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PREVENTION AND RESPONSE  
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Agenda item 8

PPR 7/8/3  
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**REDUCTION OF THE IMPACT ON THE ARCTIC OF BLACK CARBON EMISSIONS  
FROM INTERNATIONAL SHIPPING**

**The need for urgent action to stop the use of blended low sulphur residual fuels  
leading to increases in ship-source Black Carbon globally**

**Submitted by FOEI, WWF, Pacific Environment and CSC**

**SUMMARY**

*Executive summary:* This document\* responds to a recent study showing that new blended low sulphur residual fuels designed to meet the IMO 2020 mandated 0.50% global sulphur limit will result in very significant increases in ships' Black Carbon emissions, reflects on the implications of this for shipping's contribution to the climate crisis and calls on IMO to regulate to stop their use

*Strategic direction,  
if applicable:* 3

*Output:* 3.3

*Action to be taken:* Paragraph 15

*Related documents:* PPR 5/INF.15, PPR 5/24; BLG 17/INF7; PPR 6/INF.18; MEPC 74/10/8, MEPC 74/18; PPR 7/8, PPR 7/8/2, PPR 7/INF.15 and PPR 7/INF.20

**Introduction**

1 This document is submitted in accordance with paragraph 6.12.5 of the annex to *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.1) and provides comments on document PPR 7/8 (Finland and Germany).

2 In document PPR 7/8, Finland and Germany have submitted the results of a recent Black Carbon (BC) measurement campaign that analysed the impact of different ship fuel oil qualities on BC emissions. The results have profound implications for the work of IMO and for the shipping and oil refinery sectors' response to the climate crisis.

\* This document is also supported by the International Cryosphere Climate Initiative (ICCI).

3 The results of document PPR 7/8 suggest that, in an attempt to reduce the cost of creating IMO 2020 compliant fuels and maintain a semblance of business as usual, the refining industry has created a range of new blended fuels that could overnight send ship-sourced BC emissions soaring. Such an outcome would undermine IMO's attempt at tackling shipping's contribution to the climate crisis and would seriously aggravate global efforts to combat climate change in general and warming in the Arctic in particular.

4 Document PPR 7/8/2 (FOEI, WWF, Pacific Environment and CSC) draws some conclusions from the findings in document PPR 7/8 and makes the case for IMO to ensure that all ships operating in or near the Arctic switch immediately to distillate fuels. This second document looks at the wider global implications of shipping using low sulphur fuel blends which give rise to high levels of BC emissions.

### **Low sulphur residual fuel blends, aromatics and increased Black Carbon**

5 The original assumption, when amending MARPOL Annex VI in 2008 to cap the global sulphur content of marine fuels at 0.50% m/m, was that the industry would switch to distillate fuels. Doing so, it now appears, would in a best-case scenario potentially decrease BC emissions from the global fleet by up to 80% (PPR 7/8/2) and in the worst case not affect BC emissions at all. The results of the study reported in document PPR 7/8 suggest, however, that low sulphur fuel blends created to comply with the 2020 sulphur limit contain high proportions of aromatic compounds, in a range between 70% and 95%. On combustion, these fuels resulted in an increase in BC emissions of 10% to 85% compared to HFO and 67% to 145% compared to DMA (the highest quality distillate fuel, along with DMZ, that is normally supplied for marine use).

6 After more than two decades of work to clean up shipping, this is an alarming development. Scandinavian countries (Norway and Sweden) initiated ship sulphur reduction discussions at IMO in the late 1980s. The first IMO ship sulphur regulation was adopted in MARPOL Annex VI in 1997. Discussion on the reduction of particulate matter (PM) from ships at IMO, with specific or implied reference to BC, arose from the establishment of a correspondence group at BLG 10 in 2006. MEPC 61 in 2010 agreed, in relation to BC emissions from ships, "to invite interested Member Governments and international organizations to submit concrete proposals with specific measures to BLG 15". IMO commenced its work programme on reducing the impact on the Arctic of BC emissions from international shipping in 2011. The assumption at that time remained that moving to address sulphur emissions would reduce ship BC emissions.

7 And indeed, a shift from HFO to distillates was one of the six shortlisted BC abatement options identified in the December 2012 Investigation of appropriate control measures (abatement technologies) to reduce Black Carbon emissions from international shipping (BLG 17/INF.7). This remains the most detailed examination yet of BC abatement options for shipping. In section 3.6.1, the study noted, amongst other things, that "HFO is a fuel used almost exclusively in the marine shipping sector, which contains significantly higher concentrations of sulphur, aromatic hydrocarbon, and inorganic ash. All of which are known to reduce fuel combustion efficiency and produce, amongst other emissions, BC". The study went on to note that Lack and Corbett had reviewed 19 separate comparisons between HFO and higher quality fuels and concluded that this shift would result in BC reductions of 30% to 80% and that this assessment was consistent with a well-established link between fuel quality and BC emissions for on-road diesel engines.

8 Document BLG 17/INF.7 also concluded, in respect of feasibility (BLG 17/INF.7, section 6.4.6), that "significant reductions in BC are achieved when switching from HFO to a lower sulphur fuel, as in the case of distillate fuel. There are studies suggesting that there is

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no BC reduction or even increases in BC emissions as fuel quality improves, but most studies point to a genuine BC reduction potential, which is corroborated by the experience from land-based diesel engines".

9 A review of reports and documents concerning implementation of the global marine fuel 0.50 m/m sulphur limit published since IMO's 2016 decision to proceed in 2020 do not, however, reveal a specific continuing focus or concern about the impact of desulphurization on BC emissions. Documents from the Arctic Council and its Protection of the Arctic Marine Environment (PAME) Working Group, CIMAC, the European Commission, IBIA and ISO itself, all stress the necessity of new low sulphur fuel blends complying with the ISO standard 8217, without stressing the need to ensure that BC is also reduced, or at least not increased. The ISO standard itself does not include a consideration of BC emissions.

10 Yet there were warning signs of a potential BC problem as fuels were desulphurized. The 2017 update (PPR 5/INF.7) to the 2012 IMO study, undertaken by Dr. Lack and published on IMODOCS in December 2017, stated that "fuel factors such as heavy metal, oxygen, asphaltene and poly-aromatic hydrocarbon and ash content contribute to combustion characteristics" and thus BC emissions. Moreover, high aromatic content of fuels was recognized as likely having an influence on BC emissions, and was one of the contributors to the variability in measurements of BC reduction rates with a switch from residual to distillate fuels. The 2017 updated report further called for specific experiments to investigate BC emissions and aromatic content.

11 It is extremely difficult to believe that oil refiners and the oil industry in general were not aware of the potential impact of aromatic compounds on BC emissions when developing new low sulphur marine fuel blends. This is especially so given the recognition in document BLG 17/INF.7 (noted above) that HFO contains high concentrations of aromatic hydrocarbons which reduce fuel combustion efficiency and produce BC, and the fact that industry has had years of experience with the "well-established link between fuel quality and BC emissions for on-road diesel engines". Yet, as recently as a few months ago, there was no mention of this issue in industry publications dealing with the development of 2020 compliant marine fuels other than the need to comply with ISO 8217 (a good example being the "Joint Industry Guidance" entitled *The supply and use of 0.50%-sulphur marine fuel* published in August 2019 by ARA, Concawe, CIMAC, IACS, IBIA, IPIECA, IMAREST, IUMI, JPCC, OCIMF and the Royal Institute of Naval Architects). It was only at the 6<sup>th</sup> ICCT Workshop on Marine Black Carbon (Helsinki, 18-19 September 2019) that, in evaluating possible control measures, it was recognized that any ban on HFO and switch to distillates "must prohibit fuels with high aromatic/low hydrogen content, prohibit VLSFO, and prohibit desulfurized residual fuels" (PPR 7/INF.15).

12 Regrettably, there appears to be little in the existing standards and regulations to prohibit what has happened. Regulation 18.3.1 of MARPOL Annex VI requires that "The fuel oil shall not include any added substance or chemical waste" that "contributes overall to additional air pollution", but if a higher proportion of aromatic compounds doesn't qualify as an "added substance or chemical waste" in this context, then we appear to be faced with both a major regulatory failure and industry disregard of one of international shipping's key environmental and climate objectives. Clause 5.2 of ISO 8217:2017 requires that "The fuel shall be free from any material at a concentration that causes the fuel to be unacceptable for use in accordance with Clause 1 (i.e. material not at a concentration that is harmful to personnel, jeopardizes the safety of the ship, or adversely affects the performance of the machinery)". The focus here does not appear to be air pollution but, once again, it is surely legitimate to ask if the higher concentration of aromatic compounds in low sulphur residual fuel blends is consistent with this standard. Whatever the answer to that question, it is clear that the industry has important questions to answer in respect of the development and roll out of these polluting new fuels.

### **Urgent action**

13 Given the findings reported in document PPR 7/8 and in the absence of information or findings to the contrary being presented to PPR 7, the co-sponsors of this document believe that the gravity of the situation requires an immediate and urgent response from IMO.

14 More specifically, and in addition to implementing the conclusions contained in document PPR 7/8/2, we call on the Sub-Committee to forward this issue to MEPC 75 as a matter of urgency and with a recommendation for MEPC to:

- .1 amend MARPOL Annex VI to prohibit the use of low sulphur heavy fuel oil blends that increase BC emissions; and
- .2 adopt a resolution, covering the period up until the above restriction comes into effect, calling on all shipowners, charterers, Member States and fuel providers to observe a voluntary prohibition on the use of any marine fuel whose aromatic content is likely to lead to BC emissions greater than those commonly associated with distillate fuels.

### **Action requested of the Sub-Committee**

15 The Sub-Committee is invited to review the information and proposal contained in this document and to take action as appropriate.

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