



2017 Wastewater Sampling Results For Large Cruise Ships

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Alaska Department of

Environmental Conservation

Commercial Passenger Vessel Environmental Compliance Program



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1. SUMMARY

This is a summary of the 2017 onboard sampling and laboratory testing results of large cruise ship treated wastewater effluent in Alaska. This summary provides information on wastewater treatment sample results obtained under the requirements of the [2014 Large Commercial Passenger Vessel Wastewater Discharge General Permit](#) (General Permit). Tables of sample results are included in Appendix 1. Information on the sampling techniques and requirements can be found in the Methods section of this report.

Thirty four large cruise ships operated in Alaska in 2017, of those twenty ships were authorized to discharge treated wastewater in Alaska and eighteen ships discharged treated wastewater and conducted sampling. Table 1 lists large cruise ships in Alaska and their discharge status in 2017.

2. INTRODUCTION

Sampling of wastewater effluent is a requirement under the General Permit for all large cruise ships discharging in Alaska waters. Sampling is needed to:

- Check for compliance of permit effluent limits
- Obtain information on treatment system performance for future discharge permits
- Compile information on potential environmental effects

Sample result data for cruise ships has been collected by the Department of Environmental Conservation since 2000. Reports for prior years can be found on the cruise program's report webpage.

3. METHODS

Samples are grab wastewater samples taken from a sample port prior to discharge. The number of required samples and what parameters are required to be analyzed are listed in the 2014 General Permit and for the US Coast Guard in the Quality Assurance Project Plan (QAPP). Sampling may occur while underway or while the cruise ship is docked. All samples were obtained in Southeast Alaska in 2017, with the majority of samples obtained in or near Juneau. Sample results presented in this report only include data collected while a cruise ship was discharging in Alaska.

The samples were taken according to requirements in the [2017 Cruise Line International Association North West and Canada Quality Assurance Project Plan for Sampling and Analysis of Treated Sewage and Graywater from Commercial Passenger Vessels](#) (QAPP). The QAPP specifies minimum requirements for sampling and analysis of wastewater. It includes a list of approved methods, sample collection requirements, and laboratory analysis requirements. Samplers must follow the QAPP and the [Vessel Specific Sampling Plan](#) (VSSP) for each cruise ship when collecting a sample. The

Commercial Passenger Vessel Environmental Compliance (Cruise Ship) program spot checked results submitted by the cruise ship operators for compliance with the QAPP and checked all results for compliance with 2014 General Permit limits.

4. RESULTS

Wastewater sample results are listed in Appendix 1 with tables for parameters with General Permit limits, conventional and nutrient results with no limits, and metals. Full results of volatile organic compounds (VOCs) and base neutral acids (BNAs) sampling are available on request. This report does not include the results of receiving water or ambient water sampling taken in the harbors, as well as Whole Effluent Toxicity effluent testing.

In the tables of results those values highlighted in red are exceedances of the 2014 Wastewater Discharge General Permit limits. Orange highlighted results were below a daily maximum, but were an exceedance of a monthly average limit. Dark blue highlights indicate that either no sample analysis was required or no data was received. Results below the method detection limit (MDL) are recorded as zero. Full sample suites of all QAPP listed parameters are identified as “PP” for priority pollutants, and all other samples are identified as “GP” (General Permit).

Table 1: 2017 Large Cruise Ship Summary

2017 Large ¹ Commercial Passenger Vessel Discharge Status and Wastewater Treatment												
Vessel Operator	Vessel Name	Passenger Capacity ²	Voyages	Annual Passenger capacity ⁴	Crew Capacity	Wastewater Treatment System ⁶	Permitted to discharge in Alaska in 2017 ³		Skagway Docks discharge permitted?			
							Underway	Stationary	Railroad	Ore	Broadway	
1	Carnival Cruise Lines	<i>Carnival Legend</i>	2124	19	40,356	Unknown	Triton Type MSTP9	No	No	No	No	No
2	Carnival Cruise Lines	<i>Carnival Miracle</i>	2124	1	2,124	Unknown	Unknown	No	No	No	No	No
3	Celebrity Cruises	<i>Celebrity Infinity</i>	2170	16	34,720	Unknown	Zenon Zeeweed	No	No	No	No	No
4	Celebrity Cruises	<i>Celebrity Millennium</i>	2449	16	39,184	Unknown	Hydroxyl CB-100 MSD	No	No	No	No	No
5	Celebrity Cruises	<i>Celebrity Solstice</i>	3148	18	56,664	Unknown	Kruger WABAG MSD	No	No	No	No	No
6	Crystal	<i>Crystal Serenity</i>	1050	8	8,400	Unknown	Unknown	No	No	No	No	No
7	Disney	<i>Disney Wonder</i>	2834	16	45,344	920	Hamworthy MBR AWTS	Yes	No	No	No	No
8	Hanseatic	<i>Europa</i>	408	1	408	Unknown	Unknown	No	No	No	No	No
9	Holland America	<i>Amsterdam</i>	1380	10	13,800	Unknown	Hamworthy Super Trident MSD	No	No	No	No	No
10	Holland America	<i>Eurodam</i>	2106	22	46,332	929	2 Hamworthy MBR AWTS	Yes	No	No	No	No
11	Holland America	<i>Nieuw Amsterdam</i>	2106	22	46,332	929	2 Hamworthy MBR AWTS	Yes	No	No	No	No
12	Holland America	<i>Noordam</i>	1916	21	40,236	Unknown	Rochem UF MSD	No	No	No	No	No
13	Holland America	<i>Oosterdam</i>	1916	21	40,236	Unknown	Rochem Bio-Filt 16/19 Ultra Filt.	No	No	No	No	No
14	Holland America	<i>Volendam</i>	1432	22	31,504	647	Zenon AWTS	Yes	Yes	Yes	Yes	Yes
15	Holland America	<i>Zaandam</i>	1432	19	27,208	647	Zenon AWTS	Yes	Yes	Yes	Yes	Yes
16	Norwegian Cruise Line	<i>Norwegian Jewel</i>	2376	21	49,896	1100	Scanship Type II AWTS	Yes	Yes	Yes	Yes	Yes
17	Norwegian Cruise Line	<i>Norwegian Pearl</i>	2394	21	50,274	1100	Scanship Type II AWTS	Yes	Yes	Yes	Yes	Yes
18	Norwegian Cruise Line	<i>Norwegian Sun</i>	1936	19	36,784	950	Scanship Type II AWTS	Yes	Yes	Yes	Yes	Yes
19	Oceania	<i>Regatta</i>	777	16	12,432	373	Triton Water MBR AWTS	Yes	No	No	No	No
20	Ponant	<i>Le Boreal</i>	264	1	264	136	Rochem Bio-filt AWTS	No	No	No	No	No
21	Princess Cruise Line	<i>Coral Princess</i>	1986	20	39,720	900	Hamworthy MBR AWTS	Yes	No	No	No	No
22	Princess Cruise Line	<i>Emerald Princess</i>	3084	19	58,596	1127	DeNora Ozone AWWTP	Yes	Yes	No	No	No
23	Princess Cruise Line	<i>Golden Princess</i>	2636	1	2,636	1060	Hamworthy MBR AWTS	Yes	Yes - Graywater only	Yes	No	No
24	Princess Cruise Line	<i>Grand Princess</i>	2606	14	36,484	1100	Hamworthy MBR 16 AWTS	Yes	Yes - Graywater only	No	No	No
25	Princess Cruise Line	<i>Island Princess</i>	1974	19	37,506	900	Hamworthy MBR AWTS	Yes	No	No	No	No
26	Princess Cruise Line	<i>Ruby Princess</i>	3084	21	64,764	1201	Hamworthy MBR 16 AWTS	Yes	Yes - Graywater only	No	No	No
27	Princess Cruise Line	<i>Star Princess</i>	2600	20	52,000	1150	Hamworthy MBR AWTS	Yes	Yes - Graywater only	No	No	No
28	Regent Seven Seas	<i>Seven Seas Mariner</i>	769	16	12,304	431	Hamworthy MBR 240C AWTS	Yes	No	No	No	No
29	Regent Seven Seas	<i>Seven Seas Navigator</i>	544	1	544	350	Scanship AWTS	Yes	No	No	No	No
30	ResidenSea	<i>The World</i>	450	1	450	260	Scanship FA25M (two)	No	No	No	No	No
31	Royal Caribbean Cruises	<i>Explorer of the Seas</i>	4000	17	68,000	Unknown	Two Scanship Mussel FA45	No	No	No	No	No
32	Royal Caribbean Cruises	<i>Radiance of the Seas</i>	2502	16	40,032	Unknown	Hamann MSD	No	No	No	No	No
33	Seabourn	<i>Sojourn</i>	450	11	4,950	338	2 Hamworthy MBR AWTS	Yes	Yes	Yes	Yes	No
34	Silver Seas	<i>Silver Shadow</i>	382	18	6,876	305	Bio Epure/Marisan AWTS	Yes	No	No	No	No
		Totals	504	1,047,360								

MBR is a Membrane Bioreactor

Vessels highlighted in gray in the above table did not discharge wastewater in Alaskan waters in 2017.

¹ A large vessel has overnight accommodations for 250 or more passengers.

² Capacity is the number of lower berths and is calculated from Registration, Vessel Specific Sampling Plan, or Notice of Intent. Actual number of passenger aboard varies.

³ Alaska water includes the Alexander Archipelago and extends 3 miles from the coastline. Only vessels that discharge into Alaska waters are required to sample for wastewater.

⁴ Assumes full capacity on every voyage

⁵ Discharge at Broadway Dock allowed unless another ship is discharging at the Ore Dock

⁶ Nondischarging vessels are not required to provide crew or treatment system information.

APPENDIX 1: 2017 LARGE CRUISE SHIP WASTEWATER SAMPLE DATA

Table 3: Semi-monthly parameters and general permit limits

SemiMonthly General Permit Sample Results										Non-detects set to zero										
Company	Vessel	Treatment System	Waste-water Type	Sample while	Sample Date	Type	mg/L Ammonia	ug/L Dissolved Copper	ug/L Dissolved Nickel	ug/L Dissolved Zinc	S.U. pH	C Temp	Flow rate	col. per 100 ml Fecal Coliform	mg/L TSS	mg/L BOD	mg/L Hardness	umhos/cm Specific Conductance	mg/L Free Chlorine	mg/L TR Chlorine
Disney	Wonder	Hamworthy	Mixed	Underway	5/26/2017	GP					7.16	26.4	34.56	0	0	0				
Disney	Wonder	Hamworthy	Mixed	Underway	6/16/2017	PP	57	1.2	17	230	7.54	25.3	23	0	0	0	41	4660	0	0
Disney	Wonder	Hamworthy	Mixed	Underway	6/23/2017	GP					7.56	27.8	22.8	0	0	0				
Disney	Wonder	Hamworthy	Mixed	Underway	7/21/2017	GP					7.28	31.9	34.8	0	0	0				
Disney	Wonder	Hamworthy	Mixed	Underway	7/27/2017	GP					7.01	29.2	34.5	0	0	0				
Disney	Wonder	Hamworthy	Mixed	Underway	7/31/2017	GP					7.3	28.3	28.92	0	0	0				
Disney	Wonder	Hamworthy	Mixed	Underway	8/11/2017	PP	36	2.6	15	270	7.1	28.5	13.2	0	0	0	24	680	0	0
Disney	Wonder	Hamworthy	Mixed	Underway	8/25/2017	GP					7.2	27	33.18	0	0	0				
Disney	Wonder	Hamworthy	Mixed	Underway	9/1/2017	GP					7.27	30.5	6.84	0	0	0				
Holland America	Eurodam	Hamworthy	Mixed	Underway	5/18/2017	GP					7.34	25.3	42	0	0	0				
Holland America	Eurodam	Hamworthy	Mixed	Underway	5/24/2017	GP					7.58	17.1	21.1	0	0	5.3				
Holland America	Eurodam	Hamworthy	Mixed	Underway	6/7/2017	PP	78	2.7	7.8	43	7.26	28.1	14.28	0	0	3.5	27	903	0	0
Holland America	Eurodam	Hamworthy	Mixed	Underway	6/19/2017	GP					7.53	29.2	22.26	3	0	14				
Holland America	Eurodam	Hamworthy	Mixed	Underway	7/11/2017	PP	120	2.6	11	49	7.65	27	18	0	0	19	30	1250	0	0
Holland America	Eurodam	Hamworthy	Mixed	Underway	7/17/2017	GP					7.65	30.2	19.68	0	0	26				
Holland America	Eurodam	Hamworthy	Mixed	Underway	7/26/2017	PP	110				7.61	29.6	15.6	0	0	9.2	31	35400	0	0
Holland America	Eurodam	Hamworthy	Mixed	Underway	8/7/2017	GP					7.68	33.2	16.9	0	0	16				
Holland America	Eurodam	Hamworthy	Mixed	Underway	8/16/2017	GP					8.02	24.5	13.8	48	7.6	21				
Holland America	Eurodam	Hamworthy	Mixed	Underway	8/30/2017	GP					7.56	28.1	17.14							
Holland America	Eurodam	Hamworthy	Mixed	Underway	9/4/2017	GP					7.7	33.2	10	5	0	11				
Holland America	Eurodam	Hamworthy	Mixed	Underway	9/20/2017	GP					7.49	30.5	18			7.5				
Holland America	Eurodam	Hamworthy	Mixed	Underway	9/25/2017	GP					7.48	25.4	8.34	0	0					
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	5/2/2017	GP					7.75	26	7.32	0	0	0				
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	5/15/2017	GP	110	1.3	9.7	36	7.61	20.9	15.6	0	0	9.2	31	35400	0	0
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	5/30/2017	GP	110	2	9.8	46	7.81	30.5	13.88	0	0	0	54	1230	0	0
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	6/6/2017	GP					7.62	27.9	15.24	0	0	0				
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	6/20/2017	GP					7.62	26.8	17.58	0	0	0				
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	7/11/2017	GP					7.77	30	17.6	0	0	0				
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	7/25/2017	GP					7.66	31.4	12.8	0	0	0				
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	7/31/2017	GP					7.66	29.9	1.44	0	0	0				
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	8/18/2017	GP					7.52	31.5	12	0	0	3.1				
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	8/15/2017	GP	55	1.5	10	52	7.59	32	57.6	0	0	0	150	1060	0	0
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	9/5/2017	GP					7.77	31.6	0.96	0	0	0				
Holland America	Nieuw Amsterdam	Hamworthy	Mixed	Underway	9/12/2017	GP					7.26	30	12	0	0	0				
Holland America	Volendam	Zenon	Mixed	Stationary	5/12/2017	GP	22	10			7.24	24.1	24	0	0	0	25	783	0	0
Holland America	Volendam	Zenon	Mixed	Stationary	5/19/2017	PP	51	5.8		85	7.29	24.9	27.89	0	0	0	28	859	0	0
Holland America	Volendam	Zenon	Mixed	Stationary	6/9/2017	GP	57	4.7			7.56	25.6	19	0	0	0	38	965	0	0
Holland America	Volendam	Zenon	Mixed	Stationary	6/16/2017	GP	55	3.2			7.5	26.6	14	0	0	0	36	896	0	0
Holland America	Volendam	Zenon	Mixed	Stationary	7/7/2017	GP	77	5.3			7.54	28.4	10	0	0	0	41	1070	0	0
Holland America	Volendam	Zenon	Mixed	Stationary	7/21/2017	GP	39	4.1			7.37	27.9	20.58	0	0	0	30	809	0	0
Holland America	Volendam	Zenon	Mixed	Stationary	8/4/2017	PP	52	3.7	11	46	7.46	29	20.57	0	0	0	30	902	0	0
Holland America	Volendam	Zenon	Mixed	Stationary	8/18/2017	GP	39	2.3			7.45	27.8	27.25	0	0	0	31	827	0	0
Holland America	Volendam	Zenon	Mixed	Stationary	8/21/2017	USCG					7.39	26.9	27.9	0	0	0				
Holland America	Volendam	Zenon	Mixed	Stationary	9/1/2017	GP	42	4.5			7.35	26.6	28.02	0	0	0	38	931	0	0
Holland America	Volendam	Zenon	Mixed	Stationary	9/15/2017	GP	48	1.9			7.41	27.9	26.0	0	0	3.6	27	880	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	5/17/2017	PP	39	8.1	8.7	79	7.26	25.6	16.71	0	0	0	40	910	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	5/25/2017	GP	14	3.2			6.89	25.6	23	0	0	3.8	48	654	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	6/8/2017	GP	21	2			6.98	27.7	16.43	0	0	2.5	43	761	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	6/22/2017	GP	38	1.2			7.37	27.3	18.88	0	0	4	37	836	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	7/16/2017	PP	31	1.3	5.6	80	7.14	26.6	24.45	0	0	5.3	42	724	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	7/20/2017	GP	38	2.8			7.4	28	22.99	0	0	5.1	41	771	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	8/3/2017	GP	31	0			7.3	28.4	30	0	0	0	42	842	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	8/17/2017	GP	40	2			7.37	27	30	0	0	3.8	46	873	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	9/6/2017	GP	26	4.5			7.32	27.1	30	0	0	17	34	649	0	0
Holland America	Zaandam	Zenon	Mixed	Stationary	9/14/2017	GP	31	1.7			7.27	26.2	30	0	0	2.2	41	783	0	0
Norwegian	Jewel	Scanship	Mixed	Stationary	5/18/2017	PP	33	2	15	56	6.4	27	33.12	0	0	3.2	57	834	0	0
Norwegian	Jewel	Scanship	Mixed	Stationary	5/23/2017	GP	39	2.4			6.57	23.7	39.6	0	0	2.9	70	838	0	0
Norwegian	Jewel	Scanship	Mixed	Stationary	6/6/2017	GP	34	1.2			6.64	28.1	37.44	0	0	4	63	883	0	0
Norwegian	Jewel	Scanship	Mixed	Stationary	6/20/2017	GP	31	2.3			6.55	30.2	37.4	0	4	4	71	877	0	0
Norwegian	Jewel	Scanship	Mixed	Stationary	7/11/2017	PP	38	0	7.5	27	6.32	29.7	30.1	0	42	2.9	940	999	0	0
Norwegian	Jewel	Scanship	Mixed	Stationary	7/25/2017	GP	2	0.82			6.51	30.6	32.83	0	10	0	1700	31800	0	0
Norwegian	Jewel	Scanship	Mixed	Stationary	8/15/2017	GP	32	2.5			6.56	28.8	36.72	0	4.8	3.9	79	927	0	0
Norwegian	Jewel	Scanship	Mixed	Stationary	8/21/2017	USCG					6.87	30	33.4	3	0	2.5				
Norwegian	Jewel	Scanship	Mixed	Stationary	9/12/2017	GP	43	3.1			6.68	27.7	0.41	2	6.8	4.5	470	2020	0	0
Norwegian	Jewel	Scanship	Mixed	Stationary	9/19/2017	GP	38	1.8			7.07	26.8	21.6	0	6	4.6	96	956	0	0
Norwegian	Pearl	Scanship	Mixed	Stationary	5/9/2017	PP	62	2.5	5.4	63	6.87	23.7	29	23	12	10	45	1130	0	0
Norwegian	Pearl	Scanship	Mixed	Stationary	5/23/2017	GP	49	13			6.74	26.8	22	0	6.4	9.4	97	1850	0	0
Norwegian	Pearl	Scanship	Mixed	Stationary	6/16/2017	GP	69	12			7.22	26.3	22	2	4.4	3.4	30	1170	0	0
Norwegian	Pearl	Scanship	Mixed	Stationary	6/13/2017	GP	51	1.8			7.01	26	25.7	0	4.4	4.9	160	2390	0	0
Norwegian	Pearl	Scanship	Mixed	Stationary	7/11/2017	PP	55	1.3	5.3	44	6.95	28	27	3	0	6.8	35	1030	0	

SemiMonthly General Permit Sample Results

Non-detects set to zero

Company	Vessel	Treatment System	Waste-water Type	Sample taken while	Sample Date	Type	mg/L		ug/L		S.U.	C	m3/hr	col. per 100 ml	mg/L	mg/L	mg/L	umhos/cm	mg/L	mg/L
							Ammonia	Dissolved Copper	Dissolved Nickel	Dissolved Zinc										
Princess	Ruby	Hamworthy	Graywater	Stationary	5/8/2017	GP	0	6.8			7.36	30	12	0	0	2.2	27	449	0	0
Princess	Ruby	Hamworthy	Graywater	Stationary	5/15/2017	PP	0	8.6	11	88	7.15	30	20	0	0	0	24	379	0	0
Princess	Ruby	Hamworthy	Graywater	Stationary	6/5/2017	GP	0	15			7.43	25.4	12.5	0	0	0	360	3900	0	0
Princess	Ruby	Hamworthy	Graywater	Stationary	6/19/2017	GP	0	3.5			7.07	30.5	12.13	0	0	4.6	19	353	0	0
Princess	Ruby	Hamworthy	Graywater	Stationary	7/17/2017	GP	0	5.8			7.17	27.7	13	0	0	3.1	13	335	0	0
Princess	Ruby	Hamworthy	Graywater	Stationary	7/24/2017	GP	1.6	8.4			6.85	30.5	12.5	0	0	2.8	14	319	0	0
Princess	Ruby	Hamworthy	Graywater	Stationary	8/8/2017	PP	0	3.8	10	49	7.43	29.8	12.1	0	0	2	9.8	268	0	0
Princess	Ruby	Hamworthy	Graywater	Stationary	8/21/2017	GP	0	5.3			7.19	28.1	1.2	0	0	0	15	366	0	0
Princess	Ruby	Hamworthy	Graywater	Stationary	9/11/2017	GP	0	5.1			7.44	29.1	1.8	0	0	2.4	12	254	0	0
Princess	Ruby	Hamworthy	Graywater	Stationary	9/18/2017	GP	0	4.7			7.26	27.9	1.2	0	0	2.2	13	281	0	0
Princess	Star	Hamworthy	Graywater	Stationary	5/9/2017	GP	0.64	1.3			6.25	32.1	28.1	0	0	86	88	242	0	0
Princess	Star	Hamworthy	Graywater	Stationary	5/17/2017	PP	0	0	1.8	2.9	6.41	28.3	36.3	0	0	81	23	344	0	0
Princess	Star	Hamworthy	Graywater	Stationary	5/23/2017	GP					6.92	34.5	14.1	0	0	9.2			0	0
Princess	Star	Hamworthy	Graywater	Stationary	6/14/2017	GP	1.3	1.9			6.82	31.2	21.6	0	0	8.6	25	356	0	0
Princess	Star	Hamworthy	Graywater	Stationary	6/20/2017	GP	2.2	1.6			6.8	31.8	24.5	0	0	5.9	16	280	0	0
Princess	Star	Hamworthy	Graywater	Stationary	7/12/2017	GP	0	5.9			7.04	28	23.4	0	0	7.6	25	306	0	0
Princess	Star	Hamworthy	Graywater	Stationary	7/18/2017	GP	0	1.5			6.63	33.9	19.3	0	0	3.6	20	269	0	0
Princess	Star	Hamworthy	Graywater	Stationary	8/11/2017	GP	0.92	2			6.82	33.9	20.0	0	0	6.6	17	300	0	0
Princess	Star	Hamworthy	Graywater	Stationary	8/15/2017	PP	0	2.2	9.2	36	6.68	34.8	24.0	0	0	2.4	25	431	0	0
Princess	Star	Hamworthy	Graywater	Stationary	9/6/2017	GP	0	1.8			6.89	31.1	31.1	0	0	9	30	423	0	0
Princess	Star	Hamworthy	Graywater	Stationary	9/20/2017	GP	0	1.6			6.97	31.8	22.4	0	0	8.2	15	261	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	5/10/2017	GP					7.06	37.5	12.36	0	0	0	69	1080	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	5/17/2017	PP	13	16	8.2	85	7.02	37.2	12.6	0	0	0	0	0	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	6/7/2017	GP					7.08	40.6	15.84	0	0	0	0	0	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	6/21/2017	GP					7.34	38.5	16.02	0	0	0	0	0	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	7/11/2017	PP	32	4.3	14	33	7.49	37	16.2	0	0	0	63	982	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	7/19/2017	GP					7.06	32.1	17.7	0	0	0	0	0	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	8/2/2017	GP					7.03	41.1	12.0	0	0	0	0	0	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	8/22/2017	GP					7.09	37.9	15.6	0	0	0	0	0	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	9/6/2017	GP					6.78	40.5	15.42	0	0	0	0	0	0	0
Princess	Coral	Hamworthy	Mixed BW Accom	Underway	9/13/2017	GP					6.84	41.7	15.42	0	0	0	2.1	0	0	0
Princess	Golden	Hamworthy	Mixed BW Accom	Underway	6/26/2017	PP	40	6.6	7.2	100	7.59	28.4	13.14	0	0	0	20	701	0	0
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	5/13/2017	GP					7.31	35.6	23	18	0	4.3				
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	5/31/2017	GP					8.08	30.1	25.3	0	0	2.3				
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	6/2/2017	PP	49	1.3	10	13	7.78	27.9	20.2	12	0	2.9	280	3350	0	0
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	6/12/2017	GP					7.66	30.1	23.9	0	0	0	0	0	0	0
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	7/12/2017	GP					7.72	31.7	19.74	0	0	5.8				
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	7/21/2017	GP					7.79	29	24.12	0	0	7				
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	8/10/2017	PP	47	1.7	11	14	7.68	29.6	21.8	0	0	5	93	1600	0	0
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	8/21/2017	GP					7.88	28.5	24.96	0	0	2.8				
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	8/30/2017	GP					7.83	33.5	21.66	2	0	0	0	0	0	0
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	9/9/2017	GP					7.71	30.2	27.24	0	0	0	2.7			
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	9/19/2017	GP					7.39	31.2	23.4	0	0	0	0	0	0	0
Princess	Grand	Hamworthy	Mixed BW Accom	Underway	9/20/2017	GP					7.14	35.9	12.68	0	0	0	0	0	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	5/14/2017	GP	30				7.2	38.4	16.44	0	0	0	0	0	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	5/21/2017	PP	41	2.6	4.2	41	7.1	33.8	18.54	2	0	2.7	51	896	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	6/11/2017	GP	15				7	35.6	16	2	0	0	0	0	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	6/18/2017	GP	34				7.27	36.6	15.6	0	0	0	0	0	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	7/8/2017	PP	38	4.7	2.9	77	7.15	32.7	25	0	0	0	44	870	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	7/23/2017	GP					7.3	37.1	16.8	0	0	0	0	0	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	8/6/2017	GP	35				7.2	40.1	14.82	0	0	0	0	0	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	8/20/2017	GP	25				7.19	32.9	17.28	0	0	0	0	0	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	9/2/2017	GP	35				7.25	35.7	16.98	0	0	0	0	0	0	0
Princess	Island	Hamworthy	Mixed BW Accom	Underway	9/20/2017	GP	26				7.14	35.9	16.68	0	0	0	0	0	0	0
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	5/9/2017	GP					7.9	28.6	22.3	0	0	2.1				
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	5/16/2017	PP	220	8.3	9.7	94	8.27	28.1	20.0	2	0	0	75	2460	0	0
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	6/6/2017	GP					7.12	29	12.5	0	0	0	0	0	0	0
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	6/20/2017	GP					7.17	31.1	12.5	0	0	6.8				
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	7/18/2017	GP					7.54	25.9	13.0	8	0	2.8				
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	7/25/2017	GP					7.85	29	12.5	0	0	2.1				
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	7/31/2017	GP					6.95	31.1	12.5	0	0	0	0	0	0	0
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	8/8/2017	PP	22	19	10	88	6.85	32.2	12.13	0	0	4.2	52	879	0	0
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	8/22/2017	GP					6.96	32	3.6	0	0	3.1				
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	8/29/2017	GP					7.57	29.3	2.1	22	0	0	0	0	0	0
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	9/12/2017	GP					8.07	27.7	14.4	0	0	10	0	0	0	0
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	9/19/2017	GP					7.89	29.3	1.98	0	0	14	0	0	0	0
Princess	Ruby	Hamworthy	Mixed BW Accom	Underway	9/25/2017	GP					7.05	29.4	90	0	0	0	0	0	0	0
Princess	Star	Hamworthy	Mixed BW Accom	Underway	5/9/2017	GP					7.38	31.6	21.35	2	0	150				
Princess	Star	Hamworthy	Mixed BW Accom	Underway	5/24/2017	PP	3.3	1.6	12	13	7.01	35.3	19.							

Table 4: Semi-seasonal nutrients and other conventional parameters with no General Permit Limits

Vessel	Sample Date	E. coli	Chemical O ² Demand	Hexane Extractable Material	Total Organic Carbon	Alkalinity (Total)	Hardness	Nitrite/Nitrate as N	Total Phosphorus	Total Kjeldahl Nitrogen	Total Settable Solids
	Detection Limit	1	5.00	5.00	1.00	5.00	5.00	0.50	0.05	1.00	0.10
	Units	/100ml	mg/l	mg/l	mg/l	mg/l	mg/L	mg/L	mg/l	mg/l	ml/l
Disney Wonder	6/16/17	0	22	0	950	300	41	5.5	2.92	20	0
Disney Wonder	8/11/17	0	31	0	9.7	170	24	0	1.95	26	0
Eurodam	6/7/17	5	22	0	9.1	300	27	0	9.61	81	0
Eurodam	7/11/17		57	0	14	400	30	1	1.86	110	0
Eurodam	7/26/17	0			400			0.9	8.64	100	
Nieuw Amsterdam	5/16/17	0	46	0	13	170	31	0	10.4	98	0
Nieuw Amsterdam	5/30/17	0	61	0	69	450	54	0	9.69	110	0
Nieuw Amsterdam	8/15/17		38	0	12	250	150		1.52	58	0
Nieuw Amsterdam	9/5/17	0									
Volendam	5/19/17	0	47	0	14	200	28	0	4.09	54	0
Volendam	8/4/17	1	46	0	13	250	30	0.42	6.01	42	0
Zaandam	5/17/17	0	57	0	17	200	40	0.55	6.07	49	0
Zaandam	7/6/17	0	42	0	7.8	170	42	0.14	0.206	31	0
Norwegian Jewel	5/8/17	0	42	0	13	110	57	0.14	0	35	0
Norwegian Jewel	7/11/17	0	50	0	7.5	65	940	0	0	41	0
Norwegian Pearl	5/9/17	17	73	0	24	250	45	0	0.362	63	0
Norwegian Pearl	7/11/17	0	75	0	19	250	35	0	0	57	0
Vessel	Sample Date	E. coli	Chemical O ² Demand	Hexane Extractable Material	Total Organic Carbon	Alkalinity (total)	Hardness	Nitrite/Nitrate as N	Total Phosphorus	Total Kjeldahl Nitrogen	Total Settable Solids
	Detection Limit		5.00	5.00	1.00	5.00	5.00	0.50	0.05	1.00	0.10
	Units	/100ml	mg/l	mg/l	mg/l	mg/l	mg/L	mg/L	mg/l	mg/l	ml/l
Norwegian Sun	6/8/17	0	120	0	16	120	48	0	0.746	49	0
Norwegian Sun	8/10/17	0	34	0	8.1	120	60	11	0	40	0
Coral Princess	5/17/17	0	63	0	19	80	69	0.16	9.74	16	0
Coral Princess	7/11/17	0	58	0	13	170	63	0	8.79	25	0
Golden Princess-GW	6/26/17	0	33	0	7.6	79	19	2.1	1.26	3.1	0
Golden Princess	6/26/17	0	43	0	11	250	20	0.19	5.92	53	0
Grand Princess-GW	5/21/17	0	28		7.4	60	470	0	0	2.6	0
Grand Princess-GW	6/1/17			0			410				
Grand Princess-GW	7/20/17	0.0	240	0	2.4	74	1500	0	0	3.6	0
Grand Princess	6/2/17	10	130	0	4.7	190	280	0	3.34	57	0
Grand Princess	8/10/17	0	31	0	8	200	93	0	3.25	52	0
Island Princess	6/4/17	1.0	46	0	16	180	51	0	7.83	45	0
Island Princess	7/8/17	1	53	0	13	180	44	0	2.08	28	0
Ruby Princess-GW	5/15/17	0	16	0	4.7	58	24	0.32	0	0	0
Ruby Princess-GW	8/7/17	0	15	0	5.3	50	9.8	0	0.285	0.87	0
Ruby Princess	5/16/17	1	73	0	9.3	900	75	0	5.83	72	0
Ruby Princess	8/8/17	0	64	0	20	59	52	24	10.2	20	0
Vessel	Sample Date	E. coli	Chemical O ² Demand	Hexane Extractable Material	Total Organic Carbon	Alkalinity (Total)	Hardness	Nitrite/Nitrate as N	Total Phosphorus	Total Kjeldahl Nitrogen	Total Settable Solids
	Detection Limit		5.00	5.00	1.00	5.00	5.00	0.50	0.05	1.00	0.10
	Units	/100ml	mg/l	mg/l	mg/l	mg/l	mg/L	mg/L	mg/l	mg/l	ml/l
Star Princess-GW	5/17/17	0	150	0	51	60	23	0	0.221	1.7	0
Star Princess-GW	8/15/17		43	0	10	68	25		0	0.66	0
Star Princess-GW	9/6/17	0									
Star Princess	5/24/17	0	74	0	19	71	12	0	0.335	3.8	0
Star Princess	8/15/17		76	0	16	93	46		0	1.1	0
Star Princess	9/6/17	0									
Regatta-Port	6/6/17	1	72	0	9	200	120	84	8.85	0.57	0
Regatta-Port	8/3/17	0	79	0	1.5	66	72	59	1.79	38	0
Regatta-Starboard	6/6/17	3	150	0	18	180	110	56	7.95	24	2
Regatta-Starboard	8/3/17	0	43	0	9.4	60	62	97	4.14	0	0
Seabourn Sojourn	6/9/17	0	76	0	9.5	81	170	0	6.72	25	0
Seabourn Sojourn	7/11/17	0	49	0	11	48	57	13	4.86	5.1	0
Seven Seas Mariner	6/10/17	0	0	0	14	150	160	0	4.45	2.1	0
Seven Seas Mariner	8/19/17	0	53	0	18	250	35	0	5.91	24	0
Seven Seas Navigator	7/13/17	5	67	0	14	78	58	0	0	16	0
	MAX	10	240	0	950	450	1500	97	10.4	110	0
	MIN	0	0	0	1.5	48	12	0	0	0	0
	MEDIAN	0	49	0	12	170	51	0	3.715	25.5	0
	Number:										
	Parameter not sampled										
	Not discharging										
	Non-detects set to zero or ND										

Table 5: Full Suite Semi-seasonal Metal Sample Results

Vessel	Date	Antimony (TR)	Antimony dissolved	Arsenic (TR)	Arsenic dissolved	Beryllium (TR)	Beryllium dissolved	Cadmium (TR)	Cadmium dissolved	Chromium (TR)	Chromium diss	Copper (TR)	Copper diss	Lead (TR)	Lead, diss	Mercury (Total)	Nickel (TR)	Nickel, diss	Selenium (TR)	Selenium, dissolved	Silver (TR)	Silver, diss	Thallium (TR)	Thallium, dissolved	Zinc (TR)	Zinc, diss		
Disney Wonder	6/16/17	0	0	0	0	0	0	0	0	4.1	2.1	1.6	1.2	0	1.4	0	19	17	0	0	0	0	0	0	240	230		
Disney Wonder	8/11/17	0	0	1.2	0	0	0	0	0	1.3	1.4	2.9	2.6	1.6	1.6	0	16	15	0	0	0	0	0	0	280	270		
Eurodam	6/7/17	0	0	1.3	1.1	0	0	0	0	0	0	3.2	2.7	0	0	0	7.6	7.8	2.2	1.8	0	0	0	0	39	43		
Eurodam	7/11/17	0	0	1.5	1.3	0	0	0	0	0	0	2.9	2.6	0	0	0	11	11	1.7	1.6	0	0	0	0	49	49		
Nieuw Amsterdam	5/16/17	0	0	1	0	0	0	0	0	0	1.1	2	1.3	0	0	0	8.6	9.7	0	0	0	0	0	0	39	36		
Nieuw Amsterdam	5/30/17	0	0	1.4	1.4	0	0	0	0	0	0	4.3	2	0	0	0	9.8	9.8	1.9	1.3	0	0	0	0	47	46		
Nieuw Amsterdam	8/15/17	0	0	4	1.7	0	0	0	0	0	0	3.1	1.5	0	0	0	11	10	11	3.1	0	0	0	0	51	52		
Volendam	5/19/17	0	0	0	0	0	0	0	0	1.8	1.5	6.2	5.8	0	0	0	10	10	0	0	0	0	0	0	85	85		
Volendam	8/4/17	1.3	0	0	0	0	0	0	0	1.2	0	5.5	3.7	0	0	0	11	11	1.3	1.5	0	0	0	0	47	46		
Zaandam	5/17/17	0	0	0	0	0	0	0	0	1.2	0	9.4	8.1	0	0	0	9.2	8.7	1.9	1.5	0	0	0	0	80	79		
Zaandam	7/6/17	0	0	0	0	0	0	0	0	0	1.1	1.6	1.3	0	0	0	5.7	5.6	2.5	1.6	0	0	0	0	82	80		
Norwegian Jewel	5/8/17	0	0	0	0	0	0	0	0	1.3	0	2.8	2	0	0	0	16	15	0	0	0	0	0	0	54	56		
Norwegian Jewel	7/11/17	0	0	11	11	0	0	0	0	0	0	9.4	0	0	0	0	7.4	7.5	46	46	0	0	0	0	21	27		
Norwegian Pearl	5/9/17	0	0	0	0	0	0	0	0	1.6	1.1	7.7	2.5	0	0	0	6	5.4	1	0	0	0	0	0	66	63		
Norwegian Pearl	7/11/17	0	0	0	0	0	0	0	0	0	0	2.2	1.3	0	0	0	5.2	5.3	1.2	1.3	0	0	0	0	45	44		
Norwegian Sun	6/8/17	0	0	1	0	0	0	0	0	0	0	10	6.5	0	0	0	5.2	4.9	1.9	1.4	0	0	0	0	43	40		
Norwegian Sun	8/10/17	0	0	0	0	0	0	0	0	0	0	15	15	0	0	0	0	0	0	0	0	0	0	0	19	20		
Coral Princess	5/17/17	0	0	1	1.2	0	0	0	0	1.5	0	17	16	0	0	0	7.8	8.2	1.9	1.5	0	0	0	0	84	85		
Coral Princess	7/11/17	0	0	1.3	0	0	0	0	0	0	0	4.4	4.3	0	0	0	14	14	2.1	2	0	0	0	0	31	33		
Golden Princess- GW	6/26/17	0	0	0	1	0	0	0	0	0	2.4	9.3	8	0	0	0	8.3	8.5	1.6	1.5	0	0	0	0	180	180		
Golden Princess	6/26/17	0	0	0	1.1	0	0	0	0	0	2	7.2	6.6	0	0	0	6.5	7.2	1.1	1.4	0	0	0	0	100	100		
Grand Princess-GW	5/21/17	0	0	5.4	4.8	0	0	0	0	1.1	0	23	16	0	0	0	13	13	23	21	0	0	0	0	15	17		
Grand Princess-GW	7/20/17	0	0	25	23	0	0	0	0	1	0	14	5.2	0	0	0	11	0	91	89	0	0	0	0	6.3	11		
Grand Princess	6/2/17	0	0	3.7	4.4	0	0	0	0	0	0	4.9	1.3	0	0	0	9.7	10	14	17	0	0	0	0	12	13		
Grand Princess	8/10/17	0	0	1.6	1.3	0	0	0	0	1.8	2	2.4	1.7	0	0	0	11	11	3.4	3.2	0	0	0	0	14	14		
Island Princess	5/21/17	0	0	0	0	0	0	0	0	1.3	1.1	3.7	2.6	0	0	0	3.9	4.2	1.8	1.6	0	0	0	0	39	41		
Island Princess	7/8/17	0	0	1.7	1.1	0	0	0	0	0	0	5.1	4.7	0	0	0	2.9	2.9	3.6	2.5	0	0	0	0	79	77		
Ruby Princess-GW	5/15/17	0	0	0	0	0	0	0	0	1.2	1.2	10	8.6	1.1	0	0	12	11	0	0	0	0	0	0	90	88		
Ruby Princess-GW	8/7/17	0	0	0	0	0	0	0	0	0	0	4.7	3.8	0	0	0	11	10	1.3	0	0	0	0	0	49	49		
Ruby Princess	5/16/17	0	0	0	0	0	0	0	0	0	1.1	15	8.3	0	0	0	7.7	9.7	2	2.2	0	0	0	0	95	94		
Ruby Princess	8/8/17	0	0	0	0	0	0	0	0	0	0	18	19	0	0	0	14	10	1.8	1.8	0	0	0	0	82	88		
Star Princess-GW	5/17/17	0	0	0	0	0	0	0	0	1.7	1.4	1.6	0	0	0	0	18	18	0	0	0	0	0	0	2.3	2.9		
Star Princess-GW	8/15/17	0	0	0	0	0	0	0	0	0	0	2.5	2.2	0	0	0	9.4	9.2	1.1	1.1	0	0	0	0	37	36		
Star Princess	5/24/17	0	0	0	0	0	0	0	0	0	0	2.2	1.6	0	0	0	12	12	0	0	0	0	0	0	12	13		
Star Princess	8/11/17	0	0	0	0	0	0	0	0	0	0	3.4	3	0	0	0	11	11	1.5	1.6	0	0	0	0	49	45		
Regatta-Port	6/6/17	0	0	3.5	3.1	0	0	0	0	0	0	68	32	0	0	0	9.6	8.7	6.3	5.6	0	0	0	0	72	49		
Regatta-Port	8/3/17	0	0	1.8	0	0	0	0	0	0	0	32	12	0	0	0	9.5	9.1	1.4	1.3	0	0	0	0	35	12		
Regatta-Starboard	6/6/17	0	0	3.7	3.2	0	0	0	0	1.2	0	43	17	0	0	0	11	9.6	6	5.8	0	0	0	0	75	50		
Regatta-Starboard	8/3/17	0	0	2.5	0	0	0	0	0	0	0	20	14	0	0	0	8.4	8.3	1.3	1.2	0	0	0	0	18	12		
Seabourn Sojourn	6/9/17	0	0	1.1	1.4	0	0	0	0	2	2.4	16	13	3.2	0	0	3.1	3.4	2.4	2.2	0	0	0	0	240	290		
Seabourn Sojourn	7/11/17	4.7	0	1.5	0	0	0	0	0	2.3	0	12	11	0	1.3	0	4.7	4.8	3.6	3.4	0	0	0	0	220	190		
Seven Seas Mariner	6/10/17	0	0	2.6	2.3	0	0	0	0	0	1.2	4.6	3.8	0	0	0	9.2	8.6	0	0	0	0	0	0	73	68		
Seven Seas Mariner	8/19/17	0	0	1.6	1.7	0	0	0	0	0	0	9.4	7.2	0	0	0	6.9	7.3	0	0	0	0	0	0	58	54		
Seven Seas Navgator	7/13/17	0	0	1.7	1.6	0	0	0	0	0	0	1	11	6.7	0	0	12	12	2.6	2.6	0	0	0	0	110	99		
MAX		4.7	0	25	23	0	0	0	0	4.1	2.4	68	32	3.2	1.6	0	19	18	91	89	0	0	0	0	280	290		
All results in micrograms/L (ug/L)																												
Non detects recorded as zero																												

APPENDIX 2: REFERENCES

Alaska Department of Environmental Conservation (ADEC) Cruise Ship Program

<http://dec.alaska.gov/water/cruise-ships/>

2014 Large Cruise Ship General Permit

<http://dec.alaska.gov/water/cruise-ships/cruise-general-permit/>

Quality Assurance Project Plan

http://dec.alaska.gov/water/cruise_ships/pdfs/2016_CLIA-NWC_QAPP.pdf

Alaska Cruise Ship Laws and Regulations

<http://dec.alaska.gov/water/cruise-ships/laws-regs/>

Sample reports from prior years

<http://dec.alaska.gov/water/cruise-ships/cruise-reports/>