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REDUCTION OF THE IMPACT ON THE ARCTIC OF BLACK CARBON EMISSIONS FROM INTERNATIONAL SHIPPING

Fuels are key to urgent Black Carbon emission reductions

Submitted by FOEI, WWF, Pacific Environment and CSC

SUMMARY

Executive summary:	This document highlights the need for urgent action to reduce ship Black Carbon emissions impacting the Arctic. The key to reducing Black Carbon emissions is the adoption of binding measures including those aimed at improving the quality of the fuels used on board ships.
Strategic direction, if applicable:	3
Output:	3.3
Action to be taken:	Paragraph 15
Related documents:	PPR 9/8, PPR 9/8/1, PPR 9/8/2; PPR 6/20/Add.1; MEPC 76/5; PPR 8/5/1 and PPR 8/5/3

Introduction

1 This document is submitted in accordance with the provisions of paragraph 6.12.5 of the *Organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.5/Rev.2) and provides comments on document PPR 9/8/1 submitted by Denmark and Finland.

Urgent action needed to protect the Arctic

2 The recent Intergovernmental Panel on Climate Change (IPCC) AR6 assessment report, the debate at COP 26, the Arctic Ministers Reykjavik Declaration[1] and the recent EU Communication on the Arctic[2] all stress the scale and seriousness of the climate crisis unfolding in the Arctic, and clearly demonstrate the need for urgent mandatory measures.

[1] Declaration of the Foreign Ministers of the Arctic States at the 12th Ministerial meeting of the Arctic Council, Reykjavik, Iceland, 20 May 2021. Reykjavik declaration (2021) (arctic-council.org)

[2] Joint Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A stronger EU engagement for a peaceful, sustainable and prosperous Arctic. JOIN (2021) 27 final.

Black Carbon (BC) emissions affecting the Arctic must be all but eliminated and GHG emissions globally halved by 2030 for there to be any chance of limiting warming to 1.5°C. This can only be achieved in the shipping sector through mandatory measures that apply to all ships. Whether or not the world takes immediate action to curb GHG emissions and short-lived climate forcers will have a profound effect on the speed and severity of global heating.

3 The most effective measure to protect the Arctic that is available today and can be implemented immediately is a mandatory switch to distillate fuel for ships operating in or near to the Arctic. This would reduce BC emissions from ships using heavy fuels by around 44% and allow the subsequent installation of diesel particulate filters which would further reduce emissions by over 90%. A switch to distillate fuel already occurs routinely when a ship enters an emission control area (ECA). While any work at PPR 9 to establish recommendatory guidelines should reinforce the call in resolution MEPC.342(77), the PPR Sub-Committee's terms of reference also call for further consideration of regulating or directly controlling BC emissions. Agreement on a mandatory switch to distillates or other cleaner alternative fuels or methods of propulsion for ships operating in or near the Arctic should therefore remain the highest priority for PPR 9.

Fuel quality standards

4 Ongoing work to set fuel quality standards must also be completed as soon as possible because a fuel switch would be even more effective if paired with the development of a standard limiting aromatics in fuel oils. In document PPR 9/8/1, Denmark and Finland propose draft BC guidelines on recommendatory goal-based control measures that include certification of marine diesel engines, exhaust gas treatment systems, low-BC emission fuels and monitoring systems, in combination or individually to ensure low BC emissions. In effect, this means that the PPR Sub-Committee should work on limiting aromatics in fuel oils if the intention is to establish a BC threshold for certified low-BC emission fuels, which falls well below the level of distillate oil fuel. The annex to document PPR 9/8/1 provides formulas for establishing the various recommended BC thresholds with the key factors determining the level and stringency to be determined.

Engine standards

5 The annex to document PPR 9/8/1 also proposes the development of engine standards. This is, however, likely to be time-consuming and the effectiveness unclear. During the discussions of the Correspondence Group established by PPR 7, it was suggested that consultation should take place with the International Civil Aviation Organization (ICAO) over its development of jet engine emission standards for non-volatile particulate matter (nvPM), i.e. BC. The ICAO work took 10 years to complete (2010 to 2020) and highlighted the high cost associated with developing new engine types to deliver emission reductions below business as usual. A decision was also taken not to penalize operators so that all in-service jet engines pass the in-production regulatory limits. As there are many more different types/models of marine engines in operation than jet engines, a similarly lengthy process for marine engines should be expected.

6 Moreover, when the United States Environmental Protection Agency (EPA) moved in early February 2022 to incorporate ICAO's new standards into domestic law, the Agency noted that the proposed standards being aligned with ICAO's are "technology following" and therefore are not expected, in and of themselves, to result in further reductions in PM from these engines. Therefore, an improvement in air quality for those who live near airports where these aircraft operate is not anticipated.[3] "Technology following" standards, as attributed by

[3] https://www.govinfo.gov/content/pkg/FR-2022-02-03/pdf/2022-01150.pdf

the EPA to ICAO, prevent "backsliding" but they do not mandate the reduction of emission levels. An IMO process to develop either recommendatory or mandatory engine standards is likely to be similarly challenging because departing from a "technology following" approach would, at a minimum, require marine engine phaseouts.

Low BC emission fuels

7 With regard to developing a recommended BC threshold for certified low-BC emission fuels, the annex to document PPR 9/8/1 proposes that the fuel in question should emit less BC compared to a distillate oil fuel and that the standard for such testing should be a universal means of identification irrespective of whether the fuel is deployed in low, mid or high-speed engines. So, document PPR 9/8/1 would seem to suggest that the PPR Sub-Committee work to do this would first require a baseline emission level for distillate fuel independent of deployment (in low-, mid- or high-speed engines). In order to determine a realistic baseline emission level that falls well below the emission levels of distillate fuel oil, the co-sponsors urge the PPR Sub-Committee to prioritize the analysis of BC emissions from residual marine (RM) very low sulphur fuels (VLSFO) compared to distillate marine (DM) fuel oils.

8 In document MEPC 76/5, ISO indicated that work was being undertaken to evaluate whether a fuel tends to have a paraffinic or aromatic character, and this could potentially be included in the next ISO 8217 standard. An update at PPR 9 would be helpful, particularly because although the fuel test analysis reported by ISO in document MEPC 76/5, comparing the characteristics of 2020 RM VLSFOs and 2018 RM HFOs, shows improved trends pointing to VLSFOs fuels being on average more paraffinic, a sizeable percentage of VLSFOs do not show improvement. For example, 13% to 14% of the 2020 RM VLSFO samples had a viscosity at 50°C above 180 cSt. Further analysis beyond comparisons between VLSFOs with HFO would be welcome, specifically on comparing the characteristics of 2020 RM VLSFO (or 2021 RM VLSFO if available) to the equivalent year test data of DM fuels.

9 While it has been argued that VLSFO fuels are more paraffinic than RM HFOs, the evidence presented in document PPR 8/5/1 (Finland and Germany) that some VLSFOs could in fact be more aromatic and emit higher levels of BC has yet to be fully examined and conclusions drawn. Furthermore, the subsequent recommendation of PPR "to implement and limit aromatic content, or H/C ratio in marine fuels" remains to be addressed. IPIECA and IBIA in document PPR 8/5/3 also urge "consideration of a regulatory limit on aromatics or a proxy for aromatics to properly consider any trade-offs that need to be made in order to meet a specified limit, e.g. with respect to stability of the fuels concerned." In doing so, PPR 9 could quantify the emission and fuel cost benefits of the lower fuel consumption experienced as a result of the higher energy density of distillates vs VLSFOs. This, together with the reduced engine wear and NO_X emissions associated with using cleaner fuels, are contributory factors that should be taken into account when considering both recommendatory and regulatory measures concerning a fuel switch.

10 No further submissions have so far been made to PPR 9 on the issue of aromatics in fuel oil. However, document PPR 9/8 (Finland) and results of the measurement campaigns[4] provide some new insights. In terms of fuel properties, elemental carbon concentrations correlated with polyaromatic hydrocarbons (PAH(di+)) and the asphaltene content of fuels at high engine load. While the measurement campaigns found that the 0.50% sulphur fuel showed the highest BC emissions at a 25% load, which indicates that even at 0.50% sulphur level the fuel may contain a substantial amount of BC precursors depending on crude oil and processing technology. BC concentrations were found to be systematically lower for aromatic

[4] https://www.mdpi.com/2073-4433/13/1/31

free diesel fuel (AR-0) than for high-aromatic diesel fuel (Ar-20 fuel containing 20 wt% of aromatics). The highest BC emissions were observed at low (25%) engine load for fuel with 0.50% sulphur content, and at high (75%) engine load for fuel with 2.50% sulphur content. BC emissions for VLSFO fuel at low loads were also approximately five times higher than distillate fuel BC emissions at high engine load. Some of these test results appear to support the recommendation in document PPR 8/5/1 that it may be necessary to implement and limit aromatic content, or hydrogen/carbon (H/C) ratio in marine fuels.

Other measures

11 Based on the findings set out in document PPR 6/INF.15 (Finland), another area for immediate attention, preferably as a regulation, would be avoiding the use of ships equipped with older mechanical injection engines in the Arctic, or acting on the recommendations of the VTT study accompanying document PPR 6/INF.15 which identified that renewal or retrofitting the mechanical injection systems of old engines with modern fuel injection systems would reduce the BC emissions. The tuning of engines to lower BC emissions (combined with NO_X reduction technologies) should also be considered.

12 In document PPR 6/20/Add.1, the expansion and/or establishment of additional ECAs is identified as a potential control measure. The PPR Sub-Committee should consider which 0.10% sulphur compliant fuels will meet the needs of ECAs in Arctic waters, noting that some ultra-low sulphur fuels still qualify as heavy fuels (e.g. ULSFOs) and that the United States EPA mandates the use of ultra-low sulphur diesel (ULSD) by all United States domestic ships with small cylinder marine engines operating in the North American ECA. The ULSD must either have a minimum cetane index of 40 or a maximum aromatic content of 35% by volume.[5]

Proposals

13 The Sub-Committee is invited to take note of the above and, in particular, to:

.1 develop regulations that require a fuel switch to distillates with the subsequent installation of diesel particulate filters;

.2 focus on the development of fuel standards and aromatic content as opposed to engine standards; and

.3 clarify which 0.10% sulphur compliant fuels will meet the requirements of any future Arctic ECAs.

14 Importantly, the co-sponsors invite the PPR Sub-Committee to prioritize actions to reduce BC emissions that are both legally binding and can be implemented quickly.

Action requested of the Sub-Committee

15 The Sub-Committee is invited to consider this document, in particular the proposals set out in paragraphs 13 and 14, and take action as appropriate.

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[5] § 1090.305 ULSD standards eCFR :: 40 CFR 1090.305 -- ULSD standards.