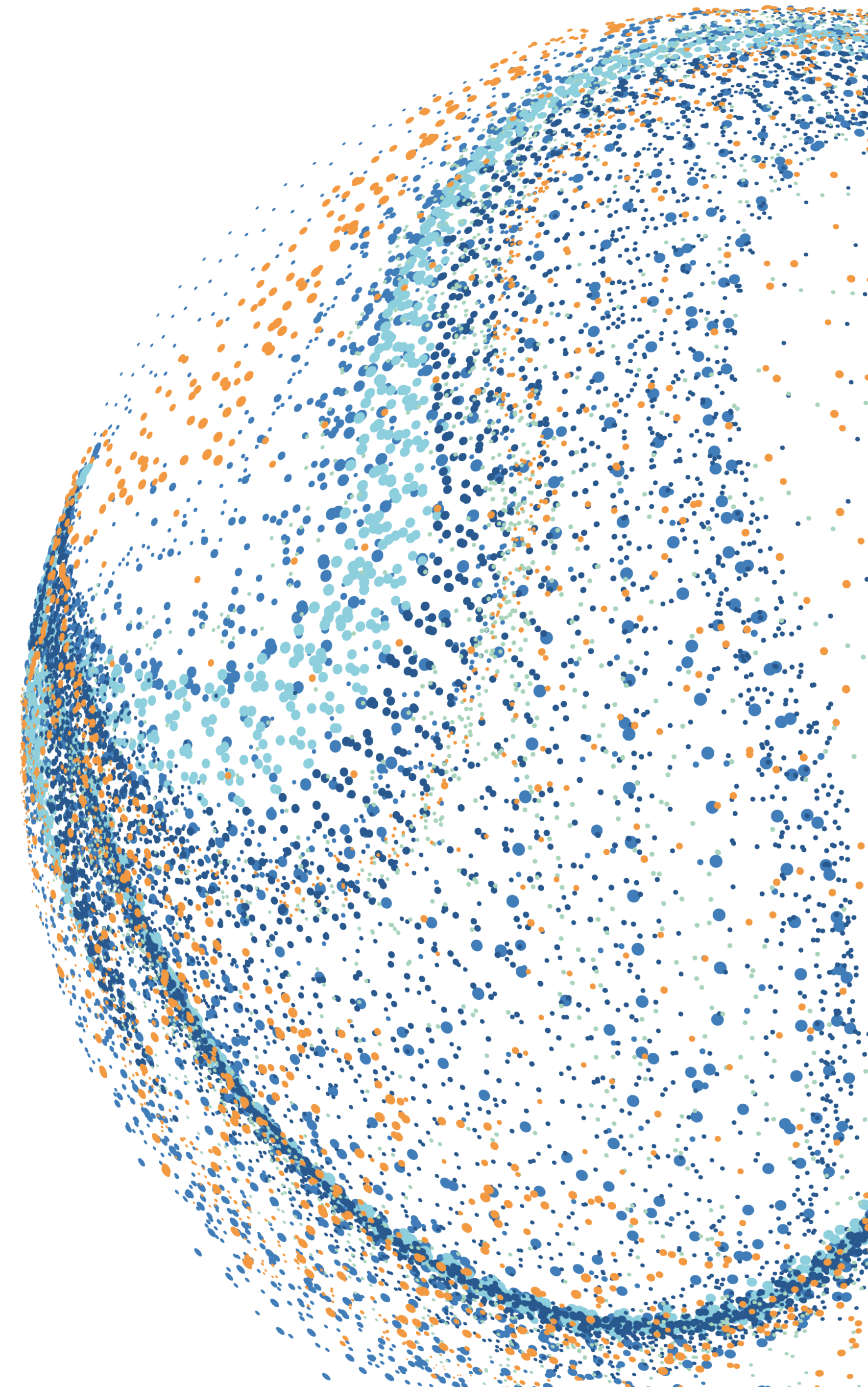


Managing your scrubber operations

Jon Helge Ulstein
Wilhelmsen Ship Management

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Background & Introduction



Jon Helge Ulstein has a combined 30 years of maritime experience ranging from his sailing days as Chief Electrician, newbuilding supervisor and Vessel Manager.

- Support 5 scrubber installation on the Wallenius Wilhelmsen vessels
- Board member in Massterly, a joint venture between Wilhelmsen & Kongsberg for autonomous logistic solutions.
- Experience with scrubber, big data projects and condition based maintenance.
- 4 years of manning scrubber vessels.

I will share my experience and lessons learnt during scrubber operations and hopefully you will benefit from it.

Operating scrubber



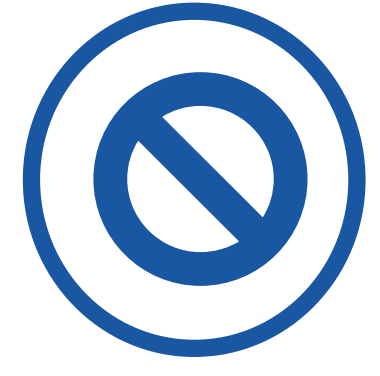
Sludge Handling



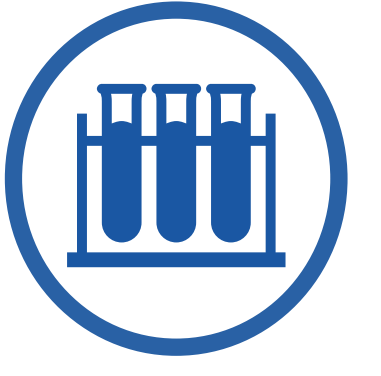
ECA Areas



Wash water – Port regulation



Malfunction of monitoring equipment



Scrubber water testing



Annual services



Training



Caustic soda

Sludge handling



EU Waste Directive

Scrubber sludge waste code : **10 01 18**

Waste from thermal processes, waste from power stations and other combustion plants, waste from gas cleaning containing dangerous substances

EBC container – 1 cubic



Common problem during sludge handling

Some ports are familiar with the EU Waste Directive while some are not.

Establish direct contact to the waste treatment company yourself as logistic issues during delivery of scrubber waste to port reception facilities could happen

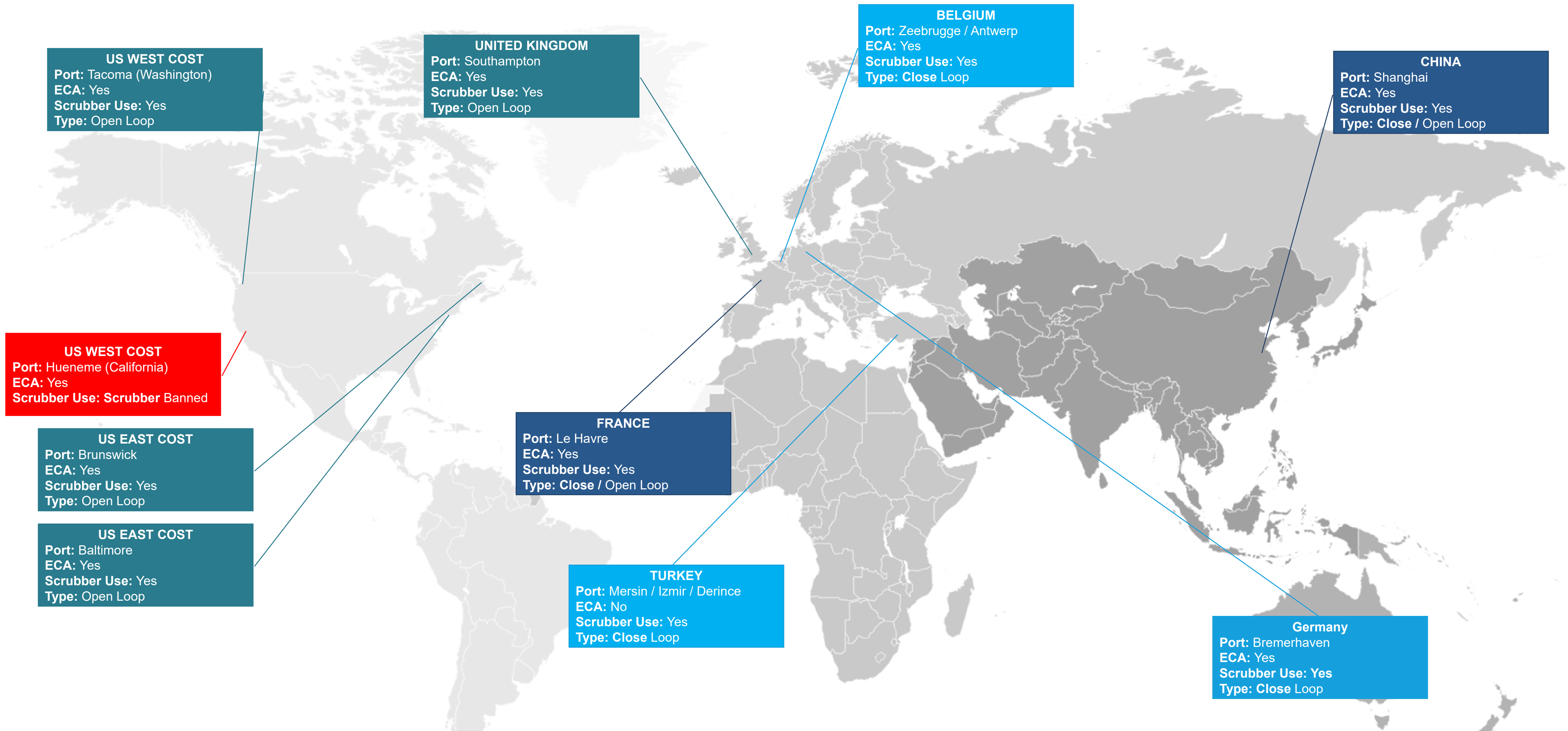
ECA Areas



- The EU EEZ (Economic Exclusive Zones) will implement 0,5%S fuel requirement inside the EU zone in 2020
- As of January 1st 2016 China has enforced 3 new ECA's: Pearl River Delta, Yangtze River Delta & Bohai Rim.

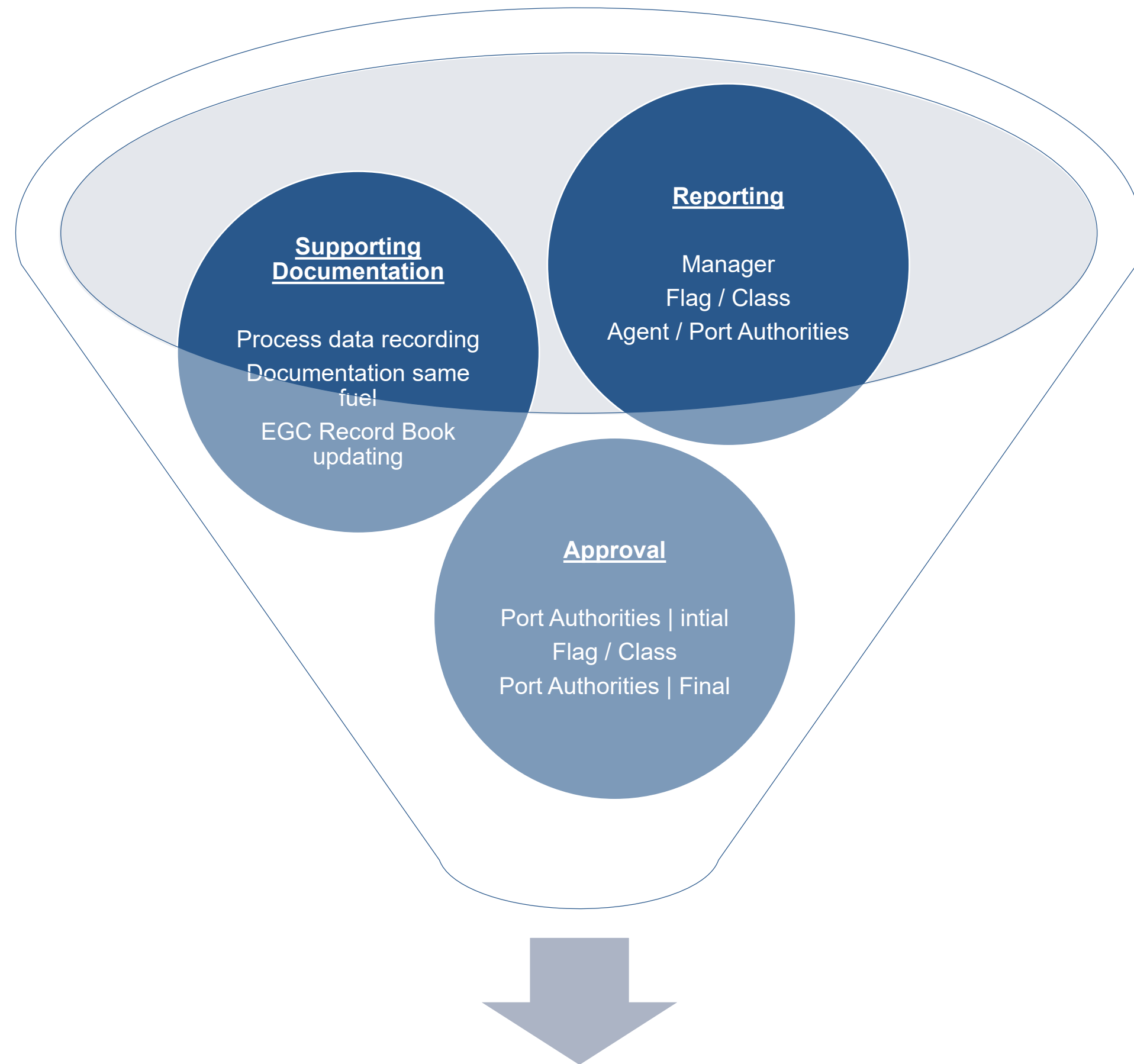
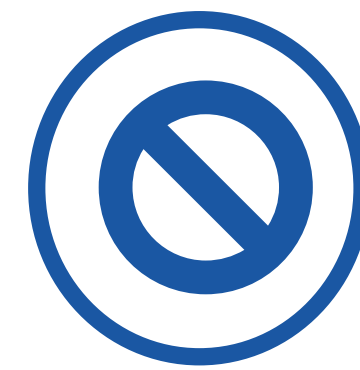


Wash water – Port regulation



Not all types of scrubber are accepted at all ports
Always check with the port authority prior to calling at the port.

Malfunction of monitoring equipment



Approval for running EGS

Reporting

- Manager
- Flag / Class
- Agent / Port Authorities

Supporting Documentation

- Process data recording
- Documentation same fuel
- EGC Record Book updating

Approval

- Port Authorities | Initial
- Flag / Class
- Port Authorities | Final

Supporting documentation

- Process data recording
- Documentation same fuel
- EGC Record book updating

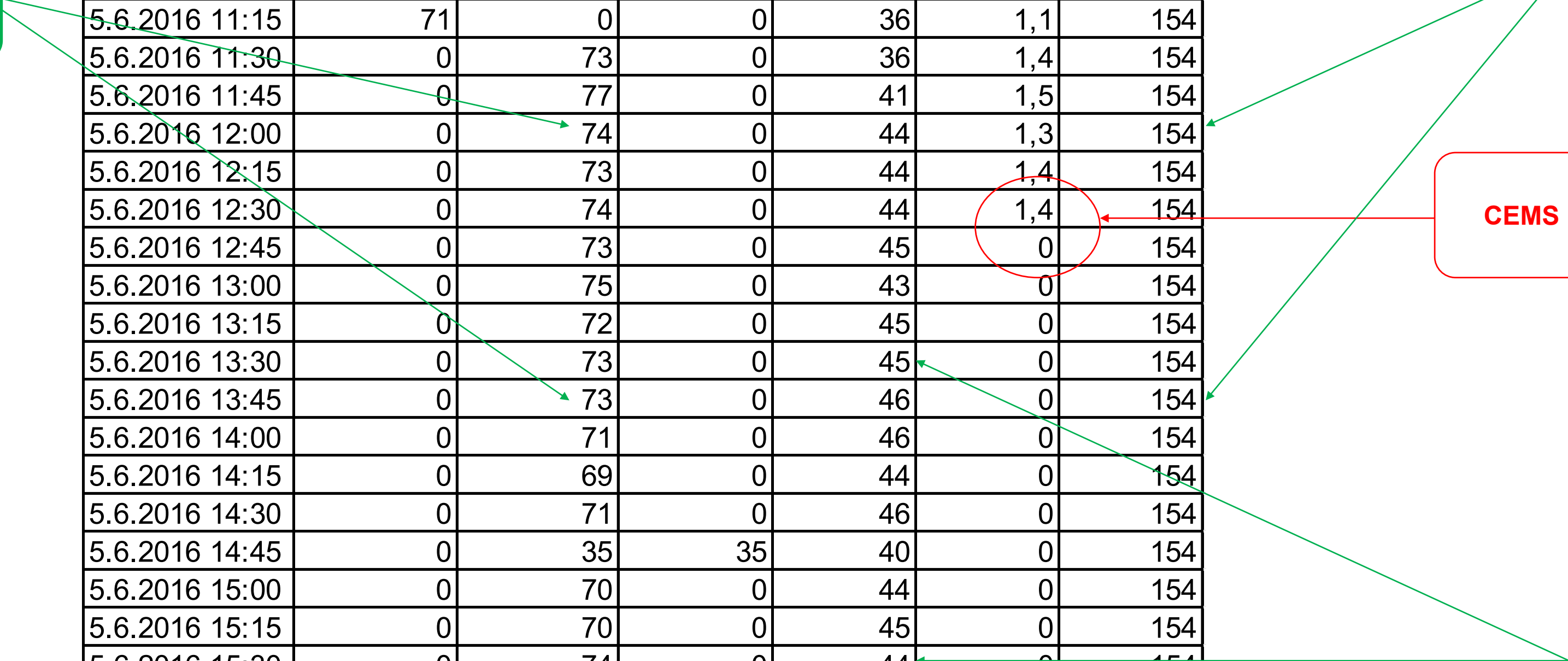
Date/Time	AUX 1 Engine Load (ANIN34) ; AUX Engine : %	AUX 2 Engine Load (ANIN34) ; AUX Engine : %	AUX 3 Engine Load (ANIN34) ; AUX Engine : %	AUX Scrubber Outlet Temp (ANIN33); AUX Engine C	AUX Scrubber SO2/CO2 Ratio (ANIN20); AUX Engine	AUX Scrubber SW Inlet Flow (ANIN27); AUX Engine, m3/h
5.6.2016 09:45	70	0	0	43	1,4	154
5.6.2016 10:00	71	0	0	41	1,3	154
5.6.2016 10:15	71	0	0	41	1,3	154
5.6.2016 10:30	74	0	0	39	1,4	154
5.6.2016 10:45	70	0	0	42	1,2	154
5.6.2016 11:00	70	0	0	41	1,3	154
5.6.2016 11:15	71	0	0	36	1,1	154
5.6.2016 11:30	0	73	0	36	1,4	154
5.6.2016 11:45	0	77	0	41	1,5	154
5.6.2016 12:00	0	74	0	44	1,3	154
5.6.2016 12:15	0	73	0	44	1,4	154
5.6.2016 12:30	0	74	0	44	1,4	154
5.6.2016 12:45	0	73	0	45	0	154
5.6.2016 13:00	0	75	0	43	0	154
5.6.2016 13:15	0	72	0	45	0	154
5.6.2016 13:30	0	73	0	45	0	154
5.6.2016 13:45	0	73	0	46	0	154
5.6.2016 14:00	0	71	0	46	0	154
5.6.2016 14:15	0	69	0	44	0	154
5.6.2016 14:30	0	71	0	46	0	154
5.6.2016 14:45	0	35	35	40	0	154
5.6.2016 15:00	0	70	0	44	0	154
5.6.2016 15:15	0	70	0	45	0	154
5.6.2016 15:30	0	74	0	44	0	154
5.6.2016 15:45	0	71	0	46	0	154
5.6.2016 16:00	0	70	0	46	0	154
5.6.2016 16:15	0	70	0	46	0	154
5.6.2016 16:30	0	69	0	47	0	154
5.6.2016 16:45	0	71	0	46	0	154

Stable engine load before and after CEMS failure

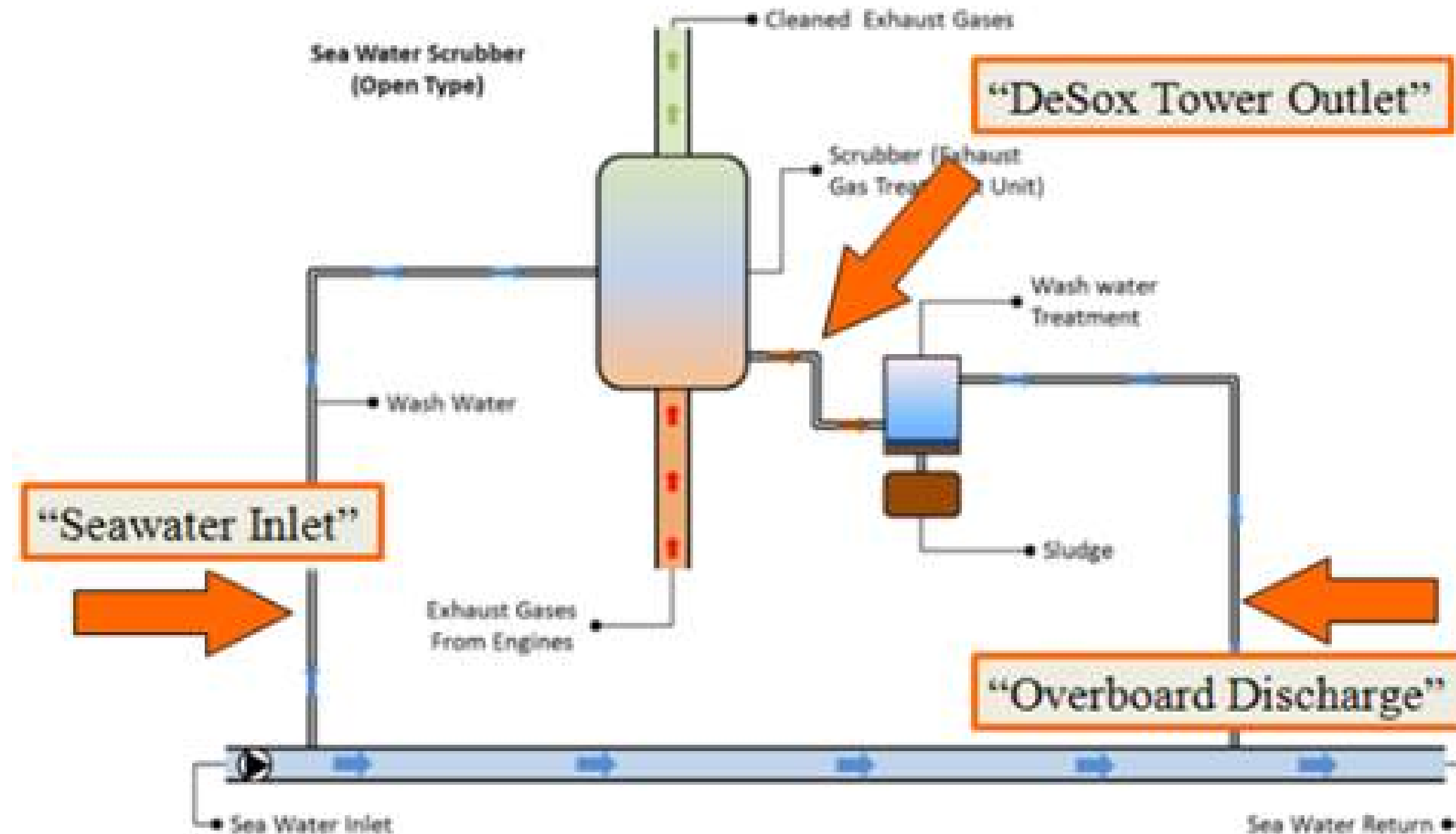
Stable water flow before and after CEMS failure

CEMS Failure

Stable outlet temp before and after CEMS failure



Scrubber water testing



MEPC 59/24/Add.1 ANNEX 9 Page 24

Sampling to be made during approval testing or shortly after commissioning and at about twelve-month intervals for a period of two years of operation (minimum of three samples).

Fixed sampling points!





Elements tested for : Nitrate | Nitrite | Cd | Cu | Ni | Pb | Zn | As | Cr | V



OPERATING IN THE US THERE IS SPECIAL REQUIREMENT WHICH NEED TO BE FOLLOWED UP

You may need to extend the test for more than the elements above

Calibration schedule

Calibration done by ship staff	Year 1												Year 2											
CEMS (Continuous emission monitoring system) measures SoX and CO2	Q1 calibration			Q2 calibration			Q3 calibration			Q4 calibration			Q1 calibration			Q2 calibration			Q3 calibration			Q4 calibration		
	Annual Calibration by maker 												Annual Calibration by maker 											
Ph probes – measures pH value of water	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
PAH probes – measures content of PAH in water as a phenanthrene equivalent													Calibration by maker once every 2 years 											
Turbidity probes – measures turbidity in water	To be calibrated as required												To be calibrated as required											
													Calibration by maker once every 2 years 											
Density sensor – measured by a Coriolis Mass Flow Measuring System	To be calibrated as required												To be calibrated as required											

Training



Training of onboard crew is important to secure correct and safe operation of the scrubber installation, knowing legislation and safety routines.

Key areas covered in training program :

- System overview
- System familiarization
- Hands on training
- Trouble shooting
- Process training

Theory and hands on training will be given in operation and calibration by maker.

Training is usually included in the first 2 years agreement and is conducted annually by maker

Caustic soda – closed loop operation



Bunkering Caustic Soda require below documentation:

- o Vessel's ISM procedures / safety measures / emergency procedure for the intake of caustic soda
- o Vessel's bunker and transfer plan
- o Details of bunker connection and location in ship side, picture file is often very useful.
- o Protective clothing and safety equipment, washing/rinsing station at the location.
- o Certificates from the hoses
- o MSDS sheet of the product

Conclusion

- Intelligence on port requirements and regulations – One size does not fit all
- Negotiate for a good service agreement to ensure you have a good support from maker as you will be running the scrubber 24/7
- Crew training is very important to ensure good operation of the scrubber
- Calibration and maintenance is very important to ensure a working scrubber