

# Draft 2010 Large Commercial Passenger Vessel Wastewater Discharge General Permit Information Sheet

January 31, 2010

Alaska Department of Environmental Conservation  
Division of Water  
Commercial Passenger Vessel Environmental Compliance Program  
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Juneau, AK 99811-1800

**The Alaska Department of Environmental Conservation proposes to issue a general permit pursuant to AS 46.03, 18AAC 69, and 18 AAC 50 for**

## **Large Commercial Passenger Vessel Discharges to Marine Waters of the State**

The Alaska Department of Environmental Conservation (ADEC), Commercial Passenger Vessel Environmental Compliance (CPVEC) Program proposes to issue the 2010 Large Commercial Passenger Vessel Wastewater Discharge General Permit (the 2010 draft General Permit), number 2009DB0026 for discharges of treated sewage, treated graywater, and other treated wastewater.

The 2010 draft General Permit places limits on the types and amounts of pollutants that can be discharged from large commercial passenger vessels and places other conditions on such activity. The 2010 draft General Permit only authorizes discharge of waste streams specifically included in this permit. Other waste streams not included in this draft permit (such as boiler blow down, pool or spa discharges) are prohibited from discharge, unless specifically authorized by the state.

This information document includes:

- information on the draft General Permit;
- discussion of significant changes from the 2008 General Permit (2007DB0002); and
- a description of the proposed effluent limits.

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## Public Comment

The Department seeks public comment on the draft permit from January 31, 2010 through March 3, 2010. Persons wishing to comment on the 2010 draft General Permit may do so in writing by the expiration date of the Public Comment period. All comments and requests for Public Hearings must be in writing and should be submitted to the Department as described in the Public Comments Section of the Public Notice.

The Department will hold a combined public information workshop and public hearing at Centennial Hall in Juneau Alaska on February 17, 2010. The public workshop will begin at 5:00 PM. The public hearing will begin at 6:00 PM. Interested members of the public can provide formal verbal testimony which will become part of the administrative record of this proposed action.

Public Comment Start Date: **January 31, 2010**

Public Comment Expiration Date: **March 3, 2010**

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After the Public Notice period expires, and all written comments and formal verbal testimony have been considered, the Department will make a final decision regarding permit issuance.

## Documents are Available for Review

The 2010 draft General Permit and related documents can be reviewed or obtained by visiting or contacting the Department between 8:00 a.m. and 4:30 p.m., Monday through Friday at the address below. The draft permit, information sheet, and other information can also be located on the Departments website [http://www.dec.state.ak.us/water/cruise\\_ships/index.htm](http://www.dec.state.ak.us/water/cruise_ships/index.htm).

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## Appeal Procedures

A person aggrieved by the Department's permit decision may request an adjudicatory hearing in accordance with 18 AAC 15.195 - 18 AAC 15.340 or an informal review by the division director in accordance with 18 AAC 15.185.

For more information on the right to an administrative appeal, visit:

<http://dec.alaska.gov/commish/reviewGuidance.htm>

## Effluent Limits

The effluent limits in the 2010 draft General Permit are found in the table below.

**Table 1: Effluent Limits and Discharge Reporting**

Effluent Characteristics	Minimum Value	Monthly Geometric Mean <sup>a</sup>	Daily Maximum	Minimum Frequency	Sample Type
Fecal Coliform Bacteria	N/A	14 per 100 mL	43 per 100 mL	Twice per month	Grab

Effluent Characteristics	Minimum Value	Monthly Average <sup>b</sup>	Daily Maximum	Minimum Frequency	Sample Type
Total Flow (cubic meters per day of effluent)	N/A	Not to exceed design capacity  Report	Not to exceed design capacity  Report	Daily	Metered or estimated
Biochemical Oxygen Demand (5-day)	N/A	30 mg/L	60 mg/L	Twice per month	Grab
Total Residual Chlorine	N/A	N/A	7.5 ug/L <sup>c</sup>	Twice per month	Field test
Ammonia	N/A	N/A	(100 mg/L <sup>d</sup> ) 28 mg/L <sup>e</sup>	Twice per month	Grab
Copper	N/A	N/A	60 ug/L	Twice per month	Grab
Nickel	N/A	N/A	21 ug/L	Twice per month	Grab
Zinc	N/A	N/A	229 ug/L	Twice per month	Grab
pH	6.5 S.U.	N/A	8.5 S.U.	Twice per month	Field test, grab, or continuous
Total Suspended Solids (TSS)	N/A	N/A	150 mg/L	Twice per month	Grab or Continuous
Conductivity	N/A	N/A	Report	Twice per season	Field test, grab, or continuous
Chemical Oxygen Demand	N/A	N/A	Report	Twice per season	Grab
Nitrate-Nitrogen (N-NO <sub>3</sub> )	N/A	N/A	Report	Twice per season	Grab
Total phosphorus	N/A	N/A	Report	Twice per season	Grab
Total Kjeldahl Nitrogen (TKN)	N/A	N/A	Report	Twice per season	Grab
Total Organic Carbon	N/A	N/A	Report	Twice per season	Grab
Base-Neutral Acid extractables (BNA) <sup>f</sup>	N/A	N/A	Report	Twice per season	Grab

Effluent Characteristics	Minimum Value	Monthly Average <sup>b</sup>	Daily Maximum	Minimum Frequency	Sample Type
Volatile Organic Compounds (VOCs) <sup>f</sup>	N/A	N/A	Report	Twice per season	Grab
Other Dissolved and Total Recoverable Metals <sup>f</sup>	N/A	N/A	Report	Twice per season	Grab

Notes:

- a. The “monthly geometric mean” is the geometric mean of all samples taken during the calendar month. A non-detect value may be substituted with a value of 1 for the purpose of calculating the geometric mean. If only one sample is collected, the result of that sample is the geometric mean.
- b. The “monthly average” is the average of all samples taken during the calendar month. If only one sample is collected, the result of that sample is the monthly average.
- c. Analytical results below the method detection limit shall be deemed compliant with the effluent limits.
- d. This ammonia effluent limit applies to wastewater discharged while underway.
- e. This ammonia effluent limit applies to wastewater discharged while stationary.
- f. The specific pollutants are listed in the most recent version of the Department approved QA/QC plan.

### Significant Changes from the 2008 Large Commercial Passenger Vessel Wastewater Discharge General Permit ([2007DB0002](#))

- The fecal coliform monthly limit is now a geometric mean instead of an arithmetic mean;
- The effluent limit for chlorine now applies to all permitted vessels. Previously, the chlorine effluent limit only applied to permittees that used chlorine as a disinfectant in the wastewater treatment works process;
- There are two effluent limits for ammonia- one applies to wastewater that is discharged while underway and one applies to wastewater that is discharged while stationary;
- The effluent limits for copper, nickel, and zinc have been adjusted based upon the ADEC analysis of the larger data set that includes 2008 and 2009 information; and
- The compliance schedule and associated requirements (Source Reduction Evaluations) were eliminated.

Table 2 compares the parameters for which the effluent limits have changed from the 2008 General Permit to the 2010 draft General Permit.

**Table 2: Comparison of Changed Effluent Limits between the 2008 General Permit and the 2010 draft General Permit**

Parameter	Ammonia	Copper <sup>a</sup>	Nickel <sup>a</sup>	Zinc <sup>a</sup>
Units	mg/L	µg/L	µg/L	µg/L
Alaska Water Quality Standards	1 <sup>b</sup>	3.1	8.2	81
2008 GP Long Term Limits	2.9 <sup>c</sup>	3.1	8.2	81
2008 GP Permit Interim Limits	80.4	66	180	230
2010 draft GP Stationary Limits	28	60	21	229
2010 draft GP Underway <sup>d</sup> Limits	100	60	21	229
Notes:				
a. Dissolved.				
b. Based on the Alaska Water Quality Criteria Manual for Toxics (12/12/2008) using an average salinity of 20 g/kg, a pH of 8.1 and a temperature of 15° C.				
c. Based on the Alaska Water Quality Criteria Manual for Toxics using an average salinity of 20 g/kg, a pH of 7.8, and a temperature of 10-15° C.				
d. Minimum of six knots speed and traveling at least one nautical mile from nearest land. The ammonia effluent limit is the only one that changes for stationary versus underway discharge.				

## Background

The ADEC Commercial Passenger Vessel Environmental Compliance (CPVEC) Program was established in July 2001 by Alaska Statute (AS) 46.03.460 - AS 46.03.490. State law set effluent limits and sampling requirements for the discharge of blackwater (toilet water) and graywater (accommodations, galley, and laundry water) from large commercial passenger vessels (“cruise ships”). Cruise ships that discharged treated sewage in Alaska were required to take samples of discharged wastewater. Effluent limits were established at 200 fecal coliform per 100 ml and 150 mg/L of Total Suspended Solids (TSS).

In August 2006, Alaskan voters approved a ballot measure that added new requirements to the CPVEC Program. The statute required owners/operators of large commercial passenger vessels to obtain a wastewater discharge permit from ADEC for the discharge of any treated sewage, treated graywater, or other treated wastewater into marine waters of the state.

The 2008 ADEC Large Commercial Passenger Vessel Wastewater Discharge General Permit No. 2007DB0002 was developed to satisfy this requirement. That permit was issued on March 25, 2008. On April 9, 2008, the Alaska Cruise Association requested an informal review of the permit. The ADEC Director of the Division of Water issued a decision on April 24, 2008. Based on that decision several corrections were made to citations and schedules in the original permit. The revised permit was issued on May 1, 2008.

In addition to the 2001 state statutory requirements, the 2008 General Permit required additional reporting and sampling requirements, and contained new limits for several wastewater parameters. The permit established long term effluent limits for ammonia, copper, nickel, and zinc that applied Alaska Water Quality Standards (WQS) at the point of discharge beginning in 2010. The permit also contained less stringent interim (2008 and 2009) limits for these parameters to allow ship owners and operators time to improve effluent quality. The interim limits required cruise ship operators to submit a Source Reduction Evaluation (SRE) to ADEC that documented progress and actions taken by the vessel operators to help achieve the long-term limits.

House Bill (HB) 134 was passed by the Legislature in 2009. This bill allows ADEC to issue a three year general permit to cruise ships that contains effluent limits or standards that are less stringent than the WQS at the point of discharge if the Department finds that a permittee is using economically feasible methods of pollution prevention, control, and treatment that the Department considers to be the most technologically effective in controlling all wastewater and other substances at the point of discharge but the permittee is unable to achieve compliance with WQS at the point of discharge.

## **Operation under the General Permit**

### **Discharges Allowed:**

The 2010 draft Cruise Ship General Permit only authorizes discharge of waste streams specifically mentioned in the permit. Other waste streams not mentioned in the permit (such as boiler blow down, pool water) are prohibited from discharge, unless specifically authorized by the state.

All discharges authorized under the 2010 draft General Permit shall be consistent with the terms and conditions of this permit and approved plans (e.g. Vessel Specific Sampling Plans, Quality Assurance/Quality Control Plan).

Vessels that do not discharge wastewater into marine waters of the state are not required to apply for coverage under the General Permit.

### **Definition of Alaskan Waters (areas covered by this permit):**

- All waters within 3 nautical miles from the baseline from which territorial seas are measured;
- Waters of the Alexander Archipelago as defined in AS 46.03.490 (18) and listed in the General Permit.

Alaskan marine waters include areas that are outside of the definition of the Alexander Archipelago, but within 3 nautical miles from shore. These areas include, but are not limited to: Hazy Islands, Forrester Island, Wolf Rock, and Lowrie Island.

### **Discharge Exclusion Areas:**

The draft 2010 General Permit prohibits wastewater discharges in certain areas including any waterbody included in the ADEC Clean Water Act (CWA) Section 305(b) report or effective CWA Section 303(d) list of waters which are “impaired” or “water quality-limited” for any of the authorized pollutant parameters.

At the time of the issuance of the 2010 draft General Permit, these areas include Skagway Harbor and Klag Bay. Klag Bay is located on the west side of Chicagof Island. Skagway Harbor is defined as being northeast of the line from Yakutania Point at 135° 20’ 13”N, 59° 27’ 7”N, approximately southeast, to a point at 135° 19’ 43”W, 59° 26’ 32”N.

For more information on the ADEC list of impaired waterbodies visit:

<http://www.dec.state.ak.us/water/wqsar/waterbody/integratedreport.htm>

## Discharge Characterization

The wastewater treatment systems that are used on large cruise ships that discharge into Alaskan marine waters have generally performed well at treating the conventional effluent parameters that have been monitored (sampled regularly) by ADEC and the U.S. Coast Guard since 2001. Conventional parameters includes fecal coliform bacteria counts (an indicator of potential pathogens), pH, chlorine, biological oxygen demand, and total suspended solids. An exceedance of one of these parameters may be an indicator of improperly working equipment.

Cruise ships that discharge wastewater into Alaska marine waters had installed Advanced Wastewater Treatment Systems (AWTS) before or during 2003. By the end of the 2004 cruise ship season, sample results indicated substantial improvements in effluent quality for fecal coliform, biochemical oxygen demand, and chlorine. Wastewater sample results can be found on the ADEC Cruise Program website at: [http://www.dec.state.ak.us/water/cruise\\_ships/reports.htm](http://www.dec.state.ak.us/water/cruise_ships/reports.htm).

The 2008 General Permit required additional wastewater sampling and contained new limits for several parameters. Long term effluent limits for ammonia, copper, nickel, and zinc were equivalent to Alaska WQS. Less stringent limits (interim limits) were allowed for these parameters during the 2008 and 2009 Alaska cruise ship seasons. Table 3 and 4 below summarizes wastewater sample results for 2008 and 2009.

**Table 3: Summary 2008 Large Ship Sampling Results (21 ships, 206 samples)**

Parameter	Ammonia as N	Copper <sup>a</sup>	Nickel <sup>a</sup>	Zinc <sup>a</sup>	pH	Bio-chemical O <sub>2</sub> Demand	Total Suspended Solids	Total Residual Chlorine	Fecal Coliform Daily Max
Units	mg/l	µg/L	µg/L	µg/L	S.U.	mg/l	mg/l	mg/l	MPN/100 ml
Alaska WQS	2.9 <sup>b</sup>	3.1	8.2	81	6.5 – 8.5	N/A	N/A	0.0075	43
Minimum	0	0	0	0	6.18	0	0	0	0
Maximum	150	140	43.2	501	9.2	126	99	0.10	210
Median	25	7.23	9.1	73.5	7.28	3	0	0	0

Notes:

- a. Dissolved metals.
- b. Ammonia standard was based on temperature, pH and salinity. This standard is from Table IX in the *Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances* using a pH 7.8, salinity of 20 g/kg and temperature between 10-15 degrees Celsius. The ammonia WQS for the 2010 draft Permit is 1 mg/L based on the latest and most comprehensive Southeast Alaska ambient water data, with a pH of 8.1, a salinity of 20 g/kg, and a temperature of 15 degrees C.

**Table 4: Summary 2009 Large Ship Sampling Results (19 ships, 201 samples <sup>a</sup>)**

Parameter	Ammonia as N	Copper <sup>b</sup>	Nickel <sup>b</sup>	Zinc <sup>b</sup>	pH	Bio-chemical O <sub>2</sub> Demand	Total Suspended Solids	Total Residual Chlorine	Fecal Coliform Daily Max
Units	mg/l	µg/L	µg/L	µg/L	S.U.	mg/l	mg/l	mg/l	MPN/ 100 ml
Alaska WQS	2.9 <sup>c</sup>	3.1	8.2	81	6.5 – 8.5	N/A	N/A	0.0075	43
Minimum	0	0	0	0	6.28	0	0	0	0
Maximum	160	130	420	450	8.32	45	116	0.11	4,800
Median	37.5	9.35	9.9	84.5	7.37	3.6	0	0	0

## Notes:

- Does not include resample events.
- Dissolved metals.
- Ammonia standard was based on temperature, pH and salinity. This standard is from Table IX in the *Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances* using a pH 7.8, salinity of 20 g/kg and temperature between 10-15 degrees Celsius. The ammonia WQS for the 2010 draft Permit is 1 mg/L based on the latest and most comprehensive Southeast Alaska ambient water data, with a pH of 8.1, a salinity of 20 g/kg, and a temperature of 15 degrees C.

Large cruise ships that discharged wastewater into Alaska marine waters in 2008 and 2009 had the most difficulty meeting the long-term effluent limits for ammonia and copper. For more information, see the ADEC “Large Cruise Ship 2008 Wastewater Sampling Results” found at: [http://www.dec.state.ak.us/water/cruise\\_ships/pdfs/2008\\_LargeShip\\_WW\\_Sampling.pdf](http://www.dec.state.ak.us/water/cruise_ships/pdfs/2008_LargeShip_WW_Sampling.pdf)

Large cruise ships that discharge wastewater into Alaska marine waters use several different types of advanced wastewater treatment systems (AWTS). A comparison of the sample results achieved by different treatment technologies can be found in Table 5.

**Table 5: Comparison of Advanced Wastewater Treatment System Medians <sup>a</sup> (2004-2008)**

	Ammonia	Copper	Nickel	Zinc
Units	mg/L	µg/L	µg/L	µg/L
Rochem	0.9	1	0.87	11.2
Zenon	13.5	6	12.4	61.4
Scanship	28	4.31	9.7	70.5
Hamworthy	48.5	13	8.5	110
Marisan	0.3	52	13.9	21

## Note:

- Does not include Hamman and Hydroxyl, in both systems there were too few samples for a meaningful comparison.

The volume of treated wastewater discharge varies from vessel to vessel. It ranges from a maximum of 91,711 gallons per day to a maximum of 374,333 gallons per day. For purposes of comparison, Table 6 below contrasts selected cruise ship populations and discharge volumes with the population and discharge volume from two small municipal wastewater treatment systems in southeast Alaska. Cruise ships produce fewer gallons per day of wastewater compared to a comparably sized municipality due to water conservation measures that are employed on board.

**Table 6: Comparison of Cruise Ship Discharge Volume with that of Similarly Populated Southeast Alaska Municipalities**

	Cruise Ship 1	Cruise Ship 2	Petersburg	Craig
Total population	4,230	2,728	3,009	1,117
Wastewater production	374,333 gals/day (maximum load)	187,165 gals/day (maximum load)	475,000 gals/day (average April 2008)	186,000 gals/day (average March 2008)
(Source of cruise ship data: 2009 Discharge Monitoring Reports)				
(Source of municipal data: 2008 Discharge Monitoring Reports)				

## Dilution Studies:

### Dilution while Stationary:

In July 2008, ADEC and EPA conducted a joint field study to characterize the near-field (0 – 15 meters) dilution that occurs to wastewater that is discharged from a stationary cruise ship. The field study was conducted in Skagway Harbor, considered to be a conservative “worst case” location for dilution. The lowest dilution factor (i.e. worst case; least dilution) that was determined during the study was 1/28.

ADEC used the dilution factor of 1/28 to determine the water quality based effluent limits for wastewater that is discharged when a vessel is stationary.

See the ADEC report entitled “Assessment of Stationary Cruise Ship Plume Dilution” for more information. This study is available at:

[http://www.dec.state.ak.us/water/cruise\\_ships/pdfs/2009\\_Plume\\_Dilution\\_Study.pdf](http://www.dec.state.ak.us/water/cruise_ships/pdfs/2009_Plume_Dilution_Study.pdf)

### Dilution while Underway:

A 2002 Science Advisory Panel and ADEC report concluded that for a typical large cruise ship moving at a minimum speed of 6 knots and discharging wastewater at 200m<sup>3</sup>/hr the dilution factor on the wastewater effluent is 50,000 (See “The Impact of Cruise Ship Wastewater Discharge on Alaska Waters,” November 2002, available at:

[http://www.dec.state.ak.us/water/cruise\\_ships/pdfs/impactofcruiseship.pdf](http://www.dec.state.ak.us/water/cruise_ships/pdfs/impactofcruiseship.pdf) ).

ADEC used the dilution factor of 1/50,000 to determine the water quality based effluent limits for wastewater that is discharged when a vessel is underway.

## Effluent Limitations

Alaska’s Water Quality Standards (18 AAC 70) include three articles: Article 1, statewide standards (18 AAC 70.005 -.050), Article 2, exceptions to state-wide standards (18 AAC 70.200 -.270), and Article 3, general provisions (18 AAC 70.900 -.990). The standards also include the Alaska Water Quality Criteria Manual for Toxic and Deleterious Organic and Inorganic Substances. The Alaska Water Quality Criteria Manual for Toxic and Deleterious Organic and Inorganic Substances has been adopted into 18 AAC 70.020(b). Numeric criterion for certain pollutants in the 2010 draft General Permit (i.e., fecal coliform) are found in 18 AAC 70.020 (b).

The Alaska Water Quality Standards are found at:

<http://www.dec.state.ak.us/water/wqsar/wqs/wqs.htm>

When ADEC issues permits for shore-based domestic wastewater treatment plants, it may authorize a mixing zone where water quality standards can be exceeded, while still protecting receiving waters. However, the 2006 law that pertained to cruise ships required that all discharges meet applicable standards -- including Alaska Water Quality Standards -- *at “the point of discharge,”* (AS 46.03.462(b)(1)(emphasis added)). ADEC concluded that the 2006 law precluded authorization of a dilution factor or mixing zone in the final 2008 General Permit for parameters that had exceeded the WQS in the effluent in recent years - ammonia, copper, nickel, and zinc.

ADEC issued the 2008 General Permit with long term effluent limits that were equivalent to the WQS. Public comment and ADEC analysis indicated that the cruise ships were not likely to be able to immediately comply with the strict long term effluent limits for ammonia, copper, nickel, and zinc. Therefore, the 2008 General Permit included interim effluent limits for the 2008 and 2009 cruise ship seasons. The upper 95<sup>th</sup> percentile limit of the 2004 through 2007 data was selected as the interim effluent limit for these parameters.

In 2009, House Bill (HB) 134 was passed by the Alaska Legislature. This new law addressed the challenges cruise ships had in meeting the long term limits at the point of discharge. Without HB 134, WQS would apply to large cruise ship wastewater at the point of discharge beginning in 2010. The law now allows ADEC to issue a permit that:

“may include effluent limits or standards less stringent than those required under (b)(1) of this section for not more than three years duration if the department finds that a permittee is using economically feasible methods of pollution prevention, control, and treatment the department considers to be the most technologically effective in controlling all wastes and other substances in the discharge but is unable to achieve compliance with Alaska Water Quality Standards at the point of discharge.” (AS 46.03.462(e))

In determining the effluent limits that were included in the 2010 draft General Permit for cruise ships, ADEC followed a similar methodology that is used when EPA issues municipal wastewater permits. A technology based limit and a water quality based effluent limit were both determined for ammonia, copper, nickel, and zinc for effluent discharged while the vessel was stationary and for effluent discharged while the vessel was underway. The technology based effluent limit was calculated as the upper 95<sup>th</sup> percentile limit of the 2004 to 2009 wastewater sample data set.

The water quality based effluent limit was determined using a reasonable potential analysis. The most important factors in the reasonable potential analysis are the WQS for the parameter and the selected dilution. The dilution factor applied to determine the water quality based effluent for wastewater that is discharged while the vessel is stationary was 1/28 based upon the joint ADEC and EPA study of stationary dilution. The dilution factor applied to determine the water quality based effluent for wastewater that is discharged while the vessel is underway was 1/50,000 based upon the previous findings of a Science Panel.

Then the stricter of the technology or water quality based effluent limit was selected as the effluent limit for ammonia, copper, nickel, and zinc in the 2010 draft General Permit.

### **BOD (Biochemical Oxygen Demand)**

There is no change from the effluent limits in the 2008 General Permit.

Alaska Water Quality Standards do not contain a numeric criterion for BOD. BOD is a technology based standard that is a useful indicator of the effectiveness of wastewater treatment. The 2010 draft General Permit uses the limit established in 40 CFR 133.102 Secondary Standard which apply to cruise ships in Alaska per U.S. Coast Guard requirements. This limit is a daily maximum of 60 mg/L and a monthly average limit of 30 mg/L.

### **Fecal Coliform**

The 2008 General Permit used the most stringent state WQS for the raw consumption of aquatic life of 14 FC/100 ml for a monthly arithmetic average and 43 FC/100 ml for a daily maximum.

In the draft 2010 General Permit, the effluent limits remain the same. However, the statistical method to calculate the monthly limit has been changed from an arithmetic mean to a geometric mean. A geometric mean is the standard statistic applied to fecal coliform. A geometric mean is applied as the metric for the federal cruise ship effluent limit (33 CFR 159.309). Geometric means are also frequently applied to fecal coliform effluent limits in municipal permits in Alaska.

### **Total Residual Chlorine**

The effluent limit in the 2008 General Permit for total residual chlorine was 0.0075 mg/L (7.5µg/L). However, the permit only required monitoring for chlorine if vessels used chlorine as part of their treatment process. Wastewater samples obtained to satisfy the requirements of the Quality Assurance Quality Control Plan occasionally indicated detectable levels of chlorine above Alaska WQS. Potential sources of chlorine include, but are not limited to: pool water, spa water, cleaning of the treatment system or distribution piping prior to a sample, and the chlorine that is present in potable (drinking) water.

Chlorine had been used in the past to disinfect (remove bacteria and viruses) treated wastewater prior to discharge. It can also be an alternative method of disinfection in case of failure of a primary disinfection system. Most current AWTS use ultraviolet light rather than chlorine to disinfect wastewater. Chlorine has been known to damage the membranes of some AWTS, which would lead to a reduction of efficiency or ability to properly treat wastewater.

Free residual chlorine is described as the portion of the chlorine injected into water that remains as molecular chlorine, hypochlorous acid, or hypochlorite ions after the solution has reached a state of equilibrium. Total residual chlorine includes free chlorine, but also includes chlorine that has combined with ammonia or other nitrogenous compounds. ADEC marine water criteria for total residual chlorine are 0.013 mg/L (acute criterion) and 0.0075 mg/L (chronic criterion). The acute criterion is based upon a 24-hour average concentration. The chronic criterion is based upon a four-day average concentration.

The 2010 draft General Permit proposes a chlorine limit of 7.5 µg/L (0.075 mg/L) for all cruise ships that discharge wastewater into marine waters of the state. The limit, however, is below the detection level for most EPA-approved analytical methods. Therefore, effluent samples will be considered compliant with the total residual chlorine limit if the sampled chlorine concentration is below the method detection limit of the analytical method used.

### **pH**

There is no change from the effluent limits in the 2008 General Permit.

Federal rules (40 CFR 133.102 Secondary Treatment) establish the criterion for pH at a value between 6 and 9. The most stringent state water quality criterion for pH (for aquaculture water supply and aquatic life) states that pH must be no less than 6.5 and no greater than 8.5 standard units and may not vary more than 0.2 pH units from natural conditions. The final General Permit limits pH to a range of 6.5 to 8.5 standard units.

### **Total Suspended Solids (TSS)**

There is no change from the effluent limits in the 2008 General Permit.

The Alaska Water Quality Standards do not contain a numeric criterion for TSS. It is a technology based standard. The proposed General Permit is based upon the limit (150 mg/L) established in Alaska's statutes relating to cruise ships, AS 46.03.463(b).

### **Ammonia**

#### Toxicity of Ammonia

Ammonia affects the life cycle as well as survival of some species. Ammonia at concentrations less than those chronically toxic to animals may stimulate growth and reduce reproduction of some red macroalgal species. Ammonia is primarily a product of biological processes such as microbial digestion of sewage due to the presence of urine. Ammonia is also present in some cleaning products.

#### Toxicity and Speciation

Ammonia is present in two forms in saltwater: un-ionized ammonia ( $\text{NH}_3$ ) and the ammonium ion ( $\text{NH}_4^+$ ). The pH, temperature, and salinity of the receiving water govern the speciation of ammonia and, therefore, its toxicity. Un-ionized ammonia is the more toxic form, but because ionic ammonium is often present in much greater concentrations, its toxicity must be considered. Both total ammonia ( $\text{NH}_3 + \text{NH}_4^+$ ) and un-ionized ammonia ( $\text{NH}_3$ ) are included in the water quality standards because both can have toxic effects on aquatic life under certain conditions.

#### Technology Based Effluent Limits

The ADEC calculation of a technology based ammonia effluent limit for the 2010 draft General Permit was based on the 2004 – 2009 cruise ship wastewater data set. Cruise ships that were granted interim ammonia effluent limits in 2008 and 2009 were required to sample for ammonia twice per month. Therefore, the inclusion of the 2008 and 2009 wastewater sample data greatly increased the number of samples that were included in the calculation of the 95<sup>th</sup> percent confidence interval.

The increase in the average ammonia values, especially in the year 2009 contributed to a higher 95<sup>th</sup> percent confidence interval that is reflected in a higher technology based effluent limit for the 2010 draft General Permit. (See Figure 1.) The technology based effluent limit (interim limit) was 80.4 mg/L in the 2008 General Permit and is calculated to be 100 mg/L based upon incorporation of the 2008 and 2009 cruise ship monitoring data.

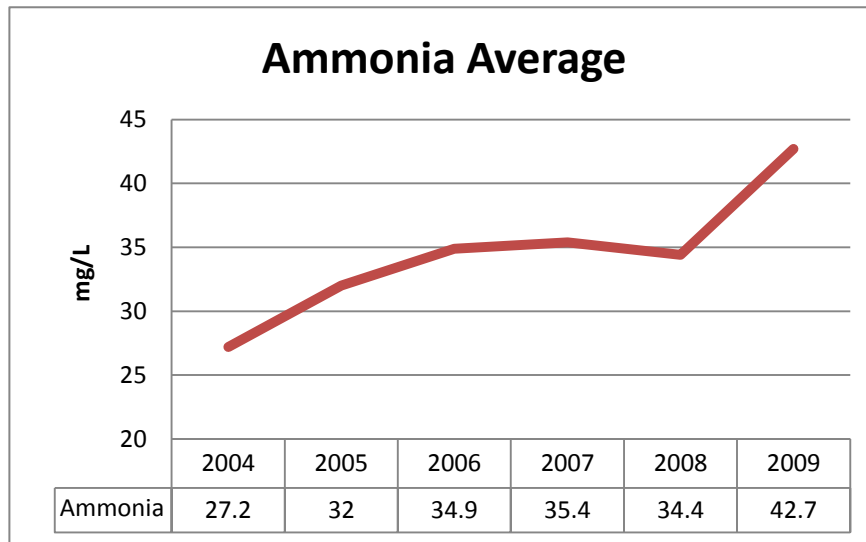


Figure 1: Ammonia Averages in Wastewater Sample Results (2004-2009)

### Water Quality Based Effluent Limits

ADEC derived an ammonia water quality standard of 1 mg/L using a receiving water pH of 8.2, a salinity of 20 g/kg, and a temperature of 15 degrees Celsius. The determination of the ammonia water quality standard is heavily dependent upon the pH of the receiving water. The receiving water characteristics were selected using the 2004 Environmental Monitoring and Assessment Program (EMAP) data for Southeast Alaska. The EMAP data is presented below:

Table 7: Port Receiving Water Characteristics

Name	Vessel Visits in 2009	pH	Temperature (C)	Salinity (PSU)
Juneau	514	8.35	14.2	13.1
Ketchikan <sup>a</sup>	479	8.27 <sup>a</sup>	17.3	24.86
Skagway	383	8.02	11.8	9.5
Sitka	159	8.06	18.3	29.4
Point Sophia	69	8.25	15.1	25.5
Haines	33	8.24	12	10.7
	Average	8.20	14.78	18.84
	Median	8.25	14.65	18.98

Notes:  
 All results taken at or near the surface.  
 a. There was no pH data for Ketchikan harbor in EMAP. The pH from the closest site with similar geographic area, temperature, and salinity (Sumner Strait AK04-0414) was selected.

### Ammonia Effluent Limit while Stationary

ADEC applied the ammonia water quality standard of 1 mg/L and a dilution factor of 1/28 to calculate a water quality based effluent limit using a reasonable potential analysis. Following

this procedure, ADEC calculated an ammonia effluent limit of 28 mg/L for a stationary cruise ship.

ADEC selected the more conservative water quality based effluent limit (28 mg/L), rather than the technology based effluent limit of 100 mg/L, as the ammonia effluent limit for wastewater samples obtained while the cruise ship is stationary.

Ammonia Effluent Limit while Underway

ADEC applied the ammonia water quality standard of 1 mg/L and a dilution factor of 1/50,000 to calculate a water quality based effluent limit of 50,000 mg/L for a cruise ship that is underway.

ADEC then selected the more conservative technology based effluent limit (100 mg/L) as the ammonia effluent limit for a cruise ship while underway.

**Table 8: Comparison of Ammonia Effluent Limits for the 2010 draft General Permit**

Former and proposed limits:	Stationary (1/28 dilution)	Underway (1/50,000 dilution)
2010 Water Quality Standard	1 mg/L	1 mg/L
2010 Technology based effluent limit (95 <sup>th</sup> percentile of 2004 – 2009 sample data)	100 mg/L	<b>100 mg/L</b>
2010 WQS based effluent limit	<b>28 mg/L</b>	50,000 mg/L
Note: The limits selected for the 2010 draft General Permit are bolded.		

**Copper**

Toxicity of Copper

Alaska has a water quality standard of 0.0031 mg/L dissolved copper in saltwater based on chronic effects to aquatic life and 0.0048 mg/L for acute effects (Table IV in the Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances). The chronic criterion is based upon a four-day average. The acute criterion is based upon a 24-hour average. Copper can be toxic in aquatic environments and bio-concentrates in many different organs in fish and mollusks.

Potential Sources of Copper in Wastewater

Potential sources of copper/ copper alloys include but are not limited to: on board piping systems (copper pipes which can leach copper when exposed to soft potable water or electrical galvanic corrosion activity), cookware (although galley wastewater is not normally mixed with other wastewater), copper parts from evaporators which are used in making potable water onboard, copper used in refrigeration and air conditioning systems, and some disinfectants.

Copper Effluent Limits

The ADEC calculation of a technology based copper effluent limit for the 2010 draft General Permit was based upon an evaluation of the 2004 – 2009 cruise ship wastewater data set. Cruise ships that were granted interim copper effluent limits in 2008 and 2009 were required to sample for copper twice per month. Therefore, the inclusion of the 2008 and 2009 wastewater sample data greatly increased the number of samples that were included in the calculation of the 95<sup>th</sup> percent confidence interval which was used as the technology based effluent limit. ADEC also

incorporated additional samples (obtained by ADEC) that were not included in the data set used to establish the technology based effluent limit (interim limit) in the 2008 General Permit.

Despite the larger data set, the 95<sup>th</sup> percentile confidence interval (technology based effluent limit) for copper is within 6 µg/L of the interim effluent limit established in the 2008 General Permit. The interim effluent limit for copper in the 2008 General Permit was 66 µg/L (0.066 mg/L). The technology based effluent limit calculated for the 2010 draft General Permit is 60 µg/L.

ADEC then applied the copper water quality standard of 0.0031 mg/L (3.1 µg/L) and a dilution factor of 1/28 to calculate a water quality based effluent limit using a reasonable potential analysis for stationary vessels. Following this procedure, ADEC calculated a water quality based copper effluent limit of 87 µg/L.

ADEC also applied the copper water quality standard of 0.0031 mg/L (3.1 µg/L) and a dilution factor of 1/50,000 to calculate a water quality based effluent limit using a reasonable potential analysis for vessels while underway. Following this procedure, ADEC calculated a copper effluent limit of 160,000 µg/L.

Since the technology based effluent limit of 60 µg/L was the more conservative value in either the scenario when a cruise ship was stationary or when it was underway, ADEC included an effluent limit of 60 µg/L for copper in the 2010 draft General Permit.

**Table 9: Comparison of Copper Effluent Limits for the General Permit**

Former or proposed limits:	Stationary (1/28 dilution)	Underway (1/50,000 dilution)
2010 Technology based effluent limit (95 <sup>th</sup> percentile of 2004 – 2009 sample data)	<b>60 µg/L</b>	<b>60 µg/L</b>
2010 WQS based effluent limit	87 µg/L	160,000 µg/L
Note: The limits selected for the 2010 Draft General Permit are bolded.		

## Nickel

### Toxicity of Nickel

Alaska has a water quality standard of 0.0082 mg/L (8.2 µg/L) dissolved nickel in saltwater based on chronic effects to aquatic life and 0.074 mg/L for acute effects (Table IV in the Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances). The chronic criterion is based upon a four-day average. The acute criterion is based upon a one-hour average.

### Potential Sources of Nickel in Wastewater

Nickel is used as an alloy in pipes (such as stainless steel), valves, fittings, and plumbing fixtures. It could also be present in potable water sources.

### Nickel Effluent Limits

The ADEC calculation of a technology based nickel effluent limit for the 2010 draft General Permit was based upon an evaluation of the 2004 – 2009 cruise ship wastewater data set. Cruise ships that were granted interim nickel effluent limits in 2008 and 2009 were required to sample for nickel twice per month. Therefore, the inclusion of the 2008 and 2009 wastewater sample

data greatly increased the number of samples that were included in the calculation of the 95<sup>th</sup> percent confidence interval. ADEC also incorporated additional samples (taken by ADEC) that were not included in the data review used to establish the effluent limits in the 2008 General Permit. The interim effluent limit for nickel in the 2008 General Permit was 180 µg/L (0.18 mg/L). The technology based effluent limit calculated for the 2010 draft General Permit is 21 µg/L.

ADEC then applied the nickel water quality standard of 0.0082 mg/L (8.2 µg/L) and a dilution factor of 1/28 to calculate a water quality based effluent limit using a reasonable potential analysis for a stationary vessel. Following this procedure, ADEC calculated a nickel effluent limit of 230 µg/L.

ADEC also applied the nickel water quality standard of 0.0082 mg/L (8.2 µg/L) and a dilution factor of 1/50,000 to calculate a water quality based effluent limit using a reasonable potential analysis for that vessel that is underway. Following this procedure, ADEC calculated a nickel effluent limit of 410,000 µg/L.

Since the technology based effluent limit of 21 µg/L was the more conservative value in either the scenario when a cruise ship was stationary or when it was underway, ADEC included an effluent limit of 21 µg/L for nickel in the 2010 draft General Permit.

**Table 10: Comparison of Nickel Effluent Limits for the General Permit**

Former or proposed limits:	Stationary (1/28 dilution)	Underway (1/50,000 dilution)
2010 Technology based effluent limit (95 <sup>th</sup> percentile of 2004 – 2009 sample data)	<b>21 µg/L</b>	<b>21 µg/L</b>
2010 WQS based effluent limit	230 µg/L	410,000 µg/L
Note: The limits selected for the 2010 Draft General Permit are bolded.		

## Zinc

### Toxicity of Zinc

Alaska has a water quality standard of 0.081 mg/L dissolved zinc in saltwater based on chronic effects to aquatic life and 0.090 mg/L for acute effects (Table IV in the Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances). The chronic criterion is based upon a four-day average. The acute criterion is based upon a one-hour average. Toxicity of zinc to an organism depends on feeding habits. Plants and most fish would not be adversely affected, but invertebrates could be affected by ingestion of sufficient quantity of particulates containing zinc.

### Potential Sources of Zinc in Wastewater

Zinc can be found in some types of piping, fittings, and valves. It is used as a coating to protect against corrosion. Zinc is also used as a sacrificial anode in cathodic protection. Zinc has been used in antifouling paints in tanks. Other potential sources of zinc include: sunscreen and diaper rash cream, toothpaste, vitamin supplements, potable water sources, and shampoos.

### Zinc Effluent Limits

The ADEC calculation of a technology based zinc effluent limit for the 2010 draft general permit was based upon an evaluation of the 2004 – 2009 cruise ship wastewater data set. Cruise ships

that were granted interim zinc effluent limits in 2008 and 2009 were required to sample for copper twice per month. Therefore, the inclusion of the 2008 and 2009 wastewater sample data greatly increased the number of samples that were included in the calculation of the 95<sup>th</sup> percent confidence interval. ADEC also incorporated additional samples (taken by ADEC) that were not included in the data review for the 2008 General Permit.

Despite the larger data set, the 95<sup>th</sup> percentile confidence interval (technology based effluent limit) for zinc is within 1 µg/L of the interim effluent limit established in the 2008 General Permit. The interim effluent limit for zinc in the 2008 General Permit was 230 µg/L (0.23 mg/L). The technology based effluent limit calculated for the 2010 draft General Permit is 229 µg/L.

ADEC then applied the zinc water quality standard of 0.081 mg/L (81 µg/L) and a dilution factor of 1/28 to calculate a water quality based effluent limit using a reasonable potential analysis for a stationary vessel. Following this procedure, ADEC calculated a zinc effluent limit of 2,300 µg/L.

ADEC also applied the zinc water quality standard of 0.081 mg/L (81 µg/L) and a dilution factor of 1/50,000 to calculate a water quality based effluent limit using a reasonable potential analysis for a vessel that is underway. Following this procedure, ADEC calculated a zinc effluent limit of 4,100,000 µg/L (4,100 mg/L).

Since the technology based effluent limit of 229 µg/L was the more conservative value in either the scenario when a cruise ship was stationary or when it was underway, ADEC included an effluent limit of 229 µg/L for zinc in the 2010 draft General Permit.

**Table 11: Comparison of Zinc Effluent Limits for the General Permit**

Former or proposed limits:	Stationary (1/28 dilution)	Underway (1/50,000 dilution)
2010 Technology based effluent limit (95 <sup>th</sup> percentile of 2004 – 2009 sample data)	<b>229 µg/L</b>	<b>229 µg/L</b>
2010 WQS based effluent limit	2,300 µg/L	4,100,000 µg/L
Note: The limits selected for the 2010 Draft General Permit are bolded		

### Evaluation of other parameters for Potential Inclusion in Permit

ADEC also evaluated the wastewater sample results for several other metals that had occasionally exceeded the Alaska Water Quality Standards (WQS) including mercury, selenium, and silver. Sampling for these parameters was only required twice per season under the QA/QC Plan. Silver and mercury each had one exceedance in the past five years, while selenium had four. These parameters were not included in the 2010 draft General Permit because each parameter had few exceedances and the upper 95<sup>th</sup> percentile of sample results was below WQS. ADEC will continue to monitor these and other pollutants for inclusion into future revisions of this General Permit.

### Data Reliability and Representative Nature of Wastewater Samples

It is crucial that wastewater sample data is reliable and representative. This data will be used to determine compliance with the General Permit. Large vessels that discharged in Alaska from

2001 to 2007 took at least two compliance samples per cruise ship season to satisfy both state and federal cruise ship requirements.

In 2008 and 2009, large cruise ships that discharged wastewater into Alaska waters were required to sample twice a month to satisfy the 2008 General Permit requirements. The same frequency of sampling is proposed in the 2010 draft General Permit.

ADEC, the U.S. Coast Guard, and the Northwest Cruiseship Association have established a [Quality Assurance/Quality Control \(QAQC\) plan](#) that ensures that the sample results are reliable and are representative of the wastewater that is discharged into Alaska marine waters. The 2010 draft General Permit requires permittees to follow the most recent version of an ADEC-approved QAQC sampling plan.

The QAQC plan includes standard sampling and laboratory quality control elements with additional instructions tailored to a maritime facility. It lists all the pollutants to be tested and the EPA analytical methods to be used. The QAQC plan requirements include duplicate sampling, independent sampling audits, and a lab technical systems audit. The samples are obtained by a third party sampler and analyzed at an approved laboratory.

The 2010 draft General Permit and state statutes also allow ADEC or its representative to take additional wastewater samples and conduct additional analysis.

Because each ship is configured differently and follows unique wastewater management practices, the state also requires the owner/operator to submit a vessel specific sampling plan (VSSP). The VSSP plan must be approved by ADEC before the first sampling event takes place.

The VSSP must demonstrate that the sample will be representative of the wastewater discharged from the particular ship. The General Permit requires onboard sampling locations to be the same as those listed in the current approved VSSP. The VSSP also documents discharge and sample ports, storage tanks, pump flows, and contains a concise description of the wastewater treatment process.

In 2008 and 2009, ADEC discovered numerous errors in the approved VSSPs. The 2010 draft General Permit requires that VSSPs be both accurate and complete, and reflect the current wastewater treatment and discharge operations. The sampled discharge must match the treatment system, tanks used, and discharge port typically used.

If wastewater is being treated and then stored in holding tanks for a period of time prior to being discharged into Alaska marine waters, then that source of wastewater may only be discharged if that effluent is sampled after a typical holding time as indicated in the VSSP.

If wastewater from tanks is mixed with wastewater from the AWTS prior to discharge, a representative sample must match the typical discharge ratios. The mix of greywater and blackwater in the treatment system should also be typical of discharges into Alaska marine waters.

## **Monitoring Requirements**

There are monitoring requirements and frequencies associated with all the effluent limits that are stated in Table 1 of the General Permit. Twice monthly sampling is required for ammonia, copper, nickel, and zinc. This is equivalent to the frequency of sampling for these parameters in the 2008 General Permit for permittees who were allowed to discharge under the terms associated with the interim effluent limits.

The draft General Permit retains the twice seasonal monitoring requirement for other parameters.

ADEC or its contractor may take additional samples in addition to those required in the 2010 draft General Permit (AS 46.03.465 (c)). ADEC will be allowed access to the vessel for the purpose of taking samples, to verify the integrity of the sampling process, and to verify recordkeeping requirements of the permit (AS 46. 03.462).

The first sampling event is required within ten (10) days of the first discharge into Alaska waters.

A cruise ship that is authorized to discharge while underway may only discharge wastewater while the vessel is traveling at least 6 knots and is at least 1 nautical mile from nearest land. Wastewater samples must be taken while the vessel is underway and is discharging into Alaska marine waters.

A cruise ship that is authorized to discharge continuously may discharge either while the vessel is stationary or while it is underway. If a cruise vessel that is authorized to discharge continuously chooses to discharge wastewater while stationary at any time during a calendar month, then at least one wastewater sample must be obtained from the vessel while the vessel is stationary during that same month.

Any samples taken while the vessel is docked, anchored, or traveling at a speed of less than 6 knots or at any distance less than 1 nautical mile will be considered a stationary sample. Wastewater samples that are obtained while the vessel is stationary must comply with the stationary effluent limits.

The permittee must complete different Discharge Monitoring Reports (DMRs) for wastewater samples depending upon whether the vessel is stationary or underway during the sample event.

## **Reporting Requirements**

### **Calculating averages:**

The monthly limit for fecal coliform bacteria must be calculated as a geometric mean. The geometric mean is the N<sup>th</sup> root of the product of N, where N is the number of samples analyzed. All non-detect sample results will use a value of 1 for calculation of the geometric mean.

Example geometric mean calculation, where N= 4 :  $\sqrt[4]{12 \times 23 \times 34 \times 990} = 55$ .

The monthly average for Biochemical Oxygen Demand (BOD) must be calculated as an arithmetic mean. This is the sum of the sample results divided by the number of samples. All non-detects will use a value of zero for the calculation of the arithmetic mean.

### **Noncompliance Notification:**

A permittee must report all violations of the General Permit within 24 hours of discovery to ADEC. For effluent limit violations that are reported on the DMR, there is no requirement that a Noncompliance Notification form to be submitted to ADEC. The 2010 draft General Permit does require a Noncompliance Forms for accidental discharges, discharges that may endanger health or the environment, or upset conditions of the wastewater treatment system.

**Discharge logs:**

Discharge logs shall be submitted monthly to ADEC no later than five calendar days after each calendar month in operation in Alaska (AS 46.03.465 (a)). This statutory requirement has not been changed by the issuance of the permit.

**Discharge Monitoring Reports (DMR):**

- All vessels authorized to discharge under the 2010 draft General Permit must submit a DMR for the months that the vessel operated in Alaska regardless of whether the vessel discharged or not. If there was no discharge, the DMR should be clearly marked that there was no discharge.
- DMRs are only submitted for those months when a vessel is in Alaskan waters.
- Daily flow must be reported on the DMR. This flow can be estimated or metered. If meters are installed, the reported flow rate must be obtained from the meters.
- DMRs must be submitted no later than 21 days following the calendar month in which sampling occurred.
- Non-detects must be reported as ND.

The 2010 draft General Permit requires that permittees submit electronic copies of analytical results. This requirement allows ADEC to receive sample results in a format which would allow for transfer to current or future recordkeeping and statistical analysis systems. This matches the format that ADEC received sample results from 2004 through 2007. Most of the sample data that was submitted to ADEC in 2008 and 2009 also followed this format.

**Acronyms:**

ADEC	Alaska Department of Environmental Conservation
AWTS	Advanced Wastewater Treatment System
BOD	Biochemical Oxygen Demand
CPVEC	Commercial Passenger Vessel Environmental Compliance program
DMR	Discharge Monitoring Report
EPA	U.S. Environmental Protection Agency
GP	General Permit
mg/L	Milligrams per liter (approximately a part per million)
QA/QC	Quality Assurance /Quality Control Plan
SU	Standard Units (for pH)
TSS	Total Suspended Solids
µg/l	Micrograms per liter (approximately a part per billion)
VSSP	Vessel Specific Sampling Plan
WQS	Water Quality Standards

## Referenced Documents and Information:

Alaska Department of Environmental Conservation  
<http://www.dec.state.ak.us/index.htm>

Commercial Passenger Vessel Environmental Compliance Program  
[http://www.dec.state.ak.us/water/cruise\\_ships/index.htm](http://www.dec.state.ak.us/water/cruise_ships/index.htm)

2008 Large Commercial Passenger Vessel Wastewater Discharge General Permit No. 2007DB0002  
[http://www.dec.state.ak.us/water/cruise\\_ships/gp/2008GP\\_Mod\\_CPVEC.pdf](http://www.dec.state.ak.us/water/cruise_ships/gp/2008GP_Mod_CPVEC.pdf)

2008 General Permit Information Sheet  
[http://www.dec.state.ak.us/water/cruise\\_ships/gp/2008\\_GP\\_Info2.pdf](http://www.dec.state.ak.us/water/cruise_ships/gp/2008_GP_Info2.pdf)

CPVEC Cruise Ship Wastewater Sampling and Science Panel Reports  
[http://www.dec.state.ak.us/water/cruise\\_ships/reports.htm](http://www.dec.state.ak.us/water/cruise_ships/reports.htm)

House Bill 134  
[http://www.legis.state.ak.us/basis/get\\_bill\\_text.asp?hsid=HB0134Z&session=26](http://www.legis.state.ak.us/basis/get_bill_text.asp?hsid=HB0134Z&session=26)

Alaska Cruise Ship Laws and Regulations  
[http://www.dec.state.ak.us/water/cruise\\_ships/Law\\_and\\_Regs/index.htm](http://www.dec.state.ak.us/water/cruise_ships/Law_and_Regs/index.htm)

Quality Assurance/Quality Control Plan (QAQCP)  
[http://www.dec.state.ak.us/water/cruise\\_ships/pdfs/2009\\_NWCA\\_QAQCP.pdf](http://www.dec.state.ak.us/water/cruise_ships/pdfs/2009_NWCA_QAQCP.pdf)

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[http://www.dec.state.ak.us/water/wqsar/wqs/pdfs/18\\_AAC\\_70%20Amended\\_September\\_19\\_2009.pdf](http://www.dec.state.ak.us/water/wqsar/wqs/pdfs/18_AAC_70%20Amended_September_19_2009.pdf)

Water Quality Criteria Manual for Toxicants (December 12, 2008)  
<http://www.dec.state.ak.us/water/wqsar/wqs/pdfs/Alaska%20Water%20Quality%20Criteria%20Manual%20for%20Toxic%20and%20Other%20Deleterious%20Organic%20and%20Inorganic%20Substances.pdf>

2004 EMAP (Environmental Monitoring and Assessment Program) Southeast Alaska  
<http://www.dec.state.ak.us/water/wqsar/monitoring/2004Southeast.htm>

ADEC List of Impaired Waterbodies  
<http://www.dec.state.ak.us/water/wqsar/waterbody/integratedreport.htm>

2009 ADEC Assessment of the Stationary Cruise Ship Plume Dilution Study  
[http://www.dec.state.ak.us/water/cruise\\_ships/pdfs/2009\\_Plume\\_Dilution\\_Study.pdf](http://www.dec.state.ak.us/water/cruise_ships/pdfs/2009_Plume_Dilution_Study.pdf)

2002 Science Panel “The Impact of Cruise Ship Wastewater Discharge on Alaska Waters”  
[http://www.dec.state.ak.us/water/cruise\\_ships/SciencePanel/documents/impactofcruiseship.pdf](http://www.dec.state.ak.us/water/cruise_ships/SciencePanel/documents/impactofcruiseship.pdf)