“Shipping as an aggressive sector of Ultrafine Particles (UfP) emissions”

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by

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Why ships and shipping and the role of EFCA

- During our Symposia EFCA is more and more evidencing various sources as regards emissions of UfPs and their characteristics
- The most aggressive sectors and not enough covered are aviation and ships/shipping; while the first is often on the agenda, the second needs much more attention at the level of policy options
- EFCA organized a session devoted to impact of ships/shipping during the CAPPA Air Protection 2021 international conference on UfP emissions and tried to develop a policy for controlling ship/shipping emissions, including the smallest PM fraction
- EFCA has contributed to the proces of revising the Gothenburg Protocol under the UNECE Air Convention by advocating an annex on ship/shipping control of atmospheric emissions, including UfPs
- Now ships/shipping are covered under the proces but need a strong political support

Shipping an aggressive sector of UfP emissions (1)

- More than 100.000 ships cruising the oceans and seas, of which 70 % are oil tankers and 13 % container ships;
- International ship transport which accounts for 80 % of global trade volume;
- The total marine fuel consumption (the dirtiest types) is estimated for more than 300 Mt and grows constantly;
- Almost 4 billion tons of goods are currently transported only throughout EU harbours;
- Annual global carbon dioxide (CO2) emissions from fossil fuels and industry is now about 36 bilion metric tons, of what international shipping accounts only for 3 %;
- But the fifteen biggest mega-ships emission alone is equal to that of 760 million cars;
- 25 % of the nitrogen oxide emissions (NOx) and 9% of the sulphur oxides emissions (SOx) come globally from shipping>the precursors of UfPs;
- PM annual emissions from ships is around 2 milion metric tons (UfP fraction ????).

Shipping an aggressive sector of UfP emissions (2)

- SOx emissions from ships are already twice higher than that from all on-road vehicles when NOx and PM ship emissions account for roughly half;
- But due to continued progress in reducing land-based emissions from stationary and mobile sources, the share of pollution caused by maritime vessels is expected to rise considerably in the coming future ;
- 85% of all ship pollution is in the northern hemisphere, the geographical area of UNECE and its Air Convention;
- According to IMO between 70-80 % of maritime emissions occur along heavily frequented trading routes connecting ports and are less than 400 km from the land;
- In general most ships spend only 20 % of the time at sea and far from land, while during 80 % of the time they are harboured (55 %) or close to the coast (25%);
- Thus local, regional and global impact of ships/shipping on air quality.

Presentations at the EFCA session

- ***Introductory report by EFCA President/Chair of the session***
- Nadine Allemand, Gregoire Bongrand (CITEPA-France): ***Maritime shipping emissions, reduction techniques and their cost***
- Ana Alebic-Juretc (Croatia): ***Characterisation of maritime impact on air quality in the port cities of Rijeka and Venice***
- Zdenko Franic (Croatia): ***System of monitoring, reporting and verificationof CO2 emissions in maritime transport***
- Matja Siroka and all: ***Port environmental index***
- Sari Repka and Maximilian Posch and all: ***Assesssing the cost and envieronmental benefits of IMO regulations of ship-originated SOx and NOx emissions in the Baltic Sea***
- ***Panel discussion on policy development***
- ***Topic conclusions by the Chair and final recommendations.***

Some conclusions from the presentations (1)

- The ship emissions of SO_2, NO_x, VOC, PM_{10}, $PM_{2.5}$ and BC (PAH) at global level is constantly rising, except in so called „Emission Control Areas";
- Most of all ship pollution is in the northern hemisphere waters:
- Harboured and/or cruising close to land (80 % of time), ships contribute greatly to local pollution and particularly to that of port areas due to high operating temperatures and pressures when manuevering (higher fuel consumption)
- Ships are increasing considerably air pollution coming directly from the port infrastructure as such;
- A part exhaust pollution, fugitive emissions from shipping is quite important related to loading and unloading activities of bulk liquid cargoes and include mainly emissions of VOC;
- Because the ship and port infrastructure emissions, remain so far poorly regulated, these sources are among the world's most polluting combustion sources per ton of fuel consumed.

Some conclusions from the presentations (2)

- On sea S deposition is the greatest along the shipping lines because SO2 is highly water soluble, especially in alkaline sea water why on land, the largest contribution from shipping to the total S deposition is along the coasts, where some SO2 has already been oxidized and the deposition consists also of secondary pollutants (sulphates);
- Most of the emitted NO2 first undergo oxidation in the atmosphere before it is deposited, primarily as particulate nitrate, which are less soluble than sulphates in water or rain droplets causing the highest deposition of oxidised N along the coasts;
- SECA and NECA are very effective measures to lower ecosystem impacts from shipping and can be subject to monetary valuation, but effects on eutrophication will come around 2040 only;
- Monitoring, reporting and verification system (MRV) for CO2 (ETS for ships in 2022), already in place can be extended on classic air pollutants;
- Port environmental index (air, water, waste and noise) is a useful tool to green its activities (electrification, LNG infrastructure and hydrogen)
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Developing a policy for controlling ship emissions

- The ongoing revision of the Amended Gothenburg Protocol (AGP) under the Air Convention offers a perfect occasion to prepare an annex on control techniques for ship emissions (85 % of ship pollution in UNECE area);
- UNECE-TFTEI technical document as of November 2020 prepared by CITEPA can be seen as an evidence in the proces and pave the way not only for an annex but also on guidance document on the matter
- Statement to manage UfPs with the revised WHO Air Quality Guidelines, may include ship-oriented measures but the related input is still needed;
- Shipping is a global business then IMO/MARPOL Convention and its Annex VI should be used as much as possible to establish SECA and NECA;
- But the initiatives to do so must come pimarily from the Governing Bodies of the regional sea conventions (the Helsinki Convention-**HELCOM**) for the Baltic Sea.DONE!) like the **OSPAR** Convention for the North Sea, the **Barcelona** Convention for the Medditeraenean Sea and the **Danube** Convention for the Black Sea.\;
- MRV system should be extended on classic pollutants emitted from ships
- ETS must covered at least mega-ships

Fuel dilemma for shipping

- The fuelEU Maritime regulation under procedure in the EP and the Council>adoption in Autumn 2022
- It calls for use of fossil gas (LNG) in the EU shipping for at least at 25 % by 2030 and
- the use of electric onshore power supply in EU ports.
- Effects>less air pollution, including PM (UfPs), but GHG intensity still high
- But according to the IPPC we need not only decarbonisation („Green Deal" and "Fit for 55" package but defossilisation>renewable energy and synthetic fuels
- New generation of fuels>**POWERFULS (PFs)** are synthetic gaseous or liquid non-biofuels that draw their energy content from re-newable electricity.
- Hydrogen is the best PF for ships if obtained via electrolysis of water using renewable energy
- Methane via methanisation may be also useful (CO2 from DAC), but …….
- It's estimated that by 2050 powerfuels could count for 27 % of total energy consumption

Green shipping utopia or reality?

By Erik Christensen

Thank you for listening to EFCA

We welcome your questions and comments

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