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POLLUTION PREVENTION AND RESPONSE

Comments on the outcome of PPR 8

Submitted by FOEI, WWF, Pacific Environment and CSC

SUMMARY

Executive summary:	This document comments on the outcome of PPR 8 on Black Carbon (BC) and on two options to reduce ship BC emissions other than an immediate switch to distillates in the Arctic – through universal marine engine standards and limiting the aromatic content in marine fuels – and identifies some possible challenges that will need to be addressed
Strategic direction, if applicable:	3
Output:	3.3
Action to be taken:	Paragraph 13
Related documents:	MEPC 75/1/3 Corr. 1, MEPC 75/5/5, MEPC 75/10, MEPC 75/10 Add.1; PPR 8/5/1, PPR 8/5/2, PPR 8/WP.1/Rev.1; MEPC 76/9/7 and MEPC 76/9/10

Introduction

1 This document is submitted in accordance with the provisions of paragraph 6.12.5 of the document on 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), comments on documents MEPC 76/9/7 (Secretariat) and MEPC 76/5 (ISO), and follows up on document MEPC 75/5/5 (FOEI, WWF, Pacific Environment and CSC) which was deferred to MEPC 76 (MEPC 75/1/3, annex 4).

2 This commenting document responds to two alternative options to an immediate switch to distillates to reduce Black Carbon (BC) emissions from ships through the setting of engine standards and limiting the aromatic content in marine fuels considered by PPR 8 (see MEPC 76/9/7, paragraphs 2.6.1, 2.6.2, 2.6.3 and 2.6.5). It sets out some of the issues and identifies some of the challenges, including technical difficulty, expense and likely long lead times.

3 In the lead up to the implementation of the IMO 2020 global fuel sulphur limit in regulation 14.1.3 of MARPOL Annex VI, industry raised concerns over the uncertainty and potential diversity of VLSFO characteristics. Debate ensued at PPR 7 in light of the results in document PPR 7/8 (Finland and Germany) which "clearly indicate that new blends of marine fuels with 0.50% sulphur content can contain a large percentage of aromatic compounds, which have a direct impact on Black Carbon emissions".

4 In paragraph 3.4.2 of document MEPC 75/10/Add.1 (Secretariat) (to be considered at MEPC 76), ISO is requested "to provide an update to PPR 8 on its consideration on if it was possible to add a further measure to what was already included in the ISO 8217 standard with a view to providing an approximate indication as to whether a fuel oil was more aromatic or more paraffinic".

5 In document MEPC 76/5, ISO reports that ISO/TC28/SC4/WG6 reviewed the characteristics and reported performance of more than 100,000 bunkers supplied to ships between January and June 2020 based on test data provided by major global testing agencies and comprising distillates (DM), residual fuels (RM) of varying sulphur content and HSFO. ISO then made comparisons with the quality of HSFO supplied during the same period. In document MEPC 76/5, ISO reports that comparative analysis of the results shows that VLSFOs have a lower average viscosity, density, micro carbon residue (MCR), Calculated Carbon Aromaticity Index (CCAI) and higher net specific energy than 2018 HSFO, pointing to "VLSFOs being more paraffinic in nature than HSFO resulting in improved combustion characteristics". The reported results are averages and do not clarify what percentage of the bunkers might have been more or less paraffinic than HSFO. Moreover, the results of aromaticity (CCAI) in table 1 showing the average of RM fuel oil characteristics, 2020 vs 2018, only compares the results of VLSFO vs HSFO and in paragraph 10 on the sulphur content of fuels, only DM and RM are compared, thus not distinguishing between DM, VLSFOs and HSFO. This is disappointing given the issues raised at PPR 7.

6 In paragraph 2.6.1 of document MEPC 76/9/7 (Secretariat), PPR 8 notes the final results of a study, reported in document PPR 8/5/1 (Finland and Germany) (first reported in document PPR 7/8), emphasizing that "the aromatic content of fuel oils is a well-known factor that affects BC formation" and has already been limited in automotive petrol and jet fuels but not marine fuels. The test results clearly showed "...increasing aromatic content leads to higher BC emissions" and that "for the reduction of BC emissions from international shipping and its impact on the Arctic, it is regarded necessary to implement and limit aromatic content, or H/C ratio in marine fuels". The study found that "the combustion of GtL together with DMA emitted the lowest particle numbers at all engine loads over the entire size range" and that "combustion of the three VLSFOs had particle sizes and numbers, which were closely together, but considerably higher than for GtL and DMA at all engine loads". It also found that "as opposed to all other PM fractions, the BC emissions of the dedicated VLSFO samples are the highest of all fuels with 21 to 26 mg/kWh, which are approximately twice as much as in PM of DMA and some 40-70% higher than the PM of HFO".

7 In document PPR 8/5/1, Finland and Germany noted that high VLSFO aromatic content investigated caused concern regarding BC emissions, the impact on human and environmental health, and the levels of polycyclic aromatic hydrocarbons (PAHs) such as naphthalenes and phenanthrenes which are among the highest sooting compounds and known to be harmful with carcinogenic and mutagenic properties. Because they are known to be harmful, PAHs are limited to 8% in automotive diesel fuel.

Aromatics and engine performance

8 In document PPR 8/5/1, Finland and Germany noted that "aromatic compounds in marine fuels stabilize the asphaltenes, keep them in 'solution' and prevent agglomeration or precipitation. Nevertheless, the determination of aromatic compounds in highly viscous media like residual fuels is a challenge and no standardized analytical method yet exists". The *2019 Guidelines for consistent implementation of the 0.50% sulphur limit under MARPOL Annex VI* (resolution MEPC.320(74)) said that "whereas aromatic components have a stabilizing effect on asphaltenes, paraffins do not". According to one global marine services provider, even before the global cap came into force "the main risk is that the asphaltenes separate out of the fuel and form sludge and that this sludge ends up in the filters effectively blocking them. The consequence of blocked fuel filters is often a blackout ship with loss of propulsion".[1] The UK P&I Club reported that 16% of all blackouts were fuel related and that most of them come from blocked fuel filters. EMSA noted that "asphaltenes and resin components of fuel oil, if spilled, will be present in the marine environment for a very long time".[2] Another marine fuel specialist recently reported that "the combustion quality of some VLSFOs is a major contributor to engine damage. When a high proportion of paraffinic components are combined with residual aromatics (which includes asphaltenes), such as in VLSFO…, the lighter paraffinic components dilute the protective aromatics, producing instability that causes the asphaltene to grow into a much larger molecules (agglomeration) that require more oxygen to burn completely...all this means that even though VSFLOs contain less residual components by mass, those that are there are far less stable than those found in most traditional HSFOs. This is because HSFO contains a high ratio of aromatics to paraffins, so that the residual aromatics are protected – remaining dispersed, stable, and small enough to burn readily during combustion…if a significant portion of fuel remains unburnt, this will impact not only the safe running of your vessel, but the overall efficiency, and therefore emissions of all shipping".[3] However, in a statement to PPR 7 (PPR 7/22/Add.1, annex 22) ISO confirmed that "early analysis of VLSFOs supplied to vessels in January 2020 when compared with HSFO analysis illustrates the more paraffinic nature of VLSFOs than most of the HSFO, the ignition and combustion performance is expected to be improved and hence to result in lower BC".

9 Document PPR 7/INF.15 (Canada, Finland, Netherlands and Republic of Korea) noted expert advice that "desulfurized residual fuels or VLSFO may not reduce BC and could be more toxic than conventional fuels.... Fuel standards may be needed on maximum aromatic content or minimum hydrogen content to control BC from blended fuels, such as VLSFO". And that aside from engine standards "a heavy fuel oil (HFO) ban, with a switch to distillate fuel or other cleaner fuels" was an appropriate control policy.

Engine standards

10 In document PPR 8/5 (Canada), the Correspondence Group on Reduction of the Impact on the Arctic of Black Carbon Emissions from International Shipping noted that work by the UN's aviation body, ICAO, "could be useful" for IMO's work on Black Carbon. ICAO refers to jet engine exhaust particulate matter (PM) consisting mainly of ultrafine soot or Black Carbon emissions as "non-volatile" PM (NvPM). Work at ICAO[4] on jet engine PM started in 2000 and on NvPM standards in 2010. They will come into effect 13 years later, on 1 January 2023 regulating about 25 jet engines. ICAO standards are mostly technology

1 https://www.wilhelmsen.com/imo2020/imo-2020-do-we-really-know-what-we-are-getting-ourselves-into/

2 EMSA Manual on the Applicability of oil spill dispersants.

3 https://innospec.com/wp-content/uploads/2020/10/Marine-technical-bulletin-Enhance-VLSFO-Quality.pdf

4 ICAO Environmental Report 2016 (https://www.icao.int/environmental-protection/Documents/EnvironmentalReports/2016/ENVReport2016_pg85-88.pdf).

following.[5] NvPM stringency levels and implementation dates were heavily influenced by industry concerns over extremely high technology costs and over compliance even to in-production standards. The IMO 4th GHG study lists hundreds of marine engines with differing BC emission factors.

11 A recent European Commission study[6] concluded that measures to reduce aromatics within jet fuel would require fuel producers to adapt their production processes and a system to monitor the aromatic content of fuels. An international standard requiring this "could potentially be introduced in the mid- (i.e. 5 to 8 years) to long-term (i.e. 8+ years)."

Switch to distillates

12 In document PPR 6/INF.15, Finland reported independent test results which endorsed particulate filters and distillates as potential BC emission reduction technologies. Document PPR 8/5/3 submitted by industry groups IPIECA and IBIA on measures in the short term, quoting document PPR 6/INF.15, noted that a number of measures could be promoted on a voluntary basis, including avoiding the use in the Arctic of ships equipped with older mechanical injection engines and a voluntary switch to distillate fuels, in particular on ships using medium or high speed 4-stroke engines.

Action requested of the Committee

13 The Committee is invited to note the likely challenges facing work on marine engine and aromatic standards when considering the comparatively straightforward and simple option to support a call for an immediate voluntary switch to distillates or other alternative cleaner fuels or forms of propulsion by ships operating in the Arctic (see MEPC 76/9/10).

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5 Source; clean-air-plans air-quality-management-plans 2022 (http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/printer-friendly-aircraft-presentation-02-04-21.pdf?sfvrsn=14).

6 SWD 2020 277 final.