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

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| Report Start Date: | Jun 25, 2018 |
| Ocean Ranger starting report: | robert.layko |
| Ship Name: | Princess Ruby |
| Ship Code: | PRU |
| Is this a revision of a previous report (Y/N)? | No |

## 1: SOx Emissions Controls

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| 1.1 Describe the SECA compliance plan. | Ship has 2 Diesel Generators with complete Scrubber systems installed. These are being used while ship is underway and in port in Alaska waters. (Except Glacier Bay and other special areas) They are using HFO with less than 2 % sulfur ( 1.76% is currently being used)<br>Scrubber systems used are approved in accordance with regulation 4 of MARPOL Annex VI as an equivalent means of achieving compliance with regulation 14 of that Annex. |
| 1.1 Completed by: | Robert Layko (robert.layko) |
| 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. | Scrubber systems are being used in the ECA which is controlling the Sox from the heavy fuels being used.<br>The ship is also using low sulfur MGO fuels when in Glacier Bay and any other special areas.<br>The fuel switch for these fuels is being done 2 hrs prior to entering Glacier Bay National Park.<br>This is done to insure all of the "heavy" fuels are burned. |
| 1.2 Completed by: | Robert Layko (robert.layko) |
| 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

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| 1.4 Which combustion sources are coupled with the EGCS system? | DG#2 and DG#3 are both fitted with Scrubber systems.<br>There are however, plans for DG#5 and DG#6 to be fitted with Scrubber systems in the next Dry Dock. |

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| 1.4 Completed by: | Robert Layko (robert.layko) |
| 1.5 EGCS units make, number, model, locations, fuel limitations (sulfur %). | #2 and #3 Diesel Generators have Scrubber systems installed.<br>Model is: ECO-DeSOx<br><br>DG#2 Fwd DG Rm<br>Engine: Wartsila 12V46 CR<br>MCR: 12,600 kW<br>Speed: 514 rpm<br>Cycle: 4-stroke<br>DG Serial # PAAE 048495<br>EGC Tower # 15-026-APC-SC-0100<br><br>DG #3 Fwd DG Rm<br>Engine: Wartsilla 12V46 CR<br>MCR: 12,600 kW<br>Speed: 514 rpm<br>Cycle: 4-stroke<br>DG Serial # PAAE 048496<br>EGC Tower # 15-026-APC-SC-0200<br><br>Ship is using HFO fuels of 1.98% sulfur. Less than 2% seems to be the best for these systems. |
| 1.5 Completed by: | Robert Layko (robert.layko) |
| 1.6 Scrubber type (closed, reagent cycle, combination or hybrid open-loop effluent to seawater)? | The systems fitted are of the open loop type.<br>Effluent to sea water.<br>These systems have In Port back wash filters installed. |
| 1.6 Completed by: | Robert Layko (robert.layko) |
| 1.7 System status (operational, commissioning, under construction)? | Both systems fully operational. |
| 1.7 Completed by: | Robert Layko (robert.layko) |
| 1.8 Provide a process description and waste flow/chemicals used (Gaseous emissions, waste effluent, ash, spent reagents, etc.). | There are no chemicals being used with these systems.<br>The waste generated is being collected in " bag" filters being used. These bags of 40 microns each are removed when the pressure differential gets too high. Once removed they are collected in a drum for offload as non hazardous waste.<br>New bag filters are then used to replace the ones removed. |
| 1.8 Completed by: | Robert Layko (robert.layko) |
| 1.9 What scrubber process parameters are monitored (flow capacities, pH, other)? | Turbidity, pH, pAH, Flow rates, Ratio between SO2 and CO2 |
| 1.9 Completed by: | Robert Layko (robert.layko) |
| 1.10 For seawater intake/effluent, please provide port locations (PS/STB Frame number, etc.). Additional notes can include distance below waterline and angles. | Suction for seawater intake is between frames 55-60 (DG#2 and DG#3)<br>Discharge is between frames 40-44 Both of these are in the aft DG room/ lower incinerator room. |
| 1.10 Completed by: | Robert Layko (robert.layko) |

## 2: Ballast Water

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| 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. | Fore Peak: 531.6 m3<br>1 Center: 308.4 m3<br>2 Center 85.1 m3 |

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| | BW 13 Port 186.5 m3<br>BW 14 Stbd 184.8 m3<br>BW 15 Port 9.8 m3<br>BW 16 Stbd 14.3 m3<br>BW 17 Port MT<br>BW 18 Stbd MT |
| 2.1 Completed by: | Robert Layko (robert.layko) |
| 2.2 Are ballast water tanks used for wastewater storage? | Yes, some Ballast water tanks are being used to hold WW.<br>3 Port<br>4Stbd<br>5 Port<br>6 Stbd<br>7 Port<br>8 Stbd<br># 9, # 10, #11, and # 12 are being used for Laundry and Galley GW. |
| 2.2 Completed by: | Robert Layko (robert.layko) |
| 2.3 Ballast Water system: brief description of the combined piping system if tanks used for both. | Common Seawater pipe is run to all tanks, Tanks can be filled/emptied using Bilge/ Ballast pumps and tank isolation valves. Pumps and valves are remotely operated using vessels IMACS system.<br>If necessary to use ballast tanks for holding WW a separate line is in place, as well as a separate WW pump and isolating valves. Programming safeguards are in place so that Ballast water isolation valves and WW isolation valves cannot be opened at the same time, to aid in preventing contamination. |
| 2.3 Completed by: | Robert Layko (robert.layko) |
| 2.4 Ballast Water treatment installation? If yes, describe operation/system specifics. | Yes, ship has an approved Ballast Water Treatment system installed. |
| 2.4 Completed by: | Robert Layko (robert.layko) |
| 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 Ballast water exchanges are being done in Alaska waters. Trim and stability is being accomplished by the use of Heeling tanks and the transfer of WW, Potable Water, and fuel oils, being held.<br>The last ballasting that was done (According to ballast water logs) was 01/23/18 this was taking on Ballast water using Ballast Water Treatment system.<br>The most recent entry was for De ballasting that was done on 04/25/18 This was all done before the Ship came to Alaska for the season. The ship is not loading or discharging any ballast water while it is in Alaska waters. |
| 2.5 Completed by: | Robert Layko (robert.layko) |

## 3: Combustion Sources

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| 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 changes or upgrades have been made to the combustion systems on board.<br>Ship has 6 Wartsilla Diesel Generators being used.<br>DG # 1 8,400 kW<br>DG # 2 12,600 kW<br>DG # 3 12,600 kW<br>DG # 4 8,400 kW<br>DG #5 12,600 kW<br>DG # 6 12,600 kW<br>There are 2 Mitsubishi stand by emergency Generators for use. |

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| | EDG1 1190 kW / 1800 rpm<br>EDG2 1190 kW / 1800 rpm<br>Two Aalborg Unex CHB- 1500 boilers in use.<br>B1 15,000 kg/ hr<br>B2 15,000 kg/ hr<br>One Deerberg Systems STPW-1600 Incinerator<br>344 kg/hr |
| 3.1 Completed by: | Robert Layko (robert.layko) |
| 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 changes found to any combustion equipment being used. |
| 3.2 Completed by: | Robert Layko (robert.layko) |
| 3.3 Are there any changes from the previous Additional Observation projects (section 3) on the incinerators make, model, fuel used, capacity? | No changes to incinerator found.<br>Incinerator is still using Low Sulfur MGO for firing this. |
| 3.3 Completed by: | Robert Layko (robert.layko) |
| 3.4 Average Hotel power (kW) in port and underway? | 8.5 -9 MW of power is being used while in port. (shore power is used in Juneau)<br>9.7 MW of power is average use while ship is Underway. |
| 3.4 Completed by: | Robert Layko (robert.layko) |
| 3.5 Average fuel consumption in port and underway? | 2 m3 per/ hr of fuel is average amount used while docked in Alaska<br>Average underway amount is around 7m3 per/hr |
| 3.5 Completed by: | Robert Layko (robert.layko) |

## 4: Food Waste Garbage Handling

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| 4.1 How is food waste handled and disposed of? | Food waste is being pulped in one of 5 pulper systems being used. It is being de watered and stored in Silos until ship is > 12 nm<br>Non Commuted food waste is stored in covered totes inside of garbage cold storage and is being off loaded in Victoria every trip. |
| 4.1 Completed by: | Robert Layko (robert.layko) |
| 4.2 Average food waste production per day (kgs/day)? | According to Staff Chief Engineer, 8 m3 of commuted food waste is being produced every week.<br>Also 13 m3 of non commuted food waste is also generated. This is being stored in 1 meter totes which are being offloaded in Victoria every trip. |
| 4.2 Completed by: | Robert Layko (robert.layko) |
| 4.3 Is the food waste de-watered? If yes, provide dewatering volumes and handling information. | Yes, all food waste being pulped is de watered. The water from the dewatering process is collected in a Double Bottom Ballast water tank used to hold galley WW. This is not being tracked on here since it is being mixed with GW. |
| 4.3 Completed by: | Robert Layko (robert.layko) |
| 4.4 How are glass bottles, broken crockery, and ceramics handled? | All glass bottles are being crushed in a bottle crusher. Any limes or foreign objects are being removed before this. It is collected in 1 m3 totes and offloaded in Victoria for recycling. (ship does not separate different colors of glass.)<br>Broken crockery is being collected in a large lined box stored in the cold room. Efforts are |

made to remove food waste from this but it is not being washed off. This to is offloaded in Victoria.

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| 4.4 Completed by: | Robert Layko (robert.layko) |
| 4.5 How is food waste monitored and/or recorded? | Food waste is all being logged in the Garbage Record log. (NAPA log). Staff Chief Engineer is making entries for this. |
| 4.5 Completed by: | Robert Layko (robert.layko) |

## 5: Sea Water Intakes

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| 5.1 List all of the seawater intakes (chests); include the locations, frame, side (PS/SB) or compartment. | Total of 7 sea chests onboard, including 1 for the Exhaust Gas Cleaning System.<br><br>*Port side, frames 64-68<br>*Starboard side, frames 64-68<br><br>*Port side, frames 108-112<br>*Starboard side, frames 108-112<br><br>*Port side, frames 196-200<br>*Starboard side, frames 196-200<br><br>*Starboard side, frames 56-60 (for Scrubber System)<br><br>Jonathan Driggers (jonathan.driggers) |
| 5.1 Completed by: | Ronald Ladd (ronald.ladd) |
| 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? | Basket strainers, pulled and cleaned monthly or as needed as indicated by the pressure differential between strainer housing inlet and outlet measurements and the sea strainer(s) will be pulled and cleaned in AK and the debris not disposed of in AK.<br><br>Jonathan Driggers (jonathan.driggers) |
| 5.2 Completed by: | Ronald Ladd (ronald.ladd) |
| 5.3 How is debris and mud from filtration/strainers handled? | The debris, organic matter and mud is collected and offloaded outside of Alaska.<br><br>Jonathan Driggers (jonathan.driggers) |
| 5.3 Completed by: | Ronald Ladd (ronald.ladd) |
| 5.4 Marine Growth Protection Systems in the sea intakes. Description of the control systems and information on checmicals if used. | The 3 sea chest systems listed below are all protected by an "electrolytic type" Marine Growth Protection System and in this case, manufactured by Marelco.<br><br>Port side, frames 64-68<br>*Starboard side, frames 64-68<br><br>*Port side, frames 108-112<br>*Starboard side, frames 108-112<br><br>*Port side, frames 196-200<br>*Starboard side, frames 196-200<br><br>The electrolytic system consists of pairs, multiple pairs in most cases, of anodes made of copper and aluminum and are mounted in the sea chest.<br><br>Controlled, low DC current is passed through the copper anodes, which produce ions that are carried with the seawater throughout the entire sea water distribution piping network. These copper ions, in the seawater, prevent |

marine organisms from settling down and multiplying on the surface of the pipes and associated surfaces of coolers or heat exchangers as the case may be.

The action of the copper ions is assisted by aluminium hydroxide which is created by the "aluminium anodes" which flocculates the released copper. The copper-aluminium hydroxide floc is carried throughout the system and has a tendency to spread out into the slow moving areas closer to the pipe surfaces where marine larvae are most likely to settle.
As a result, marine growth larvae do not settle, instead they pass along directly to discharge. At the same time, a cupro-aluminium film is built up on the internal surfaces of pipes to suppress corrosion. In this way, the system has a dual action protecting seawater pipework against bio-fouling and corrosion.

A control panel measures and monitors the output of each of the anodes and can be seen in the VO's for the PRU.

The Starboard side, and single stand alone, sea chest that serves the EGCS at frames 56-60 is protected by an ultrasonic type Marine Growth Protection System manufactured by M.E.S. S.R.L. and the control panel for this can be seen in Section A.9 of the PRU VO for July 9, 2018.

In the ultrasonic method, a wave generator produces and sends electrical impulses at high frequency. These waves are passed through a coaxial cable to transducers which are mounted externally to the sea chests or strainers. On the PRU, transducers are seen at various other points along the sea water distribution points of the EGCS water wash circuit as well.

The transducers contain piezoelectric ceramic crystals, which when excited by electrical impulses, generate an ultrasonic beam.

The main advantage of this system is that it is non-invasive and no parts are in contact with sea water. Moreover, no toxic substances are produced.

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| 5.4 Completed by: | Ronald Ladd (ronald.ladd) |
| 5.5 Hull cleaning in place in Alaska 2018? | The PRU has no plans to have the hull cleaned in AK waters this 2018 season. |
| | Jonathan Driggers (jonathan.driggers) |
| 5.5 Completed by: | Ronald Ladd (ronald.ladd) |

## 6: General

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| 6.1 Is vessel crew cooperative on this project? | Yes EO, Staff Chief Engineer, Scrubber Engineer all very helpful with getting information for these projects. |
| 6.1 Completed by: | Robert Layko (robert.layko) |
| 6.2 Do you feel the vessel has a clear understanding of compliance | Yes, ship is using Low Sulfur fuels in all |

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| requirements? | special areas in Alaska and are running their Scrubbers with HFO being used. |
| 6.2 Completed by: | Robert Layko (robert.layko) |
| 6.3 Are there other remarks/ comments the OR wants to share? | The sea chest section of Bob Layko's report was completed by Alan Ladd. The section that dealt with the MGP systems associated with the sea chest systems onboard was reported by Alan with the remaining sections attributed, and rightly so, to Ocean Ranger Mr. Jon Driggers from a duplicate report found in the library authored my himself and Ocean Ranger Mr. Mark Farley. |
| 6.2 Completed by: | robert.layko<br>ronald.ladd |

## Z: Signature & Submit

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| Ocean Rangers contributing to this report: | Jonathan Driggers (jonathan.driggers)<br>Robert Layko (robert.layko)<br>Ronald Ladd (ronald.ladd) |
| Ocean Ranger Signature: |  |