



2017 Wastewater Sampling Results For Small Cruise Ships and Ferries

2/20/2018



Alaska Department of Environmental Conservation
Commercial Passenger Vessel Environmental Compliance Program

TABLE OF CONTENTS

1. Summary.....	3
2. Introducton.....	3
3. Methods.....	3
4. Results.....	4
Appendix 1: 2017 Small Cruise Ship Sample data	5
Table 1: 2017 Small Cruise Ship and Ferry Summary.....	5
Table 2: Conventional Parameters for Mixed Treated Blackwater and Graywater.....	6
Table 3: Conventional Parameters for Treated Blackwater	7
Table 4: Conventional Parameters for Treated Graywater	8
Appendix 2: Refrences	10

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 2017. 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 2017. 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 and ferries has 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 [2016 or 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](#), 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 2017, 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.

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.

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 in US waters. Some small cruise ships and ferries also treat their graywater with their MSD.

The statutes allowing alternative terms and conditions expired at the start of 2016, ships operated under a No Action Assurance memo from the Department allowing operation under existing BMPs. The new law allowing alternative terms and conditions was passed in 2017. Regulations will be updated and updates to BMPs will occur in 2018.

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.

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. The National Geographic Quest is a new ship with a new wastewater treatment systems, the effluent performance will be reviewed prior to the 2018 Alaska cruise season. Operators have continued to make progress in corrective actions taken after high fecal coliform and suspended solids results are reported.

APPENDIX 1: 2017 SMALL CRUISE SHIP SAMPLE DATA

Table 1: 2017 Small Cruise Ship and Ferry Summary

2017 Small ¹ Commercial Passenger Vessels Wastewater Treatment										
Vessel Operator	Vessel Name	Passenger Capacity ³	Crew Capacity	Voyages	Maximum Total Passengers	Blackwater Treatment System Manufacturer	Units	BMP	Discharging in Alaska ² & Subject to sampling program	
									BW	GW
Alaska Marine Highway	<i>Columbia</i>	625	66	Apr-Oct	N/A	Omnipure 15MX	4	Yes	Yes	Yes
Alaska Marine Highway	<i>Kennicott</i>	748	42	Year Rd.	N/A	Orca II 500	3	Yes	Yes	Yes
Alaska Marine Highway	<i>Malaspina</i>	500	50	Jan-April	N/A	Omnipure 15MX	3	Yes	Yes	Yes
Alaska Marine Highway	<i>Matanuska</i>	498	50	Year Rd.	N/A	Omnipure 15MX	3	Yes	Yes	Yes
Alaska Dream Cruises	<i>Admiralty Dream</i>	66	21	18	1188	Omnipure 12M	1	Yes	Yes	Yes
Alaska Dream Cruises	<i>Chichagof Dream</i>	81	27	18	1458	Orca II A MSD	1	Yes	Yes	Yes
American Cruise Lines	<i>American Spirit</i>	96	27	10	960	Orca IIA-165	1	Yes	Yes	Yes
Hapag-Lloyd	<i>Bremen</i>	155	Unknown	4	620	Unknown		N/A	No	No
Lindblad/Nat. Geographic	<i>National Geographic Quest</i>	100	50	10	1000	Gertsen & Olufsen Bioreactor	1	N/A	Yes	Yes
Lindblad/Nat. Geographic	<i>Sea Bird</i>	62	28	17	1054	Omnipure 12MX	1	Yes	Yes	Yes
Lindblad/Nat. Geographic	<i>Sea Lion</i>	62	28	18	1116	Omnipure 12M	1	Yes	Yes	Yes
Silver Expeditions	<i>Silver Discoverer</i>	120	76	5	600	Hamman Model HI Type II	1	Yes	Yes	Yes
Un-Cruise Adventures	<i>Safari Endeavor</i>	86	35	18	1548	Omnipure 12M5508	2	Yes	Yes	Yes
Un-Cruise Adventures	<i>Wilderness Adventurer</i>	74	24	23	1702	Omnipure 12MX	1	Yes	Yes	Yes
Un-Cruise Adventures	<i>Wilderness Discoverer</i>	78	25	14	1092	Omnipure 12MX	1	Yes	Yes	Yes
Un-Cruise Adventures	<i>Wilderness Explorer</i>	76	27	20	1520	Red Fox RF-2000-FP	1	Yes	Yes	Yes
Rev 1 8/9/17			Totals	175	13,858					
¹ A small vessel has overnight accommodations for 50 to 249 passengers.										
² Alaska water extends 3 miles from the coastline and includes the Alexander Archipelago.										
³ Based on lower berths for small cruise ships and capacity for ferries.										
Vessels highlighted in gray in the above table registered for no discharge of wastewater in Alaskan waters this year.										
Note- BMP law expired in 2016 but ships are operating under a No Action Assurance Memo for 2017 until the laws are reinstated or a permit is issued.										

Table 2: Conventional Parameters for Mixed Treated Blackwater and Graywater

	Ammonia as N	pH	Temperature	Biochemical O ₂ Demand	Chemical Oxygen Demand	Total Suspended Solids	Total Chlorine	Free Chlorine	Fecal Coliform Bacteria	Specific Conductance	Oil & Grease	Total Organic Carbon	Alkalinity (Total)	Hardness (as CaCO ₃)	Nitrogen, Nitrate-Nitrite (as N)	Nitrate	Nitrate	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	1	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	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	n/a	n/a	
Vessel Name	Sample Date																				
Columbia	No voyages during summer season																				
Kennicott	4/18/17	0.056	8.00	8.0	2	913	8.56	0.56	0.39	17	52,300	0	2.87	104.0	5,160		0	0	0.11	1	0.1
Kennicott	9/19/17	0	7.60	12.0	2	856	6.74	4.2	2.7	168	36,600	0	1.39	76	3,270		0.127	0	0.03	0	0
Malaspina	4/24/17	13.2	7.00	15.0	67	704	28.7	0.1	0.15	37	45,000	4.42	39	115	4,310		0	0	2.73	27.5	0.1
Malaspina	9/18/17	17.5	7.00	20.0	62	0	55.2	0.05	0.10	1,250	29,000	8.57	36.7	130	2,640		0	0	25.80	25.8	0
Matanuska	4/20/17	7.73	6.60	15.0	92.7	845	38.5	1.17	3.8	7	44,400	9.44	61.4	103	4,030		0.187	0	2.72	29.7	0.1
Matanuska	9/27/17	4.57	6.40	22.0	78	1,000	43.2	0.02	0.12	48	31,500	5.5	43.2	88.8	1,350		0.107	0	2.62	12.7	0
Chichagof Dream	7/2/17	50	7.50	14.4	360	1,200	170	0.22	0.11	2,600,000	32,100	61.9		250	3,200						12
Chichagof Dream	7/30/17		7.65					3	4	0											
American Spirit	7/8/17	0	7.27		58	90	20	0	0	4,800	5,660	0		65	65						0
National Geo Quest	8/26/17	67	7.00	14.6	1,300	1,800	330	0	0	16,000,000	1,150	92.6	230	350	54				10.8	130	19
Wilderness Adventurer	5/13/17	8.3	7.88	14.5	190	1,500	393	4.70	0.45	90	38,200	40.8		160	4,700						38
Wilderness Discoverer	5/27/17	33	7.96	17.3	190	1,100	160	9.0	1	290,000	32,200	19.5	16	200	3,300	0.49			8.12	32	5
Minimum	0	6	8	2	0	7	0	0	0	0	1,150	0	1	65	54	0	0	0	0	0	0
Maximum	67.0	8.0	22.0	1,300.0	1,800.0	393.0	9.0	4.0	16,000,000	52,300	92.6	230.0	350.0	5,160.0	0	0.2	0.0	25.8	130.0	38.0	
Median	8.30	7.39	14.80	78.00	913.00	43.20	0.39	0.27	129	32,200	8.57	37.85	115.00	3,270.00	NA	0.05	0.00	3	26.65	0.10	
Average	18.31	NA	15.28	218.39	909.82	113.99	1.92	1.07	1,574,701	31,646	22.07	53.82	149.28	2,916.27	NA	0.07	0.00	7	32.30	6.71	
Nondetects set to 0																					
* Too numerous to count																					
Exceeds WQS, Alaska, or federal secondary treatment standards. Not a violation under BMP																					
Not analyzed																					
Holding time or temperature exceeded on fecal result																					

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 (Total)	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	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																	
Admiralty Dream																		
Safari Endeavour	6/4/17	3.6	7.61	13.1	15.0	440	24.0	0	0	77,000	27,500	0	89	3,200				0
Sea Bird																		
Sea Lion																		
Silver Discoverer	7/25/17	73	7.34	27.2	86	330	147	8.5	8.4	0	1,950	0	84	110				1
Wilderness Explorer	6/3/17	25	7.83	13.3	50	490	37	0	0.0	1,600,000	30,600	0	200	3,600				0
Minimum	3.6	7.34	13.10	15	330	24	0	0	0	1,950	0	0	84	110				0
Maximum	73.0	7.8	27.2	86	490	147	8.5	8.4	1,600,000	30,600	0	0	200	3,600				1
Median	25.0	7.6	13.3	50.0	440	37	0.0	0.0	77,000	27,500	0		89	3,200				0
Average		NA	17.867	50.33		69.33	2.8	2.8	559,000.00									
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 Treated 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 (total)	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	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																		
Admiralty Dream	7/7/17	0.5	8.89	13.1	45	100	17	0.43	0.42	900,000	160	6.6	40	13				0	
Safari Endeavour	6/4/17		7.40	22.1	490		69	0	0	36,000									
Sea Bird	6/15/17	0.55	5.31	14.9	760	1000	69	0.4	0	0	1480	28.4	520	0	63	0	1.73	7.2	0
Sea Lion	6/18/17	2.5	6.90	17.0	230	420	69	0.41	0.21	19,000	1,820	26.8	76	81	220	0	1.6	20	0
Silver Discoverer																			
Wilderness Discoverer																			
Wilderness Explorer																			
Minimum	0.49	5.31	13.1	45	100	17	0	0	0	160	6.60	76.00	0	13	0	1.58	7.20	0	
Maximum	2.5	8.9	22.1	760	1,000	69	0.43	0.42	900,000	1,820	28.4	520.0	81.0	220	0	1.7	20.0	0	
Median	0.55	7.15	15.95	360.0	420.0	69.0	0.41	0.11	27,500	1,480	26.80	298.0	40.0	63	0	1.66	13.60	0	
Average	1.18	7.13	16.78	381.25	506.7	56.0	0.31	0.16	238,750	1,153	20.60	298.0	40.33	98.7	0	1.66	13.60	0	
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	No voyages during summer season																											
Kennicott	9/19/17	Mixed	0	0	0	0	0	0	0	0	0	0	40	56	0.0	0	0	0.0	0	0	0	0	0	0	0	0	93.2	86.4
Malaspina	9/18/17	Mixed	0	0	0	0	0	0	0	0	0	0	49.7	37.7	0	2.1	0	0	0	0	0	0	0	0	0	0	83.5	76.2
Matanuska	9/27/17	Mixed	0	0	0	0	0	0	0	0	0	0	72	56.1	0	2.1	0	10	0	0	0	0	0	0	0	0	0	0
Admiralty Dream	7/7/17	GW	0	0	0	0	0	0	0	0	0	0	73	7.1	7.3	0	0	22	21	0	0	0	0	0	0	0	260	80
Chicago Dream	7/2/17	Mixed	0	0	41	39	0	0	0	0	0	0	64	28	0	0	0	12	0	170	150	0	0	0	0	0	190	130
American Spirit	7/8/17	Mixed	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	4.4	0	0	0	0	0	0	0	4400	4100	
Safari Endeavor	6/4/17	BW	0	0	55	52	0	0	0	0	0	0	72	14	0	0	0	0	11	220	200	0	0	0	0	0	38	19
Sea Bird	6/15/17	GW	0	0	0	0	0	0	0	0	4.7	5	110	95	1.9	0	0	6.9	6.9	0	0	0	0	0	0	0	210	260
Sea Lion	6/18/17	GW	0	0	2.8	1.4	0	0	0	0	2.6	3.0	62	47	1.5	0	0	11.0	9.5	8.5	5.9	0	0	0	0	0	270	150
Quest	8/26/17	Mixed	0	0	3.4	3.6	0	0	0	0	4.7	2.6	59	44	2.5	1	0	9.2	9.3	2.3	1.5	0	0	0	0	0	1500	710
Silver Discoverer	7/25/17	BW	0	0	6.6	3.2	0	0	0	0	7.5	2	72	36	0	0	0	0	6	18	4	0	0	0	0	0	410	120
Wilderness Adventurer	5/13/17	Mixed	0	0	56	56	0	0	0	0	34	0	140	29	0	0	0	23	0	260	230	0	0	0	0	0	260	69
Wilderness Discoverer	5/27/17	Mixed	0	0	47	45	0	0	0	0	0	0	190	120	0	0	0	0	19	190	180	0	0	0	0	0	170	170
Wilderness Explorer	6/3/17	BW	0	0	66	68	0	0	0	0	0	0	90	14	0	0	0	17	16	240	250	0	0	0	0	0	58	24
Minimum			0	0	0	0	0	0	0	0	0	0.0	15	0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0
Maximum			0	0	66	68	0	0	0	0	34	5.0	190	120	7.30	2	0	23	21.0	260	250	0	0	0	0	4400	4100	
Median			0	0	3	2	0	0	0	0	0	0.0	72	37	0.00	0	0	8	6.4	5	3	0	0	0	0	200	103	
Nondetects set to 0																												
Exceeds WQS. Not a violation under BMP regulations.																												
Not required to sample																												

APPENDIX 2: REFERENCES

Alaska Department of Environmental Conservation (ADEC) Cruise Ship Program

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

CLIA Northwest and Canada Quality Assurance Project Plan

http://dec.alaska.gov/water/cruise_ships/pdfs/2016_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 other years

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