



Background

General Information

Ocean Ranger Name:	mark.farley
Report Date:	Jun 15, 2018
Ship:	Princess Golden
Ship Code:	PGL

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 EGCS is largely located in the upper and lower incinerator room, as one incinerator had to be removed to accommodate the EGCS installation. The physical location of the below-deck equipment is stud side decks 1&2, fire zone #6, ~ frame station 20; this below-deck equipment includes pumps, piping, and controls. The DeSox towers extend from Deck 11 to Deck 16.

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 EGCS "open loop" is installed on DG number one and DG number two.
DG number one and two:
GMT/SULZER 16 cylinder, 400mm bore, 560mm stroke, medium speed, 4-stroke Diesel engine type 16ZAV40S.
Maximum continuous rating(MCR):
11,520kW (15,488 hp) cylinder Speed: 514 rpm

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?

Both DG number one and DG number two EGCS units were manufactured by ECOSPRAY. Lloyd's Register certified.

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

Open loop wet type.

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

DG number two EGCS is operational and currently only operated while under, except in Glacier Bay. EGCS effluent filtration to be used in Ports in AK, but is currently not being used.
DG number one EGCS has not been run since installed and commissioned. DG number one diesel engine is currently being overhauled by Wärtsilä technicians, once overhaul is completed a ECOSPRAY technician will board PGL to complete work needed to put system back in service.

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

Exhaust gas from DG number one and DG number two flow through the ECO-DeSOx tower. In the tower a natural absorption process takes place as sea water comes into direct contact with the exhaust gas. The SO₂ in the exhaust combines with alkaline constituents in the seawater and form neutral carbonated salts. The control loop

	<p>automatically sets the required seawater flow based on the DG load and calculated SO₂/CO₂ ratio of no greater than 4.3 as required at all engine loads, while maintaining both the pH and PAH within limits.</p> <p>Automatic back flushing filters are installed downstream of the seawater pumps. The filters (100 micron) back flush every 10 min. or more frequently if differential pressure is excessive.</p> <p>The towers are fitted with five nozzle banks which are in operation during normal conditions.</p> <p>A static demister is fitted at the top of the tower to remove droplets and prevent carryover.</p> <p>Absorbed seawater passes through the contact trays and drains to the base of the tower to the discharge line. The effluent then passes by gravity to the static mixer and is diluted with water from the dilution pump before being discharged overboard.</p> <p>Rack (Analyzer Rack One) one monitors pH, PAH, conductivity and turbidity for intake water.</p> <p>Rack (Analyzer Rack Three) three monitors pH and dissolved oxygen for overboard discharge.</p> <p>Fluid Monitoring is done by the three Analyzer Racks. Analyzer Rack One is located at the SW inlet. Analyzer Rack Two is located at the EGCS ECO-DeSOx tower outlet. Analyzer Rack Three is located at the effluent overboard discharge.</p> <p>No additives are used in conjunction with EGCS "open loop" system.</p> <p>Reinforced fiberglass piping.</p> <p>SW pump to ECO-DeSOx tower: Pump manufacturer - Garabino Max flow 600 m³/hr Min flow 350 m³/hr Variable Frequency Drive Motor rating 200 kW</p> <p>Dilution pumps: Pump manufacturer - Garabino Max flow 1000 m³/hr Min flow 350 m³/hr Variable Frequency Drive Motor rating 450 kW</p> <p>SW pumps: min: 0 m³/hr; 8.7 kW max: 750 m³/hr; 200 kW</p> <p>Dilution pumps: min: 550 m³/hr; 3.3 kW max: 1300 m³/hr; 88.8 kW</p> <p>Ash / sludge collected by filters are handled along with strainer debris. Once the "In Port" filters are in use, such debris will be collected in drums and handled in the non-hazardous waste stream, discharged ashore outside of Alaska to Tymac in Vancouver, B.C.</p> <p>EGCS are used when DG number one and two burn HFO, IFO, or RMG. Currently DG number two has been operated on RMG 380 with sulphur content of 1.8%</p>
8. Additives used for the scrubber process? (De-sludge's etc.) If so full description.	
9. Describe the materials used in the piping systems.	
10. System capacities and mode of operations, bottlenecks, etc.? E.g. pump(s) capacity and control (constant or variable speed), systems energy consumption, etc.	
11. Discharge volume(s) for pumps in (m ³ /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.	
12. Ash/ sludge removal or catchment in the system and how disposed of? Average waste production 24-hrs, etc.	
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?

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

(observed fuel oil bunker notes/receipts and PGL has been bunkering RMG 380 with sulphur content < 2.0% since the start of the 2018 AK cruise season).

Fuel oil burned is monitored per combustion source per day, Chief Engineer has log.

PGL has a dedicated Third Engineer to oversee the EGCS operations. Compliance computer monitors operational parameters, these are verified by the Environmental Officer.

EGCS discharge ports: Stbd Side, Aft, Frame 47, Compartment 5. Vertically 2.9 & 3.6mm below waterline.

Inlet piping and pumps are one deck below.

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,);

16.a pH

16.a.1 Is intake monitored?

16.a.2 How?

16.a.3 Is effluent monitored?

16.a.4 How?

EGCS wash water monitoring is done by the Analyzer Racks.

Analyzer Rack One is located at the SW inlet. Analyzer Rack Two is located at the scrubber tower outlet.

Analyzer Rack Three is located at the effluent overboard discharge.

Yes

Intake water is analyzed by Analyzer Rack One. PAH, turbidity, and conductivity are monitored.

Yes

Final effluent is monitored by Analyzer Rack Three. pH and dissolved oxygen are monitored.

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

16.b.1 Is intake monitored?

16.b.2 How?

16.b.3 Is effluent monitored?

16.b.4 How?

Yes

Intake water is analyzed by Analyzer Rack One - PAH, turbidity, and conductivity are monitored.

Yes

Final effluent is monitored by Analyzer Rank Three - pH

16.c Oily discharges or sheens

16.c.1 Is effluent monitored?

16.c.2 How?

Yes

Oily discharges or sheens must be monitored visually which is undertaken by the dedicated EGCS engineer.

16.d Sludge or residues generated in treatment

16.d.1 Is effluent monitored?

16.d.2 How?

16.d.3 Where offloaded?

Yes

PGL EGCS Engineer has reportedly not generated substantial sludge or residue.

The reportedly small amounts of residue accumulated is retained for discharge in Vancouver, B.C.

16.e Flow rate t/hr

16.e.1 Is intake monitored?

16.e.2 How?

Yes

EGCS automation determines and adjusts the flow rate, based on effluent pH and EDG load. Intake flow meters are installed in the vicinity of Analyzer Rack One.

16.e.3 Is effluent monitored?

Yes

16.e.4 How?

EGCS automation determines and adjusts the flow rate, based on effluent pH and EDG load. Effluent flow meters are installed in the vicinity of Analyzer Rack Two.

16.f Scrubber system power consumption MWH.

16.f.1 Present?

Yes

16.f.2 How?

There is no dedicated EGCS kW meter. Rather, overall power consumption of the system can be determined by summing the constituent electrical loads which each have kW meters on the control panels.

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 is the unit used.

16.g.3 How?

Turbidity is measured by Analyzer Rack One and Two.

16.g.4 Is intake monitored?

Yes

16.g.5 How?

Intake turbidity is monitored by Analyzer Rack One.

16.g.6 Is effluent monitored?

Yes

16.g.7 How?

Turbidity of wash water prior to dilution is analyzed by Analyzer Rack Two.

16.h mg/L nitrate + nitrate

16.h.1 Is effluent monitored?

No

16.h.2 How?

N/A

16.h.3 Where?

N/A

16.i Temperature

16.i.1 Is intake monitored?

Yes

16.i.2 How?

Intake temperature is monitored at sensor point TT9-11

16.i.3 Where?

Temperature sensors are located in various places both in the gas stream and the liquid streams.

16.i.4 Is effluent monitored?

Yes

16.i.5 How?

Effluent temperature is monitored at sensor point TT2-12

16.i.6 Where?

Temperature sensors are located in various places both in the gas stream and the liquid streams.

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

The compliance computer retains data for minimum of 3 years. From the technical manual: "The data from this computer can be accessed and viewed at any time and either a process or compliance report can be generated." No device similar to a white box is in place.

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

Interface with IMACS automation in ECR for compliance values.

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"?

A third party calibration service, Hach, is used for calibration and mandatory parameter monitoring.

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

According to the dedicated scrubber engineer, the system incorporates a high degree of automation. Essentially it is

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)?

primarily a monitoring task, with the exception of start-up / shut-down. EGCS will be lined up and started prior to DG number one or DG number two start up and shut down after DG number one or DG number two is stopped.

According to scrubber engineer, vessel procedures, including record keeping and reporting, are consistent with and will lead to compliance with VGP requirements. Requirements of EPA VGP DMR are understood.

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.

Photo attached.

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?

No after burners installed with either DG number one or DG number two EGCS.

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

Exhaust Gas boilers are fitted on both DG number one and DG number two. The existing gas-side cleaning equipment has been retained. Residue from gas-side cleaning joins the exhaust stream before the ECGS thus is included in the ECGS process.

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?

SO₂/CO₂ is monitored and analyzed by the Gas Analyzer. HFO, IFO, or RMG burned in DG number one and DG number using EGCS is tracked by means of times of operation and consumption based on soundings, fuel oil flow meters, etc.

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

Stack gas monitoring equipment, located on deck 16. Equipment is calibrated and certified by third party CONSILIUM. Data collection, retention, secured by the compliance computer.

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

Yes.
Alarm for Gas Analyzer SO₂/CO₂ is 3.8; alarm limit is 4.3.

28. Are sensors calibrated? Certified and to what standard? How often? Records or instructions?

Equipment is calibrated and certified by third party CONSILIUM.

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

Essentially start-up / shut-down procedures are detailed elsewhere; largely automated according to EGCS Engineer.

Section 4: General Observations

30. Is vessel crew cooperative on this project?

Yes

31. Do you feel the vessel has a "good grip" on compliance requirements; how difficult is this survey to complete?

Yes, OR had to work around EGCS working hours and rest hours during days onboard for the first voyage, During second voyage onboard PGL, EGCS Engineer has to stand watch to cover watch for Third Engineer that was medically unfit to stand watch. Environmental Officer worked between OR's questions and answers from EGCS Engineer.

32. Are there other remarks/ comments the OR wants to share?

DG number one currently going through overhaul and EGCS for DG number one has not been run since commissioning. PGL was operating outside ECA waters since departing AK several years ago. During last voyage, EGCS Engineer had to stand watch due to another Third Engineer becoming medically unfair to stand watch.

Photos and Comments

Photo 1



Photo 1 Caption

EGCS control panel location upper incinerator compartment. Parameters and sensor placing.

Photo 2



Photo 2 Caption

Static mixer units for EGCS for DG number one and DG number two.

Complete

Is this report complete?

Yes

If this report is complete, tap on Send now. Do not make a selection in the next field. The report will be submitted for final review.