



2010 Assessment of Cruise Ship Environmental Effects in Washington



July 2011
Publication no. 11-10-053

Publication and Contact Information

This report is available on the Department of Ecology's website at <http://www.ecy.wa.gov/biblio/1110053.html>

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2010 Assessment of Cruise Ship Environmental Effects in Washington

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Executive Summary

A Memorandum of Understanding (MOU) between Department of Ecology (Ecology), the North West & Canada Cruise Association (NWCCA) and the Port of Seattle was originally signed on April 20, 2004, and has been amended five times since. This MOU covers large passenger ships that are members of the NWCCA. It does not cover ships such as Alaska Marine Highway ferries, shipping vessels, small passenger ships or boats.

The MOU prohibits discharges of both blackwater and graywater to Washington state waters from all cruise ships except discharges treated with advanced wastewater treatment systems (AWTS) and when stringent requirements are met. Such systems have been and are being installed on some of the cruise ships serving the Alaska market. AWTS are installed to provide treatment that meets or exceeds Alaska's requirements under federal law.

The MOU defines the subject waters as being consistent with Washington marine waters. It requires sampling and monitoring of wastewater discharges and allows for vessel inspections by Ecology. The MOU includes additional elements, such as:

- Sewage sludge (biomass) discharges are prohibited within 12 nautical miles from shore and within the Olympic Coast National Marine Sanctuary.
- No discharges within a half a mile of shellfish beds.
- Specific sampling regimen, testing, and reporting are required.
- Continuous monitoring for turbidity and disinfection with capability to shut down immediately.
- Advanced notification and documentation are required from ships planning to discharge via an AWTS.
- Cruise ships must comply with Washington's more restrictive hazardous-waste laws, are prohibited from dumping garbage into state waters and may only discharge oily bilge water per regulation.

The MOU continues to be a valuable tool in meeting the goal of protecting Washington's marine waters from cruise-ship waste water. The requirement for discharges to be treated with AWTS ensures only high quality effluent is discharged. The requirement to allow vessels to be inspected leads to increased compliance. The need to understand the requirements of the MOU has called for increased communication between Ecology, and the cruise lines and vessel staff.

The cruise lines and vessels operating under the MOU were in compliance with MOU requirements throughout the 2010 season. Some notable successes include, sampling results for conventional pollutants continue to show excellent effluent quality, and increased waste minimization efforts.

The cruise-ship MOU has resulted in several benefits to Washington's environment:

- It ensures that we have a water-quality strategy in place for large passenger vessels.
- It increases Ecology's understanding of the operational practices of the cruise industry, and increases the cruise industry's understanding of the environmental concerns in Washington.
- It forges a new and valuable partnership between state regulators, the cruise industry and other interested parties.
- It retains the state's authority to enforce Washington's water quality laws.

Admittedly, the MOU also has its limitations:

- Compliance is voluntary.
- Enforceability is limited to those federal and state water quality laws that continue to apply to cruise ships.
- Applicability is limited. Cruise ships that do not make a port call while in Washington waters or are not a member of the North West & Canada Cruise Association are not covered by the MOU.

The Department of Ecology recommends that:

1. The MOU continues to be used as a complement to environmental regulations until state specific regulations for cruise ship waste management in Washington State are put in place.
2. Ecology continues to inspect ships that are subject to the MOU, including closely looking at wastewater management and the management of other waste streams.
3. The parties of the MOU continue to work together on evaluating discharges in MOU waters.
4. It is recommended that the parties of the MOU work together this year to re-evaluate the funding mechanism to provide for funding beyond 2011.
5. The cruise lines review their policies and procedures related to outside vessel maintenance activities while in port and to ensure that best management practices are being followed.
6. The cruise lines continue to conduct a thorough review of records on an on-going basis throughout the season as well as at the end of the season to evaluate compliance, and that all recommendations made in inspection reports are implemented.

1. Introduction

1.1 Assessment report

The purpose of this report is to assess the performance of the cruise industry for environmental impacts to state waters for the 2010 cruise season. The goals of this report are to:

1. Analyze the overall compliance with the Memorandum of Understanding.
2. Evaluate the performance of the advanced wastewater treatment systems.
3. Make recommendations in relation to the matters discussed in the report.

This report also presents general background information and detailed appendices of wastewater sampling data. Issues and concerns related to the discharge of bilge and ballast water are beyond the scope of this report.

1.2 Cruise industry operations in Washington State

North West & Canada Cruise Association's (NWCCA) Carnival Cruise Lines, Celebrity Cruises, Holland America Line, Norwegian Cruise Line, Princess Cruises, and Royal Caribbean International operated regularly scheduled cruises of large ships between Seattle and Alaska. Most of these large ships have a capacity of about 2,000 to 4,200 persons on board. There were also two calls to Port Angeles. There were no calls to ports in Washington from large cruise ships that are not part of NWCCA. Alaska's Marine Highway runs regular cruises out of Bellingham to Alaska. The ships have a passenger/crew capacity of about 175 to 225.

This report centers on the operations of the large cruise ships that are covered under a Memorandum of Understanding (MOU); however, smaller passenger vessels frequent areas such as the Columbia and Snake Rivers, Puget Sound, and the San Juan Islands. The Department of Ecology and the Department of Health are in the beginning stages of a process to petition EPA for no-discharge zone (NDZ) status for all or parts of Puget Sound. The purpose of the project is to prevent pathogen and nutrient loading from vessel sewage. The NDZ would apply to all types and sizes of vessels. The multi-year process will begin with an evaluation of current pump-out stations, vessel usage, costs and benefits, and will also include surveys and outreach to stakeholders.

Large cruise ships have operated out of Seattle since 1999. The cruise business is one of the fastest growing business segments at the Port of Seattle. The Port has had two berths suitable for large vessels at Terminal 91. There is one berth at Pier 66. Three vessels departed Seattle on Fridays, Saturdays, and Sundays, one vessel departed Seattle on Tuesdays, one vessel departed Seattle every other Monday and some additional calls. The figure below shows the rising number of passengers enjoying Alaska-bound cruises since 1999.

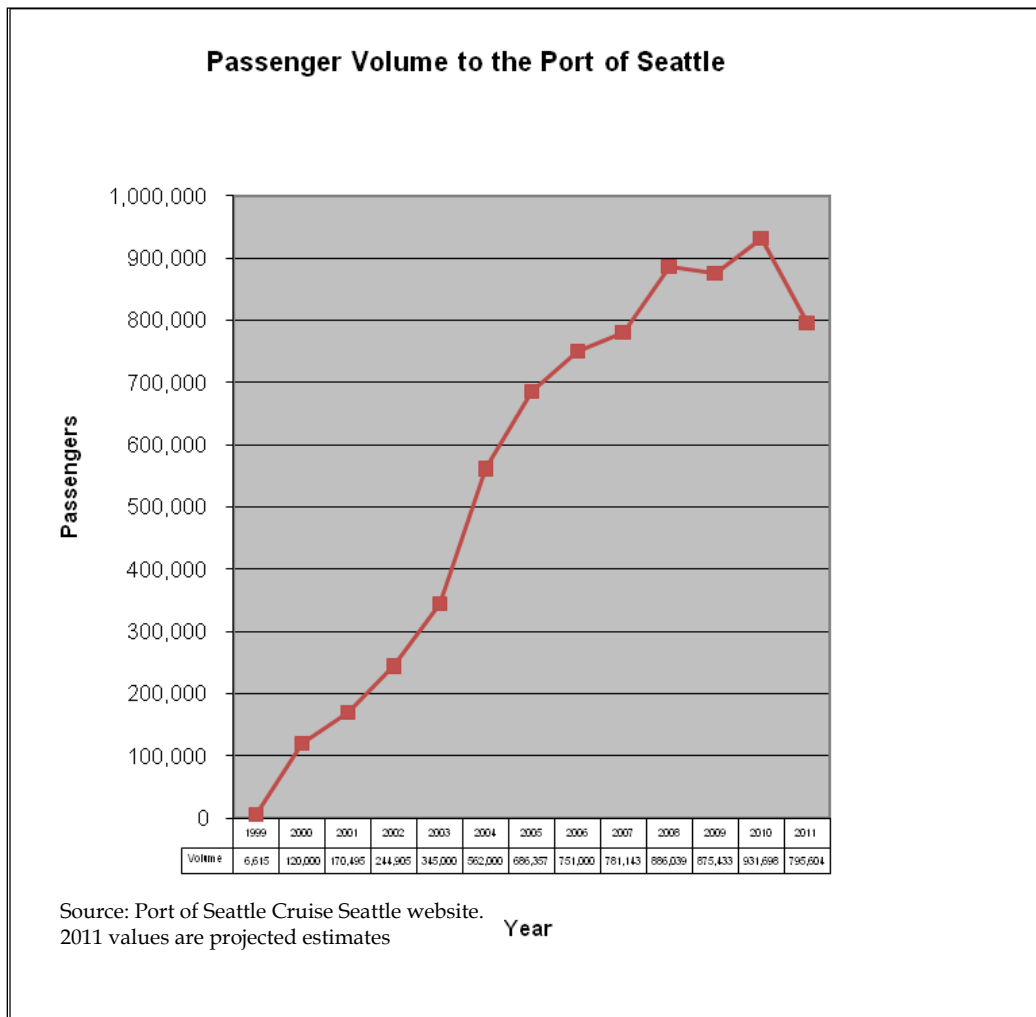


Figure 1. Passenger Volume

Cruise ships have been operating under a rather ambiguous set of environmental standards. Cruise ships and their wastewater treatment systems have been excluded from many of the U.S. environmental laws and regulations that land-based industries must meet. In 2008, the Environmental Protection Agency issued the Vessel General Permit (VGP) for commercial vessels greater than 79 feet. The permit covers various discharge types including, but not limited to, graywater, oily bilge, pool/spa water, and ballast water. The permit does not cover blackwater unless it is combined with graywater.

Several other environmental standards may apply to certain vessels. The United States Coast Guard (USCG) certifies marine sanitation devices to meet certain operational standards for performance but does not monitor wastewater effluent quality. Large ships operate under International Convention for the Prevention of Pollution from Ships (MARPOL), an environmental treaty drafted by the International Maritime Organization (IMO). Annex IV of MARPOL addresses the disposal of sewage. The U.S. did not sign Annex IV; therefore, it is not mandatory that ships follow Annex IV in the United States. Most large ships have adopted the “Cruise Industry Waste Management Practices and Procedures” put forth by the Cruise Lines International Association (CLIA).

The North West & Canada Cruise Association (NWCCA) consisted of the following member lines during the 2010 season:

- | | |
|--------------------------|-----------------------------------|
| 1. Carnival Cruise Lines | 7. Oceania Cruises |
| 2. Celebrity Cruises | 8. Princess Cruises |
| 3. Crystal Cruises | 8. Regent Seven Seas Cruises |
| 4. Disney Cruise Line | 10. Royal Caribbean International |
| 5. Holland America Line | 11. Silversea Cruises |
| 6. Norwegian Cruise Line | |

In 2010, 100% of port calls by large vessels to Washington State ports were made by NWCCA member ships. Table 1 below depicts the member lines, the ships visiting Seattle, the number of port calls and the persons on board.

Table 1. 2010 Cruise Ships Calling to Ports in Washington

Vessel Operator	Vessel Name	2010 Number of Port Calls ¹	Total Persons on Board ²
NWCCA MEMBERS			
Carnival Cruise Lines	CARNIVAL SPIRIT	19	3434
Celebrity Cruises	INFINITY	19	3379
Celebrity Cruises	MERCURY	1	2785
Celebrity Cruises	MILLENIUM	2	3450
Holland America Line	AMSTERDAM	14	2027
Holland America Line	OOSTERDAM	21	2716
Holland America Line	ROTTERDAM	18	2232
Holland America Line	STATENDAM	2*	1848
Holland America Line	VOLENDAM	1	2079
Holland America Line	ZAANDAM	21	2079
Holland America Line	ZUIDERDAM	1*	2758
Norwegian Cruise Line	NORWEGIAN PEARL	19	3494
Norwegian Cruise Line	NORWEGIAN STAR	20	3448
Princess Cruise Line	GOLDEN PRINCESS	20	3658
Princess Cruise Line	ROYAL PRINCESS	10	1062
Princess Cruise Line	SAPPHIRE PRINCESS	20	3916
Royal Caribbean International	RHAPSODY OF THE SEAS	18	3381
Total		224	
NON NWCCA MEMBERS			
None			

¹ Numbers come from Port of Seattle 2010 Cruise Ship Sailing Schedule and the Port of Seattle staff and annual reports from the cruise lines.

² Numbers come from Alaska DEC 2010 Large Commercial Vessel Discharge Status and research. Actual # of passengers/crew may vary.

*one call to Port Angeles

The Port of Seattle's schedule for 2011 includes a total of 195 port calls from the following vessels: Carnival Cruise Line's CARNIVAL SPIRIT, Celebrity Cruises CENTURY, Celebrity Cruises INFINITY, Celebrity Cruises MILLENNIUM, Crystal Cruises CRYSTAL SYMPHONY, Holland America Line's AMSTERDAM, OOSTERDAM, WESTERDAM, and ZAANDAM, Norwegian Cruise Line PEARL and STAR, Princess Cruises' GOLDEN

PRINCESS, and SAPPHIRE PRINCESS, and Royal Caribbean's RHAPSODY OF THE SEAS. P&O's ARCADIA is also making one port call. All of the scheduled port calls are from vessels that are part of the North West & Canada Cruise Association, except for the ARCADIA port call.

1.3 Memorandum of Understanding summary

On April 20, 2004, a Memorandum of Understanding (MOU) between Ecology, the North West & Canada Cruise Association (NWCCA) and the Port of Seattle was signed. The MOU covers ships that are members of the NWCCA, and therefore does not cover ships such as the Alaska Marine Highway ferries, or any of the small ships. The MOU bans cruise-ship wastewater discharges (blackwater and graywater), except from vessels with advanced treatment systems (AWTS). The MOU allows continuous discharge in Washington waters from these AWTS with stringent provisions. Sewage sludge (biomass) may only be discharged more than 12 nautical miles from shore and not within the Olympic Coast National Marine Sanctuary. The MOU specifies a sampling regime, testing, reporting and limit requirements, and requires advanced notification and documentation from ships planning to discharge. The MOU also specifies that the ships comply with Washington's more restrictive hazardous waste laws and stipulates that garbage may not be discharged in state waters.

The MOU and related documents are available on Ecology's website at:
http://www.ecy.wa.gov/programs/wq/wastewater/cruise_mou/index.html

A copy of the current MOU (Amendment No. 5) is included in Appendix A.

1.4 MOU funding

Ecology, the Port of Seattle, the NWCCA and its member lines finalized a process via an agreement to recover costs incurred by Ecology associated with implementing the MOU. A funding agreement for the 2006, 2007, 2008, 2009, 2010 and 2011 seasons were signed and employed.

The parties of the MOU will need to re-evaluate the funding mechanism to provide for funding beyond 2011.

2. MOU Requirements

2.1 Description of requirements

Applicability of MOU

The MOU applies to cruise ships that are part of the North West & Canada Cruise Association (NWCCA) and only to those member ships making a call at a port in Washington. NWCCA member ships that do not make a port call in Washington are not subject to the provisions of the MOU while transiting off the Washington coast. All the ships subject to the MOU are engaged in cruise itineraries greater than one-day duration.

The geographic area in which the terms of the MOU apply was developed with much consideration. Washington’s definition of “waters of the state” reaches to the international border with Canada. The cruise industry agreed to recognize Washington’s definition of state waters for the purposes of the MOU. The “Waters subject to this MOU” are defined as including the Puget Sound and the Strait of Juan de Fuca south of the international boundary with Canada. Off the west coast of Washington, “Waters subject to this MOU” include the belt of seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending seaward a distance of three miles, as illustrated in Appendix iii of the MOU. The definition of the “waters subject to this MOU” is inclusive of the marine waters of the state as defined in Washington law. See figure 2 below.

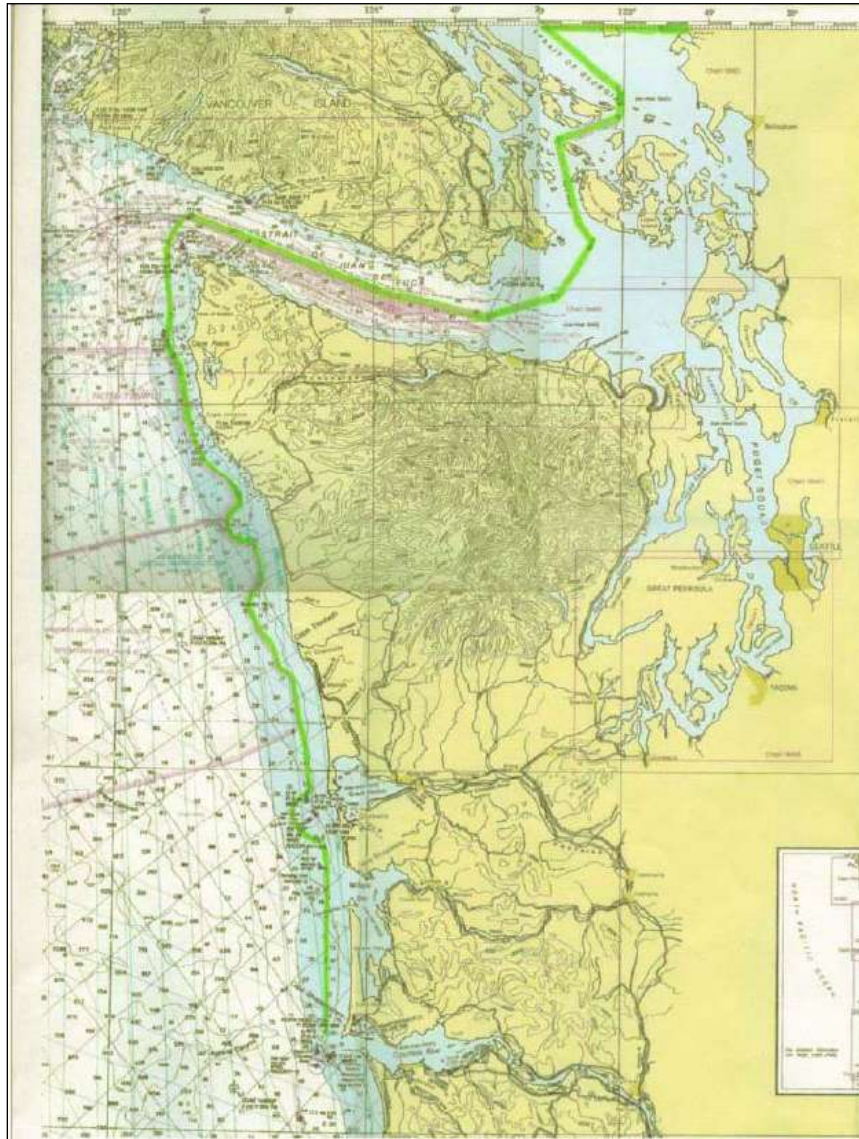


Figure 2. Map of “Waters” Subject to this MOU

Wastewater discharges

The MOU defines “blackwater” as wastes from toilets, urinals, medical sinks and other similar facilities, and “graywater” as including drainage from dishwasher, shower, laundry, bath, galley drains and washbasin drains.

Advanced wastewater treatment systems (AWTS) are systems that meet the higher standards and testing regime as set out in federal law, Title XIV, Certain Alaska Cruise Ship Operations, Section 1404(c). The AWTS are systems such as the Zenon and Hamworthy membrane biological reactor ultrafiltration system, the Scanship biological reactor and ultrafiltration system, and the Rochem reverse osmosis ultrafiltration system. Table 2 identifies the type of treatment in use during the 2010 season by NWCCA member ships.

Table 2. 2010 Vessels and Wastewater Treatment

Vessel Operator	Vessel Name	Blackwater (BW) Treatment System Manufacturer	Graywater (GW) Treatment System Manufacturer	Type of Treatment System
NWCCA MEMBERS				
Carnival Cruise Lines	CARNIVAL SPIRIT	Traditional MSD - Triton	None	Non AWTS: traditional Marine Sanitation Device with aeration, settling and chlorination
Celebrity Cruises	INFINITY	Zenon	Mixed with BW	AWTS: Zenon is a bioreactor and ultrafiltration system with UV disinfection.
Celebrity Cruises	MERCURY	Traditional MSD - Biopure	None	Non AWTS: traditional Marine Sanitation Device with aeration, settling and chlorination
Celebrity Cruises	MILLENIUM	Hydroxyl	Hydroxyl	AWTS: Hydroxyl is a biological reactor and ultrafiltration system with UV disinfection.
Holland America Line	AMSTERDAM	Traditional MSD	None	Non AWTS: traditional Marine Sanitation Device with aeration, settling and chlorination
Holland America Line	OOSTERDAM	Traditional MSD	None	Non AWTS: traditional Marine Sanitation Device with aeration, settling and chlorination
Holland America Line	ROTTERDAM	Traditional MSD	None	Non AWTS: traditional Marine Sanitation Device with aeration, settling and chlorination
Holland America Line	STATENDAM	Zenon	Mixed with BW	AWTS: Zenon is a bioreactor and ultrafiltration system with UV disinfection.
Holland America Line	VOLENDAM	Zenon	Mixed with BW	AWTS: Zenon is a bioreactor and ultrafiltration system with UV disinfection.
Holland America Line	ZAANDAM	Zenon	Mixed with BW	AWTS: Zenon is a bioreactor and ultrafiltration system with UV disinfection.
Holland America Line	ZUIDERDAM	Unknown	Unknown	Unknown
Norwegian Cruise Line	NORWEGIAN PEARL	Scanship	Mixed with BW	AWTS: Scanship is a biological reactor and ultrafiltration system with UV disinfection.
Norwegian Cruise Line	NORWEGIAN STAR	Scanship	Mixed with BW	AWTS: Scanship is a biological reactor and ultrafiltration system with UV disinfection.
Princess Cruise Line	GOLDEN PRINCESS	Hamworthy Bioreactor	Accommodations mixed with BW	AWTS: Hamworthy is a biological reactor and ultrafiltration system with UV disinfection.
Princess Cruise Line	ROYAL PRINCESS	Hamworthy Bioreactor	Accommodations mixed with BW	AWTS: Hamworthy is a biological reactor and ultrafiltration system with UV disinfection.
Princess Cruise Line	SAPPHIRE PRINCESS	Hamworthy Bioreactor	Accommodations mixed with BW	AWTS: Hamworthy is a biological reactor and ultrafiltration system with UV disinfection.
Royal Caribbean International	RHAPSODY OF THE SEAS	Hamman/NAVALIS	NAVALIS (undergoing start-up)	Non AWTS: traditional Marine Sanitation Device with aeration, settling and chlorination + AWTS: biological ultrafiltration with oxidation and UV disinfection.
NON NWCCA MEMBERS				
None				

The MOU prohibits discharges of untreated blackwater and untreated graywater within waters subject to the MOU from any type of treatment system. The MOU also bans discharges of treated blackwater and treated graywater unless treated with an AWTs which meets the Alaska requirements and under these terms:

- The ships are allowed to discharge equal to or greater than one nautical mile away from its berth and equal to or greater than 6 knots with the submittal of documentation and provisions including 24-hour continuous monitoring for turbidity and UV disinfection, and emergency shutdown for treatment upsets.
- The ships are allowed to discharge within one nautical mile of berth with further documentation and provisions including 24-hour continuous turbidity or equivalent monitoring and UV disinfection, emergency shutdown for treatment upsets, and ultraviolet light disinfection immediately prior to discharge.

All ships discharging within waters subject to the MOU must:

- Not discharge within 0.5 miles of bivalve shellfish beds that are recreationally harvested or commercially approved to harvest. For the 2010 season, this includes three areas (President's Point, Apple Tree Cove, and Tyee Shoal).
- Immediately stop all discharges when high turbidity occurs and when a disinfection system upset occurs (and make appropriate notifications).
- Sample the effluent once per month while in Washington using a Washington state-certified laboratory.
- Meet the limitations on discharge as set in Alaska regulation.
- Split samples with Ecology upon request.
- Conduct Whole Effluent Toxicity (WET) testing once every two years for homeported vessels and once every 40 calls for other vessels (applies to continuous discharge approved vessels only).
- Provide test results provided to Alaska.
- Notify Ecology prior to sampling and allow Ecology to conduct inspections to verify compliance with the MOU (all vessels).
- Notify Ecology of any material changes made to the system.

The MOU prohibits the discharge of residual solids from the treatment system (sludge or biomass) in waters subject to the MOU, within 12 nautical miles from shore, and within the Olympic Coast National Marine Sanctuary. Residual solids are defined as including grit or screenings, ash generated during the incineration of sewage sludge and sewage sludge, which is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works and includes scum or solids removed in advanced wastewater treatment processes.

The discharge of oily bilge water is prohibited if not in compliance with applicable federal and state laws. Vessels typically discharge at less than 15 parts per million, and some are more stringent at 10 or five parts per million.

Hazardous waste

Per the MOU, Washington and the NWCCA agreed to a uniform application procedure for the EPA national identification number under the Resource Conservation and Recovery Act (RCRA). The MOU details that Washington has the right to inspect all records upon request for hazardous waste management. NWCCA member lines shall provide an annual report regarding the total hazardous waste offloaded in Washington. NWCCA agrees to comply with the guidelines for certain waste streams per Washington regulations.

Solid waste

The discharge of solid waste (garbage) is prohibited in waters subject to the MOU.

2.2 Alaska requirements and certification

The U.S. Congress enacted Title XIV – Certain Alaskan Cruise Ship Operations in December 2000. The law creates wastewater standards for vessels. The regulations to implement the law (AS 46.03.460 – AS 46.03.490 and 18 AAC 69) became effective in July 2001 and November, 2002, and are enforced by the United States Coast Guard. Under the legislation, large cruise ships may discharge blackwater and graywater in Alaska while underway and law allows continuous discharge of blackwater and graywater that meet more stringent standards through a certification process. A ship approved by the U.S. Coast Guard to discharge continuously must sample their wastewater twice per month.

In August 2006, a ballot measure added new requirements to the Alaska Commercial Passenger Vessel Environmental Compliance Program. The new statute requires vessels to obtain a wastewater discharge permit for the discharge of any treated sewage, graywater, or other wastewater into marine waters of the state. The General Permit has stringent monitoring and reporting requirements as well as interim and final effluents limits.

All of the cruise ships subject to the Washington Cruise MOU are also subject to the Alaska requirements.

3. Documentation of Discharges from Advanced Wastewater Treatment Systems per the MOU

3.1 Documentation required

Discharges at least one nautical mile away from its berth at a port in Washington and traveling at a speed of at least six knots:

Documentation is required for discharges from an AWTS occurring at least one nautical mile away from its berth at a port in Washington and traveling at a speed of at least six knots. The documentation must identify the type of treatment system in use on the ship, include schematic diagrams of the system and show that the system is certified by the United States Coast Guard. Additional submissions include vessel specific information on how the ship's system meet 24-hour continuous turbidity or equivalent monitoring and UV monitoring, and documentation of system design that demonstrates emergency shut-down capacity.

Discharges continuously

The cruise ship operator is required to submit the above documentation when the discharge occurs continuously. Additional submissions include vessel specific information that all treated effluent will receive disinfection using an ultraviolet light system immediately prior to discharge, copies of water quality test results for the past six months and a vessel specific plan that identifies storage capacities and notification procedures.

3.2 2010 approvals

Ship(s) receiving approval to discharge at least one nautical mile away from berth and traveling at least six knots

The Norwegian Cruise Line NORWEGIAN PEARL and NORWEGIAN STAR submitted documentation that the systems were certified by the USCG for continuous discharge in Alaska for the 2010 season and requested approval to discharge one mile or more from berth while traveling at a speed of six or more knots. Schematics and other documentation had also been provided. Ecology staff reviewed the documentation and on May 4, 2010 sent a letter detailing approval for discharge one mile or more from berth while traveling at a speed of six or more knots.

Ships receiving approval to discharge continuously

There were no requests or approvals for continuous discharge.

Table 3. 2010 Approval to Discharge

Vessel Operator	Vessel Name	Discharging in Washington ¹ ≥ 1nm from berth and ≥ 6 knots		Discharging in Washington ¹ continuously (at berth or within 1 nm of berth)		Date Approved
		BW	GW	BW	GW	
Carnival Cruise Lines	CARNIVAL SPIRIT	NO	NO	NO	NO	NA
Celebrity Cruises	INFINITY	NO	NO	NO	NO	NA
Celebrity Cruises	MERCURY	NO	NO	NO	NO	NA
Celebrity Cruises	MILLENIUM	NO	NO	NO	NO	NA
Holland America Line	AMSTERDAM	NO	NO	NO	NO	NA
Holland America Line	OOSTERDAM	NO	NO	NO	NO	NA
Holland America Line	ROTTERDAM	NO	NO	NO	NO	NA
Holland America Line	STATENDAM	NO	NO	NO	NO	NA
Holland America Line	VOLENDAM	NO	NO	NO	NO	NA
Holland America Line	ZAANDAM	NO	NO	NO	NO	NA
Holland America Line	ZUIDERDAM	NO	NO	NO	NO	NA
Norwegian Cruise Line	NORWEGIAN PEARL	YES	YES	NO	NO	May 4, 2010
Norwegian Cruise Line	NORWEGIAN STAR	YES	YES	NO	NO	May 4, 2010
Princess Cruise Line	GOLDEN PRINCESS	NO	NO	NO	NO	NA
Princess Cruise Line	ROYAL PRINCESS	NO	NO	NO	NO	NA
Princess Cruise Line	SAPPHIRE PRINCESS	NO	NO	NO	NO	NA
Royal Caribbean	RHAPSODY OF THE SEAS	NO	NO	NO	NO	NA

BW = Blackwater; GW = Graywater; NA = not applicable

¹ Washington waters refers to the "waters subject to this Memorandum of Understanding (MOU)" as defined in the MOU signed April 20, 2004 and as amended.

4. Sampling per the MOU

4.1 Sampling required

Alaska requires twice-monthly sampling of conventional pollutants, as well as sampling of additional pollutants as part of the Alaska general permit. Per the MOU, the vessels that are approved for discharge are required to sample the quality of the treated effluent using a Washington state-certified laboratory at least one time per month while at port in Seattle during each cruise season. The cruise lines must use the sampling requirements set up by the USCG, Captain of the Port, Southeast Alaska Policy for conventional pollutants continued compliance monitoring regime. The MOU requires that the following parameters be sampled: pH, Biochemical Oxygen Demand (BOD), Fecal Coliform, Total Suspended Solids (TSS), and Total Residual Chlorine (TRC).

Whole effluent toxicity testing

Whole effluent toxicity (WET) testing is required for vessels that are approved to discharge continuously, once every 2 years for homeported vessels (20 or more calls/turnarounds per season) and once per 40 port calls or turnarounds for all other vessels. WET testing guidelines were developed specifically for cruise ships by Ecology and are available on Ecology's website on cruise ships.

http://www.ecy.wa.gov/programs/wq/wastewater/cruise_mou/WETtestguideMOU2008.pdf

For the 2010 season, there were no WET tests required nor submitted. A synopsis of previous results is included in annual reports for those seasons.

Copies of the cruise ship WET test reports can be provided upon request.

4.2 Sampling Data

Sampling results were received for the cruise ships that were approved for discharge in waters subject to the MOU:

- Norwegian Cruise Line's PEARL and STAR

Sampling results were compared to the limits established by Alaska/the Washington Cruise MOU and are also compared to Washington's water quality standards. Sampling results are summarized for all data received in Appendix B.

Table 4 below shows the results for the cruise ships during the approval period and within Washington/Alaska voyages.

Table 4. Sample Results - Cruise Ships Approved for Discharge into Washington Waters

SHIP: NORWEGIAN PEARL											
		pH	BOD ³	TSS ⁴	Chlorine Residual ⁵	Fecal Coliform ⁶	Ammonia	Copper (dissolved)	Nickel (dissolved)	Zinc (dissolved)	Comments
		St. Units	mg/l	mg/l	mg/l	#/100 ml	mg/l	ug/l	ug/l	ug/l	
MOU/Alaska Limits ¹		6-9	30/45	30/45	10 ug/l	20 / 40	Ammonia, Copper, Nickel and Zinc required in Alaska only.				
WA State Water Quality Standards ²		7.0-8.5	NA	NA	13 / 7.5 ug/l	14 / 43					
Sample Date	Location/ Lab										
5/12/2010	Juneau/Admiralty/Microbac	6.81	ND	ND	ND	ND	0.52	21	3.5	83	
5/16/2010	Seattle/Spectra	7.1	6.2	6.4	ND	ND					
5/19/2010	Juneau/Admiralty/Microbac	6.77	2.9	ND	ND	2	11	5.3	4.9	100	unannounced
5/25/2010	Juneau/Admiralty/Microbac	6.56	3.1	11	ND	96	1.9	22	16	82	
6/2/2010	Juneau/Admiralty/Microbac	6.88	ND	ND	ND	15	12	5	4.6	64	
6/6/2010	Seattle/Spectra	6.76	ND	4.0	ND	ND					
6/9/2010	Juneau/Admiralty/Microbac	6.78	ND	ND	ND	ND	21	6.2	ND	200	
7/7/2010	Juneau/Admiralty/Microbac	6.79	2.1	ND	ND	2	22	7	1.9	45	
7/11/2010	Seattle/Spectra	6.74	2.7	4.0	ND	4					
7/14/2010	Juneau/Admiralty/Microbac	6.92	2.8	ND	ND	ND	26	7.8	4.8	54	
8/4/2010	Juneau/Admiralty/Microbac	7.14	6.6	10	ND	ND	14	5.7	6.5	35	
8/8/2010	Seattle/Spectra	6.75	4	10	ND	ND					
8/11/2010	Juneau/Admiralty/Microbac	6.86	4.3	5	ND	ND	26	9	5.2	25	
		6.94	3.3	11	ND	*					
8/18/2010	Juneau/Admiralty/Microbac						12	11	6.4	50	unannounced. Fecal coliform had invalid results and were re-sampled on 8/20 and 8/22
8/20/2010	Ketchikan/R&M	6.87	NA	NA	ND	ND					
8/22/2010	Seattle/Spectra	7.02	NA	NA	ND	ND					
9/8/2010	Juneau/Admiralty/Microbac	6.91	ND	ND	ND	ND	13	7.5	4.4	67	
9/12/2010	Seattle/Spectra	6.89	4	4.7	ND	10					
	MINIMUM	6.56	ND	ND	ND (<0.1)	ND	0.5	5.0	ND	25	met Seattle sampling requirement
	AVERAGE		3.3	5.9			14.5	9.8	5.8	73	
	MAXIMUM	7.14	6.6	11	ND (<0.1)	96	26.0	22.0	16.0	200	
	GEOMETRIC MEAN					3.24					

SHIP: NORWEGIAN STAR											
		pH	BOD ³	TSS ⁴	Chlorine Residual ⁵	Fecal Coliform ⁶	Ammonia	Copper (dissolved)	Nickel (dissolved)	Zinc (dissolved)	Comments
		St. Units	mg/l	mg/l	mg/l	#/100 ml	mg/l	ug/l	ug/l	ug/l	
MOU/Alaska Limits¹		6-9	30/45	30/45	10 ug/l	20 / 40	Ammonia, Copper, Nickel and Zinc required in Alaska only.				
WA State Water Quality Standards²		7.0-8.5	NA	NA	13 / 7.5 ug/l	14 / 43					
Sample Date	Location/ Lab										
5/11/2010	Ketchikan/Admiralty/Microbac	6.92	14	ND	ND	ND	1.7	2.5	12	220	
5/18/2010	Ketchikan/Admiralty/Microbac	6.92	6.4	ND	ND	4	9.6	3	12	46	Unannounced
5/22/2010	Seattle/Spectra	7.04	5.2	3.3	ND	7					
5/25/2010	Ketchikan/Admiralty/Microbac	7.03	10	ND	ND	ND	29	6.6	14	69	
6/5/2010	Seattle/Spectra	6.96	17	7.3	ND	ND					
6/8/2010	Ketchikan/Admiralty/Microbac	6.98	9.8	8	ND	2	23	3.5	10	190	
6/15/2010	Ketchikan/Admiralty/Microbac	7.02	12	ND	ND	ND	30	2.4	10	70	
7/6/2010	Ketchikan/Admiralty/Microbac	6.87	7.5	4	ND	50	16	1.4	9.5	39	
7/24/2010	Seattle/Spectra	6.97	10	3.5	ND	ND					
7/27/2010	Ketchikan/Admiralty/Microbac	6.88	9.8	ND	ND	ND	23	3.0	11	81	
8/3/2010	Ketchikan/Admiralty/Microbac	6.6	9.8	12	ND	10	20	1.2	9.5	73	
8/7/2010	Seattle/Spectra	6.87	10	7	ND	ND					
8/10/2010	Ketchikan/Admiralty/Microbac	7.16	13	ND	ND	ND	28	2.1	8.9	30	
8/18/2010	Juneau/Admiralty/Microbac	7.15	10	4	ND	2	16	2.5	6.9	23	Unannounced
9/7/2010	Ketchikan/Admiralty/Microbac	7.13	5	ND	ND	ND	35	3.0	7.6	59	
9/11/2010	Seattle/Spectra	7.11	4.0	0.67	ND	ND					
9/14/2010	Ketchikan/Admiralty/Microbac	6.96	4.1	ND	ND	ND	30	ND	7.5	42	
	MINIMUM	6.6	4.0	ND	ND (<0.1)	ND	1.7	ND	6.90	23	met Seattle sampling requirement
	AVERAGE		9.3	4.8			21.8	2.8	9.9	78.5	
	MAXIMUM	7.16	17	12	ND (<0.1)	50	35	7	14	220	
	GEOMETRIC MEAN					3.05					

ND = Non Detect, value in box is the detection level. Unannounced sampling includes other parameters not listed above.

NA = Not Applicable. Sample not required, nor taken.

BOD = Biochemical Oxygen Demand - or organics; TSS = Total Suspended Solids

mg/l = milligrams per liter; ug/l = micrograms per liter; #/100 ml = coliforms per 100 milliliters

¹MOU/Alaska limits from Title XIV, Certain Alaska Cruise Ship Operations, Section 1404(c) /40CFR 133.102

BOD and TSS: 30-day average shall not exceed 30 mg/l, 7-day average shall not exceed 45 mg/l

Fecal Coliform: geometric mean of any 30-day period shall not exceed 20 fecal coliform/100 ml and not more than 10% of the samples exceed 40 fecal coliform/100 ml

²Washington State Water Quality Standards for Surface Waters of the State of Washington Chapter 173-201A WAC

Fecal Coliform: shall not exceed a geometric mean of 14 colonies/100 ml and not more than 10% of a samples shall exceed a geometric mean of 43 colonies/100 ml

pH: 7-8.5 with a human-caused variation within less than 0.2

chlorine: 13 µg/l is the acute limit (1-hour average); 7.5 µg/l is the chronic limit (4-day average)

For the ships that discharged from the AWTS's, the results were in compliance with the Washington MOU and Alaska limits. However, when the samples were compared to Washington's water quality standards, pH might have violated the standards at the point of discharge. Cruise-ship discharges are not allowed a mixing zone at the point of discharge. On-land sewage treatment plants are granted mixing zones around the stationary point of discharge. Most on-land sewage treatment plants discharging to marine waters are permitted for pH limits of 6.0-9.0 and must comply with the water quality standards at the boundary of the mixing zone. The results from the cruise ships for the parameters listed as above are generally as good as or better than most of the on-land plants.

Random unannounced samples were taken by the Alaska Department of Environmental Conservation in Alaska throughout the season. The samples taken included other parameters than the conventional pollutants detailed in Table 4. Copies of laboratory results received by Ecology can be obtained through Ecology's public disclosure office.

The sample results submitted by the lines included some results for other parameters required as part of the Alaska General Permit including copper, zinc, nickel, and ammonia. Ammonia ranged from 0.5 mg/l to 35 mg/l (avg = 18). Dissolved copper ranged from Non-detect to 22 µ/l. Dissolved nickel ranged from Non-detect to 16 µ/l. Dissolved zinc ranged from 23 µ/l to 220 µ/l. Ammonia, copper and zinc results were lower than previous seasons. These results are included in Appendix B.

5. Inspections

5.1 Inspections per the MOU

Eight different vessels were inspected by Ecology staff throughout the 2010 season. A list of vessels inspected is included in Table 6. The inspections were per the MOU and included a walkthrough of the wastewater systems, a review of discharge records, a review of notification and discharge procedures, and a review of other wastestreams. The inspections typically also included sampling for vessels approved to discharge. Results are included in the inspection reports.

In general, the ship's wastewater systems were operating well and produced high quality effluent. In addition to the required monitoring, there is more process control sampling being done on board the vessels to monitor system performance. Discharge protocols are thorough and include verifications.

Recommendations included statements to continue to work towards high functioning wastewater treatment systems.

It was noted that during the inspections, many of the vessels have greatly increased their efforts to minimization the generation of waste. Increased recycling rates, minimization of materials

used, decreased water usage, and reusing more items has all contributed to the overall minimization of wastes being burned or sent to a landfill.

Recommendations were also made to improve best management practices for outside vessel maintenance work in response to a reported complaint and concerns seen during a couple of inspections. Outside vessel maintenance includes items such as vessel washing, paint chipping and scraping, painting, refinishing and hull work. Requirements for preventing paint and other materials were presented to cruise lines during a meeting with representatives of the cruise lines after the cruise season.

As not all vessels could be inspected, copies of discharge documents were requested and received for all vessels from the date of inspection till the end of the season for those inspected and for the entire season for those not inspected. Upon review, no violations of the MOU were discovered.

Copies of the inspection reports are included in Appendix C.

Table 5. 2010 Vessel Inspections

Vessels Inspected	Date Inspected
RHAPSODY OF THE SEAS (Royal Caribbean)	June 18, 2010
CARNIVAL SPIRIT (Carnival Cruise Lines)	July 6, 2010
ROTTERDAM (Holland America Line)	July 31, 2010
ROYAL PRINCESS (Princess Cruises)	August 16, 2010
NORWEGIAN PEARL (Norwegian Cruise Line)	August 29, 2010
SAPPHIRE PRINCESS (Princess Cruises)	September 12, 2010
CELEBRITY MILLENNIUM (Celebrity Cruises)	September 20, 2010
AMSTERDAM (Holland America Line)	September 24, 2010

6. Compliance

6.1 Compliance with MOU requirements

There were no reported incidents of non-compliance with any provision of the MOU.

Letters detailing compliance with the MOU from member lines are included in Appendix D.

7. Shellfish and Viruses

In 2007, The Washington State Department of Health issued a report from a study to examine the potential human health impacts from virus discharges from large passenger vessels. Their results indicate that viral discharges from large cruise ships should not cause illness through shellfish

when AWTS are fully functional. However, virus discharges from cruise ships could reach some shellfish beds at levels that may lead to illness if the treatment systems malfunction. The Department of Health report recommends measures to reduce the risk to shellfish. Recommendations include:

- No discharge should occur within 0.5 nautical miles of bivalve shellfish beds that are recreationally harvested or commercially approved to harvest.
- Cruise ships should withhold discharge when a system upset occurs.
- DOH should be notified immediately in the event of an AWTS upset.

The full report can be found at: www.doh.wa.gov/ehp/sf/Pubs/cruise-ship-report.pdf

The recommendations were incorporated into the MOU via the 2008 amendments.

Norwegian Cruise Line was the only company with vessels approved for discharge in 2009 and 2010, and implemented discharge protocols to prevent discharges within 0.5 nautical miles from identified shellfish beds. No upsets of the treatment system or disinfection system occurred.

An additional shellfish bed has been added to the amended MOU effective for the 2011 cruise season.

8. Annual Review and Amendments

The MOU specifies that all of the parties agree to at least one annual meeting to review the effectiveness of the MOU. The annual meeting was held on January 13, 2011. The Port of Seattle, the Department of Ecology, representatives from the North West & Canada Cruise Association and some of its member lines (Norwegian Cruise Line, Princess Cruises, Holland America Line, and Royal Caribbean/Celebrity Cruises), the Department of Health, as well as other interested parties convened for the meeting. Agenda items included:

- Welcome and Introductions.
- Compliance with the 2010 season.
- Updates – EPA Vessel Discharge Permit, MOU funding, WET testing, No-Discharge Zones.
- MOU amendment on amendment process.
- Looking Ahead.
- Comments/Discussion from cruise lines and interested parties.

The meeting notes are included in Appendix E.

During 2010, the parties of the MOU reviewed and discussed the process for amending the MOU. The parties then proposed a new method for amending the MOU and for including public input. The proposed amendment to the MOU that lays out this process was presented during the annual meeting and then later adopted by amending the MOU. Section 9 of the MOU now includes a process for amending the MOU once every three years starting in 2012. A request for

proposed amendments will be posted on Ecology's and the Port's websites. There will be a review period and amendments that meet criteria laid out in the MOU will be posted for a 30-day public comment period. At the end of the comment period, MOU signatories will review the comments and decide on adoption by unanimous approval. The only exception to the process is an amendment proposed by one of the signatories and supported unanimously by the other two signatories.

The new MOU, amended on March 14, 2011 is available on Ecology's website.

9. Conclusions

9.1 Overall

The Memorandum of Understanding continues to be a key tool in protecting water quality by having requirements in place to allow only discharges from advanced wastewater treatment systems, to allow for inspections to verify compliance, and to increase communication and understand on the requirements of the MOU with the cruise lines and vessel staff.

The cruise lines and vessels operating with the MOU had a successful season and were in compliance with MOU requirements throughout. The sampling results for conventional pollutants continue to show excellent effluent quality.

Advantages to the MOU include having something in place to protect water quality, building a partnership with the cruise industry and other key stakeholders, and being able to inspect and evaluate the quality of treatment from the ships that discharge. Limitations of the MOU include the inability to effectively enforce upon a voluntary agreement, and the lack of coverage under the MOU for large passenger ships that are not members of the North West & Canada Cruise Association.

9.2 Recommendations

1. The Department of Ecology recommends that the MOU continue to be used as a complement to environmental regulations until state specific regulations for cruise ship waste management in Washington State are put in place.
2. Ecology recommends that Ecology continue to inspect ships that are subject to the MOU, including closely looking at wastewater management and the management of other waste streams.
3. It is recommended that the parties of the MOU continue to work together on evaluating discharges in MOU waters.
4. It is recommended that the parties of the MOU work together this year to re-evaluate the funding mechanism to provide for funding beyond 2011.
5. It is recommended that the cruise lines review their policies and procedures related to outside vessel maintenance activities while in port and to ensure that best management practices are being followed.

6. It is recommended that the cruise lines continue to conduct a thorough review of records on an on-going basis throughout the season as well as at the end of the season to evaluate compliance, and that all recommendations made in inspection reports be implemented.

**Appendix A. Amendment No. 5 of the
Memorandum of Understanding, Cruise
Operations in Washington State**

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Appendix B. Sampling Data for Compliance

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Appendix C. Inspection Reports

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Appendix D. Letters of Compliance from Member Lines

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Appendix E. Annual Cruise Meeting Notes