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AIR POLLUTION PREVENTION

Regulating Black Carbon emissions from international shipping impacting the Arctic and the importance of fuel quality

Submitted by FOEI, WWF, Pacific Environment and CSC

SUMMARY

Executive summary:	This document provides additional comment and background on marine fuel quality issues to support the proposals set out in document MEPC 81/5/5 (FOEI et al.) for concrete actions to control and reduce Black Carbon emissions from ships operating in or near to the Arctic.
Strategic direction, if applicable:	3
Output:	3.3
Action to be taken:	Paragraph 13
Related documents:	MEPC 81/5/5; PPR 11/6/1 and PPR 11/6/3

Introduction

1 This document comments on document MEPC 81/5/5 (FOEI, WWF, Pacific Environment and CSC), providing additional information, and is submitted in accordance with paragraph 6.12.5 of the Committees' Method of Work.

Background

2 The principal underlying the proposals set out in document MEPC 81/5/5 is that cleaner fuels will generally result in lower and less harmful emissions of Black Carbon (BC). This fact is well recognized by the road transport sector where both the sulphur and aromatic content of road fuels have been heavily regulated for decades in both Europe and North America to mitigate air quality and human health impacts. This has also facilitated the mandatory installation of particulate filters on vehicles in parallel with increasingly stringent engine emission standards. In both Europe and North America inland shipping is extensive, and its fuels have been subject to similar strict limits on both sulphur and aromatic content for over a decade.

3 The need to reduce the human health and environmental impacts of sulphur in international shipping fuels has been recognized with the introduction of increasingly stringent limits on sulphur content, the introduction of SO_x-ECA provisions for coastal States, the implementation of the 0.5% global limit on the sulphur content of marine fuels in 2020, and the accompanying worldwide ban on the carriage of non-compliant fuels for combustion on board a ship.

4 As noted in document MEPC 81/5/5, and despite 13 years of IMO deliberations, international shipping has yet to face any regulatory action to limit emissions of BC, a potent short-lived climate pollutant, in or near the Arctic, the very region where such emissions do the greatest harm to the climate. This is, in-part, because of a widespread belief that factors such as engine load, ship and engine age, ship size and other conditions, including weather, are the main determinant of BC emissions.

5 A technology-based approach does not, however, take account of the scientific consensus that has emerged over recent years that the levels of hydrogen and aromatics in fossil fuels are a major determinant of these fuels' sooting propensity. A finding which underpins the call, in resolution MEPC.342(77), for all ships to voluntarily use distillate or other, cleaner, alternative fuels or methods of propulsion that are safe for ships and could contribute to the reduction of BC emissions from ships when operating in or near the Arctic.

Need for action

6 BC emissions from shipping in or near the Arctic have doubled in less than seven years and shipping activity in the Arctic region is expected to continue to grow.[1] The need for regulatory action to address shipping BC emissions has been heightened by the recognition of the International Civil Aviation Organization (ICAO) and European regulators, that aviation soot (BC or non-volatile particulate matter – nvPM) affects not only air quality and human health but also the climate, with BC an important short-lived climate pollutant. Soot emissions from jet exhaust are higher when lower hydrogen content (higher aromatic) fuels are used at altitudes subject to super ice saturated conditions, leading to the greater formation of contrails. Persistent contrails, if formed at night, cause up to 60% of aviation's total climate impact by acting as a blanket preventing Earth's radiation from escaping back into space. Ship BC on the other hand has its greatest climate impact when emitted above 60 degrees North – in and near the Arctic – dramatically increasing atmospheric heating and altering the albedo effect. At ground level – around airports and around seaports, estuaries or along coasts – the impacts of BC emissions on air quality and human health from both sectors are significant.

Importance of fuel quality and non-CO_2 issues

7 Work at ICAO to cut soot/BC emissions from jet engines began in 2008 and focussed on addressing the harmful effects on human health of nvPM – ultrafine particulate matter – around airports. During this work it was recognised that the hydrogen/carbon (H/C) ratio as an indicator of the aromatic content is the best measure of a fuel's sooting propensity. ASTM International[2] tests for H/C ratio were included in certification procedures for ICAO jet engine nvPM standards which came into force in 2021. Attention has now turned to the climate impacts of soot emissions at altitude and the pursuit of fuel options to complement the engine standards – both 'cleaner' kerosene as well as alternative fuels. In addition, over 20 years of work by climate scientists on aviation's non-CO2 climate impacts (engine NO_x at cruise and principally persistent contrails) has now led to EU Fit For 55 regulations requiring the monitoring and reporting of the actual aromatic content of uplifted jet fuel and of total aviation non-CO_2 climate impacts from 2025.

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1 Document PPR 11/6/3 (FOEI, WWF, Pacific Environment and CSC) paragraph 9 https://www.pame.is/projects/arctic-marine-shipping/arctic-shipping-status-reports/723-arctic-shipping-report-1-the-increase-in-arctic-shipping-2013-2019-pdf-version/file

2 Formerly the American Society for Testing and Materials founded in 1898.

8 Based on the reported results, the European Commission will in the future consider amending the aviation ETS Directive to put a price on non-CO_2 impacts, while a separate study is now getting underway on regulatory options to reduce fossil jet fuel's aromatic content through additional refinery processing. Despite known scientific uncertainties in calculating contrail non-CO_2 equivalents, tackling the sector's non-CO_2 climate impact is now widely regarded as low-hanging fruit. The past year has seen an unprecedented surge of financial and human effort to act on aviation non-CO_2 in both Europe and North America, where impacts are greatest.

Fuel quality and Arctic BC ship emissions

9 BC emissions from ships operating in and near to the Arctic have a disproportionate Arctic climate impact and as a result PPR is actively considering documents such as PPR 11/6/1 (Canada, Germany and Iceland) and PPR 11/6/3 (FOEI, WWF, Pacific Environment and CSC) which cite multiple scientific studies showing that hydrogen content and aromatics greatly influence the sooting propensity, and thus levels of BC emissions from fossil fuels. Both documents support the use of the H/C ratio of a marine fuel to be the most scientifically accurate approach to determining a marine fuel's sooting propensity in the context of mitigating Arctic ship BC emissions. The proposal in document PPR 11/6/2 (ISO) to use the Viscosity Gravity Constant (VGC) as an indicator of a fuel's paraffinic nature has raised concerns because it was developed before the advent of fuel blending to comply with the 2020 sulphur limits. It also drew on an often-cited 2005 ASTM study[3] on fuel quality issues which had clearly spelled out the importance of the H/C ratio, noting that:

.1 the "quality of a fuel is directly related to the hydrogen and sulphur contents";

.2 "hydrogen is an example of a perfect fuel with zero CH weight ratio (CH = 0), while black carbon is an example of the worst fuel with a CH value of infinity"; and

.3 "a fuel with higher hydrogen or lower carbon content is more valuable and has higher heating value".

As set out in annex 2 of document PPR 11/INF.3 (United States), ISO acknowledged that "the higher the H/C ratio the better the combustion characteristics of a fuel are".

10 It is not clear, however, how simply incorporating a methodology to determine a fuel's paraffinic nature in ISO 8217 would lead, in practice, to changes in fuel use in or near the Arctic unless IMO first took action to adopt a regulation which required the prior testing of fuels for aromatic/paraffinic/hydrogen content and the result being recorded on the bunker delivery note (BDN). Without such action, ships will have no way of knowing the sooting propensity of the fuels they are bunkering, or even be able to order such fuels in advance if there is no pre-existing requirement on fuel suppliers to produce more paraffinic fuels. Document PPR 11/6/INF.7 (ISO) explains that fuel test results for HFO and VLSFO/ULSFO fuels were analysed – but not distillates which being more severely refined can generally be expected to be more paraffinic. A quick way to verify this would be for MEPC to request the ISO to analyse the distillate fuel test results it has access to as proposed in document PPR 11/6/3.

11 The Committee should urge industry and national bodies to undertake tests on the H/C ratio of marine fuels as a matter of urgency and request that the H/C ratio be included in ISO 8217, as proposed in document PPR 11/6/1, for the purposes of mitigating ship BC emissions in or near the Arctic. Member States and national standards bodies should also

[3] Riazi M. R. Characterization and properties of petroleum fractions. ASTM International, 2005.

pursue such action. An H/C ratio test for marine fuels – document PPR 11/6/1 identifies ASTM 5291 – needs to be incorporated in ISO 8217 in such a way that fuel suppliers are required to measure and report sooting propensity. Data on trends and variances could then be generated, which would enable PPR and MEPC to agree appropriate limits that could be used as the basis for both the polar fuel standard and Arctic BC ECA approaches (see document MEPC 81/5/5).

12 It has been argued for over a decade and is now borne out by work on aviation BC emissions, that switching to a cleaner marine fuel such as distillates, will reduce ship BC emissions in all cases. It will do so by varying amounts according to engine, load, ship size and other characteristics. In addition, the impact will be immediate. Two documents recently submitted to PPR 11 (PPR 11/INF.6/Rev.1 (RINA) and PPR 11/6/6 (IPIECA)) acknowledge the efficacy of switching to distillate fuels as an Arctic BC mitigation strategy while suggesting that installing exhaust after treatment technology (scrubbers) can be a viable alternative. However, this is not borne out by the science,[4] would effectively promote the continued use of residual fuels, and, as document PPR 11/INF.6/Rev.1 acknowledges, there are currently no BC-related regulatory incentives for the uptake of such after-treatment measures.

Action requested of the Committee

13 The Committee is invited to consider the fuel quality steps detailed in paragraphs 10 and 11, namely, to pursue the H/C ratio as a measure of a marine fuel's sooting propensity and to support the development of the polar fuel standard and Arctic BC ECA options, as well as the proposal in document MEPC 81/5/5 to implement a mandatory switch to distillates or other cleaner fuels by ships operating in or near the Arctic, and to take action, as appropriate.

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[4] A 2020 ICCT literature review revealed that ships equipped with scrubbers and burning HFO emit 81% more BC than MGO from 2-stroke engines and 34% more from 4-stroke engines. https://theicct.org/publication/air-emissions-and-water-pollution-discharges-from-ships-with-scrubbers/