MARINE ENVIRONMENT PROTECTION COMMITTEE
69th session
Agenda item 20

MEPC 69/20/1
12 February 2016
Original: ENGLISH

ANY OTHER BUSINESS

Heavy fuel oil use by vessels in Arctic waters

Submitted by FOEI, WWF, Pacific Environment and CSC[1]

SUMMARY

Executive summary:	Heavy fuel oil (HFO) use poses a significant hazard to the Arctic marine environment, including to wildlife and coastal communities, through the risk of spills that would be difficult if not impossible to clean up. Burning HFO also produces harmful emissions. The concerns of co-sponsors are expounded and the co-sponsors welcome views of other parties.
Strategic direction:	7.1 and 7.3
High-level action:	7.1.2 and 7.3.1
Output:	No related provisions
Action to be taken:	Paragraph 19
Related documents:	DE 54/23; DE 56/10/10, DE 56/INF.14; DE 57/11/11 and MEPC 65/22

Introduction

1 The new Strategic Plan for IMO (2016-2021) recognizes the need to identify and address possible adverse impacts (strategic direction 7.1) and the need to keep under review measures to reduce adverse impacts on the marine environment caused by ships (high-level action 7.1.2). In addition, the UNFCCC Paris Agreement includes commitments to pursue efforts to limit global temperature increases to 1.5°C above pre-industrial levels, as well as to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience. This document identifies the hazards and risk heavy fuel oil (HFO)[2] poses to the Arctic environment – its ecosystems and indigenous and local communities – and summarizes the concerns of the co-sponsors.

---

[1] The preparation of this document was assisted by Ocean Conservancy, Environmental Investigation Agency, and International Council on Clean Transportation.

[2] The term heavy fuel oil in this document denotes residual marine fuel or mixtures containing predominately residual fuel and some distillate fuel, such as intermediate fuel oil.

HFO threat to the Arctic

2 The Arctic Council's Protection of the Arctic Marine Environment Group (PAME) began assessing HFO in the Arctic in earnest following the landmark 2009 Arctic Marine Shipping Assessment (AMSA), which concluded, "[t]he most significant threat from ships to the Arctic marine environment is the release of oil through accidental or illegal discharge"[3], and recommended that the Arctic States "cooperatively support efforts at the International Maritime Organization to strengthen, harmonize and regularly update international standards for vessels operating in the Arctic"[4]. A subsequent report commissioned by PAME found that "[i]n light of the particular HFO properties, significant risk reduction will be achieved if the onboard oil type is of distillate type rather than HFO"[5]. HFO spills are up to 50 times more toxic than medium and light crude oil spills, and account for roughly 60% of ship-sourced oil spills worldwide.[6] In addition to its toxicity, HFO is extremely viscous and breaks down slowly in the marine environment, particularly in colder regions like the Arctic[7]. Studies have shown that while 90% of HFO remains after 20 days in the ocean, marine diesel can take as few as three days to completely break down[8]. If a spill were to occur in ice-covered waters, oil could be trapped in ice, causing the oil to persist even longer and enabling oil to transport even longer distances[9]. More recently, PAME's Arctic Ocean Review (AOR) and Arctic Marine Strategic Plan 2015-2025 further emphasize the need to reduce the risks related to international shipping in the Arctic, including from HFO specifically in the AOR[10,11].

3 The risk of HFO spills in the Arctic poses a threat to the four million people living there, in particular to the food security of the subsistence-hunting peoples in indigenous communities. Arctic marine ecosystems have low species diversity and many Arctic species have slow growth rates and infrequent reproduction cycles. In the event of a spill, more damage can occur more quickly and with longer lasting effects than in more diverse marine ecosystems. In addition to the acute impacts of an HFO spill, such as the hypothermia and death many seabirds and marine mammals could face after HFO adheres to their fur or feathers,[12] the persistence of HFO leads to a myriad of chronic impacts on affected ecosystems. Studies on the long-term ecosystem impacts of the 1989 **Exxon Valdez** spill found oil persisted in the area for more than a decade. Long-term effects of the persistent, toxic oil on the marine ecosystem included "chronic persistence of oil, biological exposure, and population impacts to species closely associated with shallow sediments, (ii) delayed population impacts by sublethal doses (comprising health, growth and reproduction), (iii) indirect effects of trophic and interaction cascades, all of which transmit impacts well beyond the acute phase mortality"[13].

4 Furthermore, HFO produces considerable waste sludge, 1 to 5% of fuel volume consumed[14], that must be discharged onshore, incinerated, or burned as fuel after further processing. One study found that shipping within the Barents and Norwegian Seas produces 13,000 metric tonnes of fuel oil sludge a year[15], while the use of many alternative fuels, such as marine distillate fuels or LNG, does not result in any sludge residue.

3 Arctic Marine Shipping Assessment 2009 Report (AMSA, 2009). Arctic Council, April 2009 (5).
4 Id. at 6.
5 Det Norske Veritas AS, (DNV, 2011), “Report for PAME: Heavy Fuel in the Arctic (Phase 1)” (2).
6 Bornstein, J., Adams, J., Hollebone, B., King, T., Hodson, P.V. & Brown, R.S.(2014). Effects-driven chemical fractionation of heavy fuel oil to isolate compounds toxic to trout embryos. Environ. Toxic. & Chem. (33): 814-24.
7 DNV (2011) (40).
8 DNV (2011) (38).
9 DNV (2011) (41).
10 PAME, The Arctic Ocean Review Project, Final Report, (Phase II 2011-2013), Kiruna May 2013 (39).
11 PAME, Arctic Marine Strategic Plan 2015-2025, Iqaluit April 2015 (16).
12 AMSA 2009 (136).
13 Peterson, C. H. (2003). Long-Term Ecosystem Response to the Exxon Valdez Oil Spill. *Science*, *302*(5653), 2082–2086. http://doi.org/10.1126/science.1084282.
14 AMSA (2009) at 139
15 Id. at 139

5 HFO not only poses a hazard to the Arctic's marine environment, but the use of HFO as fuel also produces harmful and significantly higher emissions of sulphur, nitrogen oxides and black carbon (BC), which has a potent climate warming effect when emitted at high latitudes[16,17]. Black carbon is the second largest contributor to human-induced climate warming to date after carbon dioxide (CO_2)[18]. It strongly absorbs visible light and when it falls on the light-coloured surfaces, such as Arctic snow and ice, it reduces the amount of sunlight reflected back into space. This can accelerate snow and ice melt, increase the surface area of exposed, dark ocean water, and promote a self-reinforcing cycle of land and sea ice melting and climate warming[19].

6 Emissions from HFO use also impact human health. Inhaling BC nanoparticles is associated with cardiopulmonary morbidity and mortality, and the combustion of HFO further produces polycyclic aromatic hydrocarbons and heavy metals. Apart from the direct impact on human health, these substances can also enter the marine environment. This is particularly worrisome given that significant amounts of persistent organic pollutants are already present in the Arctic – gravitating toward the region from southern latitudes – and appear at high levels in Arctic residents and certain large marine mammals[20].

7 Marine vessels are already a large source of diesel particulate matter (PM) and BC emissions worldwide. Bond et al. have estimated that international shipping accounted for 7 to 9% of global diesel BC emissions in 2000[21], while AMAP's latest report on BC explains that "shipping currently accounts for about 5% of black carbon emissions [in the Arctic], but could double by 2030 and quadruple by 2050 under some projections of Arctic vessel traffic."[22] At the same time, emissions from land-based sources are expected to fall due to stricter controls[23], increasing the relative importance of addressing emissions from shipping. Switching from HFO fuels to alternatives, such as low-sulphur distillate fuel will not eliminate BC emissions but will be expected to reduce BC emission levels by on average 30% and possibly up to 80%[24].

Arctic waters

8 Figures for 2012 indicate that 1347 ships operated in the Arctic, with all bulk carrier, tanker, cargo, container and passenger vessels greater than 10,000 GT using HFO. The majority of smaller vessels (e.g. fishing boats) use distillate fuels. Although only 28% of the vessels used HFO, HFO accounted for 75% of the total bunker mass of all vessels operating in the region[25]. Increasing access and navigability of the Arctic facilitates growth in natural resource extraction, shipping, tourism, and development interests, resulting in a

---

16 AMAP (2015). Summary for Policy-Makers: Arctic Climate Issues 2015, Short-lived Climate Pollutants, AMAP Secretariat (9).

17 Vard Marine (2015). *Fuel Alternatives for Arctic Shipping*.

18 Bond T. C., Doherty S. J., Fahey D. W., Forster, P. M. (2013) Bounding the role of black carbon in the climate system: A scientific assessment. Journal of Geophysical Research: Atmospheres 118(11): 5380- 5552.

19 Azzara, A., Minjares, R., and Rutherford, D. (2015), "Needs and opportunities to reduce black carbon emissions from maritime shipping," International Council on Clean Transportation (March 23).

20 See, e.g. L. Ritter et al., A Review of Selected Persistent Organic Pollutants, for the IPCS (1995), available at http://www.who.int/ipcs/assessment/en/pcs_95_39_2004_05_13.pdf.

21 Bond et al. (2013) and Eyring, V., Isaksen, I. S. A., Berntsen, T., Collins, W. J., Corbett, J.J., Endresen, O., Grainger, R. G., Moldanova, J., Schlager, H., and Stevenson, D. S. (2010) Assessment of Transport Impacts on Climate and Ozone: Shipping, Atmos. Environ., 44(37), 4735– 4771

22 AMAP (2015). (7).

23 Johnson, J. E., Jalkanen, J. P., and Johansson, L. (2015). Model calculations of the effects of present and future emissions of air pollutants from shipping in the Baltic Sea and the North Sea, Atmos. Chem. Phys., 15, 783-798.

24 Lack, D. & Corbett, J. (2012) *Black carbon from ships: a review of the effects of ship speed, fuel quality and exhaust gas scrubbing*, 12 Atmos. Chem. Phys. 3985 (2012).

25 Det Norske Veritas (2013). HFO in the Arctic-Phase 2, for Norwegian Environmental Agency, DNV Doc. No./Report No.: 2013-1542-16G8ZQC-5/1, 6, 33 (2013), *available at* http://www.pame.is/index.php/projects/arctic-marine-shipping/heavy-fuel-in-the-arcticphase-i.

considerable rise in near- and long-term vessel traffic in the region. By 2025, shipping transits in the United States; Arctic are projected to increase between 100 and 500%[26]. Other Arctic navigability projections show that, by 2050, diminishing sea-ice conditions will allow open water class vessels to (seasonally) transit the Northern Sea route, and moderate ice-strengthened vessels to transit over the North Pole[27].

9 The Arctic marine environment poses many unique challenges to maritime traffic, increasing the possibility of an accident and HFO spill. Arctic weather is characterized by periods of prolonged seasonal darkness, as well as intense storms and high waves, which can threaten vessels and impair any search and rescue effort or oil spill response. For instance, in 2011, the oil rig **Kolskaya** capsized and sank in the Sea of Okhotsk during a winter storm with 20 foot waves[28]. Similarly, in 2004 extremely rough weather hampered efforts to rescue the crew of the **M/V Selendang Ayu** near Dutch Harbor in the Aleutian Islands. Conditions also delayed oil spill response efforts by more than three weeks and the majority of the 1.7 million litres of intermediate fuel oil and 55,564 litres of marine diesel spilled was never recovered[29]. Sea ice retreat creates even more hazardous conditions for maritime traffic as ice floes shift unpredictably. In 2012, the drilling rig **Kulluk** and its supporting vessels were forced to abandon exploratory drilling in the Chukchi Sea when a section of ice pack 30 miles by 12 miles drifted towards the operation[30].

10 Compounding natural hazards are uncharted waters; the majority of the Arctic's waters have not been surveyed with modern methods. For example, less than 1% of Arctic waters have been surveyed with modern techniques capable of penetrating sea ice within the Exclusive Economic Zone of the United States, although efforts are underway to update these nautical charts[31]. Uncharted waters create an additional challenge even to ice strengthened vessels. In 2015, the commercial icebreaker **Fennica** opened a 39-inch gouge in its hull on an uncharted shoal while travelling through an area near Dutch Harbor that had not been surveyed since 1935[32]. The harsh physical environment and dearth of navigational aids all elevate the risk to ships operating in the Arctic, and the statistical likelihood of a major HFO spill will only rise as maritime traffic increases. According to an analysis by Lloyd's of London, there were 55 shipping casualties within the Arctic Circle in 2014, up from just three in 2005[33]. Since 2005, there have been 347 casualties among vessels larger than 100 gross tonnes, including 19 complete losses[34].

11 Wind, waves, visibility and daylight are all key factors in the success of any clean-up operation and, as noted above, those variables in the Arctic are unpredictable and severe. Not only would emergency response toward the end of shipping season face shorter and shorter periods of daylight, but also as winter approaches newly forming ice can trap oil, transport it long distances and release it elsewhere in the spring upon melting[35]. Even in ideal conditions, spill response in the Arctic is difficult if not impossible[36], and the properties of HFO make the limited possibility more unlikely.

---

26 U.S. CMTS, (2015). A 10-Year Projection of Maritime Activity in the U.S. Arctic, 2015. Available at http://www.cmts.gov/Bulletin.aspx?id=87

27 Smith, L. C., & Stephenson, S. R. (2013). New Trans-Arctic shipping routes navigable by midcentury. *Proceedings of the National Academy of Sciences of the United States of America*, *110*(13), E1191–5. http://doi.org/10.1073/pnas.1214212110

28 Vasilyeva, N. (2011). Kolskaya Oil Rig Sinking Sparks Doubt Over Arctic Plan. *Huffington Post*.

29 AMSA (2009) (88)

30 Joling, D. (2012). Drifting sea ice halts Shell's Arctic drilling. *Alaska Dispatch News*.

31 DeMarban, A. (2015). Seafloor area where Shell vessel was damaged uncharted since 1935. A*laska Dispatch News*.

32 Id.

33 Allianz (2015). Safety and Shipping Review 2015. *Allianz Global Corporate & Security.*

34 Id.

35 DNV (2011).

36 PEW (2010). *Oil spill prevention and response in the U.S. Arctic Ocean: unexamined risks, unacceptable consequences*. Report commissioned by Pew Environment Group from Nuka Research and Planning Group LLC

12 All the three commonly used methods of oil spill clean-up – in situ burning, containment and recovery, and dispersants – are more challenging with thicker and viscous oils like HFO. With the tendency for HFO to emulsify in the water column, ignition for in situ burning is more difficult than with lighter fuels. Its total volume increases rapidly over a few days and spreads throughout the water column. Conventional booms and skimmers for containment and recovery are increasingly ineffective in ice concentrations beyond 1/10 (10% or more ice coverage). Mechanical recovery of oil trapped under drifting ice floes in a pack ice environment is also challenging and at present there are no proven technologies or techniques for dealing with such a scenario after a medium to large spill. Finally, dispersants are only effective on some oil types and are unlikely to be effective on more viscous oils such as IFO and HFO[37].

13 The lack of infrastructure in the Arctic presents another significant limitation to emergency response in the event of a large oil spill[38]. Navigability constraints due to seasonal ice can inhibit the transport of equipment into the Arctic region, and in the remote polar regions response resources are likely to be far removed from the accident. It may take the authorities days to reach the site of a vessel incident and even longer to begin the task of mounting an effective spill response. For example, in 2010 the **MV Clipper Adventurer** cruise ship ran aground in the Canadian Arctic on a rock initially claimed to be "uncharted". The Canadian Coast Guard vessel took two days to reach the site[39].

Current status of HFO in IMO instruments

14 MARPOL Annex VI (1997) sets a limit of 4.50% m/m for the sulphur content of marine fuel. In October 2008, MEPC 58 agreed to reduce the maximum sulphur content to 3.50% m/m from 2012 and to 0.50% m/m from 2020 and also provided for stricter limits to apply in agreed emission control areas. From 2020 the uses of any fuel oil exceeding the 0.50% limit would be prohibited, except that the 2008 MARPOL Annex VI amendment provided for certain alternative compliance options as long as those options were at least as effective in terms of sulphur emission reductions as the fuel sulphur content limits. The sulphur alternative compliance options comprise the use of exhaust gas cleaning systems that remove sulphur oxides from the exhaust (commonly called scrubbers) and the use of liquefied natural gas (LNG) as a fuel.

15 MEPC 58 also agreed on a review provision such that, by 2018, a group of experts should have completed: 1) a review of the availability of fuel oil to comply with the 2020 0.50% global limit, taking into account the global market supply and demand for compliant fuel oil; 2) an analysis of the trends in the fuel oil markets; and 3) any other relevant issues. IMO would then decide whether to proceed with the 2020 implementation date. MEPC 68 agreed to the terms of reference for this review by experts, and consultants were appointed in mid-2015 to carry out the review. Its findings will be considered at MEPC 70.

16 In response to the threat from an HFO spill, IMO adopted an amendment to MARPOL Annex I in 2010 that introduced a new chapter eliminating the use and carriage of heavy grade oils on ships operating in the Antarctic area. The provisions of regulation 43 took effect from 1 August 2011. In 2014, following an incident where a fishing vessel sank in the Antarctic area while carrying heavy grade oil as ballast in the vessel's ballast tank, regulation 43 was amended to prohibit "the carriage in bulk as cargo, use as ballast, or carriage and use as fuel" of HFO in the Antarctic area.

---

and Pearson Consulting LLC, 137 pp. and WWF (2009). Not so fast: some progress in technology, but U.S. still ill-prepared for offshore development. Report commissioned by WWF from Harvey Consulting LLC, 15pp.

37 PPR 3/15. Guide on Oil Spill Response in Ice and Snow Conditions. Submitted by Norway. 11 November, 2015.

38 National Academy of Science (2014). Available at http://www.nap.edu/catalog/18625/responding-to-oil-spills-in-the-us-arctic-marine-environment

39 Emmerson, C. and Lahn, G. (2012). Arctic Opening: Opportunity and Risk in the High North. Prepared by Lloyds, London.

17 At DE 54 (October 2010), during plenary debate on the development of the International Code for Ships Operating in Polar Waters, some delegations expressed support for the introduction of a ban on the use and carriage of HFO for Arctic areas. However, other delegations did not support this view[40]. Further consideration of an HFO ban took place at MEPC 65 (May 2013), when the Committee endorsed the view of the majority of delegations who spoke that it was premature to regulate the use of HFO on ships operating in Arctic waters and noted the view of some delegations that it might be desirable and possible to have such regulations in place in the future[41]. As a consequence, Part I-B of the Code includes a recommendatory provision encouraging application of regulation 43 of MARPOL Annex I when operating in Arctic waters.

Limiting impacts of shipping in the Arctic environment

18 Since it is more than six years since the Arctic Marine Shipping Assessment identified the most significant threat from ships to the Arctic marine environment to be the release of oil through accidental or illegal discharge and five years since IMO first discussed HFO use in Arctic waters, the co-sponsors of this document believe that legal options for reducing the environmental risk of HFO use in Arctic waters should be reassessed. A range of IMO measures to reduce the increasing risk of a major pollution incident occurring already exist (e.g. a new regulation, emission control areas, use of spatial protection and routeing measures), and the co-sponsors undertake to elaborate on these for consideration at a future meeting of the Committee.

Action requested of the Committee

19 The co-sponsors welcome formal or informal views from Member States and observers during MEPC 69 or ahead of MEPC 70, and invite the Committee to note the concerns raised by this document.

---

[40] DE 54/23 Report to the Maritime Safety Committee. 17 November 2010. Paragraph 13.8.3.

[41] MEPC 65/22 Report of the Marine Environment Protection Committee on its Sixty-Fifth Session. 24 May 2013. Paragraph 11.53.