2021 Large Cruise Ship Wastewater Sampling Report

COMMERCIAL PASSENGER VESSEL ENVIRONMENTAL COMPLIANCE (CPVEC) PROGRAM

November 2021

Alaska Department of Environmental Conservation

Abbreviations:

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AMHS	Alaska Marine Highway System (State Ferry System)
AS	Alaska Statutes
AWTS	Advanced Wastewater Treatment Systems
BMP	Best Management Practices
BOD	Biological Oxygen Demand (sampled parameter)
BW	Blackwater
CLIA	Cruise Lines International Association
COD	Chemical Oxygen Demand (sampled parameter)
FC	Fecal Coliform (sampled parameter)
GW	Graywater
MSD	Marine Sanitation Device
ND	Non-detect value
QAPP	Quality Assurance Project Plan
SC	Specific Conductance (sampled parameter)
LCPV	Large Commercial Passenger Vessel
TSS	Total Suspended Solids (sampled parameter)
VSSP	Vessel Specific Sampling Plan

Table of Contents

INTRODUCTION

In 2020 no large commercial passenger vessels operated in Alaska waters due to Covid-19. In 2021 the Alaska season was composed of a limited return to service with reduced capacity and new operational protocols to mitigate for the ongoing Covid-19 pandemic (e.g., reduced passenger capacities onboard vessels). Eight (8) cruise ships operated in Alaska in 2021, of those two ships were authorized to discharge treated wastewater in Alaska, Silver Muse and Norwegian Encore, and one ship, the Encore, discharged treated wastewater and conducted sampling. Table 1 lists passenger and voyage counts for the 2021 season. Appendix A lists wastewater treatment systems onboard large cruise ships and discharge status.

This report summarizes 2021 onboard sampling and laboratory testing results of large cruise ship treated wastewater effluent in Alaska. Effluent sampling requirements are contained within the 2014 Large Commercial Passenger Vessel Wastewater Discharge General Permit (General Permit).

Sampling of wastewater effluent is a requirement under the General Permit for all large cruise ships discharging in Alaska waters. Sampling is needed to:

- Check for compliance of permit effluent limits
- Obtain information on treatment system performance for future discharge permits
- Compile information on potential environmental effects

Sample result data for cruise ships has been collected by the Department of Environmental Conservation since 2000. Reports for prior years can be found on the cruise program's report webpage:

https://dec.alaska.gov/water/cruise-ships/cruise-reports/

Table 1. 2021 Large Cruise Ship Voyages and Passenger Counts

Vessel Operator	Vessel Name		Passenger Capacity [1]	Planned Voyages	Annual Passenger capacity [2]	Approx. Crew Capacity
Carnival Cruise Lines	*Carnival Miracle*	*ND*	2124	11	23,364	930
Celebrity Cruises	*Celebrity Millenium*	*ND*	2158	11	23,738	1000
Holland America	*Nieuw Amsterdam*	*ND*	2106	10	21,060	930
Norwegian Cruise Line	*Norwegian Encore*		3998	13	51,974	1700
Princess Cruise Line	*Majestic Princess*	*ND*	3560	10	35,600	1250
Royal Caribbean Cruises	*Serenade of the Seas*	*ND*	2146	11	23,606	900
Royal Caribbean Cruises	*Ovation of the Seas*	*ND*	4180	10	41,800	1500
Silver Seas	*Silver Muse*		596	5	2,980	400
			Totals	**81**	**224,122**	

[1] Based on the number of lower berths. Actual number of passengers aboard varies.

[2] Assumes full capacity on every voyage.

METHODS

Samples are grab wastewater samples taken from a sample port prior to discharge. The number of required samples and what parameters are required to be analyzed are listed in the 2014 General Permit and for the US Coast Guard in the Quality Assurance Project Plan (QAPP). All samples were obtained in Southeast Alaska while the vessel was underway. Sample results presented in this report only include data collected while a cruise ship was discharging in Alaska.

The samples were taken according to requirements in the 2021 Cruise Line International Association Alaska Quality Assurance Project Plan for Sampling and Analysis of Treated Sewage and Graywater from Commercial Passenger Vessels (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 Commercial Passenger Vessel Environmental Compliance (Cruise Ship) program spot checked results submitted by the cruise ship operators for compliance with the QAPP and checked all results for compliance with 2014 General Permit limits.

RESULTS

No summary tables are provided due to limited sampling in 2021. Sample data for Norwegian Encore is provided in Appendix B. The number of samples received (n) are noted in each table. Non-detect (ND) values are entered as zeros[1]

Sampling for Priority parameters [volatile organic compounds (VOCs) and base neutral acids (BNAs)], and Nutrients are not required with every sample. There were two priority samples taken in 2020 and the results are listed in Appendix B.

REFERENCES

Helsel, D.R. (1990). Less than obvious; statistical treatment of data below the detection limit. Environ. Sci. Technol 24(12);1767-1774.

ONLINE RESOURCES

Alaska Department of Environmental Conservation (ADEC) Cruise Ship Program

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

2014 Large Cruise Ship General Permit

http://dec.alaska.gov/water/cruise-ships/cruise-general-permit/

Links for operators, including 2021 Quality Assurance Project Plan

http://dec.alaska.gov/water/cruise-ships/cruise-operator

Alaska Cruise Ship Laws and Regulations

http://dec.alaska.gov/water/cruise-ships/laws-regs/

Sample reports from prior years

http://dec.alaska.gov/water/cruise-ships/cruise-reports/

[1] To be consistent with large cruise ship data, that requires calculations for geometric means, all non-detect values (except those for metal concentrations) are presented as zero.

APPENDIX A: LARGE PASSENGER VESSEL DISCHARGE INFORMATION

Vessel Operator	Vessel Name		Wastewater Treatment System [1]		Authorization	Discharged in Alaska [2]	
			Manufacturer	Model (Units)		Underway	Stationary
Carnival Cruise Lines	*Carnival Miracle*	*ND*			None	No	No
Celebrity Cruises	*Celebrity Millenium*	*ND*	Hydroxyl	AWP CB-100	None	No	No
Holland America	*Nieuw Amsterdam*	*ND*	Hamworthy	MBR 360N (x2)	2013DB0004-0023	No	No
Norwegian Cruise Line	*Norwegian Encore*		Scanship	AWP 60	2013DB0004-0036	Yes	No
Princess Cruise Line	*Majestic Princess*	*ND*			None	No	No
Royal Caribbean Cruises	*Serenade of the Seas*	*ND*			None	No	No
Royal Caribbean Cruises	*Ovation of the Seas*	*ND*	Scanship	AWP 60	2013DB0004-0032	No	No
Silver Seas	*Silver Muse*		Scanship	AWP 25	2013DB0004-0029	No	No

[1] Nondischarging vessels are not required to provide treatment system information. MBR = membrane bioreactor

[2] Alaska water extends 3 miles from the coastline and inlcudes the Alexander Archipelago

Vessels highlighted in gray (and indicated by 'ND') did not discharge to AK waters.

APPENDIX B: WASTEWATER RESULTS

Color Key for Wastewater Results:

	Parameter Result Exceeds Daily Maximum in Large Cruise Ship GP.
	Exceedance of both Daily & Monthly GP Limits for Parameter.
	Parameters not tested or failed Quality Assurance (e.g. holding time not met).
"value"	Outlier flow rates from lab field data (i.e. determined by using 1.5x Quartile Range method), not used for Summary Statistics.

Table B1. 2021 Wastewater Results: NCL Encore

Company	Vessel	Sample Date	SampleNo	Temp (C)	pH (S.U.)	Free Cl (mg/L)	TR Cl (mg/L)	Fecal Coliform (FC/100mL)	TSS (mg/L)	BOD (mg/L)	Ammonia (as N) (mg/L)	Spec. Conductance (umhos/cm)
Norwegian	Encore	8/17/2021	AE 27243	29.5	6.84	0	0	0	4.4	2.8		
Norwegian	Encore	8/18/2021	AE 27244	31.2	6.92	0	0	0	0	2.6	0	991
Norwegian	Encore	8/18/2021	AE 27249	30.7	6.88	0	0	0	0	2.6	0	992
Norwegian	Encore	9/1/2021	AE 27245	31.5	6.76	0	0	0	6.8	12		
Norwegian	Encore	9/15/2021	AE 27246	26.9	6.83	0	0	3.0	12	16	9.1	797
Norwegian	Encore	10/6/2021	AE 27247	28.7	6.63	0	0	2.0	10	26		
Norwegian	Encore	10/13/2021	AE 27248	28.8	6.73	0	0	0	9.0	20		

Company	Vessel	Sample Date	E.coli (MPN/ 100mL)	COD (mg/L)	Total Organic Carbon	Alkalinity (Total)	Hardness (mg/L)	Nitrogen, Nitrate-Nitrite (as N) (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (as P) (µg/L)	Settleable Solids (mg/L)	Oil & Grease	3&4-Methylphenol	phenol
Norwegian	Encore	8/18/2021	1.0	44	12.7	98	72	4.0	2.2	0	0	0	0	0
Norwegian	Encore	9/15/2021	0	77	23.6	130	48	0.66	12	0	0	0	29	48

Table B2. 2021 Metals Results: NCL Encore

			DISSOLVED [1]					TOTAL [1]					
			Antimony (DISS)	Arsenic (DISS)	Copper (DISS)	Nickel (DISS)	Zinc (DISS)	Antimony (TR)	Arsenic (TR)	Copper (TR)	Nickel (TR)	Zinc (TR)	Mercury (Total)
Units			µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg	µg/mg
Reportable Limit (PQL)			2.5	2.5	1	1	1	1	1	1	1	1	0.2
Vessel Name	**Date**	**WW Type**											
Encore	8/18/2021	MIX	42	ND	ND	ND	24	ND	ND	ND	ND	37	ND
Encore	9/15/2021	MIX	ND	1.4	2.3	6.1	50	ND	1.0	3.7	6.5	50	ND

[1] ND=non-detect. **Note:** Lab analysis conducted for: Beryllium, Cadmium, Chromium, Lead, Selenium, Silver, and Thallium. All results were non-detects so these metals were omitted from the table.