution and oil tankers can be found in the MARPOL Convention.

4.3.2 MARPOL Convention

As mentioned in chapter 2.3.3 of this report, Annex I of the MARPOL Convention provides regulations for the prevention of maritime pollution from oil. The Annex covers not only pollution from the oil which was on board as cargo, but also pollution from oil which served as fuel for the ship or as engine

[217] Article 1 (6), HNS Convention 2010. Emphasis added.
[218] Article 4 (3) (a), HNS Convention 2010.
[219] Regulation II-1/2 (12), SOLAS Convention. The definition of oil tanker in the SOLAS Convention includes not only crude oil tankers, but also tankers carrying non-persistent oils as discussed in section 4.2.1 of this report.
[220] Regulation II-1/3-6 (2), SOLAS Convention.
[221] Clause 6, Annex 2, SOLAS Convention.
[222] Clause 3, Annex 2, SOLAS Convention.
[223] Regulation XI-1/2, SOLAS Convention, in conjunction with IMO Resolution A.744(18), as amended.

lubricant. To that effect, the provisions of Annex I apply not only to oil tankers but to all ships, unless expressly provided otherwise.[224] To prevent such pollution as much as possible, the Annex contains criteria for the design, construction, equipment and operation of ships.

According to Annex I, every oil tanker of 150 gross tonnage and above, and every other ship of 400 gross tonnage and above is subject to surveys. This system is very similar to the system of surveys under the SOLAS Convention and the appurtenant IMO Codes. An initial survey is conducted before the ship is put in service. This survey includes a complete survey of its structure, equipment, systems, fittings, arrangements and material in so far as the ship is covered by this Annex.[225] If the ship passes the survey, it is issued an International Oil Pollution Prevention Certificate.[226] After the initial survey, a thorough renewal survey is conducted at least every five years.[227] In between the renewal surveys there are also less rigorous intermediate and annual surveys to be conducted to ensure that the ship is maintained in good functioning order, as well as additional surveys after every important repair or renewal.[228]

If it is determined through a survey that the condition of the ship or its equipment is such that the ship is not fit to proceed to sea without presenting an unreasonable threat or harm to the marine environment, corrective action and notification of the authorities of the flag State are required. If such corrective action is not taken, the Certificate is withdrawn and the flag State and port State are notified immediately. When applicable, the Government of the port State concerned takes the necessary steps to ensure that the ship does not leave the port.[229]

Besides the aforementioned International Oil Pollution Prevention Certificate, every oil tanker must keep an Oil Record Book. In part II of this record book, an overview must be kept up to date of where, when, and how much oil was loaded and unloaded.[230] Any discharge of oil, for example as a consequence of damage to the ship or an incident, must be mentioned in the Oil Record Book including a description of the circumstances of, and the reasons for, the discharge.[231] With respect to the construction of oil tankers, the MARPOL Convention prescribes, among other things, that large crude oil tankers must be furnished with segregated ballast tanks, a double hull and double bottoms.[232]

4.4 National legislation on oil pollution damage

The Dutch legislator has implemented the CLC Convention into national law in the Oil tanker Liability Act (*Wet Aansprakelijkheid Olietankschepen*).[233] The Act is in essence a translation of the CLC Convention, with the addition of some practical provisions. For instance, the Act dictates that the Court of Rotterdam is exclusively competent to consider claims stemming from the Convention and from the Act.[234] The Court of Rotterdam is also the place to go for shipowners who want to limit their liability for oil pollution damage. Upon such a request, the Court determines the amount to which the liability of the shipowner is limited and orders that a procedure for the distribution of the amount is set into motion.[235]

[224] Regulation 2 (1), Annex I, MARPOL Convention.
[225] Regulation 6 (1) (1), Annex I, MARPOL Convention.
[226] Regulation 7 (1), Annex I, MARPOL Convention.
[227] Regulation 6 (1) (2), Annex I, MARPOL Convention.
[228] Regulation 6 (1) (3 - 5), Annex I, MARPOL Convention.
[229] Regulation 6 (3) (3), Annex I, MARPOL Convention.
[230] Regulation 36 (2) in conjunction with Appendix III, Annex I, MARPOL Convention.
[231] Regulation 36 (4), Annex I, MARPOL Convention.
[232] Regulations 18 - 20, Annex I, MARPOL Convention. Other methods for the design and construction of the oil tanker may be accepted as an alternative to the double bottom and double hull, on the condition that this method ensures at least the same level of protection against oil pollution in case of a collision or stranding. See Regulation 19 (5), Annex I, MARPOL Convention.
[233] Original title: *Wet van 11 juni 1975, tot uitvoering van het op 29 november 1969 te Brussel tot stand gekomen Internationaal Verdrag inzake de wettelijke aansprakelijkheid voor schade door verontreiniging door olie, met Bijlage (Trb. 1970, 196) alsmede regeling van die aansprakelijkheid in overeenstemming met dat Verdrag*, but commonly referred to as *Wet aansprakelijkheid olietankschepen* (Oil tanker Liability Act).
[234] Article 8a, *Wet aansprakelijkheid olietankschepen*.
[235] Article 9 (1), *Wet aansprakelijkheid olietankschepen*.

Furthermore, the Act contains provisions with respect to the issuing and revocation by the Minister of the mandatory certificate proving the financial security of the shipowner.[236] The Act also clarifies that all ships, even those registered in States which are not a Party to the CLC Convention, will have to maintain a financial security covering their liability if they want to enter or leave a Dutch harbour.[237] Enforcement of the obligation to have a certificate on board which proves such financial security is also regulated in the Act.[238] In comparison with the national legislation on liability for nuclear damage, it is interesting to note here that the Dutch legislator has not found it necessary to adopt a higher liability limit than the one internationally prescribed.[239] A reason for this could lie in the fact that the CLC Convention in combination with the Fund Convention and the Supplementary Fund Protocol provide a more realistic chance of covering the actual costs of damage for oil pollution damage than the Conventions on liability for nuclear accidents do for damage caused by nuclear accidents.

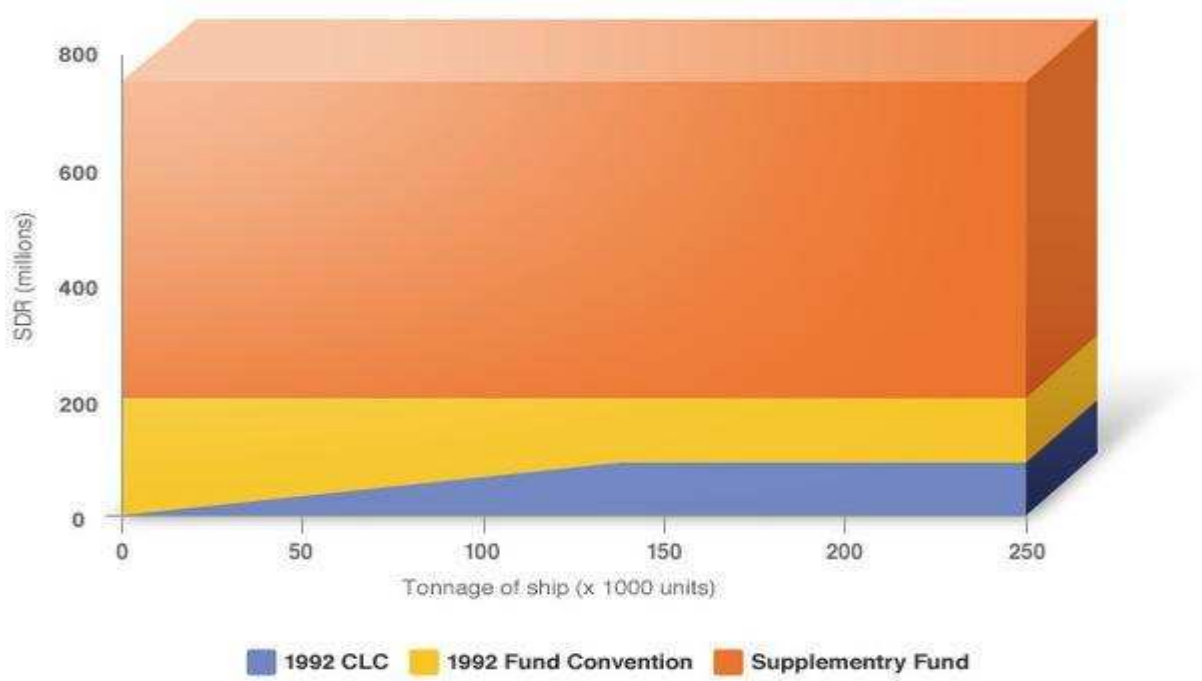
The 1992 Fund Convention and the 2003 Supplementary Fund Protocol have been implemented into national law in the Oil Tanker Fund Act (*Wet Schadefonds Olietankschepen*), which provides a rather straightforward enactment of the Convention and the Protocol on which it is based, with the addition of certain practical provisions.[240] Like the Oil tanker Liability Act, it too appoints the Court of Rotterdam as the competent Court for all disputes arising in relation to this Act.[241] Furthermore, it dictates that the Minister can demand the oil receiving persons to allow inspection of their books and other business records, so that the Minister can effectively fulfil its duty of informing the Director of the Funds. If necessary, inspectors specially assigned by the Minister may obtain access to the necessary information with the help of the police.[242] The Act also provides a more detailed definition of the concept of “associated persons”.[243]

4.5 Closing remarks

Considering the plethora of legislation discussed above, it is clear that the international legislative framework on ship transportation of oil is extensive and complex. With regard to international liability for oil pollution damage, there is a three tiered system which provides a comprehensive and extensive legislative framework, be it only in respect of the States that are party to it. Since the Conventions and the Protocol have differing numbers of State Parties, the applicability of the different regimes will have to be assessed on a case by case basis. Then there are also the private STOPIA 2006 and TOPIA 2006 agreements, which reflect the good intentions of the oil shipping industry to keep the costs of this system as fair and balanced as possible. With regard to the safety of ships carrying oil as cargo, the SOLAS Convention provides the main body of provisions with which ships need to comply while further requirements are set by the MARPOL Convention.

[236] Articles 15-20, *Wet aansprakelijkheid olietankschepen*. The competent Minister under this Act is the Minister of Infrastructure and the Environment.
[237] Article 12, *Wet aansprakelijkheid olietankschepen*.
[238] Articles 22-26, *Wet aansprakelijkheid olietankschepen*.
[239] Article 4 (1), *Wet aansprakelijkheid olietankschepen*. The article refers to the limit set in article V of the CLC Convention and thus the limit under Dutch law is exactly the same as under that Convention. On the contrary, the Nuclear Accidents Act provides for a liability limit which is far larger than the international standard. See chapter 3.
[240] Original title: *Wet van 14 mei 1981, houdende uitvoering van het op 18 december 1971 te Brussel tot stand gekomen Internationaal Verdrag ter oprichting van een internationaal fonds voor vergoeding van schade door verontreiniging door olie (Trb. 1973, 101)*, but commonly referred to as *Wet schadefonds olietankschepen* (Oil Tanker Fund Act).
[241] Articles 2 and 3, *Wet schadefonds olietankschepen*.
[242] Article 7, *Wet schadefonds olietankschepen*. The competent Minister under this Act is the Minister of Economic Affairs.
[243] Article 6, *Wet schadefonds olietankschepen*.

Figure 1: Maximum limits of compensation for oil pollution damage



Source: http://www.iopcfunds.org/about-us/legal-framework/

Figure 2: Ratifications of oil pollution liability conventions in Europe

Source: http://www.gard.no/ikbViewer/Content/72868/CLC%20and%20Fund%20Convention%202012.pdf

Chapter 5 Shipping of liquefied gases: LNG and CO_2

5.1 Introduction

Liquefied Natural Gas (LNG) is shipped across the seas and oceans of our planet in huge amounts. Back in 1959, the *Methane Pioneer* was the first commercial LNG carrier taken into service, capable of carrying 5,000 cubic meters of LNG.[244] Since then, the volume capacity per ship individually as well as the amount of LNG transported by ships collectively has grown steadily. In 2011, the volume of LNG traded reached a new high of 241.5 megaton.[245] At the end of 2012, the total global LNG tanker fleet consisted of 378 vessels and the standard size for LNG ships was around 155,000 cubic meters.[246] Carbon dioxide, on the other hand, is only transported by ship in small amounts for the food and beverage industry. It is envisaged, however, that if large scale offshore permanent storage of CO_2 is deployed in the not so distant future, liquefied CO_2 may be transported in similar amounts and in similar ships as LNG. That is why it makes sense from a comparative point of view to investigate and discuss the regulation of the ship transport of LNG on the one hand with that of CO_2 on the other.

5.2 Regulation of liability for ship transport of LNG and CO_2

In the two previous chapters, we discussed the liability for pollution damage resulting from accidents with, and leakage of, oil and nuclear material during transport at sea. As we have found, their applicable regulation is rather extensive, which can be explained by the severely hazardous direct and indirect consequences which oil and nuclear pollution can have. However, the destructive capacities of both LNG and CO_2 in case of an accident during their shipment by sea are very different. Liquefied gases which stream out of a ship during transport will soon dissipate, whereas oil, for example, will persist due to its buoyant nature until it is either collected or burnt off. On the other hand, a loss of containment of liquefied natural gas during transport will create a risk of fire in the direct vicinity of the leak. In addition, leakage of CO_2 and LNG from a ship will have a detrimental effect on the climate since CO_2 and methane are greenhouse gases. So even though the direct consequences for the environment and society of a loss of containment of these liquefied gases are smaller than what would be the case for a similar incident involving oil or nuclear material, the potential for damage caused by them is significant and thus deserving of international regulation.

5.2.1 HNS Convention 2010[247]

As we already found in chapter 4, the *International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea* was drafted in 1996 within the framework of the IMO to regulate the compensation for accidents involving such substances. The vast array of substances covered by this Convention includes not only oil but also liquefied gases such as LNG and CO_2. This clearly follows from the Convention, which states that the term “hazardous and noxious substances" (HNS) means:

> “(a) any substances, materials and articles carried on board a ship as cargo, referred to in (i) to (vii) below:
> (…)
> (v) liquefied gases as listed in chapter 19 of the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, as amended (…).”[248]

[244] URL: www.total.com (visited on 2 July 2013).
[245] ‘World LNG Report 2011’, International Gas Union (IGU), URL: www.igu.org (visited on 2 July 2013).
[246] ‘The LNG Industry in 2012’, GIIGNL, URL: www.giignl.org (visited on 3 July 2013).
[247] The *International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea* has not entered into force yet. The Kingdom of the Netherlands signed the Convention in 1997 but has not ratified it yet.
[248] Article 1 (5), HNS Convention 2010.

Chapter 19 of the 1993 version of the IGC Code already listed methane, which is what LNG consists of. That edition of the list of products in chapter 19 did not, however, include carbon dioxide. This problem was mended by the IMO's Maritime Safety Committee, which adopted a Resolution in 2006 which added carbon dioxide to the list of substances in chapter 19.[249] Both LNG and liquefied CO_2 are thus covered by the HNS Convention. Soon after signature of the 1996 HNS Convention it was found, however, that certain elements of the original text led to practical problems that prevented many States from ratifying the Convention, thus inhibiting its entry into force. To address these practical problems, a Protocol was adopted in 2010. The resulting consolidated text is referred to as the HNS Convention 2010, the primary elements of which we will discuss below. It is important to note at this point, however, that the HNS Convention has not entered into force yet due to an insufficient number of ratifications. Reaching a sufficient number now seems to have become a matter of time, however, since the 2010 Protocol has removed the main reasons for not ratifying. Since the Convention is expected to have entered into force by the time that large scale ship transport of CO_2 takes place, an extensive discussion of its substance is warranted.

The purpose of the HNS Convention is to ensure adequate, prompt and effective compensation to persons who suffer damage caused by incidents in connection with the carriage by sea of hazardous and noxious substances.[250] In order to achieve this goal, the drafters of the HNS Convention deemed it wise to model it to a large extent on the oil pollution damage regime, more specifically the 1992 CLC Convention and the 1992 Fund Convention.[251] Similarities between the two regimes are evident, as we will find below. What stands out most of all is that the liability system under the HNS Convention 2010 consists of two tiers, similar to the three tiers under the international oil pollution compensation system. The first tier of liability rests on the shipowner, who is liable for the loss or damage up to a certain amount which should be covered by insurance.[252] The second tier of liability is provided by the HNS Fund, which is a compensation fund – filled with contributions from the large receivers of hazardous and noxious substances via ship transport – which provides additional compensation where the first tier proves to be insufficient.[253]

Before we discuss these two tiers, however, it is important to discuss the scope of the concept of damage under the Convention, as well as the geographical scope of application of the Convention. As we found in chapter 4, damage is broadly defined in the HNS Convention 2010 to include loss of life or personal injury on board or outside the ship; loss of or damage to property outside the ship; loss or damage by contamination of the environment; and the costs of preventative measures and further loss or damage caused by them.[254] From a European point of view with respect to the transport of CO_2 for geological storage, it is essential to note here that climate liability, that is the liability under the Emissions Trading Scheme (ETS) for emissions of CO_2, is not covered.[255]

The geographical scope of the HNS Convention is defined in a complex manner. Within the territory of a State Party, which includes its territorial sea, the Convention applies to any of the forms of damage listed in the previous paragraph. In the Exclusive Economic Zone (EEZ) beyond the territorial sea,[256] the Convention only applies to damage by contamination of the environment. In this zone beyond the territorial sea, the Convention only applies to other forms of damage on the condition

[249] IMO Resolution MSC.220(82), adopted 8 December 2006, "Adoption of Amendments to the International Code for the Construction and Equipment of Ships carrying Liquefied Gases in Bulk", Annex, operative paragraph 11.
[250] The HNS Convention clearly stipulates that "carriage by sea" means the period from the time when the substances enter any part of the ship's equipment, on loading, to the time they cease to be present in any part of the ship's equipment, on discharge. If no ship's equipment is used, the period begins and ends respectively when the hazardous and noxious substances cross the ship's rail (see article 1 (9), HNS Convention). A loss of containment at either the onshore loading facility or the offshore injection facility are thus not covered by the HNS Convention.
[251] See chapter 4.2 for a discussion of these Conventions.
[252] Chapter II, HNS Convention 2010.
[253] Chapter III, HNS Convention 2010.
[254] Article 1 (6), HNS Convention 2010. Note that the liability of the shipper towards the receiving party for not delivering (all) the cargo due to a loss of containment is a different liability than the liability for damage caused by the loss of containment. The former falls outside the scope of this report.
[255] See CATO2-Deliverable D4.1.10 entitled "Overview of regulatory uncertainties with regard to offshore CCS" for a more in depth discussion of climate liability.
[256] Or, if a State has not established such a zone, in an area beyond and adjacent to the territorial sea extending not more than 200 nautical miles from the baseline from which the territorial sea is measured. See article 3 (b).

that this damage was caused by a substance carried on board a ship registered in a State Party or legitimately flying the flag of that State.[257]

Example A
Assume that the HNS Convention has entered into force and the Netherlands is a party to it. An incident takes place in the Dutch EEZ, involving a Dutch ship carrying hazardous and noxious substances in bulk. The loss of containment causes damage to persons and damage by contamination of the environment. In accordance with article 3 of the HNS Convention, the Dutch shipowner is liable for both the damage to persons and the damage by contamination of the environment.

Example B
Assume that the HNS Convention has entered into force and the Netherlands is a party to it, but Cambodia is not. An incident takes place in the Dutch EEZ, involving a Cambodian ship carrying hazardous and noxious substances in bulk. The loss of containment causes damage to persons and damage by contamination of the environment. In accordance with article 3 of the HNS Convention, the Cambodian shipowner is not automatically liable for the damage to persons under the HNS Convention, but under that same convention he is liable for the damage by contamination of the environment. This is in line with UNCLOS, which gives coastal States functional jurisdiction in their EEZ with respect to the protection and preservation of the marine environment.[258]

5.2.1.1 The first tier: liability of the shipowner

Under the HNS Convention 2010, the liability for damage caused by a loss of containment is imposed not on the owner of the cargo but on the shipowner. Furthermore, this liability is strict. As we have found in the previous chapters, this means that the owner of the ship that is involved in an incident is liable if there is a causal link with the damage, even if he is not at fault. The fact that there is a causal link between the escaped HNS and the damage that has occurred will be sufficient to establish the liability of the shipowner.[259]

There are, however, as is the case in the previously discussed regimes, situations in which the shipowner is exempt from liability. First of all, this is the case when the loss or damage is a consequence of an act of war, hostilities, civil war, insurrection or a natural phenomenon of an exceptional, inevitable and irresistible character. Secondly, the shipowner is exempted if the damage was caused – either through action or omission – by a third party who had the intent to cause damage. A third exemption applies when the damage occurs as a direct consequence of negligence or wrongful conduct on the part of the national authority responsible for lights and navigational aids, such as lighthouses. The fourth exemption under the HNS Convention applies when the shipper or any other person had failed to inform the shipowner of the hazardous or noxious nature of the cargo before the incident occurred and that this fact caused the damage or led the shipowner not to obtain insurance. This fourth exemption only applies, however, if neither the shipowner, nor his employees knew or reasonably should have known of the hazardous or noxious nature of the cargo.[260] Finally, the shipowner may be exonerated from his obligation to pay compensation to a third party who suffered damages if that damage resulted from an act or omission of that person with the intent to cause damage.[261]

Another element that is clearly based on the nuclear and oil pollution damage regimes is the limitation of liability. A shipowner carrying HNS in bulk may limit his liability for any one incident to an aggregate amount, the total of which depends on the gross tonnage of the ship. For ships under 2000

[257] Article 3 (a), (b), (c), HNS Convention 2010. See also: W. Van der Velde, *De positie van het zeeschip in het internationaal privaatrecht*, Kluwer 2006, p. 232 ff.
[258] Article 56 (1) (b) (iii), UNCLOS.
[259] Article 7 (1), HNS Convention 2010.
[260] Article 7 (2) (a) through (d), HNS Convention 2010.
[261] Article 7 (3), HNS Convention 2010. The definition of "person" in the HNS Convention is rather broad, as it means any individual or partnership or any public or private body, whether corporate or not, including a State or any of its constituent subdivisions. See article 1 (2).

tonnes, that amount is 10 million SDR.[262] The limit of larger ships is increased proportionally for every excess unit of tonnage in two stages, up to a maximum of 100 million SDR.[263] However, if it is proved that the shipowner caused the damage with intent or recklessly and knowing that damage would probably result, the right of limitation of liability is denied.[264]

If an incident occurs which involves his ship and which has resulted in damage, the shipowner will have to constitute a fund for the total sum of his liability. He does this either by depositing the sum or by providing a bank guarantee or some other acceptable guarantee to that amount.[265] If a claim is subsequently brought, the fund will be distributed among the claimants in proportion to the amounts of their established claims.[266] Claims in respect of expenses reasonably incurred or sacrifices reasonably made by the owner voluntarily to prevent or minimize damage rank equally with other claims against the fund.[267] As we found in earlier chapters, this is an important rule which provides an incentive to the shipowner to take efficient preventive measures in case of an incident, since the costs that he incurs in the process will thus, to a certain extent a least, be deductible from his aggregate liability. What is special about the HNS system is, however, that claims in respect of death or personal injury have priority over other claims, such as loss or damage to property or contamination of the environment.[268]

In order to cover his liability, the shipowner is obliged to take out insurance which is sufficient to cover damages up to that limit.[269] In order to prove that he is in compliance with this requirement, the shipowner must have a certificate, issued by the flag State, as evidence of insurance cover. When a ship enters the port or arrives at an offshore facility of a State which is party to the Convention, such a certificate must be on board so that the local authorities can check it. For this matter, it is irrelevant whether the ship is registered in a State which is a party to the Convention or a State which is not.[270]

As is the case in the nuclear and oil pollution compensation regimes discussed earlier, the liability for damage under the HNS Convention is limited in time; the right to compensation under the first tier as well as the second tier is extinguished when an action is not brought thereunder within three years after the date when the person suffering damage knew or ought reasonably to have known of the damage and of the identity of the owner.[271] Since significant amounts of time can lapse between the date of the incident and the date of the damage, the Convention further stipulates that an action can in no case be brought after ten years from the date of the incident which caused the damage.[272]

5.2.1.2 The second tier: the HNS Fund

The second tier of liability for shipping incidents involving HNS is provided by the International Hazardous and Noxious Substances Fund (HNS Fund). This will pay out compensation to victims of such incidents in cases where the total amount of admissible claims exceeds the liability of the shipowner. In addition, the Fund pays out compensation when the shipowner is exonerated from liability or when the shipowner is financially incapable of meeting his obligations.[273] The Fund does not pay out if the damage was caused by an act of war, hostilities, civil war or insurrection, nor when it is proved that the damage resulted from an act or omission done with the intent to cause damage by the person who suffered damages. Unlike under the first tier, however, under this second tier compensation is possible for damage caused by a natural phenomenon of an exceptional, inevitable and irresistible character.[274]

[262] "SDR" stands for Special Drawing Rights. See chapter 3.2 of this report for an explanation of the SDR system.
[263] Article 9 (1), HNS Convention 2010. Between 2,000 and 50,000 tonnes this is 1,500 SDR per unit of tonnage; in excess of 50,000 tonnes this is 360 SDR per unit of tonnage.
[264] Article 9 (2), HNS Convention 2010.
[265] Article 9 (3), HNS Convention 2010.
[266] Article 9 (4), HNS Convention 2010.
[267] Article 9 (8), HNS Convention 2010.
[268] Article 11, HNS Convention 2010.
[269] Article 12 (1), HNS Convention 2010.
[270] Article 12 (2) and in conjunction with article 12 (4) and article 12 (11), HNS Convention 2010.
[271] Article 37 (1) and (2), HNS Convention 2010.
[272] Article 37 (3), HNS Convention 2010. Where this incident consists of a series of occurrences, the ten-year period will run from the date of the last of such occurrences. See article 37 (4), HNS Convention 2010.
[273] Article 13 (1) (a) in conjunction with article 14 (1), HNS Convention 2010.
[274] Article 14 (3) and (4) in conjunction with article 14 (5) (b), HNS Convention 2010.

The HNS Fund has a limit of compensation, which is currently set at 250 million SDR. This amount already includes any compensation paid out under the first tier. If the total amount of legitimate admissible claims exceeds 250 million SDR, the claimants receive compensation proportionately.[275]

As indicated earlier, the Fund is filled with contributions from the persons who have received (large) contributing cargoes of hazardous and noxious substances after ship transport. Unlike the International Oil Pollution Compensation Fund, the HNS Fund consists of not one but four accounts. There is a general account which covers the vast majority of substances covered by the Convention, including CO_2. Separate accounts exist for oil, LNG, and LPG. The reason for this division into four accounts is that the types of substances specified in each account have different safety records and different levels of risk.[276] Each account is funded by contributions from the receivers of the specified substances and there is no cross-subsidization between the accounts.[277] This means that, for example, a large receiver of CO_2 will not have to contribute to the HNS Fund to pay for damages caused by an incident in the ship transport of oil or LNG. The HNS Convention sets thresholds for each account in order to distinguish who is a "large receiver" and who is not. For CO_2 this threshold is 20,000 tons of contributing cargo per year, whereas for LNG any amount of received contributing cargo is enough to qualify as a receiver.[278] The levies subsequently paid by the receivers are in proportion to the quantities of HNS received by that person or associated persons within one calendar year.[279] Interesting to note in this context is that the contributions will only be made after an incident involving the HNS Fund takes place, and the amount levied will depend on how much is required to make the payments.[280]

A peculiar feature of the HNS Convention is that it gives the person who physically receives LNG on behalf of the true titleholder the option to enter into an agreement with that titleholder, which designates that titleholder as the receiver for the purposes of the HNS Fund.[281] This could be relevant for storage companies who have neither the intention nor the means to actually use the LNG. In this context one could think of a company like Vopak, which stores petroleum products in several harbours in the Netherlands for strategic purposes on behalf of others. Importantly, for shipments of CO_2 the HNS Convention does not provide this option of designating the titleholder as the receiver for the purposes of the HNS Fund. As the amounts of CO_2 envisaged to be transported by ship for permanent storage are enormous, this means that the operators of storage sites for CO_2 could be faced with having to make relatively large contributions to the general account of the HNS Fund.

Analogous to the International Oil Pollution Compensation Fund system, State Parties to the HNS Convention are required to inform the Director of the HNS Fund of the name and contact details of the large receivers during the preceding calendar year, as well as of the quantities of HNS received by each of them. If a State fails to deliver the necessary information it will be liable for all financial losses which the HNS Fund suffers as a consequence of that failure.[282]

Finally, the administration of the HNS Fund will be handled by an Assembly, a Secretariat and a Director, similar to the International Oil Pollution Compensation Funds.[283] As we indicated before, however, the HNS Convention 2010 has not yet entered into force due to an insufficient number of ratifications, so the organization and administration as such do not exist yet. The Kingdom of the Netherlands signed the Convention in 1997 but has not ratified it yet due to practical problems stemming from the original text. Since the 2010 Protocol addresses these problems, it is expected that the Kingdom of the Netherlands and other States which had similar objections will ratify the HNS Convention in the near future.

[275] Article 14 (5) and (6), HNS Convention 2010.
[276] Article 16 (1) and (2), HNS Convention 2010.
[277] See also: <http://hnsconvention.org/Pages/Reporting.aspx> (visited on 4 September 2013).
[278] Article 18 (1) and 19 (1*bis*), HNS Convention 2010.
[279] Article 16 (3), (5) and (6) in conjunction with articles 18 and 19, HNS Convention 2010. Associated person means any subsidiary or commonly controlled entity, as determined by the national law of the State concerned.
[280] Article 17, HNS Convention 2010.
[281] Article 19 (1*bis*) (b), HNS Convention 2010.
[282] Article 21 in conjunction with article 21*bis* (1), HNS Convention 2010.
[283] Article 24, HNS Convention 2010.

5.2.2 Convention on Limitation of Liability for Maritime Claims (LLMC)

Until the HNS Convention enters into force, claims which would otherwise fall within its scope will have to be handled on existing national law and, where necessary, private international law.[284] The limitation of the liability for shipping incidents involving LNG or CO_2, however, will, until then, remain covered by the Convention on Limitation of Liability for Maritime Claims (LLMC Convention) that we discussed in Chapter 2.[285] At the moment of writing a shipowner thus has the possibility to limit his liability under the LLMC Convention for any single incident involving a loss of containment of liquefied gas, up to a limit which depends on the tonnage of the ship. As soon as the HNS Convention enters into force for the Kingdom of the Netherlands, owners of ships legitimately flying the Dutch flag can no longer limit their liability for such incidents under the LLMC Convention but will instead be bound by the limits of the HNS Convention. The limits set by the HNS Convention are significantly higher than those currently set by the LLMC, as shown in the scenario below.

Scenario: comparison of the liability limits under the HNS Convention and the LLMC Convention
Consider the same scenario we used in chapter 2.3.1: a carrier of liquefied gas with a gross tonnage of 50,000 tonnes causes personal injury to persons on a boat near the carrier, as well as property damage to that boat.

LLMC Convention:
As we found in the example in chapter 2.3.1, the shipowner may limit his liability with respect to this incident up to 36.4 million SDR for loss of life and personal injury claims, and up to 18.2 million SDR for other claims. The total liability limit is thus 54.6 million SDR.

HNS Convention
Ships exceeding 2,000 gross tonnage can limit their liability up to 10 million SDR, plus 1,500 SDR for every unit of tonnage between 2,000 and 50,000 gross tonnage. Therefore, the total liability limit under the HNS Convention for the owner of a 50,000 gross tonnage gas carrier is:
10 million SDR + (48,000 x 1,500 SDR =) 62 million SDR = 72 million SDR.

As a final remark on this subject, it is interesting to note at this point that the amendment to the limits under the LLMC Convention as mentioned in chapter 2 is expected to enter into force in June 2015. This amendment will increase the financial limits of liability under this Convention by 51%.[286] In the scenario above, this would actually make the liability limit under the LLMC Convention higher than the one under the HNS Convention: 81.9 million under the LLMC Convention versus 72 million under the HNS Convention.

5.3 Safety regulation of LNG- and CO_2-carriers

The importance of safety in the field of transporting carbon dioxide was recently illustrated by a tragic incident in June 2013, when a trucker was killed in the process of offloading his cargo of liquefied carbon dioxide in the harbour of Antwerp. At the time of writing it is still unclear what happened exactly, but liquefied carbon dioxide inadvertently streamed out of the tank and overwhelmed him instantly.[287] A similar incident could happen on board a ship carrying carbon dioxide. Considering the magnitude of the envisaged amounts of carbon dioxide to be transported, it is fair to say that incidents could be much bigger and more consequential than the one in Antwerp. That is why it is necessary to assess what the existing regulatory framework is for the safety of ship transport of carbon dioxide, and

[284] In Dutch civil law, the liability for damage caused by a sea ship is codified in Book 8 of the Dutch Civil Code (article 540 and onwards).
[285] The Kingdom of the Netherlands reserves the right to exclude claims for damage within the meaning of the HNS Convention, in accordance with article 7 of the 1996 Protocol to the LLMC Convention. It has not used this right yet, however, as it wishes for the 1996 Protocol to remain applicable to such claims until the HNS Convention enters into force. The reservation of the Kingdom of the Netherlands to the 1996 Protocol to the LLMC Convention can be found at: <http://www.minbuza.nl/producten-en-diensten/verdragen/zoek-in-de-verdragenbank/1996/5/007428.html> (visited on 23 July 2013).
[286] Annex of Resolution LEG.5(99), *Adoption of amendments of the limitation amounts in the Protocol of 1996 to the Convention on Limitation of Liability for Maritime Claims, 1976*, adopted on 19 April 2012. See *Tractatenblad* 2013, 31.
[287] 'Ter Apeler laat leven in ijskoud gas', Dagblad van het Noorden (15 June 2013), p. 5.

whether this is adequate to deal with the expected increase in size and scale of such transport in the future.

5.3.1 SOLAS Convention

The SOLAS Convention was already discussed at some length in the previous chapters. Apart from general provisions which apply irrespective of the cargo, it also contains some specific regulations with respect to gas carriers. For instance, it provides that every tanker or gas carrier constructed on or after 1 July 1998 has to be provided with the means to enable the crew to gain safe access to the bow even in severe weather conditions.[288] Also, emergency towing arrangements must be fitted at both ends on board every carrier of not less than 20,000 tonnes deadweight.[289] Also, in every tanker or gas carrier of 10,000 gross tonnage and upwards, the main steering gear should comprise two or more identical power units so that steering capability can be regained within 45 seconds after one of them fails.[290]

Part C of Chapter VII of the SOLAS Convention deals specifically with safety requirements with respect to the construction and equipment of ships carrying liquefied gases in bulk. It does not provide any substantive requirements, but rather dictates that a gas carrier needs to comply with the applicable requirements of the Convention as well as with those of the International Gas Carrier Code in particular.[291]

5.3.2 International Gas Carrier (IGC) Code

As we already found in chapter 2, there are a number of IMO Codes under the SOLAS Convention, each dedicated to a different subtheme. One of these Codes is dedicated to the ship transport of liquefied gases in bulk: the *International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* (IGC Code). The Code is mandatory under chapter VII of the SOLAS Convention for gas carriers constructed on or after 1 July 1986.[292]

The preamble of the IGC Code (1993) provides its main purpose:

> "(…) to provide an international standard for the safe carriage by sea in bulk of liquefied gases and certain other substances listed in chapter 19 of the Code, by prescribing the design and construction standards of ships involved in such carriage and the equipment they should carry so as to minimize the risk to the ship, to its crew and to the environment, having regard to the nature of the products involved."[293]

In order to reach that objective, the Code has a broad scope of application. The IGC Code applies to "ships regardless of their size, including those of less than 500 tons gross tonnage, engaged in the carriage of liquefied gases having a vapour pressure exceeding 2.8 bar absolute at a temperature of 37.8°C, and other products as shown in chapter 19, when carried in bulk."[294] As we already found in section 5.2.1 above, chapter 19 of the 1993 version of the IGC Code does indeed list methane, which is what LNG consists of. That list of products in chapter 19 did not, however, include carbon dioxide. This problem was mended by the IMO's Maritime Safety Committee, which adopted a Resolution in 2006 which added carbon dioxide to the list of substances in chapter 19.[295] Even without this amendment, the ships carrying liquefied CO_2 in bulk would in effect be covered by the IGC Code since CO_2 has a vapour pressure exceeding 2.8 bar absolute at a temperature of 37.8°C. In fact, the vapour pressure of CO_2 is already 58.5 bar at 20°C, thus well beyond the minimum provided by the IGC Code.[296]

[288] Regulation II-1/3-3 (2), SOLAS Convention.
[289] Regulation II-1/3-4 (1), SOLAS Convention.
[290] Regulation II-1/29 (15), SOLAS Convention.
[291] Regulation VII/12 in conjunction with regulation VII/13, SOLAS Convention.
[292] Regulation VII/13 (1), SOLAS Convention.
[293] Preamble, IGC Code.
[294] Section 1.1.1, IGC Code. Vapour pressure is the equilibrium pressure of the saturated vapour above the liquid expressed in bars absolute at a specified temperature. See section 1.3.39, IGC Code.
[295] IMO Resolution MSC.220(82), adopted 8 December 2006, "Adoption of Amendments to the International Code for the Construction and Equipment of Ships carrying Liquefied Gases in Bulk", Annex, operative paragraph 11.
[296] See the factsheet on carbon dioxide in the online Gas Encyclopaedia of Air Liquide. URL: <http://encyclopedia.airliquide.com/encyclopedia.asp> (visited on 2 July 2013).

Now that we have established the applicability of the IGC Code to ship transport of LNG and liquefied carbon dioxide in bulk, it is time to look at the substance of the Code. It stipulates that one of the primary obligations of a ship carrying LNG or liquefied CO_2 is to comply with the requirements of the "International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk". In order to receive and retain this certificate, which has to be available on board at all times, the ship is subject to surveys carried out by officers of the government of the flag State in question.[297] An initial survey is carried out before the ship is put into service, which includes a complete examination of its structure, equipment, fittings, arrangements and material in so far as the ship is covered by the Code. If the ship fully complies with the requirements, the aforementioned certificate of fitness is issued. Subsequently, the ship must be subjected to a periodical survey at least every five years – which is the maximum period of validity of the certificate – to ensure that the ship stays compliant. Within that maximum five year interval, the ship has to be subjected to at least one intermediate survey which focuses mainly on the safety equipment. Furthermore, a mandatory annual survey should be carried out, which should include a general examination to ensure that the ship remains in all respects satisfactory for its intended service. Finally, an additional survey can be ordered whenever an incident occurs to a ship or a defect is discovered.[298] If the surveyor determines that the ship or its equipment does not comply substantially with the necessary particulars of the certificate or is not considered fit, corrective action should be taken. If such action is not taken, the certificate is withdrawn and the local authorities are informed.[299]

All ships that are subject to the Code should be able to survive the effects of flooding due to a certain extent of hull damage.[300] Furthermore, the cargo tanks should be protected from penetration in the case of minor damage to the ship, caused for example by contact with a tugboat. To this effect, they need to be located at specified minimum distances inboard from the shell plating of the ship. How large this distance needs to be, depends on the hazard of the gas that is being carried.[301] In recognition of the fact that not all liquefied gases require the same level of safety measures, the Code identifies three different classes of ship. Type 1G ships are the ones which carry very hazardous substances, requiring maximum preventive measures to preclude the escape of such cargo and thus also the maximum prescribed distance between the tanks and the shell plating. Chlorine is an example of this sort of substances. Type 2G ships carry hazardous substances requiring significant preventive measures. Methane (LNG) and butane-propane mixtures (LPG) fall within this category. Finally, type 3G ships carry less hazardous substances requiring moderate preventive measures.[302] Nitrogen falls under this final and least strict category. Carbon dioxide was added to this category through the 2006 Resolution of the IMO's Maritime Safety Committee, as mentioned above. The Code stipulates that for both type 2G and type 3G ships the minimum distance between cargo tanks and the shell plating should be no less than 760 mm.[303]

The Code further discusses a vast array of ship safety issues like segregation of the cargo area, access to spaces in the cargo area, requirements of tanks and piping systems, materials of construction, pressure and temperature control of the cargo, vent systems, fire protection and fire extinction, instrumentation, personnel protection, filling limits for cargo tanks, use of cargo as fuel (e.g. LNG), and operating requirements. It goes beyond the scope of this report to discuss these at length, but it is illustrative for the level of detail of the Code to mention here that even the size and capacity of pressure relief valves is regulated.[304]

[297] Section 1.5.1.1 in conjunction with section 1.5.4.1, IGC Code.
[298] Section 1.5.2.1, IGC Code.
[299] Section 1.5.1.3 in conjunction with section 1.5.4.1, IGC Code.
[300] Section 2.1.1 in conjunction with section 2.5.1, IGC Code.
[301] Section 2.1.1, IGC Code.
[302] Section 2.1.2 in conjunction with chapter 19, IGC Code.
[303] Section 2.6.1, IGC Code. Dispensation may be considered for small ships if alternative measures can be taken which maintain the same degree of safety. See section 2.8.2.
[304] Section 8.5, IGC Code.

5.4 National legislation on ship transport of LNG and CO_2

5.4.1 Act on transport of hazardous substances

The Act on transport of hazardous substances (*Wet vervoer gevaarlijke stoffen*, hereinafter referred to as "the Act" or WVGS) exists since 1995 and aims to provide rules on the transport of such substances in the interest of public safety. With respect to ship transport, the Act is applicable to ships on inland waters,[305] their loading and offloading of hazardous substances in the Dutch territory,[306] and the exploitation of such a ship.[307] Hazardous substances are defined by the act to comprise, inter alia, compressed gasses, liquefied gasses and gasses dissolved under pressure.[308] LNG and CO_2 are thus inherently covered by this Act.

The Act provides a framework for the Dutch legislator to enact legislation under the Act, to further regulate the ship transport of hazardous substances. To that effect, it provides a list of subjects to which those regulations may apply, such as requirements regarding the construction, equipment and facilities of the ships carrying hazardous substances.[309] The Act further gives the Minister the power to designate waterways or parts thereof over which certain designated hazardous substances may not be transported whatsoever.[310] Importantly, it also provides the Minister of Infrastructure and Environment with the general power to derogate from such rules set by means of the Act.[311]

Enforcement of the provisions of the Act and the lower legislation enacted by means of the Act is provided by civil servants appointed by the Minister.[312] To that effect, the Act provides the Minister with the power to impose an administrative order, called a *last onder bestuursdwang*.[313] Finally, the person carrying out the actions covered by the Act is required to inform the Minister as soon as possible of any incident during such activities which endanger or may endanger public safety.[314]

5.4.2 Regulation on transport of hazardous substances by sea ships

Under the abovementioned Act, the Dutch legal system further regulates the ship transport in the national regulation on transport of hazardous substances by sea ships (*Regeling vervoer gevaarlijke stoffen met zeeschepen*, hereinafter referred to as "the Regulation" or RVGZ). The Regulation defines hazardous substances in an expansive way, stating that they are those substances which fall under the requirements of several Annexes of MARPOL and of several IMO Codes, including the IGC Code.[315] Since we established above that LNG and CO_2 are covered by the IGC Code, this means that the Regulation also applies to the transport of these liquefied gases by sea ship. The Regulation in turn provides that the IGC Code is applicable to all the actions to which the Act, as discussed in the previous paragraph, is applicable.[316]

The main provision of the Regulation dictates that activities listed in the Act are, unless provided otherwise, permitted with respect to the transport of hazardous substances by a sea ship in so far as the requirements in the Regulation are complied with.[317] This provision is limited by the geographical scope of the Regulation, which is restricted to the waterways which connect the major Dutch harbours with the sea, as well as to the harbours themselves.[318]

The Regulation provides a number of procedural rules in the field of safety. First of all, it provides that ships carrying liquefied gases covered by the IGC Code should have on board the

[305] Article 2 (1)(a), WVGS.
[306] Article 2 (1)(g), WVGS.
[307] Article 2 (1)(h), WVGS.
[308] Article 1 (1)(b), WVGS.
[309] Article 6 (a), WVGS.
[310] Article 26 (1) in conjunction with article 12 (2), WVGS.
[311] Article 9 (1) in conjunction with article 3 (a), WVGS.
[312] Article 26 (1) in conjunction with article 34 (1), RVGZ.
[313] Article 46, RVGZ.
[314] Article 47, RVGZ.
[315] Article 1 (k), RVGZ. Other IMO Codes listed here include the IMDG Code, the IBC Code and the BCH Code.
[316] Article 15 (1), RVGZ.
[317] Article 3, RVGZ.
[318] Article 2, RVGZ. The harbours that are covered include those of Amsterdam, Rotterdam, Scheveningen, Den Helder, Harlingen, Eemshaven and Delfzijl.

certificates required by that Code at all times, in order to verify that the ship in question complies with the relevant requirements.[319] Secondly, it prescribes that an incoming liquefied gas tanker should ask for permission to anchor or to take berth from the local competent authority[320] at least 24 hours in advance.[321] The local authority should further be informed at least 24 hours in advance of any relocation of that ship within the harbour, as well as of actions like loading and offloading the hazardous cargo. If the local authority so prescribes, the ship will have to ask for permission for these activities.[322] Another procedural point is that a liquefied gas tanker should report to the competent authority as soon as possible any malfunctions which could compromise the safety of the ship or the cargo.[323] Because fire on board a ship carrying hazardous substances can be more dangerous than on regular ships, the Regulation provides explicitly that all measures should be taken to prevent and fight fire. This means taking all the measures that are prescribed by the SOLAS Convention, and for ships flying the Dutch flag also those prescribed by the Dutch Executive Order on Ships (*Schepenbesluit*) of 2004.[324] The Regulation stipulates in this respect, among other things, that there should always be plenty of appropriate fire extinguishers on immediate standby and that activities which may cause a fire hazard may only take place with permission of the local competent authority.[325] An additional issue which the Regulation touches upon is the cleaning of the tanks of the ship. It stipulates that they may in principle only be cleaned or flushed after permission has been granted by the local competent authority, unless local rules provide otherwise.[326] All these procedural rules together put quite a substantial administrative burden upon the captain of the ship, who is responsible for the compliance with the provisions of the Regulation.[327]

Crucially, the Regulation prohibits that certain liquefied gases are transported by ships at all, because they are deemed too dangerous. To this effect, it refers to its Annex 2 which consists of two elements. The first is that it lists three categories of gases which may not be transported, based on three different criteria. The section of the Annex regarding the criteria reads as follows:

> Criteria for liquefied gases which may not be transported.
>
> In this Annex, the following definitions apply:
> *Tcrit*: critical temperature at atmospheric pressure, expressed in degrees Kelvin;
> *Tboil*: boiling point at atmospheric pressure, expressed in degrees Kelvin;
> LC_{50}: LC_{50} inhalation of a rat with 1 hour exposure, expressed in parts per million (ppm).[328]
>
> Liquefied gases to which the following criteria apply, are not transported:
>
> a. Tcrit < 440,
> Tboil < 273, and
> $LC_{50} < 10^3$ ppm;
>
> b. 400 < Tcrit < 440,
> 253 < Tboil < 273 and
> $LC_{50} < 10^4$ ppm;
>
> c. 293 < Tcrit < 400,
> 182 < Tboil < 253, and
> $LC_{50} < 5 .10^5$ ppm.

[319] Article 16, RVGZ.
[320] The local competent authority in a harbour is the harbourmaster. Annex 1 of the RVGZ provides which are the competent authorities in other locations where the Regulation is applicable, such as the Dutch Wadden Sea and the Western Scheldt.
[321] Article 12 (1) in conjunction with article 14, RVGZ. If the journey from the previous harbour takes less than 24 hours, permissions should be requested at least before the ship leaves that harbour.
[322] Article 12 (3) in conjunction with articles 14 and 20, RVGZ.
[323] Article 13 in conjunction with article 14, RVGZ.
[324] Article 8 in conjunction with article 14, RVGZ.
[325] Article 10 in conjunction with article 14, RVGZ.
[326] Article 17, RVGZ.
[327] Article 5, RVGZ.
[328] LC stands for lethal concentration. The concentration of the chemical in air that kills 50% of the test animals in a given time, in this case rats in one hour, is the LC_{50} value.

Secondly, it provides a list of liquefied gases which explicitly fall within these criteria, including hazardous substances such as chlorine, phosphine and phosgene. LNG and carbon dioxide are not on this list, however, so it needs to be assessed whether they fall within any of the three categories of Annex 2.

LNG consists of methane (CH_4), which has a critical temperature of -82.7 °C (190,5 K) and a boiling point of -161.6 °C (111,6 K).[329] Based on these two properties, the only Annex 2-category which it could potentially fall within is (a). An LC_{50} value in the sense of the RVGZ, that is the concentration of a chemical in air which kills fifty per cent of rats in one hour, is much harder to provide. Generally, experiments are conducted with mice, not rats, and LC_{50} values are usually calculated for a four hour period, not one. However, one source provides an LC_{50} value of 500,000 ppm for mice subjected to two hours of exposure.[330] This is far higher than the 1,000 ppm which category (a) of the Annex to the RVGZ prescribes, so LNG does not fall inside one of the three categories and may thus be transported by ship according to the Regulation.

Making this assessment for carbon dioxide is more complex. The critical temperature atmospheric pressure is 31 °C (304,2 K).[331] The other two criteria provide problems, however. First of all, CO_2 does not have a boiling point at atmospheric pressure. This is because carbon dioxide cannot be a liquid at atmospheric pressure; it can only exist in the liquid phase under high pressure. What is does have is a sublimation point at atmospheric pressure of -78.5 °C (194,6 K), meaning that at that temperature it goes from being in the solid phase ("dry ice") to the gas phase without passing through a liquid phase and thus without boiling. It is not clear from the text of the RVGZ whether in this matter the sublimation point should be used for substances like CO_2 which do not have a boiling point at atmospheric pressure. Assuming that this is the case and considering the previously mentioned critical temperature, then, CO_2 could potentially fall within the Annex 2-categories (a) and (c). Whether it does and, if so, within which category depends on the LC_{50} value of CO_2.

Unfortunately, however, also for CO_2 the LC_{50} value is difficult to provide, even more so because the lethality of the air mixture also depends on the amounts of other gases in it. The LC_{50} value is the concentration of a chemical in air that kills 50% of the test animals in a given time. In the RVGZ, the animals in question are rats and the exposure time is one hour, but other institutions may work with values based on experiments done with other animals (e.g. mice) and other exposure periods (e.g. four hours). As a result, there is no universally accepted list of LC_{50} values for chemicals, which in turn means that we will have to assess whether CO_2 falls within categories (a) or (c) in a different manner.

According to the measurements from the observatory on top of the Mauna Loa volcano on Hawaii, which has been taking measurements of CO_2-levels in the atmosphere since 1958, the air we breathe outdoors currently contains around 400 parts per million (400 ppm) CO_2.[332] Indoors, we are exposed to air with CO_2-levels of 1000 ppm and more all the time. For instance, in the Netherlands, the air in a working environment may contain up to 5,000 ppm CO_2, so 1,000 ppm ($LC_{50} < 10^3$ ppm) will have no lethal effect on rats within one hour whatsoever.[333] CO_2 can thus not fall within category (a). However, it can be argued that air which contains just under 500,000 ppm CO_2 ($LC_{50} < 5 \cdot 10^5$ ppm), meaning that is has a CO_2 component of almost fifty per cent, should be plenty to kill a rat within one hour. For instance, the National Institute for Occupational Safety and Health (NIOSH) of the United States of America provides that – according to research dating back to the 1970s – 100,000 ppm CO_2 is the atmospheric concentration immediately dangerous to human life, and that exposure to 100,000 ppm for only a few minutes can cause people to lose consciousness.[334] With this

[329] See the factsheet on methane in the online Gas Encyclopaedia of Air Liquide. URL: <http://encyclopedia.airliquide.com/encyclopedia.asp> (visited on 2 July 2013).
[330] The LC_{50} for mice is 500,000 ppm/2hour. See <http://www.voltaix.com/images/doc/Msc000_Methane.pdf> (visited on 2 July 2013).
[331] See the factsheet on carbon dioxide in the online Gas Encyclopaedia of Air Liquide. URL: <http://encyclopedia.airliquide.com/encyclopedia.asp> (visited on 2 July 2013).
[332] J.H. Butler, 'CO2 at NOAA's Mauna Loa Observatory reaches new milestone: Tops 400 ppm', Earth System Research Laboratory, 10 May 2013. URL: http://www.esrl.noaa.gov (visited on 19 August 2013).
[333] H. Croezen e.a., 'AMESCO: Algemene Milieu Effecten Studie CO2 Opslag – eindrapport', 1 july 2007, p. 101. URL: <www.provinciegroningen.nl> (visited on 19 August 2013).
[334] 'Documentation for Immediately Dangerous To Life or Health Concentrations (IDLHs): Carbon Dioxide', Centers for Disease Control and Prevention, May 1994. URL: http://www.cdc.gov/niosh/idlh/124389.html (visited on 19 August 2013).

in mind, it seems fair to conclude that a concentration of CO_2 which is almost five times as high should be enough to kill fifty per cent of rats in one hour. This is supported by research which shows that instant exposure to air containing almost 300.000 ppm CO_2 is already lethal to mammals.[335] As a consequence, CO_2 could fall within category (c) of Annex 2 to the RVGZ, meaning that liquefied CO_2 may technically be forbidden from transport by sea ship between Dutch harbours and the sea according to the law as it stands today.

This is a peculiar outcome, since the RVGZ aims to ban the transport of gases which are very dangerous. While CO_2 is an asphyxiant, it is by no means as dangerous as other gases explicitly prohibited from transport by Annex 2 to the RVGZ, such as chlorine, phosphine and phosgene.[336] The explanatory memorandum of the RVGZ is silent on why the values that are in the Annex were chosen. The older version of the RVGZ merely provided a limitative list of substances that were prohibited from ship transport, and provided no criteria. As it turns out, the Dutch legislator attempted to prohibit the ship transport of the highly toxic gases falling within the categories GT4 and GT5 as set in a table of the *Systematiek voor indeling van stoffen ten behoeve van risico-berekeningen bij het vervoer van gevaarlijke stoffen* – a national guidance document from 1999 – which provides a systematic categorization of substances for the calculation of risk in the road, rail and ship transport of hazardous substances.[337] The three categories of Annex 2 to the RVGZ are based on that table. However, in the process of transferring the values from that table into three neat categories, the Dutch lawmaker made a mistake with respect to the LC_{50} values. The table in the *Systematiek* provides an LC_{50} value of 50.000 ppm ($5 . 10^4$) as the upper limit for toxic gasses, and not 500.000 ppm ($5 . 10^5$) as codified in category (c) of Annex 2 to the RVGZ.[338] Moreover, the *Systematiek* explicitly lists both gaseous state CO_2 and liquefied CO_2 as not falling within category GT4 or GT5 of the annex to that document, but rather in category GNR, which stands for Gas Not Relevant.[339] It seems, then, that the Dutch legislator inadvertently may have technically prohibited the ship transport of CO_2 from Dutch harbours to the sea by incorrectly adding the discussed criteria to the RVGZ and failing to provide that it only applies to highly toxic gases.

In principle the RVGZ may thus constitute a legal barrier to the shipping of CO_2 from Dutch point sources to storage sites offshore. However, as was mentioned in section 5.4.1 above, the Minister of Infrastructure and Environment has the general power to derogate from prohibitions created in legislation under the Act.[340] This means that in practice, the fact that it could be argued that CO_2 falls in the discussed category (c) of the RVGZ may only be a limited legal barrier as it can easily be set aside if the Minister decides that such derogation is warranted.

5.5 Closing remarks

Whereas ship transport of LNG is already taking place at a large scale, the ship transport of carbon dioxide is still in its infancy. Nonetheless, we have found in this chapter that an international regulatory framework on liability for the loss of containment of liquefied gases during ship transport has already been created by means of the HNS Convention and Protocol, which encompasses not only LNG but also carbon dioxide. This regulatory framework will cover a broad range of claims that can stem from such an incident, including personal injury on board or outside the ship, damage to property outside the ship, and damage by contamination of the environment. However, due to a lack of ratifications, the HNS Convention has not entered into force yet. And even when the HNS does enter into force, the resulting regulatory framework will not be flawless. Most prominently the issue of climate liability remains an outstanding issue, but also the fact that large scale transport of CO_2 was not envisaged by the Convention and that there is thus no separate account for it in the HNS Fund could lead to problems.

[335] See also figure 6.10 in Croezen e.a. 2007, p. 102. This graph provides that air containing almost 30% CO_2 (= 300.000 ppm) is not only lethal to people, but also to mammals, birds, insects and plants.
[336] Annex 2, RVGZ.
[337] *Systematiek voor indeling van stoffen ten behoeve van risico-berekeningen bij het vervoer van gevaarlijke stoffen*, Second edition, AVIV 1999, p. 12 (hereinafter referred to as *Systematiek 1999*).
[338] Systematiek 1999, p. 12.
[339] *Systematiek 1999*, Annex 2. Carbon dioxide has UN number 1013. Liquefied carbon dioxide has UN number 2187.
[340] Article 9 (1) in conjunction with article 3 (a), WVGS.

The international regulatory framework with respect to safety of liquefied gas carriers leaves less to be desired. The SOLAS Convention and the International Gas Carrier Code have been in force for decades and provide detailed regulations with regard to the construction, equipment and safety of the ships involved in shipping liquefied gases in bulk. At the national level, this issue has further been regulated by the WVGS and RVGZ which provide more procedural rules which ships need to comply with within the Dutch territory. A legal barrier may be posed by the RVGZ, the definitions of which could put CO_2 in a category of substances which are prohibited from being transported. Considering the source on which these definitions are based, this seems likely to be an unintentional barrier as CO_2 is not a highly toxic gas. Be that as it may, the Minister of Infrastructure and Environment has the means to derogate from this prohibition, meaning that the legal barrier is expected to be of limited interference to the future large scale rolling out of ship transport of liquefied CO_2. An amendment of the law as it stands today may be welcome, however, in order to prevent unnecessary procedures and paperwork in the future when large scale ship transport of carbon dioxide becomes a reality.

Chapter 6 Analogies, gaps and uncertainties

6.1 Analogies

Having reviewed the issues of liability and safety in ship transport of nuclear materials, oil, LNG and liquefied CO_2, we find that there are certain analogies in their regulation. A hallmark of the regulation of liability for loss of containment in all of the reviewed shipping sectors is strict liability. All four substances discussed are deemed inherently dangerous so that the shipowner, or the sending or receiving installation when it comes to nuclear material, is to be liable for damages caused by an incident during shipping regardless of his fault or negligence, whereas under normal tort law such fault or negligence needs to be established before someone can be held liable for damage. Equally, all the discussed liability regimes contain some sensible exceptions to this rule, such as if the damage was caused by an armed conflict or by the party who suffers the damage. The liable party must have insurance or some other form of financial security in order to be able to fulfil his financial liability, as well as carry a certificate on board the ship as proof of this.

A further common feature of the discussed liability regimes is the limitation of their scope in time and place. This refers to the fact that the right of compensation under the respective regimes expires if an action is not brought within a certain number of years from the date of the incident. It also refers to the fact that the relevant conventions are limited to the territory or jurisdiction of the Contracting States in question, since treaties can only bind States which are Parties to that treaty.

Another analogy that we can identify is that all of the discussed liability regimes allow for limitation of the liability by the primary liable party for damage resulting from a loss of containment during the ship transport. The total amount that needs to be made available for compensation is, however, different for each liability regime. Nonetheless, each of them has a system that spreads the costs over parties who gain the most from the transport in question. As we have found, the shipowner or the sending or receiving installation bears the primary liability, depending on the regime. A supplementary liability is provided, again depending on the regime, by either the (large) receivers of the substance in question or by (a group of) Contracting States. Both the international oil pollution compensation system and the HNS system set up a fund system to provide this secondary liability.

With respect to the safety regulation of ships involved in the transport of the discussed dangerous substances, we have found that the SOLAS Convention provides the backbone of mandatory provisions in this field. More specific safety provisions can be found in the relevant IMO Codes and the MARPOL Convention. A common feature in these is the extensive systems of surveys and inspections by local authorities, which are aimed at ensuring that the safety regulations are upheld.

Finally, it is important to note that all the discussed liability and safety regimes of ship transport are limited in their global application due to the non-universal ratification of the treaties on which they are based. The treaty law principle of ‘consent to be bound’ dictates that States can only be bound by a treaty if they are a party to it. This means that the assessment of which the applicable treaties and regimes to a certain incident are, will have to be done on a case-by-case basis.

6.2 Gaps

As we found in in this report, a peculiar feature of the HNS Convention is that it gives the person who physically receives LNG on behalf of the true titleholder the option to enter into an agreement with that titleholder, which designates that titleholder as the receiver for the purposes of the HNS Fund.[341] This is relevant for storage companies who have neither the intention nor the means to actually use the substance in question. In this context one could think of a company like Vopak, which stores petroleum products in several harbours in the Netherlands for strategic purposes on behalf of others. However, for shipments of CO_2 the HNS Convention does not provide this option of designating the titleholder as the receiver for the purposes of the HNS Fund, even though this could be very relevant. This is particularly so because the amounts of CO_2 envisaged to be transported by ship for permanent

[341] Article 19 (1*bis*) (b), HNS Convention 2010.

storage are significant, meaning that the operators of storage sites for CO_2 could be faced with having to make large contributions to the general account of the HNS Fund.

Similarly, on a national level, we have found that the Nuclear Accidents Act provides for an important exception to the general rule that the liability for the transport of nuclear materials lies with the operator of the nuclear installation on shore. The Act stipulates that, upon request of the transporter and with the consent of the operator of the nuclear installation, the Minister of Finance can decide that, on certain conditions, the transporter will be liable instead of the operator of the nuclear installation.[342] In ship transport of CO_2, it is in the first place the shipowner who is liable and supplementary liability lies with the receivers of CO_2. Since it will usually be the party who captures the CO_2 who has the financial incentive to actually store the CO_2, it can therefore be considered to be a gap that the Minister currently does not have the option to shift the primary liability for ship transport of CO_2 to the capture plant operator instead of the shipowner.

Another potentially relevant feature of the Nuclear Accident Act is that it empowers the Minister of Finance, on certain conditions and upon payment of a premium by the operator, to provide the necessary financial security to the liable nuclear operator in the name of the State. This may for example be the case if that operator cannot attain a sufficient financial security in the market or if it can only be attained at too high a price.[343] This could also be the case in the early stages of large scale ship transport of CO_2, as insurance companies may not be familiar with the risks and potential costs involved. Furthermore, the Nuclear Accidents Act provides for a back-up if a nuclear accident happens and the financial security of the operator turns out not to be sufficient to cover the ensuing damages. In such a scenario, the State may make public funds available to the operator up to the maximum amount of his liability.[344] These issues could be relevant for the ship transport of CO_2 as well. However, the current national legislation does not provide these options to the Minister with respect to the ship transport of CO_2, which could be considered to be a gap in the national legislation.

We also found in this report that with respect to the ship transport of CO_2 for geological storage, climate liability is not covered by the HNS Convention.[345] In Europe, that liability is regulated in the EU Emissions Trading Scheme (ETS), which dictates that "[a]n obligation to surrender allowances shall not arise in respect of emissions verified as captured and transported for permanent storage to a facility for which a permit is in force in accordance with [the CCS] Directive (…)."[346] A problem in this respect is that ship transport was not envisaged in the CCS Directive nor in the updated ETS Directive as a mode of such transport; instead both these Directives as well as the recently adopted European Regulation on Monitoring and Reporting of greenhouse gas emissions are geared towards transport by pipeline.[347] As a consequence, no ETS permit is currently required for ship transporters of CO_2. It is thus unclear who has to hand over ETS emission credits in case of a loss of containment of CO_2 during ship transport towards a permanent storage site. Further clarification is required on this point.

While this report focuses on the regulation of liability and safety during ship transport, it is unclear what regulates liability and safety during injection of CO_2 offshore. This is relevant because there could very well be loss of containment issues during this process, since the process of transferring the liquefied CO_2 is challenging for engineers due to the extremely low temperatures and high pressure under which CO_2 is shipped. Lessons could be learned from the oil sector, where the liability for offshore production in the North Sea has been regulated by the industry on a voluntary basis through the OPOL Agreement.[348] Like the STOPIA 2006 and TOPIA 2006 discussed in chapter 4, the OPOL Agreement is not a treaty but a private agreement concluded between companies on a voluntary basis.[349] The goal of the OPOL Agreement is to provide a means for compensating and reimbursing those persons who sustain pollution damage and public authorities which incur costs for

[342] Article 6, WAKO.
[343] Article 9, WAKO.
[344] Article 10, WAKO.
[345] See CATO2-Deliverable D4.1.10 entitled "Overview of regulatory uncertainties with regard to offshore CCS" for a more in depth discussion of climate liability.
[346] Article 1 (15) (b),Directive 2009/29/EC.
[347] See article 49, Regulation 601/2012; Annex 1, Directive 2009/29/EC; and article 3 (22), Directive 2009/31/EC.
[348] The Offshore Pollution Liability Agreement (OPOL), 4 September 1974. URL: <http://www.opol.org.uk/agreement.htm> (visited on 21 August 2013).
[349] The OPOL Agreement was last updated on 27 June 2013. Parties to the Agreement include BP, Total and Shell. See <http://www.opol.org.uk/downloads/opol-agreement-jun13.pdf> (visited on 21 August 2013).

taking remedial measures to combat a discharge of oil from an offshore facility within the jurisdiction of a "Designated State", provided that this OPOL Agreement is applicable to that offshore facility.[350] Apart from the OPOL Agreement, there is also the Convention on civil liability for oil pollution from seabed minerals.[351] This Convention was drafted with the intention of making it the successor to the OPOL Agreement, but then between States instead of between private parties. Its relevance in this context is purely academic, however, as it has not entered into force and is not expected to do so in the near future. Be that as it may, an analogy might be made with CO_2 in the future; storage site operators might enter into a similar agreement to regulate the liability for the offshore injection and storage of CO_2. So instead of covering exploration for and extraction of oil, such an agreement could deal with injection and (permanent) storage of CO_2.

6.3 Uncertainties

Extensive as the existing legal framework may be, some uncertainties in the field of the regulation of ship transport of carbon dioxide remain. The main uncertainty is the date of entry into force of the HNS Convention. As indicated in this report, the adoption of the 2010 Protocol removed the reservations that many Signatories to the HNS Convention had with respect to ratification, but it remains unclear when it will enter into force. Until then, liability for incidents with shipping of CO_2 will be covered by a patchwork of national law systems, where possible aided by the applicable provisions of Private International Law.

A second uncertainty lies in the structure of the HNS Fund. As we found in this report, separate accounts exist in the HNS Fund for oil, LNG, and LPG, but not for CO_2.[352] As it stands today, contributions to the Fund for received CO_2 will therefore have to be made to the general account of the Fund. When ship transport of CO_2 eventually takes place at the envisaged scale, the transported amounts of CO_2 are expected to be very large in comparison with other substances covered by the general account of the Fund. As a consequence, the large receivers of CO_2 transported by ship are at risk of having to make relatively large contributions to the Fund. It is uncertain whether a separate account will be created for CO_2 in the HNS Fund by the time that large scale ship transport of CO_2 for geological storage becomes a reality.

A third uncertainty lies in the national provisions on transport of dangerous substances that we discussed in the previous chapter. We found that it can be argued that CO_2 falls within category (c) of Annex 2 to the RVGZ, meaning that liquefied CO_2 may technically be forbidden from transport by sea ship between Dutch harbours and the sea according to the law as it stands today. In principle the RVGZ may thus constitute a legal barrier to large scale ship transport of CO_2 from Dutch point sources to storage sites offshore. However, as we have found the Minister of Infrastructure and Environment has the general power to derogate from prohibitions created in legislation under the Act.[353] This means that in practice, the fact that it could be argued that CO_2 falls in the discussed category (c) of the RVGZ may only be a limited legal barrier as it can easily be set aside if the Minister decides that such derogation is warranted. An amendment of the law as it stands today may be preferable, however, since the lawmaker appears to have had no intention to create this potential barrier.

A final uncertainty lies in the fact that large scale ship transport of CO_2 is not taking place yet. As indicated earlier, technical issues are still being worked out with respect to the offshore transfer of the cargo due to complications caused by extreme temperatures and pressure. Also, ships dedicated to the large scale transport of CO_2 are yet to be built.

[350] Preambular paragraph 2, OPOL Agreement. The list of Designated States includes the UK, the Netherlands, Belgium, Denmark, Germany, France and Norway.
[351] The *Convention on civil liability for oil pollution damage resulting from exploration for and exploitation of seabed mineral resources* was signed in 1977 by the Netherlands Germany, Norway, Sweden, the UK, and Ireland. However, none have ratified it, so it is not in force. See <http://www.minbuza.nl/en/key-topics/treaties/search-the-treaty-database/1977/5/000997.html> (visited on 21 August 2013).
[352] Article 16 (1) and (2), HNS Convention 2010.
[353] Article 9 (1) in conjunction with article 3 (a), WVGS.

Chapter 7 Conclusions and recommendations

7.1 Conclusions

This report set out to investigate how the envisaged large scale ship transport of liquefied CO_2 fits into the existing international and Dutch national legal framework with respect to issues of safety of ships, and liability for any loss of containment during such ship transport. To provide the proper context, we first delved into the regulation of ship transport of three other relevant types of dangerous cargo: nuclear materials, oil, and LNG. As a result we managed to identify some valuable analogies, gaps, and uncertainties in the previous chapter. Broadly speaking, we can say that the issues of safety and liability for loss of containment in ship transport of CO_2 are already regulated to a large extent. Especially the international regulatory framework on safety appears quite comprehensive as it stands today. The regulation of liability for damage caused by a loss of containment is less certain. Yes, a comprehensive international legal framework has been created by means of the amended HNS Convention, but as this has not been sufficiently ratified yet it remains ineffective until it enters into force. Indeed, even when it does enter into force, which is expected to happen in the near future, some gaps will remain, most notably the issue of climate liability. While the ship transport of CO_2 through the territorial seas and EEZs is legal and should in principle be tolerated by the respective coastal States, the Dutch lawmaker appears to have inadvertently created a legal barrier to the ship transport from Dutch harbours to the territorial sea by means of the RVGZ. In order to help achieve a smooth and successful implementation of large scale ship transport of CO_2, some recommendations can be made.

7.2 Recommendations

At the international level

- Ratification of the amended HNS Convention should be encouraged, to ensure that it enters into force before the large scale ship transport of CO_2 becomes a reality.

- Before ship transport of CO_2 takes place on a large scale, it should be contemplated whether it is wise and desirable to create a new separate account within the HNS Fund for received CO_2, similar to the separate accounts for oil, LNG and LPG.

- As the amounts of CO_2 envisaged to be transported by ship for permanent storage could become considerable, operators of storage sites for CO_2 could be faced with having to make very large contributions to the HNS Fund. It should therefore be investigated whether the HNS Convention should be amended in order to provide the option of designating the titleholder of the CO_2 as the receiver for the purposes of the HNS Fund.

At the EU level

- Further legislative measures are required to pave the way for the large scale ship transport of CO_2 for permanent storage offshore. To that effect, the EU CCS Directive, the ETS Directive and the Regulation on Monitoring and Reporting of greenhouse gas emissions should be considered for amendment in order to explicitly envisage transport of CO_2 by ship.

- Specifically, it should be clarified if CO_2 transporting ships need to apply for a permit under the EU emissions trading scheme, as is the requirement for CO_2 pipelines. If so, guidelines on an appropriate monitoring and reporting methodology should be outlined, as these already exist for capture, transport and storage components.

- The inclusion, or not, of CO_2 shipping into the EU Emissions Trading Scheme, will establish whether climate liability for a loss of containment of CO_2 during ship transport is applicable.

At the national level

- The RVGZ should be amended to make the ship transport of CO_2 between Dutch harbours and the sea unequivocally legal.

- Since it will usually be the party who captures the CO_2 who has the financial incentive to actually store the CO_2, it should be investigated if it can be made possible for the competent Minister, on certain conditions, to shift the primary liability for ship transport of CO_2 to the capture plant operator instead of the shipowner.[354]

Further research

- It should be investigated how the liability for a loss of containment of CO_2 during the offshore transfer and injection process is regulated. In the North Sea area, a separate liability regime exists for the production of oil offshore. Since the injection of CO_2 is in a way the inverse of the production of hydrocarbons, lessons could be learnt from the oil industry.

[354] The inverse possibility exists under the Nuclear Accidents Act. See chapter 3.4 of this report.

Bibliography

Books

A. Aust, *Handbook of International Law*, Second Edition, CUP Cambridge 2010.

I. Havercroft, R. Macrory & R. Stewart (Eds.), *Carbon Capture and Storage: Emerging Legal and Regulatory Issues*, Hart Publishing Oxford 2011.

J. Kraska, *Maritime Power and the Law of the Sea*, Oxford University Press, 2011.

R. Leféber, *Transboundary Environmental Interference and the Origin of State Liability*, Kluwer Law International 1996.

F.A. Nelissen, *Scheepswrakken en wrakke schepen – Een volkenrechtelijke beschouwing vanuit milieu-perspectief*, T.M.C. Asser, 1997.

M. Roggenkamp & E. Woerdman (Eds.), *Legal Design of Carbon Capture and Storage: Developments in the Netherlands from an International and EU Perspective*, Intersentia Publishers, Antwerp 2009.

P. Sands, *Principles of International Environmental Law*, 2nd edition, CUP Cambridge 2003.

W. Van der Velde, *De positie van het zeeschip in het internationaal privaatrecht*, Kluwer 2006.

R. Wallace and O. Martin-Ortega, *International Law*, Sixth edition, Sweet & Maxwell, London 2009.

S. Zeidan, *State Responsibility and Liability for Environmental Damage Caused by Nuclear Accidents*, Tilburg University Press 2012.

Unknown authors, *Systematiek voor indeling van stoffen ten behoeve van risico-berekeningen bij het vervoer van gevaarlijke stoffen*, Second edition, AVIV, Enschede 1999.

Articles

C. Armeni, 'Legal Developments for Carbon Capture and Storage under the International and Regional Marine Legislation', in I. Havercroft, R. Macrory & R. Stewart (Eds.), *Carbon Capture and Storage: Emerging Legal and Regulatory Issues*, Hart Publishing, Oxford 2011, p. 145-158.

M. Brus, 'Challenging Complexities of CCS in Public International Law', in M. Roggenkamp & E. Woerdman (Eds.), *Legal Design of Carbon Capture and Storage: Developments in the Netherlands from an International and EU Perspective*, Intersentia Publishers, Antwerp 2009.

J.H. Butler, 'CO2 at NOAA's Mauna Loa Observatory reaches new milestone: Tops 400 ppm', *Earth System Research Laboratory*, 10 May 2013. URL: www.esrl.noaa.gov (visited on 19 August 2013).

H. Croezen e.a., 'AMESCO: Algemene Milieu Effecten Studie CO2 Opslag – eindrapport', 1 july 2007. URL: www.provinciegroningen.nl (visited on 19 August 2013).

A. Hoffmann, 'Navigation, Freedom of', in R Wolfrum (ed), *The Max Planck Encyclopedia of Public International Law*, Oxford University Press, 2008-, online edition, [www.mpepil.com], visited on 22 July 2013.

R.A.F. Pedrozo, 'Transport of Nuclear Cargoes at Sea', in *Journal of Maritime Law and Commerce*, Vol. 28, 1997.

A. Raine, 'Transboundary Transportation of CO_2 Associated with Carbon Capture and Storage Projects: An Analysis of Issues under International Law', in *Carbon and Climate Law Review*, Issue 4, 17-12-2008, p. 353-365.

M.M. Roggenkamp, 'Afvang, transport en -opslag van CO2 – een analyse van de keten', in *Nederlands Tijdschrift voor Energierecht*, vol. 5/6, 2011.

C.P. Verwer, 'The Law Applicable to the Continental Shelf and in the Exclusive Economic Zone: The Netherlands Perspective', in *Ocean Yearbook*, vol. 25, Martinus Nijhoff Publishers Leiden (2011).

'The LNG Industry in 2012', GIIGNL. URL: www.giignl.org (visited on 3 July 2013)

'World LNG Report 2011', International Gas Union (IGU), URL: www.igu.org (visited on 2 July 2013).

Treaties

LLMC Convention
Convention on Limitation of Liability for Maritime Claims 1976, London 19 November 1976.

1996 Protocol to the LLMC Convention
Protocol of 1996 to amend the Convention on Limitation of Liability for Maritime Claims, 1976, London 2 May 1996

SOLAS Convention
International Convention for the Safety of Life at Sea, 1974, London 1 November 1974.

MARPOL Convention (MARPOL 73/78)
International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, London 2 November 1973 & 17 February 1978.

Paris Convention
Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982, Paris 29 July 1960.

2004 Protocol to the Paris Convention
Protocol to amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982, Paris 12 February 2004.

Brussels Supplementary Convention
Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, as amended by the additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982, Brussels 31 January 1963.

UNCLOS
United Nations Convention on the Law of the Sea, Montego Bay 10 December 1982.

Vienna Convention
Vienna Convention on Civil Liability for Nuclear Damage, Vienna 21 May 1963.

1997 Protocol to the Vienna Convention
Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage, Vienna 29 September 1997.

Supplementary Compensation Convention
Convention on Supplementary Compensation for Nuclear Damage, Vienna 29 September 1997.

Joint Protocol
Joint Protocol relating to the application of the Vienna Convention and the Paris Convention, Vienna 21 September 1988

Maritime Carriage of Nuclear Material Convention
Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material, Brussels 17 December 1971.

Physical Protection Convention
Convention on the Physical Protection of Nuclear Material, Vienna/New York 3 March 1980

CLC Convention 1969
International Convention on Civil Liability for Oil Pollution Damage, 1969, Brussels 29 November 1969.

CLC Convention 1992
Protocol of 1992 to amend the International Convention on Civil Liability for Oil Pollution Damage, 1969, London 27 November 1992.

Fund Convention 1971
International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Supplementary to the International Convention on Civil Liability for Oil Pollution Damage, 1969), Brussels 18 December 1971.

Fund Convention 1992
Protocol of 1992 to amend the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971, London 27 November 1992.

Supplementary Fund Protocol
Protocol of 2003 to the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1992, London 16 May 2003.

HNS Convention
International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 1996, London 3 May 1996.

2010 Protocol to the HNS Convention
Protocol of 2010 to the International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 1996, London 30 April 2010.

Convention on civil liability for oil pollution from seabed minerals
Convention on civil liability for oil pollution damage resulting from exploration for and exploitation of seabed mineral resources, London 1 May 1977.

IMO Codes

INF Code
Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Waste in Flasks on Board Ships, IMO Assembly Resolution A.748(18) (4 Nov. 1993)

IMDG Code

International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Waste on Board Ships, IMO Assembly Resolution MSC.88(71) (27 May 1999).

IGC Code
International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, IMO Assembly Resolution MSC.5(48) (17 June 1983).

Resolutions
IMO Resolution MSC.220(82), 'Adoption of Amendments to the International Code for the Construction and Equipment of Ships carrying Liquefied Gases in Bulk', adopted 8 December 2006

IMO Resolution LEG.5(99), 'Adoption of amendments of the limitation amounts in the Protocol of 1996 to the Convention on Limitation of Liability for Maritime Claims', 1976, adopted on 19 April 2012.

European law
Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC [2003] OJ L 275/32.

Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community [2009] OJ L 140/63.

Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the Geological Storage of Carbon Dioxide [2009] OJ L 140/114.

Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council [2012] OJ L 181/30.

Private International Agreements
STOPIA 2006
Small Tanker Oil Pollution Indemnification Agreement 2006

TOPIA 2006
Tanker Oil Pollution Indemnification Agreement 2006

OPOL Agreement
Offshore Pollution Liability Agreement, 4 September 1974.

National law
Nuclear Accident Act (WAKO)
Wet van 17 maart 1979, houdende regelen inzake aansprakelijkheid voor schade door kernongevallen, Staatsblad 1979, 225.

Oil tanker Liability Act (*Wet aansprakelijkheid olietankschepen*)
Wet van 11 juni 1975, tot uitvoering van het op 29 november 1969 te Brussel tot stand gekomen Internationaal Verdrag inzake de wettelijke aansprakelijkheid voor schade door verontreiniging door olie, met Bijlage (Trb. 1970, 196) alsmede regeling van die aansprakelijkheid in overeenstemming met dat Verdrag, Staatsblad 1975, 321.

Oil Tanker Fund Act (*Wet schadefonds olietankschepen*)

Wet van 14 mei 1981, houdende uitvoering van het op 18 december 1971 te Brussel tot stand gekomen Internationaal Verdrag ter oprichting van een internationaal fonds voor vergoeding van schade door verontreiniging door olie (Trb. 1973, 101), Staatsblad 1981, 294.

WVGS
Wet van 12 oktober 1995, houdende regels voor het vervoer van gevaarlijke stoffen, Staatsblad 1995, 525.

RVGZ
Regeling vervoer gevaarlijke stoffen met zeeschepen, Staatcourant 2008, 235.

Newspaper Articles

'Alleen Kamp gelooft in CO_2-opslag', Volkskrant (16 July 2013) 18.

'Groningse hoogleraar: CO2 opslag onontkoombaar en onvermijdelijk voor oplossen klimaatprobleem', Groninger Internet Courant (12 August 2013).

'Ter Apeler laat leven in ijskoud gas', Dagblad van het Noorden (15 June 2013) 5.