

2006 Large Ship Wastewater Continued Compliance Samples for Continuous Discharge Certification by the United States Coast Guard

U.S. Congress enacted Title XIV – Certain Alaskan Cruise Ship Operations on December 21, 2000. Under this federal legislation, large¹ cruise ships may discharge blackwater² and graywater³ in Alaska while underway.⁴ The state law sets standards and sampling requirements for the underway discharge of blackwater in Alaska that are identical to the blackwater standards in the federal law (Table 1). Because of the high fecal coliform counts detected in graywater during 2000, the state law also set graywater standards (Table 1). During an underway discharge, blackwater effluent must contain no more than 200 fecal coliform per 100 ml and no more than 150 mg/l total suspended solids. There are currently no federal effluent standards for underway graywater discharges.⁵ Ships that discharge blackwater in Alaska while underway must take at least two blackwater samples per cruise ship season to fulfill federal requirements. Alaska state law requires ships to take two samples of both blackwater and graywater.

The federal law also allows continuous discharge of blackwater and graywater that meet more stringent standards also listed in Table 1. Ship owner/operators have installed advanced wastewater treatment systems on their vessels to meet the more stringent standards. A ship owner/operator must submit to the U.S. Coast Guard (USCG) and the Alaska Department of Environmental Conservation (ADEC) five sample results taken within 30 consecutive days that meets the more stringent requirements. The USCG and ADEC evaluate the data submitted. If the conditions are met, the USCG issues a continuous discharge approval letter, which allows ships to discharge continuously including times when the ship is at anchor. A ship approved by the U.S. Coast Guard to discharge continuously must sample their wastewater twice per month to maintain this approval.

Table 1. Comparison of Federal and Alaska standards

		Law	
		State	Federal
UNDERWAY	No. of Overnight Passengers	50+	500+
		Blackwater & Graywater	Blackwater only
		Standards	
	Fecal Coliform Bacteria (FC/100ml)	Geometric Mean of 200	200
	Total Suspended Solids (mg/L)	150	150
CONTINUOUS DISCHARGE		Blackwater & Graywater	Blackwater only
		Standards	
	Fecal Coliform Bacteria (FC/100ml)	Refers to Federal Law	Geometric Mean of 20
	Total Suspended Solids (mg/L)		30
Chlorine (mg/L)	10		

* Chlorine limits were corrected to 10 ug/L in federal regulations

The ADEC's *Assessment of Cruise Ship and Ferry Wastewater Impacts in Alaska* (January 2004), located on the State website at http://www.state.ak.us/dec/water/cruise_ships/assessreport04.htm, Section 6 contains detailed information on the advanced systems that treat wastewater discharged into Alaska water. There are four main systems installed on large cruise ships operating in Alaska waters. Table 2 compares the calculated medians⁶ from the continued compliance sampling results of each advanced wastewater treatment system.

¹ 500+ overnight passengers

² wastewater from toilets

³ wastewater from galley, sinks and showers and laundry.

⁴ Traveling at least 6 knots while at least 1 nautical mile from shore.

⁵ The Administrator of the EPA may promulgate different wastewater effluent standards in the future. EPA recently began the process of evaluating whether the current federal standards are consistent with Alaska Water Quality Standards.

⁶ The median is the middle of a distribution: half the scores are above the median and half are below the median. The median is less sensitive to extreme scores than an average and is thus a better measure for skewed distributions.

Table 2. Comparison of Advanced Treatment System Medians⁷

Number of Samples =	pH	BOD5	TSS	Fecal Coliform	Total Chlorine Residual	Free Chlorine Residual
Treatment (number of samples)		mg/L	mg/L	FC/100 ml	mg/L	mg/L
Biopure/Marisan (5)	6.69	11.2	20	0	0	0
Scanship (35)	6.6	6.87	5	0	0	0
Rochem (38)	7.5	8.91	0	0	0	0
Hamworthy (67)	7.45	0	0	0	0	0
Zenon (58)	7.62	0	0	0	0	0

The following tables include all the 2006 continuous compliance sampling results. Continuous discharge sample results highlighted in yellow indicate that the parameter exceeded the continuous discharge limits. Ships that had an exceedance stopped discharging continuously when they received the sampling results and submitted corrective actions with additional sampling results to the USCG and ADEC that showed the problem corrected. For more specific information refer to Compliance and Enforcement Report.

Table 3. Biopure/Marisan System's 2006 Continuous Discharge Sample Results

Vessel	Sample Date	pH	Biochemical Oxygen Demand	Total Suspended Solids	Fecal Coliform Bacteria	Chlorine, Residual	Chlorine, Free
Silver Shadow	6/24/2006	6.69	19.7	55	0	0	0
Silver Shadow	7/15/2006	6.5	11.3	22	0	0	0
Silver Shadow	8/4/2006	6.28	6.93	20	0	0	0
Silver Shadow	8/14/2006	6.87	11.2	19	0	0	0
Silver Shadow	9/8/2006	6.92	5.5	20	0	0	0
	MIN	6.28	5.5	19	0	0	0
	MAX	6.92	19.7	55	0	0	0
	MEDIAN	6.69	11.2	20	0	0	0

0= No detection

⁷ Since 2000, ADEC has collected substantial amounts of wastewater sampling data on cruise ships and ferries subject to the Commercial Passenger Vessel Environmental Compliance Program. In order to characterize the central tendency of the large quantity of data, the median was used. The median is the middle of a distribution: half the scores are above the median and half are below the median. The median is less sensitive to extreme scores than an average and is thus a better measure for skewed distributions.

Table 4. Scanship System's 2006 Continuous Discharge Sample Results

VESSEL	Sample Date	pH	Biochemical Oxygen Demand	Total Suspended Solids	Fecal Coliform Bacteria	Chlorine, Residual	Chlorine, Free
		SU	mg/L	mg/L	FC/100 ml	mg/L	mg/L
Norweigian Star	5/9/06	7.13	2.48	0	0	0	0
Norweigian Star	5/14/06	6.6	18	5	0	0	0
Norweigian Star	5/28/06	6.5	6	2	0	0	0
Norweigian Star	6/4/06	6.5	0	0	0	0	0
Norweigian Star	6/20/06	7.28	0	0	0	0	0
Norweigian Star	7/2/06	6.6	5	2	0	0	0
Norweigian Star	7/18/06	7.49	3.37	4	0	0	0
Norweigian Star	8/1/06	7.49	0	4	0	0	0
Norweigian Star	8/6/06	6.6	0	0	0	0	0
Norweigian Star	9/3/06	6.6	4	2	0	0	0
Norweigian Star	9/5/06	7.27	0	0	0	0	0
Norweigian Sun	5/16/06	6.71	26.4	5	0	0.15	0
Norweigian Sun	5/20/06	6.5	28	8	0	0	0
Norweigian Sun	6/3/06	6.4	16	4	0	0	0
Norweigian Sun	6/13/06	6.7	6.87	0	0	0	0
Norweigian Sun	7/1/06	6.5	16	5	11	0	0
Norweigian Sun	7/18/06	7.49	3.37	4	0	0	0
Norweigian Sun	8/5/06	6.5	11	6	0	0	0
Norweigian Sun	8/22/06	6.99	13.7	4	2	0.12	0
Norweigian Sun	9/2/06	6.4	6	4	0	0	0
Norweigian Sun	9/12/06	6.87	10.8	6	0	0	0
Norweigian Wind	6/28/06	7.16	20.5	7	0	0	0
Norweigian Wind	7/12/06	6.71	15.3	11	18	0	0
Norweigian Wind	7/26/06	6.97	8.8	8	0	0	0
Norweigian Wind	8/16/06	6.6	9.47	5	0	0	0
Norweigian Wind	9/6/07	6.77	5.94	0	0	0	0
Norweigian Wind	9/13/06	6.56	6.34	15	0	0	0
Serenade of the Seas	5/10/06	6.34	245	1870	17000	0.47	0.18
Serenade of the Seas	5/28/06	6.31	30	10	0	0	0
Serenade of the Seas	6/4/06	6.09	15	6	0	0	0
Serenade of the Seas	6/11/06	6.08	19	18	0	0	0
Serenade of the Seas	6/22/06	6.95	4.64	16	0	0	0
Serenade of the Seas	7/9/06	6.01	12	8	0	0	0
Serenade of the Seas	7/16/06	6.12	0	4	0	0	0
Serenade of the Seas	7/13/06	7.08	6.12	6	0	0	0
	Minimum	6.01	0.00	0	0	0.00	0.00
	Maximum	7.49	245.00	1870	17000	0.47	0.18
	Median	6.60	6.87	5	0	0.00	0.00

0= No detection

Table 5. Rochem System's 2006 Continuous Discharge Sample Results

VESSEL	Sample Date	pH	Biochemical Oxygen Demand	Total Suspended Solids	Fecal Coliform Bacteria	Chlorine, Residual	Chlorine, Free
		SU	mg/L	mg/L	FC/100 ml	mg/L	mg/L
Carnival Spirit	5/12/06	6.86	11.10	0	0	0.0	0.0
Carnival Spirit	5/20/06	6.98	9.78	0	0	0.0	0.0
Carnival Spirit	6/10/06	7.59	10.50	0	0	0.0	0.0
Carnival Spirit	6/24/06	7.39	7.41	0	0	0.0	0.0
Carnival Spirit	7/15/2006	6.84	8.9	0	0	0.0	0.0
Carnival Spirit	7/31/06	7.04	6.50	0	0	0.0	0.0
Carnival Spirit	8/12/06	7.07	9.89	0	0	0.0	0.0
Carnival Spirit	8/26/06	8.38	7.47	0	0	0.0	0.0
Mercury	5/19/06	6.90	5.00	2	0	0.1	0.1
Mercury	5/26/06	7.60	6.00	2	0	0.1	0.1
Mercury	6/2/06	7.00	5.00	3	0	0.1	0.1
Mercury	6/9/06	7.00	5.00	2	0	0.1	0.1
Mercury	7/7/06	7.20	5.00	2	0	0.0	0.0
Mercury	7/14/06	6.90	5.00	2	0	0.0	0.0
Mercury	8/11/06	6.10	7.00	0	0	0.0	0.0
Mercury	8/18/06	6.50	0.00	0	0	0.0	0.0
Oosterdam	6/26/06	7.56	13.00	0	0	0.0	0.0
Oosterdam	7/1/06	7.20	7.00	2	0	0.0	0.0
Oosterdam	7/17/06	7.68	4.81	0	2	0.0	0.0
Oosterdam	7/24/06	7.49	15.50	4	0	0.0	0.0
Oosterdam	7/31/06	7.64	19.80	0	0	0.0	0.0
Oosterdam	8/5/06	7.30	6.00	5	0	0.0	0.0
Oosterdam	8/7/06	7.78	6.66	6	16	0.0	0.0
Oosterdam	9/2/06	7.40	4.00	6	17	0.0	0.0
Oosterdam	9/4/06	7.99	19.60	0	0	0.0	0.0
Oosterdam	9/11/06	7.73	8.91	0	38	0.0	0.0
Westerdam	6/21/06	7.79	19.20	6	0	0.0	0.0
Westerdam	6/28/06	7.66	24.40	0	0	0.0	0.0
Westerdam	7/2/06	7.50	8.00	2	2	0.0	0.0
Westerdam	7/5/06	7.80	11.40	5	1	0.0	0.0
Westerdam	7/12/06	8.06	11.70	4	0	0.0	0.0
Westerdam	7/26/06	7.89	20.60	0	0	0.0	0.0
Westerdam	8/2/06	7.82	18.60	0	0	0.0	0.0
Westerdam	8/6/06	7.60	12.00	2	0	0.0	0.0
Westerdam	8/9/06	7.81	20.50	0	0	0.0	0.0
Westerdam	8/16/06	7.39	23.40	6	0	0.0	0.0
Westerdam	9/3/06	7.50	7.00	2	4	0.0	0.0
Westerdam	9/6/06	8.03	21.30	0	0	0.0	0.0
Minimum		6.10	0.00	0	0	0.0	0.0
Maximum		8.38	24.40	6	38	0.1	0.1
Median		7.50	8.91	0	0	0.0	0.0

0= No detection

Table 6. Hamworthy System's 2006 Continuous Discharge Sample Results

Vessel	Sample Date	pH	Biochemical Oxygen Demand	Total Suspended Solids	Fecal Coliform Bacteria	Chlorine, Residual	Chlorine, Free
	Units		mg/L	mg/L	FC/100 ml	mg/L	mg/L
Coral Princess	5/18/06	7.3	0	0	0	0	0
Coral Princess	5/25/06	7.72	2.58	0	0	0	0
Coral Princess	6/2/06	7.87	0	0	0	0	0
Coral Princess	7/6/06	7.83	0	0	0	0	0
Coral Princess	7/14/06	7.56	0	0	0	0	0
Coral Princess	8/3/06	7.68	0	0	0	0.11	0
Coral Princess	8/11/06	7.44	0	0	0	0	0
Coral Princess	9/8/06	8.03	19.3	0	0	0	0
Coral Princess	9/14/06	7.83	6.92	0	0	0	0
Dawn Princess	5/13/06	7	7	2	17	0	0
Dawn Princess	5/22/06	7.38	0	13	2	0	0
Dawn Princess	6/3/06	6.7	0	2	0	0	0
Dawn Princess	6/12/06	7.22	2.25	5	0	0	0
Dawn Princess	7/1/06	6	0	0	23	0	0
Dawn Princess	7/10/06	6.87	5.65	0	0	0	0
Dawn Princess	8/5/06	6.8	9	6	0	0	0
Dawn Princess	8/14/06	7.5	0	12	0	0	0
Dawn Princess	9/2/06	6.5	5	0	0	0	0
Dawn Princess	9/11/06	6.92	0	6	18	0	0
Diamond Princess	5/16/06	7.97	12	0	0	0	0
Diamond Princess	6/7/06	7.13	0	0	16	0	0
Diamond Princess	6/21/06	7.84	0	0	0	0	0
Diamond Princess	7/5/06	7.49	0	0	0	0	0
Diamond Princess	7/11/06	7.85	0	0	0	0	0
Diamond Princess	8/8/06	7.64	0	5	0	0	0
Diamond Princess	9/5/06	8.02	0	0	0	0	0
Diamond Princess	9/13/06	7.72	0	0	0	0	0
Island Princess	5/6/06	7	0	0	0	0	0
Island Princess	5/18/06	7.3	0	6	0	0	0
Island Princess	6/1/06	7.22	0	6	0	0	0
Island Princess	6/9/06	7.43	0	0	0	0	0
Island Princess	7/7/06	6.86	0	0	0	0	0
Island Princess	7/13/06	7.58	2.45	5	0	0	0
Island Princess	8/4/06	7.45	3.19	0	2	0	0
Island Princess	8/10/06	7.39	5.69	8	120	0	0
Island Princess	9/1/06	7.36	2.44	5	0	0	0
Island Princess	9/7/06	7.87	0	5	0	0	0
Island Princess	9/15/06	7.41	0	9	6	0	0
Regal Princess	5/19/06	6.7	14	0	23	0	0
Regal Princess	5/24/06	6.2	0	0	0	0	0
Regal Princess	6/1/06	7.12	3.67	0	104	0	0
Regal Princess	6/5/06	6.6	0	0	4	0	0
Regal Princess	6/18/06	6.66	4.17	0	0	0.14	0
Regal Princess	7/9/06	7.66	9.87	0	0	0	0
Regal Princess	7/29/06	7.31	3.67	0	0	0	0
Regal Princess	8/9/06	7.49	4.15	0	0	0.14	0
Regal Princess	8/18/06	7.17	0	0	0	0	0
Regal Princess	9/7/06	7.74	4.41	0	0	0	0
Regal Princess	9/17/06	7.49	13.3	0	2	0	0
Sapphire Princess	5/23/06	7.94	0	0	2	0	0
Sapphire Princess	6/6/06	7.99	11.5	0	0	0	0
Sapphire Princess	6/14/06	8	4.41	0	0	0	0
Sapphire Princess	7/4/06	8.02	3.1	0	0	0	0
Sapphire Princess	7/12/06	7.92	2.03	4	0	0	0
Sapphire Princess	8/1/06	7.96	3.63	0	0	0	0
Sapphire Princess	8/9/06	8.07	38.1	0	60	0	0
Sapphire Princess	8/23/06	7.89	0	0	0	0	0
Sapphire Princess	9/6/06	7.53	0	0	0	0	0
Sapphire Princess	9/12/06	7.64	0	0	0	0	0
Sun Princess	5/14/06	7.1	34	4	0	0	0
Sun Princess	5/31/06	7.18	0	0	0	0	0
Sun Princess	6/4/06	6.9	0	0	0	0	0
Sun Princess	6/14/06	7.66	0	0	0	0	0
Sun Princess	7/2/06	7.3	3	0	0	0	0
Sun Princess	7/12/06	7.91	3.48	0	0	0	0
Sun Princess	8/6/06	7.1	9	2	0	0	0
Sun Princess	9/3/06	7.3	0	0	4	0	0
	MIN	6	0	0	0	0	0
	MAX	8.07	38.1	13	120	0.14	0
	MEDIAN	7.45	0	0	0	0	0
0= No detection							

Table 7. Zenon System's 2006 Continuous Discharge Sample Results

Vessel	Sample Date	pH	Biochemical Oxygen Demand	Total Suspended Solids	Fecal Coliform Bacteria	Chlorine, Residual	Chlorine, Free
		SU	mg/L	mg/L	FC/100 ml	mg/L	mg/L
Infinity	5/10/06	6.82	300.00	0	0	0.0	0.0
Infinity	5/30/06	7.60	0.00	0	12	0.0	0.0
Infinity	6/4/06	6.73	0.00	0	0	0.0	0.0
Infinity	6/11/06	6.79	0.00	0	18	0.0	0.0
Infinity	7/9/06	6.79	14.00	0	0	0.0	0.0
Infinity	7/23/06	6.42	0.00	0	0	0.0	0.0
Infinity	8/13/06	7.04	0.00	0	0	0.0	0.0
Infinity	8/20/06	6.22	0.00	0	0	0.0	0.0
Ryndam	5/9/06	7.73	0.00	0	0	0.0	0.0
Ryndam	5/16/06	7.86	0.00	0	0	0.0	0.0
Ryndam	6/7/06	7.40	0.00	0	0	0.0	0.0
Ryndam	6/15/06	7.76	0.00	0	0	0.0	0.0
Ryndam	7/5/06	7.99	5.29	0	0	0.0	0.0
Ryndam	7/19/06	7.63	6.01	0	0	0.0	0.0
Ryndam	8/10/06	7.75	0.00	0	0	0.0	0.0
Ryndam	8/24/06	7.91	0.00	0	0	0.0	0.0
Ryndam	9/7/06	8.18	0.00	0	0	0.0	0.0
Ryndam	9/19/06	8.25	0.00	0	0	0.0	0.0
Statendam	5/23/06	7.80	12.80	0	0	0.0	0.0
Statendam	6/6/06	7.75	0.00	0	0	0.0	0.0
Statendam	6/27/06	7.82	0.00	0	0	0.0	0.0
Statendam	7/18/06	8.05	0.00	0	0	0.0	0.0
Statendam	8/8/06	7.59	0.00	0	0	0.0	0.0
Statendam	8/22/06	7.57	21.60	9	0	0.0	0.0
Statendam	9/5/06	8.02	0.00	4	0	0.0	0.0
Statendam	9/11/06	7.33	2.46	0	0	0.0	0.0
Veendam	5/12/06	7.60	8.00	2	0	0.0	0.0
Veendam	5/17/06	7.47	2.65	0	0	0.0	0.0
Veendam	5/31/06	7.57	2.75	0	0	0.0	0.0
Veendam	6/8/06	7.56	3.13	12	0	0.0	0.0
Veendam	6/22/06	7.75	2.57	0	0	0.0	0.0
Veendam	7/12/06	8.19	9.90	0	0	0.0	0.0
Veendam	7/20/06	7.67	0.00	0	0	0.0	0.0
Veendam	8/17/06	7.69	0.00	0	0	0.0	0.0
Veendam	8/31/06	7.91	0.00	0	0	0.0	0.0
Veendam	9/14/06	7.83	6.36	0	0	0.0	0.0
Veendam	9/21/06	7.41	0.00	0	0	0.0	0.0
Veendam	9/25/06	7.40	8.00	5	0	0.0	0.0
Volendam	5/12/06	7.67	4.92	0	0	0.0	0.0
Volendam	5/26/06	7.86	0.00	0	0	0.0	0.0
Volendam	6/2/06	8.16	0.00	0	0	0.0	0.0
Volendam	6/23/06	7.65	0.00	0	0	0.0	0.0
Volendam	7/7/06	7.59	0.00	0	0	0.0	0.0
Volendam	7/14/06	7.33	3.66	0	0	0.0	0.0
Volendam	8/11/06	7.69	0.00	4	0	0.0	0.0
Volendam	8/18/06	8.24	0.00	0	0	0.0	0.0
Volendam	9/15/06	7.45	6.82	0	0	0.0	0.0
Volendam	9/22/06	7.77	0.00	0	0	0.0	0.0
Zaandam	5/5/06	7.40	5.00	4	0	0.0	0.0
Zaandam	5/28/06	7.35	0.00	0	0	0.0	0.0
Zaandam	6/2/06	7.40	0.00	10	0	0.0	0.0
Zaandam	6/11/06	7.76	8.08	0	0	0.0	0.0
Zaandam	7/7/06	7.40	5.00	10	0	0.0	0.0
Zaandam	7/30/06	7.56	7.43	0	0	0.0	0.0
Zaandam	8/4/06	7.10	0.00	0	0	0.0	0.0
Zaandam	8/13/06	7.73	14.40	0	0	0.0	0.0
Zaandam	9/1/06	7.00	8.00	0	0	0.0	0.0
Zaandam	9/17/06	7.46	6.71	0	0	0.0	0.0
Minimum		6.22	0.00	0	0	0.00	0.00
Maximum		8.25	300.00	12	18	0.00	0.00
Median		7.62	0.00	0	0	0.00	0.00

0= No detection