The UK Liability Framework for the Transport of CO_2 for Offshore CCS Operations

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Abstract

Carbon (dioxide) capture and storage (CCS) is one of the solutions for decarbonising society whereby CO_2 is captured, transported, and injected into geological formations. It can be transported to offshore locations through pipelines or ships. Which method provides for a better deal for investors depends to an extent on the financial risk associated with these two methods, which in turn is linked with exposure to liability. This paper compares the potential liability arising from the carriage of CO_2 by ships and by pipelines in the UK offshore context. The two modes of transport are governed by significantly different regimes, even though they concern the same material. It is argued that the transport of CO_2 by ships and by pipelines poses similar risks and therefore they should have a similar liability regime. This would afford pipeline operators the economic advantages available to shipowners and incentivise investment in the transport phase of CCS.

Keywords

Carbon capture and storage; offshore; transport; ship; pipeline; liability; limitation; insurance

Introduction[1]

Carbon (dioxide) capture and storage (CCS) involves capturing carbon dioxide at power plants and other industrial facilities, compressing, transporting, and injecting it into a suitable geological formation, typically saline aquifers and depleted hydrocarbon reservoirs. The attraction of CCS is that it can contribute to the reduction of greenhouse gas concentrations in the atmosphere and permit a longer phase-out period for fossil fuels, including coal.[2]

The United Nations Framework Convention on Climate Change (UNFCCC)[3] recognises

[1] The authors are grateful to Dr. Johanna Hjalmarsson for her comments and suggestions on the draft of this paper. Part of the research for this paper has been done in the frame of the FP7 ECO_2 project (no 265847). While this article was being written, the UK voted (in June 2016) to leave the European Union. The authors expect that the already acquired European environmental legislation will remain in force in the UK for the immediate future. This article considers the legal framework as applicable in England.

[2] Recent research suggests that if the injections take place in basaltic rocks, mineralisation will occur within two years, eliminating leakage risk, reducing any monitoring program of the storage site, and increasing public acceptance (see: JM Matter, M Stute, SÓ Snæbjörnsdottir, EH Oelkers, SR Gislason, ES Aradottir, B Sigfusson, I Gunnarsson, H Sigurdardottir, E Gunnlaugsson, G Axelsson, HA Alfredsson, D Wolff-Boenisch, K Mesfin, D Fernandez de la Reguera Taya, J Hall, K Dideriksen, WS Broecker, 'Rapid carbon mineralization for permanent disposal of anthropogenic carbon dioxide emissions' (2016) 352(6291) *Science* 1312-1314).

[3] 1992 United Nations Framework Convention on Climate Change (UNFCCC) (New York, 9 May 1992, in force 21 March 1994) 1771 *UNTS* 107 as amended by subsequent protocols.

CCS[4] as a Clean Development Mechanism (CDM)[5] and supports its use.[6] The European Union (EU) is also a promoter of this technology.[7] In order to facilitate the deployment of CCS, a comprehensive legal system has been developed which includes changes in international and regional conventions[8] as well as an EU Directive.[9] Worldwide, large-

[4] FCCC/KP/CMP/2010/12/Add.2, 15 March 2011, at pp.27-29; Also see: FCCC/KP/CMP/2011/10/Add.2, 15 March 2012, at pp.13-30.

[5] "The Clean Development Mechanism (CDM), defined in Article 12 of the [Kyoto] Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO_2, which can be counted towards meeting Kyoto targets." Available at http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php; accessed 15 February 2016.

[6] See the reply of Christiana Figueres, Executive Secretary of the UNFCCC, to the SCCS research group's open letter on the safety of the geological storage of CO_2. Available at http://www.sccs.org.uk/unfccc-reply; accessed 20 January 2016.

[7] See for example: Energy Roadmap 2050, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2011) 885 final, Brussels, 15.12.2011. See also: Commission staff working document - Accompanying document to the Proposal for a Directive of the European Parliament and of the Council on the geological storage of carbon dioxide - Summary impact assessment {COM(2008) 18 final} {SEC(2008) 54}.

[8] 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, (London, 7 November 1996, in force 24 March 2006) 36 *ILM* 7 as amended by Resolution LP.1(1) of 2 November 2012 and Resolution LP.3(4) of 30 October 2009; Convention for the Protection of the Marine Environment of the North-East Atlantic of 1992, (Paris, 22 September 1992, in force 25 March 1998) 2354 *UNTS* 67 as amended by OSPAR Commission, Summary Record OSPAR 2007, OSPAR 07/24/1-E, Annex 6 and OSPAR Commission, Summary Record OSPAR 2007, OSPAR 07/24/1-E, Annex

scale commercial projects already exist and 22 such facilities are expected to be operational by the end of 2017.[10] New developments, such as the adoption of the 2015 Paris Agreement[11] and the findings of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC),[12] are likely to strengthen the place of CCS in the portfolio of measures combating climate change.

CCS is not yet economically viable[13] and is in competition with renewable energy.[14] National energy demands, which determine the timing for the construction of new power

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4 and OSPAR Commission, Summary Record OSPAR 2007, OSPAR 07/24/1-E, Annex 5 amending the OSPAR Convention.

[9] Directive 2009/31/EC (the CCS Directive), OJ L 140, 5.6.2009, pp. 114–135; this has been implemented in the UK through various regulations, notably the Storage of Carbon Dioxide (Amendment of the Energy Act 2008) Regulations 2011/2453, the Storage of Carbon Dioxide (Licensing) Regulations 2010/2221, and the Storage of Carbon Dioxide (Termination of Licences) Regulations 2011/1483.

[10] Global CCS Institute, *The Global Status of CCS: 2015, Summary Report* (Global CCS Institute, Melbourne, 2015) 1-15, at p.1.

[11] FCCC/CP/2015/L.9/Rev.1, 12 December 2015; the Paris Agreement is a key document designed for enhancing the implementation of the UNFCCC by "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C, increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production", and "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development" (Article 2, Paris Agreement, FCCC/CP/2015/10/Add.1). At the time of writing the Paris Agreement is not in force.

[12] IPCC, *Climate Change 2014: Synthesis Report* (IPCC, Geneva, 2014) 1-151.

[13] M Lupion, HJ Herzog, 'NER300: Lessons learned in attempting to secure CCS projects in Europe' (2013) 19 *Int. J. of Greenhouse Gas Control* 19-25.

plants, are also factors affecting CCS development.[15] The remaining uncertainties concern the efficiency of the various capture techniques and their associated emissions, the leakage of CO_2 from storage sites and the potential environmental impacts, as well as the resources required for the development of CCS technology. These considerations drive research in countries which are under pressure to update their national power generation by less polluting methods. Overall, the widespread adoption of this technology is to a large extent dependent on political will[16] and the removal of legal barriers.[17]

Preliminary Considerations

The Transport of CO_2 to Offshore Storage

A part of the overall considerations concerning offshore CCS is the carriage of the CO_2 from the source to the storage reservoir. The offshore carriage of CO_2 is possible both by

[14] P Viebahn, J Nitsch, M Fischedick, A Esken, D Schüwer, N Supersberger, U Zuberbühler, O Edenhofer, 'Comparison of carbon capture and storage with renewable energy technologies regarding structural, economic, and ecological aspects in Germany' (2007) 1(1) *Int. J. of Greenhouse Gas Control* 121-133.

[15] *Ibid.*

[16] See for example: V Scott, S Gilfillan, N Markusson, H Chalmers, RS Haszeldine, 'Last chance for carbon capture and storage' (2013) 3 *Nature Climate Change* 105-111.

[17] See for example: M Lassen, 'Sub-Seabed Storage in the Maritime Zones of the 1982 Law of the Sea Convention: Equitability over Sovereignty?' (2014) 29(3) *International Journal of Marine and Coastal Law* 381-401; D Langlet, 'Exporting CO_2 for Sub-Seabed Storage: The Non-Effective Amendment to the London Dumping Protocol and Its Implications' (2015) 30(3) *International Journal of Marine and Coastal Law* 395-417.

vessels[18] and pipelines.[19] It depends on the particular scenario which arrangement is more economic.[20] Ship transport can rely on the experience gained in the transport of liquefied

[18] There are several studies on the issue. Reviews of the topic can be found in: A Aspelund, MJ Mølnvik, G De Koeijer, 'Ship Transport of CO_2, Technical Solutions and Analysis of Costs, Energy Utilization, Exergy Efficiency and CO_2 Emissions' (2006) 84(A9) *Chemical Engineering Research and Design* 847-855; A Aspelund and T Gundersen, 'A liquefied energy chain for transport and utilization of natural gas for power production with CO_2 capture and storage – Part 1' (2009) 86(6) *Applied Energy* 781-792; J Geske, N Berghout, M van den Broek, 'Cost-effective balance between CO_2 vessel and pipeline transport. Part I – Impact of optimally sized vessels and fleets' (2015) 36 *Int. J. Greenhouse Gas Control* 175-188; J Geske, N Berghout, M van den Broek, 'Cost-effective balance between CO_2 vessel and pipeline transport. Part II – design of multimodal CO_2 transport. The case of the West Mediterranean region' (2015) 33 *Int. J. Greenhouse Gas Control* 122-134; J Jung, 'CO_2 transport strategy and its cost estimation for the offshore CCS in Korea' (2013) 111 *Applied Energy* 1054-1060; S Roussanaly, JP Jakobsen, EH Hognes, AL Brunsvold, 'Benchmarking of CO_2 transport technologies: Part I – Onshore pipeline and shipping between two onshore areas' (2013) 19 *International Journal of Greenhouse Gas Control* 584–594; S Roussanaly, AL Brunsvold, ES Hognes, 'Benchmarking of CO_2 transport technologies: Part II – Offshore pipeline and shipping to an offshore site' (2014) 28 *International Journal of Greenhouse Gas Control* 283-299; BY Yoo, DK Choi, C Huh, SG Kang, IS Kim, 'A feasibility study on CO_2 marine transport in South Korea' (2013) 37 *Energy Procedia* 3199-3211; Chiyoda Corporation for the global CCS Institute, 'Preliminary Feasibility Study on CO_2 Carrier for Ship-based CCS', (2011) October, available at http://hub.globalccsinstitute.com/sites/default/files/publications/24452/preliminary-feasibility-study-co2-carrier-ship-based-ccs.pdf; accessed 16 June 2015; Mitsubishi Heavy Industries for IEA, Ship Transport of CO_2, Report number PH4/30, July 2004; http://www.ieaghg.org/docs/General_Docs/Reports/PH4-30%20Ship%20Transport.pdf; P Brownsort for SCCS, 'Ship transport of CO2 for Enhanced Oil Recovery – Literature Survey', (2015) January, available at http://www.sccs.org.uk/images/expertise/reports/co2-eor-jip/SCCS-CO2-EOR-JIP-WP15-Shipping.pdf; accessed 16 June 2015; IPCC, Special Report on Carbon Dioxide Capture and Storage (Cambridge University Press; Cambridge, United Kingdom and New York, NY, USA; 2005), 1-442, at p.186 available at https://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf; accessed 27 June 2016.

natural gas (LNG) and it offers relatively low costs at the beginning of the operations and when focused on isolated sources.[21] Also, this form of transport may be attractive to countries where pipeline networks are not in place and the amount of CO_2 produced does not justify such development. Thus, it should be considered here what liabilities may arise from the carriage of CO_2 by ship. However, in general, large-scale CCS will require pipeline networks.[22] Just like CCS itself, subsea CO_2 pipelines are an already existing solution. Hammerfest in Norway is connected to the Snøhvit oil field in the Barents Sea by a 160-km offshore pipeline.[23] UK projects opted for this form of transport as well.[24]

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[19] See for example: R Svensson, M Odenberger, F Johnsson, L Strömberg, 'Transportation systems for CO_2—application to carbon capture and storage' (2004) 45(15-16) *Energy Conversion and Management* 2343–2353; IPCC, 2005 (n 18), at pp.190-192; See for example: J Kjärstad, J Morbee, M Odenberger, F Johnsson, E Tzimas, 'Modelling Large-scale CCS Development in Europe Linking Techno-economic Modelling to Transport Infrastructure', (2013) 37 *Energy Procedia* 2941-2948; J Morbee, J Serpa, E Tzimas, 'Optimised deployment of a European CO_2 transport network' (2012) 7 *International Journal of Greenhouse Gas Control* 48-61; F Neele, M Koenen, J van Deurzen, A Seebregts, H Groenenberg, T Thielemann., 'Large-scale CCS transport and storage networks in North-west and Central Europe', (2011) 4 *Energy Procedia* 2740-2747; The transport of carbon dioxide through pipelines for enhanced oil recovery (EOR) is already an important industry in the United States, see Svensson *et al.* (n 19) at p.2346.

[20] See Svensson *et al*. and IPCC, 2005 as at (n 19).

[21] Scott (n 16).

[22] See Kjärstad *et al*., Morbee *et al*., and Neele *et al*. at (n 19).

[23] Parliamentary Office of Science and Technology, 'CO_2 Capture, Transport and Storage' *Postnote* (2009) 335 at pp. 1-4; Available at http://www.parliament.uk/documents/post/postpn335.pdf; accessed 14 February 2016.

[24] The Yorkshire and Humber CCS Project and the Peterhead CCS Project; currently, funding for these two projects have been withdrawn. (D Carrington, 'UK cancels pioneering £1bn carbon capture and storage competition' (2015) 25 November, *The Guardian*; available at

Even though pipelines are a safe mode of carrying substances if maintained with diligence, pipeline leaks and accidents are not uncommon.[25] In this light, it is also apposite to investigate what liabilities pipeline operators may bear in case of a leak or accident and whether carriage on ships could provide a better alternative.

Damage by CO_2 Leakage

The expected consequences of a leakage from an incident on board a CO_2 carrying ship can be identified from the published literature and from relevant incidents. The 2005 IPCC report on CCS stated:

> [Liquid CO_2's] interactions with the sea would be complex: hydrates and ice might form, and temperature differences would induce strong currents. Some of

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http://www.theguardian.com/environment/2015/November/25/uk-cancels-pioneering-1bn-carbon-capture-and-storage-competition; accessed 15 February 2016).

[25] Perhaps the most well-known pipeline leaks are those occurring in Nigeria. For a discussion from a multinational corporation accountability perspective see: DM Ong, 'Regulating environmental responsibility for the multinational oil industry: continuing challenges for international law' (2015) 11(2) *International Journal of the Law in Context* 153-173; The recent pipeline burst on the California coast is another example of pipeline accidents. See P Vercammen and P St Claire, 'Wildlife, pristine beaches focus of 'aggressive' oil spill cleanup' (2015) 21 May *CNN* available at http://edition.cnn.com/2015/05/20/us/california-oil-spill/; accessed 15 February 2016. 21 000 US gallons (79 494 litres) of crude oil were spilled into the Pacific Ocean, affecting marine life and coastal birds. About five times this amount were spilled on the coast. CO_2 pipelines also carry certain risks: see A Oosterkamp and J Ramsen for Polytec, 'State-of-the-Art Overview of CO_2 Pipeline Transport with relevance to offshore Pipelines' (2008) 8 January, Report number: POL-O-2007-138-A; pp. 1-87, at pp.64-65; Available at https://www.researchgate.net/publication/228688545_State-of-the-Art_Overview_of_CO_2_Pipeline_Transport_with_Relevance_to_Offshore_Pipelines; accessed 14 February 2016).

> the gas would dissolve in the sea, but some would be released to the atmosphere. If there were little wind and a temperature inversion, clouds of CO_2 gas might lead to asphyxiation and might stop the ship's engines.[26]

The environmental impact of a CO_2 leakage from sub-seabed storage sites has been investigated.[27] However, shipping incidents have not been considered yet. Thus, it is difficult at this stage to envisage specific examples of environmental and related damage. Oil spills and LNG spill estimations do not provide a good comparison.

> An accident to a liquid CO_2 tanker might release liquefied gas onto the surface of the sea. However, consideration of such an event is a knowledge gap that requires further study. CO_2 releases are anticipated not to have the long-term environmental impacts of crude oil spills. CO_2 would behave differently from LNG, because liquid CO_2 in a tanker is not as cold as LNG but much denser…[28]

A conceivable scenario may be whereby a CO_2 carrier sinks in an environmentally sensitive area and the cargo escapes. The effect of such an event would depend on the depth of the sea, the speed of the escaping gas, the physical and chemical reaction of the gas with the water, and the speed of the currents. It should be noted that due to the novelty of CCS, the currently small scale of CO_2 transport, and the very good safety record of LNG transport (as an analogue), there is no background for detailed examples.

[26] IPCC, 2005 (n 17), at p.189.

[27] See for example the ECO_2 project (FP7, project no. 265847).

[28] IPCC, 2005 (n 17), at pp.188-189.

When in port, people and property may be affected. In 1986 the Lake Nyos disaster claimed 1700 lives when naturally occurring CO_2 at the bottom of the lake escaped.[29] As to the amount, estimates vary between 0.14 km^3 and 1.2 km^3.[30] Even the lower figure is magnitudes larger than the capacity of planned CO_2 carriers.[31] However, in the 2008 Mönchengladbach incident in Germany, the escape of a mere 15 tonnes (approximately 8200 m^3 at 1 atm) of CO_2 from a fire extinguishing installation led to the intoxication of 107 and hospitalisation of 19 people.[32]

The Legal Framework

For environmental damage, the polluter-pays principle[33] is a widely accepted principle for establishing liability.[34] The original principle required states to ensure that

[29] GW Kling, 'The 1986 Lake Nyos Gas Disaster in Cameroon, West Africa' (1987) 286 *Science* 169-175.

[30] See *ibid*. and M Kusakabe, T Ohba, Issa, Y Yoshida, H Satake, T Ohizumi, WC Evans, G Tanyileke, GW Kling, 'Evolution of CO_2 in Lakes Monoun and Nyos, Cameroon, before and during controlled degassing' (2008) 42 *Geochemical Journal* 93-118, at p.115.

[31] Completely escaping CO_2 from a typical vessel (see n 18) would have the volume of approximately 0.0003 km^3 at 1 atm.

[32] See: HSE, Assessment of the major hazard potential of carbon dioxide (CO_2), June 2011; available at: http://www.hse.gov.uk/carboncapture/assets/docs/major-hazard-potential-carbon-dioxide.pdf, p. 4; accessed 23 June 2016.

[33] For a discussion of the principle see: P Sands, J Peel, A Fabra, and R MacKenzie, *Principles of International Environmental Law* (3rd ed., Cambridge University Press, Cambridge, 2012) 1-926, at pp.228-229; see also: SE Gaines, 'The Polluter-Pays Principle: From Economic Equity to Environmental Ethos' (1991) 26 *Texas International Law Journal* 463-496; in the context of CCS in general see: P Bailey, E McCullough, and S Suter, 'Can Governments Ensure Adherence to the Polluter Pays Principle in the Long-term CCS Liability Context?' (2012) 12(2) *Sustainable Development Law & Policy* 46-70; there is extensive literature on the principle, which is not free from criticism, see for example: R Coase, 'The

environmental damage costs are internalised; thus states do not indirectly subsidise polluting practices.[35] However, the principle has been extended, and legally it now provides for the requirement that compensation for pollution incidents is provided by the 'polluter'.[36] Who the 'polluter' is and whether there is only one 'polluter' or whether different parts of an economic sector contribute as 'polluters' is as much a matter of legal principles as of enforcement considerations. For example, in the carriage of persistent oil by sea the legal regime[37] provides for the registered shipowner and his insurer to be the 'polluter' and compensation up to the relevant limitation amounts; the oil industry

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Problem of Social Cost' (1960) 3(1) *Journal of Law & Economics* 1-44, and more recently, D Schmidtchen, J Helstroffer, and C Koboldt, 'Replacing the Polluter Pays Principle by the Cheapest Cost Avoider Principle: On the Efficient Treatment of External Costs' (2015) *Bureau d'économie théorique et appliquée*, Document de Travail n° 2015 – 08.

[34] See for example the 1992 Rio Declaration on Environment and Development (Rio de Janeiro, 14 June 1992) 31 *ILM* 874, Principle 16; Art. 235 of the LOSC imposes similar liability.

[35] The polluter-pays principle first appeared in Recommendation C(72)128, 26 May 1972, of the Organisation for Economic Co-operation and Development (OECD): "The principle to be used for allocating costs of pollution prevention and control measures to encourage rational use of scarce environmental resources and to avoid distortions in international trade and investment is the so-called "Polluter-Pays Principle". This principle means that the polluter should bear the expenses of carrying out the above-mentioned measures decided by public authorities to ensure that the environment is in an acceptable state. In other words, the cost of these measures should be reflected in the cost of goods and services which cause pollution in production and/or consumption. Such measures should not be accompanied by subsidies that would create significant distortions in international trade and investment".

[36] See for example: Principle 16 of the Rio Declaration of 1992 of the United Nations Environment Programme (UNEP); who the polluter is varies between legal frameworks and the liability is not always on a fault basis but may be strict.

[37] See the relevant conventions mentioned at the beginning of the section on the 2010 HNS Convention.

contributes through an intergovernmental organisation, the IOPC Fund, towards damages exceeding the shipowner's limits of liability.

The two transport methods expose the carrier of the CO_2 or the pipeline operator to potential environmental liability, including payment of damages to third parties, which in turn is important in determining the overall financial risk involved in the CCS operation. It can be argued that when the same substance is carried from the same source to the same destination, the environmental liability exposure, as well as the third-party liability arising from leakage, should be the same whether it is carried by sea or through pipelines. However, liability for pipeline accidents is largely a matter of national rules, whereas liability deriving from shipping accidents is a matter of an extensive international legal framework. This paper compares the two modes of transport with respect to liability for the carriage of CO_2 to the storage reservoir. The differences in the liability regimes between the two modes of transport can be informative on how attractive each method is to potential investors, and these differences can also provide an incentive for the development of a uniform liability regime which will not bias CCS development towards one or the other mode of transport by imposing different liability standards.

The article discusses the tortious liability framework for the two transport methods.[38] The liability regime related to transport by sea is considered first. This part discusses the application of the Environmental Liability Directive (ELD)[39] as implemented,[40] the

[38] Contractual considerations fall outside the scope of this article.

[39] Directive 2004/35/EC, OJ L 143, 30.4.2004, pp. 56–75.

[40] See most notably the Environmental Damage (Prevention and Remediation) (England) Regulations 2015/810.

1976/1996 Convention on Limitation of Liability for Maritime Claims (LLMC),[41] and the 2010 International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (2010 HNS Convention).[42] Currently, the ELD as implemented forms part of UK law, as well as the LLMC, whereas the 2010 HNS Convention is a regime which may become applicable in the future. In the following part, the article discusses the UK liability framework as applicable to CO_2 transport by pipelines. Within this part, the operation of the ELD, the European Emission Trading System,[43] and the potential role of the UK pipeline licensing system are considered. Subsequently, a note is made about the oil pipeline liability regimes in the US and Canada. Finally, the resulting legal positions for the competing transport methods are compared.

[41] Convention on Limitation of Liability for Maritime Claims, 1456 *UNTS* 221 (adopted: 19 November 1976, London; in force: 1 December 1986) (1976 LLMC) and its Protocol of 1996 amending the Convention on Limitation of Liability for Maritime Claims of 19 November 1976, 35 *ILM* 1433, (adopted: 2 May 1996, London; in force: 13 May 2004) and also the 2012 Protocol (Resolution LEG.5(99)) to the 1996 Protocol (adopted 19 April 2012, London; in force: 8 June 2015); the 1996 LLMC is implemented in the UK by s. 185 and Part I of Sch. 7 of the Merchant Shipping Act 1995; for a detailed discussion of the LLMC see: BWB Reynolds and MN Tsimplis, Shipowners' Limitation of Liability, (Wolters Kluwer, Alphen aan den Rijn, 2012) 1-454.

[42] The original version of this convention was the 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) 35 *ILM* 1406, which never came into force;it was amended by a protocol (see IMO LEG-CONF.17/DC/1, 29 April 2010) to create the 2010 HNS Convention. The 2010 HNS Convention is also not in force. The authors would like to thank the reviewers for pointing out that the UK has no legislation yet which would enable the implementation of the 2010 HNS Convention.

[43] See most notably Directive 2003/87/EC (OJ L 275, 25.10.2003, pp. 32–46) and Directive (2009/29/EC OJ L 140, 5.6.2009, pp. 63–87). For the UK implementation see most notably the Greenhouse Gas Emissions Trading Scheme Regulations 2012, SI 2012/3038.

Liability for Transport by Ships

A simple scenario for the carriage of CO_2 is considered in this article. An operator (OC) who is the owner of the CO_2 charters a ship directly from the registered shipowner (RSO). The CO_2 is then delivered to an offshore structure (OS) from which the storage operation proceeds. Several legal problems can be envisaged: shipping accidents at the loading or discharge points or *en route* to the offshore structure, involving only the specific ship or other ships; navigational hazards leading to loss of human life or property damage would be the most serious; environmental damage may also be important, although its potential extent is not well documented. The OC will potentially have an interest that operational leakage through ship transport is minimised.[44] Any disputes between the OC and the RSO will be resolved on the agreed charterparty. Specialised arrangements will need to be developed to ensure smooth operations and easy resolution of disputes. Currently, carriage of CO_2 by ship would be subject to existing international legal instruments, including the ELD and provisions on shipowners' limitation of liability. The liability of third parties, e.g., a colliding ship, will generally be covered by tort law and could be subject to the general limitation rights enjoyed by the shipowner. Here we assume that the LLMC as amended by its 1996 Protocol and its amended limits adopted on 19 April 2012 apply.

CO_2 as Dangerous Cargo

CO_2 qualifies as dangerous cargo according to the International Maritime Organization (IMO) classification. Both liquefied[45] and refrigerated-liquefied[46] CO_2 are listed in the

[44] This depends on the contractual arrangements between the owner of the CO_2 and the shipowner, and on the method of calculating the transported CO_2 (not yet ascertained for ships under European legislation).

[45] UN No. 1013.

International Maritime Dangerous Goods Code (IMDG Code) as a non-flammable, non-toxic gas substance.[47] Currently, liability arising from CO_2 transport would be governed by national tort law and the ELD. However, as discussed below,[48] CO_2 may also come under the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code).[49] If so, this may in turn create obligations and liabilities on the parties involved in its carriage under the IMO's[50] 2010 HNS Convention if it comes into force.[51] This would replace the currently applicable tort law and ELD framework.[52] Claims falling under the 2010 HNS Convention would be subject to limitation and therefore it is considered here that the LLMC[53] would not be relevant in this case. However, as long as the 2010 HNS Convention is not in force and the status of CO_2 is not clarified, the ELD's UK implementation will apply to the carriage of CO_2 by ships and the LLMC will be relevant to this form of liability. Thus, below the ELD and the LLMC are considered first, and the 2010 HNS Convention second, as the regime which may prevail in the UK if it comes into force.

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[46] UN No. 2187.

[47] The IMDG Code is compulsory under the Safety of Life at Sea Convention (SOLAS) from 1 January 2004.

[48] See the section on the 2010 HNS Convention.

[49] IMO Resolution MSC.5(48) as amended. The IGC Code is mandatory under Chapter VII of the 1974 International Convention for the Safety of Life at Sea (SOLAS; London, 1 November 1974, in force 25 May 1980, 1184 *UNTS* 2) by virtue of IMO Resolution MSC.6(48).

[50] The International Maritime Organization (IMO) is a "United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships". Source: IMO website; accessed 24 May 2016.

[51] See the section on the 2010 HNS Convention.

[52] Article 7, paras. 4, 5.

[53] See reference at (n 41).

The Environmental Liability Directive

The purpose of the ELD is to prevent or to halt environmental pollution and to remediate environmental damage[54] at the operator's expense on the basis of the polluter-pays principle.[55] The ELD is a public liability instrument. The ELD covers state claims for damage to land, water and damage to protected species and natural habitats,[56] but it does not cover civil liability claims by private parties.[57] Natural or legal persons may request action under the ELD from the competent authority.[58] As it is a Directive, it is not directly applicable and Member States must implement it into their national legislation.[59] Damage to protected species, natural habitats, non-marine waters, and marine waters are covered by the Directive. Damage to non-marine waters is defined with reference to the Water Framework Directive.[60] The Marine Strategy Framework Directive[61] as amended

[54] In brief terms, operators must remediate environmental damage by restoring the affected resources to the state in which they were before the damage occurred, e.g., repopulation of the affected areas with certain fish stocks.

[55] Art. 1, ELD.

[56] Art. 2.1, ELD.

[57] Art. 3.3 and Annex II, ELD.

[58] Art. 12, ELD.

[59] For example: in England it has been implemented by the Environmental Damage (Prevention and Remediation) (England) Regulations 2015/810.

[60] Directive 2000/60/EC, OJ L 327, 22.12.2000, pp. 1–73.; This directive has been implemented in the UK through numerous legislative items whose list can be found in EUR-Lex (http://eur-lex.europa.eu/).

[61] Directive 2008/56/EC, OJ L 164, 25.6.2008, pp. 19–40; for the UK implementation see in particular the Marine Strategy Regulations 2010/1627.

by the Directive on the Safety of Offshore Oil and Gas Operations[62] adds the significant further head of damage, that of damage to marine waters.

The main duties of the operator under the ELD are to take preventive measures where there is an imminent threat of environmental damage[63] and to take remedial measures[64] if damage occurs.[65] If the operator fails to comply and does not take preventive and/or remedial measures, or if he cannot be identified, or if he is not required to bear the costs under the ELD, the competent authority may take these measures itself[66] and where the competent authority takes the required measures, it shall recover the costs from the operator.[67] The ELD permits cost allocation under national law in a case of multiple-party causation.[68] The competent authority has to act within five years from the date on which the remediation measures have been completed or the liable operator has been identified, whichever is later.[69]

[62] Directive 2013/30/EU, OJ L 178, 28.6.2013, pp. 66–106.; For the UK implementation see in particular the Offshore Petroleum Licensing (Offshore Safety Directive) Regulations 2015/385.

[63] Art. 5, ELD.

[64] Remedial measures are defined in Art. 2, para. (11) of the ELD as "any action, or combination of actions, including mitigating or interim measures to restore, rehabilitate or replace damaged natural resources and/or impaired services, or to provide an equivalent alternative to those resources or services as foreseen in Annex II [of the Directive]".

[65] Art. 6, ELD.

[66] Arts. 5(4), 6(3), ELD; in the latter case this is to be done as the last resort.

[67] Art. 8.2, ELD.

[68] Art. 9, ELD.

[69] Art. 10, ELD.

Under the ELD, the operator is strictly liable for the activities listed in Annex III.[70] Transport by ships is included in this annex[71] and refers to, amongst others, the IMDG Code and the IGC Code.[72] As noted above, CO_2 comes under the IMDG Code and it is strongly arguable that it also comes under the IGC Code. Thus, an accident related to the ship transport of CO_2 attracts strict liability under the ELD.[73] The operator's liability does not attach when the accident arises from 'acts of armed conflict, hostilities, civil war or insurrection'; or a 'natural phenomenon of exceptional, inevitable and irresistible character'. The ELD provides four further exemptions with respect to the costs of preventive and remedial measures.[74] Thus, the operator does not have to bear the costs of the preventive or remedial action when he can prove that the environmental damage or imminent threat of such damage was caused by a third party and it occurred despite appropriate safety measures being in place; or when he can prove that the damage or threat of damage resulted from compliance with a compulsory order or instruction emanating from a public authority which was not consequent upon an incident or emission caused by the operator himself.[75] The ELD provides for two defences which the

[70] Art. 3.1(b), ELD; The operator must take preventive measures or must remediate regardless of fault on his part.

[71] See Annex III, para. 8 referring to Directive 93/75/EEC (OJ L 247, 05/10/1993, pp. 19–27). This directive has been repealed by Directive 2002/59/EC (OJ L 208, 05/08/2002, pp. 10–27).

[72] Art. 3, para.(g); Directive 2002/59/EC.

[73] It is arguable that for the purposes of CCS as bulk carriage of CO_2, only the IGC is the relevant instrument for determining whether CO_2 for this form of carriage comes under Annex III. Here, the broader view is taken whereby once a substance is mentioned in one of the definition's instruments, it falls under the definition of 'dangerous goods' of the Directive generally.

[74] Art. 8(3), (4).

[75] Art. 8(3).

Member States can adopt: the 'permit defence' and the 'state-of-the-art' defence.[76] In order to invoke these defences the operator has to prove that he was not at fault or negligent.[77] Whether these exemptions apply to costs only and not also to taking preventive or remedial action has been debated.[78]

[76] Art. 8, para.4, ELD; For example: in the UK the state-of-the-art defence is applicable and certain activities can also evoke the permit defence; see (n 78), source 2, pp. 371-372.

[77] Art. 8, para.4, ELD.

[78] On the basis of the wording of the Directive, the available sources, and practical considerations, it is strongly arguable that the exemptions apply to costs only. The detailed discussion of this point falls beyond the scope of this article. For the background see: BIO Intelligence Service in collaboration with Stevens & Bolton LLP prepared for the European Commission – DG Environment, 'Implementation challenges and obstacles of the Environmental Liability Directive, Final report' (2013) 1-154, at pp. 61-62 in particular, available at http://ec.europa.eu/environment/archives/liability/eld/eldimplement/pdf/ELD%20implementation_Final%20report.pdf; accessed 14 February 2016; in relation to the United Kingdom see: BIO Intelligence Service in collaboration with Stevens & Bolton LLP prepared for European Commission — DG Environment, 'Implementation challenges and obstacles of the Environmental Liability Directive, Annex — Part A: Legal analysis of the national transposing legislation' (2013) 1-386, at pp.369-370, available at http://ec.europa.eu/environment/archives/liability/eld/eldimplement/pdf/ELD%20implementation_Annex%20Part%20A.pdf; accessed 14 February 2016; The summary report from the 2nd ELD stakeholder conference notes: "[i]t was clarified that from a legal point of view [the 'state-of-the-art' and the 'permit' defence] relate only to the costs of remediation but not to the application of the ELD as such – the scope of the ELD stays untouched." (European Commission, 'Evaluating the experience gained in the ELD Implementation, Summary Report' from the 2nd ELD Stakeholder Conference (Brussels, European Commission, 2013) 1-20, at p. 11, available at http://ec.europa.eu/environment/legal/liability/pdf/eld_meetings/11_06_2013/Conference%20Report%20-%20final.pdf; accessed 14 February 2016); a 2014 study on the effectiveness of the ELD understood this to be a clarification from the Commission. However, there is no statement to this effect in the summary

The development of the ELD has provided a common standard between EU Members States but the principles involved, especially with respect to remediation, differ significantly from the basis of the various maritime liability regimes. These latter are based primarily on the strict but limited liability of the registered owner (with some exceptions), including liability in respect of reasonable measures of reinstatement for environmental damage.

The potential conflicts are, however, avoided by the operation of Art. 4(2) of the ELD[79] which excludes from its scope incidents which come under the maritime conventions listed in its Annex IV and are in force in the Member State concerned.[80] Among the excluded conventions is the 2010 HNS Convention, which is thus expected to take over this form of liability from the ELD when it comes into force.[81] This exclusion of maritime conventions has attracted commentary and criticism.[82] Perhaps the best illustration of the coarse seam between shipping law and European environmental law is the European Court of Justice case of *Commune de Mesquer*.[83] In this case, spilled oil cargo mixed with water and sediment was considered as 'waste' bringing it under the

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report. As it appears in the report, it is merely a stakeholder opinion. (BIO Intelligence Service prepared for European Commission – DG Environment, 'ELD Effectiveness: Scope and Exceptions, Final Report' (2014) 1-319, at pp.151-152, available at http://ec.europa.eu/environment/legal/liability/pdf/BIO%20ELD%20Effectiveness_report.pdf; accessed 14 February 2016).

[79] In the UK the provision to the same effect is Art. 7 of the 2015 implementing regulations.

[80] This exclusion also relates to the amendments of the maritime conventions in question.

[81] See the discussion below on the 2010 HNS Convention.

[82] For a starting point on the issues see: (n 78), source 4, sections of 6.1.

[83] Case C-188/07 *Commune de Mesquer v Total France SA and Total International Ltd*; Also see (n 200) and the related text.

then applicable Directive 75/442/EEC[84] on waste, which in turn allowed to avoid the shortcomings of the international oil pollution compensation regime.[85] .

The 1996 Convention on Limitation of Liability for Maritime Claims

The ELD operates without prejudice to the shipowners' rights to limit liability under the 1996 LLMC[86] as amended.[87] Thus, a claim arising under the ELD could be subject to the LLMC's limits.[88]

The term 'shipowners' includes charterers, managers, and operators of the ship, who also have the right to limit liability. Liability insurers also have the same right. Shipowners of ships constructed for the carriage of CO_2 will be entitled to limit their liability under the 1996 LLMC.[89] The shipowners' limitation right is virtually certain,[90] whereas the

[84] OJ L 194, 25.7.1975, pp. 39–41.

[85] See (n 117), (n 118). It is strongly arguable that this judgment was an unwarranted extension of the Waste Directive. See also: L Grellet 'Avoiding International Legal Regimes: the *Erika* Experience' in B Soyer and A Tettenborn (eds), *Pollution at Sea: Law and Liability* (Informa, London, 2013) 141-153

[86] See (n 41).

[87] Art. 4(3), ELD; Art. 7(2) of the 2015 Regulations.

[88] In the meaning of Art. 2 of the LLMC, the limitation of liability applies to claims irrespective of their legal basis.

[89] In the UK the 1996 LLMC applies to sea-going ships and "…any structure (whether completed or in course of completion) launched and intended for use in navigation as a ship or part of a ship" – 1995 MSA, Sch 11, Part II, s.12. The 1996 LLMC expressly excludes floating platforms for the exploration and exploitation of natural resources; however, the UK implementation does not include the particular article; therefore, whether such a structure would be subject to limitation of liability would depend on whether it can be described as a ship under English Law. Thus, for CCS operations it is possible that the platform of discharge may have an independent right to limit liability: 1976 LLMC Art. 15(5).

limitation amount depends on the size of the ship. As liability is limited and known, the shipowner can establish a limitation fund and be free of further liability or legal actions and security measures against his property in respect of these claims.[91] The shipowner can thus avoid multiple litigation and security demands in various jurisdictions, and can continue to trade, leaving the claimants and the court managing the limitation fund to arrange for the appropriate distribution of the claims. Qualifying claims are subject to limitation whether they are enforced by personal action against the owner or other person(s) or against the ship.[92] Loss of life, personal injury, loss of or damage to property claims, as well as consequential losses, are all subject to limitation, provided that they occur either on board or in direct connection with the operation of the ship.

Article 2, para. 1 of the LLMC sets out the claims to which the Convention's limitation applies:

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[90] Under Art. 4 of the 1996 LLMC, the shipowner loses the right to limited liability if the damage is caused by "his personal act or omission, committed with the intent to cause such loss, or recklessly and with knowledge that such loss would probably result." This test is almost impossible to satisfy because it requires the shipowning company to undertake the intentional or reckless act and to have, at the time it commits the act or omission, actual knowledge of the damage that is caused.

[91] 1996 LLMC Arts. 11-13. Persons entitled to limit liability under the 1996 LLMC may bring claims against each other. Their contractual relationship will determine the legal basis of such claims. In the context of ships used for CCS the charterer/operator will be entitled to limit liability for the period the shipowner would have been entitled to limit liability and, in addition, he will be entitled to limit liability against the shipowner in the case where an indemnity claim is raised against it. Note, however, that such a limitation will not include damage caused to the ship. See *The Aegean Sea* [1998] 2 Lloyd's Rep. 39 and the *CMA CGM S.A. v. Classica Shipping Co. Ltd* [2004] 1 Lloyd's Rep. 460.

[92] 1976 LLMC, Art. 1(5).

(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, …

(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.

When CO_2 leaks from a ship, damage may well fall under the above provisions. Regarding para. (a) it can be noted that, being an asphyxiant,[93] CO_2 in large concentrations can suffocate the crew, the crew of another vessel, and people in the

[93] See (n 32).

vicinity.[94] Pressurised CO_2 also carries the risk of explosion, the formation of ice plugs, and frostbite injuries.[95] The effect of a large release of CO_2 at sea is not well understood yet.[96]

Paragraph (b) may cover situations where the shipper of the CO_2 has a contractual agreement for timely delivery to the injection site, or where a storage facility loses business while waiting for the vessel to return and load the next shipment of CO_2.

Paragraph (c) is a particularly broad provision. It includes claims from parties that may have suffered losses not linked to property damage. In the *Aegean Sea*,[97] an oil pollution case, the view of the court was that the loss of use and loss of profit by users of the sea and the coasts were covered by this article. In particular, owners of fishing boats and yachts, fish and shellfish farm owners, local shop owners, local municipalities, local governments, and the coastal State were held to fall in this category. Therefore, it is submitted that claims by third parties arising from the escape of CO_2 from ships will be subject to limitation of liability.

Concerning paras. (d) and (e), contracting states to the LLMC have the possibility to opt out, as for example the UK has done in relation to para. (d).[98] This would exclude wreck removal expenses from limitation of liability. However, costs for removing the cargo

[94] See *ibid*.

[95] IPCC, 2005 (n 17), at pp.390-393; It should be noted that the requirement in para. (a) 'occurring on board or in direct connexion with the operation of the ship' for limitation to be available is crucial; see the cases noted at (n 91).

[96] See text to (n 28).

[97] See (n 91).

[98] Merchant Shipping Act 1995, Sch. 7, Pt. II, para. 3.

remain subject to limitation, because para. (e) is available under the UK implementation. If a ship carrying CO_2 becomes a wreck, then it will also be subject to the 2007 Nairobi Convention on the Removal of Wrecks.[99] Limitation of liability rights are preserved under this convention and therefore the position regarding limitation remains as under the LLMC, i.e., wreck removal claims are not subject to limitation, but cargo removal operations are subject to limitation of liability. However, under the 2007 Nairobi Convention liability is excepted insofar as it would conflict with liability arising under the 2010 HNS Convention.[100] If the 2010 HNS Convention enters into force,[101] it is expected that HNS damages will be exempted from the LLMC, thus leaving the 2010 HNS Convention as the only legal instrument regulating ships carrying HNS cargo.

Finally, in specific scenarios para. (f) may be applicable, where a party who is not remunerated by the party liable (Art.2, para.2) takes measures to avert or minimize loss for which the person liable could limit its liability.[102]

Under the LLMC as amended, the applicable limits are calculated in bands on the basis of the tonnage of the ship as defined under the International Convention on Tonnage

[99] Nairobi International Convention on the Removal of Wrecks (Nairobi, 18 May 2007, in force 14 April 2015) 46 *ILM* 697; this convention has been implemented in the UK by ss.255A – 255U and Schedule 11ZA of the Merchant Shipping Act 1995.

[100] Art. 11.1(b) of the Nairobi Convention.

[101] See the discussion in the first paragraph of the section on the 2010 HNS Convention.

[102] Thus, a contractually engaged salvor by a liable shipowner would not come under this provision (also claims for salvage are exempted from limitation: Art. 3(a)). On the other hand, where salvors are employed by a non-liable party and that party claims damages including the amount paid to the salvors, the amount so claimed would come under the provision in question (see *The Breydon Merchant* [1992] 1 Lloyd's Rep. 373).

Measurement of Ships 1969[103] and depend on the type of claim.[104] A 35,000 m^3 LPG carrier (as an analogy) has an approximate gross tonnage of 23,000.[105] Once the new limits are adopted in the UK,[106] should an accident happen to a vessel of this size leading to personal injury, death, and property damage, the limit with respect to personal injury and death would be 28,388,000 SDR (39,743,200 USD)[107] and 14,194,000 SDR (19,871,600 USD) for property damage.[108] Claims for environmental damage,[109] including those under the ELD, would also come under the part allocated to property damage. However, recovery for environmental damage would only be possible where death/injury claims do not exceed substantially the corresponding part of the limitation fund.

Once a limitation fund has been established in accordance with the rules of the LLMC as amended, any security through the arrest of the ship or attachment of other property or

[103] International Convention on Tonnage Measurement of Ships 1969, (London, 23 June 1969, in force 18 July 1982) 1291 *UNTS* 3; SI 1997/1510 is the latest version adopted under English Law.

[104] The limit for property damage is set at 1.51 m SDR which increases by 604 SDR for every ton between 2,001 and 30,000 tons; above this size 453 SDR is calculated up to 70,000 tons. Above this latter size 302 SDR per ton applies. In cases where there is personal injury or loss of life, the additional applicable limit is 3.02 m SDR increasing by 1208, 906, and 604 SDR as in the case of property claims.

[105] See for example the MT *Gaschem Bremen*. Factsheet available at http://www.hartmann-reederei.de/shared_files/fleet/pdf/ship-info/bremen.pdf; accessed 23 June 2016.

[106] See the 2012 Protocol in (n 41).

[107] The value of 1 SDR at the time of writing is approximately 1.40 USD, see: http://www.imf.org/external/np/fin/data/rms_sdrv.aspx; accessed 28 June 2016.

[108] If the limitation amount for personal injury and death is not sufficient to cover such claims, the limitation amount set for property damage can be used in addition for these claims, sharing in proportion with property claims – 1976/1996 LLMC, Art. 6, para.2.

[109] As it was noted above, the effect of a CO_2 leak at sea is still to be understood.

security in any other form may be released.[110] Thus, when the fund is constituted at the first port of call after an incident[111] or the port of discharge in respect of cargo[112] or the port where the ship is arrested,[113] then the ship or other property or security should be released. In the general CCS scenario there will be no discharge port and discharge will take place at offshore platforms and facilities linked to the storage reservoir.

The LLMC does not require compulsory insurance cover for the claims subject to liability limitation. However, Directive 2009/20/EC,[114] as implemented, on the insurance of shipowners for maritime claims, requires ships flying a Member State flag, or any other flag if the ship is to enter a Member State's port, to have insurance "equal to the relevant maximum amount for the limitation of liability as laid down in the 1996 Convention."[115]

[110] 1976/1996 LLMC, Art. 13.

[111] 1976/1996 LLMC, Art. 13(2)(a), or at the port where the incident happened if it did happen within a port. Presumably the word 'port' denotes the administrative characteristics of the port area rather than the physical location within the breakwaters and docks.

[112] 1976/1996 LLMC, Art. 13(2)(c).

[113] 1976/1996 LLMC, Art. 13(2)(d).

[114] OJ L 131, 28.5.2009, pp. 128–131; implemented in the UK by the Merchant Shipping (Compulsory Insurance of Shipowners for Maritime Claims) Regulations 2012/2267.

[115] *Ibid.*, at Art. 4, para. 3; The value of the Directive seems to be limited. "The International Group of P&I Clubs issued a memorandum [not currently available online] following the issuance of the Directive emphasising that those shipowners who have their P&I insurance with an International Group member will already have had liability insurance in excess of the limits required by the Directive." J Hjalmarsson, 'EU Directive on Maritime Liability Insurance' (2009) 157 *Insurance and Reinsurance Law Briefing* 3-5.

The 2010 HNS Convention: A Future Environmental Liability Regime Also Applicable to CO_2 Transport by Ships?

The 2010 HNS Convention[116] is an amended form of its 1996 version and it is part of the IMO's liability conventions which have emerged after the *Torrey Canyon* oil spill in 1967, along with the International Convention on Civil Liability for Oil Pollution Damage 1969 (now replaced and amended),[117] the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971 (now superseded),[118] the International Convention on Liability for Bunker Oil Pollution Damage 2001;[119] and the LLMC (as amended),[120] which has been discussed above.[121] If

[116] See (n 42).

[117] 1969 International Convention on Civil Liability for Oil Pollution Damage (Brussels, 29 November 1969, in force, 19 June 1975) 973 *UNTS* 3; 1992 Protocol to Amend the 1969 International Convention on Civil Liability for Oil Pollution Damage (London, 11 November 1992, in force 30 May 1996) 1956 *UNTS* 255; the 2000 Amendments (London, 18 October 2000, in force 1 November 2003) Resolution LEG.1(82).

[118] 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Brussels, 18 December 1971, in force 16 October 1978) 1110 *UNTS* 57; 1992 Protocol to Amend the 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (London, 27 November 1992, in force 30 May 1996) 1953 *UNTS* 330; 2000 Protocol (terminating the 1971 Fund) (London, 27 September 2000, in force 27 June 2001) LEG/CONF.11/6, 2003 Protocol (supplementary fund) (London, 16 May 2003, in force 3 March 2005) LEG/CONF.14/20.

[119] 2001 International Convention on Civil Liability for Bunker Oil Pollution Damage (London, 23 March 2001, in force 21 November 2008) [2009] *ATS* 14.

[120] See (n 41).

[121] For the interrelationship and history of these conventions see: C Wu, 'Liability and Compensation for Bunker Pollution' (2002) 33(5) *Journal of Maritime Law and Commerce* 553 – 568, at pp.556-557;

the 2010 HNS Convention comes into force, it will determine liability to third parties for pollution by contamination arising from ship transport, as well as for preventive measures, property damage, personal injury, and loss of life. The 1996 version of this convention never came into force due to the heavy burden of States having to report the vast range of packaged substances, the problem of the identity of the contributor for LNG cargo (titleholder vs. receiver), and the non-submission by States of contributing cargo reports.[122] Although the 2010 Protocol intended to address these issues, States are still reluctant to ratify this treaty. The Council of the EU has in two decisions[123] authorised and requested the Member States to ratify the 2010 HNS Convention. If the European Parliament consents to these decisions and Member States ratify the 2010 HNS Convention by sending the required notifications to the IMO, the Article 46 (Entry into force) requirement of a minimum 12 parties will be satisfied and the Convention will be more likely to come into force thereafter.[124] An additional requirement for the coming

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M Jacobsson 'The HNS Convention and its 2010 Protocol' in B Soyer and A Tettenborn (eds), *Pollution at Sea: Law and Liability* (Informa, London, 2013) 23-55

[122] See in (n 42) *An Overview of the International Convention on Liability and Compensation for Damage in connection with the Carriage of Hazardous and Noxious Substances By Sea, 2010*, para.4 (pp.1-2), unmarked document, available at: http://www.hnsconvention.org/fileadmin/IOPC_Upload/hns/files/HNS%20Convention%20Overview_e.pdf ; accessed 17 August 2016; see also: J Albers, *Responsibility and Liability in the Context of Transboundary Movements of Hazardous Wastes by Sea: Existing Rules and the 1999 Liability Protocol to the Basel Convention* (Springer, Heidelberg, 2014) 1-370, at p.176; for an early discussion see M Göransson, 'The 2010 HNS Convention' (1997) 2 *Uniform Law Review* 249-270.

[123] Council of the European Union, Interinstitutional File: 2015/0135 (NLE), 13806/15, 1 December 2015, and Council of the European Union, Interinstitutional File: 2015/0136 (NLE), 14112/15, 8 December 2015

[124] The requirement that at least four parties must have at least 2 million units of gross tonnage is already satisfied. The current parties are Denmark, Canada, France, Germany, Greece, the Netherlands, Norway

into force of the Convention is that the IMO Secretary-General receives notification of a total of 40 m tonnes of cargo contributing to the general account as by Art. 46, para.1(b). It is unclear at this point whether the 27 Member States by themselves can satisfy this requirement. Also, this poses a very significant reporting burden.[125] It is also unclear whether the ratification process would take place before the UK formally withdraws from the EU and whether the UK would ratify the 2010 HNS Convention nonetheless.

If the 2010 HNS Convention comes into force, it is submitted that the ELD and the LLMC will cease to be applicable to the carriage of HNS cargoes. Therefore, it has to be considered whether CO_2 for the purposes of CCS would be a HNS cargo. As discussed below, what comes under the 2010 HNS Convention is not a closed list, and it is partly a matter of interpretation. Under Article 1, para. 5(a)(iv) of the 2010 HNS Convention, CO_2 is a 'class iv' substance, which is a category for goods in packaged form.[126] CO_2 for the purposes of CCS is unlikely to be carried in packaged form. However, it is mentioned here because the inclusion of packaged CO_2 in the 2010 HNS Convention bolsters the interpretation below whereby CO_2 carried in bulk should come under the Convention as well.[127] Liquefied gases are defined in Article 1, para. 5(a)(v) by reference to Chapter 19

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and Turkey. For tonnage statistics see: https://www.gov.uk/government/statistical-data-sets/fle05-world-fleet-registered-vessels; accessed 24 May 2016.

[125] See: Documents Considered by the European Scrutiny Select Committee on 21 July 2015 at para. 17.24, http://www.publications.parliament.uk/pa/cm201516/cmselect/cmeuleg/342-i/34220.htm; accessed 24 June 2016.

[126] See: 'HNS Finder' at http://www.hnsconvention.org/Pages/FinderOverview.aspx; accessed 25 May 2016.

[127] In other words, if packaged CO_2 has qualities which classify it as dangerous, then bulk CO_2 should also be classified this way. In teleological terms, if it is among the purposes of the Convention to protect from

and Article 1.1.6 of the IGC Code. Chapter 19 of the Code does not list CO_2. However, Article 1.1.6 of the Code provides:

> Where it is proposed to carry products *which may be considered to come within the scope of the Code* but are not at present designated in chapter 19, *the Administrations and the port Administrations involved in such carriage should establish preliminary suitable conditions of carriage based on the principles of the Code* and notify the Organization of such conditions.

Regarding the first italicised part, CO_2 has certain properties which make it dangerous during transport, and when CO_2 is carried in bulk by vessels it is a pressurised cryogenic gas; this creates some of the very risks for which the IGC Code was developed. Thus, first, it can be said independently of the above teleological argument that due to the inherent risks, bulk CO_2 should come under the Code. The previous argument is a reinforcement of this view: that is, the dangerous properties of packaged CO_2 have already been recognised, so bulk CO_2 should also come within the scope of the Code. The third argument for inclusion follows from Article 1.1.1 of the Code:

> [t]he Code applies to ships … engaged in 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.

The vapour pressure exercised by CO_2 at this temperature is above 2.8 bars.[128] Thus, the Code applies to ships which carry CO_2 in bulk. It is only natural that if a ship designed

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the hazards of packaged CO_2, then it is also (or should be) among the Convention's purposes to protect from the hazards of bulk CO_2.

[128] The vapour pressure of CO_2 at 20°C is 58.5 bar, see IPCC, 2005 in (n 18), at p.386.

for the carriage of a certain substance comes under the Code, then the substance itself also should come under the Code.

If this line of thought is accepted, according to the second italicised part, the relevant Administrations are requested by Article 1.1.6 to establish the same conditions for the bulk carriage of CO_2 as for other gases listed in the Code. If (and only if) this has been done, bulk CO_2 would come under the 2010 HNS Convention in the meaning of its Article 1, para. 5(a)(v). Thus, the inclusion of bulk CO_2 into the 2010 HNS Convention depends on its categorisation by the relevant Administrations under the IGC Code. This is an unfortunate solution because it carries the risk of different States categorising CO_2 differently, and consequently CO_2 could come under the IGC Code and the 2010 HNS Convention in one State and be outside it in another. Given the definitional uncertainty, it is strongly submitted that as soon as the carriage of CO_2 in bulk is initiated, CO_2 should be included in Chapter 19 of the Code.

In terms of the scenario set out above, the consequence of the inclusion of CO_2 into the IGC would be that it would then fall under the 2010 HNS Convention and therefore strict liability[129] would be imposed on the RSO in respect of damage and injury arising from the carriage of CO_2. Claimants against the RSO have access to a two-tier system of liability. The first tier is covered by the RSO[130] with liability depending on the size of the

[129] 2010 HNS, Art. 7.

[130] 2010 HNS, Art. 1.3. If there is no registration then persons owning the vessel qualify as owners. For State-owned ships registered by a Company, the Company is the owner. A person includes individuals, legal persons at corporate levels, and States (for the exact wording see Art. 1.2).

ship,[131] and the second tier is covered by an international body, the HNS Fund, with limited liability available to claimants up to a limit which does not depend on the size of the ship.

The 2010 HNS Convention provides compensation for:

a) loss of life and personal injury on board as well as outside the ship[132] caused by the HNS substances, in this case CO_2,

b) property damage outside the ship caused by the hazardous and noxious substance

c) physical damage by contamination to property outside the ship,

d) financial loss arising from damage to the environment,[133]

e) costs for reasonable measures for the reinstatement of the environment[134] and

f) costs of and damage caused by preventive measures.[135]

The carriage of CO_2 as bulk cargo may lead to any of these types of damage where, for example, the vessel chartered from the RSO collides with the OS and the carried gas

[131] 2010 HNS, Art. 1.1 defines a "*ship*" as "*any seagoing vessel and seaborne craft, of any type whatsoever*". Small ships which do not exceed 200 gross tonnage and carry hazardous and noxious substances only in packaged form and are employed in coastal trade within one contracting State or exclusively between two neighbouring States can be excluded from the application of the 2010 HNS Convention (Art. 5, paras. 1, 2). In the case of an exclusion between neighbouring States, both contracting States must agree and make a declaration (Art. 5, paras. 2, 4). These exclusions will not be available for CO_2 carried in bulk.

[132] 2010 HNS. Art. 1.6(a).

[133] 2010 HNS, Art. 1.6(c).

[134] *Ibid.*

[135] 2010 HNS, Art. 1.6(d).

escapes, or where the vessel grounds in a shallow area of the sea, or if it collides with another vessel. In addition, the RSO may be liable for the OC's lost greenhouse gas trading benefit.[136] The damages covered depend on the jurisdictional area in question.[137] In the UK, the recent establishment of the Exclusive Economic Zone[138] means that the 2010 HNS Convention can have full effect if it enters into force, without further legal arrangements in relation to its geographical scope.

The claimant only needs to prove that damage was caused by the CO_2 while it was being carried by the ship. There is no need to prove fault. Liability is exempted if the damage is caused by "*an act of war, hostilities, civil war, insurrection or a natural phenomenon of exceptional, inevitable and irresistible nature*";[139] where the damage was wholly caused by an act of a third party with intention to cause damage,[140] and where damage was wholly caused by negligent acts by a government or authority in respect of maintaining navigational aids.[141] The owner also escapes liability where it was not informed by the shipper of the dangerous and noxious nature of the cargo and that lack of information caused, at least partly, the damage or led to a failure to obtain the compulsory insurance required by Art. 9 of the 2010 HNS Convention.[142] In a CCS carriage scenario, this

[136] See (n 44).

[137] See Table 1.

[138] Exclusive Economic Zone Order 2013/3161.

[139] 2010 HNS, Art. 7.2(a).

[140] 2010 HNS, Art. 7.2(b).

[141] 2010 HNS, Art. 7.2(c).

[142] 2010 HNS, Art. 7.2(d).

exception could become relevant where the CO_2 loaded on board contains additional hazardous[143] components.[144]

The RSO can only be sued under the 2010 HNS Convention[145] and the same protection is given to the owner's servants or agents, pilots, charterers of all types (like the OC in the present scenario), the manager and operator of the ship, salvors and others involved in preventive measures, and the servants and agents of these entities.[146] In other words, once the 2010 HNS Convention comes into force, claims under common law and national legislation cannot be brought against these entities. In a CCS scenario, this channelling provision will protect charterers from claims in negligence. However, the 2010 HNS Convention only covers the period when the cargo is on board. Damage that occurs before or after this period (e.g., while waiting in storage tanks in port) is not covered, even if the cargo is in the possession of the RSO or a charterer, as in the present scenario. Once in force, HNS damage will be covered by the compulsory insurance of the RSO[147]

[143] The applicable criteria for the degree of purity of the CO_2 stream are set out under Art. 12 of Directive 2009/31/EC; Holwerda considers that there is little scope for imposing more stringent criteria. (M Holwerda, 'Deploying Carbon Capture and Storage 'Safely': The Scope for Member States of the EU to Adopt More Stringent CO_2 Stream-Purity Criteria Under EU Law' (2011) 2(1) *Climate Law* 37-61).

[144] 2010 HNS, Art. 7.3. The owner may also avoid liability, partly or fully, where it can prove that acts or omissions by the victim of the incident with intent to cause damage, or the victim's negligence, contributed to the victim's damage.

[145] 2010 HNS, Art.7.4.

[146] 2010 HNS, Art. 7.5. However, the protection is removed if "the damage resulted from their personal act or omission, committed with the intent to cause such damage, or recklessly and with knowledge that such damage would probably result".

[147] Art. 12.1, an insurance certificate is required (Art. 12.2) and has to be carried on board (Art. 12.4), otherwise the vessel will not be permitted to trade (Art. 12.10).

and direct action against the insurer.[148] Thus, the use of ships for the transport of CO_2 ensures that liability for accidents is covered by the RSO and his insurer.

The liability of the owner and its insurer for incidents[149] is limited.[150] The limits are set on the basis of the tonnage of the vessel and the cargo's form rather than on the amount of hazardous and noxious substances actually carried. For example, if the ship in the scenario above was a 35,000 gt bulk CO_2 carrier, the total limit would be 59,500,000 SDR (83,300,000 USD).[151] The right to limit liability is very similar to that applicable under the LLMC and therefore it is also virtually unbreakable. For the owner to benefit from limited liability, a limitation fund should be established[152] in any of the competent courts or authorities to the amount corresponding to the size of their vessel under Art. 9.1.[153]

[148] 2010 HNS, Art. 12.8.

[149] 'Incident' is defined as "any occurrence or series of occurrences having the same origin which causes damage or creates a grave and imminent threat of causing damage", Art. 1.8. Thus the 2010 HNS would not only apply where damage has occurred but also where damage is threatened. However, the terms '*grave and imminent*' restrict the application of the Convention to preventive measures in cases of major threats. However, such restrictions do not apply where damage has occurred even where the extent of the damage is small.

[150] 2010 HNS, Art. 9.

[151] The limit for the first 2000 units of tonnage is 10 m SDR. Between this and 50,000 units, the limit is 1,500 SDR per unit of tonnage, and 360 SDR apply above 50,000 units of tonnage. The total limit shall not exceed 100 m SDR in any event.

[152] 2010 HNS, Art. 9.3.

[153] 2010 HNS, Art. 9.2; The competent courts under the Convention are those defined in Art. 38.

The second tier of compensation comes from the HNS Fund. The HNS Fund provides compensation up to 250,000,000 SDR[154] (approx. 351m USD) inclusive of any compensation already provided by the owner under the 2010 HNS Convention. The HNS Fund will provide compensation in cases covered by the convention and where either:

- the damages exceed the owner's limit of liability,[155] or
- the owner and his insurer are financially incapable of covering their part of liability,[156] or
- the owner is exempted from liability under the 2010 HNS Convention.[157]

The HNS Fund is only exempted from liability where the damage was caused by war, hostilities, insurrections etc., or where the damage was caused by ships excluded from the application of the 2010 HNS Convention.[158] The circumstances in which a vessel can be excluded from the 2010 HNS Convention are narrow and unlikely to apply to CO_2 transport for the purposes of CCS.[159] If the CO_2 transport scenario above involved loss of life, personal injury, property damage, and environmental damage, loss of life and personal injury claims would be paid first, within the first two-thirds of the fund,[160] and

[154] 2010 HNS, Art. 14.5.

[155] 2010 HNS, Art. 14.1(c).

[156] 2010 HNS, Art. 14.1(b).

[157] 2010 HNS, Art. 14.1(a).

[158] 2010 HNS, Art. 14.3; However, the 2010 HNS Fund provides for the burden of proving the exemption.

[159] 2010 HNS, Art. 5; an exclusion can be made if the vessel is smaller than 200 gt, and it carries hazardous and noxious substances only in packaged form, and the voyage takes place within one State or two neighbouring States agreeing on this exclusion.

[160] 2010 HNS, Art. 11.

the residual third would be distributed *pro-rata* between any unpaid loss of life and personal injury claims, and all other property, environmental damage and preventive measure claims.

The HNS Fund is financially supported by contributions from traders or importers of the various hazardous and noxious substances. The 2010 HNS Convention provides for the creation of a general account divided into sectors[161] and, in addition, an oil account,[162] an LNG account,[163] and an LPG account.[164] The reason for the various separate accounts appears to be the unwillingness of the various sectors to cross-subsidise damages. Thus, relatively safe sectors, like the LNG sector, lobbied and achieved the creation of separate accounts.[165] However, for the system to work, each account needs to be sustainable: that is, there should be sufficient contribution[166] for the account to be capable of compensating accidents arising from contributing cargo.

In line with the 2010 Protocol, packaged CO_2 is not contributing cargo. However, if bulk CO_2 will come under the 2010 HNS Convention as described above, then in principle,

[161] Art. 16.1.

[162] Art. 16.2(a), with oil as defined in Art. 1.5(a)(1).

[163] Art. 16.2(b), liquefied natural gases of light hydrocarbons with methane as the main constituent.

[164] Art. 16.2(c), liquefied petroleum gases of light hydrocarbons with propane and butane as the main components.

[165] See: M Göransson, 'The HNS Convention' (1997) 2 *Uniform Law Review* 249-270, at pp. 265-266; P Wetterstein, 'Carriage of Hazardous Cargoes by Sea–The 2010 HNS Convention' (1997) 26(3) *Georgia Journal of International and Comparative Law* 595-614, at pp. 608-609.

[166] This provided an obstacle for the ratification of the 1996 HNS, which never came into force and is now unlikely to do so, and was one of the controversial issues of the 2010 Protocol.

bulk CO_2 should also be a contributing cargo to the General account.[167] However, specific questions arise in the case of CCS. It is not certain whether the definition of 'receiver' would cover offshore structures or injection facilities as the OS in the scenario above.[168] The identity of the contributor and the method of calculating the received CO_2 also require attention. It is arguable that a system where the exporter should contribute on the basis of their gain in emission trading allowances or where the burden is shared by the exporter and the receiver would be fairer than asking only the receiver to contribute. Contributions based on the amount of CO_2 actually injected at the offshore facility could provide a reasonable option for calculation, avoiding the inaccuracies that would result from leakage and evaporation during transport.

As long as the 2010 HNS Convention is not in force, the ELD's implementation prescribes remediation without a limit[169] and the backing of a fund, which is expected to be covered from the RSO's insurance up to the LLMC limit.

Liability for Transport by Pipelines

In the absence of a convention on liability arising from escaping substances from pipelines, national rules apply. Offshore CO_2 pipelines do not seem to have a specific

[167] Whereas it could be argued that a separate account for CO_2 transport may be useful, as in the case of LNG, the drafting history of the 2010 HNS Convention and the delay in its implementation suggest that this would be a particularly unlikely scenario.

[168] Article 1, para.4 of the 2010 HNS Convention defines the 'receiver' by reference to 'discharge in ports or terminals'.

[169] Subject to para.1.3.3 of Annex II, ELD.

environmental liability regime in the UK.[170] Fault-based liability regimes are particularly weak in providing compensation for environmental damage.[171] In the UK, certain regulations, including the ELD as implemented, and perhaps the licensing regime may provide a basis for liability in the case of offshore CO_2 pipelines.[172]

The Environmental Liability Directive and Other Legislation

The key points of the ELD have already been described above in relation to ship transport. Here, a brief note is necessary because, unlike storage and ship transport, the pipeline transport of CO_2 is not included in Annex III[173] of the ELD; therefore, although the ELD applies to CO_2 carriage by pipelines, the operator's liability is not strict but fault-based. In the UK implementation the relevant standard is either intent or negligence.[174] Furthermore, in this case the applicability of the ELD is limited to cases of

[170] It is arguable that the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 would be applicable to CO2 leaking from pipelines as amended by Article 9 of the Energy Act 2008 (Consequential Modifications) (Offshore Environmental Protection) Order 2010. However, the terminology of the amended Act has not been changed; it refers to oil releases only and the explanatory note of the Order restates rather than clarifies this position.

[171] See Gordon below at (n 187). However, in the onshore context, s. 69 of the Pipelines Act 1962 expressly leaves the law of nuisance applicable.

[172] Negligence is not considered here because in the UK it is a particularly weak basis for a claim in the present context. Most notably, the claimant would need to show a property interest in the damaged resources and they would have to prove a breach of duty on technical facts which are not readily available to them. See also Gordon below at (n 187).

[173] In light of the relevant European legislation (see: Recital (46) of the CCS Directive (n 9)), the pipeline transport of CO_2 would not be considered as transboundary shipment of waste which would bring it under the strict liability regime of Annex III of the ELD (para. 12) and Schedule 2 of the 2015 Regulations (para. 10).

[174] Reg. 5, 2015 Regulations.

significant adverse effect on protected species or natural habitats or a site of special scientific interest.[175] Of course, neither the 2010 HNS Convention nor the LLMC would cover this liability, and so it would be unlimited.[176] Damage to property and loss of life and personal injury would be subject to the applicable national regime and would also be unlimited. Other parties involved in the transport of CO_2 will also be exposed to claims and liability under national laws. The Environmental Permitting (England and Wales) Regulations 2010[177] and the Water Resources Act 1991 may also be the basis of liability, similar to that arising under the ELD's implementation, up to three nautical miles from the baselines from which the breadth of the territorial sea is measured.[178] The Pipelines Safety Regulations 1996[179] prescribe rules for the design, construction, operation, maintenance, and decommissioning of onshore and offshore pipelines.[180] However, as a

[175] Art. 3, para. 1(b), ELD and Reg. 5, 2015 Regulations. Outside the activities covered by Annex III, the exceptions and exemptions offered by the ELD under Art. 4 or Art. 8 are of little importance because they imply no fault on the part of the operator.

[176] However, the competent authority may decide that the costs of further remediation would be disproportionate to the benefits once any significant risk has been removed – see (n 169).

[177] SI 2010/675.

[178] Under Reg. 57 of the 2010 Regulations, the regulator may 'arrange for steps to be taken to remedy the effects of pollution' and recover from the operator the costs so incurred. Similarly to this, under ss.161A-D of the WRA 1991 the appropriate agency can serve a works notice on the operator if "any poisonous, noxious or polluting matter or any waste matter is or has been present in, or is likely to enter, any controlled waters …, or any controlled waters are being or have been harmed, or are likely to be harmed, by any event, process or other source of potential harm" (s.161A, (1)(b); WRA 1991). If the appropriate agency undertakes the necessary works itself, it can recover the costs from the operator (s.161ZC, (2); WRA 1991).

[179] SI 1996/825.

[180] See also: https://hub.globalccsinstitute.com/publications/legislation-relating-co2-transport-storage/uk-laws-regulating-co2-transport-storage; accessed 15 February 2016.

public law instrument, civil liability does not arise directly for operators under this instrument.

The European Emissions Trading Scheme (ETS)

The reduction of CO_2 emissions through CCS operations falls under the European Emissions Trading Scheme Directive (ETS Directive);[181] therefore, the industries producing the stored CO_2 will receive the financial benefit of not having to surrender emission allowances.[182] Just like the ELD, this legal arrangement is part of UK law, and being part of the UK climate policy, it is not expected to change in the near future.[183]

Under the ETS Directive certain operators must purchase or surrender allowances for the greenhouse gas emissions they make. The ETS Directive specifically and separately includes the 'transport of greenhouse gases by pipelines for geological storage in a storage site permitted under the CCS Directive'.[184] If CO_2 leakage occurs, credits have to be surrendered.[185] This form of liability is not dependent on fault. It should be noted that

[181] Directive 2003/87/EC; OJ L 275, 25.10.2003, pp. 32–46; The current UK implementation of the ETS Directive is in the Greenhouse Gas Emissions Trading Scheme Regulations 2012, SI 2012/3038.

[182] Art.12, para.3a of the ETS Directive as amended by Directive 2009/29/EC, OJ L 140, 5.6.2009, pp. 63-87.

[183] The detailed discussion of this supposition falls beyond the scope of this article.

[184] Art.2 and Annex I of the ETS Directive as amended by Directive 2009/29/EC.

[185] In the meaning of Regulation (EU) No 601/2012 (OJ L 181, 12.7.2012, pp. 30–104) on the monitoring and reporting of greenhouse gas emissions pursuant to the ETS Directive, the calculation is to include at least the "combustion and other processes at installations functionally connected to the transport network including booster stations; fugitive emissions from the transport network; vented emissions from the transport network; and emissions from leakage incidents in the transport network." In other words, in case

the transport of CO_2 by ships is not mentioned in the ETS Directive. It is also not mentioned in the European regulation setting out the method of monitoring and calculating emissions.[186] This arises from the assumption that the primary way of transport will be through pipelines. There is no reason why similar rules should not apply to CO_2 carried onboard ships, although this is not provided for at present.

The Potential Role of the Licensing System

Gordon has argued in the context of offshore production that the licensing system creates a basis for environmental liability:[187] The legal nature of the petroleum licence is both regulatory and contractual.[188] Such licences contain a model clause on the 'avoidance of harmful methods of working'.[189] If the operator does not comply with this clause, he is in breach and Gordon argues that the losses arising from the breach of the licence terms may be recovered by the Minister as damages for breach of contract. However, if the operator can demonstrate that he acted according to the 'methods and practices customarily used in good oilfield practice', he will not be in breach of his licence.[190]

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of an incident, the operator will have to surrender emission allowances corresponding to the leaked amount of CO_2.

[186] Regulation (EU) No 601/2012 (n 185); see ss. 21-23 of Annex IV. These three sections correspond to the three CCS-related categories covered by the amended ETS Directive (Annex I), namely, capture, pipeline transport, and geological storage.

[187] G Gordon, 'Oil, water and law don't mix: environmental liability for offshore oil and gas operations in the UK, Part 1: Liability in the law of tort/delict and under the petroleum licence' (2013) 25 *Environmental Law & Management* (*ELM*) 3-11.

[188] Gordon (n 187), at p. 10.

[189] Clause 23, Sch. 1, Petroleum Licensing (Production) (Seaward Areas) Regulations, SI 2008/225.

[190] See also: Gordon (n 187), at p. 11.

Gordon's argument is compelling in the case of offshore production. However, the same argument is not readily available for pipelines. Submarine pipelines are subject to a separate authorisation regime under Part III of the Petroleum Act 1998, which applies to pipelines passing CO_2 as well.[191] Unlike for petroleum licences, no model clauses are provided for these authorisations. Therefore, it depends on the particular terms of the granted authorisation whether an argument which is similar to Gordon's would be available in the case of CO_2 pipelines. It should be noted though that under the Petroleum Act the Secretary of State may insert terms into the authorisation as to the "operation of the pipeline, including the methods by which it is to be operated and the persons by whom it may be operated",[192] and as to the "steps to be taken to ensure that funds are available to discharge any liability for damage attributable to the release or escape of any thing from the pipeline."[193]

A Comparison with Oil Pipelines in the United States and Canada

By contrast to the UK system, in some jurisdictions there is liability legislation which is similar to the shipping liability regime discussed above but applicable specifically to pipelines carrying oil. In the United States the Trans-Alaska Pipeline Authorisation Act[194] (an onshore pipeline) establishes a system similar to the one in the shipping industry. The holder of the pipeline right-of-way is strictly liable to "all damaged parties,

[191] This is because s. 26 defines 'pipeline' as "a pipe or system of pipes (excluding a drain or sewer) for the conveyance of any thing, together with all apparatus, works and services associated with the operation of such a pipe or system"; indeed, s. 28 defines 'controlled carbon dioxide pipelines' specifically.

[192] Section 15(3)(h).

[193] Section 15(3)(e).

[194] 43 U.S.C. §§ 1651-56 (Supp. III, 1973).

public or private, without regard to fault for such damages, and without regard to ownership of any affected lands, structures, fish, wildlife, or biotic or other natural resources relied upon by Alaska Natives, Native organizations, or others for subsistence or economic purposes". Liability is limited to $350 million for any one incident; above this amount the ordinary rules of negligence apply. The regime is strict but not absolute. An act of war, negligence of the United States, other government entity, or the damaged party provide exceptions; the burden of proof is on the operator. However, on the basis of US common law and the relevant environmental impact statements, acts of God as earthquakes and tidal waves would not be exemptions from liability in Alaska and the Arctic.[195] The compensation fund connected to the Act is now consolidated by the Oil Pollution Act 1990[196] into the Oil Spill Liability Trust Fund. Another example to note is the Canadian Pipeline Safety Act.[197] The operator's liability is unlimited when he is at fault or negligent. Otherwise he is entitled to limited liability. If "he operates one or more pipelines that individually or in the aggregate have the capacity to transport at least 250,000 barrels of oil per day" the limit is C$1 billion. Furthermore, pipeline operators must maintain financial security corresponding to their limit of liability. Although these two regimes apply to oil transport, they illustrate that it is possible to establish for pipelines a liability system which is similar to that in the shipping industry. A similar system could be applied to CO_2 pipelines once adjusted to the specificities of CO_2 transport, most notably, the type and likelihood of damage and the size of the financial risk. The authors are not aware of such incentives in the UK or the EU.

[195] AG Stone, 'The Trans-Alaska Pipeline and Strict Liability for Oil Pollution Damage' (1975) 9 *Urban Law Annual | Journal of Urban and Contemporary Law* 179-201.

[196] Sec.8102, 101 H.R.1465, P.L. 101-380.

[197] An Act to amend the National Energy Board Act and the Canada Oil and Gas Operations Act (Short title: Pipeline Safety Act), Bill C-46.

Similar Risk but Different Consequences

The polluter-pays principle can be understood in two ways. On the one hand, anything that reduces the actual polluter's responsibility, such as channelling to a particular entity, limitation of liability, and the availability of a fund, are considered as running against the polluter-pays principle.[198] Other authors do not consider such devices to be incompatible with the principle.[199] The *Commune de Mesquer*[200] case falls in line with this latter approach where Advocate-General Kokott stated in relation to the situation where the public has to foot the bill above the limit for damages from oil pollution: "The general public at least accepts the relevant risks, since the States permit risky maritime oil transportation."[201] She did not consider the need for the public to foot part of the bill as a violation of the polluter-pays principle.

Thus, in the shipping context the principle prevails to the extent that in case of pollution at least a substantial part of the costs has to be covered by the entity which makes profit

[198] See for example: D Ibrahima 'Recovering Damage to the Environment *per se* Following an Oil Spill: The Shadows and Lights of the Civil Liability and Fund Conventions of 1992' (2005) 14(1) *Review of European, Comparative & International Environmental Law* (*RECIEL*) pp.63-72.

[199] See for example: P Schwartz 'The polluter-pays Principle' in M Fitzmaurice, D M Ong and P Merkouris (eds), *Research Handbook on International Environmental Law* (Edward Elgar, Cheltenham, 2010) 1-703, at pp.251-254.

[200] See (n.83); the case concerned the oil pollution damage liability regime as contained in the 1992 Civil Liability Convention, the 1992 International Oil Pollution Compensation Fund and the 2003 Supplementary Fund Protocol. However, as the 2010 HNS Convention has been modelled on the oil pollution liability regime and the arrangements are in many aspects identical, at least as long as the liability of the shipowner is concerned, it is submitted that the same principles apply to the 2010 HNS arrangements.

[201] Opinion of Advocate General Kokott delivered on 13 March 2008 in Case C-188/07, at para. 142.

from the transport, and that insurance must be in place (internalising the cost of the risk), and that some part of the risk may need to be covered by society – the ultimate beneficiary of the risky activity. Having said that, the principle is adjusted to accommodate the reality of the sector: channelling liability to the shipowner so that recovery is not hindered by complicated parallel proceedings, strict liability so that recovery is not hindered by the need to prove highly technical issues and facts, and limitation of liability combined with funds, reflecting the size of potential liability which would otherwise bar smaller entities from entering the market.

As regards pipeline liability, the ELD is based on the polluter-pays principle.[202] Although the liability is not strict in this case, it is also not limited.[203] However, due to the fact that the ELD's application is fault-based, there is a higher probability that the damages will not be met by the operator but by the public.

Although the polluter-pays principle is common to the shipping conventions and the ELD, the transport of CO_2 for offshore CCS demonstrates two significantly different regimes for the same type of risk. Even if these different liability regimes are consistent with the polluter-pays principle, they cannot be at the same time fair to pipeline operators and shipowners because different parts of the risks are underwritten by the tax-payer whereas the nature of the risk is similar in the two cases. The only justification for this discrepancy would arguably be if the risks were significantly different. The reason for the different legal approach appears to be that shipping liability typically falls under international regimes, whereas pipelines are handled solely under the national jurisdiction

[202] Art. 1, ELD.

[203] Subject to proportionality, see (n 176).

of the state within its jurisdictional areas and therefore no international liability regime was considered necessary.

Conclusions

This paper compared the liability arising from the transport of CO_2 in offshore CCS operations through pipelines and ships. At present, environmental liability arising from the escape of CO_2 either from a ship or from a pipeline is subject to the ELD. However, two significant differences exist. First, the shipowner's liability is strict, whereas the same liability of the pipeline operator is fault-based. Second, the shipowner's liability is limited under the LLMC as amended, whereas the pipeline operator's environmental liability is unlimited. Loss of life, personal injury and damage to property are currently covered by national laws of tort. The shipowner's right to limit liability applies equally to these types of damage.

The existing situation will probably change with respect to ship transport if the 2010 HNS Convention enters into force, providing a comprehensive system of strict but limited liability accompanied by compulsory insurance and direct action against the insurer, and supported by a second tier of liability guarantee up to 250 million SDR of compensation. The Convention will address environmental liability, preventive measures, property damage, personal injury and death. It has been argued in this paper that the 2010 HNS Convention should cover the carriage of CO_2 by sea. A perceived disadvantage of the 2010 HNS Convention, on the other hand, concerns the prohibition of actions against several other parties connected with the operation of the ship, even if such parties are in a financially stronger position than the shipowner.

Although both systems considered here are built on the polluter-pays principle, they are significantly different. Considering that the risks are similar, it is argued here that this is an unjustified position. It is suggested that the UK legal regime for the transportation of CO_2 by pipelines should be replaced by a liability system similar to that applicable to shipping liability, as is the case in the US and Canada for certain oil pipelines.[204] This would provide a simplified and integrated legal framework for various heads of liability, assure compensation, and make the calculation of potential liability more certain. It would also enable stakeholders to consider both transportation modes and this, in turn, would encourage investment and facilitate the faster adoption of CCS.

[204] This may become easier when the UK moves outside the EU legal framework.