2016 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 2016. 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 2016. 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. INTRODUCTON

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 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 2016, 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.

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 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.

APPENDIX 1: 2016 SMALL CRUISE SHIP SAMPLE DATA

Table 1: 2016 Small Cruise Ship and Ferry Summary

2016 Small[1] 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	*Columbia*	625	66	May-Sept	N/A	Omnipure 15MX	Yes	Yes	Yes
Alaska Marine Highway	*Kennicott*	748	42	Feb-Oct	N/A	Orca II	Yes	Yes	Yes
Alaska Marine Highway	*Malaspina*	500	50	Jan-May	N/A	Omnipure 15MX	Yes	Yes	Yes
Alaska Marine Highway	*Matanuska*	498	50	Year Rd.	N/A	Omnipure 15MX	Yes	Yes	Yes
Alaska Marine Highway	*Taku*	370	42	NA	N/A	Omnipure 15MXMP	Yes	Yes	Yes
Alaska Dream Cruises	*Admiralty Dream*	66	21	18	1188	Omnipure 12M	Yes	Yes	Yes
Alaska Dream Cruises	*Chichagof Dream*	84	Unknown	14	1176	BMP in progress			
American Cruise Lines	*American Spirit*	96	27	7	672	Orca IIA-165	Yes	Yes	Yes
Hapag-Lloyd	*Hanseatic*	160	Unknown	2	320	Unknown	N/A	No	No
National Geographic	*Sea Bird*	63	28	18	1134	Omnipure 12MX	Yes	Yes	Yes
National Geographic	*Sea Lion*	63	28	18	1134	Omnipure 12M	Yes	Yes	Yes
Silver Expeditions	*Silver Discoverer*	120	76	5	600	Hamman Model HI Type II	Yes	Yes	Yes
Un-Cruise Adventures	*Wilderness Adventurer*	64	24	23	1472	Omnipure 12MX	Yes	Yes	Yes
Un-Cruise Adventures	*Wilderness Discoverer*	79	25	19	1501	Omnipure 12MX	Yes	Yes	Yes
Un-Cruise Adventures	*Wilderness Explorer*	76	27	21	1596	Red Fox RF-2000-FP	Yes	Yes	Yes
Un-Cruise Adventures	*Safari Endeavor*	86	35	21	1806	Omnipure 12M5508	Yes	Yes	Yes
			Totals	166	12,599				

[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 did not discharge wastewater in Alaskan waters this year.

Table 2: Conventional Parameters for Mixed Treated Blackwater and Graywater

		Ammonia as N	pH	Temp	BOD	COD	TSS	Total Chlorine	Free Chlorine	Fecal Coliform Bacteria	Specific Conductance	Oil & Grease	Total Organic Carbon	Alkalinity (Total)	Hardness (as CaCO3)	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	ml/L
Alaska Marine WQS, Secondary Treatment standards (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	7/18/16	4.86	6.70	16.7	47	798	26	0.15	0.5	64	32,600	3.4	32.1	83.6			0	0	1.6	11.7	0.1
Columbia	8/22/16	0	7.70	22.0	10	234	11.9	6	6	0	33,900	0	5.37	68.6			0.0724	0	0.13	0.594	0.4
Kennicott	7/20/16	0	6.00	16.7	0	699	3.65	0.2	0.4	6	29,900	0	1.56	69.9			0	0	0.0348	0	0
Kennicott	8/23/16	0	8.30	15.0	0	918	4.08	1.7	2.5	10	35,900	0		74			0	4.55	0	0	0
Malaspina																					
Matanuska	7/20/16	19.2	6.70	21.9	156	826	97.5	0	0	170,000	22,900	27.2	113	133			0.0594	0.0480	4.75	52.5	0.7
Matanuska	8/15/16	14	7.10	20.0	144	864	39.5	0.78	0.56	8,900	30,800	15.0	79.6	130			0.154	0.0488	4.51	37.2	0
Chichagof Dream	7/31/16	11	6.80	20.0	1,100	1,900	660	0.5		2,100,000	15,100	129		110	1,800						
Chichagof Dream	8/28/16	1.9	6.80	18.0	710	1,200	632	60		0	20,500	43.9		100	2,700						1.0
American Spirit	6/23/16		7.30	17.5	15.0		0	0.12	0	110											
Wilderness Adventurer	6/4/16		7.75	16.8	200		292	3.3	0.0	33,000											
Wilderness Discoverer	6/25/16		7.88	18.3	340		308	12.0	0	20,000											
	Minimum	0	6	15	0	234	0	0	0	0	15,100	0	2	69	1,800	0	0	0	0	0	0
	Maximum	19.2	8.3	22.0	1,100	1,900	660	60.0	6.0	2,100,000	35,900	129.0	113.0	133.0	2,700	0	0.2	4.6	4.8	52.5	1.0
	Median	3.38	7.10	18.0	144.0	845	39.50	0.78	0.40	110	30,350	9.20	32.10	91.80	2,250	NA	0.03	0.02	1	6.15	0.11
	Average	6.37	NA	18.45	247.5	929.9	188.6	7.71	1.11	212,008	27,700	27.31	46.33	96.14	2,250	NA	0.05	0.77	2	17.00	0.34

Non-detects = 0

* Too numerous to count

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

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 CaCO3)	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	5/26/16		7.16	16.1	77		103	33	4.0	0									
Safari Endeavour	7/10/16		7.68	14.5	6.8		5.2	12	9	0									
Sea Bird	6/18/16		7.25	14.7	>400		69	0	0	56									
Sea Lion	6/19/16		8.2	17.4	180		189	0.44	0	0									
Silver Discoverer	7/28/16		8.57	22.7	520		295	4.7	0.9	0									
Wilderness Explorer	5/7/16		7.76	14.8	130		180	82	4.3	0									
Minimum			**7.16**	**14.5**	**7**		**5**	**0**	**0**	**0**									
Maximum			**8.57**	**22.7**	**520**		**295**	**82.0**	**9.0**	**56**									
Median			**7.72**	**15.5**	**130**		**141.5**	**8.4**	**2.5**	**0**									
Average			**NA**	**16.7**	**182.76**		**140.20**	**22.0**	**3.03333**	**9.33**									

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 CaO3)	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	Not Required																		
Safari Endeavour	Not Required																		
Sea Bird	Not Required																		
Sea Lion	Not Required																		
Silver Discoverer	Not Required																		
Wilderness Discoverer	Not Required																		
Wilderness Explorer	Not Required																		
	Minimum																		
	Maximum																		
	Median																		
	Average																		

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
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	7/18/16	Mixed	0	0	0	0	0	0	0	0	0	0	31.7	27.5	0	0	0	7.4	0	0	0	0	0	0	0	53	0
Kenicott	7/20/16	Mixed	0	0	0	0	0	0	0	0	0	0	78	14	2.83	0	0	16.6	0	0	0	0	0	0	0	154	66
Kenicott	8/15/16	Mixed	0	0	0	0	0	0	0	0	0	0	16.9	14	0.00	0	0	7.5	0	0	0	0	0	0	0	59	66
Malaspina																											
Matanuska	7/20/16	Mixed	0	0	0	0	0	0	0	0	0	0	400	69.6	3.22	0	0	45	39.6	0	0	0	0	0	0	157	0
Admiralty Dream	Not Required																										
Chicagof Dream	Not Required																										
American Spirit	Not Required																										
Safari Endeavor	Not Required																										
Sea Bird	Not Required																										
Sea Lion	Not Required																										
Silver Discoverer	Not Required																										
Wilderness Adventurer	Not Required																										
Wilderness Discoverer	Not Required																										
Wilderness Explorer	Not Required																										
Minimum			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0**	**17**	**14**	**0**	**0**	**0**	**7**	**0.0**	**0**	**0**	**0**	**0**	**0**	**0**	**53**	**0**
Maximum			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0**	**400**	**70**	**3.22**	**0**	**0.00**	**45**	**39.6**	**0**	**0**	**0**	**0**	**0**	**0**	**157**	**66**
Median			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0**	**55**	**21**	**1.42**	**0**	**0**	**12**	**0.0**	**0**	**0**	**0**	**0**	**0**	**0**	**106**	**33**

Nondetects set to 0

Exceeds WQS. Not a violation under BMP regulations.

Not required to sample

APPENDIX 2: REFRENCES

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/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