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DEVELOPMENT OF MEASURES TO REDUCE RISKS OF USE AND CARRIAGE OF HEAVY FUEL OIL AS FUEL BY SHIPS IN ARCTIC WATERS

Summary of the work undertaken by the Arctic Council's Protection of the Marine Environment Working Group on Heavy Fuel Oil

Submitted by Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden and the United States

SUMMARY

Executive summary:	This document provides information on projects relevant to HFO use and carriage in the Arctic that have been completed or are in progress by the Arctic Council's Working Group on the Protection of the Arctic Marine Environment.
Strategic direction:	7.2
High-level action:	7.1.2
Output:	No related provisions
Action to be taken:	Paragraph 28
Related documents:	MEPC 69/20/1, MEPC 69/21 (paragraphs 20.3 to 20.4), MEPC 70/17/4, MEPC 70/17/9, MEPC 70/17/11, MEPC 70/18 (paragraphs 17.18 to 17.20), MEPC 71/14/4, MEPC 71/17

Introduction

1 The Arctic Council is the leading intergovernmental forum promoting cooperation, coordination and interaction among the Arctic States, Arctic indigenous communities, and other Arctic inhabitants on issues of sustainable development and environmental protection.

2 The work of the Arctic Council is primarily carried out through six working groups. The Working Group on the Protection of the Arctic Marine Environment (PAME) focuses on policy and non-emergency pollution prevention efforts that support the protection and sustainable use of the Arctic marine environment. PAME provides a unique collaborative forum to pursue the development of coordinated action programmes and guidelines designed to complement existing legal arrangements that cover topics ranging from shipping, to marine protected areas, to resource exploration and development, to the ecosystem approach to management.

3 With respect to marine transportation, PAME has produced significant and wide-ranging work under the thematic areas of 'Enhancing Arctic Marine Safety', 'Protecting Arctic People and the Environment', and 'Building the Arctic Marine Infrastructure'. These themes provided the framework for PAME's flagship report on Arctic shipping – the 2009 *Arctic Marine Shipping Assessment* (AMSA) – and continue to guide PAME's ongoing efforts.

4 Indeed, the AMSA recommended that the Arctic States cooperatively support efforts at the International Maritime Organization (IMO) to augment global ship safety and pollution prevention conventions with specific Arctic requirements. This recommendation was further complemented by Arctic Council Ministers issuing a declaration "encourag[ing] active cooperation within the [IMO] on development of relevant measures to reduce the environmental impacts of shipping in Arctic waters."[1] Accordingly, in 2010 PAME initiated the first of several reports tasked with identifying trends and environmental risks, as well as options for minimizing those risks, associated with the use and carriage of heavy fuel oil (HFO) by ships in the Arctic.

5 Recognizing recent efforts undertaken by the IMO in implementing the *Mandatory Code for Ships Operation in Polar Waters* (Polar Code) in 2017, as well as the forthcoming implementation a global sulphur limit of 0.50% by 2020, the co-sponsors of this paper – all members of PAME – have summarized the content and findings of the PAME reports herein for the benefit of the IMO in its consideration of potential mitigation measures for ships using HFO in the Arctic.

Heavy Fuel Oil in the Arctic Report – Phase I[2]

Summary

6 The first of four multi-phase reports commissioned by PAME, the Phase I identifies the risks associated with the use and carriage by ships of HFO in the Arctic and considers potential mitigation strategies to address these identified risks. It additionally examines the reliance on HFO as both fuel and cargo in the Arctic and forecasts HFO use and carriage trends. The report concludes by examining the regulatory environment for HFO at local, regional, and international levels.

7 To identify vessel traffic patterns and statistics used to support these objectives, DNV (the author of Phase I) relied upon satellite-based Automatic Identification System (AIS) data provided by the Norwegian Coastal Administration for the period of August to November 2010. In addition, fuel sample data from DNV Petroleum Services (DNVPS) was applied in order to identify vessels most likely to use HFO and to identify Arctic ports where HFO bunkering operations occur. The definition of the Arctic used for this report is the same as the definition used by the IMO for the Polar Code.

Findings

8 Based on the analysis of satellite AIS data, Phase I determined that fishing vessels make up the greatest percentage of vessels operating within the Arctic Region, followed by a mixed grouping of 'Other Vessels' comprised primarily of service vessels, research vessels, community support vessels (mainly cargo ships), and passenger vessels. Out of a total of 954 AIS-registered vessels operating in the Arctic during the study period, 189 were identified as

[1] Tromsø Declaration (Sixth Ministerial Meeting of the Arctic Council). Arctic Council, April 2009 (4).

[2] https://pame.is/images/05_Protectec_Area/2011/PAME_I_2011/04_Agenda/agenda_item_4_AMSA_IB_action_point_3-phase_I_HFO_project-Final_report-1.pdf

most likely running on HFO. The vessels using HFO as fuel typically include larger cargo, tanker, and passenger ships.

9 With regard to the amount of HFO transported as cargo, obtaining results required making certain assumptions. Based on available bunker samples from the DNVPS database and analysing the traffic patterns of oil tankers, HFO bunkering was identified as being carried out primarily within near or sub-Arctic areas, with only a few instances of samples being registered within the region.

10 While certain polar hazards (e.g. low temperatures, extended periods of darkness and daylight, the presence of both ice and snow), elevate the risk environment for ships operating within the Arctic Region, the report noted that of critical importance is the fate of oil spills in ice covered waters, and the effectiveness of spill response and clean-up in Arctic conditions. Trapping of oil in ice makes the pollution longer-lasting, facilitating the transport of oil over long distances. Relevant risk mitigating strategies should therefore focus on prevention. In light of the particular HFO properties, significant risk reduction will be achieved if oil consumed is of a distillate type.

11 Phase I also noted that the forecasted changes in shipping activity in the Arctic Region will likely influence the pattern of HFO utilization. The potential for an increase in global commercial transit of cargo via emerging trade routes, in addition to an increase in Arctic petroleum activities, could result in an increased number of larger cargo and tanker vessels which typically rely upon HFO as fuel. However, the future picture of HFO or distillate fuel use will also be impacted by how global and regional legislation influences fuel markets.

Heavy Fuel Oil in the Arctic Report – Phase II[3]

Summary

12 A natural progression of Phase I, the Phase II report (also authored by DNV) provides a more comprehensive picture of maritime traffic, fuel types used, and oil cargo transported within the Arctic Region. Unlike Phase I which drew conclusions from a smaller, four month data set of AIS information (due to satellite operational limitations), Phase II instead draws from an entire years' worth (2012) of available AIS information. Based on this data, Phase II identifies vessel composition (type and size), geographical distribution, sailed distances, and operating hours throughout the year. In addition, it models fuel consumption and emissions to air, performs a high-level risk analysis of frequencies of incidents leading to HFO spills, conducts a qualitative review of expected traffic development in the Arctic Region, and concludes with a gap analysis on the regulatory regime for both the use and carriage of HFO in the Arctic.

Findings

13 Based on an analysis of AIS data, a total of 1347 unique vessels were found to have operated in the Arctic throughout 2012. From this total, 371 (28%) were identified as most likely using HFO as fuel. As with Phase I, it was generally found that larger ocean going vessels used HFO whereas the smaller and more numerous fishing vessels, as well as community support, research, and service vessels were more likely to rely upon distillate fuels.

14 This same AIS data was introduced into a risk analysis model to identify accident return periods for a variety of incidents (e.g. grounding, collision, machinery failure) with results

[3] https://pame.is/images/05_Protectec_Area/2014/PAME_I_2014/04_Agenda/HFO_in_th_Arctic_Phase_2_Final_report_V2.pdf

indicating that an incident resulting in a spill of oil could on average be expected once every 1.6 years, with the grounding of a tanker representing the greatest spill potential.

15 Based on these accident return periods, eight risk control options were identified and evaluated, two of which were found to give the highest potential yield on investment: i) area based vessel management (e.g. vessel restrictions during certain times of year, establishment of traffic channels, designation of areas to be avoided, etc.), and ii) speed reductions.

Heavy Fuel Oil in the Arctic Report – Phase II(b)[4]

Summary

16 The Phase II(b) report relies upon similar methodologies, calculations and assumptions used during the previous Phase I and Phase II reports, though focuses instead on those areas of the Bering Sea south that fall outside of IMO's definition of Arctic used for the Polar Code, though within the geographic scope of the 2009 Arctic Marine Shipping Assessment (AMSA). Further, whereas Phase II relies upon AIS data from 2012, the II(b) is based on a dataset covering August 2012 to August 2013.

Findings

17 Vessels demographics in the Bering Sea region are significantly different when compared against the demographics identified in the larger area of study analysed in the previous Phase II report, with traffic comprised predominately by the intercontinental shipping of large bulk carriers and container vessels operating along the Great Circle Route, the majority of which use HFO as fuel. Unlike the previous report where Arctic ship traffic is generally identified by huge variations in operational hours and sailed distances throughout the year, the majority of the Great Circle Route traffic is not affected by sea ice and other seasonal variations.

18 The Phase II(b) report identified groundings of tankers as being at greatest risk of resulting in an accidental oil spill, though this risk is restricted to certain areas along the Aleutian Chain and not to those parts of the Great Circle Route located further from shore. An incident of this type was found by the Phase II(b) report as likely to happen once every two years within the Bering Sea.

Heavy Fuel Oil in the Arctic Report – Phase III(a)[5]

Summary

19 The Phase III(a) report examines shipping incidents involving releases of HFO and other fuels in the Arctic and near-Arctic marine environment. The first section of the report provides a general overview and description of the characteristics of HFO. The second section identifies shipping incidents in the region involving HFO and other oil releases and any resulting reported liability. This information is captured in a separate annex of shipping incidents and sources. The third and final section of the Phase III(a) report examines the effect of HFO releases on the marine environment.

[4] https://pame.is/images/03_Projects/AMSA/Heavy_Fuel_in_the_Arctic/HFO%20in%20the%20Arctic%20Phase%20IIb%20final%20report%20by%20DNV_signed.pdf

[5] https://pame.is/images/05_Protectec_Area/2016/PAME-II_2016/Agenda_Item_5/5.2/Agenda_5.2a-Arctic_Shipping-HFO_Incidents-final_version_.pdf

Findings

20 The appendix accompanying this report captures shipping incidents between 1970 and 2014 identified in publicly available sources that involved a release or spill from a vessel of oil and any resulting liability from such release. 13 incidents of HFO release were identified while other non-HFO incidents were also captured. The majority of these incidents occurred in near-Arctic waters, which for purposes of this report encompass those waters north of latitude 55° N.

21 Although the effect of HFO releases on the Arctic marine environment requires more study, the Phase III(a) identifies three key factors that influence the consequence of an oil or analogous HFO discharge into the marine environment: i) the properties of the HFO; ii) the characteristics of the Arctic ecosystem and its inhabitants, and; iii) the nature of the clean-up or remediation process. While the first two aspects are addressed, the third remains outside the scope of this report.

Heavy Fuel Oil in the Arctic Report – Phase III(b)[6]

Summary

22 The Phase III(b) report investigates the possible hazards to engines and fuel systems using HFO in cold climates by comparing the rate of engine or fuel system failures for ships that use HFO in the Arctic to the rate of similar failures for ships that rely upon other fuel types in similar Arctic conditions. HFO characteristics and operational challenges related to HFO use by ships are explained, and known risk factors related to HFO operation are discussed.

Findings

23 The Phase III(b) report identifies three primary factors for engine failure or engine stop for ships that use HFO as fuel: i) risks related to disruption of fuel supply; ii) risks related to fuel quality, and; iii) risks related to fuel switchover. Moreover, the report highlights that the safe use of HFO as fuel requires careful attention by skilled personnel following established on-board procedures. Because 'off-spec' fuel is probably the most important risk factor for engine failure or loss of propulsion, effective on-board fuel management will therefore significantly reduce the risk of engine break-down, engine repair, or grounding.

Ongoing Projects

24 Recognizing the need for additional research and information, PAME – in the approval of the 2017-2019 Work Plan – indicated its intention to continue to advance the work of research into mitigating risks associated with the use and carriage of HFO by ships in the Arctic. Accordingly, the following HFO reports have been initiated and are in various stages of development with completion dates anticipated by 2019.

Collect and Report Information on the Use of Heavy Fuel Oil (HFO) in the Arctic

25 An update of the Phase I and II reports, this project sets out to collect information for the most recent three-year period on the number, types, and routes of ships in the Arctic that used HFO as fuel (including quality or grade) or transported it as cargo, including if available the volume of HFO carried as bunker fuel and/or cargo as well as the destination of HFO transported as cargo.

[6] https://pame.is/images/03_Projects/AMSA/Heavy_Fuel_in_the_Arctic/Final_report_HFO_hazards_engines_and_fuels.pdf

Collect, Report and/or Review Information about On-shore use by Indigenous Peoples and Local Communities of HFO

26 A project in partnership with the Arctic Council's Sustainable Development Working Group (SDWG) this report sets out to collect, report and/or review information about on-shore use by indigenous peoples and local communities of HFO in the Arctic Region as well as the extent to which such peoples and communities rely on ships that burn HFO to deliver supplies and provisions.

Explore the Environmental, Economic, Technical and Practical Aspects of the use by Ships in the Arctic of Alternative Fuels

27 The Phase IV (d) report will explore the environmental, economic, technical and practical aspects of the use by ships in the Arctic of alternative fuels, including liquefied natural gas.

Action Requested of the Committee

28 The Committee is invited to note the information contained in this document.

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