

2002 Wastewater Sampling and Analysis for Commercial Passenger Vessels

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Background

Due to concerns regarding the quality and quantity of commercial passenger ship wastewater discharged into Alaska marine waters and the potential effects of those discharges, environmentalists, government agencies, the cruise ship industry, and other stakeholders formed the Alaska Cruise Ship Initiative in 1999. In 2000, this work group began a voluntary sampling program to test the effluents of large cruise ships that discharge in Alaska waters. Large cruise ships are defined as ships that have overnight accommodations for 500 or more people.

In 2001, the Alaska legislature passed a law affecting commercial passenger ships operating in Alaska marine waters with overnight accommodations for 50 or more passengers. The law set fecal coliform and TSS effluent discharge limits for both gray and blackwater. It also allows the ADEC to perform necessary studies to determine if additional water quality limits are needed to protect human health and environment. Small ships are ships that have 50-249 overnight passengers. Large ships have more than 250 overnight passengers.

Commercial passenger ships produce two “types” of wastewater: blackwater and graywater. Blackwater is wastewater from ship’s toilets and medical facilities. Graywater is water produced from showers, sinks and laundry. Graywater comes from three main sources: (1) galley or kitchen areas, (2) passenger/crew accommodations, and (3) laundry facilities. Anytime blackwater and graywater are combined the resulting wastewater is technically called blackwater.

These ships have been sampled from 2000-2002. The Science Advisory Panel is a group of scientists that are researching impacts of wastewater discharges from ships. The Panel prepared a final white paper in December 2002. The white paper included Section II that deals with the wastewater sampling from commercial passenger vessels. The 2002 sampling results were not available during the drafting of this white paper so most of the small ship data and all of the large ship data were not included. The white paper stated that the Alaska Department of Environmental Conservation (DEC) would finish the 2002 sampling report when all the data was submitted to ADEC. This is that 2002 report.

For the tables, the ADEC, for statistical purposes, used one-half ($\frac{1}{2}$) the minimum detection limit (MDL) for results that are zeros or non-detection. The ADEC included tables for all pollutants with sample set geometric means¹ greater than the MDL or where at least one sample result was over 10 times the detection limit. If all sample of a particular priority pollutant were non-detects, they were excluded from the table. This was done for the sake of brevity.

¹ “Geometric mean” means the *n*th root of the product of a series of *n* numbers; eg. $(2 \times 9 \times 5)^{1/3} = 4.48$

SAMPLES

Pollutants Analyzed

Wastewater sampling and laboratory analysis, following approved laboratory methods, provides measurements of conventional and priority pollutants.

All ships discharging in Alaska water were required to sample twice a year for the following conventional pollutants.

- Total Suspended Solids (TSS)
- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Ammonia – Total
- Fecal Coliform
- pH
- Total and Free Residual Chlorine

In 2001, on the advice of the Science Advisory Panel, the conventional pollutants monitoring requirements were increased to include the following parameters as well.

- Settleable Solids (SS)
- Oil and Grease
- Total Organic Carbon
- Specific Conductance (to measure seawater influx)
- Alkalinity
- Total Nitrogen (Ammonia, Nitrate, Nitrite, and Total Kjeldahl Nitrogen (TKN))
- Total Phosphorus

One of the two required sampling events must sample wastewater for priority pollutants.

Priority pollutants include:

- Base/Neutrals, Acids
- PCBs
- Volatile Organic Chemicals (VOCs)
- Trace Metals (Total Recoverable and Dissolved)

There are 126 so-called “priority” pollutants on the EPA list². In 2000 and 2001, ships sampled for all 126 pollutants. Since many of the priority pollutants were not discovered in these wastewater samples, the ADEC and United States Coast Guard (USCG) shortened the list to 55 pollutants. However, the 55 pollutants on the USCG list have 110 chemical analytes.³

² The list used is from the *Compilation of the USEPA's Water Quality Criteria for the Priority Toxic Pollutants* By Katy McKerney Sept 1997

³ For example, the pollutant class PCB is actually comprised of seven PCBs.

Sampling Strategy

The number and types of samples taken depended on the individual ship configuration and the ability to get the samples to a laboratory for analysis within a 6-hour time frame. The sampling strategy changed from a voluntary initiative in 2000 to regulatory compliance in 2001 and 2002.

In 2002, the wastewater data from large ships reflects the increase in the number of large vessels that had installed advanced treatment technology, from two in 2001 to seven in 2002. Of the seven ships with advanced treatment, six met more stringent effluent standards⁴.

The wastewater sampling strategy from small ships in 2002 was similar to that of 2001. Small ships took their first priority pollutant data in 2002.

⁴ More stringent standards are 20 fecal colonies per 100 ml of sample and TSS of 15 mg/L compared with 200 and 150 comparatively. The more stringent standards also include a chlorine residual limit of 10 mg/l.

Large Ships

Voluntary sampling of large ships began in 2000. The federal government had legislation in place for the entire 2001 cruise season. The State of Alaska had legislation regulating wastewater discharges as of July 1, 2001. Large ships by Alaska law is defined as ships having 250 or more overnight passengers. Federal Law defines large ships as ships having 500 passengers or more.

Both laws require sampling twice per season on large ships that discharge wastewater within three miles of the Alaska coastline. Ships that discharge outside three miles were not sampled.

In 2002, twenty-four large ships registered with the State program. Only 15 of the twenty-four ships discharged within the 3-mile coastline and were part of the sampling program.

Of that group of 15 ships, seven ships had advanced systems using ultra-filtration. These advanced systems treated both gray and black water. These systems produce tertiary treated quality effluent. The other eight ships discharged graywater only and held their blackwater for disposal outside 12 miles. Eight ships discharge graywater within 3 miles but hold their blackwater for discharge outside 12 miles.

The samples were taken from discharge lines as one or more holding tanks were discharged or were taken from the ballast pumps or other discharging pump. The sample names include where the sample was taken. Tables A1-A12 located in the Appendix include all 2002 test results for large ships.

Large Ship Conventional Sampling

Advanced treatment systems sampling results for conventional pollutants showed low fecal coliform and total suspended solids. Three samples are over the fecal coliform standard. None of the samples exceed the total suspended solids standard. The rest for the pollutant results show ranges in the good water quality parameters. The Biological oxygen demand (BOD) and Chemical oxygen demand (COD) were quite low. Only two samples from the *Seven Seas Navigator* had high COD and oil&grease. The phosphorus and Nitrate results are low.

Graywater systems had a geometric mean of fecal coliform and TSS of 32,834 and 247, respectively. The highest results for TSS is 13,000. The pH of this water is low with a geometric mean of 5.88. The minimum pH is 3.73 with a maximum of 7.76. Phosphorus and nitrate are 5.72 and 0.17 mg/L respectively. The Total Organic Carbon ranges widely with a geometric mean of 292 mg/L. The minimum is 41 mg/L and a maximum of 5090 mg/L. The Alkalinity geometric mean is 15.8 mg/L which is low and suggests the acid buffering capacity of the water is weak. Galley graywater has the highest COD, BOD, TSS, TOC, nitrates, phosphorus and oil & grease of the other graywater types as shown in Table 3.

*Alaska Department of Environmental Conservation Science Advisory Panel
Commercial Passenger Vessel Environmental Compliance Program*

Table 1 Large Ships Conventional Pollutants Geometric Means

# samples	All Data In table	Sample Date	Sample From	Waste Type	Ammonia	PH	BOD	COD	TSS	T CI	FREE CL	FECAL	CONDUCT
				Units	Mg/L		Mg/L	Mg/L	Mg/L	Mg/L	Mg/L	MPU	Umhos/cm
				MDL	0.16	0.1	1.0	0.3	0.1	0.1	0.1	2	1.0
22	White paper	2000	MSD	Treated BW	105.0	7.28	105	845	478	0.21	0.086	18,213	not taken
11	White paper	2000	Ballast Tanks	BW&GW	7.0	6.73	146	338	119	0.16	0.118	12,824	not taken
16	White paper	2001	Treatment	BW&GW	1.1	6.88	7	17	3	0.09	0.07	2	223
19	Table 2	2002	Discharge lines	BW&GW	7.0	7.57	3	83	0.2	0.05	0.05	5	1302
24	White paper	2000	Collecting Tanks	GW mixed	1.0	6.62	223	573	124	0.06	0.068	118,052	not taken
4	White paper	2001	Ballast tanks	GW mixed	0.1	6.14	259	367	114	0.05	0.05	649,994	1220
13	White paper	2001	Collecting tank	GW mixed	0.5	6.96	246	474	108	0.22	0.11	38,933	562
20	Table	2002	Discharge lines	GW mixed	0.5	6.14	432	805	190	0.14	0.1	32,834	2627
11	White paper	2000	Collecting Tanks	GW galley	1.6	6.43	728	1317	420	0.16	0.179	13,750	not taken
23	White paper	2001	Collecting tanks	GW Galley	1.3	7.04	728	1414	349	2.00	0.34	Not taken	904
10	White paper	2001	Ballast tanks	GW Galley	0.1	4.80	1587	2404	512	0.12	0.23	784,072	1008
7	Table	2002	Discharge line	GW galley	2.93	4.14	2790	5603	1520	0.11	0.06	6279	2360
3	White paper	2000	Collecting Tanks	GW Accom.	6.6	8.38	324	1340	297	0.27	0.05	104	not taken
15	White paper	2001	Ballast tanks	GW Accom	0.1	6.36	266	573	77	0.21	0.15	10,896	939
12	Table	2002	Discharge lines	GW Accom	1.21	6.63	304	589	145	0.23	0.16	47,357	3743
3	White paper	2000	Collecting Tanks	GW laundry/ Accommodation	5.3	7.00	63	240	78	0.37	0.126	6	not taken
10	White paper	2000	Collecting Tanks	GW laundry	0.4	7.72	74	340	38	0.20	0.11	8	not taken
7	White paper	2001	Ballast tanks	GW laundry	0.6	7.56	230	634	66	0.22	0.12	651,460	545
2	White paper	2001	Collecting tank	GW laundry	Not taken	8.36	86	571	22	0.32	0.32	30	2510
1	Table	2002	Discharge lines	GW laundry	4.21	6.58	194	643	44	0.05	0.05	110,000	646

Large Ship Priority Pollutant Conclusions

Out of the 55-priority pollutant categories graywater and blackwater contains, sometimes in trace amounts only the 17 pollutants. Graywater has thirteen additional priority pollutants. A majority of priority pollutant results are below the minimum detection limit. The Geometric means of the results are in Table 2. There are no cadmium, mercury, and PCB results over the detection limit. The samples do not give provide enough information for blackwater because most blackwater has not been sampled in 2001 and 2002.

All 2002 sample sets from large ships had:

- 1,2, 4-Trimethylbenzene
- 2-Butanone
- Acetone
- Bis(2-ethylhexyl)phthalate
- Chloroform*
- Di-n-Butylphthalate
- M&p Xylenes
- Tetrachloroethane
- Toluene
- Antimony Dissolved (D) and total recoverable (T)
- Arsenic (D) and (T)
- Chromium (D) and (T)
- Copper (D) & (T)
- Lead (D) & (T)
- Nickel (D) & (T)
- Selenium (D) & (T)
- Zinc (D) & (T)

The large ships' graywater results also had over detection limits for:

- Benzoic Acid
- Benzyl Alcohol
- 3&4 Methyl Phenol
- 4 Isopropyl toluene
- 4-Methyl Pentanone
- Bromodichloromethane
- Bromoform*
- Butylbenzyl phthalate
- Chloroethane
- Chloromethane
- Dibromochloromethane*
- Diethyl phthlate
- O-Xylene

* by-products produced when chlorine is added to kill bacteria

Table 2. Large Ships Priority Pollutants Geometric Means (All units of measure in µg/l unless noted)

Sample Date	COD mg/l	Total CL mg/l	bis(2-ethylhexyl) phthalate	Butylbenzyl phthalate	Diethylphthalate	Bromo form	Chloro form	Chromium (TR)	Copper (TR)	Lead (TR)	Nickel (TR)	Selenium (TR)	Zinc (TR)
MDL	3.4	0.10	0.69	0.38	0.55	0.32	0.25	2.3	1.2	1.4	1.1	4.8	2.8
2000 BW	845	0.21	1.25	ND	ND	2.17	8.84	3.1	107	1.8	ND	ND	124
2000 GW	573	0.06	2.17	ND	1.11	ND	4.19	13.82	1.55	1.8	ND	ND	21.45
2001 BW	17	0.07	0.93	ND	ND	0.778	5.86	ND	44.278	1.377	12.840	12.895	112.286
2001 GW	700	0.22	6.51	0.357	5.913	0.522	7.77	3.833	103.439	4.039	11.084	2.047	179.346
2002 BW	83	0.05	0.72	ND	ND	ND	2.21	7.45	12.10	1.10	17.75	3.29	247
2002 GW	522	0.17	13.00	0.63	6.5	0.61	57	47.3	130.21	11.51	14.99	6.63	295

Table 3. 2002 Large Ship Graywater Geometric Means

Sample Name	n-samples	Alkalinity, as CaCO3	Ammonia as N	BOD	COD	Conductivity	Fecal coliform	Total Cl	Free chlorine residual	Oil & Grease	PH	Phosphorous, Total	Nitrate as N	TOC	Total settleable solids	TSS
Units		Mg/L	Mg/L	Mg/L	Mg/L	Umhos/cm	MPN	mg/L	mg/L	Mg/L		Mg/L	Mg/L	Mg/L	mg/L	mg/L
MDL		0.5	0.016	1	3.4	1	2	0.1	0.1	1.7	0.1	0.22	0.3	0.22	0.1	0.1
Laundry	1	59.3	4.21	194	643	646	110000	0.05	0.05	50	6.58	3.39	0.15	160	0.53	44
Galley	7	0.3	2.93	2790	5603	2360	6279	0.11	0.06	315	4.14	12.18	0.15	1506	28.45	1520
Accommodations	12	68.5	1.21	304	589	3743	47357	0.23	0.16	125	6.63	4.71	0.15	188	0.43	145
Mixed	20	26.5	0.46	432	805	2085	38603	0.14	0.08	116	6.14	5.22	0.19	229	0.66	190

Small Ships

The State of Alaska had legislation regulating wastewater discharges as of July 1, 2001. Small ships are defined in Alaska law as ships having 50-249 overnight passengers.

In 2002, sixteen small ships and 5 State ferries registered with the State program. Only the 21 small ship vessels, two did not discharge within 3 miles of coast. Nineteen small ships discharged within the 3-mile coastline and were part of the sampling program.

Of the 19 ships, two ships had biological system and the other 17 had macerator chlorinating treatment systems. These nineteen ships discharge both black and gray water.

The samples were taken from discharge lines. Tables A13-A17 located in the Appendix include all 2002 test results for small ships.

Small Ship Conventional Sampling

The individual conventional sample results vary greatly. The geometric means are listed in Table 4. The geometric means of fecal coliform and TSS for mixed treated black and graywater is 5673 and 92, respectively. The geometric means for fecal coliform and TSS for treated blackwater is 8248 and 121, respectively. The graywater has fecal and TSS geometric means of 83 and 24.

The ADEC took samples of small ships and completed the conventional list of parameters recommended by the Science Panel. The results are included in the Appendix, Table A18. The TOC is high for some of the samples. The nitrite and phosphorus are low.

The graywater has low BOD and ammonia compared to the mixed BW&GW and blackwater.

Small Ship Priority Pollutant Conclusions

Out of the 55-priority pollutant categories graywater and blackwater contains, sometimes in trace amounts only the 25 pollutants. A majority of priority pollutant results are below the minimum detection limit. The Geometric means of the results are in Tables 5 and 6. There are no cadmium, mercury, and PCB results over the detection limit. The metals are higher in samples containing blackwater than graywater except for copper which is about the sample. The copper and zinc could come from pipes.

All 2002 sample sets from small ships had:

- 1,2, 4-Trimethylbenzene
- 1,4 Difluorobenzene
- Acetone
- Benzoic Acid
- Benzyl Alcohol
- Bis(2-ethylhexyl)phthalate
- Bromodichloromethane
- Bromoform*
- Bromomethane
- Chloroform*
- Chloromethane
- Dibromochloromethane*
- Diethyl phthlate
- Di-n-Butylphthalate
- M&p Xylenes
- Phenol
- Toluene
- Antimony Dissolved (D) and total recoverable (T)
- Arsenic (D) and (T)
- Chromium (D) and (T)
- Copper (D) & (T)
- Lead (D) & (T)
- Nickel (D) & (T)
- Selenium (D) & (T)
- Zinc (D) & (T)

* by-products produced when chlorine is added to kill bacteria

Table 4. 2002 Small Ship Geometric Means for Conventional Pollutant Results

Sample Name	Ammonia as N	COD	Conductivity	BOD	Fecal coliform	Total Cl	Free Cl	TSS	PH
Units	Mg/L	Mg/L	umhos/cm	mg/L	MPN/100ml	mg/L	mg/L	mg/L	
MDL	0.016	3.4	1	1	2	0.1	0.1	1	0.1
Mixed (19)	7.51	752	29077	85	5673	2.95	0.69	92	7.40
BW(11)	14.98	831	34500	37	8248	0.34	0.15	121	7.52
GW(12)	0.14	162	369	89	83	0.51	0.10	24	7.57

Table 5. 2002 Small Ship Geometric Mean for Metals Results

Water Type (#samples)	Antimony-dis	Antimony-TR	Arsenic-dis	Arsenic-TR	Chromium-dis	Chromium-TR	Copper-dis	Copper-TR	Lead-dis	Lead-TR	Nickel-dis	Nickel-TR	Selenium-dis	Selenium-TR	Zinc-dis	Zinc-TR
MDL	0.036	0.05	0.044	0.83	1.2	1.68	4.66	13.2	0.03	0.047	0.05	0.036	0.14	0.16	0.084	0.094
Mixed GW&BW (12)	0.07	0.28	21.17	22.91	6.27	5.35	45.69	143.57	0.69	5.80	11.07	14.49	76.15	67.88	78.21	130.51
GW(7)	0.20	0.22	0.64	1.27	1.84	2.01	15.59	112.22	0.28	2.64	2.03	2.10	1.54	2.54	30.98	68.72
BW (7)	0.10	0.28	8.92	11.43	4.25	4.22	21.43	76.20	0.51	4.05	7.05	9.00	41.31	36.13	54.58	147.08

Table 6. 2002 Small Ship Geometric Means for BNAs and VOCs Results

Water Type (# samples)	1,2,4-Trimethylbenzene	1,4-Difluorobenzene	Acetone	Benzoic Acid	Benzyl Alcohol	Bis(2-Ethylhexyl)Phthalate	Bromodichloromethane	Bromoform	Bromomethane	Chloroform	Chloromethane	Dibromochloromethane	Diethylphthalate	Di-n-Butylphthalate	m&p Xylenes	Naphthalene	Phenol	Toluene
MDL	0.3	0.57	2.5	47	0.56	0.67	0.46	0.63	1.5	1.3	0.29	0.32	0.53	1.4	0.15	0.098	0.83	0.25
BW(7)	0.02	250.00	9.10	78.17	0.45	0.78	0.63	4.99	0.75	1.25	0.15	1.15	0.40	1.55	0.08	0.05	1.51	0.18
GW&BW (12)	0.62	50.00	10.14	263.30	0.62	2.64	2.92	19.29	1.19	6.65	0.75	6.59	1.74	1.10	0.40	0.10	2.89	0.20
GW(7)	0.02	0.57	21.75	37.55	0.50	6.49	2.76	0.84	0.75	28.04	0.46	0.92	5.00	1.11	0.08	0.05	1.41	0.33

APPENDIX

*Alaska Department of Environmental Conservation Science Advisory Panel
Commercial Passenger Vessel Environmental Compliance Program*

Table A1. Large Ships Advanced Treatment Conventional Pollutant Results

Sample Name	Alkalinity CaCO3	Ammonia as N	BOD	COD	Conduc- tivity	Fecal coliform	Total CL	Free Cl	Oil & Grease	Nitrate as N	TKN	pH	Phospho- rous	TOC	Settleabl- e	TSS
Units	Mg/L	mg/L	mg/L	Mg/L	Umhos/ cm	MPN	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	Mg/L	mg/L
MDL	0.5	0.016	1	3.4	1	2	0.1	0.05	1.7	0.095	0.1	0.1	0.22	0.3	0.1	0.1
Mercury Rochem	Not taken	0.997	0.5	1.7	Not taken	1	0.05	0.05	not taken	Not taken	Not	7.66	not	not	Not taken	0.05
7 Seas Navigator TWW-C	70.9	43.8	0.5	169	1940	1	0.05	0.05	13	56.9	43.9	6.74	18.2	32	0.05	0.05
7 Seas Navigator TWW-E Ballast Tank	102	0.113	11	1040	42.1	1	0.05	0.05	150	0.05	2	8.13	0.0624	not	0.05	65.2
7 Seas Navigator TWW-F Ballast Tank	127	27	45	324	16100	80	0.05	0.05	19	12.9	28.5	7.34	13	8	0.8	126
Seven Seas TWW-C	329	87.2	0.5	147	4450	1	0.05	0.05	7.1	0.05	59.1	7.59	19.4	48	0.05	0.05
Seven Seas TWW-E	135	0.008	11.9	1210	47000	1	0.05	0.05	280	0.05	2.1	7.6	0.399	29	0.05	152
Seven Seas TWW-F	507	130	231	536	7730	2200	0.05	0.05	15	0.05	11.4	7.51	16.1	153	0.05	11.2
Ballast Overboard Discharge D	114	6.17	2.49	68.2	638	70	0.05	0.05	0.85	0.05	6.8	7.09	3.04	23	0.05	0.05
Direct Overboard Discharge A	108	5.73	3.33	61.6	602	1	0.05	0.05	0.85	0.05	8.9	6.99	1.71	23	0.05	0.05
Ryndam TWW	174	18.8	0.5	31	588	1	0.05	0.05	0.85	0.05	21	7.65	0.608	13	0.05	0.05
Ryndam TWW-B	135	18.6	4.43	52.9	2000	900	0.05	0.05	0.1	0.05	27	7.35	2.28	16	0.1	0.05
52902 Zenon Graywater	151	8.83	114	101	795	2	0.05	0.05	not taken	0.05	10.7	7.23	3.37	28	0.05	0.05
Statendam TWW	208	27.7	0.5	59.4	854	1	0.05	0.05	0.85	0.05	33	7.73	5	20	0.05	0.05
Veendam Zenon 71702-WW	161	29.4	0.5	48.5	632	1	0.05	0.05	0.85	0.05	18.9	7.36	2.31	247	0.05	0.05
Volendam TWW Port A	60.1	0.603	5.38	46.3	375	900	0.05	0.05	0.85	5.03	1.9	7.49	2.86	12	0.05	7.1
Volendam TWW Port F UV	68.2	0.008	0.5	28.9	371	1	0.05	0.05	0.85	3.44	1.5	7.54	2.66	12	0.05	0.05
Volendam TWW-1	189	24.2	10.8	83.5	593	1	0.05	0.05	8.4	0.05	26.6	7.48	8.47	25	0.05	0.05
Volendam TWW-2	202	23.6	10	70.4	623	1	0.05	0.05	12	0.05	27.8	7.54	7.64	28	0.05	0.05
Zaandam TWW	52.1	22.7	3.12	52.9	732	1	0.05	0.05	0.85	0.05	27.7	7.83	4.51	16	0.05	0.05
Zaandam TWW-A Discharge Line	238	36.5	0.5	44.2	797	1	0.05	0.05	12	0.05	39.3	7.78	5.59	19	0.05	0.05
Min	52	0.01	0.50	28.90	371.00	1.00	0.05	0.05	0.10	0.05	1.50	7.35	0.40	12	0.05	0.05
Max	507	130	231	1210	47000	2200	0.05	0.05	280	5.03	59.1	7.83	19.4	247	0.10	152
GeoMean	157	7	3	83	1302	5	0.05	0.05	3	0.10	14	7.57	3.70	28	0.05	0.21

Table A2. 2002 Large ship advanced treatment Metals results Total Recoverable (T) and Dissolved (D)

Sample Name	Antimony-D	Antimony-T	Arsenic-D	Arsenic-T	Chromium-D	Chromium-T	Copper-D	Copper-T
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MDL	0.027	0.049	0.044	0.12	0.049	0.076	0.034	0.04
7 Seas Navigator TWW-C MBR	0.298	0.255	3.38	3.13	2.27	1.82	131	135
7 Seas Navigator TWW-F Ballast Tank	0.014	3.37	61.5	23.4	198	11	140	3970
Ryndam TWW	0.014	0.202	0.576	0.729	7.35	0.641	5.16	5.5
Statendam TWW	0.667	0.721	0.893	0.987	5.45	0.715	1.67	2.04
Veendam Zenon 71702-WW	0.181	0.255	1.26	1.45	3.36	0.856	5.9	6.49
Volendam TWW-1	0.106	0.255	0.552	0.82	5.72	0.972	7.52	7.9
Volendam TWW-2	0.014	0.255	0.569	0.801	5.83	1.42	7.91	7.66
Zaandam TWW	0.255	0.366	0.662	0.944	4.72	0.596	8.3	8.31
Min	0.01	0.20	0.55	0.73	2.27	0.60	1.67	2.04
Max	0.67	3.37	61.50	23.40	198.00	11.00	140.00	3970.00
GeoMean	0.08	0.41	1.52	1.62	7.45	1.26	12.10	19.35

Table A2. 2002 Large ship advanced treatment Metals results Total Recoverable (T) and Dissolved (D)

Sample Name	Lead-D	Lead-T	Nickel-D	Nickel-T	Selenium-D	Selenium-T	Zinc-D	Zinc-T
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MDL	0.03	0.047	0.05	0.036	0.14	0.16	0.084	0.094
7 Seas Navigator TWW-C MBR	2.22	5.01	17.7	18	9.55	8.35	466	446
7 Seas Navigator TWW-F Ballast Tank	4.66	62.4	112	94.8	231	90.7	2470	7660
Ryndam TWW	1.22	1.35	22.9	22.1	0.948	1.54	208	183
Statendam TWW	0.236	1.43	23.3	22.2	1.27	1.63	24.8	23.6
Veendam Zenon 71702-WW	0.358	0.323	15.7	17.1	0.936	1.37	196	201
Volendam TWW-1	0.975	2.09	8.96	9.82	0.755	1.87	195	176
Volendam TWW-2	0.963	2.48	9.4	9.73	0.764	1.43	194	174
Zaandam TWW	2.09	3.3	7.36	7.19	0.915	1.95	195	152
Min	0.24	0.32	7.36	7.19	0.76	1.37	24.80	23.60
Max	4.66	62.40	112.00	94.80	231.00	90.70	2470.00	7660.00
GeoMean	1.10	2.76	17.85	17.75	2.45	3.29	232.66	246.89

Table A3. 2002 Large Ship Sample Results for Advanced treatment Ships for all Priority Pollutants except Metals

Sample_Name	1,2,4-Trimethyl benzene	2-Butanone	Acetone	Bis(2-Ethylhexyl) Phthalate	Chloroform	Di-n-Butyl phthalate	M&p Xylenes	Tetrachloroethene	Toluene
	Ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	Ug/L	ug/L	Ug/L
MDL	0.29	1	2.5	0.67	1.3	1.4	0.15	0.12	0.25
7 Seas Navigator TWW-C MBR	0.45	0.5	4.3	2.2	2.1	0.7	1.1	0.06	0.51
7 Seas Navigator TWW-F Ballast	2.2	0.5	6.2	5.2	3.1	0.7	3	0.06	1.2
Mercury Rochem Sample Port	0.15	0.5	1.25	0.335	0.65	0.7	0.075	0.06	0.125
Ryndam TWW	0.15	0.5	4.9	3.3	0.85	1.8	0.075	0.06	0.125
Statendam TWW	0.15	0.5	11	0.335	1.3	2.4	0.075	3.4	0.53
Trip Blank	0.15	0.5	2.8	not taken	0.65	not taken	0.075	0.06	0.57
Veendam Zenon 71702-WW	0.15	0.5	21	0.335	1.3	3.4	0.075	0.06	0.92
Volendam TWW-1	0.15	2.8	25	0.335	1.2	1.8	0.075	0.06	1.1
Volendam TWW-2	0.15	3.1	26	0.335	1.2	3.1	0.075	0.06	0.96
Zaandam TWW	0.15	0.86	6.1	0.335	1.1	0.7	0.075	0.06	0.125
Min	0.15	0.50	1.25	0.34	0.65	0.70	0.08	0.06	0.13
Max	2.20	3.10	26.00	5.20	3.10	3.40	3.00	3.40	1.20
GeoMean	0.22	0.77	6.61	0.72	1.21	1.39	0.14	0.09	0.43

*Alaska Department of Environmental Conservation Science Advisory Panel
Commercial Passenger Vessel Environmental Compliance Program*

Table A4. 2002 Largeship Graywater Conventional Pollutant ALL Results

Sample Name	Alkalinity, as CaCO ₃	Ammonia as N	BOD	COD	Conducti vity	Fecal coliform	Total chlorine	Free chlorine
Units	Mg/L	mg/L	Mg/L	mg/L	Umhos/cm	MPN	mg/L	Mg/L
MDL	0.5	0.016	1	3.4	1	2	0.1	0.1
Dawn Princess GW-11 Galley	0.25	2.56	2130	3060	3270	60000	0.05	0.05
Dawn Princess GW-A-15	69.3	1	403	460	1920	1600000	0.05	0.05
Dawn Princess GW-A-4 Dom/Laundry	113	0.97	50.6	240	36500	300000	0.05	0.05
Dawn Princess GW-A-4 Domestic	70.7	0.836	158	372	15100	2400000	0.05	0.05
Dawn Princess GW-A-8 Domestic	80.2	0.64	62.3	180	29600	130000	0.05	0.05
Dawn Princess GW-A-8 Domestic	58.9	1.99	388	752	14600	220000	0.05	0.05
Dawn Princess GW-D-11 Galley	0.25	8.88	6920	18100	13800	30000	0.05	0.05
Sea Princess GW - A	0.25	1.71	1800	3280	7640	24000	0.2	0.05
Sea Princess GW – B	53.4	2.35	328	503	528	2400000	0.1	0.05
Sea Princess GW – D	52.2	1.11	799	1660	2500	240000	0.05	0.05
Norwegian Wind GW-1 C Laundry	59.7	4.21	194	643	646	110000	0.05	0.05
Norwegian Wind GW-2 Mixed GW	94.8	0.008	199	652	31100	3000000	0.05	0.05
Norwegian Wind GW-3 Mixed GW	81.2	0.008	178	639	32200	5000000	0.05	0.05
Norwegian Sky GW-A	69.8	2.2	158	374	3440	3000000	0.05	0.05
Ocean Princess GW-A-DB4 Domestic	54.6	0.768	263	553	617	300	3	0.2
Ocean Princess GW-A-DB8 Galley	0.25	1.26	1490	2680	1810	500	0.05	0.05
Norwegian Sky GW-B	75.3	2.51	146	300	344	3000000	0.05	0.05
Ocean Princess GW-C Collection Tanks	40.6	0.191	110	389	188	300	0.05	0.05
Star Princess GW-C DB#8 Graywater	44.6	1.11	122	374	8100	1700000	2	0.3
Star Princess GW-D DB#10 Galley	0.25	3.68	3660	6170	1190	300	0.05	0.05
Norwegian Sky GW-A Mixed	38.1	1.56	987	2600	558	2090	1	0.05
Norwegian Sky GW-B Mixed	32.2	1.86	1310	3540	606	2910	1.5	0.2
Norwegian Wind GW-2 Mixed GW	78.8	0.081	326	430	22700	1600	0.05	0.05
Norwegian Wind GW-3 Mixed GW	80.8	0.15	163	170	23200	1600	0.05	0.05
Ocean Princess GW-C Overboard	78.5	0.008	260	228	499	1	8	5.5
Ocean Princess GW-C-H Overboard	35.5	0.658	7660	4200	4800	1	7	4
Regal Princess GW-AD Overboard	129	23.4	151	509	4660	800000	0.5	0.05
Regal Princess GW-ADC Overboard	0.25	0.008	1170	1900	808	800000	0.05	0.05
Regal Princess GW-AFT Mixed	0.25	0.878	1940	2260	509	110000	0.05	0.05
Regal Princess GW-FWD Mixed	36.2	4.17	330	621	1060	500000	0.05	0.05
Sea Princess GW-A-11 Galley	0.25	1.54	1370	2080	2000	8000	0.3	0.05
Sea Princess GW-D-6 Domestic	76.2	1.37	555	556	834	500000	0.05	0.05
Sea Princess GW-D-8 Domestic	20.6	3.98	1310	1840	6100	110000	0.05	0.05
Sea Princess GW-D-9 Domestic	70.3	1.46	541	674	820	800000	0.05	0.05
Star Princess GW-C (accom)	68.8	2.76	152	254	392	240	3.5	3.1
Star Princess GW-D (galley & laundry)	0.25	4.29	4280	17800	1250	198000	0.3	0.1
Sun Princess GW-A2 accomodations	83.3	0.632	875	1540	4080	130000	0.2	0.1
Sun Princess GW-A3 accomodations	92.3	0.776	346	793	7270	500	4	3.5
Sun Princess GW-A4 accomodations	89.4	1.16	669	1220	1060	30000	4	1.7
Sun Princess GW-C galley	0.25	2.66	2790	5110	1680	900	0.3	0.1
Min	0.25	0.008	50.6	170	188	1	0.05	0.05
Max	129	23.4	7660	18100	36500	5000000	8	5.5
GeoMean	15.80	0.87	521.93	1009.43	2627.33	32833.62	0.17	0.10

Table A5. 2002 Largeship Graywater Conventional Pollutant ALL Results

Sample Name	Oil&Grease	PH	Phosphorous	Nitrate as N	TOC	Settleable	TSS
Units	mg/L		Mg/L	mg/L	mg/L	Mg/L	mg/L
MDL	1.7	0.1	0.22	0.3	0.22	0.1	0.1
Dawn Princess GW-11 Galley	520	4.82	14.1	0.15	1070	23	1070
Dawn Princess GW-A-15	150	6.7	2.2	0.15	156	0.32	92.5
Dawn Princess GW-A-4 Domestic/Laundry	140	7.59	1.6	0.15	149	0.05	68.2
Dawn Princess GW-A-4 Domestic	51	6.76	6.07	0.15	106	0.05	70.2
Dawn Princess GW-A-8 Domestic	46	7.17	1.9	0.15	41	0.21	71.1
Dawn Princess GW-A-8 Domestic	110	6.25	2.74	0.15	233	6	292
Dawn Princess GW-D-11 Galley	5500	3.88	52.2	0.15	5090	280	7700
Sea Princess GW – A	360	4.46	20.6	0.15	770	10	604
Sea Princess GW – B	120	7.06	3.06	0.15	114	0.66	122
Sea Princess GW – D	270	5.87	9.36	0.15	358	6.5	356
Norwegian Wind GW-1 C Laundry	50	6.68	3.39	0.15	160	0.53	43.8
Norwegian Wind GW-2 Mixed GW	56	6.92	1.86	0.15	83	0.05	128
Norwegian Wind GW-3 Mixed GW	52	6.86	2.16	0.15	85	0.22	122
Norwegian Sky GW-A (overboard line)	70	6.53	1.88	0.15	97	0.22	79.5
Ocean Princess GW-A-DB4 Domestic	87	7.1	2.8	0.15	148	0.05	48.5
Ocean Princess GW-A-DB8 Galley	57	4.3	3.46	0.15	843	0.05	144
Norwegian Sky GW-B (overboard line)	37	6.89	2.14	0.15	82	0.05	56.5
Ocean Princess GW-C Collection Tanks	33	7.28	8.46	0.15	98	2.2	46.6
Star Princess GW-C DB#8 Graywater	39	6.78	1.77	0.15	72	0.05	86.4
Star Princess GW-D DB#10 Galley	950	3.73	3.11	0.15	2070	44	2660
Norwegian Sky GW-A Mixed	not taken	4.79	12	0.15	1260	1.1	333
Norwegian Sky GW-B Mixed	not taken	4.75	17.6	0.15	849	6	566
Norwegian Wind GW-2 Mixed GW	170	6.82	2.5	0.15	174	0.2	210
Norwegian Wind GW-3 Mixed GW	61	7.05	2.5	0.15	72	0.05	107
Ocean Princess GW-C Overboard	290	7.76	0.855	0.15	470	0.05	145
Ocean Princess GW-C-H Overboard	780	4.86	13	0.15	996	22	5470
Regal Princess GW-AD Overboard	34	7.16	4.59	0.15	128	0.8	82.6
Regal Princess GW-ADC Overboard	290	4.36	27	12.1	469	0.51	464
Regal Princess GW-AFT Mixed	440	5.06	27.3	0.15	579	9.2	1230
Regal Princess GW-FWD Mixed	63	7.02	7.59	0.15	165	0.42	64.8
Sea Princess GW-A-11 Galley	72	4.38	17.1	0.15	669	90	346
Sea Princess GW-D-6 Domestic	160	6.45	8.94	0.15	257	0.05	125
Sea Princess GW-D-8 Domestic	310	4.65	10.3	0.15	597	15	560
Sea Princess GW-D-9 Domestic	170	6.5	8.96	0.15	283	0.05	136
Star Princess GW-C (accom)	68	6.68	2.68	0.15	78	0.05	44.1
Star Princess GW-D (galley & laundry)	2800	3.85	13.8	0.15	1730	370	13000
Sun Princess GW-A2 accommodations	230	6.21	9.12	0.15	369	9	591
Sun Princess GW-A3 accommodations	140	7.58	4.93	0.15	186	2.6	212
Sun Princess GW-A4 accommodations	240	7.19	8.49	0.15	381	6	333
Sun Princess GW-C galley	9.9	4.11	21.3	0.15	1600	32	1320
Min	9.9	3.73	0.855	0.15	41	0.05	43.8
Max	5500	7.76	52.2	12.1	5090	370	13000
GeoMean	138.46	5.88	5.72	0.17	292	1.05	247

Table A6. 2002 Large Ship Graywater Conventional Pollutant GALLEY Results

Sample Name	Alkalinity, as CaCO ₃	Ammonia as N	BOD	COD	Conductivity	Fecal coliform	Total chlorine	Free chlorine residual
Units	Mg/L	mg/L	Mg/L	mg/L	Umhos/cm	MPN	mg/L	mg/L
MDL	0.5	0.016	1	3.4	1	2	0.1	0.1
Dawn Princess GW-11 Galley	0.25	2.56	2130	3060	3270	60000	0.05	0.05
Dawn Princess GW-D-11 Galley	0.25	8.88	6920	18100	13800	30000	0.05	0.05
Ocean Princess GW-A-DB8 Galley	0.25	1.26	1490	2680	1810	500	0.05	0.05
Star Princess GW-D DB#10 Galley	0.25	3.68	3660	6170	1190	300	0.05	0.05
Sea Princess GW-A-11 Galley	0.25	1.54	1370	2080	2000	8000	0.3	0.05
Star Princess GW-D (galley & laun)	0.25	4.29	4280	17800	1250	198000	0.3	0.1
Sun Princess GW-C galley	0.25	2.66	2790	5110	1680	900	0.3	0.1
Min	0.25	1.26	1370	2080	1190	300	0.05	0.05
Max	0.25	8.88	6920	18100	13800	198000	0.3	0.1
GeoMean	0.25	2.93	2790	5603	2360	6279	0.11	0.06

Table A6. 2002 Large Ship Graywater Conventional Pollutant GALLEY Results

Sample Name	Oil & Grease	PH	Phosphorus, Total	Nitrate as N	TOC	Settleable solids	TSS
Units	mg/L		mg/L	mg/L	mg/L	Mg/L	mg/L
MDL	1.7	0.1	0.22	0.3	0.22	0.1	0.1
Dawn Princess GW-11 Galley	520	4.82	14.1	0.15	1070	23	1070
Dawn Princess GW-D-11 Galley	5500	3.88	52.2	0.15	5090	280	7700
Ocean Princess GW-A-DB8 Galley	57	4.3	3.46	0.15	843	0.05	144
Star Princess GW-D DB#10 Galley	950	3.73	3.11	0.15	2070	44	2660
Sea Princess GW-A-11 Galley	72	4.38	17.1	0.15	669	90	346
Star Princess GW-D (galley & laun)	2800	3.85	13.8	0.15	1730	370	13000
Sun Princess GW-C galley	9.9	4.11	21.3	0.15	1600	32	1320
Min	9.9	3.73	3.11	0.15	669	0.05	144
Max	5500	4.82	52.2	0.15	5090	370	13000
GeoMean	315	4.14	12.18	0.15	1506	28.45	1520

Table A7. 2002 Large Ship Results for Accommodations (Domestic) Graywater

Sample Name	Alkalinity, Total as CaCO ₃	Ammonia as N	Biochemic al Oxygen Demand— 5 Day	Chemical Oxygen Demand	Conductivity	Fecal coliform bacteria by MPN	Total chlorine residual	Free chlorine residual
Units	mg/L	Mg/L	Mg/L	mg/L	Umhos/cm	MPN	mg/L	mg/L
MDL	0.5	0.016	1	3.4	1	2	0.1	0.1
Dawn Princess GW-A-4 Domestic/Laun	113	0.97	50.6	240	36500	300000	0.05	0.05
Dawn Princess GW-A-4 Domestic	70.7	0.836	158	372	15100	2400000	0.05	0.05
Dawn Princess GW-A-8 Domestic	80.2	0.64	62.3	180	29600	130000	0.05	0.05
Dawn Princess GW-A-8 Domestic	58.9	1.99	388	752	14600	220000	0.05	0.05
Ocean Princess GW-A-DB4 Domestic	54.6	0.768	263	553	617	300	3	0.2
Sea Princess GW-D-6 Domestic	76.2	1.37	555	556	834	500000	0.05	0.05
Sea Princess GW-D-8 Domestic	20.6	3.98	1310	1840	6100	110000	0.05	0.05
Sea Princess GW-D-9 Domestic	70.3	1.46	541	674	820	800000	0.05	0.05
Star Princess GW-C (accom)	68.8	2.76	152	254	392	240	3.5	3.1
Sun Princess GW-A2 accommodations	83.3	0.632	875	1540	4080	130000	0.2	0.1
Sun Princess GW-A3 accommodations	92.3	0.776	346	793	7270	500	4	3.5
Sun Princess GW-A4 accommodations	89.4	1.16	669	1220	1060	30000	4	1.7
Min	20.6	0.632	50.6	180	392	240	0.05	0.05
Max	113	3.98	1310	1840	36500	2400000	4	3.5
GeoMean	68.5	1.21	304	589	3743	47357	0.23	0.16

Table A7. 2002 Large ship Results Accommodations (Domestic) Graywater

Sample Name	Oil & Grease	PH	Phosphorus, Total	Nitrate as N	TOC	Total settleable solids	TSS
Units	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L
MDL	1.7	0.1	0.22	0.3	0.22	0.1	0.1
Dawn Princess GW-A-4 Domestic/Lau	140	7.59	1.6	0.15	149	0.05	68.2
Dawn Princess GW-A-4 Domestic	51	6.76	6.07	0.15	106	0.05	70.2
Dawn Princess GW-A-8 Domestic	46	7.17	1.9	0.15	41	0.21	71.1
Dawn Princess GW-A-8 Domestic	110	6.25	2.74	0.15	233	6	292
Ocean Princess GW-A-DB4 Domestic	87	7.1	2.8	0.15	148	0.05	48.5
Sea Princess GW-D-6 Domestic	160	6.45	8.94	0.15	257	0.05	125
Sea Princess GW-D-8 Domestic	310	4.65	10.3	0.15	597	15	560
Sea Princess GW-D-9 Domestic	170	6.5	8.96	0.15	283	0.05	136
Star Princess GW-C (accom)	68	6.68	2.68	0.15	78	0.05	44.1
Sun Princess GW-A2 accommodations	230	6.21	9.12	0.15	369	9	591
Sun Princess GW-A3 accommodations	140	7.58	4.93	0.15	186	2.6	212
Sun Princess GW-A4 accommodations	240	7.19	8.49	0.15	381	6	333
Min	46	4.65	1.6	0.15	41	0.05	44
Max	310	7.59	10.3	0.15	597	15.00	591
GeoMean	125	6.63	4.71	0.15	188	0.43	145

Table A8. 2002 large Ship Mixed Graywater

Sample Name	Alkalinity, Total as CaCO3	Ammonia as N	BOD	COD	Conductivity	Fecal coliform	Total chlorine residual	Free chlorine residual
Units	mg/L	mg/L	Mg/L	mg/L	Umhos/cm	MPN	mg/L	mg/L
MDL	0.5	0.016	1	3.4	1	2	0.1	0.1
Dawn Princess GW-A-15	69.3	1	403	460	1920	1600000	0.05	0.05
Sea Princess GW - A	0.25	1.71	1800	3280	7640	24000	0.2	0.05
Sea Princess GW - B	53.4	2.35	328	503	528	2400000	0.1	0.05
Sea Princess GW - D	52.2	1.11	799	1660	2500	240000	0.05	0.05
Norwegian Wind GW-2 Mixed GW	94.8	0.008	199	652	31100	3000000	0.05	0.05
Norwegian Wind GW-3 Mixed GW	81.2	0.008	178	639	32200	5000000	0.05	0.05
Norwegian Sky GW-A (overboard line)	69.8	2.2	158	374	3440	3000000	0.05	0.05
Norwegian Sky GW-B (overboard line)	75.3	2.51	146	300	344	3000000	0.05	0.05
Ocean Princess GW-C Collection Tanks	40.6	0.191	110	389	188	300	0.05	0.05
Norwegian Sky GW-A Mixed	38.1	1.56	987	2600	558	2090	1	0.05
Norwegian Sky GW-B Mixed	32.2	1.86	1310	3540	606	2910	1.5	0.2
Norwegian Wind GW-2 Mixed GW	78.8	0.081	326	430	22700	1600	0.05	0.05
Norwegian Wind GW-3 Mixed GW	80.8	0.15	163	170	23200	1600	0.05	0.05
Ocean Princess GW-C Overboard	78.5	0.008	260	228	499	1	8	5.5
Ocean Princess GW-C-H Overboard	35.5	0.658	7660	4200	4800	1	7	4
Regal Princess GW-AD Overboard	129	23.4	151	509	4660	800000	0.5	0.05
Regal Princess GW-ADC Overboard	0.25	0.008	1170	1900	808	800000	0.05	0.05
Regal Princess GW-AFT Mixed	0.25	0.878	1940	2260	509	110000	0.05	0.05
Regal Princess GW-FWD Mixed	36.2	4.17	330	621	1060	500000	0.05	0.05
Min	0.25	0.008	110	170	188	1	0.05	0.05
Max	129	23.4	7660	4200	32200	5000000	8.0	5.5
GeoMean	26.54	0.46	432	805	2085	38603	0.14	0.08

Table A8. 2002 Large Ship Mixed Graywater

Sample Name	Oil & Grease	pH	Phosphorus, Total	Nitrate as N	TOC	Conductivity	Total settleable solids	TSS
Units	mg/L		mg/L	mg/L	mg/L	Umhos/cm	mg/L	mg/L
MDL	1.7	0.1	0.22	0.3	0.22	1	0.1	0.1
Dawn Princess GW-A-15	150	6.7	2.2	0.15	156	1920	0.32	92.5
Sea Princess GW - A	360	4.46	20.6	0.15	770	7640	10	604
Sea Princess GW - B	120	7.06	3.06	0.15	114	528	0.66	122
Sea Princess GW - D	270	5.87	9.36	0.15	358	2500	6.5	356
Norwegian Wind GW-1 Discharge Line C Laundry	50	6.68	3.39	0.15	160	646	0.53	43.8
Norwegian Wind GW-2 Mixed GW	56	6.92	1.86	0.15	83	31100	0.05	128
Norwegian Wind GW-3 Mixed GW	52	6.86	2.16	0.15	85	32200	0.22	122
Norwegian Sky GW-A (overboard line)	70	6.53	1.88	0.15	97	3440	0.22	79.5
Norwegian Sky GW-B (overboard line)	37	6.89	2.14	0.15	82	344	0.05	56.5
Ocean Princess GW-C Collection Tanks	33	7.28	8.46	0.15	98	188	2.2	46.6
Norwegian Sky GW-A Mixed	not taken	4.79	12	0.15	1260	558	1.1	333
Norwegian Sky GW-B Mixed	not taken	4.75	17.6	0.15	849	606	6	566
Norwegian Wind GW-2 Mixed GW	170	6.82	2.5	0.15	174	22700	0.2	210
Norwegian Wind GW-3 Mixed GW	61	7.05	2.5	0.15	72	23200	0.05	107
Ocean Princess GW-C Overboard	290	7.76	0.855	0.15	470	499	0.05	145
Ocean Princess GW-C-H Overboard	780	4.86	13	0.15	996	4800	22	5470
Regal Princess GW-AD Overboard	34	7.16	4.59	0.15	128	4660	0.8	82.6
Regal Princess GW-ADC Overboard	290	4.36	27	12.1	469	808	0.51	464
Regal Princess GW-AFT Mixed	440	5.06	27.3	0.15	579	509	9.2	1230
Regal Princess GW-FWD Mixed	63	7.02	7.59	0.15	165	1060	0.42	64.8
Min	33	4.36	0.855	0.15	72	188	0.05	43.8
Max	780	7.76	27.3	12.1	1260	32200	22	5470
GeoMean	116	6.14	5.22	0.19	229	2085	0.66	190

**Table A9. 2002 Large Ship
Graywater Metal Results**

	Antimony-D	Antimony-T	Arsenic-D	Arsenic-T	Chromium-D	Chromium-T	Copper-D	Copper-T	Lead-D	Lead-T
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MDL	0.027	0.049	0.044	0.12	0.049	0.076	0.034	0.04	0.03	0.047
Dawn Princess GW-A-4	0.0135	0.025	3.12	0.06	4.5	5.81	46.3	144	11.7	18
Dawn Princess GW-A-8	4.13	0.025	59.5	39.8	3.3	0.038	11.4	73.6	6.17	15.8
Norwegian Sky GW-A	0.923	4.49	0.54	2.54	2.25	10.6	5.61	318	17	60
Norwegian Sky GW-B	3.93	3.69	1.61	1.74	6.58	10.7	2.59	195	14.5	26.5
Norwegian Wind GW-2	0.0135	0.025	43.6	44.8	4.15	7.15	9.31	77.4	12.8	22.9
Norwegian Wind GW-3	0.0135	0.025	39.1	50	7.52	6.44	9.81	84.3	23.6	24.3
Ocean Princess GW-C	0.242	0.303	0.209	2.32	0.785	3.83	79.2	129	0.654	7.22
Ocean Princess GW-C-H	0.528	0.199	3.43	3.52	4.83	5.77	50.3	109	1.18	2.81
Regal Princess GW-AFT	0.189	0.025	1.22	1.03	4.24	6.99	302	71.2	0.567	5.31
Regal Princess GW-FWD	0.122	0.128	1.62	1.41	3.05	4.65	114	294	0.672	4.5
Sea Princess GW-A-11	0.0135	0.025	1.62	0.06	8.33	15.7	2.93	55.1	3.21	20.8
Sea Princess GW-D-8	0.0135	0.025	9.93	10.7	10.6	10.1	3.72	60.5	1.07	12.8
Star Princess GW-C	0.518	0.549	0.459	0.388	1.5	1.86	61.4	143	2.07	6.48
Star Princess GW-D	0.378	0.025	3.3	5.48	30.5	47.3	17	1980	0.777	21.3
Sun Princess GW-A4	0.271	0.272	0.878	0.979	2.35	3.7	58.1	76.9	2.18	3.84
Sun Princess GW-C galley	0.176	0.199	2.43	2.58	17.1	15.8	53.7	74.5	0.937	5.49
Min	0.01	0.03	0.21	0.06	0.785	0.038	2.59	55.1	0.567	2.81
Max	4.13	4.49	59.50	50.00	30.5	47.3	302	1980	23.6	60
GeoMean	0.16	0.11	2.86	2.37	4.69	5.49	22.17	130.21	2.84	11.51

**Table A9. 2002 Large Ship
Graywater Metal Results**

Sample Name	Nickel-D	Nickel-T	Selenium-D	Selenium-T	Silver-D	Silver-T	Zinc-D	Zinc-T
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MDL	0.05	0.036	0.14	0.16	0.028	0.031	0.084	0.094
Dawn Princess GW-A-4	5.19	6.12	13.6	14	0.014	0.0155	78.3	303
Dawn Princess GW-A-8	12.8	11	108	70.9	3.96	0.0155	60.6	71.1
Norwegian Sky GW-A	4.7	19.8	0.538	2.16	0.014	0.381	522	1740
Norwegian Sky GW-B	11.3	12.6	1.24	1.36	0.014	0.153	766	794
Norwegian Wind GW-2	33.8	25.5	74.9	88.6	0.014	0.0155	54.5	145
Norwegian Wind GW-3	29.6	32.8	91.2	83.6	0.014	0.0155	463	185
Ocean Princess GW-C	6.22	7.71	0.52	3.78	0.014	1.93	270	327
Ocean Princess GW-C-H	12.9	13	8.28	9.91	0.887	3.74	221	224
Regal Princess GW-AFT	17	14.8	1.66	0.538	0.205	0.75	251	30.5
Regal Princess GW-FWD	12.6	14.4	3.74	3.45	0.197	0.297	221	306
Sea Princess GW-A-11	9.47	11.9	5.89	6.83	0.014	0.0155	277	264
Sea Princess GW-D-8	11.6	13	42	26.1	0.014	1.31	158	192
Star Princess GW-C	15.4	16.6	0.914	0.537	0.014	0.174	599	742
Star Princess GW-D	53	64.5	4.65	9.34	0.014	4.08	1170	1390
Sun Princess GW-A4	7.59	8.61	2.12	2.42	0.373	0.147	484	418
Sun Princess GW-C galley	20	15.2	2.98	4.24	0.014	1.59	259	280
Min	4.7	6.12	0.52	0.537	0.014	0.0155	55	31
Max	53	64.5	108	88.6	3.96	4.08	1170	1740
GeoMean	13.18	14.99	5.68	6.63	0.04	0.21	266	295

Table A10. 2002 Large Ship Bases, Neutral and Acids Graywater Results

Sample Name	Benzoic Acid	Benzyl Alcohol	3&4-Methyl phenol	Bis(2-Ethylhexyl)Phthalate	Butyl benzyl phthalate	Diethyl phthalate	Di-n-Butyl phthalate	Phenol
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MDL	23	0.55	1.2	0.66	0.36	0.52	1.4	0.85
Dawn Princess GW-A-4	190	8.5	11	11	1.9	13	4.8	2.5
Dawn Princess GW-A-8	46	2.9	6.3	2.8	0.18	3.9	5.3	0.4
Norwegian Sky GW-A	240	20	21	51	0.18	3.8	0.7	0.4
Norwegian Sky GW-B	310	25	26	48	0.18	3.8	0.7	0.4
Norwegian Wind GW-2	45	4.1	2	56	0.18	3	9.6	0.4
Norwegian Wind GW-3	54	3.4	2.3	13	0.18	2.7	3.9	0.4
Ocean Princess GW-C	220	24	0.6	5.6	0.18	14	0.7	0.4
Ocean Princess GW-C-H	250	28	0.6	7.6	0.18	12	2.4	0.4
Regal Princess GW-AFT	40	23	31	13	5.4	2.2	0.7	4.3
Regal Princess GW-FWD	28	28	3.9	5.3	0.18	17	4.4	1.9
Sea Princess GW-A-11	900	19	36	4.6	0.18	3.9	0.7	3
Sea Princess GW-D-8	560	22	53	5.1	0.18	7.9	0.7	2.8
Star Princess GW-C (acc)	410	24	18	15	2.6	18	0.7	3.2
Star Princess GW-D (G&L)	840	46	9.8	31	7.7	6.8	0.7	0.4
Sun Princess GW-A4	76	0.28	5.9	18	6.4	21	9.5	0.4
Sun Princess GW-C galley	350	0.28	140	36	12	3.5	7.7	0.4
Min	28	0.28	0.6	2.8	0.18	2.2	0.7	0.4
Max	900	46	140	56	12	21	9.6	4.3
GeoMean	169	9.21	9	13	0.63	6.5	2	0.84

Table A11. 2002 Large Ship Graywater Volatile Organic Compounds Results

Sample Name	Acetone	1,2,4-Tri methyl benzene	2- Butanone	4- Isopropyl toluene	4-Methyl- 2- Pentanone	Bromo dichlorom ethane	Bromo form	Butyl benzyl phthalate
Units	Ug/L	ug/L	ug/L	Ug/L	ug/L	Ug/L	ug/L	Ug/L
MDL	2.5	0.15	0.51	0.11	0.15	0.23	0.32	0.36
Dawn Princess GW-A-4	72	0.08	4.2	0.055	0.08	0.48	0.16	1.9
Dawn Princess GW-A-8	38	0.08	2.9	0.055	0.08	0.12	1.8	0.18
Norwegian Sky GW-A	34	0.08	16	0.82	0.67	0.77	0.7	0.18
Norwegian Sky GW-B	35	0.08	13	0.87	1.7	0.89	0.94	0.18
Norwegian Wind GW-2	29	0.08	0.25	0.055	0.08	0.85	0.16	0.18
Norwegian Wind GW-3	18	0.08	0.25	0.055	0.08	0.86	0.16	0.18
Ocean Princess GW-C	140	0.08	24	0.055	0.08	4.2	0.16	0.18
Ocean Princess GW-C-H	120	0.08	0.25	0.055	0.08	7.5	0.16	0.18
Regal Princess GW-AFT	1.75	8.8	390	16	0.08	20	10	5.4
Regal Princess GW-FWD	970	42	56	5.2	0.08	27	9.4	0.18
Sea Princess GW-A-11	54	0.08	0.25	2.2	0.08	4.3	1.2	0.18
Sea Princess GW-D-8	53	0.08	17	6.1	0.08	3.9	3.3	0.18
Star Princess GW-C (acc)	55	0.08	5.3	0.055	5.1	0.88	0.16	2.6
Star Princess GW-D (G&L)	130	0.08	0.25	0.055	0.08	7.6	2	7.7
Sun Princess GW-A4	93	0.08	8.9	0.055	0.08	7	0.16	6.4
Sun Princess GW-C galley	220	0.08	0.25	3.4	0.08	6.1	0.16	12
Min	1.75	0.08	0.25	0.055	0.08	0.12	0.16	0.18
Max	970	42	390	16	5.1	27	10	12
GeoMean	59	0.16	3.36	0.32	0.14	2.5	0.61	0.63

Table A12. 2002 Large Ship Graywater Volatile Organic Compounds Results

Sample Name	Chloroethane	Chloroform	Chloromethane	Dibromochloromethane	Diethyl phthalate	Di-n-Butyl phthalate	M&p Xylenes	O-Xylene	Phenol	Tetrachloroethene	Toluene
Units	Ug/L	ug/L	ug/L	Ug/L	ug/L	ug/L	Ug/L	ug/L	ug/L	ug/L	ug/L
MDL	0.72	1.3	0.29	0.32	0.52	1.4	0.15	0.28	0.85	0.12	0.25
Dawn Princess GW-A-4	0.36	20	0.15	0.16	13	4.8	0.69	0.14	2.5	0.06	0.125
Dawn Princess GW-A-8	0.36	17	0.15	0.16	3.9	5.3	0.96	0.52	0.4	0.06	0.125
Norwegian Sky GW-A	0.36	18	0.15	0.16	3.8	0.7	0.08	0.14	0.4	0.06	0.125
Norwegian Sky GW-B	0.36	17	0.15	0.52	3.8	0.7	0.51	0.47	0.4	0.06	0.125
Norwegian Wind GW-2	0.36	3.1	0.15	0.16	3	9.6	1.2	1.2	0.4	0.85	0.125
Norwegian Wind GW-3	0.36	5.3	0.15	0.79	2.7	3.9	0.73	0.14	0.4	1.3	0.125
Ocean Princess GW-C	3.5	780	2.9	0.16	14	0.7	0.6	0.14	0.4	0.06	0.125
Ocean Princess GW-C-H	3.4	880	0.15	1.7	12	2.4	0.08	0.14	0.4	0.06	0.125
Regal Princess GW-AFT	0.36	140	0.15	18	2.2	0.7	14	0.14	4.3	0.06	93
Regal Princess GW-FWD	0.36	170	18	18	17	4.4	52	15	1.9	21	0.125
Sea Princess GW-A-11	0.36	140	0.15	1.6	3.9	0.7	1.9	0.83	3	1.8	0.125
Sea Princess GW-D-8	0.36	63	0.15	2.4	7.9	0.7	15	6	2.8	84	0.125
Star Princess GW-C (accom)	41	30	160	0.16	18	0.7	15	6.1	3.2	0.06	0.125
Star Princess GW-D (galley & laundry)	0.36	58	0.15	0.16	6.8	0.7	14	5	0.4	0.06	0.125
Sun Princess GW-A4	15	180	100	0.16	21	9.5	2.1	0.73	0.4	4.5	1.5
Sun Princess GW-C galley	5.3	180	17	0.16	3.5	7.7	0.08	0.14	0.4	0.06	1.4
Min	0.36	3.1	0.15	0.16	2.2	0.7	0.08	0.14	0.4	0.06	0.125
Max	41	880	160	18	21	9.6	52	15	4.3	84	93
GeoMean	0.96	57	0.76	0.55	6.5	2	1.52	0.62	0.84	0.31	0.27

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Table A13. 2002 Small Ships Blackwater Conventional Results

Sample Name	Ammonia as N	COD	Conductivity	BOD	Fecal coliform	Total Cl	Free Chlorine	TSS	pH	Alkalinity As CaCO ₃	TOC	Oil & grease	settleable solids	Phosphorus,	TKN
Units	mg/L	mg/L	Umhos/cm	Mg/L	MPN/100ml	mg/L	Mg/L	mg/L		Mg/l	mg/l	mg/L	mg/L	mg/l	mg/l
MDL	0.016	3.4	1	1	2	0.1	0.1	1	0.1	0.5	0.3	1	0.05	0.22	0.1
Clipper Odyssey TBW	4.39	1830	n/a	4.38	90000	0.5	0.05	32.8	8	not taken	Not taken	not taken	not taken	not taken	not taken
Sea Bird TBW	23.5	844	n/a	105	4000	1.6	2.2	101	7.83	not taken	Not taken	not taken	329	not taken	not taken
Sea Lion	26.7	996	n/a	293	220000	0.1	0.05	486	6.2	not taken	Not taken	not taken	not taken	not taken	not taken
Sea Lion-	10.9	767	n/a	335	30000000	n/a	0.5	801	8.01	not taken	Not taken	not taken	not taken	not taken	not taken
Spirit of 98 Treated Blackwater	102	897	n/a	127	220	n/a	1.2	96.8	8.02	not taken	Not taken	not taken	not taken	not taken	not taken
Spirit of Columbia	21.4	700	n/a	146	200	0.1	0.05	133	7.26	not taken	Not taken	not taken	not taken	not taken	not taken
Spirit of Endeavour	83.3	1400	n/a	478	16000000	0.5	0.05	657	7.67	not taken	Not taken	not taken	not taken	not taken	not taken
Taku TBW	9.55	425	n/a	84.7	8	3	0.8	173	8.17	not taken	Not taken	not taken	not taken	not taken	not taken
York Clipper BW	n/a	512	34500	5.47	2400	0.05	0.05	66.6	7	116	299	8.5	0.05	2.33	5.7
Yorktown Clipper	6.44	634	n/a	1	220	0.5	0.05	25.4	7.04	not taken	Not taken	not taken	not taken	not taken	not taken
Yorktown Clipper	1.7	914	n/a	1	1700	0.2	0.05	26.2	7.82	not taken	Not taken	not taken	not taken	not taken	not taken
Min	1.7	425	34500	1	8	0.05	0.05	25.4	6.2	116	299	8.5	0.05	2.33	5.7
Max	102	1830	34500	478	30000000	3	2.2	801	8.17	116	299	8.5	329	2.33	5.7
GeoMean	15	831	34500	37	8248	0.34	0.15	121	7.52	116	299	8.50	4.06	2.33	5.70

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Table A14. 2002 Small Ships Mixed Blackwater and Graywater Conventional Results

Sample Name	Ammonia as N	COD	Conductivity	BOD	Fecal coliform	Total Cl	Free Cl	TSS	PH
Units	mg/L	mg/L	Umhos/cm	mg/L	MPN/100ml	mg/L	mg/L	mg/L	
MDL	0.016	3.4	1	1	2	0.1	0.1	1	0.1
ADEC Matanuska	1.27	451	23000	134	1	25	10	75.2	6.88
Columbia TWW	35	260	n/a	110	5000000	0.5	0.05	40.8	7.27
Columbia TWW-2	48.2	726	n/a	283	2400000	0.5	0.05	77	7.43
Columbia WW-1	29.4	495	22800	117	22	20	12	73.9	7.67
Mixed									
Kennicott MSD 3	0.5	870	31200	1	1	40	25	22.5	8.1
Mixed Wastewater									
Kennicott TWW	0.008	1200	37000	1	14	n/a	2	32	8.02
Kennicott WW1	12	1180	36400	246	9000000	n/a	0.05	179	7.04
Malaspina	10.1	876	28300	88.8	5	n/a	4	100	6.99
Malaspina MSD-1	0.121	514	23800	1	1	3.5	2.5	22.9	7.91
Malaspina TWW-2	8.9	220	n/a	93.9	2	n/a	0.05	55.6	7.16
Matanuska #1	11	600	n/a	225	3000	n/a	0.1	140	7.61
Matanuska TWW	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
Matanuska WW	16.8	1240	35500	154	50000	n/a	5	73.7	7.5
Spirit of Oceanus	58.4	1810	n/a	1060	5000000	n/a	0.2	232	6.89
Spirit of Oceanus	21.1	1610	n/a	870	3000000	0.25	0.05	295	5.26
Taku TWW	10.7	780	28200	177	5000	15	10	311	8.33
Wilderness Adventurer	39.2	931	n/a	174	2200000	2.1	1.1	155	8.16
Wilderness Adventurer	42.4	800	n/a	163	500000	2.1	1.1	114	8.2
Wilderness Discoverer	43.4	920	n/a	354	9000000	0.5	0.05	192	7.45
Min	0.008	220	22800	1	1	0.05	0.05	22.5	5.26
Max	58.4	1810	37000	1060	9000000	40	25	311	8.33
GeoMean	7.51	752.31	29077.11	85.27	5673.10	2.95	0.69	91.78	7.40

Table A15. 2002 Small Ships Mixed Blackwater and Graywater Conventional Results

Sample Name	Alkalinity As CaCO ₃	TOC	Oil & Grease	Settleable solids	Phosphorus, us,	TKN
Units		mg/l	Mg/L	mg/L	Mg/l	mg/l
MDL	0.5	0.3	1	0.05	0.22	0.1
ADEC Matanuska	79.5	336	27	0.05	2.38	17.6
Columbia TWW	not taken	not taken	Not taken	not taken	Not taken	not taken
Columbia TWW-2	not taken	not taken	Not taken	not taken	Not taken	not taken
Columbia WW-1	166	419	30	0.23	5.65	42.4
Kennicott MSD	76.3	274	1	0.05	0.11	28.7
Kennicott TWW	not taken	not taken	Not taken	not taken	Not taken	not taken
Kennicott WW1	not taken	not taken	Not taken	not taken	Not taken	not taken
Malaspina	not taken	not taken	Not taken	not taken	Not taken	not taken
Malaspina MSD-1	62.3	6	13	0.05	0.345	0.8
Malaspina TWW-2	not taken	not taken	Not taken	not taken	Not taken	not taken
Matanuska #1	not taken	not taken	Not taken	not taken	Not taken	not taken
Matanuska TWW	not taken	not taken	Not taken	not taken	Not taken	not taken
Matanuska WW	not taken	not taken	Not taken	not taken	Not taken	not taken
Spirit of Oceanus	not taken	not taken	Not taken	not taken	Not taken	not taken
Spirit of Oceanus	not taken	not taken	Not taken	not taken	Not taken	not taken
Taku TWW	148	186	37	23	4.92	48
Wilderness Adventurer	not taken	Not taken	Not taken	not taken	Not taken	not taken
Wilderness Adventurer	not taken	Not taken	Not taken	not taken	Not taken	not taken
Wilderness Discoverer	not taken	Not taken	Not taken	not taken	Not taken	not taken
Min	62.3	6	1	0.05	0.11	0.8
Max	166	419	37	23	5.65	48
GeoMean	98.53	133.90	13.13	0.23	1.20	15.24

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Table A16 2002 Small Ship Graywater Priority Pollutants except for metals

Sample Name	1,2,4-Trimethyl benzene	Acetone	Benzoic Acid	Benzyl Alcohol	Bis(2-Ethylhexyl)Phthalate	Bromodichloroethane	Bromoform	Bromomethane	Chloroform	Chloromethane	Dibromochloroethane	Diethylphthalate	Di-n-Butylphthalate	m&p Xylenes	Naphthalene	Phenol	Toluene
Units	ug/L	Ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MDL	0.3	2.5	47	0.56	0.67	0.46	0.63	1.5	1.3	0.29	0.32	0.53	1.4	0.15	0.098	0.83	0.25
Sea Bird GW	n/a	N/a	n/a	n/a	64	13	38	0.75	66	0.15	21	25	0.7	n/a	0.049	16	0.125
Sea Lion GW-1	n/a	N/a	n/a	n/a	15	1.8	0.315	0.75	120	0.15	0.16	17	1.7	n/a	0.049	7	0.125
Spirit of Columbia GW	n/a	N/a	n/a	n/a	7.9	2.1	0.55	0.75	7.5	0.15	1.6	0.265	0.7	n/a	0.049	0.415	0.125
Spirit of Endeavour GW	n/a	N/a	n/a	n/a	17	1.9	0.315	0.75	18	0.15	0.16	11	1.9	n/a	0.049	3.4	0.54
York Clipper	0.015	9.1	23.5	0.028	0.335	0.23	0.315	0.75	0.65	0.15	0.16	0.265	2.6	0.075	0.049	0.415	0.125
York Clipper GW Discharge Line	0.015	52	60	9	2.8	7.2	0.315	0.75	140	2.7	1.7	14	0.7	0.075	0.049	0.415	1.2
Yorktown Clipper GW	n/a	N/a	n/a	n/a	4	7.9	1.4	0.75	140	21	2.4	17	0.7	n/a	0.049	0.415	2.7
Min	0.015	9.1	23.5	0.028	0.335	0.23	0.315	0.75	0.65	0.15	0.16	0.265	0.7	0.075	0.049	0.415	0.125
Max	0.015	52	60	9	64	13	38	0.75	140	21	21	25	2.6	0.075	0.049	16	2.7
GeoMean	0.02	21.75	37.55	0.50	6.49	2.76	0.84	0.75	28.04	0.46	0.92	5.00	1.11	0.08	0.05	1.41	0.33

Table A17. 2002 Mixed Small Ship Metals

Sample Name	Antimony-dis	Antimony-TR	Arsenic-dis	Arsenic-TR	Chromium-dis	Chromium-TR	Copper-dis	Copper-TR
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MDL	0.036	0.05	0.044	0.83	1.2	1.68	4.66	13.2
ADEC Matanuska WW-1	0.018	0.351	35	33.6	4.18	4.96	163	339
Columbia TWW	Not taken	0.729	Not taken	41.3	Not taken	14.1	Not taken	2210
Columbia WW-1 Mixed	0.018	0.025	31.9	37.3	13	4.82	76.3	122
Kennicott MSD 3 Mixed Wastewater	0.018	0.409	50	37	4.32	2.97	119	166
Kennicott TWW	1.37	0.025	48.6	41.3	7.55	9.18	103	319
Malaspina MSD-1	0.018	1.55	39.4	23.2	10.3	1.54	18.7	30.7
Malaspina TWW-2		1.66		49.5		13.3		120
Matanuska TWW	0.018	0.025	37.7	39.8	5.94	7.18	319	565
Spirit of Oceanus Mixed TBW and GW	0.018	0.025	33	3.53	8.52	8.1	6.85	451
Taku TBW	0.018	0.855	49.4	38.1	17.4	2.9	50.7	88.6
Wilderness Adventurer WW #1	1.3	1.69	30.2	32.9	5.08	5.52	16.8	513
Wilderness Adventurer WW #2	1.25	0.4	30.7	33.2	5.69	5.75	13.9	87.9
Wilderness Discoverer Mixed GW & TBW	0.536	5.82	30.3	24.9	6.62	9.39	241	6.6
Min	0.018	0.025	0.044	0.83	1.2	1.54	4.66	6.6
Max	1.37	5.82	50	49.5	17.4	14.1	319	2210
GeoMean	0.07	0.28	21.17	22.91	6.27	5.35	45.69	143.57

Table A17. 2002 Small Ship Mixed GW&BW Metals

Sample Name	Lead-dis	Lead-TR	Nickel-dis	Nickel-TR	Selenium-dis	Selenium-TR	Zinc-dis	Zinc-TR
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MDL	0.03	0.047	0.05	0.036	0.14	0.16	0.084	0.094
Sea Bird TBW	0.246	1.35	21.1	17.5	177	194	1350	619
Sea Lion TBW	14.6	16.9	14.7	21.9	201	196	69.3	227
Spirit of Columbia TBW	0.207	2.85	12.2	14.8	163	160	28	223
Spirit of Endeavour GW	Missing	2.04	Missing	6.87	missing	31.1	Missing	296
Spirit of Endeavour TBW	Missing	1.35	Missing	14	missing	216	Missing	524
Spirit of Oceanus Mixed TBW and GW	16.6	91.1	10.4	9.17	145	11.5	34.6	451
Taku TBW	2.75	9.89	22	24.8	128	156	65.8	96
Wilderness Adventurer WW #1	4.67	97.3	24.1	76.8	134	133	556	8100
Wilderness Adventurer WW #2	0.74	4.04	11.9	17	126	142	225	2170
Wilderness Discoverer Mixed GW & TBW	5.95	4.25	16.6	14.4	132	104	317	9.74
York Clipper BW from MSD	0.015	0.804	15.1	14.4	233	143	26.2	missing
York Clipper GW Discharge Line	0.294	1.62	1.77	2.55	0.601	1.17	86.9	missing
Yorktown Clipper GW	0.123	3.27	13.7	3.38	232	1.19	31.6	191
Yorktown Clipper TBW	0.015	23.8	1.4	19.8	0.934	50.8	26.7	23.3
Min	0.015	0.047	0.05	0.036	0.14	0.16	0.084	0.094
Max	16.6	97.3	24.1	76.8	233	216	1350	8100
GeoMean	0.51	4.05	7.05	9.00	41.31	36.13	54.58	147.08

Table A18. 2002 Small Ship Complete Conventional Results

Sample Name	Alkalinity As Total CaCO ₃	T. Organic Carbon	Oil & grease	Settleable solids	Phospho- rous, Total	Nitrogen, TKN
Units	ug/L	Mg/l	mg/L	mg/L	mg/l	mg/l
MDL	0.5	0.3	1	0.05	0.22	0.1
ADEC Matanuska WW-1	79.5	336	27	0.05	2.38	17.6
Columbia WW-1 Mixed	166	419	30	0.23	5.65	42.4
Kennicott MSD 3 Mixed Wastewater	76.3	274	1	0.05	0.11	28.7
Malaspina MSD-1	62.3	6	13	0.05	0.345	0.8
Sea Bird GW	n/a	N/a	n/a	123	n/a	n/a
Sea Bird TBW	n/a	N/a	n/a	329	n/a	n/a
York Clipper BW from MSD	116	299	8.5	0.05	2.33	5.7
York Clipper GW Discharge Line	61	352	52	0.05	0.856	0.4
Min	61	6	1	0.05	0.11	0.4
Max	166	419	52	329	5.65	48
GeoMean	94.17	172.42	15.02	0.74	1.26	7.87