

# Emission Abatement Methods

## Scrubbers' Washwater & Sludge

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*As per article 4c of the revised Sulphur Directive (2012/33/EU):*

*Member States shall allow the use of emission abatement methods by ships of all flags in their ports, territorial seas, exclusive economic zones and pollution control zones, as an alternative to using marine fuels that meet the requirements of Articles 4a and 4b...*

*As per article 4c of the Sulphur Directive, the following EAM are to be considered:*

- Mixture of marine fuel and boil-off gas (BOG) for LNG carriers, Biofuels, on-shore power supply, alternative fuels e.g. LNG, Methanol, **and...**
- Exhaust Gas Cleaning Systems (**EGCS**), commonly known as '**scrubbers**'



Source ALFA-LAVAL/DFDS

## EGCS 'scrubbers' - An Overview

- Incentive: Difference in fuel price HFO vs MDO/MGO
- EGCS Concept: Have been used efficiently on-board ships for long time, mainly combined with the IGS (e.g. tankers)
- Driving Factors: Alkalinity, pH, Salinity and Temperature

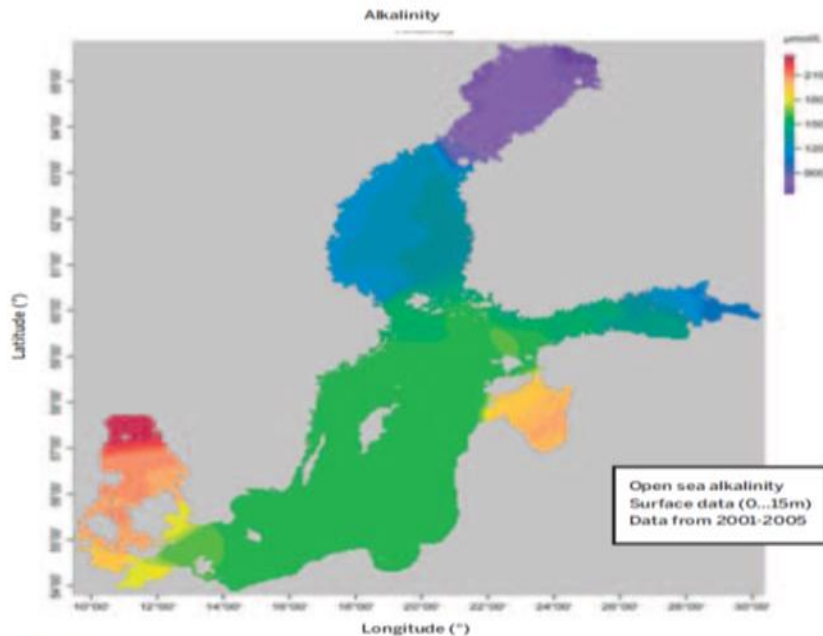
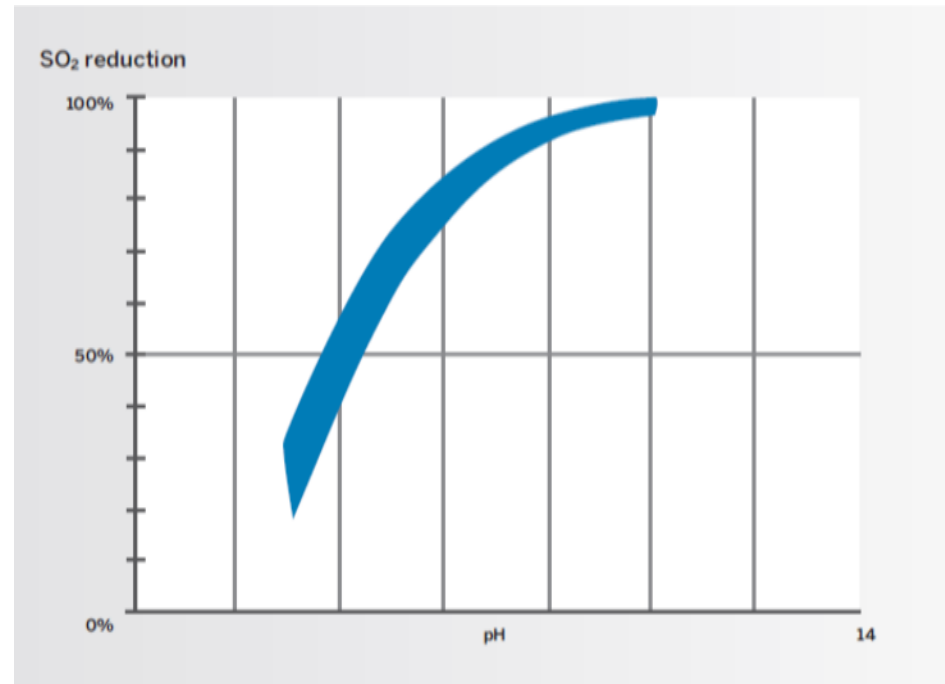


Fig 2. - Alkalinity of the Baltic Sea.



## *EGCS 'scrubbers' - An Overview*

**The Challenge** - Meeting the IMO EGCS Guidelines

*Resolution MEPC.184(59) of 17 July 2009*



*Source Wärtsilä*

- Fulfilment of the **SO<sub>2</sub>/CO<sub>2</sub>** emission ratio (flue-gas)
  - Lower natural alkalinity characteristics of water lead to lower scrubbing efficiency i.e. lower SO<sub>2</sub> neutralisation
  
- Fulfilment of the **washwater** discharge criteria
  - Higher SO<sub>2</sub> neutralisation lead to Higher acidic effluents



## *EGCS 'scrubbers' - An Overview*

*Resolution MEPC.259(68) of 15 May 2015*

- *Washwater discharge criteria*

- pH
- PAH and oil (detailed GC-MS analysis)
- Nitrate
- Nitrite
- Cd
- Cu
- Ni
- Pb
- Zn
- As
- Cr
- V

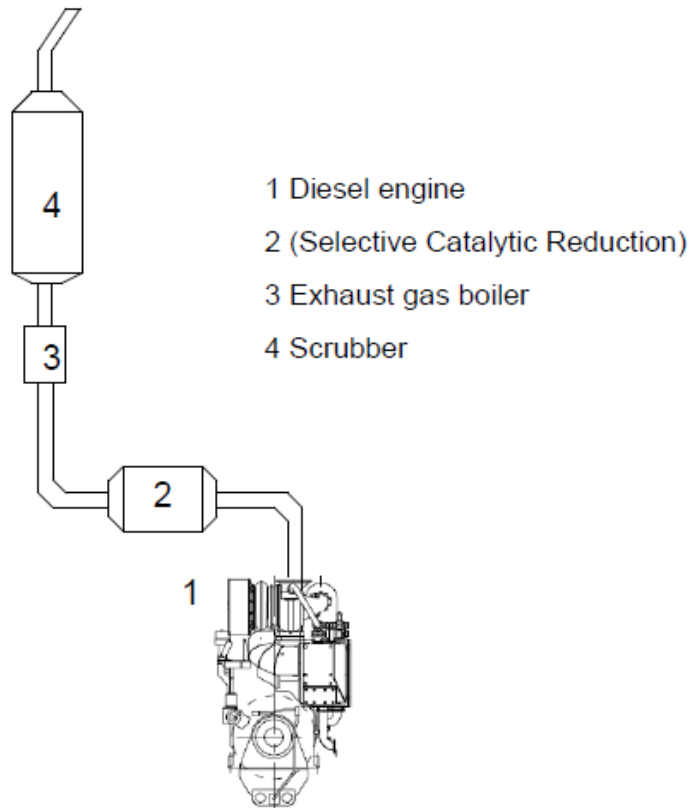
- *pH criteria, PAHs (Polycyclic Aromatic Hydrocarbons), Turbidity - suspended Particle Matter, Nitrates, washwater additives and other substances. Heavy metals are already foreseen.*

- *Washwater residue (waste - sludge)*

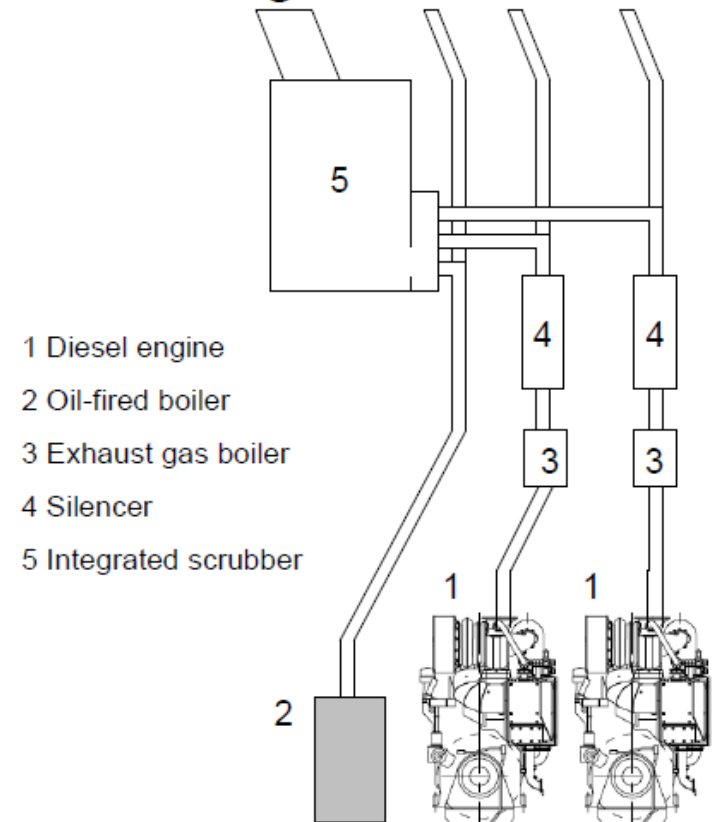
- *Residues generated by the EGC unit should be delivered ashore to adequate reception facilities. Such residues should not be discharged to the sea or incinerated on board.*

**Note** - **Volumes** and **Composition** of the washwater and sludge will vary with: scrubber efficiency, machinery item connected - load rate and running hours, type of fuel and sulphur content, seawater characteristics, etc.

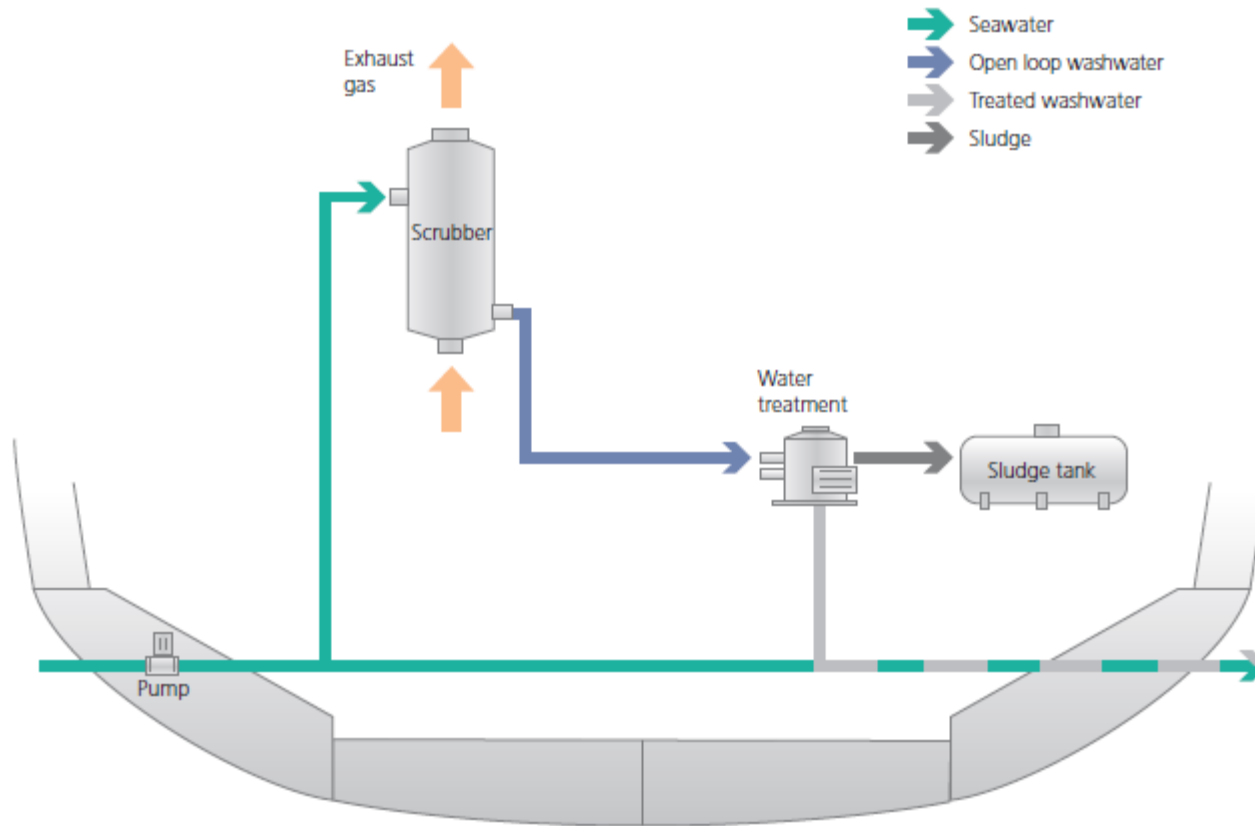
## Main stream scrubber



## Integrated scrubber



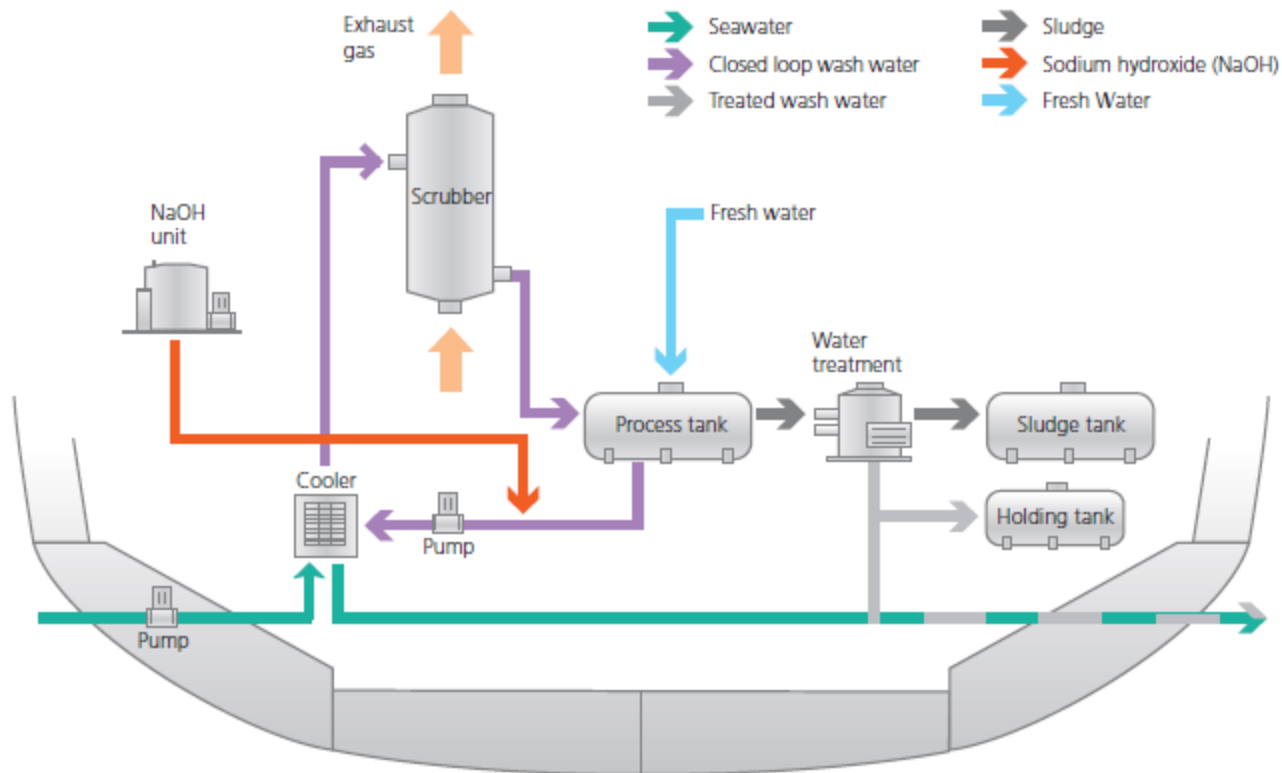
## *An open-loop wet SO<sub>x</sub> scrubbing system*



Source LR



## *A closed-loop wet SOX scrubbing system*



Source LR

## *EGCS 'scrubbers' - European Sustainable Shipping Forum (ESSF) - EGCS Sub-Group*

### *Barriers hampering the adoption of EGCS - safe and environmentally responsible processing and disposal of EGCS waste and sludge*

- IMO guidelines do not include references to scrubbers' open or closed-loop operations leading to confusion around these terms e.g. closed-loop to mean zero-discharge of washwater.
- Lack of clarity on the terms waste, sludge and washwater.
  - Dirty effluent with similarities to fuel treatment sludge, resulting from washwater filtration and conditioning equipment which is retained on-board and transferred ashore to a PRF as waste.
  - Washwater discharge is seawater meeting the discharge emission limits contained within the IMO guidelines.
- Patchwork of international, regional and local legal framework (Impact of local ecosystems, enclosed seas and ports on limitations of the use of open-loop scrubbers, washwater discharge criteria e.g. pH).

## *EGCS 'scrubbers' - European Sustainable Shipping Forum (ESSF) - EGCS Sub-Group*

### *Key aspects related to EGCS residues*

- 2011 Guidelines for PRF under MARPOL Annex VI define these as a product of the water treatment process i.e. removed from the washwater, containing: sulphates, ash/soot, heavy metals and hydrocarbons.
- Can be from liquid to solid, packed or not with direct impact on the PRF.
- Different views:
  - EGCS residues can be collected and treated in the same way, and together with the traditional oily waste.
  - EGCS and 'engine room' residues should not be mixed due to different composition (e.g. high concentration of heavy metals).

## *EGCS 'scrubbers' - European Sustainable Shipping Forum (ESSF) - EGCS Sub-Group*

### *On-going work - Sampling Exercise*

- To facilitate evidence-based decision-making, the sub-group has agreed to engage in a joint sampling exercise.
- Shipowners/operators, EGCS manufacturers and waste management companies to collect both washwater & sludge samples from 10-15 ships in Europe and later sent to a laboratory for analysis (covering a wide range of potential pollutants). Priority was given to washwater.
- Results achieved so far have shown that the composition of the washwater are well within the limits set by the IMO EGCS Guidelines.

## *EGCS 'scrubbers' - European Sustainable Shipping Forum (ESSF) - EGCS Sub-Group*

### *On-going work - PRF related*

- *The Sub-group recommended that the advance notification required by Directive 2000/59/EC on PRF for ship-generated waste and cargo residues should be updated and that the Directive is reviewed to ensure that the particular requirements associated with EGCS waste are recognised.*
- *Following a questionnaire from the PRF Sub-Group sent to the EGCS Sub-Group - clarification on the open and close-loop operational modes, quantification of sludge, proposal for hazardous classification of sludge, clarification on the process water (bleed-off) in result of close-loop operation and its classification as residue.*

# Questions?

# Thank you!

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