

Black Carbon Information

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Introduction

- Black Carbon (BC) is a species of particulate matter with negative impacts on climate, air quality and public health;
- IMO started working on BC in 2011 when MEPC62 agreed an output on the impact on the Arctic of emissions of Black Carbon from international shipping; and
- Current IMO work is focused on developing recommendatory guidance to assist ship operators to reduce emissions of BC from shipping in or near the Arctic.

This presentation addresses policy work, however, some attention on technical matters is necessary to understand policy options.

What is BC?

IMO agreed the Bond et al definition:

"Black Carbon is a distinct type of carbonaceous material, formed only in flames during combustion of carbon-based fuels. It is distinguishable from other forms of carbon and carbon compounds contained in atmospheric aerosol because it has a unique combination of the following physical properties:

- it strongly absorbs visible light with a mass absorption cross section of at least 5 m²g⁻¹ at a wavelength of 550 nm;
- it is refractory; that is, it retains its basic form at very high temperatures, with vaporization temperature near 4000 K;
- it is insoluble in water, in organic solvents including methanol and acetone, and in other components of atmospheric aerosol; and
- it exists as an aggregate of small carbon spherules."

What is BC?

In plain language, Bond et al can be summarized as defining BC as a particulate created during combustion of a carbon fuel which is:

- Light absorbing;
- Refractory;
- Insoluble; and
- Small.

This has implications for BC control. For example, since BC is insoluble, wet scrubbing designed for dry phase operation will reduce emissions of BC but if designed for wet phase operation (typical of most scrubbers) they will not be effective (assuming wash water is managed to avoid environmental impacts).

BC Formation

BC is a particulate matter (PM) created during combustion, however not all PM is BC. Influencing factors include:

- Engine operating cycle, design and load;
- Engine condition;
- Fuel type (e.g. HFO, gas oil, natural gas) and fuel composition (e.g. aromatic content).

BC could be eliminated or reduced without after treatment by combusting carbon free fuels, fuels associated with lower BC emissions, or managing engine condition and load. Alternatively, there are after treatment options such as diesel particulate filters (DPF). Some measures will need to be used in combination, for example use of DPFs with oil fuels currently requires a switch to automotive quality fuel.

Discussion Points

- IMO has identified three ways of measuring BC – filter smoke number (FSN), light induced incandescence (LII) and photo-acoustic spectroscopy (PAS);
- All three methods have demonstrated good correlation and can be accepted as effective, but there is no measurement standard;
- There is no agreed emission limit and no existing control regulation;
- Ultimately, the solution is a switch to future alternative fuels, as per the revised GHG strategy.

Combusting a carbon free fuel would negate needing to measure BC or define an emission limit value. Alternatively, IMO could proceed with measures which demonstrate good correlation with BC reduction on the basis that this should have a positive impact.

Some potential measures

- Fuel switch (distillates, LNG, methanol, carbon free alternatives);
- Development of an engine test and certification scheme, equivalent to that applied to emissions of NO_x;
- Engine load optimization;
- Revising fuel standards to include limits for aromaticity; and
- Exhaust gas after treatment (DPF, scrubbing).

An engine test and emissions certification regime, such as that used for NO_x certification, or use of after treatment would require a measurement standard and emission limit values to be effective.

Mandatory vs recommendatory

IMO developing recommendatory guidance/guidelines, as part of a pathway to mandatory measures:

- Mandatory measures would be more effective, but need time to agree and enter into force;
- Agreement by MEPC, adoption at following session and 18 months for entry into force means there is a lag of 2 – 2.5 years from agreement until entry into force;
- Recommendatory measures are less demanding but can be developed and implemented more quickly; and
- Including aromaticity in ISO8217 is not in itself a regulatory measure.

Recommendatory guidance/guidelines as part of a pathway to mandatory measures is the most appropriate way forward given the need to make progress. We anticipate the guidance/guidelines under development will result in the equivalent of a ‘Black Carbon SEEMP’, to stimulate BC reduction and is achievable in the near term.

Mandatory long-term measures

Given the time-line for a mandatory instrument to enter into force after reaching agreement, and the time needed to reach agreement, and that there is one session of the PPR Sub-Committee each year:

- Mandatory measures would need four to five years from today before entering into force, assuming rapid progress and quick agreement;
- As such, if mandatory measures are supported then IMO needs to reach a quick agreement on which measures to take forward to facilitate the necessary detailed technical work to develop regulatory text;
- WSC is open minded on measures provided they are technically sound and would be effective; and
- Longer term measures are linked to the wider work of IMO to reduce GHG emissions, particular since the most effective solution for both BC and GHGs in general is a shift to alternative fuels

Regulatory alignment

IMO should maintain alignment across different instruments, for example:

- Engine test cycles;
- Definitions; and
- Measurement.

Work should be cognizant of other regulatory work, such as the prohibition of HFO in the Arctic, Mid-term GHG measures and work on emissions such as NO_x.

Conclusion

- **Recommendatory guidelines (a ‘BC SEEMP’) is a good way forward in the short-term;**
- **The long-term solution is tied to the work of IMO to reach zero GHG emissions as agreed in the revised 2023 strategy;**
- **WSC supports further work, including potential mandatory measures;**
- **Further work should pay attention to other work outputs (for example, GHG mid-term measures) and time; and**
- **Some possible mandatory measures require significant technical work, decisions are needed as a matter of urgency if IMO seeks a mandatory BC regulation.**



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