



2015 Wastewater Sampling Results For Small Cruise Ships and Ferries

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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 results of onboard sampling and laboratory testing of small cruise ship and ferry wastewater effluent in Alaska during 2015. 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 summary. Table 1 lists small cruise ships and ferries with BMPs in Alaska and their discharge status in 2015. Small cruise ships and state ferries have made progress in terms of overall wastewater effluent quality since the beginning of the Commercial Passenger Vessel Environmental Compliance (CPVEC) BMP program.

2. INTRODUCTION

Sampling of wastewater effluent was conducted for all small cruise ships and ferries with over 50 overnight passenger berths discharging in Alaska waters. Sampling is needed to:

- Check if treatment systems are operational
- Obtain information on treatment system performance for future discharge permits or Best Management Practices Plans
- Compile information on potential environmental effects

Sample result data for cruise ships have been collected by the Department of Environmental Conservation since 2000. Reports and summaries for prior years can be found on the cruise program's report webpage. http://dec.alaska.gov/water/cruise_ships/reports.htm

3. METHODS

Samples are grab wastewater samples taken from a sample port prior to discharge. The grab samples were taken according to requirements in the ship's approved Quality Assurance Project Plan (QAPP). Several vessels used the [2015 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](#), and some ships use their own Department approved 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 cruise ship program reviews results submitted by the cruise ship operators for compliance with the QAPP and VSSPs.

Sampling may occur while underway or while docked. All samples were obtained in Southeast Alaska in 2015, with the majority of samples obtained in or near Juneau.

In the attached tables, there are results which have been highlighted in orange indicating an exceedance of water quality standards or Marine Sanitation Device (MSD) certification standards. Regulations (18 AAC 69.080) allow the department to work with the small cruise ship operators to develop corrective actions to address these exceedances, and develop revisions to the BMPs to improve the working order of the MSD. Dark blue highlights indicate that either no sample data was received or accepted. Results below the method detection limit (MDL) are recorded as zero.

4. RESULTS

Wastewater sample results are listed in Appendix 1 with tables for conventional parameters, nutrient parameters, and metals. Full results of volatile organic compounds (VOCs) and base neutral acids (BNAs) are available on request.

Small cruise ships and ferries are required to meet standard terms and conditions, or seek alternative terms and conditions with Best Management Practices Plans in order to discharge blackwater and graywater in Alaska marine waters. Under standard terms and conditions blackwater, graywater, and other wastewater must contain no more than 200 fecal coliform per 100 milliliters and no more than 150 milligrams per liter of total suspended solids. These are the US Coast Guard performance requirements for approval of Type II Marine Sanitation Devices (MSD) under test conditions. A MSD is required for discharge of blackwater (sewage) in US waters. Some small cruise ships and ferries also treat their graywater with their MSD.

Small cruise ships and ferries continue to balance bacterial disinfection and chlorine use. Chlorine is used to disinfect bacteria, but it is toxic to marine organisms and high residuals must be avoided. Several vessels have installed equipment to dechlorinate the treated wastewater.

The fecal coliform standard is 200 colonies per 100 ml for approved Type II Marine Sanitation Devices. The Alaska marine water quality standards (AMWQS) is a daily maximum of 43 colonies per 100 ml. This AMWQS is used due to the collection of shellfish for raw consumption. This more stringent AMWQS is used by the Cruise Ship Program as it is assumed that the use of this standard would provide adequate protection to all other uses of all marine waters. Traditionally blackwater has had the highest median fecal coliform results, although very high results have also been found in graywater (especially untreated or partially treated).

Conclusion

The CPVEC program continues to work with small cruise ships and the state ferries to make progress in terms of overall wastewater effluent quality. Since the beginning of the CPVEC program and implementation of the small cruise ship BMPs there has been an increased improvement in the results. Unfortunately, some ships continue to struggle with meeting the standards for suspended solids, fecal coliform, BOD, and chlorine. Operators have continued to make progress in corrective actions taken after high fecal coliform and suspended solids results are reported.

Sampling requirements were modified in late 2015 to match similar changes in the 2014 large cruise ship general permit pertaining to nutrients and priority parameters. Ships with separate greywater discharges were allowed to sample greywater for conventional parameters every other year starting in 2016.

APPENDIX 1: 2015 SMALL CRUISE SHIP SAMPLE DATA

Table 1: 2015 Small Cruise Ship and Ferry Summary

2015 Small¹ Commercial Passenger Vessels Wastewater Treatment

Vessel Operator	Vessel Name	Passenger Capacity ³	Crew Capacity	Voyages	Maximum Total Passengers	Blackwater Treatment System Manufacturer	BMP	Discharging in Alaska ² & Subject to sampling program	
								BW	GW
Alaska Marine Highway	<i>Columbia</i>	625	66	Year Rd.	N/A	Omnipure 15MX	Yes	Yes	Yes
Alaska Marine Highway	<i>Kennicott</i>	748	42	Year Rd.	N/A	Orca II	Yes	Yes	Yes
Alaska Marine Highway	<i>Malaspina</i>	500	50	Year Rd.	N/A	Omnipure 15MX	Yes	Yes	Yes
Alaska Marine Highway	<i>Matanuska</i>	498	50	Year Rd.	N/A	Omnipure 15MX	Yes	Yes	Yes
Alaska Marine Highway	<i>Taku</i>	370	42	Year Rd.	N/A	Omnipure 15MXMP	Yes	Yes	Yes
Alaska Dream Cruises	<i>Admiralty Dream</i>	66	21	17	1122	Omnipure 12M	Yes	Yes	Yes
American Cruise Lines	<i>American Spirit</i>	98	27	7	686	Orca IIA-165	Yes	Yes	Yes
Hapag-Lloyd	<i>Bremen</i>	164	123	2	328		N/A	No	No
National Geographic	<i>Sea Bird</i>	66	28	18	1188	Omnipure 12MX	Yes	Yes	Yes
National Geographic	<i>Sea Lion</i>	66	28	18	1188	Omnipure 12M	Yes	Yes	Yes
Silver Expeditions	<i>Silver Discoverer</i>	128	76	4	140	Hamman Model HI Type II	Yes	Yes	Yes
Un-Cruise Adventures	<i>Wilderness Adventurer</i>	78	24	17	1326	Omnipure 12MX	Yes	Yes	Yes
Un-Cruise Adventures	<i>Wilderness Discoverer</i>	74	25	21	1554	Omnipure 12MX	Yes	Yes	Yes
Un-Cruise Adventures	<i>Wilderness Explorer</i>	76	27	19	1444	Red Fox RF-2000-FP	Yes	Yes	Yes
Un-Cruise Adventures	<i>Safari Endeavor</i>	86	35	19	1634	Omnipure 12M5508	Yes	Yes	Yes
			Totals	142	10,610				

¹A small vessel has overnight accommodations for 50 to 249 passengers.

²Alaska water extends 3 miles from the coastline and includes the Alexander Archipelago.

³Based on lower berths for small cruise ships and capacity for ferries.

Vessels highlighted in gray in the above table did not discharge wastewater in Alaskan waters in 2015.

Table 2: Conventional Parameters for Mixed Treated Blackwater and Graywater

		Ammonia as N	pH	Temper ature	Biochemical O ₂ Demand	Chemical Oxygen Demand	Total Suspended Solids	Total Chlorine	Free Chlorine	Fecal Coliform Bacteria	Specific Conductan ce	Oil & Grease	Total Organic Carbon	Alkalinity	Hardness (as CaCO ₃)	Nitrogen, Nitrate- Nitrite (as N)	Total Phosph orus	Total Kjeldahl Nitrogen	Total Settleable Solids
Reportable Limit (PQL)		0.1	0.1	0.1	2	10	4	0.1	0.1	2	2	5	1	2		1	0.05	1	0.1
Units		mg/L	s.u.	C	mg/L	mg/L	mg/L	mg/L	mg/L	FC/100ml	umhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Alaska Marine Water Quality Standards, Secondary Treatment standards, or AS 46.03.463		1	6.5-8.5	n/a	60	n/a	150	0.0075	n/a	200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Vessel Name	Sample Date																		
Columbia	5/18/15		6.68	15.0	82	260	39	0	0	0	35,400	0		130					0
Columbia	9/14/15	7.1	6.87	14.3	63	250	48	7.3	1.16	0	34500	0	21	110	4,000	0.2	0.22	27	0
Kennicott	4/29/15	0	7.90	11.3	46	230	10	4.8	3.7	2	46,100	0	0	110	5,800	0	0	0.67	0
Kennicott	6/30/15	0.38	7.23	18.5	130	240	53	0	0	5,000,000	27,700	15		170	3,000				
Kennicott	7/14/15	0	7.92	16.0	11	190	9	4.1	1.9	15									0
Malaspina	4/20/15	18	7.12	16.5	70	910	50	0	0	3	38,300	7.3	23	150	4,500	0.27	3.0	31	0
Malaspina	10/12/15	14	7.11	18.3	110	1,200	80	0	0	46,000	33,100	18		160	2,000				0
Matanuska	5/18/15		6.38	16.2	120	300	346	0	0	0	36,100	18.0		100					1
Matanuska	7/30/15	11	6.91	20.2	110	440	55	0	0	1,100	18,100	8.2	29.0	98	1,800	2	0.41	39	2.0
Taku	4/16/15	1.7	6.13	15.2	160	1,200	112	0.60	0.1	0	37,800	20	28	64	3,900	0.29	0.8	24	2.5
American Spirit	8/1/15	0.17	7.08	26.1	2.5	23	0	0	0	420	171	0	3.60	50	59	0.15	0	0	0
American Spirit	11/5/15	0.78	7.60	14.6	170	180	63	0	0	466,000	219	97		84		0	0.2	4.6	0
Wilderness Adventurer	6/6/15		8.05	20.0	280	820	250	11.3	0.1	68,000	28,100	27		200	3,000				14
Wilderness Adventurer	8/15/15	55	8.09	25.2	260	710	244	20	0.21	140	21,500	32	61	300	2,200	0.73	12	98	0
Minimum		0	6.13	11.3	2.5	23	0	0	0	0	171	0	0	50.0	59	0	0	0	0
Maximum		55.0	8.09	26.1	280	1,200	346	20.0	3.70	5,000,000	46,100	97.0	61.0	300.0	5,800	2.0	12.0	98.0	14.0
Median		1.70	7.12	16.4	110.0	280.0	54.0	0.00	0.00	77.5	33,100	15.00	23.0	110.0	3,000	0.24	0.32	25.50	0.0
Average		9.83	7.22	17.7	115.3	496.6	97.1	3.44	0.51	398,691	27,468	18.65	23.7	132.8	3,026	0.48	2.08	28.03	1.51

Nondetects set to 0

* Too numerous to count

Exceeds WQS, Alaska, or federal secondary treatment standards. Not a violation under BMP

Not analyzed

Table 3: Conventional Parameters for Treated Blackwater

	Ammonia as N	pH	Temperature	Biochemical O ₂ Demand	Chemical Oxygen Demand	Total Suspended Solids	Total Chlorine	Free Chlorine	Fecal Coliform Bacteria	Conductivity	Oil & Grease	Total Organic Carbon	Alkalinity	Hardness (as CaCO ₃)	Nitrogen, Nitrate-Nitrite (as N)	Total Phosphorus	Total Kjeldahl Nitrogen	Total Settleable Solids	
Reportable Limit (PQL)	0.1	0.1	0.1	2	10	4	0.1	0.1	2	2	5	1	2		1	0.05	1	0.1	
Units	mg/L	s.u.	C	mg/L	mg/L	mg/L	mg/L	mg/L	FC/100ml	umhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ml/L	
Alaska Marine Water Quality Standards, Secondary Treatment standards, or AS 46.03.463	1	6.5-8.5	n/a	60	n/a	150	0.0075	n/a	200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Vessel Name	Sample Date																		
Admiralty Dream	6/23/15	15	7.36	21.9	110	1,100	107	2.2	1.60	6,000	29,200	6	44	150	3,400	0.33	7.1	52	6
Admiralty Dream	8/24/15	8.5	7.64	14.4	100	860	156	3.9	0	360	34,600	8.8	230	130	4,200	0.26	4.8	49	7
Safari Endeavour	5/31/15		7.32	15.3	80	250	90	3	1	1,800	21,000	16		84	2,500				2
Safari Endeavour	8/2/15		7.08	14.1	25	650	4.4	3.6	1.42	45	28,300	0		72	2,900				0
Sea Bird	6/20/15	6.7	6.63	17.2	310	510	79	0.99	0.92	460	32,000	19	130	110	3,600	0.19	2.6	9.5	0
Sea Bird	8/29/15	5.6	7.15	15.3	360	1,100	82	0	0	160	25,900	14	210	100	2,800	0.2	1.30		2
Sea Lion	6/21/15	23	7.96	16	310	450	108	0.39	0.2	0	37,000	12	53	170	4,400	0.19	6.2	74	0
Sea Lion	8/30/15		7.25	12.7	14	280	9.2	0.63	0	0	16,300	0		44	1,800				0
Silver Discoverer	7/11/15		8.67	20.3	15	68	20	3.4	0.2	3	6,470	0		110	550				0
Wilderness Discoverer	5/16/15		7.84	18.3	390	2,700	258	3.6	0	2,600	31,300	78		200					13
Wilderness Discoverer	7/25/15		7.16	18.1	170	750	75	0	0	6,400,000	28,400	28		200	2,000				2.5
Wilderness Explorer	6/13/15	12	7.76	17.6	170	600	180	0	0	10,000,000	29,600	0	41	200	3,400	0	7.9	72	10
Wilderness Explorer	8/8/15		7.97	19.2	160	500	196	0	0	7,600,000	29,700	12		450	3,200				10
Minimum	5.60	6.63	12.7	14	68	4	0	0	0	6,470	0	41	44.0	550	0	1.3	9.50	0	
Maximum	23	8.67	21.9	390	2,700	258	3.9	1.6	10,000,000	37,000	78	230	450	4,400	0.33	7.9	74.00	13.0	
Median	10.25	7.36	17.2	160	600	90.0	1.0	0.0	460	29,200	12	91.5	130.0	3,050.0	0.20	5.5	52.00	2.0	
Average	11.8	7.5223	16.954	170.31	755.23	104.97	1.7	0.4	1,847,033	26905.4	14.9231	118	155.3846	2895.8	0.195	4.9833	51.3	4.04	

Nondetects set to 0

* Too numerous to count

Exceeds WQS, Alaska, or federal secondary treatment standards. Not a violation under BMP

Not sampled

Table 4: Conventional Parameters for Graywater

	Ammonia as N	pH	Temperature	Biochemical O ₂ Demand	Chemical Oxygen Demand	Total Suspended Solids	Total Chlorine	Free Chlorine	Fecal Coliform Bacteria	Conductivity	Oil & Grease	Total Organic Carbon	Alkalinity	Hardness (as CaO ₃)	Nitrogen, Nitrate-Nitrite (as N)	Total Phosphorus	Total Kjeldahl Nitrogen	Total Settleable Solids	
Reportable Limit (PQL)	0.1	0.1	0.1	2	10	4	0.1	0.1	2	2	5	1	2		1	0.05	1	0.1	
Units	mg/L	s.u.	C	mg/L	mg/L	mg/L	mg/L	mg/L	FC/100ml	umhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ml/L	
Alaska Marine Water Quality Standards, Secondary Treatment standards, or AS 46.03.463	1	6.5-8.5	n/a	60	n/a	150	0.0075	n/a	200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Vessel Name	Sample Date																		
Admiralty Dream	6/23/15	2.9	7.45	18.6	220	450	87	1.14	1.27	519	69	52	66	51	0	1.1	15.0	0.4	
Admiralty Dream	6/23/15								1,500,000										
Admiralty Dream	8/24/15		7.54	18.3	420	783	320	8.4	0	843								3.5	
Safari Endeavour	5/31/15		6.76	27.3	300	530	21	0	0	630	17		82	59				0	
Safari Endeavour	8/2/15	1.2	6.89	21.6	320	520	34	0	0	689	17	120	48	39	0	2.0	19	0	
Sea Bird	6/20/15	0.51	3.71	20.2	1400	2500	28	0	0	684	17	1300	0	58	0.14	2.1	3.9	0	
Sea Bird	8/29/15		7.01	16.6	500	680	8	0	0	1,090	10.0		20	49				0	
Sea Lion	6/21/15	3.5	7.22	16.9	200	230	42	0.36	0.14	1,742	15	50	110	190	0	2.5	16	9.3	
Sea Lion	8/30/15	0.75	6.97	17.3	316	480	45	0	0	1,810	36	130	52	160	0	1.00	11	0.1	
Silver Discoverer	7/11/15	18	8.55	17.5	12	56	14	3.3	0.4	6,480	0	6.3	88	580	3.7	1.3	26	0	
Wilderness Discoverer	5/16/15		6.48	26.5	2,700	1,800	311	0	0	392	240		72	160				4	
Wilderness Discoverer	7/25/2015	0.12	7.21	15.3	79	730	57	0.16	0	264	68	39	110	110	0.21	0.92	12	0.3	
Wilderness Explorer	6/13/2015		7.48	17.9	5	0	5	0	0	259	0		190	62				0	
Wilderness Explorer	8/8/2015		7.69	20.8	12	0	6.8	0	0	281	0		66	72				0	
Minimum	0.12	3.71	15.3	5	0	5	0	0	0	259	0	6	0	39	0.00	0.92	3.90	0	
Maximum	18	8.55	27.3	2,700	2,500	320.0	8.4	1.3	1,500,000	6,480	240	1,300	190	580	3.70	2.50	26.00	9.3	
Median	1.20	7.21	18.3	300	520	34.0	0.0	0.0	27	684	17	52	69	67	0.00	1.30	15.00	0.0	
Average	4.01	6.96	19.68	522.00	692.42	74.30	1.02	0.05	122,800.85	1,264	38.18	274.22	76.18	139.91	0.68	1.64	14.65	1.43	

Nondetects set to 0

* Too numerous to count

Exceeds WQS, Alaska, or federal secondary treatment standards. Not a violation under BMP

Not sampled

Table 5: Full Suite Metal Sample Results

			Antimony (TR)	Antimony dissolved	Arsenic (TR)	Arsenic dissolved	Beryllium (TR)	Beryllium dissolved	Cadmium (TR)	Cadmium dissolved	Chromium (TR)	Chromium dissolved	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	
Reportable Limit (PQL)			1	1	1	2.5	1	1	1	1	1	1	1	1	1	1	0.2	1	1	1	1	1	1	1	1	1	1	
Units			µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg
Alaska Marine Water Quality Standards (chronic for marine life)			N/A	N/A	N/A	36	N/A	N/A	N/A	8.8	N/A	50 (chromium IV)	N/A	3.1	N/A	8.1	0.94	N/A	8.2	N/A	71	N/A	1.9 (acute)	N/A	N/A	N/A	81	
Vessel Name	Sample Date	Sample Type																										
Columbia	9/14/15	Mixed	0	0	33	24	0	0	0	0	2.7	0	100	97	0	0	0	5.9	0.0	110	110	0	0	0	0	42	34	
Kenicott	4/29/15	Mixed	0	0	93	85	0	0	0	0	0	0	230	210	0	0	0	12	12.0	280	270	0	0	0	0	47	45	
Malaspina	4/20/15	Mixed	0	0	50	0	0	0	0	0	5.2	0.0	190	160	0	0	0.6	11	0.0	170	0	0	0	0	52	18		
Matanuska	7/30/15	Mixed	0	1.3	44	41	0	0	0	0	6	2.3	250	140	0	0	0	23	20	150	140	0	0	0	0	31	23	
Taku	4/16/15	Mixed	0	0	26	10	0	0	0	0	0	0	1500	890	16	0	0	140	150	97	100	0	0	0	0	100	140	
Admiralty Dream	8/24/15	BW	1.4	0	16	52	0	0	0	0	4.8	0	300	120	1.1	0	0	9.3	0	26	210	0	0	0	0	120	57	
American Spirit	8/1/15	Mixed	0	0	0	0	0	0	0	0	0	0	26	6.9	2.0	0	0	2.9	2.5	2	2.3	0	0	0	0	1100	970	
Safari Endeavor	8/2/15	GW	0	0	1.1	1.1	0	0	0	0	1.2	0	83	68	2.1	1.3	0	2.9	2.4	2.8	2.9	0	0	0	0	500	350	
Sea Bird	8/29/15	BW	0	1.6	53	44	0	0	0	0	4.7	2	65	56	0	0	0	6.8	5.7	120	150	0	0	0	0	53	35	
Sea Lion	8/30/15	GW	0	1.7	1.6	1.3	0	0	0	0	1.6	1.6	100	71	4.4	3	0	7.1	6.8	6.4	6.4	0	0	0	0	850	470	
Silver Discoverer	7/11/15	GW	0	0	7.5	7	0	0	0	0	0	0	60	12	1.2	0		1.4	1	27	27	0	0	0	0	50	26	
Wilderness Adventurer	8/15/15	Mixed	0	2.1	29	31	0	0		0	0.0	2.8	150	100	0	0	0	9.4	5.9	64	68	0	0	0	0	230	76	
Wilderness Discoverer	7/25/15	GW	0	0	0	0	0	0	0	0	0.0	0	30	5.9	0	0	0	1.9	1.7	0	0	0	0	0	0	74	41	
Wilderness Explorer	6/13/15	BW	0	0	55	59	0	0	0	0	0	0	150	72	0	0	0	8.6	7.7	190	190	0	0	0	0	190	52	
Minimum			0	0	0	0	0	0	0	0	0	0.0	26	6	0	0	0	1	0.0	0	0	0	0	0	0	31	18	
Maximum			1	2	93	85	0	0	0	0	6	2.8	1,500	890	16.00	3	0.60	140	150.0	280	270	0	0	0	0	1100	970	
Median			0	0	28	17	0	0	0	0	1	0.0	125	85	0.00	0	0	8	4.1	81	84	0	0	0	0	87	49	

average

Nondetects set to 0

Exceeds WQS. Not a violation under BMP regulations.

APPENDIX 2: REFERENCES

Alaska Department of Environmental Conservation (ADEC) Cruise Ship Program

http://www.dec.state.ak.us/water/cruise_ships/index.htm

CLIA Northwest and Canada Quality Assurance Project Plan

http://dec.alaska.gov/water/cruise_ships/pdfs/2015_CLIA-NWC_QAPP.pdf

Small Cruise Ship Discharge Options

http://dec.alaska.gov/water/cruise_ships/small_vessel_dischargeoptions.htm

Alaska Cruise Ship Laws and Regulations

http://www.dec.state.ak.us/water/cruise_ships/Law_and_Regs/index.htm

Sample reports and summaries from prior years

http://www.dec.state.ak.us/water/cruise_ships/reports.htm