



## Background

The goal of this project is to learn more about cruise ship combustion sources. To date, ADEC has not obtained sufficient information from the operators about onboard combustion sources to complete an inventory. Please report if there are any access issues in obtaining information in this questionnaire in the Daily report and immediately notify your manager (Crowley). Address any questions to your manager who will forward to ADEC. Feel free to share information about this project with the crew.

The authority for this project comes from AS 46.03.476 (b):

The ocean ranger shall monitor, observe, and record data and information related to the engineering, sanitation, and health related operations of the vessel, including but not limited to registration, reporting, record-keeping, and discharge functions required by state and federal law.

Findings will be entered in the spaces provided below each item; feel free to use additional notes separately when needed. Sketches, diagrams, photos of handwritten notes, or copies of schematics are welcome where appropriate. Please be as detailed and clear as possible.

Scope:

This verification Project includes three main areas:

- Combustion sources inventory;
- Combustion equipment and operations for power and propulsion; and
- Auxiliary combustion equipment (incinerators, etc.)

## General Information

Ocean Ranger Name:	tony.putnik
Report Date:	Jul 18, 2018
Ship:	Princess Emerald
Ship Code:	PEM

## Section 1: Emissions Inventory Instructions

### Section 1: Emissions Inventory

1 - Item Type	Diesel Generator
1 - Make/Model	Wartsila / 8L46CR
1 - Year	2005
1 - Serial Number/Unique Identifier	91689
1 - Maximum Rating	8,400kW or 11,264HP
2 - Item Type	Diesel Generator
2 - Make/Model	Wartsila / 12V46CR with EGCS
2 - Year	2005
2 - Serial Number/Unique Identifier	91691
2 - Maximum Rating	12,600kW or 16,896 HP
3 - Item Type	Diesel Generator
3 - Make/Model	Wartsila / 12V46CR with EGCS
3 - Year	2005
3 - Serial Number/Unique Identifier	91692
3 - Maximum Rating	12,600kW or 16,896 HP
4 - Item Type	Diesel Generator
4 - Make/Model	Wartsila ; 8L46CR
4 - Year	2005

4 - Serial Number/Unique Identifier

91690

4 - Maximum Rating

8,400kW or 11264 HP

5 - Item Type

Diesel Generator

5 - Make/Model

Wartsila ; 8L46CR

5 - Year

2005

5 - Serial Number/Unique Identifier

91693

5 - Maximum Rating

8,400kW or 11,264HP

6 - Item Type

Diesel Generator

6 - Make/Model

Wartsila ; 8L46CR

6 - Year

2005

6 - Serial Number/Unique Identifier

91694

6 - Maximum Rating

8,400kW or 11,264HP

7 - Item Type

Boiler

7 - Make/Model

Alborg Unex CHB -1500

7 - Year

2005

7 - Serial Number/Unique Identifier

6924

7 - Maximum Rating

15000 kg/h

8 - Item Type

Boiler

8 - Make/Model

Aalborg Unex/ CHB-1500

8 - Year

2005

8 - Serial Number/Unique Identifier

6924

8 - Maximum Rating

15,000 kg/hr

9 - Item Type

Incinerator

9 - Make/Model

Aalborg Unex/ CHB-1500

9 - Year

2005

9 - Serial Number/Unique Identifier

6295

9 - Maximum Rating

15,000 kg/hr

10 - Item Type

Emergency Diesel Generator

10 - Make/Model

Caterpillar/ 3512BDita

10 - Year

2005

10 - Serial Number/Unique Identifier

24Z10207

10 - Maximum Rating

1000 kW

11 - Item Type

Emergency Diesel Generator

11 - Make/Model

Caterpillar/ 3512BDita

11 - Year

2006

11 - Serial Number/Unique Identifier

24710209

11 - Maximum Rating

1000kW

## Section 2: Power and Propulsion

1. Propulsion system: describe in detail how it works and how it is done.  
(Reduction gear, master slave, Azipod, Fixed Pitch, CPP etc.)

The 2 main propulsion electric motors(PEMs) are Lloyd Dynamowerke S5L2000M66-16SA+WK. Each is rated at 21,000 kW(28,161 HP) 4,250V and a rated speed of

2. Include for each component the output / make / model (see next point);

3. If possible provide for engines blower configuration (by pass valve / waste gate etc.) including load set points.

4. Engines in particular Diesel engines have an MCR rating (kW @RPM). Provide all these ratings (name plate) make and model.

5. What is the maximum rating the vessel uses in their power management set up? (85 % 90% of MCR?).

6. Include the operation modes. For example Gas turbine is used for "sprint power" include such operation in the descriptions.

7. If possible small hand sketch of system;

8. Bow / Aft Thrusters? Description and use.

9. Are fuels saving methods in place? (Reduced speed, fuel savers etc.)

10. What fuels are used? Fuel consumption at average speed per day?

150 RPM. The propulsion transformers take incoming 11.000V from the generators and transform it to 2,202V. The synchroconverters then change the 2.2kV into a DC voltage, this passes through a circuit, which converts DC back to AC, with a specific frequency.

The two main propulsion motors are synchronous i.e. they rotate at a speed proportional to the frequency of the supply voltage.

Therefore the frequency from the synchroconverters varies according to the required speed of the ship.

The 2 main propulsion electric motors (PEMs) are Lloyd Dynamowerke S5L2000M66-16SA+WK. Each is rated at 21,000 kW (28,161 HP) 4,250V and a rated speed of 150 RPM. The propulsion transformers take incoming 11.000V from the generators and transform it to 2,202V

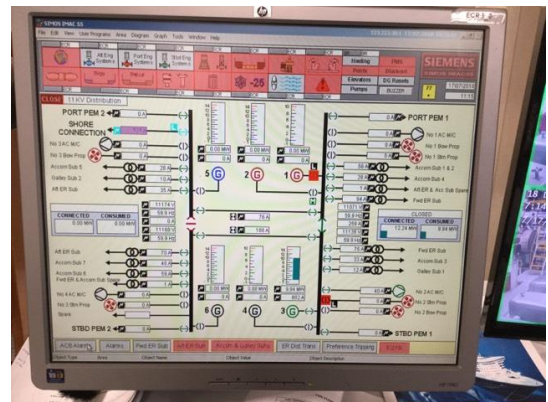
The by pass valve opens at 60% load on Engine.

By pass valve is supplied by control air -7 bars

DG # 3 MCR set at 80%, load is 10 MW at 516 rpm.

Maximum is 85%

Number of DG engines online vary depending on the speed and load. After 85% MCR, the Power Management System will start the stand-by engine. If no engine is available the PMS will reduce the load.



PEM is fitted with six transverse thrusters, three forward and three aft. The purpose of the thrusters is to move the ship transversely to assist in maneuvering. An electric motor at a constant speed and direction of rotation drives each thruster. Hydraulics alter the pitch of the blades to create thrust in the required direction. The forward thrusters are rated at 1700 kW (2,278 HP) each and the aft at 1,400 kW (1,876 HP).

Yes / Reduced speed DG from 3+2 down to 3+1

2&3 on LSHFO and 1-4-5&6 on LSMGO. LSHFO 4m3

Fuel consumption for each 12V engine uses about 2m3/hr, and for each 8L engine

	1.3m3/hr. Possible 10.8 m3/hr or 258 m3 per day. The LSHFO is heated in the fuel modules to 115 deg C to reduce the viscosity to 20 centistokes to enable complete combustion to take place within the cylinders. The fuel is delivered to the engines fuel rails at 10.5 bar, where high pressure pumps deliver fuel to the common rail and on to the injectors at up to 1500 bar- depending on the engine load. The fuel injection timing is electronically controlled to ensure the best combustion control and minimal emissions from the engines. With a fuel holding capacity of 3540 m3.
11. Power generation on board. Which units are used? Which type of equipment? (Gas turbines, diesel etc.)	Four Wartsila engines 12V46CR maximum continuous ratings of 12,600 kW or 16,896 HP and two Wartsila 8L46CR max. Continuous ratings of 8,400kW or 11,264HP.
12. Describe which units are used normally under which conditions (sea mode, Port mode, maneuvering mode etc.)	Sea mode 4+2 or 3+2; Port mode; DG #2 V12 if is necessary start one more engine. maneuvering mode 2+2 or 3+1
13. What is the average Hotel power while underway?	10.7MW
14. What is the average Hotel power while docked?	9.5 MW
15. Are source shared used for Hotel power / propulsion power?	Yes, on main switchboard the main machinery is connected with propulsion motors, air conditioning compressors, galley equipment etc.
16. What is relatively the largest group of Hotel power consumers? (Light, airco?), please identify the kW.	Air Conditioning is the largest consumer of power. 8-9 MW total power use in port. 2-3 MW for Air conditioning. 5-6 MW for lighting, ventilation, Galley, laundry, etc.

### Section 3: Auxiliary Sources

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17. Incinerators please provide inventory make model and location. What fuel is used for co-firing the incinerator? (if any);	Deerberg System; Type - DS 1600; Thermal capacity 1600 kW; Combustion Chamber Temperature 650 - 1200 deg C. Fabricated year 2005. Using only LSMGO
18. Are the incinerators equipped with emissions controls? (After-burners, filters etc.)	Emissions monitoring is available on incinerator screen in ECR
19. Are dryers used on board other than laundry dryers? For example sludge dryers etc.	No
20. What are the average operating hours in Alaska / or per day (24 hours in Alaska?) for the incinerators?	Average 5 per day in AK waters
21. What are the average operating hours on a voyage to / from Alaska for the incinerators?	Average 8 hrs/day at sea from / to AK

### Section 4: General Observations

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22. Is vessel crew cooperative on this project?	Very cooperative.
23. Are there other remarks/ comments the OR wants to share?	No

### Photos and Comments

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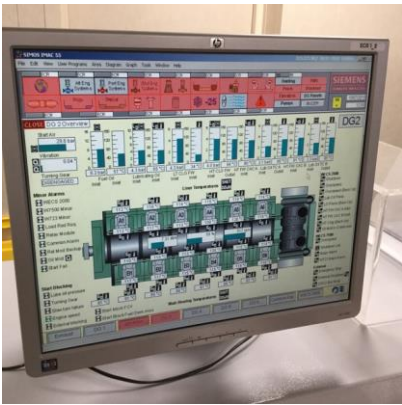
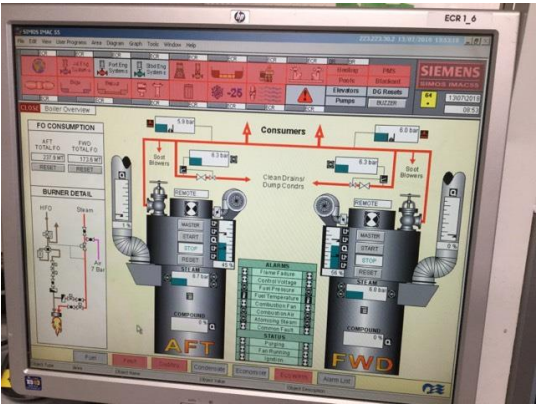


Photo 1 Caption

PEM 7/17/17, DG V12

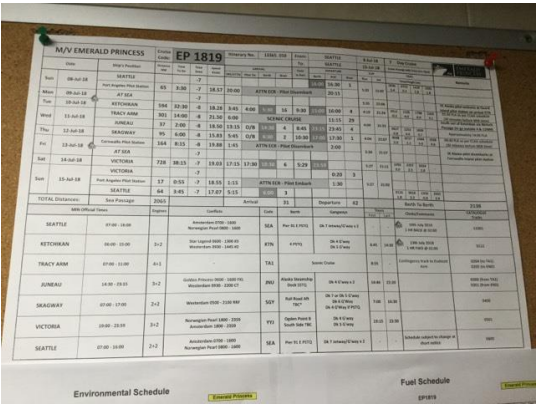
Photo 2



PEM 7/17/17, Ship's boilers

Photo 2 Caption

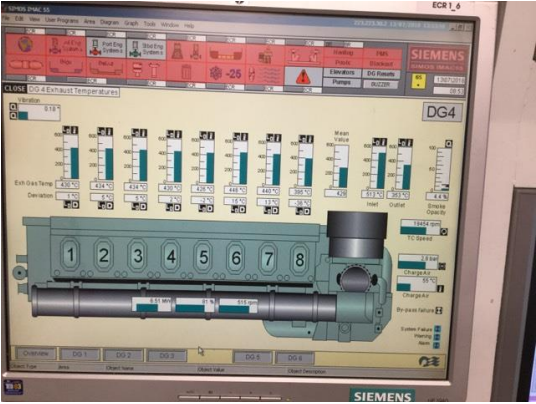
Photo 3



PEM 7/17/17, configurations for DG's during voyage

Photo 3 Caption

Photo 4



PEM 7/17/17, DG 8L

Photo 4 Caption

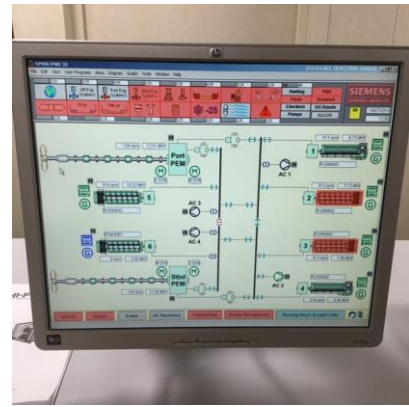


Photo 5 Caption

PEM 7/17/17, DG online underway

## **Complete**

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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.