Regulating Black Carbon emissions from international shipping impacting the Arctic

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In its Strategic Plan 2024 – 2029, the International Maritime Organization (IMO) commits to taking concrete actions that ensure that international shipping bears its fair share of responsibility in responding to climate change and reducing greenhouse gas emissions from international shipping. With respect to reducing the impact on the Arctic of emissions of short-lived climate pollutant Black Carbon (BC), the IMO established a work plan in 2011 to "investigate appropriate control measures to reduce the impact of BC emissions from international shipping" the plan envisage a final report and agreement on the appropriate action or actions within two years. In the intervening years, emissions of BC from ships operating in and near to the Arctic have more than doubled[1]. At the same time, other sectors responsible for BC emissions impacting the Arctic have actively introduced measures to reduce BC emissions and are on track to achieve between 25 - 33% reductions in BC emissions based on 2013 baselines by 2025[2].

Black carbon is a short-lived climate pollutant, produced by the incomplete burning of fossil fuels, it has an impact over 3000 times that of CO2 on a 20 year global warming potential (GWP20) basis, and it makes up around one-fifth of international shipping's CO2equivalent emissions[3]. When released near to the Arctic black carbon has a disproportionately high impact. Not only does it contribute to warming while in the atmosphere, it accelerates melting if it deposits onto snow and ice. The melting snow and ice exposes darker areas of land and water which absorb further heat from the sun. The reflective capacity of the planet's polar ice cover - the albedo effect - is severely reduced. More heat in the polar systems – results in increased melting - a feedback that contributes to 'Arctic amplification' of climate warming.

The Arctic is a major climate regulator and is now considered by scientists to be warming as much as four times faster than the planet as a whole[4]. It is also an important ice habitat for wildlife – unique ecosystems supporting a huge productivity of plant and animal life in the oceans, and it is a highway and provides cultural identity for the Inuit people and other Indigenous communities. But we are losing Arctic sea ice - at a rate of around 13% per decade since 1979[5] and the older, multiyear ice is disappearing - with unprecedented consequences for the global biodiversity crisis and the loss of the Inuit homeland.

Following the release of the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5◦C in 2018, the UN Environment Programme reiterated that "fast and immediate action on short-lived climate pollutants can avoid a half a degree of warming by 2050" and such action "will also avoid over 50% of the predicted warming in the Arctic by 2050, thereby significantly decreasing the chances of triggering dangerous climate tipping points…"[6]. The urgent need to reduce highly potent short-lived pollutants including

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[1] Osipova, L, Black carbon emissions from Arctic shipping: A Review of Main Emitters and Time Trends, International Council on Clean Transportation (2023) (https://cleanarctic.org/wp-content/uploads/2023/04/BC_in_Arctic_prePPR10.pdf).

[2] Arctic Council (2019). Expert Group on Black Carbon and Methane - Summary of Progress and Recommendations 2019. 88 pp (https://oaarchive.arctic-council.org/server/api/core/bitstreams/50c0522a-5755-469b-9154-ccbfcb88d5de/content).

[3] Greenhouse gas emissions from global shipping, 2013–2015 - International Council on Clean Transportation (theicct.org)

[4] The Arctic is warming four times faster than the rest of the world | Science | AAAS

[5] September | 2021 | Arctic Sea Ice News and Analysis (nsidc.org)

[6] United Nations Environment Programme, Keeping warming to 1.5˚C impossible without reducing Short-lived Climate Pollutants (2018) (https://www.unep.org/news-and-stories/press-release/keeping-warming-15c-impossible-without-reducing-short-lived-climate).

BC was considered the best chance to avoid runaway warming and must be "hand-in-hand with deep and persistent cuts in long-lived greenhouse gases".[7]

This paper proposes an approach for a regulation in MARPOL Annex VI, which could deliver "fast and immediate" action on BC emissions via a fuel switch, followed by stricter stepped emission cuts via a polar fuel standard and designation of BC emission control areas (ECAs).

In 2022, an IMO intersessional correspondence group reduced a long list of potential BC control measures to those that could be applied to existing ships immediately, including a switch to distillate fuels and emission control areas, and longer-term measures such as a fuel standard or engine certification.

A fuel switch, first proposed in 2013 in an IMO study sponsored by Transport Canada has featured throughout subsequent discussions on ways to control BC emissions. IMO Resolution MEPC.342(77) makes clear that it is the simplest and quickest way to reduce BC emissions in or near the Arctic. While confirming that BC emissions vary considerably according to engine power, test results estimating that such a fuel switch would on average cut BC emissions by 41% for 2 stroke engines and about 31% for 4 stroke engines and installing diesel particulate filters (DPFs) would see ship BC cut by as much as 99%[8].

A polar fuel standard established to reduce BC emissions via the adoption of an amendment to MARPOL Annex VI would require all ships to only use fuels complying to an aromatic fuel standard. This would preferably be based on the hydrogen / carbon (H/C) ratio which could be required to be stated on the Bunker Delivery Note (BDN) provided to ships when they refuel and if operating in a defined Arctic region. Establishing a polar fuel standard will require a comprehensive fuel testing procedure to ascertain the H/C ratio of marine fuels. Over time the H/C ratio set by the regulation could be tightened leading to zero BC emissions.

A Black Carbon emission control area (BC ECA) would also require compliance with a fuel H/C ratio, potentially more stringent than a fuel standard if preferred by littoral states, or complementary to a polar fuel standard to cut BC emissions further south. A BC ECA regulation could also for example combine both the required 1000 ppm sulphur limits and the H/C threshold.

A mandatory switch to distillate fuels and a polar fuel standard will require a geographic scope to be defined. The Arctic Council's Arctic Monitoring and Assessment Programme (AMAP) has highlighted the significance of close-to and within Arctic sources of BC, concluding BC emissions above 60 degrees North were more significant than those at lower latitudes and mitigating measures should recognise this[9]. AMAP defined the Arctic as all regions north of 60 degrees North. It has previously been proposed that at a minimum the geographic scope of measures cover the maritime waters of the Arctic Human Development Report area or those defined by AMAP, or alternatively, all waters above 60 degrees North (excluding the Baltic Sea) may be a simpler definition for navigational purposes[10].

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[7] United Nations Environment Programme, Broken Record, Temperatures hit new highs, yet world fails to cut emissions (again) (https://www.unep.org/resources/emissions-gap-report-2023).

[8] PPR11.INF10 Reduction of Black Carbon emissions data submitted to IMO and from available scientific literature. Submitted by Euromot. 15 December 2023.

[9] MEPC 65/4/22 Emissions of Black Carbon from shipping inside and outside the Arctic. Submitted by Norway. 8 March 2013.

[10] MEPC 80/9/2 Geographic scope of Black Carbon emissions in the Arctic. Submitted by FOEI, WWF, Pacific Environment and CSC. 12 May 2023.

Both a polar fuel standard and a BC ECA proposed regulations are based on setting a fuel standard that will lead to reductions in emitted BC, albeit varying according to ship and engine type, age and operating conditions. The standard which all fuels will need to comply with will limit the aromaticity of the regulated fuel by setting a maximum H/C ratio as measured by an H/C fuel test undertaken by fuel suppliers and incorporated in the BDN. Whether the H/C limit would be the same in both the fuel standard and the BC ECA would be a point for discussion and would be dependent on whether the BC ECA sets a stricter requirement for BC emissions in or near to the Arctic or aims to reduce BC emissions from further afield. The appropriate fuel test to measure the H/C content of marine fuels would need to be agreed and a testing regime undertaken to ascertain the paraffinic/aromatic levels of different fuel samples. Data on trends and variances could then be generated to enable agreement on appropriate limits.

The need for mandatory measures to control emissions of BC from ships operating in and near to the Arctic is necessary and the approaches outlined in this paper can achieve the fast and immediate reductions called for by the UN IPCC.