2007 Large Cruise Ship Unannounced Sampling Results (2 samples per season)

Federal and State Laws

U.S. Congress enacted Title XIV – Certain Alaskan Cruise Ship Operations on December 21, 2000. Under this federal legislation, large[1] cruise ships may discharge blackwater[2] in Alaska marine waters while underway[3] or continuously[4] while meeting effluent standards. Federal law states that during an underway discharge, blackwater effluent must contain no more than 200 fecal coliform bacteria per 100 milliliters and no more than 150 milligrams per liter of total suspended solids. Large ships must meet more stringent standards to discharge continuously.

Alaska Statute AS 46.03.460-46.03.490 establishes the same standards for blackwater as the federal law and includes graywater[5] discharges. Large ships that discharge blackwater, graywater or other wastewater in Alaska are subject to two unannounced sampling events each season to demonstrate compliance with state and federal standards. Large ships certified by the United States Coast Guard (USCG) to discharge continuously must sample twice per month to maintain their certification. Please refer to the "2007 Large Ship Wastewater Continued Compliance Samples" report for more information on continuous compliance samples.

Of the thirty large ships that visited Alaska in 2007, 17 discharged into Alaska waters and were subject to the unannounced sampling requirements. The other 13 discharged outside Alaska waters. All ships discharging in Alaska waters had continuous discharge approval from the USCG, except for Seven Seas Mariner who discharged outside 1 nautical mile from shore traveling greater than six knots.

Tables 1 through 4 provide a summary of the two unannounced sampling results for all large ships for the 2007 season. The samples from one sampling event were analyzed for Conventional Pollutants only and a second set of samples included analyses for Conventional and Priority Pollutants. Table 5 provides a list of analyses included in Conventional and Priority Pollutant test suites.

In 2006 Alaska voters passed Ballot Measure 2, which included language requiring a general permit for large cruise ship wastewater discharge that set limits at Alaska Water Quality standards at the point of discharge. In 2007 large cruise ships operated under Compliance Order by Consent (COBC) that allowed discharge under previous federal and state legislation until an Alaska General Permit was released. Some large ships wastewater discharges have ammonia, dissolved copper, dissolved nickel and dissolved zinc results that exceed Alaska water quality standards. These four pollutants are addressed in the General Permit issued for cruise ships in March 2008.

Table 1. Summary 2007 Large Ship Unannounced Sampling Results, Excluding Priority Pollutants (17 ships, 35 samples)

	Ammonia as N	pH	Biochemical O_2 Demand	Chemical O_2 Demand	Total Suspended Solids	Chlorine, Free	Chlorine, Residual	Fecal Coliform Bacteria by MPN
Alaska Water Quality Standards	2.9[6]	6.5-8.5	N/A	N/A	N/A	0.0075	N/A	14[7]
Units	mg/l	s.u.	mg/l	mg/l	mg/l	mg/l	mg/l	MPN/100ml
Minimum	0.52	6.3	0	0	0	0	0	0
Maximum	100	8	28.6	120	224	0.16	0.13	20
Median	35	7.71	2.21	55.5	0	0	0	0

[1] 500+ overnight passengers
[2] Wastewater from toilets
[3] Traveling at a minimum speed of six knots and at least one nautical mile from shore.
[4] Traveling at less than six knots and within one nautical mile from shore.
[5] Wastewater from galley, sinks and showers and laundry.
[6] Ammonia standards are based on temperature, pH and salinity. This standard is from Table IX in the *Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances.*
[7] Standard used for consumption of raw shellfish.

Table 2. Summary 2007 Large Ship Unannounced Sampling Results, Excluding Priority Pollutants (17 ships, 35 samples)

	Conductivity	Oil & Grease	Total Organic Carbon	Alkalinity	Total Nitrate	Phosphorus, Total	Total Kjeldahl Nitrogen	Total Settleable Solids
Alaska Water Quality Standards	N/A	N/A	N/A	N/A	N/A	N/A	N/A	SS[8]
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Minimum	229	0	9.9	0	0	0.079	7.44	0
Maximum	6520	6.3	170	448	63	17	100	0
Median	920	0	18	162	0	7.5	38.4	0

Table 3 includes the 2007 unannounced twice-per-season sampling results for Conventional Pollutants. Sample results highlighted in yellow indicate that the parameter exceeded the continuous discharge or underway limits. Sample results highlighted in blue indicate that the parameter exceeded Alaska's water quality standards.

One unannounced sample per season included testing for 167 priority pollutants: 13 total metals, 12 dissolved metals, 72 volatile organic compounds (VOC's), and 70 bases, neutral, acids (BNA's). Table 4 includes only pollutants with sample medians that exceeded the reportable limit (PQL) or a pollutant with a sample maximum that was 10 times the PQL.A list of all the priority pollutants that were analyzed and the associated PQL can be found in Table 5. The pollutants not listed in Table 4 are considered not detected and the statistical analysis of those pollutants is unnecessary. Sample results highlighted in blue indicate that the parameter exceeded Alaska's water quality standards.

It should be noted that some of the dissolved metal totals are higher than the total recoverable metals, which is not what is expected. This issue has also been observed in past season's sample results, and ADEC is looking into reasons for these discrepancies. One reason for the discrepancies could be explained through comparison of the range of acceptability for each test method, which is +/- 10% of the actual result. A situation where dissolved metal totals are higher than total metals could be attributed to a dissolved metal result at the top of the variance and total metal result at the end of the variance. Since the allowable variance can be as much as 20% there can be a significant difference in the results for dissolved and total metals.

[8] Alaska Water Quality Standards definition- No measurable increase in the concentration of settleable solids above natural conditions, as measured by the volumetric Imhoff cone method.

Table 3. 2007 Large Ships Unannounced Sampling Results for Conventional Pollutants

Vessel	Sample Date	Ammonia as N	pH	Biochemical O^2 Demand	Chemical O^2 Demand	Total Suspended Solids	Free Chlorine	Residual Chlorine	Fecal Coliform Bacteria by MPN	Conductivity	Hexane Extractable Material	Total Organic Carbon	Alkalinity	Total Nitrate	Total Phosphorus	Total Kjedahl Nitrogen	Total Settable Solids
	Detection Limit	0.10	0.10	2.00	10.00	4.00	0.10	0.10	2.00	2.00	5.00	1.00	2.00	1.00	0.05	1.00	
	Units	mg/l	s.u.	mg/l	mg/l	mg/l	mg/l	mg/l	MPN/100 ml	umhos/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Alaska Water Quality Standards		2.9	6.5-8.5	None	None	None	0.0075	None	14	None	None	None	None	None	None	None	None
Noordam	8/8/07	54	7.74	2.21	59	2	ND	ND	ND	883	ND	39	250	ND	11	51	ND
Noordam	8/17/07	43	7.81	28	74	1	ND	ND	ND	1170	ND	19	78	ND	4.7	41	ND
Ryndam	5/16/07	6.8	7.39	ND	44	ND	ND	ND	ND	1670	ND	11	127	45	7.1	7.44	ND
Ryndam	8/31/07	13	7.77	ND	25	16	ND	ND	ND	929	ND	35	51	21	7.5	13	ND
Statendam	6/14/07	26	7.75	7.68	61	ND	ND	ND	ND	631	ND	18	190	ND	3.1	27.9	ND
Statendam	8/2/07	32	7.82	6.54	68	ND	ND	ND	8	709	ND	23	212	ND	0.2	32.7	ND
Volendam	7/10/07	34	7.76	ND	ND	ND	ND	ND	ND	NA	ND	15	NA	ND	5.5	33.9	ND
Volendam	7/31/07	23	7.85	ND	48	ND	ND	ND	ND	1070	ND	17	448	ND	6.5	24.1	ND
Zaandam	6/1/07	19	7.66	ND	51	ND	ND	ND	ND	669	ND	14	229	ND	2.1	19.3	ND
Zaandam	7/27/07	20	8	ND	34	ND	ND	ND	ND	746	ND	14	255	ND	0.65	20.1	ND
Zaandam	9/21/07	0.52	7.6	ND	40	2	ND	ND	ND	930	ND	170	190	ND	0.27	45	ND
Norwegian Sun	5/16/07	34	6.93	6.37	53	4	ND	ND	ND	1030	ND	15	106	35	0.13	38.4	ND

Vessel	Sample Date	Ammonia as N	pH	Biochemical O^2 Demand	Chemical O^2 Demand	Total Suspended Solids	Free Chlorine	Residual Chlorine	Fecal Coliform Bacteria by MPN	Conductivivty	Hexane Extractable Material	Total Organic Carbon	Alkalinity	Total Nitrate	Total Phosphorus	Total Kjedahl Nitrogen	Total Settable Solids
	Detection Limit	0.10	0.10	2.00	10.00	4.00	0.10	0.10	2.00	2.00	5.00	1.00	2.00	1.00	0.05	1.00	
	Units	mg/l	s.u.	mg/l	mg/l	mg/l	mg/l	mg/l	MPN/100 ml	umhos/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Alaska Water Quality Standards		2.9	6.5-8.5	None	None	None	0.0075	None	14**	None	None	None	None	None	None	None	None
Norwegian Sun	8/2/07	46	7.27	6.44	50	ND	ND	ND	ND	991	ND	16	114	ND	0.18	45.5	ND
Norwegian Pearl	6/5/07	20	6.98	14	74	ND	ND	ND	ND	793	ND	23	101	ND	0.079	21.7	ND
Norwegian Pearl	7/17/07	38	6.53	19.4	79	13	0.16	ND	ND	850	ND	26	123	ND	0.38	31.9	ND
Norwegian Star	6/5/07	17	7.17	10.6	49	6	ND	ND	ND	615	ND	13	76.6	18.2	0.17	18.2	ND
Norwegian Star	7/17/07	27	6.85	2.43	34	ND	ND	ND	ND	716	ND	9.9	80.7	ND	0.083	23.7	ND
Coral Princess	6/15/07	73	7.73	ND	71	ND	ND	ND	4	1100	ND	23	397	ND	14	72.7	ND
Coral Princess	7/27/07	46	7.71	ND	76	ND	ND	0.13	ND	1120	ND	26	201	7.6	13	44.7	ND
Dawn Princess	6/5/07	44	7.79	ND	56	ND	ND	ND	20	1920	ND	16	271	ND	12	43.6	ND
Dawn Princess	7/13/07	76	7.54	2.49	55	ND	ND	ND	ND	1010	6.3	17	314	ND	10	69.1	ND
Diamond Princess	5/23/07	35	7.86	ND	36	ND	ND	ND	ND	881	ND	19	147	6.1	10	36.7	ND
Diamond Princess	7/31/07	41	7.66	ND	38	ND	ND	ND	6	850	ND	14	161	16	7.3	40.8	ND
Golden Princess	6/4/07	24	6.99	8.31	63	6	ND	ND	ND	6520	ND	10	36.8	44	10	20.2	ND

ND means not detected

* Ammonia standards are based on temperature, pH and salinity. This standard is from Table IX in the *Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances* using a ph 7.8, salinity of 20 g/kg and temperature between 10-15 degrees Celsius

** Standard used for the consumption of raw shellfish.

*** Alaska Water Quality Standards definition- No measurable increase in the concentration of settleable solids above natural conditions, as measured by the volumetric Imhoff cone method.

Table 3 continued

Vessel	Sample Date	Ammonia as N	pH	Biochemical O^2 Demand	Chemical O^2 Demand	Total Suspended Solids	Free Chlorine	Residual Chlorine	Fecal Coliform Bacteria by MPN	Conductivivty	Hexane Extractable Material	Total Organic Carbon	Alkalinity	Total Nitrate	Total Phosphorus	Total Kjedahl Nitrogen	Total Settable Solids
	Detection Limit	0.10	0.10	2.00	10.00	4.00	0.10	0.10	2.00	2.00	5.00	1.00	2.00	1.00	0.05	1.00	
	Units	mg/l	s.u.	mg/l	mg/l	mg/l	mg/l	mg/l	MPN/100 ml	umhos/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Alaska Water Quality Standards		2.9	6.5-8.5	None	None	None	0.0075	None	14**	None	None	None	None	None	None	None	None
Golden Princess	7/31/07	34	6.3	5.47	46	ND	ND	ND	ND	3030	ND	12	9.44	63	9.7	25.8	ND
Island Princess	5/31/07	48	7.83	ND	68	ND	ND	ND	ND	911	ND	18	221	13	10	46.7	ND
Island Princess	8/27/07	72	7.7	ND	63	6	ND	ND	ND	1080	ND	44	64	1.2	9.9	73	ND
Pacific Princess	7/7/07	44	7.94	5.75	ND	ND	ND	0.11	ND	873	ND	26	207	ND	16	44.9	ND
Pacific Princess	8/18/07	48	8	5.22	87	ND	ND	ND	ND	865	ND	30	36	2.9	15	50	ND
Sapphire Princess	5/30/07	66	7.83	ND	60	ND	ND	ND	ND	996	ND	17	300	ND	10	65.3	ND
Sapphire Princess	7/31/07	56	7.58	ND	55	ND	ND	ND	ND	883	ND	20	201	16	9.8	55.7	ND
Sun Princess	5/30/07	75	7.83	ND	84	ND	ND	ND	ND	1560	ND	23	354	ND	9.7	77.5	ND
Sun Princess	8/22/07	100	7.97	17.9	120	224	ND	ND	ND	2500	ND	110	80	ND	9.4	100	ND
Seven Seas Mariner	6/11/07	14	7.2	28.6	99	ND	ND	ND	ND	229	ND	34	ND	ND	17	15.5	ND
Seven Seas Mariner	7/22/07	21	7.14	2.81	37	ND	ND	ND	ND	559	ND	18	163	ND	5.6	19.3	ND

ND means not detected

*Ammonia standards are based on temperature, pH and salinity. This standard is from Table IX in the *Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances* using a ph 7.8, salinity of 20 g/kg and temperature between 10-15 degrees Celsius

** Standard used for the consumption of raw shellfish

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Table 4. 2007 Large Ships Unannounced Sampling Results for Priority Pollutant

Vessel	Date	Acetone	chromium (TR)	Chromium dissolved	copper (TR)	Copper dissolved	nickel (TR)	Nickel dissolved	selenium (TR)	Selenium dissolved	zinc (TR)	Zinc dissolved
	PQL	50.0	2.5	2.5	1.0	1.0	1.0	1.0	2.5	2.5	2.5	2.5
	Units	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Alaska Water Quality Standards		N/A	N/A	50.00	N/A	3.10	N/A	8.20	N/A	71.00	N/A	81.00
Noordam	8/17/07	20	0	4.3	1.6	2.7	9.7	10	0	0	14	16
Ryndam	8/31/07	0	0	1.2	13	1.3	14	14	1.9	0	54	54
Statendam	8/29/07	13	0	0	4.8	6	17	18	0	0	0	14
Volendam	7/10/07	0	3.1	3.63	7.89	7.52	10.7	10.7	1.48	1.75	41	40.4
Zaandam	7/27/07	0	4.24	6.22	4.84	5.17	9.11	9.47	1.15	1.34	30.4	35.8
Zaandam	9/21/07	0	0	2.7	4.8	5	12	12	0	0	31	31
Norwegian Sun	5/16/07	11	1.7	1.25	4.24	2.93	8.9	8.83	0	0	88.2	90.3
Norwegian Pearl	7/17/07	117	5.95	3.87	38.3	11.2	3.35	3.29	1.52	1.47	46.9	49
Norwegian Star	7/17/07	16.1	4.25	2.33	2.14	1.72	7.57	7.97	1.53	2.27	48	47.8
Coral Princess	7/27/07	0	3.87	4.22	18.4	17.4	8.3	8.44	2.36	2.22	79.1	75.1
Dawn Princess	6/5/07	32	10.3	10.5	5.92	1.93	3.08	2.92	7.42	6.95	44.7	44.7
Diamond Princess	7/31/07	0	5.48	5.14	8.69	8.2	8.38	8.36	2.81	3.13	79.5	78.9
Golden Princess	6/4/07	0	3.73	3.69	17.8	18.4	7.6	8.41	8.03	9.81	138	142
Pacific Princess	8/18/07	25	0	3.5	43	41	16	15	0	0	62	60
Sapphire Princess	5/30/07	7.9	6.7	7.35	52.2	34.9	15.6	15	2.83	2.4	87.8	84.5
Sun Princess	8/22/07	20	0	4.1	4.9	6.6	9.4	7.6	0	0	35	33
Seven Seas Mariner	7/22/07	0	3.26	3.44	5.38	5.07	4.48	4.7	0	0	76.5	76.7

Conventional and Priority Pollutants Analyzed

Conventional Pollutants	**Method**	**Reportable Limit (PQL) mg/L**
Ammonia- Total	350.3	0.10
Biochemical Oxygen Demand	405.1	2.0
Chemical Oxygen Demand	410.4	10
Chlorine, residual	SM 4500	0.1
Chlorine, free	SM 4500	0.1
Alkalinity	SM 2320 B	2.0
Settable Solids	160.5	0.10 (ml/L)
Total Suspended Solids	160.2	4.0
Fecal Coliform	SM 9221E or SM 9222 D	2 (FC/100 ml)
Specific Conductance-Conductivity	120.1	2 (µmHos/cm)
Total Organic Carbon	SM 5310 B	1.0
Oil and Grease	1664	5.0
Total Kjeldahl Nitrogen	EPA various	1.0
Total Phosphorus	EPA 365.2	0.050
Priority Pollutants	**Method**	**Reportable Limit (PQL)**
Total Recoverable Metals		**Ug/l**
Antimony	200.8	2.5
Arsenic	200.8	2.5
Beryllium	200.8	1.0
Cadmium	200.8	1.0
Chromium	200.8	2.5
Copper	200.8	1.0
Lead	200.8	1.0
Mercury (Total)	245.1	1.0
Nickel	200.8	1.0
Selenium	200.8	2.5
Silver	200.8	1.0
Thallium	200.8	1.0
Zinc	200.8	2.5
Dissolved Metals		
Antimony	200.8	2.5
Arsenic	200.8	2.5
Beryllium	200.8	1.0
Cadmium	200.8	0.5

Chromium	200.8	2.5
Copper	200.8	1.0
Lead	200.8	1.0
Nickel	200.8	1.0
Selenium	200.8	2.5
Silver	200.8	1.0
Thallium	200.8	1.0
Zinc	200.8	2.5
VOCs		
1,1,1,2-Tetrachloroethane	624	2
1,1,1-Trichloroethane	624	2
1,1,2,2-Tetrachloroethane	624	2
1,1,2-Trichloroethane	624	2
1,1-Dichloroethane	624	2
1,1-Dichloroethene	624	2
1,1-Dichloropropene	624	2.5
1,2,3-Trichlorobenzene	624	2.8
1,2,3-Trichloropropane	624	2.5
1,2,4-Trichlorobenzene	624	2.8
1,2,4-Trimethylbenzene	624	2.7
1,2-Dibromo-3-Chloropropane	624	10
1,2-Dichlorobenzene	624	2
1,2-Dichloroethane	624	2
1,2-Dichloroethane	624	2
1,2-Dichloropropane	624	2
1,3,5-Trimethylbenzene	624	2
1,3-Dichlorobenzene	624	2
1,3-Dichloropropane	624	2
1,4-Dichlorobenzene	624	2
2,2-Dichloropropane	624	2
2-Butanone	624	50
2-Chloroethyl Vinyl Ether	624	10
2-Chlorotoluene	624	2.1
2-Hexanone	624	20
4-Chlorotoluene	624	2
4-Isopropyltoluene	624	2.8
4-Methyl-2-Pentanone	624	20
Acetone	624	50
Acrolein	624	100
Acrylonitrile	624	10

VOCs continued		
Benzene	624	2
Bromobenzene	624	2
Bromochloromethane	624	2
Bromodichloromethane	624	2
Bromoform	624	2
Bromomethane	624	5
Carbon Disulfide	624	2
Carbon Tetrachloride	624	2
Chlorobenzene	624	2
Chloroethane	624	5
Chloroform	624	2
Chloromethane	624	5
Cis-1,2-Dichloroethene	624	2
Cis-1,3-Dichloropropene	624	2.3
Dibromochloromethane	624	2
Dibromomethane	624	2
Dichlorodifluoromethane	624	5
Ethylbenzene	624	2
Hexachlorobutadiene	624	2
Iodomethane	624	5
Isopropylbenzene	624	2.6
m&p Xylenes	624	2
Methylene Chloride	624	5
Naphthalene	624	2.8
n-Butylbenzene	624	2.8
n-Propylbenzene	624	2
O-Xylene	624	2.3
sec-Butylbenzene	624	2.3
Styrene	624	2.6
tert-Butyl Methyl Ether	624	2
tert-Butylbenzene	624	3.0
Tetrachloroethene	624	2
Toluene	624	2
Trans 1,2-Dichloroethene	624	2
trans-1,3-Dichloropropene	624	2.1
trans-1,4-Dichloro-2 Buten	624	10
Trichloroethene	624	2
Trichlorofluoromethane	624	2
Trichlorotrifluoroethane	624	2

Vinyl Acetate	624	5
Vinyl Chloride	624	2
BNAs		
1,2,4-Trichlorobenzene	625	5
1,2-Dichlorobenzene	625	5
1,2-Diphenylhydrazine	625	5
1,3-Dichlorobenzene	625	5
1,4-Dichlorobenzene	625	5
2,4,5-Trichlorophenol	625	5
2,4,6-Trichlorophenol	625	5
2,4-Dichlorophenol	625	5
2,4-Dimethylphenol	625	25
2,4-Dinitrophenol	625	100
2,4-Dinitrotoluene	625	5
2,6-Dinitrotoluene	625	5
2-Chloronaphthalene	625	10
2-Chloronapthalene	625	10
2-Chlorophenol	625	5
2-Methylnaphthalene	625	5
2-Methylphenol	625	5
2-Nitroaniline	625	100
2-Nitrophenol	625	5
3&4-Methylphenol	625	5
3,3’-Dichlorobenzidine	625	20
3-Nitroaniline	625	50
4,6-Dinitro-2-methylphenol	625	25
4-Bromophenyl Phenyl ether	625	5
4-chloro-3-methylphenol	625	5
4-Chloroaniline	625	5
4-Chlorophenyl methylsulfone	625	20
4-Chlorophenyl Phenyl ether	625	5
4-Nitroaniline	625	50
4-Nitrophenol	625	100
Acenaphthene	625	5
Acenaphthylene	625	5
Anthracene	625	5
Benzidine	625	200
Benzo (A) Anthracene	625	5
Benzo (A) Pyrene	625	5
Benzo (B) Fluoranthene	625	5

BNAs continued		
Benzo (g,h,i) Perylene	625	5
Benzo (K) Fluoranthene	625	5
Benzoic Acid	625	130
Benzyl Alcohol	625	10
Bis (2-Chloroethoxy) methane	625	5
Bis (2-chloroethyl) ether	625	5
Bis (2-Chloroisopropyl) ether	625	5
Bis (2-Ethylhexyl) Phthalate	625	2.5
Butyl Benzyl Phthalate	625	5
Chrysene	625	5
Dibenzo (a,h) Anthracene	625	5
Dibenzofuran	625	5
Diethyl Phthalate	625	5
Dimethyl Phthalate	625	5
Di-N-Butyl Phthalate	625	5
Di-N-Octyl Phthalate	625	5
Fluoranthene	625	5
Fluorene	625	5
Hexachlorobenzene	625	5
Hexachlorobutadiene	625	5
Hexachlorocyclopentadiene	625	10
Hexachloroethane	625	5
Indeno (1,2,3-CD) Pyrene	625	5
Isophorone	625	5
Napthalene	625	10
Nitrobenzene	625	5
N-Nitrosodimethylamine	625	5
N-Nitrosodi-N-Propylamine	625	5
N-Nitrosodiphenylamine	625	10
Pentachlorophenol	625	5
Phenanthrene	625	5
Phenol	625	5
Pyrene	625	5