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 14, 2018 |
| Ocean Ranger starting report: | todd.stafford |
| Ship Name: | Norwegian Jewel |
| Ship Code: | NJE |
| 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. | NJE Closely Monitors position of vessel in accordance with ECA requirements throughout the world and adjusts environmental practices as required.<br>Following a detailed plan and documentation of actions ensures requirements are met and maintained.<br>Data recording of the process will take place in Green Tech Marines GUI located in the ECR. The Data Recording and Processing Device is of a robust, tamper proof design with read only capability. The Device (Beiderbecke Electronics T15C, DNV GL certificate no. A-13686) records the data required by MEPC.184(59) sections: 4.4.7, 5.4.2, and 10.3 against UTC and ship's position by a Global Navigational Satellite System.<br>Compliance with annual EPA, VGP, and DMR are understood. |
| 1.1 Completed by: | Todd Stafford (todd.stafford) |
| 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 Boilers are only burning MGO.<br>The incinerator also only burns MGO and is only operated outside of Alaska/12nm.<br>The (5) DG's May burn either IFO 380 or MGO. Fuel switchover procedures are done accordingly.<br>By using the Scrubber system in a closed loop configuration SOX emissions are greatly reduced. A open loop configuration is only done outside 12nm while burning IFO.<br>Within GB area the DG's are burning MGO and utilize a closed loop configuration. This is a zero discharge area. |
| 1.2 Completed by: | Todd Stafford (todd.stafford) |

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| 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? | All 5 DG's are coupled with the Exhaust Gas Scrubber System.<br>Up to 3 units may be used with the closed loop configuration simultaneously.<br>DG #2 is a common rail engine that naturally burns cleaner and more efficiently. |
| 1.4 Completed by: | Todd Stafford (todd.stafford) |
| 1.5 EGCS units make, number, model, locations, fuel limitations (sulfur %). | The EGC System Type: GTM-R scrubbers were manufactured by YARA Marine Technologies. Scrubber serial numbers: 0030/0031/0032/0033/0034<br>The scrubbers generate washwater that meets the MEP-C.184(59) compliance prior to discharge.<br>Scrubbers are used when the five DGs burn HFO. The Maximum allowable Sulphur content in fuel to the main engines is 3.5%.<br>The scrubber system is installed primarily in the incinerator spaces, port side, in Compartments 14 and 15, on Decks 1, 2, 3, and 4. The large intake and effluent discharge pipes are on Deck 1 in Compartment 15, port side which connect to pumps in Compartment 14, also on the port side. One of the two incinerators in Compartment 14 was removed to make room for the scrubber system installation. The silencers in the stack were also removed to make room for the scrubber towers installation. The stack scrubber tower units are located on Decks 9, 10, 11, and 12. |
| 1.5 Completed by: | Todd Stafford (todd.stafford) |
| 1.6 Scrubber type (closed, reagent cycle, combination or hybrid open-loop effluent to seawater)? | This YARA GTM-R is a hybrid system with an open or closed loop of the wet Scrubber type where the dirty exhaust gas stream is brought into contact with the scrubbing liquid by spraying it with washwater (seawater, which may contain additives). |
| 1.6 Completed by: | Todd Stafford (todd.stafford) |
| 1.7 System status (operational, commissioning, under construction)? | Operational |
| 1.7 Completed by: | Todd Stafford (todd.stafford) |
| 1.8 Provide a process description and waste flow/chemicals used (Gaseous emissions, waste effluent, ash, spent reagents, etc.). | The GTM Scrubber is of the wet scrubber type, where dirty exhaust gas stream is brought into contact with the scrubbing liquid by spraying it with washwater (seawater, which may contain additives). The scrubber is designed to collect particulates and gaseous pollutants in the scrubbing washwater. Droplets that are in the flue gas can then be separated from the clean exhaust system by means of another referred to as Demister, leaving only cleaned outflow gas in the exhaust duct. The resultant scrubbing washwater may be treated prior to any ultimate discharge or recycled in the process. The configuration of scrubber and scrubbing system are designed to provide good contact between the washwater and the exhaust gas stream.<br>If the washwater is taken from the ship's sea chest, pumped through a scrubber, and then |

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| | (after neutralizing SOx emissions in the exhaust gases) drained overboard, this is called an Open Loop system.<br>If the washwater is taken from a ship's (process washwater) tank, pumped through a scrubber, and (after treatment such as filtering), circulated without any discharge overboard, this is called a Closed Loop system.<br>The functional description would be sea water pumped to the scrubber tower from the sea chest, via the washwater process pump. The washwater enters the scrubber tower through remote controlled valves. During the scrubbing process, SOx and harmful gases are neutralized and mixed with sea water. Cleaned exhaust gas passes through the exhaust duct to the atmosphere. The contents of the exhaust gas is measured using the Continuous Emissions Monitoring System (CEMS).<br>The washwater inside the scrubber tower is drained out through the remote controlled drain valves.<br>Inlet and discharge water quality is measured continuously using the Water Monitoring Unit (WMU), measuring: Turbidity and PAH and pH.<br>Magnesium Oxide powder (MgO) is used as an alkali. MgO powder is supplied in big bags form and turned into a slurry before it is injected into the process washwater. |
| 1.8 Completed by: | Todd Stafford (todd.stafford) |
| 1.9 What scrubber process parameters are monitored (flow capacities, pH, other)? | The contents of the exhaust gas is measured using the Continuous Emissions Monitoring System (CEMS).<br>The washwater inside the scrubber tower is drained out through the remote controlled drain valves.<br>Inlet and discharge water quality is measured continuously using the Water Monitoring Unit (WMU), measuring: Turbidity and PAH and pH,,flow rate,pressure. |
| 1.9 Completed by: | Todd Stafford (todd.stafford) |
| 1.10 For seawater intake/effluent, please provide port locations (PS/STB Frame number, etc.). Additional notes can include distance below waterline and angles. | The complete scrubber system is installed between Fr. 77 to Fr. 117. The large pumps, other pumps, mixing tanks, dewatering unit, filter units, and control cabinet are in Comp. 14 between Deck 1 and Deck 4. The large intake pipes are on Deck 1 in Comp. 15, Port side, and the large pipes for washwater effluent discharge when using the Open Loop mode are also on Deck 1 in Comp. 15, Port side.<br>The Closed Loop mode "Bleed Off" overboard valve is on Deck 2 in Comp. 14, Fr. 94, Portside.<br>According to current Chief of Staff the intake and discharge of the Scrubber sea water system is between 3-4m. |
| 1.10 Completed by: | Todd Stafford (todd.stafford) |

## 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. | BW1 BW TK 1 Fore Peak 562.01 m3<br>BW2 BW DB 2. 129.87 m3<br>BW 11 BW DB 3 212.65 m3<br>BW 7 BW/GW DB 4 P 444.18 m3 |

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| | BW 5 BW/GW DB 4S 459.63 m3<br>BW 47 BW DB 8C 199.38 m3<br>BW 31 BW DB 9 P 98.06 m3<br>BW 32 BW DB 9 S 98.06 m3<br>BW 35 BW DB 10 P 150.88 m3<br>BW 36 BW DB 10 S 161.25 m3<br>BW 53 BW DB 11/12 P 169.15 m3<br>BW 54 BW DB 11/12 S 169.15 m3<br>BW. 8 BW DB 16 C 217.87 m3<br>BW 21 BW D. 17-18 Skeg 349.76 m3<br>BW 43 BW DB 18 P 325.84 m3<br>BW 44 BW TK 18 S 325.84 m3<br>BW 45 BW TK 18 inner P 294.20 m3<br>BW 46 BW TK 18 inner S 294.20 m3<br>TOTAL: 4661.98 m3 |
| | 14 P/S used to be Ballast tanks but are now part of the Scrubber closed loop system.<br><br>BW 51 BW DB 14 P 67.59 m3<br>BW 59 BW DB 14 S 64.10 m3 |
| 2.1 Completed by: | Todd Stafford (todd.stafford) |
| 2.2 Are ballast water tanks used for wastewater storage? | Yes.<br>BW/GW double bottom Port-Scanship effluent 444m3<br>BW/GW double bottom Starboard- Scanship effluent 460m3<br>BW/GW double bottom Port inner- Gray Water- 294m3<br>BW/GW double bottom Starboard inner- Gray Water-294m3<br><br>Total used: 1492m3<br><br>For emergency use only the following Ballast water tanks may be used for WW storage.<br><br>BW DB 8 C-466m3<br>BW DB 10 P-151m3<br>BW DB 10 S-161m3<br>BW to 16 C- 218m3<br>BW DB 17/19 Skeg- 350m3<br>BW tk 18 P outer- 326m3<br>BW tk 18S outer-326m3<br><br>Total- 1998m3 |
| 2.2 Completed by: | Todd Stafford (todd.stafford) |
| 2.3 Ballast Water system: brief description of the combined piping system if tanks used for both. | 18 segregated ballast tanks use three main ballast pumps, one "Eco" ballast pump, and one emergency/stripper ballast pump. There is a common line for both ballast water and gray water. |
| 2.3 Completed by: | Todd Stafford (todd.stafford) |
| 2.4 Ballast Water treatment installation? If yes, describe operation/system specifics. | No. Installation of this system is to begin in Singapore in the fall/ winter 2018. |
| 2.4 Completed by: | Todd Stafford (todd.stafford) |
| 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 have been done in Alaska in 2028.<br>May 25th was the last Ballast water exchange.<br>N49.00.9, W126.26.4 |
| 2.5 Completed by: | Todd Stafford (todd.stafford) |

## 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 to these systems has been done since 2017. |
| 3.1 Completed by: | Todd Stafford (todd.stafford) |
| 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 since 2017 Alaska season has occurred for the 5 DG's.<br><br>1 - Item Type DG 1<br>1 - Make/Model MAN B&W 12V48/60 B<br>1 - Year 2004<br>1 - Serial Number/Unique Identifier 1135314<br>1 - Maximum Rating 14400 kW<br>2 - Item Type DG 2<br>2 - Make/Model MAN B&W 12V48/60 B CR<br>2 - Year 2004<br>2 - Serial Number/Unique Identifier 1135315<br>2 - Maximum Rating 14400 kW<br>3 - Item Type DG 3<br>3 - Make/Model MAN B&W 12V48/60 B<br>3 - Year 2004<br>3 - Serial Number/Unique Identifier 1135316<br>3 - Maximum Rating 14400 kW<br>4 - Item Type DG 4<br>4 - Make/Model MAN B&W 12V48/60 B<br>4 - Year 2004<br>4 - Serial Number/Unique Identifier 1135317<br>4 - Maximum Rating 14400 kW<br>5 - Item Type DG 5<br>5 - Make/Model MAN B&W 12V48/60 B<br>5 - Year 2004<br>5 - Serial Number/Unique Identifier 1135318<br>5 - Maximum Rating 14400 kW |
| 3.2 Completed by: | Todd Stafford (todd.stafford) |
| 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 machinery has been done since 2017 Alaska<br>One incinerator was removed to make room for scrubber equipment. Only one incinerator remains onboard and is located on the port side lower engine room below the Waste Processing room. The Incinerator only burns MGO and was manufactured by Scanship Environmental in 2006 - Model SE 152/04<br>The Incinerator is only used when outside of Alaska waters.<br>12+nm. |
| 3.3 Completed by: | Todd Stafford (todd.stafford) |
| 3.4 Average Hotel power (kW) in port and underway? | Hotel power consumption is approximately 11.4MW while underway and 7.4 M/W dockside.<br>These values are from last years report.<br>Hotel power while in Glacier Bay is approximately 2.5MW. |
| 3.4 Completed by: | Todd Stafford (todd.stafford) |
| 3.5 Average fuel consumption in port and underway? | 2017 Information:<br><br>With 3 DGs online @ 80% load the ship is using an average of 168m3 HFO fuel burned per 24 hours<br>The week of June 11-18 a total of 1766nm were covered underway. 53 maneuvering miles.<br>525 mt of HFO/IFO 380 used.<br>81.25mt of MGO used. |

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| | Underway/IP fuel consumption averages for June 11-18, 2018. Per 2nd Engineer & interpretations of documentation.<br><br>Propulsion: 2.3mt/hr.<br>Boiler: 0.7mt/hr.<br><br>In Port fuel consumption:<br><br>Hotel: 1.7mt/hr.<br>Boiler: 0.34mt/hr |
| 3.5 Completed by: | Todd Stafford (todd.stafford) |

## 4: Food Waste Garbage Handling

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| 4.1 How is food waste handled and disposed of? | Food waste is pulped via pulpers from 21 feed station locations and through one bone crusher then collected in food waste collection tank 5000ltrs. food waste discharge pump to de-water unit (screw press), to 6 m3 dewatered food waste holding tank, > 12 NM through de-watered food waste pump to overboard.<br>NJE does have equipment to dry food waste and either bag or incinerate food waste. These units are onboard, but not used. |
| 4.1 Completed by: | Todd Stafford (todd.stafford) |
| 4.2 Average food waste production per day (kgs/day)? | 3-5m3/day according to EO. Production amounts may vary. |
| 4.2 Completed by: | Todd Stafford (todd.stafford) |
| 4.3 Is the food waste de-watered? If yes, provide dewatering volumes and handling information. | Volumes are not recorded. Amounts discharged overboard from DB 15 port & 15 starboard are logged as entries in the Sewage and Gray Water Discharge Record Book as USG. |
| 4.3 Completed by: | Todd Stafford (todd.stafford) |
| 4.4 How are glass bottles, broken crockery, and ceramics handled? | These items are separated,crushed and offloaded to shore facilities. |
| 4.4 Completed by: | Todd Stafford (todd.stafford) |
| 4.5 How is food waste monitored and/or recorded? | Entries made in NAPA electronic log under deck and in Garbage Record Book for food waste discharged overboard. Including NJE position and start time at beginning of operation. Qualities of overboard discharge, position, and stop time after operation is completed. |
| 4.5 Completed by: | Todd Stafford (todd.stafford) |

## 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. | There are 3 main sea water intakes located in compartment 9,10 & 15.<br><br>Compartment 9 intake has a port and starboard sea chest exposed to the outermost hull where the anodes (6) are located.<br>The High suction is on the Port side, low suction on the starboard side that feed a center bay where machinery suction is taken. Compartment 9 supplies Air conditioning units and Emergency Fire pump.<br><br>Compartment 10 has a port side sea chest |

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| | that supplies the evaporator requirements.<br><br>Compartment 15 has a port (high)and starboard (low) sea chest that feed a center bay. The Main Engines/DG'S are supplied from here. |
| 5.1 Completed by: | Todd Stafford (todd.stafford) |
| 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? | The filtration for all of the sea chests are made of metal strainers that are cleaned when differential pressure limits are approached.<br>Cleaning intervals depend on location, sea temperature etc.<br>Cleaning would be performed in Alaska if required. |
| 5.2 Completed by: | Todd Stafford (todd.stafford) |
| 5.3 How is debris and mud from filtration/strainers handled? | This debris will generally be fed into the incinerator. |
| 5.3 Completed by: | Todd Stafford (todd.stafford) |
| 5.4 Marine Growth Protection Systems in the sea intakes. Description of the control systems and information on checmicals if used. | All MPGS units are identical.<br>Corrpro-AM1546 x'3<br>Copper and aluminum anodes are utilized to prevent marine growth fowling.<br>No chemicals are used within the sea water systems. |
| 5.4 Completed by: | Todd Stafford (todd.stafford) |
| 5.5 Hull cleaning in place in Alaska 2018? | No<br>Vessel is scheduled for dry dock period in Singapore this fall and will get hull maintenance procedures done then. |
| 5.5 Completed by: | Todd Stafford (todd.stafford) |

## 6: General

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| 6.1 Is vessel crew cooperative on this project? | Yes. EO Tonci is a very helpful and knowledgeable ex engineer.<br>Automation engineer and others were helpful and friendly.<br>EO Alana has officially taken over as of June 18. She is helpful and friendly with some previous EO experience on the Norwegian Sun. She has an environmental degree. |
| 6.1 Completed by: | Todd Stafford (todd.stafford) |
| 6.2 Do you feel the vessel has a clear understanding of compliance requirements? | Yes. It appears NJE does a very good job at following requirements throughout the vessel and maintains documentation. Maintenance of the vessels equipment appears to be very good. |
| 6.2 Completed by: | Todd Stafford (todd.stafford) |
| 6.3 Are there other remarks/ comments the OR wants to share? | Norwegian Jewel appears to be a well built German vessel. Vessels crew appear to do a good job at maintaining equipment and documentation. |
| 6.2 Completed by: | todd.stafford |

## Z: Signature & Submit

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| Ocean Rangers contributing to this report: | Todd Stafford (todd.stafford) |

Ocean Ranger Signature: