



COMITE MARITIME INTERNATIONAL

THE GOTHENBURG DECARBONISATION DISCUSSION PAPERS

GREEN FUELS DISCUSSION PAPER

Comité Maritime International aisbl/ivzw

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NOTE FROM THE CHAIR OF THE INTERNATIONAL WORKING GROUP ON MARITIME DECARBONISATION

When the Comité Maritime International was founded in 1897, the transition from wind to steam was not yet complete. We are now on the cusp of a third energy transition, and decarbonisation is one of the most significant challenges of our era.

The maritime industry has increasingly become aware of the role it's called upon to play, mostly as a result of regulatory initiatives of the International Maritime Organisation and the European Union.

Overwhelmingly, attention is focused on the technical aspects of alternative fuels and energy efficiency, and on the policy ramifications, especially as those inform the regulatory environment.

This International Working Group was set up a year ago on a simple premise: maritime law has been largely absent from the decarbonisation debate, despite its unquestionable importance as a foundation of the entire edifice of maritime trade. And central in any discussion regarding maritime law is the CMI. It has been an honour and a privilege to chair this IWG, which brought together colleagues from several maritime jurisdictions.

The work of the IWG was presented at the CMI Colloquium in Gothenburg in May 2024 and is summarised in three Discussion Papers ("*The Gothenburg Decarbonisation Discussion Papers*"), which cover three separate, but related, areas: "*Green Fuels*" (on issues of civil liability for non-hydrocarbon fuels), "*Green Contracts*" (an outline of some contractual adaptations that decarbonisation may require) and "*Green Vessels*" (introducing definitions as to "readiness" of ships to consume new fuels).

This Note accompanies the Gothenburg Decarbonisation Discussion Paper on "*Green Fuels*". The technical and regulatory challenges of new fuels attract ample attention. Equally important is the fundamental legal question of civil liability, in circumstances where the present regime was designed for hydrocarbons. It took several catastrophic oil pollution incidents for the international community to create compensation structures and a civil liability framework for mineral oil as both cargo and fuel. It would be a paradox and, potentially, a tragedy, if the deployment of zero-emission fuels, is not informed by that experience, so that the appropriate civil liability regime is put in place at the appropriate time. The Green Fuels Discussion Paper describes the present

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civil liability regime, outlines the alternative fuel liability and compensation gap, and proposes a series of possible adaptations.

The Gothenburg Decarbonisation Discussion Papers represent the first phase of IWG's work. The second phase will include more detailed analysis, involving – as and where appropriate – associations and organisations that can work with the CMI to address the issues identified.

I am grateful to the members of the IWG for their time and efforts, and to the members of the Steering Committee (Jolien Kruit, Neil Henderson and Charles Debattista) for their support and dedication.

London, July 2024

Haris Zografakis
Partner, Stephenson Harwood LLP
Chair
CMI International Working Group on Maritime Decarbonisation

CMI INTERNATIONAL WORKING GROUP ON MARITIME DECARBONISATION

"Green Fuels" Workstream

GOTHENBURG DISCUSSION PAPER 4 June 2024¹

“Liability and compensation regimes for incidents on board vessels involving the carriage or consumption of alternative fuels”

1. Introduction

- 1.1. IMO’s revised strategy of July 2023 includes an enhanced common ambition to reach net-zero GHG emissions from international shipping close to 2050.² In order to meet this goal, shipping needs to move away from fossil fuels. The revised strategy inter alia contains a commitment to ensure an uptake of alternative zero and near-zero GHG fuels by 2030. The most mentioned alternative fuels are LNG (as transition fuel), biofuels, hydrogen, methanol and ammonia.³ Technology and the order book for vessels with the capacity to operate on an alternative fuel are advancing fast⁴; the international civil law framework is not.
- 1.2. There is currently no international civil liability regime in force to deal with incidents involving alternative fuels when being used as fuel, or when carried as cargo.⁵ Whilst we understand that considerable work is currently being undertaken at the IMO and elsewhere on crew training requirements and technical/design aspects to reduce risks and that changes are needed to MARPOL and SOLAS to regulate the safe use of alternative fuels, such efforts are separate from the question of civil liability (and these subjects therefore also fall outside the scope of this discussion paper).
- 1.3. This Discussion Paper analyses the gaps in the current civil liability regimes. The Paper first sets out the civil liability system that has been developed to deal with oil pollution incidents involving a ship. Following

¹ The authors are the following members of the Comité Maritime International’s International Working Group on Maritime Decarbonization: Jolien Kruit (Attorney at Law Van Traa Advocaten, Rotterdam), Hannah Mosmans (Researcher, Erasmus University Rotterdam), Nick Gaskell (Emeritus Professor of Maritime and Commercial Law, University of Queensland), and Neil Henderson (Industry Liaison, Gard, London), with comments and feedback from the Chair, Haris Zografakis (Partner, Stephenson Harwood LLP, London). The authors have had the benefit of views from a number of interested parties.

² Resolution MEPC.377(80), adopted on 7 July 2023, ‘2023 IMO Strategy on Reduction of GHG Emissions from Ships’.

³ Nuclear power is also mentioned as a potential alternative fuel. However, at present, it seems unlikely that nuclear propulsion will be an important driver in the maritime energy transition, at least in the near future. It is also subject to specific regulation. Nuclear power is therefore not covered by this paper.

⁴ In 2023, a total of 539 ships, equivalent to 45% of all newbuild orders placed by gross tonnage, could run on alternative fuels. In 2022, 55% of all newbuild orders by gross tonnage were alternative fuel capable, up from 27% in 2020 and 8% in 2016. Source: Offshore Energy.biz [Clarksons: 45% of ships ordered in 2023 embrace alternative fuels, with LNG still in the lead - Offshore Energy \(offshore-energy.biz\)](https://www.offshore-energy.biz/Clarksons-45%-of-ships-ordered-in-2023-embrace-alternative-fuels-with-LNG-still-in-the-lead/).

⁵ For further detail on the not yet in-force HNS Convention, see Section 3, below.

that, it shows that no such regime is in force to deal with incidents involving alternative fuels and sets out some of the consequences of not having such a regime in place.⁶ Additionally, it discusses potential options to cover the liability gaps. It is argued that there is a clear need for a wide international discussion on the necessity for a legal regime to deal with civil liability and compensation in case of an incident involving alternative fuels. This Discussion Paper concludes that there are strong arguments supporting a compelling need for the implementation of such a regime. No disaster involving alternative fuels should be necessary before the establishment of an appropriate legal framework.

2. *Civil liability systems for oil pollution*

- 2.1. The civil law on liability for environmental pollution caused by ships has developed over the last 50 years mainly in response to disastrous accidents.
- 2.2. The first steps to regulate civil liability for the consequences of polluting incidents were taken after the oil spill of the oil tanker “Torrey Canyon” in 1967. This accident exposed the insufficiency of general national liability regimes and thereby the necessity of specific regulations, both regarding the establishment of liability and the actual compensation of victims that had suffered damage. International and national regimes were created - and thereafter regularly updated - which effectively regulated these issues.
- 2.3. At international level, for oil carried in bulk and bunkers on board such vessels, the International Convention on Civil Liability for Oil Pollution Damage, 1992 (“CLC”) now combines strict liability of the shipowner with limitation, compulsory insurance and direct action for victims against the shipowners’ insurers. In addition, the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (“Fund Convention”) 1992 adds an additional layer of compensation paid by the oil receivers, in case the limitation amount proves to be insufficient to make good damage caused. In 2003, a third layer of compensation was added by the International Oil Pollution Compensation Supplementary Fund, 2003 (“Supplementary Fund Protocol”).⁷
- 2.4. ‘Oil’ is defined in Art.1 of the CLC as “any persistent hydrocarbon mineral such as crude oil, fuel oil, heavy diesel oil and lubricating oil whether carried as cargo or bunkers”. This would not presently cover alternative fuels, including biofuels.
- 2.5. For pollution caused by bunker oil of ‘non-CLC-vessels’⁸, the International Convention on Civil Liability for Bunker Oil Pollution Damage (“Bunkers Convention”), 2001 was created. Bunker oil is defined in Art. 1(5) of the Bunkers Convention as “any hydrocarbon mineral oil, including lubricating oil, used, or intended to

⁶ The risks presented in this paper include worst case scenarios, but a realistic risk assessment will naturally take account of data and analysis still to be made available.

⁷ The maximum compensation payable by the 1992 Fund is 203 million SDR for incidents occurring on or after 1 November 2003, irrespective of the size of the ship. For incidents occurring before that date, the maximum amount payable is 135 million SDR. These maximum amounts include the sums actually paid by the shipowner under the 1992 CLC. The Supplementary Fund provides additional compensation beyond the amount available under the 1992 Fund Convention in 1992 Fund Member States which are also Parties to the Protocol. The total amount available for compensation for each incident is 750 million SDR, including the amounts payable under the 1992 Conventions. [IOPC FUNDS | 1992 Fund Convention and Supplementary Fund Protocol](#).

⁸ Vessels that do not fall within the definition of a ship of the CLC (art. 1(1) CLC 1992) and hence fall outside the CLC’s scope and within the Bunker Convention’s scope.

be used for the operation or propulsion of the ship, and any residues of such oil". As with the CLC, this would not presently cover alternative fuels, even biofuels.

- 2.6. In the Bunkers Convention, strict liability of the shipowner is accompanied - again - by compulsory insurance. However, unlike the CLC and Fund Convention, the Bunkers Convention does not provide for a specific limitation amount and/or an additional compensation fund. It merely provides that limitation of liability under any other regime is not precluded.⁹ This means that claims deriving from bunker spills will, in principle,¹⁰ fall within the limitation regime either of the Convention on Limitation of Liability for Maritime Claims 1976, whether or not amended by the 1996 Protocol (jointly the "LLMC 1996")¹¹, or domestic law together with non-loss of life or personal injury claims. The result is that the ship's LLMC limitation fund will be exhausted sooner¹²
- 2.7. As such, whilst there are civil liability systems in place for oil and bunker oil-caused pollution, neither the CLC (and Fund Convention) nor the Bunkers Convention apply to alternative fuels. However, it is readily apparent that the needs that dictated the adoption of those conventions are present in the case of alternative fuels. Indeed, the features described in para. 2.3 above would be wholly desirable in the case of alternative fuels, especially in relation to those that potentially pose risks to health and the environment.

3. *Civil liability for HNS incidents?*

- 3.1. When the liability regime for oil spills was developed, it was generally acknowledged that a spill of hazardous and noxious substances ("HNS") carried as cargo have a greater potential than oil to cause greater threat to life and substantial property damage, but lesser pollution-related damage and clean-up costs. To address these risks, the HNS Convention was developed and adopted in 1996. However, it never entered into force due to lack of sufficient ratifications, in particular because of the practical difficulties of establishing the HNS Fund. In a 2010 Protocol, practical amendments¹³ were made to facilitate adoption of an "HNS Convention 2010"¹⁴. Both the IMO¹⁵ and the European Council¹⁶ have urged (member) states to ratify the convention. It is currently anticipated that the HNS Convention 2010 may enter into force in 2025/2026, but past experience suggests that even this may be optimistic.¹⁷

⁹ Art. 6 Bunkers Convention. No separate limitation provisions were added to the Convention as no provision had been made in the LLMC 1996 for a separate limitation for bunkers and it was considered that a clash of conventions was to be prevented. N. Gaskell, 'The Bunker Pollution Convention 2001 and limitation of liability', 15 *Journal of International Maritime Law*, 2009, p. 478.

¹⁰ Whether environmental pollution claims come within the scope of the LLMC will depend upon national law, which varies between nations.

¹¹ References in this paper are to the LLMC 1976 as amended by the 1996 Protocol; Art. 6(1)(b) LLMC 1996.

¹² N. Gaskell, 'The Bunker Pollution Convention 2001 and limitation of liability', 15 *Journal of International Maritime Law*, 2009, p. 478.

¹³ Packaged cargo does not need to be reported, or contribute to the fund; contributions for LNG are to be paid by the receiver; and states that do not submit reports will be unable to join/claim compensation. See also: HNS-Convention-Overview_e.pdf (hnsconvention.org).

¹⁴ The 2010 HNS Protocol will enter into force 18 months after the date on which it was ratified by at least 12 states. Among these twelve, there must be four States with not less than 2 million units of gross tonnage. Furthermore, contributors in the States that have ratified the Convention must, between them, have received during the preceding calendar year a minimum of 40 million tonnes of cargo consisting of bulk solids and other HNS liable for contributions to the general account. 2010 HNS Protocol, Article 21.

¹⁵ IMO Resolution, A.932(22).

¹⁶ Council decisions 2017/769 and 2017/770.

¹⁷ An agreement was made by Belgium, Germany and the Netherlands to ratify HNS 2010 jointly; Travaux Préparatoires to the Approval Act for the Dutch ratification and implementation of the HNS Convention, Parliamentary Papers 36 323-3, p. 2-3.

- 3.2. The HNS Convention 2010 is modelled on the CLC and Fund Convention (discussed in section 2 above).¹⁸ In addition to pollution damage, it will also cover damage caused by other risks, including fire and explosion. The wide variety of HNS translates itself to a multiplicity of risks¹⁹: 1) death and personal injury and evacuation of local population, 2) economic losses (property damage as well as impact on fisheries, tourism and interruption of navigation and port traffic), and 3) clean-up costs and impacts on the environment.
- 3.3. Just as under the CLC, the shipowner is to be strictly liable for loss or damage caused by the transported HNS up to a certain amount, in respect of which it will be obliged to have insurance cover. If the damage is higher than the prescribed limits, which vary pursuant to the size of the ship, a second tier HNS Fund paid for by HNS receivers will provide additional compensation. The HNS Fund, when fully operational, will have four accounts: oil, LNG, LPG and a general account with two sectors (bulk solids and other HNS). In case there is insufficient contribution in the early years of the HNS Fund, the separate accounts may be postponed, and the HNS Fund may, therefore, have only two accounts: one separate account for oil and one general account including four sectors (LNG, LPG, bulk solids and other HNS).²⁰
- 3.4. Whilst alternative fuels will be covered by the HNS Convention 2010 when being transported as cargoes, because the Convention applies only to the “carriage of goods as cargo” it will not cover bunker oil or alternative fuels onboard a ship as bunkers.

4. *The risks associated with the carriage and use of alternative fuels*

- 4.1. The alternative fuels that are currently expected to be most suitable (at least temporarily and/or partially) to replace oil as main shipping fuel are e-LNG, bio-LNG, biofuels, green ammonia, green methanol, green hydrogen. These all have their own characteristics and risk profile.²¹ As concluded in the ‘Future Fuels Risk Assessment 2022’, prepared by the Together in Safety coalition: “Out of the fuels reviewed, methanol poses the least risk, followed by LNG, hydrogen and ammonia risk ratings increasing.”
- 4.2. The principal characteristics and risks associated with each of the alternative fuels are briefly considered in turn (more detailed descriptions can be found in Annexe I). These vary in nature and in the event of an incident, so too does the potential financial impact:
- 4.3. *Ammonia*: a highly toxic chemical which, in ambient conditions, is a toxic gas. In liquid form, risks of exposure increase if under pressure, as large volumes can be rapidly released into the air. Even though established industry best practices can safely handle ammonia, it remains corrosive, toxic and potentially

¹⁸ Under the 2010 HNS Convention, the shipowner is liable for the loss or damage up to a certain amount, which is covered by insurance (1st tier). A compensation fund (the HNS Fund) will provide additional compensation when the victims do not obtain full compensation from the shipowner or its insurer (2nd tier). The HNS Fund will be funded by those companies and other entities which receive HNS after sea transport in a Member State in excess of the thresholds laid down in the Convention. [HNS-Convention-Overview_e.pdf \(hnsconvention.org\)](#).

¹⁹ International Maritime Organization, ‘The HNS Convention: why it is needed’ (IMO, n.d.) < <https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/HNS%20ConventionWebE.pdf> > accessed 6 November 2023.

²⁰ Non-pollution damage caused by persistent oil, e.g. damage caused by fire or explosion, is covered by the 2010 HNS Convention. Pollution damage caused by persistent oil is covered by the CLC-IOPC regime.

²¹ We have specifically not included nuclear fueled ships in this Discussion Paper.

life-threatening upon inhalation in high concentrations (more than 0.1 volume-percent).²² Ammonia can cause serious damage to biodiversity: spills of ammonia into seawater can cause increased growth of bacteria, plankton and macrophytes, potentially smothering habitats; the toxicity of ammonia can alter the dynamics of food chains, which is expected to have a greater impact on fish than oil spills, but a lesser (but still serious) impact on invertebrates and birds.²³

- 4.4. *Methanol*: a colourless liquid which is highly flammable.²⁴ Methanol is toxic: exposure can cause lethal consequences by ingestion of more than 20 milliliters; lesser amounts can cause irreversible blindness. Unlike ammonia, methanol is water soluble and readily biodegradable.²⁵
- 4.5. *Hydrogen*: a flammable, potentially explosive, non-toxic gas in ambient conditions. The main hydrogen risk is explosion as a result of medium-pressure leaks. This can be a particular challenge where dispersal space is constrained, such as on board ships.²⁶
- 4.6. *Biofuels*²⁷: these fuels are produced from biomass, which can include biological waste and crops.²⁸ In case of a bunker tanker rupture, there is a substantial risk of pollution at sea, including forming slicks and coating and/or poisoning aquatic life. Biofuels are generally biodegradable, lessening long-term impacts.^{29,30} Otherwise, risks of damage to life and property are similar in profile to traditional bunker fuels.
- 4.7. *LNG*: a significant spill can cause large-scale evaporation upon contact with water, resulting in explosion without combustion and pressure-wave damage.³¹ Conventional ignition of LNG vapours can put nearby humans and property at risk.³²
- 4.8. Available incident data on the carriage of HNS cargoes shows that to date serious incidents involving alternative fuel cargoes have fortunately been limited³³, although it should be noted that the usage of HNS as alternative fuels may have a differing risk profile to the carriage of HNS cargoes.

²² Z. Wan, Y. Tao, J. Shao, Y. Zhang, H. You, 'Ammonia as an effective hydrogen carrier and a clean fuel for solid oxide fuel cells' (2021) 228 Energy Conversion and Management, 113729.

Although a land-based example, the 1992 explosion and consequent ammonia vapour cloud in Dakar, Senegal killed 129 and injured 1,150 is indicative of the potential risk to life in the event of a serious incident in a populated area, such as a city port. Fuller details of the incident can be found at: [Process Safety Beacon: Learning from the Worst Ammonia Accident | AIChE](#)

²³ Report by the Environmental Defense Fund, 'Ammonia at Sea: studying the potential impact of ammonia as a shipping fuel on marine ecosystems', 2022

²⁴ P. Balcombe, J. Brierley, C. Lewis, L. Skatvedt, J. Speirs, A. Hawkes, I. Staffell, 'How to decarbonise international shipping: Options for fuels, technologies and policies' (2019) 182 Energy Conversion and Management 72, 78.

²⁵ John J Clary, 'General Animal and Aquatic Toxicity' in John J Clary (eds), *The Toxicology of Methanol* (Wiley) 73.

²⁶ DNV, 'Hydrogen Forecast to 2050 – Energy Transition Outlook 2022', DNV Høvik 2022, 21.

²⁷ Microsoft Word - HNS Finder - Guidance notes (hnsconvention.org)

²⁸ In this Discussion Paper, the term biofuels does not include methanol, which is considered separately.

²⁹ [Qiuwen Wang et al.], 'The use of alternative fuels for maritime decarbonization: Special marine environmental risks and solutions from an international law perspective' (2023) Front. Mar. Sci., Sec. Marine Affairs and Policy, Volume 9 – 2022 <https://doi.org/10.3389/fmars.2022.1082453>

³⁰ European Maritime Safety Agency, 'Update on Potential of Biofuels for Shipping [updated]', 2023, available at: Latest News - Update on Potential of Biofuels for Shipping [updated] - EMSA - European Maritime Safety Agency (europa.eu).

³¹ Cheng Wang, Yonglin Ju, Yunzhun Fu, 'Dynamic modeling and analysis of LNG fuel tank pressurization under marine conditions' (2021) 232 Energy 121029.

³² Laurens Vandebroek, Jan Berghmans, 'Safety Aspects of the use of LNG for Marine Propulsion' (2012) 45 Procedia Engineering 21, 22.

³³ Incident data relating to the carriage of HNS cargoes collated by the International Group of P&I Clubs for the period January 2010 to September 2019, which was submitted to the 107th session of the IMO Legal Committee, records 220 incidents for damage governed by the HNS Convention. Of these, only 6 incidents were attributable to products that could be used as an alternative fuel. Only 1 incident of the 220 would have exceeded the shipowner's limit of liability (and this did not relate to an alternative fuel product).

4.9. The significant difference between alternative fuels and mineral oil bunkers is the greater risks of injury, death and property damage from alternative fuels, due to their higher toxicity and/or flammability. Whilst there are still serious environmental risks in the event of a spill of alternative fuels, based on current evidence these would appear to be lesser than those posed by bunker oil. This brings into focus the need for a civil liability regime which reflects the potentially greater 'human losses' and the need for adequate and guaranteed compensation for the victims of such an incident.

5. *Civil liability for alternative fuels under existing law?*

5.1. The five types of alternative fuel covered in this Discussion Paper (LNG, methanol, ammonia, hydrogen, and biofuels) do not fall within the Bunkers Convention or the CLC³⁴. That is because the definitions in the two conventions are limited to mineral oils³⁵, meaning that not even biofuels are covered.³⁶

5.2. Those alternative fuels will fall within the scope of the HNS Convention 2010, but only when carried in bulk as cargo and not when carried as maritime fuel (i.e. as bunkers).³⁷

5.3. If the HNS Convention 2010 enters into force, this does not mean that all issues concerning alternative fuels will have been solved. Many countries will not (yet) have acceded to the HNS Convention 2010.³⁸ In addition, the convention does not cover all potential incidents. First, its scope is geographically limited; it does not cover, for example, spills on the high seas. Secondly, the HNS Convention 2010 does not include HNS for all ships and/or for all purposes. Exceptions are possible for, inter alia, small and special purpose vessels. Thirdly and most notably, the convention does not relate to HNS which are on board vessels as 'bunkers'.³⁹

5.4. It follows that any incident involving the five types of alternative fuel onboard a vessel as bunkers will not be covered by an existing IMO regime creating strict liability with compulsory insurance and rights of direct action. There will be a need to rely on existing national law with many of the pre-Torrey Canyon disadvantages, or to risk a lack of uniformity through the creation of regional laws (e.g. in the EU).

5.5. In case of a shipping incident involving alternative fuel, a party that suffered damage would need to establish that a ship-interested party was liable for the incident (i.e. that the party was at least negligent) in the relevant jurisdiction under the applicable law. This may not be straightforward. If that hurdle is cleared, a shipowner may be entitled to limit its liability under the LLMC 1996 (so long as the relevant State is a party to the LLMC) or a national regime. Existing limits may prove to be insufficient to compensate all damage suffered and costs incurred to mitigate such damage, especially in the case

³⁴ Notably, biofuels do not come within the definition of "persistent hydrocarbon mineral" or "hydrocarbon mineral oil" used respectively in the CLC and the Bunkers Convention.

³⁵ See para 2.4 and 2.5 above.

³⁶ Biofuels do not come within the definition of "persistent hydrocarbon mineral" or "hydrocarbon mineral oil" used respectively in the CLC and the Bunkers Convention.

³⁷ Art. 1(5)(a) 2010 HNS Convention.

³⁸ The Council of the European Union has authorised the EU member states to ratify or accede to both the HNS 1996 (Council decision 2002/971 of 18 November 2002) and the HNS 2010 (Council Decision (EU) 2017/770 of 25 April 2017).

³⁹ The Bunkers Convention does not cover alternative fuels either.

of a large incident involving a smaller ship⁴⁰. Moreover, a suit against a single ship company with no other assets could be unattractive in the absence of a right of direct action against an insurer.

- 5.6. The history of oil pollution incidents shows that having a civil liability regime in place, comprising strict liability, mandatory insurance and insurance certification, a right of direct action and tiered funds, helps to mitigate the consequences of an incident. At present, no such regime is available at an international level for alternative fuels⁴¹. As well as the environmental pollution risks of alternative fuels, the greater risks vis-à-vis injury, death or property damage, as compared to traditional mineral oil bunkers, means that this could significantly disadvantage victims of an incident involving alternative fuels. A lack of robustness in the liability and compensation arrangements may harm confidence and may therefore represent a barrier in the adoption and uptake of alternative fuels.

6. *Possible ways forward*

6.1. *Compelling need for action*

6.1.1. As alternative fuels become more widely used as fuel,⁴² the volume of alternative fuels on board vessels at sea will increase, and with it the risk of an alternative fuel spill⁴³ – either as cargo or as fuel. The cost of damage to life and property caused by such a spill (even regardless of the potential ecological damage) may be very high. If an incident occurs with an alternative fuel, at present there is no special international civil liability regime in place. This would mean that liability would need to be proven under the applicable domestic law regime, which may be difficult and may lead to forum shopping. Even if liability is established, this does not guarantee recovery since there is no general overall obligation for shipowners to ensure that adequate insurance is in place.⁴⁴ Affected third parties may not be adequately compensated, as LLMC or domestic law limits may well be insufficient and there is no second-tier fund for major incidents which exceed existing limits⁴⁵. As well as the unsatisfactory situation of potentially inadequate compensation of the victims of such an incident, this will also likely cause negative publicity for the use of alternative fuels. This potential barrier would not be ideal as it may result in reluctance amongst owners, operators, insurers and financiers to support greater adoption of alternative fuels at a time when shipping needs alternative fuels to decarbonize soonest.

⁴⁰ The LLMC limits were last increased in 2012 under the tacit amendment procedure; further work is needed to determine the potential liabilities in the event of a significant incident involving alternative fuels when being used as bunkers.

⁴¹ Although insurance already provides cover for HNS substances which are carried as cargoes under the existing regime of the LLMC and national laws, the propensity or ability of insurers to pay out compensation to victims of incidents can vary.

⁴² IRENA estimates that the demand for ammonia would increase fourfold by mid-century to 688 million tonnes — with 197 million tonnes of that used as a shipping fuel and 127 million tonnes as a hydrogen carrier. Report IRENA and Ammonia Energy Association, 'Innovation Outlook: Renewable Ammonia', International Renewable Energy Agency, Abu Dhabi, Ammonia Energy Association, Brooklyn 2022.

⁴³ R. Parkes, 'SPECIAL REPORT | Burns, blindness and agonising deaths: is it safe to ship hydrogen-derived ammonia around the world?', *Recharge* 27 July 2022.

⁴⁴ Whether such insurance is in place depends on the tortfeasor and the applicable regime. The EU has obliged its member states to arrange insurance at least up to the amount of LLMC limits; Directive 2009/20/EC of 23 April 2009 on the insurance of shipowners for maritime claims. See on the topic of compulsory insurance in general E. Rosaeg, 'Compulsory Maritime Insurance', *Scandinavian Institute of Maritime Law Yearbook* 2000, 2000, Compulsory Marine Insurance.

⁴⁵ Whether these limits are under the LLMC or national laws.

6.1.2. It follows that maintaining the status quo does not appear to be an attractive option. Leaving it to the various nation states to legislate is likely to lead to uncertainty, fragmentation, forum shopping and the absence of a level playing field.

6.1.3. This begs the question as to what international framework could be put in place to deal with civil liability issues deriving from alternative fuel incidents. If and when the HNS Convention 2010 enters into force, incidents involving alternative fuels carried as cargo will be duly regulated. It is therefore, first of all, recommended that the ratification of the HNS Convention 2010 is actively promoted. But this does not solve the question of finding an appropriate regime for alternative fuels being used as bunkers.

6.1.4. For the situations not already covered by the HNS Convention 2010, several possibilities to regulate the civil liability are set out and briefly discussed below. It is assumed that an international alternative fuel regime should be similar to and build upon the existing civil liability regimes as these have found (varying levels of) acceptance in the market. Any solution should, at least, provide for strict liability, with limitation for the shipowner, as well as compulsory insurance and a right of direct action against the vessel's insurers.

6.2. It will be for member states of the IMO to decide upon the need for, and content of, any possible changes to existing international law. The possibilities discussed below are intended to create awareness, encourage discussion and are offered as part of the CMI's function of providing assistance to the international legal community in identifying challenges and possible solutions. Any solution should take into account the fact that vessels, at least in the near future, may operate on dual fuel systems.

6.3. *Include alternative fuels in the Bunkers Convention*

6.3.1. Alternative fuels could be included in the Bunkers Convention by way of a protocol. Alternative fuels would need to be included either in the definition of Article 1, paragraph 5, possibly by way of an annex, as the list of alternative fuels may be long. It would also require amendments to other articles. A protocol would require states to also ratify the Bunkers Convention if they would like to implement a civil liability regime for alternative fuels.

6.3.2. A disadvantage of bringing alternative fuels under the Bunkers Convention would be that the Convention only deals with pollution damage. In case of an alternative fuel spill, personal injury and loss of life claims should also be covered comprehensively by an international regime.

6.3.3. Another general disadvantage of inclusion of alternative fuels in the Bunkers Convention is that it does not provide for a separate limitation of liability regime, unlike the CLC and the not yet in-force HNS Convention. This leads to legal uncertainty on the compensation level and the risk of forum shopping. In addition, LLMC and national limits may provide insufficient compensation in case of a serious incident involving alternative fuels.⁴⁶ If an alternative fuels protocol to the Bunkers Convention were to be developed, it might be appropriate for the IMO to consider this alongside its next periodic consideration of the LLMC limits.

⁴⁶ N. Gaskell, 'The Bunker Pollution Convention 2001 and limitation of liability', 15 *Journal of International Maritime Law*, 2009.

6.3.4. Lastly, the Bunker Convention's official name, i.e. "International Convention on Civil Liability for Bunker Oil Pollution" would not reflect an amended convention covering alternative fuels, liability beyond pollution damage, and would need to be changed.

6.4. *Include alternative fuels (as fuels) in the HNS Convention 2010*

6.4.1. Alternative fuels on board vessels as fuels could be included in the HNS Convention 2010 by way of a new protocol.

6.4.2. Alternative fuels (when used as bunkers) could be added to the definition of Article 1, paragraph 5. This would require parties that have already ratified HNS to ratify the amended version, which may lead to delayed implementation. To circumvent this problem, a (short) protocol could be designed to supersede the HNS Protocol 2010. States could be advised not to ratify the HNS Convention 2010, but only to accede to the new protocol which would create a composite HNS Convention [202x], replacing all previous versions. However, the use of a protocol would require states to also ratify HNS, which may negatively impact the number of ratifications for an alternative fuel regime (to date the HNS Convention 2010 has not proved to be popular amongst states) and further delay the HNS Convention coming into force.

6.4.3. It should also be noted that without further amendment, inclusion of alternative fuels in the HNS Convention 2010 would result in the two-tier compensation regime applying to alternative fuels (when used as bunkers). If so, a funding mechanism would need to be put in place for the alternative fuels, which might be based on contributions from the owners of the alternative fuel or perhaps the suppliers. This would introduce extra complexity, but without it cargo receivers (who contribute to the second-tier fund) are likely to be reluctant to pay into a fund that also covers alternative fuels. Notably, attempts to include bunkers within the scope of the HNS Convention when it was originally drafted were rejected by states and so a similar approach might be taken for alternative fuels used as bunkers.

6.4.4. To avoid this issue, the HNS Protocol [202x] could be formulated to only include alternative fuels in the first tier and not the second-tier fund. The first-tier limits would be considerably higher than existing LLMC limits.

6.4.5. An advantage of including alternative fuels in the HNS Convention 2010 is that the scope of damage in the HNS Convention 2010 is much wider than that in the Bunkers Convention, covering inter alia damage due to fire and explosions in addition to pollution damage.⁴⁷

6.5. *A separate civil liability system for alternative fuels: an Alternative Fuels Convention*

6.5.1. A new convention could be developed to regulate the civil liability of incidents involving alternative fuels. Such a convention would complement the existing regimes, but being free-

⁴⁷ Art. 1(6) cf. Art. 3 2010 HNS Convention.

standing would not depend on/impact their ratification. Basing an Alternative Fuels Convention on the Bunkers Convention has the advantage that the approach taken in that Convention is widely accepted. A separate regime may mean it is easier to apply a similar regime to non-HNS covered situations.⁴⁸

6.5.2. A separate convention could provide for limitation based on any applicable national or international regime (in line with art. 6 of the Bunkers Convention). This would create the same level of compensation as for bunker spills which, as identified above, might be inadequate in some circumstances and would need to be increased substantially. If instead an Alternative Fuels Convention were to provide for limits other than those in the LLMC, this would require amendment of the LLMC in any event.⁴⁹

6.5.3. Because of the greater risks to life (and property) posed by alternative fuels, an Alternative Fuel Convention should not be limited to pollution damage (as the CLC and Bunkers Convention are), but should also include loss of life and personal injuries.

6.6. *A Voluntary International Agreement solution*

6.6.1. An option may also be to opt for a voluntary international agreement, possibly on an interim basis whilst awaiting a permanent convention solution. There have been a number of such voluntary agreements in respect of oil pollution to provide interim or additional insurance-backed compensation to victims. Following the Torrey Canyon Spill in 1967, two voluntary agreements, TOVALOP and CRISTAL were set up by tanker and oil industries to encourage prompt and effective compensation for clean-up and damages, even before the CLC 1969 and the Fund Convention 10971 entered into force.⁵⁰

6.6.2. A similar industry-led international solution could be taken for alternative fuels. Care would be needed to ensure that the agreed liabilities were fully backed by appropriate insurance. An agreement could potentially be implemented sooner than the time necessary to agree a treaty-based solution (and for it to enter into force).

6.6.3. In principle, it does not seem ideal to make adequate compensation permanently dependent upon a voluntary agreement, rather than a treaty. An agreement is naturally confined to the terms of those creating it and there can be uncertainty, e.g. as to those entitled to claim and the extent of any loss covered. This would not create an internationally negotiated level playing field. However, in the absence of any other option, one or more voluntary international agreements to provide the necessary compensation structure might be a last resort or serve as a temporary bridging mechanism until an international regime has been implemented. If such a voluntary scheme is created it should be designed only as an interim measure before any treaty solution

⁴⁸ In view of the advantages of the HNS Convention 2010, including the higher compensation levels for victims and the second tier, it does not seem sensible to also include alternative fuels carried as cargo within the scope of a new regime.

⁴⁹ LLMC 1976 nor 1996 provides for a reservation for a separate liability system for alternative fuels outside the scope of the HNS Convention.

⁵⁰ Catherine Redgwell 'Compensation for oil pollution damage: Quantifying environmental harm' (1992) 16 *Marine Policy* 2 90, 91.

and its terms should not be drafted unilaterally by one sector (e.g. shipowners and insurers) but be subject to wider discussion, for example at the IMO Legal Committee.

7. Recommendations

7.1 There is clearly a need for wide international discussion on the necessity for a legal regime to deal with civil liability and compensation in case of an incident involving alternative fuels. This Discussion Paper concludes that there are strong arguments in favour of there being a compelling need for such a regime. The CMI IWG on Maritime Decarbonisation recommends that:

1. CMI supports the IMO in relation to legal aspects of alternative fuels, including the issues raised in this Discussion Paper.
2. CMI contributes to creating awareness as to the current lack of a suitable international civil liability and compensation framework in place to deal with the consequences of shipping incidents involving alternative fuels, either on board vessels as cargo or as fuel;
3. CMI actively promotes adoption by states of the HNS Convention 2010;
4. CMI promotes discussion of the need to consider the development of an international civil liability regime for alternative fuels which are on board vessels to be used as fuel (bunkers)⁵¹ including through the wider circulation of a finalized Discussion Paper.
5. The CMI IWG on Maritime Decarbonisation continues to work with interested parties, including the ICS and IG, to work on an aligned approach that could be of use to the international community.
6. The CMI IWG on Maritime Decarbonisation will consider the need for and possible content of sending out a questionnaire to national MLA's (including as to finding out what national laws are in existence or might be in preparation). It will also work on identifying a checklist of the key elements that might need to be considered in any future legislation.

Annexes:

1. Characteristics and risks of alternative fuels.
2. Overview of ratifications.
3. Comparison of liability and compensation systems for vessel source pollution.

⁵¹ The IRENA report (fn 3) does not mention the lack of a liability and compensation framework.

Annexe 1: Characteristics and risks of alternative fuels

- 1.1. *Ammonia*: a highly toxic chemical which, in ambient conditions, is a toxic gas. Ammonia can be used as a gaseous or liquid fuel and can be made from coal (brown ammonia), natural gas (grey ammonia), natural gas with carbon capture and storage (blue ammonia) and from renewable energy sources (green ammonia). Due to lower volumetric efficiency and energy density, ships using ammonia need higher fuel storage capacity. In liquid form, risks of exposure increase if under pressure, as large volumes can be rapidly released into the air. Ammonia has a relatively low reactivity and narrow flammability range compared to other toxic gasses.⁵² Even though established industry best practices can safely handle ammonia, it remains corrosive, toxic and potentially life-threatening upon inhalation in high concentrations (more than 0.1 volume-percent).⁵³ In the case of spills into water, ammonia can cause severe pH changes, which disrupts marine life.⁵⁴ Spills into seawater can cause increased growth of bacteria, plankton and macrophytes, potentially smothering habitats. The toxicity of ammonia can alter the dynamics of food chains, which is expected to have a greater impact on fish than oil spills, but a lesser impact on invertebrates and birds.⁵⁵ In case of an explosion on board, the damage figures would likely be very high, especially if the incident occurs in a port. Although a land-based example, the risk to human life is illustrated by the 1992 accident in Dakar, Senegal involving the release of 22 metric tonnes of anhydrous ammonia from a tanker truck at a peanut processing mill. Debris from the explosion pierced other nearby process equipment also containing ammonia. The dense ammonia cloud quickly spread over the oil mill, surrounding businesses and the nearby community. Ultimately, 129 people were killed and 1,150 were injured.⁵⁶
- 1.2. *Methanol*: a colourless liquid and can be produced from the same sources as ammonia. Methanol as a fuel is highly flammable, burning with a low-temperature clear blue flame and is smokeless.⁵⁷ Methanol is toxic: exposure can cause lethal consequences by ingestion of more than 20 millilitres; lesser amounts can cause irreversible blindness. Methanol vapour dispersion and cloud behaviour can cause toxic exposure. Unlike ammonia, methanol is water soluble and readily biodegradable.⁵⁸
- 1.3. *Hydrogen*: a flammable, potentially explosive, non-toxic gas in ambient conditions. Hydrogen can be burned in combustion engines, blended with other fuels, or used in fuel cells. Explosion can occur as a result of medium-pressure leaks; in a worst-case scenario, hydrogen flames can burn an order of magnitude faster than natural gas and significantly faster than most commonly used hydrocarbons. If concentrations of hydrogen are maintained below 15% in the air, nonetheless, explosion risks are

⁵² A. Valera-Medina, H. Xiao, M. Owen-Jones, W.I.F. David, P.J. Bowen, 'Ammonia for power' (2018) 69 *Progress in Energy and Combustion Science* 63.

⁵³ Z. Wan, Y. Tao, J. Shao, Y. Zhang, H. You, 'Ammonia as an effective hydrogen carrier and a clean fuel for solid oxide fuel cells' (2021) 228 *Energy Conversion and Management*, 113729.

⁵⁴ Report IRENA and Ammonia Energy Association, 'Innovation Outlook: Renewable Ammonia', International Renewable Energy Agency, Abu Dhabi, Ammonia Energy Association, Brooklyn 2022, 30.

⁵⁵ Report by the Environmental Defense Fund, 'Ammonia at Sea: studying the potential impact of ammonia as a shipping fuel on marine ecosystems', 2022.

⁵⁶ Fuller details of the incident can be found at: Process Safety Beacon: Learning from the Worst Ammonia Accident | AIChE.

⁵⁷ P. Balcombe, J. Brierley, C. Lewis, L. Skatvedt, J. Speirs, A. Hawkes, I. Staffell, 'How to decarbonise international shipping: Options for fuels, technologies and policies' (2019) 182 *Energy Conversion and Management* 72, 78.

⁵⁸ John J Clary, 'General Animal and Aquatic Toxicity' in John J Clary (eds), *The Toxicology of Methanol* (Wiley) 73.

relatively low. This is a particular challenge, however, where dispersal space is constrained such as onboard ships.⁵⁹

- 1.4. *Biofuels*⁶⁰: these produced from biomass, which can include biological waste and crops. Unlike fossil fuel bunkers, biofuels can exhibit instability and microbe growth, which can result in corrosion to vessels' tanks and equipment caused by microbes (microbial corrosion) and the presence of water in the biofuel (causing chemical corrosion). In the event of a rupture of the bunker tankers, there is a substantial risk of pollution at sea. This is initially similar to a fossil fuel spill, including forming slicks and coating and/or poisoning aquatic life, although the particular consequences will depend upon the type of biofuel. In the longer term, the outcome is likely to be less harmful than a fossil fuel spill since biofuels are generally biodegradable.^{61 62} The dangers of biofuels in terms of risks of damage to life and property are otherwise similar in profile to traditional bunker fuels.
- 1.5. *LNG*: liquified natural gas (-162 degrees Celsius). Compared to other fuels, it has the highest energy density and is not toxic or corrosive. A significant spill can cause large-scale evaporation of LNG upon contact with water, resulting in explosion without combustion and damage caused by the consequent pressure waves.⁶³ If LNG vapours are ignited upon release, a pool fire will result, putting nearby humans and property at risk; ⁶⁴ if ignition of vapours is slower, the vapour cloud will cause a flash fire upon ignition.

⁵⁹ DNV, 'Hydrogen Forecast to 2050 – Energy Transition Outlook 2022', DNV Høvik 2022, 21.

⁶⁰ [Microsoft Word - HNS Finder - Guidance notes \(hnsconvention.org\)](#).

⁶¹ [Qiuwen Wang et al.], 'The use of alternative fuels for maritime decarbonization: Special marine environmental risks and solutions from an international law perspective' (2023) *Front. Mar. Sci., Sec. Marine Affairs and Policy*, Volume 9 – 2022 <https://doi.org/10.3389/fmars.2022.1082453>.

⁶² European Maritime Safety Agency, 'Update on Potential of Biofuels for Shipping [updated]', 2023, available at: [Latest News - Update on Potential of Biofuels for Shipping \[updated\] - EMSA - European Maritime Safety Agency \(europa.eu\)](#)

⁶³ Cheng Wang, Yonglin Ju, Yunzhun Fu, 'Dynamic modeling and analysis of LNG fuel tank pressurization under marine conditions' (2021) 232 *Energy* 121029.

⁶⁴ Laurens Vandebroek, Jan Berghmans, 'Safety Aspects of the use of LNG for Marine Propulsion' (2012) 45 *Procedia Engineering* 21, 22.

Annexe 2: Overview of ratifications and accessions

Only the CLC, Fund Conventions and Bunkers Conventions are currently in force. Table 2 displays the number of ratifications and accessions per convention.

There are 32 States party to the 1969 CLC, which is the older version of the 1992 CLC. These Member States are mostly located in the Arabian and Asian subcontinents. 26 States are a party to the 1992 CLC, but not to the 1992 Fund Convention. By far the most States are a party to the 1992 CLC and the Fund Convention: 121 countries. Of those 121 countries, 32 States are a party to the Supplementary Fund. Most notably, the first three most oil importing countries, i.e. China, India and the USA, have not ratified either CLC-Fund regime.

The Bunkers Convention has been ratified by 109 countries.

The HNS Convention was adopted in May 1996, but had not entered into force by 2009 due to an insufficient number of ratifications. In April 2010, a Protocol to the HNS Convention was adopted, that was designed to address the practical problems that had prevented many States from ratifying the original Convention.⁶⁵ The 2010 HNS Protocol will enter into force 18 months after the date on which it was ratified by at least 12 states. In October 2023, France became the seventh State and in November 2023, Slovakia became the eighth State to ratify the 2010 HNS Protocol, joining Canada, Denmark, Estonia, Norway, South Africa and Turkey, who have already deposited instruments of ratification to the Protocol. Belgium, Germany, the Netherlands, Sweden and Finland are involved in the ratification process.

Table 2 Number of ratifications per liability convention⁶⁶

Convention	Number of Ratifications
Oil	
Civil Liability Convention 1992 and the Fund Convention 1992	121
Supplementary Fund Protocol 2003	34
Civil Liability Convention 1992 but not to the Fund Convention 1992	26
Civil Liability Convention 1969	32
Bunker oil	
Bunkers Convention	109
Hazardous and noxious substances	
HNS Convention 1996	14
HNS Protocol 2010	8

⁶⁵ 2010 HNS Protocol.

⁶⁶ International Oil Pollution Compensation Funds, 'Parties to the international liability and compensation Conventions' (*IOPC Funds*, 2023) < <https://iopcfunds.org/membership-map/> > accessed 13 December 2023; International Maritime Organization, 'Status of Conventions' (*IMO*, 2023) < <https://www.imo.org/en/About/Conventions/Pages/StatusOfConventions.aspx> > accessed 13 December 2023

Annexe 3: Comparison of liability and compensation systems for vessel source pollution

Regime	CLC-Fund Conventions	Bunkers Convention	HNS Convention
Definitions			
Vessel	any seagoing vessel and any seaborne craft of any type whatsoever, actually carrying oil in bulk as cargo, provided that a ship capable of carrying oil and other cargoes shall be regarded as a ship only when it is actually carrying oil in bulk as cargo and during any voyage following such carriage unless it is provided that it has no residues of such carriage of oil in bulk aboard	any seagoing vessel and seaborne craft, of any type whatsoever	any seagoing vessel and seaborne craft, of any type whatsoever
Type of system	Three tiers 1. Shipowner 2. Fund 3. Supplementary Fund	Single tier 1. Shipowner	Two tiers 1. Shipowner 2. HNS Fund
Coverage	Oil, meaning any persistent hydrocarbon mineral oil such as crude oil, fuel oil, heavy diesel oil and lubricating oil, whether carried on board a ship as cargo or in the bunkers of such a ship	Bunker oil, meaning any hydrocarbon mineral oil, including lubricating oil, used or intended to be used for the operation or propulsion of the ship and any residues of such oil	Hazardous and noxious substances, meaning any substances, materials and articles carried on board of ship as cargo and residues from the previous carriage in bulk of substances referred to in (a) (i) to (iii) and (v) to (viii) of HNS 2010, including (various types of) LNG, methanol and ammonia.
Who	Shipowner, meaning the person registered as the owner of the ship or, in the absence of registration, the person or persons owning the ship. However, in the case of a ship owned by a State and operated by a company in which that State is registered as the ship's operator, "owner" shall mean such company	Shipowner, meaning the owner, including the registered owner, bareboat charterer, manager and operator of the ship	Shipowner, meaning the person registered as the owner of the ship or, in the absence of registration, the person or persons owning the ship. However, in the case of a ship owned by a State and operated by a company which in that State is registered as the ship's operator, "owner" shall mean such company
Compensation coverage			
Damages covered	a) loss or damage caused outside the ship by contamination, provided that compensation for impairment of the environment other than loss of profit from such impairment shall be limited to costs of reasonable measures of reinstatement actually undertaken or to be undertaken; and b) costs of preventive measures (i.e. any reasonable measures taken by any person after an incident has occurred to prevent or minimize pollution damage) and further loss or damage caused by preventive measures	a) loss or damage caused outside the ship by contamination, provided that compensation for impairment of the environment other than loss of profit from such impairment shall be limited to costs of reasonable measures of reinstatement actually undertaken or to be undertaken; and b) costs of preventive measures (i.e. any reasonable measures taken by any person after an incident has occurred to prevent or minimize pollution damage) and further loss or damage caused by preventive measures	a) loss of life or personal injury on board or outside the ship b) loss of or damage to property outside the ship c) loss or damage by contamination of the environment other than loss of profit from such impairment shall be limited to costs of reasonable measures of reinstatement actually undertaken or to be undertaken; and d) costs of preventive measures (i.e. any reasonable measures taken by any person after an incident has occurred to prevent or minimize damage) and further loss or damage caused by preventive measures.

Regime	CLC-Fund Conventions	Bunkers Convention	HNS Convention																																												
	(Limitation of) liability																																														
Liability	Strict	Strict	Strict																																												
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	Insurance and direct action against the insurer																																														
Insurance based on	To cover his liability for pollution damage under this Convention	To cover the liability of the registered owner for pollution damage in an amount equal to the limits of liability under LLMC	Cover maximum liability that may be incurred by the shipowner under the HNS limitation regime																																												
Direct action	Yes	Yes	Yes																																												