



Background

General Information

Ocean Ranger Name:	jonathan.driggers
Report Date:	Aug 23, 2018
Ship:	Holland Eurodam
Ship Code:	HER

Section 1: Scrubber Installation and Operation

1. Is the vessel operating or installing an exhaust gas scrubber system in the 2017 Alaska Cruise Season? Yes

If you answered Yes, continue to the next page.

If you answered No, answer the next 3 questions and submit the report.

Section 1: Scrubber Installation and Operation, ctd.

2. Physical location of the scrubber system, and if applicable, list the "removed" engine / sundries / stack equipment to accommodate the scrubber installation?

The vessel first had three (3) Scrubbers installed for DGs #1, #2, and #6 (Job Number 2015_032_APC), and then at a later date had one (1) Scrubber installed for DG #5 (Job Number 17310_MAR). The following information was obtained from vessel's EGCS Technical Manual-Scheme B, which was revised 4/24/18, and approved by Lloyd's Register EMEA on 5/8/18, per Design Appraisal Document (DAD) number UKITSO/MPL/32482846; Information regarding all four (4) Scrubbers as follows:

*Purchase Order Number: 1075619/1261777
*Job Number: 2015_032_APC/17310_MAR
*Ship Name: MV EURODAM
*IMO Number: 9378448
*System Manufactured By: Ecospray Technologies S.r.l., Alzano Scrivia, Alessandria, Italy
*Unit Model: ECO-DeSOx
*Ecospray Project Number: 15-032-APC/17-310-MAR

Vessel removed Forward Incinerator to facilitate installation of three (3) Scrubbers for DGs #1, #2, and #6. Vessel removed/altered a Cage/Storeroom to facilitate installation of one (1) Scrubber for DG #5. Exhaust silencers were removed for installation of Towers. Components of the Scrubber Systems are located throughout the Engine Room, all the way up to vessel's stacks.

3. What is the location and source that the scrubber system is installed to treat? Include design capacity etc. of the fuel oil combustion equipment (include maximum power rating).

The EcoSpray EGCS is installed for SOx emissions control for the Diesel Generators (DGs) listed below, with each DG having a designated ECO-DeSOx Tower:

•DG1- Engine Room Aft
Caterpillar MaK 12M43C
MCR: 12,000kW
Speed: 514 RPM
Cycle: 4 stroke
DG Serial Number: 69009

4. Brand, make, model, or other identification information for the scrubber system. Who installed the system? Certification of the system IMO ANNEX VI certification? Classification?

5. Scrubber type, e.g. closed, reagent cycle, combination or hybrid, or open-loop effluent to seawater?

6. System status, i.e.: operational, commissioning, under construction, etc.? Expected install date?

7. Process description and waste flow (gaseous emissions, waste effluent, ash or spent reagent, etc.)?

EGCS Tower Number: 15-032-APC-0100-SC-DG1
•DG2- Engine Room Aft
Caterpillar MaK 8M43C
MCR: 8,000kW
Speed: 514 RPM
Cycle: 4 stroke
DG Serial Number: 66067
EGCS Tower Number: 15-032-APC-0200-SC-DG2
•DG5- Engine Room Forward
Caterpillar MaK 8M43C
MCR: 8,000kW
Speed: 514 RPM
Cycle: 4 stroke
DG Serial Number: 66068
EGCS Tower Number: 17-310-MAR-SC-500
•DG6- Engine Room Forward
Caterpillar MaK 12M43C
MCR: 12,000kW
Speed: 514 RPM
Cycle: 4 stroke
DG Serial Number: 69012
EGCS Tower Number: 15-032-APC-0600-SC-DG6

Ecospray Technologies Open Loop Seawater DeSOx Absorption System (ECO DeSOx):
*Purchase Order Number: 1075619/1261777
*Job Number: 2015_032_APC/17310_MAR
*Ship Name: MV EURODAM
*IMO Number: 9378448
*System Manufactured By: Ecospray Technologies S.r.l., Alzano Scrivia, Alessandria, Italy
*Unit Model: ECO-DeSOx
*Ecospray Project Number: 15-032-APC/17-310-MAR
Scrubbers were installed by Ecospray Technicians, and certified by Lloyd's Register EMEA, amended Document Number UKITSO/MPL/32482846, approved on 5/8/18.

Scrubber System onboard is a Wet Open Loop Seawater DeSOx Absorption System (ECO-DeSOx).

System is currently operational. Vessel has ability to run Scrubber System underway and in port in AK waters. Scrubbers #1 and #2 each have "Alpha Filters", allowing these Scrubbers to be run in port. Scrubber #1 has a 105 micron filter, and #2 has an 80 micron filter. However, as of the date of this report, and for the entire time I have been onboard (8/4/18-8/25/18), vessel has only operated Scrubber System while underway in AK waters, per Chief Engineer's decision. Vessel on MGO while in port during my 3 week VO onboard.

•DeSOx Tower
The DeSOx Tower is a Wet Open Loop Type Absorbing System that utilizes the natural alkalinity contained in seawater to turn SOx into neutral carbonate salts. The absorption process takes place inside the DeSOx Tower which has been installed in place of the silencers.
The DeSOx Tower is designed to achieve an SO2/CO2 ratio of 4.3 (equivalent to the use of 0.10% sulphur content fuel oil) or less

when the Engine Load is 85% MCR and the vessel is using 3.5% m/m sulphur content HFO and is operating in areas where the seawater alkalinity content is equal to 1300umol kg.

Seawater is continuously supplied to the DeSOx Tower by the variable speed SW Pumps. When the system is in its standard automatic control mode, the Automation System automatically sets the required seawater flow rate based on the DG Load and calculated SO₂/CO₂ ratio. Values for SO₂ and CO₂ are taken from the Exhaust Gas Analyzer readings. For each installation, a Minimum and Maximum flow rate value is set during commissioning of the EGCS. This Automation System not only maintains the SO₂/CO₂ ratio as required at all engine loads (including transient loads), but also maintains both the pH and PAH values within the required IMO MARPOL limits.

Downstream of the SW Pumps, fully automated SW Filters are installed. The filters automatically go into back washing mode when the differential pressure across them exceeds 0.3 bar. In addition, a back wash timing cycle independent of the differential pressure can be set by the vessel, at the Ecospray PLC Setting Page. The interval can be adjusted as needed for environmental conditions or in the event of a failure of the differential pressure function.

NOTE- When the filter is in back washing mode, the flow of washwater to the DeSOx Tower is not affected and thus the EGCS will maintain compliance throughout the back washing cycle.

The DeSOx Towers are fitted with nozzle banks which spray seawater into the exhaust gas stream. A Static Demister is fitted at the top of each DeSOx Tower to remove water droplets and mist to avoid carry-over. The water removed by the Static Demister is drained back to the main body of the Towers by gravity. Differential pressure across the Static Demister is measured in order to monitor the pressure drop.

In the dry condition, no SW is pumped into the DeSOx Tower, and the Tower operates as a silencer only. The DeSOx Tower is designed to withstand dry hot conditions for extended periods. When in the dry hot condition, and when the vessel is sailing within Emission Control Areas (ECAs or EU Ports), the vessel's engines shall burn a fuel oil in compliance with the regulations.

•Wash Water System

Wash water is drained from the ECODESOx Tower by gravity. Wash water monitoring of PAH and Turbidity is done before DeSOx Tower at Rack #1 (Sea Suction Rack), and after DeSOx Tower at Rack #2 (DeSOx Outlet Rack), in order to derive differential readings of PAH and Turbidity. Wash water is mixed in the Static Mixer with additional SW to control the pH of water discharged overboard. The pH of the water discharged overboard is controlled and managed by mixing SW (the pH of which corresponds to that of the local SW) and the low pH water

discharged from the ECODeSOx Tower. Therefore, the only component of wash water treatment is the Static Mixer Unit. The Static Mixer Unit is fitted with internal baffles to ensure the complete mixing of the two input streams, thereby resulting in a homogenous outlet stream, as monitored by Rack #3 (Overboard Discharge Rack), after the Static Mixer and before Overboard Discharge.

NOTE- Vessel has two "Alpha Filters", used for two of its Scrubbers for use in port:
Scrubber #1/ 105 micron filter
Scrubber #2/ 80 micron filter
As of the date of this report, and for the time I was onboard (8/4/18-8/25/18), vessel has chosen to not operate its Scrubbers in port, but only while underway.

8. Additives used for the scrubber process? (De-sludge's etc.) If so full description.

No additives are being used in vessel's Scrubber Systems. Systems are Wet Open Loop Type Absorbing System, that pump seawater to the ECO-DeSOx Towers and back into the sea.

9. Describe the materials used in the piping systems.

Piping is reinforced epoxy manufactured by Wavistrong.

10. System capacities and mode of operations, bottlenecks, etc.? E.g. pump(s) capacity and control (constant or variable speed), systems energy consumption, etc.

Each Scrubber onboard has one SW Pump, and one Dilution Pump, for a total of 4 SW Pumps and 4 Dilution Pumps. All 8 pumps are manufactured by Pompe Garbarino, and all 8 are variable speed. Nameplate data as follows:

#1 SW: 200kW/800m3
#1 Dilution: 72.9kW/800m3

#2 SW: 250kW/800m3
#2 Dilution: 72.9kW/800m3

#5 SW: 232kW/800m3
#5 Dilution: 87.3kW/1200m3

#6 SW: 200kW/800m3
#6 Dilution: 72.9kW/800m3

11. Discharge volume(s) for pumps in (m3/hr)? Note: if pump speed varies pending on operation include the capacities by each speed setting, including the max cap and low cap, etc. -If applicable, include the intake volume of the pump(s) system. See previous Note.

Each Scrubber onboard has one SW Pump, and one Dilution Pump, for a total of 4 SW Pumps and 4 Dilution Pumps. All 8 pumps are manufactured by Pompe Garbarino, and all 8 are variable speed. Nameplate data as follows:

#1 SW: 200kW/800m3
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#2 SW: 250kW/800m3
#2 Dilution: 72.9kW/800m3

#5 SW: 232kW/800m3
#5 Dilution: 87.3kW/1200m3

#6 SW: 200kW/800m3
#6 Dilution: 72.9kW/800m3

12. Ash/ sludge removal or catchment in the system and how disposed of? Average waste production 24-hrs, etc.

EGCS onboard doesn't really generate ash or sludge. Any debris found in filters is nominal, and usually solids and carryover from seawater. Any and all debris is collected and offloaded outside AK waters as Non Hazardous Waste.

13. Fuel use? Fuel specification limits for the scrubber system? How is fuel tracked or monitored to determine removal efficiency and compliance status?

14. General notes on scrubber operations & maintenance, instructions, logs, etc?

Vessel currently using HFO with sulphur content of 1.82% with Scrubber Systems. Per manufacturer, HFO sulphur content is not to exceed 3.5%, with engine load not greater than 85% MCR. Exhaust gas is monitored after exiting DeSOx Towers and data is continuously recorded and stored. Exhaust gas sample is analyzed for composition and SO₂/CO₂ ratio.

Records of the EGCS operation, compliance, and maintenance will be kept as specified below (these records will be available at surveys as required to confirm the correct operation of the EGCS):

- In service operating and compliance parameters: Recorded in Compliance Computer automatically (Compliance Report and Process Report);
- Completed component adjustments: Recorded in ship's electronic maintenance system (AMOS);
- Required maintenance and servicing activities: Recorded in ship's electronic maintenance system (AMOS);
- Completed maintenance and servicing activities: Recorded in ship's electronic maintenance system (AMOS);
- Like for like replacement of equipment/components: Recorded in ship's electronic maintenance system (AMOS);
- Daily spot checks: Recorded in EGCS Record Book;
- Alarms and troubleshooting activities: Recorded in EGCS Record Book;
- Storage and disposal of sludge residuals: Recorded in EGCS Record Book and ship's electronic Garbage Log;
- Nitrate discharge data and analysis certificates: Recorded in EGCS Record Book;
- Supporting EGCS documents, ie gas certificates, calibration documents, and service records: Recorded in EGCS Record Book;

By keeping all of the above records, the regulatory requirements related to the keeping of EGCS records are fulfilled. The operating parameters that are required by the regulations to be checked daily are recorded continuously. In addition, a daily spot check will be carried out and the record of the daily spot check recorded in the EGCS Record Book. All EGCS records must be retained for a minimum of 3 years.

In addition, the following manuals and documents are available as well:

*EGCS Operating Manual- primary source of information on the EGCS, contains detailed system description, regulations and compliance requirements, operating procedures and safety systems, troubleshooting and corrective actions, etc.

*Sampling and Monitoring Compliance Handbook- contains information on periodic sampling, regulations and compliance requirements, procedures for collecting samples, etc.

*System Information Manual (SIM)- focuses on system maintenance and contains maintenance requirements for each system

15. For seawater intake/effluent, please provide port locations (PS/STB Frame number, etc.)? Additional notes can include distance below waterline or vertical angle.

component, OEM manuals and data sheets, etc.

Additional maintenance information for system can be found in vessel's AMOS System onboard.

For Scrubbers #1, #2, and #6:

*Intake is Starboard side, Frames 106-110;

*Overboard Discharge is Starboard side, Frames 86-89;

For Scrubber #5:

*Intake is Port side, Frames 84-86;

*Overboard Discharge is Port side, Frame 78;

Section 2: Compliance and Auxiliary Monitoring - Water & Solid Waste

16. Pursuant requirements of EPA VGP 2.2.26, 40 CFR 110, and section 10 for Exhaust Gas Cleaning (EGC) Systems under IMO (resolution MEPC.184(59)), does the vessel monitor scrubber system parameters for the following items, (Notes: include sampling schedule or monitoring interval (e.g. twice per second, once per minute, etc.), you may circle Yes (Y), No (N), or units measured where applicable,);

Yes; Vessel is monitoring and recording parameters via use of compliance monitoring equipment, which sends parameter values to Ecospray PLC, then finally to the dedicated Compliance Computer, located in ECR, where parameter values are recorded and stored. Parameter values are monitored continuously and recorded every 3 minutes. Recording frequency onboard is in compliance with regulations of IMO MEPC 259(68). Data is retained onboard for a period of not less than 3 years from date of recording.

16.a pH

16.a.1 Is intake monitored?

Yes

16.a.2 How?

With Hach Lange pH sensor located in Sea Suction Rack (Rack #1). Difference between intake and effluent pH is recorded as "pH Differential".

16.a.3 Is effluent monitored?

Yes

16.a.4 How?

With Hach Lange pH sensor located in Overboard Discharge Rack (Rack #3). Difference between intake and effluent pH is recorded as "pH Differential".

16.b PAHs (Polycyclic Aromatic Hydrocarbons) µg/L PAHphe (phenanthrene equivalence)

16.b.1 Is intake monitored?

Yes

16.b.2 How?

With Hach Lange PAH sensor located in Sea Suction Rack (Rack #1). Difference between intake PAH and PAH of water after DeSOx Tower but before Static Mixer (undiluted) is recorded as "PAH Differential".

16.b.3 Is effluent monitored?

No

16.b.4 How?

Effluent is not monitored; However, PAH is monitored of water after DeSOx Tower but before Static Mixer (undiluted) with Hach Lange PAH sensor located in DeSOx Outlet Rack (Rack #2). Difference between intake PAH and PAH of water after DeSOx Tower but before Static Mixer (undiluted) is recorded as "PAH Differential".

16.c Oily discharges or sheens

16.c.1 Is effluent monitored?

Yes

16.c.2 How?

Any oily discharges or sheens are visually monitored by Deck and/or Bridge Watch personnel of waterline at overboard discharge.

16.d Sludge or residues generated in treatment

16.d.1 Is effluent monitored?	Yes
16.d.2 How?	Monitored by visual inspection of filters in System.
16.d.3 Where offloaded?	Any debris found caught in filters within System is collected and offloaded outside AK waters.
16.e Flow rate t/hr	
16.e.1 Is intake monitored?	Yes
16.e.2 How?	Water flow rate through Sea Suction Rack (Rack #1), and water flow rate at inlet connection to DeSOx Tower, by means of flow transmitters.
16.e.3 Is effluent monitored?	Yes
16.e.4 How?	Water flow rate through DeSOx Outlet Rack (Rack #2), after DeSOx Tower but before Static Mixer (undiluted), and flow rate through Overboard Discharge Rack (Rack #3), after Static Mixer (diluted); Both by means of flow transmitters.
16.f Scrubber system power consumption MWH.	
16.f.1 Present?	No
16.f.2 How?	The only values monitored and recorded are Engine Load, in %, and Generated Power, in MW.
16.g Turbidity in any of the following units: FNU (Formazin Nephelometric Units), NTU (Nephelometric Turbidity Units), or equivalent units.	
16.g.1 Are other equivalent units used?	No
16.g.2 What kind?	FNU used as unit of measurement for Turbidity.
16.g.4 Is intake monitored?	Yes
16.g.5 How?	With Hach Lange Turbidity sensor in Sea Suction Rack (Rack #1). Difference between Turbidity of Sea Suction Rack (Rack #1) and Turbidity of DeSOx Outlet Rack (Rack #2) is recorded as "Turbidity Differential".
16.g.6 Is effluent monitored?	No
16.g.7 How?	Effluent isn't monitored for Turbidity; However, Hach Lange Turbidity sensor located in DeSOx Outlet Rack (Rack #2) monitors water after DeSOx Tower but before Static Mixer (undiluted). Difference between Turbidity of intake and Turbidity of DeSOx outlet is recorded as "Turbidity Differential".
16.h mg/L nitrate + nitrate	
16.h.1 Is effluent monitored?	No
16.h.2 How?	Nitrates are monitored via periodic sampling and not continuous monitoring.
16.h.3 Where?	At periodic sampling of overboard discharge.
16.i Temperature	
16.i.1 Is intake monitored?	Yes
16.i.2 How?	Seawater temperature transmitter and exhaust gas temperature transmitter.
16.i.3 Where?	Both located at DeSOx Tower inlet.
16.i.4 Is effluent monitored?	Yes

16.i.6 Where?

17. How are monitoring systems secured, data collected, e.g. white-box, etc?

Washwater and exhaust gas temperature transmitters.

At DeSOx Tower outlet for both water and exhaust gas temperatures, and at Static Mixer outlet (prior to discharge Overboard) for water temperature.

The interconnections for the vessel's EGCS data recording, storage, and reporting is as follows:

- EGCS monitoring equipment (exhaust gas and wash water) records data;
- Monitoring equipment sends data to Ecospray PLC via Ethernet connections;
- Ecospray PLC sends data to Compliance Computer via Ethernet connections;
- Data may be transferred from Compliance Computer to external device; i.e. flash or thumb drive;

The onboard Compliance Computer, which is based on a Simatic WinCC Runtime Professional, gathers the monitoring data from the Exhaust Gas and Washwater Systems and holds it in a database; The database is read only, tamper proof, and cannot be modified in any way. When required, the Compliance Computer can generate a Compliance Report and a Process Report for any given period of time. These reports demonstrate the compliance of the EGCS during the specified period of time. A report is generated by entering the times and dates for the required period into the Compliance Computer and requesting the required report. The reports are produced in a .csv form that can be transferred to an external device, i.e. a thumb or flash drive. Vessel's EO checks data in Compliance Computer daily and downloads and submits monthly reports containing EGCS data monthly. Data will be retained for a period of not less than 3 years from the date of recording. If the unit is changed over that period, it will be ensured that the required data is retained onboard and made available as required.

18. Do the monitoring systems have alarms or warnings in place for non-compliance?

Yes; Compliance Computer (in ECR) has alarms for non-compliance, as well as vessel's automation (ABB), that gives Watch Engineers audible and visual alarms when compliance parameters aren't being met.

19. Are sensors calibrated? Certified and to what standard (Note: critical for pH electrode and turbidity monitors) How often? Records or instructions? Generic notes for monitoring system "robustness"?

Calibration records are kept onboard; The following information details calibration and maintenance for wash water sensors in vessel's EGCS:

- pH Sensor- sensor is cleaned every 90 days; Calibrated annually; Salt Bridge and Fill Solution annually.
- Turbidity Sensor- sensor is pre-calibrated on leaving the factory; Correct calibration is checked annually with known value liquid sample; Wiper profile replaced after 1200 cycles; Dessicant replaced every 2 years; Test equipment monitored every 2 years (factory test with certification); Gradient checked annually.
- PAH Sensor- factory calibration performed every 2 years with UV fluorescence calibration standard; Plugs and flash bulb checked (system inspection) every 2 years.

20. Are their vessel procedures for system switch-over between operational modes, startup, shut-down, docking/maneuvering, etc. and how is this done?

Vessel has the ability to operate its EGCS underway and in port in AK waters. However, as of the date of this report, and for entire time I have been onboard, 8/4/18-8/25/18, vessel has only operated EGCS while underway and during maneuvering, using MGO while in port. For maneuvering into port, vessel will have 2 DGs with Scrubber System on HFO, and one DG on MGO. Once all fast and FWE (finished with engines), the 2 DGs on HFO are secured, followed by securing the Scrubber System, leaving the DG on MGO online. On maneuvering out of port, the same engine configuration is used, with the DG on MGO being secured after departure. IF the vessel were to operate its EGCS in port, it would maneuver in/out with 3 DGs on HFO and Scrubber System, ensuring that one of the DGs was #1 or #2 (as these 2 DGs have Alpha Filters for running in port), and that vessel would be docking Port side to (Port side against the dock), as Overboard Discharge for Scrubbers #1 and #2 is on Starboard side). As previously stated, vessel has been choosing to use MGO in port, due to Chief Engineer's decision to do so. Prior to arriving in Special Area (GB), Engine Room is given timely notice, to complete Engine Reconfiguration (FO Changeover) so that vessel is completely on MGO prior to entering Special Area and remains on MGO for entire time inside Special Area.

21. How and where does the vessel intend to satisfy compliance with receiving water monitoring requirements for EGCs under the EPA VGP 2.2.26.2.3 and if conducted, are reports, or documentation available for 2.2.26.2.4 (Annual EPA VGP DMR, due by February 28 of the following year)?

Documentation for EGCS sampling/testing available onboard and located in EO's office. Most recent documentation reflects Scrubbers #1, #2, and #6 having been done on 3/11/18, and Scrubber #5 having been done on 6/2/18.

Section 3: Compliance and Auxiliary Monitoring - Air

22. Describe or provide a diagram of exhaust air flow and stack emissions. Mark and describe the sensors / measurement points installed to collect and monitor exhaust flow data. Diagram may be scanned as a photo.

See photo #1 in "Photos" section of this report.

23. Are there after-burners in the exhaust stack for scrubber emissions? Where? If so, what is the fuel consumption and operational control of this system?

There are no after burners in the exhaust stack for Scrubber System emissions onboard the HER.

24. Economizer / Heat Recovery, how is "boiler (air side) washing performed? Soot blowing operations? Details include the frequency used equipment etc.

Air side washing is currently being done every 500 hours; Soot blowing is done nightly, while underway.

25. Pursuant requirements of MEPC 59/24/Add.1 ANNEX 9, how and where is the SO₂ (ppm)/CO₂ (%) ratio monitored? -Additionally, how is fuel use in the associated combustion equipment tracked?

Monitoring of SO₂/CO₂ in vessel's exhaust gas is done by means of a WR Systems EMSYS Exhaust Gas Analyzer System, and Vimex ShipCEMS Continuous Exhaust Emission Monitoring System. Sample probes are located in each of the 4 DGs (Scrubbers #1, #2, #5, and #6) exhaust stacks. Fuel use is tracked by means of Logs and soundings.

26. How are monitoring systems secured, data collected, e.g. white-box, etc?

The interconnections for the vessel's EGCS data recording, storage, and reporting is as follows:

- EGCS monitoring equipment (exhaust gas and wash water) records data;
- Monitoring equipment sends data to Ecospray PLC via Ethernet connections;
- Ecospray PLC sends data to Compliance Computer via Ethernet connections;
- Data may be transferred from Compliance

	<p>Computer to external device; i.e. flash or thumb drive;</p> <p>The onboard Compliance Computer, which is based on a Simatic WinCC Runtime Professional, gathers the monitoring data from the Exhaust Gas and Washwater Systems and holds it in a database; The database is read only, tamper proof, and cannot be modified in any way. When required, the Compliance Computer can generate a Compliance Report and a Process Report for any given period of time. These reports demonstrate the compliance of the EGCS during the specified period of time. A report is generated by entering the times and dates for the required period into the Compliance Computer and requesting the required report. The reports are produced in a .csv format that can be transferred to an external device, i.e. a thumb or flash drive. Vessel's EO checks data in Compliance Computer daily and downloads and submits monthly reports containing EGCS data monthly. Data will be retained for a period of not less than 3 years from the date of recording. If the unit is changed over that period, it will be ensured that the required data is retained onboard and made available as required.</p>
27. Do the monitoring systems have alarms or warnings in place for non-compliance?	<p>Yes; Compliance Computer (in ECR) has alarms for non-compliance, as well as vessel's automation (ABB), that gives Watch Engineers audible and visual alarms when compliance parameters aren't being met.</p>
28. Are sensors calibrated? Certified and to what standard? How often? Records or instructions?	<p>Yes; Sensors calibrated annually, with documentation and certification retained onboard. Vessel's AMOS System contains information for any maintenance done.</p>
29. Are there vessel procedures for system switch-over between operational modes, startup, shut-down, docking/maneuvering, etc. and how is this done?	<p>Vessel has the ability to operate its EGCS underway and in port in AK waters. However, as of the date of this report, and for entire time I have been onboard, 8/4/18-8/25/18, vessel has only operated EGCS while underway and during maneuvering, using MGO while in port. For maneuvering into port, vessel will have 2 DGs with Scrubber System on HFO, and one DG on MGO. Once all fast and FWE (finished with engines), the 2 DGs on HFO are secured, followed by securing the Scrubber System, leaving the DG on MGO online. On maneuvering out of port, the same engine configuration is used, with the DG on MGO being secured after departure. IF the vessel were to operate its EGCS in port, it would maneuver in/out with 3 DGs on HFO and Scrubber System, ensuring that one of the DGs was #1 or #2 (as these 2 DGs have Alpha Filters for running in port), and that vessel would be docking Port side to (Port side against the dock), as Overboard Discharge for Scrubbers #1 and #2 is on Starboard side). As previously stated, vessel has been choosing to use MGO in port, due to Chief Engineer's decision to do so. Prior to arriving in Special Area (GB), Engine Room is given two hour notice, to complete Engine Reconfiguration (FO Changeover) so that vessel is completely on MGO prior to entering Special Area, and remains on MGO for entire time inside</p>

This project seemed to take quite some time to get started, as HAL didn't "want to do the same report twice", although this vessel was one of the last HAL vessels to have a Scrubber Report done. The vessel had the Scrubber Report questions prior to my arrival onboard, as well as a copy of HVO Scrubber Report from 2017 that I shared, as an example of what information would be needed. After waiting to get approval from Corporate to access EGCS manuals, I was finally able to get some solid, detailed information on the System. EO assisted as much as possible, as did the Scrubber Engineer.

I feel the vessel has a “good grip” on compliance requirements. As previously stated, it seemed as though this report didn’t want to get done, for whatever reason, as it took time and waiting for approval from Corporate, although they knew what information AK was asking for ahead of time.

Permission was given by my Manager and CPVEC to share this report with the vessel, and a copy was sent to vessel's EO. This vessel was one of two HAL vessels left to do Scrubber Report on.

Photos and Comments

The diagram illustrates the exhaust gas treatment system for a Diesel Engine. The system components and their associated parameters are as follows:

- Diesel Engine:**
 - Exhaust gas flow rate (Kg/h)
 - SO₂ (ppm)
 - Exhaust gas temperature at IOX outlet (°C)
 - Max drop pressure admissible (mbar)
 - Dust drop (pressure mbar)
- Economizer:**
 - Economizer drop (pressure mbar)
 - Exhaust gas flow rate (Kg/h)
 - SO₂ (ppm)
 - Exhaust gas temperature at Economizer outlet (°C)
 - Back-pressure (mbar)
- Ecologizing DeSO_x Tower:**
 - Drop Pressure at DeSO_x Tower (mbar)
 - Elevation (m)
 - SW Supply to Ecologizing DeSO_x Tower
- Static Mixer:**
 - Ecologizing DeSO_x Tower Discharge
 - Flow rate at DeSO_x outlet (m³/h)
 - Water temperature at Static Mixer outlet (°C)
 - pH value at Static Mixer outlet
- Pumps and Flow:**
 - Dilution Pump: Dilution Pump nominal flow (m³/h), Dilution Pump pressure (m), Dilution Pump nominal power (kW)
 - SW Pump: SW Pump nominal flow (m³/h), SW Pump pressure (m), SW Pump nominal power (kW)
- Other Components:**
 - SEA (Sea)
 - SW (Seawater)

Diagram showing layout and flow of vessel's EGCS. Vessel has 4 Ecospray DeSOx Scrubbers onboard, connected to DGs #1, #2, #5, and #6.

Photo of 3 SW Pumps (blue) and 3 Dilution

Pumps (black), for Scrubbers #1, #2, and #6. Each Scrubber onboard has 1 SW Pump, and 1 Dilution Pump, part of EGCS. Pumps for Scrubber #5 are located in another Compartment, on Port side.

Photo 3

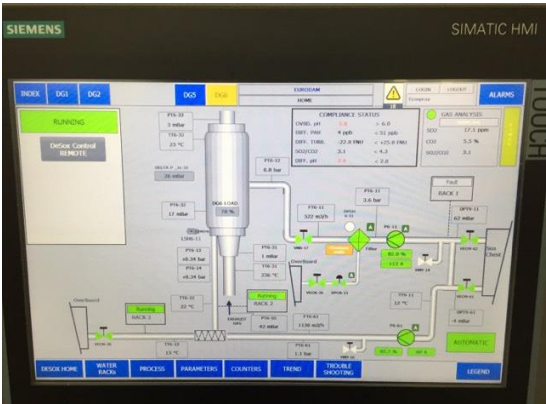


Photo 3 Caption

Photo of EGCS VDU Touchscreen, this one located in ECR, where System can be monitored by Watchstanders. Photo shows information for Scrubber #6 that is online at time of photo.

Photo 4



Photo 4 Caption

Photo of one of three wash water "Racks" attached to each Scrubber onboard. This is Rack #3 (Overboard Discharge Rack), that measures pH of wash water before being discharged overboard. Rack #1 (Sea Suction Rack) measures PAH, pH, and Turbidity of inlet wash water, and Rack #2 (DeSOx Outlet Rack) measures PAH and Turbidity of wash water after the DeSOx Tower, but before the Static Mixer.

Photo 5

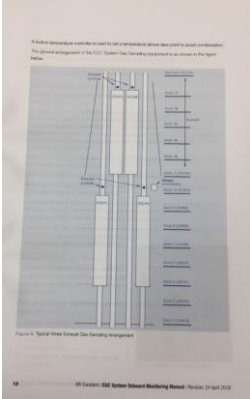


Photo 5 Caption

Photo of probe arrangement of vessel's Vimex exhaust gas sampling system in

vessel's funnels. Vessel has two exhaust gas sampling and monitoring systems: Vimex and Emsys; Both sample and monitor SO₂ and CO₂ in exhaust gas.

Complete

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