Marine Black Carbon Emissions: Identifying Research Gaps

Technical Workshop – Black Carbon Abatement in the Shipping industry

Dan Lack

September 9th and 10th, 2014

Ottawa, Canada

BC Abatement Options

- Fuel Efficiency
- Slow Steaming
- Fuel Treatment
- Fuel Quality
- Alternative Fuels
- Exhaust Treatment

Litehauz, Lack, D. A., Thuesen, J., and Elliot, R (2012) Investigation of appropriate control measures (abatement technologies) to reduce black carbon emissions from international shipping, IMO (http://www.imo.org/OurWork/Environment/pollutionprevention/airpollution/documents/air%20pollution/report%20imo%20black%20carbon%20final%20report%2020%20november%202012.pdf)

Fuel Efficiency (up to 30?%)

- Reduced BC from fuel efficiency = financial savings
  - Assume that industry will pursue this?
  - E.g. Hull coatings, new designs, propeller optimisation etc.

Slow Steaming (up to 30%)

- Power ~ Speed^3 → Slowing down = fuel efficiency gains
- However, slow steaming may increase BC.
- Engine manufacturers are redesigning engines to allow for most efficient combustion at most speeds.
- Longer term solution

Fuel Treatment (50 – 90%)

- Water-in-Fuel Emulsion: improves fuel atomisation → decreases BC formation.

Fuel Quality (up to 80?%)

- A switch from HFO to distillate may decrease BC emissions.

Fuel Treatment (50 – 90%)

- Water-in-Fuel Emulsion: improves fuel atomisation → decreases BC formation.

Fuel Quality (up to 80?%)

- A switch from HFO to distillate may decrease BC emissions.

Alternative Fuels (up to 99%)

- LNG: 99% reduction.
- Biodiesel: 50 – 90% reduction.

Exhaust Treatment (up to 99%)

- Diesel Particulate Filters: Can have issues with high sulfur fuel.
- Scrubbers: Up to 70%. Depends on fuel sulfur level.

The biggest issue…

- Detailed measurements using accurate technologies!