CROWLEY
People Who Know

Consolidated Additional Observations

This questionnaire combines all standard Additional Observation Questions in one condensed questionnaire.
1. SOx Emissions Controls
2. Ballast Water Project
3. Combustion Source Project
4. Food Waste Project
5. Sea Intake Project

Findings can be reported in the spaces provided for each item; feel free to use additional space for notes and information. Sketches, diagrams, photos of handwritten notes, or copies of schematics are welcome.

Several questions are checks on previous Additional Observations, check these against the previous observations. If a ship is required to have an additional observation project on a section below, skip the section below. For example if a combustion source project is required leave the section in this project blank.

A: General Information

Report Start Date:	May 14, 2018
Ocean Ranger starting report:	chris.schneider
Ship Name:	Celebrity Solstice
Ship Code:	XSO
Is this a revision of a previous report (Y/N)?	No

1: SOx Emissions Controls

1.1 Describe the SECA compliance plan.	Forward 2 Main Engines are equipped with Wartsilla hybrid scrubber which will operate in closed-loop mode while XSO is in AK waters. Main Engines 3 & 4 are run on MGO only, which will generally be used in sensitive areas or when more power additional power is needed for maneuvering.
1.1 Completed by:	Chris Schneider (chris.schneider)
1.2 How does the vessel control SOX emissions in the ECA? Provide description. If the vessel used low sulfur fuels in AK describe the fuel switches and which combustion sources are operated on low fuel sulfur, and when.	The two Main Engines that are operating on scrubbers can be changed to MGO from HFO during the season when three MGO M/E's are needed for times like maneuvering through Tracy Arm. The 2 Main Engines that are on MGO will only be using that throughout the season anyway.
1.2 Completed by:	Chris Schneider (chris.schneider)
1.3 Is the vessel operating or installing an exhaust gas scrubber system in the 2018 Alaska Cruise Season? If yes, complete section 1A. Otherwise skip to section 2.	Yes

1.a: SOx Emissions Controls

1.4 Which combustion sources are coupled with the EGCS system?	Generator engines 1 & 2.
1.4 Completed by:	Chris Schneider (chris.schneider)
1.5 EGCS units make, number, model, locations, fuel limitations (sulfur %).	Inline 15N06F/1-SC200F Inline 15N06F/2-SC230F Location of system is Port side Compartment #12 deck 30 From Section 2.5 of Manual: The EGC system is designed to reduce SOx-emissions to a level not exceeding an

	equivalent of .1% m/m sulphur content in the fuel (SO2/CO2 ratio of 4.3 or less), when the combustion units are operated on a fuel that contains a maximum of 3.5 % m/m sulphur.
1.5 Completed by:	Chris Schneider (chris.schneider)
1.6 Scrubber type (closed, reagent cycle, combination or hybrid open-loop effluent to seawater)?	Scrubber can be run in closed-loop mode, open-loop, or a hybrid mode. In the 2018 season, as of the time this report was submitted, the scrubber had been run in closed-loop mode only when the XSO was operating it in AK waters.
1.6 Completed by:	Chris Schneider (chris.schneider)
1.7 System status (operational, commissioning, under construction)?	System is operational. Closed loop in AK waters.
1.7 Completed by:	Chris Schneider (chris.schneider)
1.8 Provide a process description and waste flow/chemicals used (Gaseous emissions, waste effluent, ash, spent reagents, etc.).	FWD Open Loop Principles of Operation: • The SOx in the exhaust gas along with some of the particulate matter is absorbed into the sea water. • The alkalinity in sea water allows the absorption through chemical reaction. • The SOx dissolves and ionizes in the water to form Bisulphite and Sulphite which readily oxidizes to Sulphate in sea water. • Any Sulphuric acid that is generated is also converted to Sulphate in sea water. FWD Closed Loop Principles of Operation: • The principle of SOx absorption efficiency is higher due to the alkali chemicals used which maintain a higher alkalinity in the water. • The drain water is treated in bleed off treatment units (BOTU) using flocculation chemicals to separate the solids from the water. • The water is drained from the system based on the density of the water, which increases as particulate matter and Sulphur are dissolved. • A bleed off cycle consists of draining approx. 10% of the Process tank and then refilling the 10% with sea water. • Bleed off tank is used to process % of water while in closed loop to allow (better) make-up water and caustic soda to be added to the scrubber water. This water is treated and can be discharged once > 3 nm / outside restricted areas FWD Dual Water Mode Principles of Operation • The Dual Water mode is used where the sea water does not have enough alkalinity to ensure full SOx absorption. • An economic way to scrub >2.5% Sulphur fuel without going to a full closed loop. • The lower section using sea water provides the initial cleaning function. • The closed loop in the upper section provides a polishing function. • Excess flow from OL scrubbing pump is bleed off overboard. Consumption and Production • Sludge Production

	- Sludge produced from the Closed Loop: 5-10L/MWh • Chemical Consumption - Alkali (Caustic Soda) consumed during Closed Loop Operations: 15-20L/MWh. - Flocculant (Polymer) consumed during BOTU operations: 50-100ml/m3 - Coagulant (Polyaluminiun Chloride) consumed during BOTU ops: 200-600ml/m3 - Alkali (Caustic Soda) consumed during BOTU Operations: 200-600ml/m3
1.8 Completed by:	Chris Schneider (chris.schneider)
1.9 What scrubber process parameters are monitored (flow capacities, pH, other)?	SO2/CO2 ratio Open loop PH Open loop PAH (diff) Open Loop Turbidity (diff) Closed loop pH Closed loop PAH Closed loop turbidity Engine load
1.9 Completed by:	Chris Schneider (chris.schneider)
1.10 For seawater intake/effluent, please provide port locations (PS/STB Frame number, etc.). Additional notes can include distance below waterline and angles.	Compartment #14 port side. Frame 96-100
1.10 Completed by:	Chris Schneider (chris.schneider)

2: Ballast Water

2.1 Check the previous Additional Observation Reports (section 1.1) list of tanks used for Ballast Water storage. Including volumes and locations. List any changes.	No changes, all information from 2017 is accurate.
2.1 Completed by:	Chris Schneider (chris.schneider)
2.2 Are ballast water tanks used for wastewater storage?	Yes. GW / BW double bottom tank 8 P/S / G
2.2 Completed by:	Chris Schneider (chris.schneider)
2.3 Ballast Water system: brief description of the combined piping system if tanks used for both.	2 ballast pumps located in compartment 11, 13, water goes through sea chest then circulated through piping. An eductor pump is used for emergencies.
2.3 Completed by:	Chris Schneider (chris.schneider)
2.4 Ballast Water treatment installation? If yes, describe operation/system specifics.	No
2.4 Completed by:	Chris Schneider (chris.schneider)
2.5 Ballast Water operations in AK waters (overboard intake/discharge, etc.)? Include the last date of ballast water discharges. Typically in the ballast water logs.	No, vessel does not conduct any ballast operation in Alaska. Vessel has permanent ballast tanks that can be used for internal transfers. If in any case vessel has to deballast or ballast Vessel does it outside of Alaska waters.
2.5 Completed by:	Chris Schneider (chris.schneider)

3: Combustion Sources

3.1 Are there any changes from the previous Additional Observation projects (Section 2.1) on the propulsion system question on brief description of propulsion and power systems used on board (Diesel direct/reduction gears/PTO's DE, FP, CPP Azipod, etc.)?	No change.
3.1 Completed by:	Chris Schneider (chris.schneider)
3.2 Are there any changes from the previous Additional Observation projects (Section 1.1) on the list of the combustion equipment used for Power/Propulsion (make/model/output)?	No change.
3.2 Completed by:	Chris Schneider (chris.schneider)

3.3 Are there any changes from the previous Additional Observation projects (section 3) on the incinerators make, model, fuel used, capacity?	No change.
3.3 Completed by:	Chris Schneider (chris.schneider)
3.4 Average Hotel power (kW) in port and underway?	6 to 7 Mega Watts of power is used while ship is under way.
3.4 Completed by:	Chris Schneider (chris.schneider)
3.5 Average fuel consumption in port and underway?	Total fuel consumption in one 7 day cruise from May 11 to May 18 was 449.7 MT of HFO and 308.5 MT of MGO.
3.5 Completed by:	Chris Schneider (chris.schneider)

4: Food Waste Garbage Handling

4.1 How is food waste handled and disposed of?	All food waste is either incinerated or processed through the pulper system. 60% of food waste is processed through either: 17 pulper stations in the galleys - > vacuum system --> shredder --> spirale press --> food waste silo --> overboard. OR Food waste hatch (Photo 5) --> shredder --> spirale press (Photo 9) --> food waste silo (Photo 6) --> overboard. The other 40% is incinerated at Deck 2 by feeding the incinerators (Photos 11-13).
4.1 Completed by:	Chris Schneider (chris.schneider)
4.2 Average food waste production per day (kgs/day)?	For May 2018 the average food waste produced was 5.2m3/day, with 3.2m3 /day going overboard (average).
4.2 Completed by:	Chris Schneider (chris.schneider)
4.3 Is the food waste de-watered? If yes, provide dewatering volumes and handling information.	Yes, de-watering volumes are not tracked and would be difficult to track if attempted.
4.3 Completed by:	Chris Schneider (chris.schneider)
4.4 How are glass bottles, broken crockery, and ceramics handled?	All of these items are recycled in Victoria.
4.4 Completed by:	Chris Schneider (chris.schneider)
4.5 How is food waste monitored and/or recorded?	XSO appears to keep very good records of volumes of waste streams.
4.5 Completed by:	Chris Schneider (chris.schneider)

5: Sea Water Intakes

5.1 List all of the seawater intakes (chests); include the locations, frame, side (PS/SB) or compartment.	35 seawater intakes were counted from the drawings, all of them are located in compartments 11, 13, 15, and 16.
5.1 Completed by:	Chris Schneider (chris.schneider)
5.2 List filtration systems for each intake. Describe how filter systems are maintained. What is the frequency of cleaning? Is this performed in Alaska?	Standard basket filters are used.
5.2 Completed by:	Chris Schneider (chris.schneider)
5.3 How is debris and mud from filtration/strainers handled?	It is removed manually and subsequently incinerated.
5.3 Completed by:	Chris Schneider (chris.schneider)
5.4 Marine Growth Protection Systems in the sea intakes. Description of the control systems and information on checmicals if used.	Marine Growth Protection System is in use, no chemicals are used. From the Biofouling Management Plan: Maintenance Jobs: Sea chest strainers Inspected by shipboard

	team every month (Job No.: CL-80020 - CLEANING OF SEA CHEST) Electrical panel and connections inspected by shipboard team every 2 weeks (Job no.: IC-80082 - 2 WK. ANTI FOULING SYSTEM MAINTENANCE). A/F anodes Current Settings: The effective working of the system can only be determined by inspection and it is suggested that if after 6 months of operation the opportunity to examine a strainer, length of pipe or heat exchanger, presents itself, this should be done. This routine can be repeated at intervals, the current being adjusted accordingly. The seagoing current settings are adjusted manually. If there is evidence of mussel or other marine growth beginning to appear in strainers or heat exchangers, adjust this setting for the copper (A/F) anodes upwards in increments of 0.2 amps until new growth ceases to appear. Each increment should be left set for 30 days before further adjustment up or down, when 'not in use' settings given in manual must be made manually. Cathelco recommends doing this whenever a port stay or with the main sea water circulating pumps shut down that lasts more than 24 hours or whenever a sea chest is not in use. Daily Checks: Cathelco recommends recording the current readings or at least deviations, for each anode daily on a log sheet. This will ensure that anomalies can be dealt with promptly.
5.4 Completed by:	Chris Schneider (chris.schneider)
5.5 Hull cleaning in place in Alaska 2018?	Yes
5.5 Completed by:	Chris Schneider (chris.schneider)

6: General

6.1 Is vessel crew cooperative on this project?	Crew was very cooperative, I feel like they have it figured that if they just work hard to help me get information for my report it actually saves us both time.
6.1 Completed by:	Chris Schneider (chris.schneider)
6.2 Do you feel the vessel has a clear understanding of compliance requirements?	The XSO gave me the impression that the crew is one of the best prepared for the operational nuances of the Alaska season that I have been on.
6.2 Completed by:	Chris Schneider (chris.schneider)
6.3 Are there other remarks/ comments the OR wants to share?	EO Nick Asproudas was very professional and cooperative helping me gather information for this report.
6.2 Completed by:	chris.schneider

Z: Signature & Submit

Ocean Rangers contributing to this report:	Chris Schneider (chris.schneider)

Ocean Ranger Signature: