Cruise Line International Association – Alaska
Discharge of Effluents in Alaska Waters
by Cruise Vessel Operations

Quality Assurance Project Plan (QAPP)
For
Ambient Receiving Water Testing

February 2019

Effective: May 1, 2019 – April 30, 2020

LIST OF ABBREVIATIONS

ACEC	Acute Critical Effluent Concentration
ACWA / CWA	Alaska's Clean Water Act / Clean Water Act
ADEC	Alaska Department of Environmental Conservation
APDES	Alaska Pollutant Discharge Elimination System
AWQS	Alaska Water Quality Standard
COC	Chain of Custody
DMR	Discharge Monitoring Report
DQO	Data Quality Objective
DO	Dissolved Oxygen
DOW	Division of Water
EPA	Environmental Protection Agency
EPS	Environmental Program Specialist
GPS	Global Positioning System
IC	Inhibition Concentration
IDL	Instrument Detection Limit
LC	Lethal Concentration
MQO	Measurement Quality Objective
MDL	Method Detection Limit
mS/cm	microsiemens/centimeter
mg/L	milligrams/liter
µg/L	micrograms/liter
ND	Non-Detect
NELAC	National Environmental Laboratory Accreditation Counsel
PE Sample	Performance Evaluation Sample
PT Sample	Performance Test Sample
PQL	Practical Quantification Limit
QA/QAP	Quality Assurance / Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SOP	Standard Operating Procedure
TMDL	Total Maximum Daily Load
VSSP	Vessel Specific Sampling Plan

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A. PROJECT MANAGEMENT ELEMENTS

A.1__TITLE AND APPROVALS:

Title: Quality Assurance Project Plan (QAPP) For Ambient Receiving Water Testing

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A.2 DISTRIBUTION LIST

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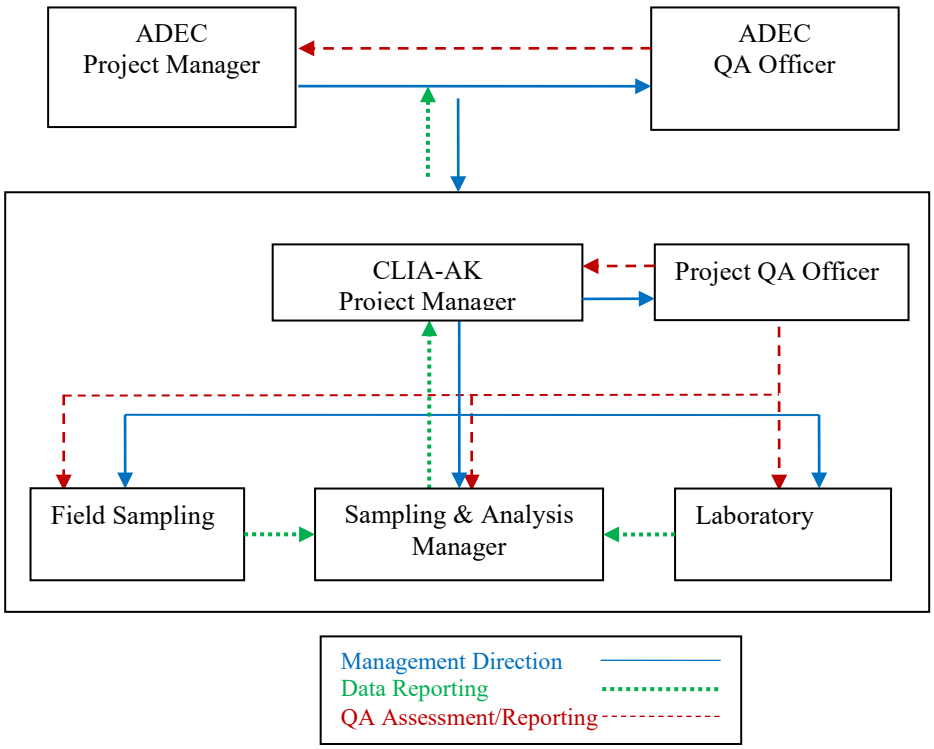
A.3__PROJECT TASK/ORGANIZATION

Position Title	Company / Agency	Responsibilities
Project Manager	CLIA-Alaska / Admiralty Environmental	[Refer to the current revision of the *Cruise Line International Association Alaska Discharge of Effluents in Alaska Waters by Cruise Vessel Operations Quality Assurance Project Plan For Sampling and Analysis of Treated Sewage and Graywater From Commercial Passenger Vessels* (referred to as the "CLIA-Alaska QAPP" for the remainder of this document), "Management and Contractors"]
Project QA Officer	University of Alaska SE	[Refer to the CLIA-Alaska QAPP, "Management and Contractors"]
Sampling Team Leader	Admiralty Environmental	The sampling team leader will notify the ADEC Project Manager at least 36 hours prior to sampling events. [Refer to the CLIA-Alaska QAPP, "Management and Contractors"]
Field Sampling staff	Admiralty Environmental	Samplers are responsible for sample collection, sample integrity, and custody, field measurements, and accurate field notes.
Laboratory QA Officer/ Laboratory Manager	Brooks Applied Laboratories, Microbac Laboratories	Responsible for overall review and approval of analytical work. Responsible for QA/QC of water quality laboratory analyses as specified in the QAPP. Along with Laboratory QA Manager, the Lab QA Officer reviews and verifies the validity of sample data results as specified in the QAPP and appropriate EPA approved analytical methods.
Project Manager	ADEC-DOW	[Refer to the CLIA-Alaska QAPP, "Management and Contractors"]
DEC QA Officer	ADEC-DOW WQSR/QA	[Refer to the CLIA-Alaska QAPP, "Management and Contractors"]

Figure 1. Program Organization and Data Flow Chart



A.4__PROBLEM, BACKGROUND, AND OBJECTIVES

Problem Definition

The Alaska Department of Environmental Conservation (ADEC), Commercial Passenger Vessel Environmental Compliance (CPVEC) program is responsible for authorizing proposed discharges from cruise ships to marine waters. The ADEC issued a *Large Commercial Passenger Vessel Wastewater Discharge General Permit* in 2014 ("2014 ADEC General Permit") for these discharges that requires compliance with effluent limits at the point of discharge and monitoring the concentration of certain contaminants at the edge of a mixing zone. In order to confirm modeling authorizing mixing zones and to determine the mixing zone size, the concentration of these contaminants and the physical properties of the receiving water, or ambient water quality, must be known. The current general permit is based on the best available ambient water quality data; however, these data are limited.

Project Background

Previous ambient water quality data for marine waters collected by ADEC is summarized in Table 1 below.

Project Objective(s)

The objective of Section 6.9 of the 2014 ADEC General Permit is to monitor pollutant levels at the boundary of the mixing zone, which will allow ADEC to assess decisions based on mixing zone modeling and make adjustments if necessary. Data collected will also be used in the development of future permits.

Table 1. Summary of ambient data for ammonia and copper.

Date	Location	NH_3-N (mg/L)	Cu (µg/L)
1989	Gastineau Channel	0.025	0.99 (TR)
1990	Gastineau Channel	0.023	0.66 (TR)
1991	Gastineau Channel	0.007	0.59 (TR)
2006-2010	Hawk Inlet		0.41 (Diss)
2008	Skagway harbor		<2.6 (Diss)
2015	Juneau harbor	0.029	1.33 (Diss)
2015	Skagway harbor	0.034	1.28 (Diss)
2016	Juneau harbor	0.093	0.48 (Diss)
2016	Skagway harbor	0.098	0.16 (Diss)

A.5__PROJECT/TASK DESCRIPTION AND SCHEDULE

Project Description

The project objective is to obtain measures of ambient water quality parameters for the calculation of the minimum size of mixing zones, when necessary, in support of ADEC's General Permit for the discharge of treated wastewater from large commercial passenger vessels. The following sampling design has been developed to meet this objective. The sampling design describes the selection of sampling locations, sample collecting timing and frequency, sample parameters, and additional site data to be collected during each sampling event.

Sampling locations

Sampling locations will be selected based on the 83 meter mixing zone outlined in the 2014 ADEC General Permit. Receiving water quality monitoring for permit compliance will be performed outside of large cruise vessels in the Juneau harbor that are discharging within 1 mile of shore and at a speed less than 6 knots. Samples will be collected at points 83 meters upstream of the overboard discharge point and 83 meters downstream of the overboard discharge point as determined by prevailing current set and drift measured at the time of sampling.

Sampling Dates and Sample Timing

Sampling dates will be selected to coincide with concurrent sampling of the overboard effluent at the point of discharge from large cruise vessels. This will allow a comparison of the concentration of effluent contaminants to the concentration of contaminants in both the upstream and downstream locations in the receiving water. Sampling times will be selected based on

arrival times of vessels into port of Juneau. Since the time of day each vessel arrives to Juneau typically does not vary, this will randomize the tidal conditions at the time of receiving water sampling. Sampling of the receiving waters will occur as close in time as practicable to the concurrent effluent sampling event. This is coordinated by selecting the same pre-determined sampling times for both the effluent and receiving water events, and by field sampling staff communication via cell phone on the day of sampling.

Sample Parameters

Receiving water current direction and velocity will be measured at the overboard discharge location at 1 m water depth. Water quality field parameters to be measured include pH, specific conductivity, dissolved oxygen, and temperature. Water samples will also be collected for the laboratory analyses of total ammonia and dissolved copper. All samples will be collected from a depth of 1m at upstream and downstream sampling locations.

Table 2. Parameters to be Measured

Field Measurements	Laboratory Measurements
Temperature	Dissolved copper
Current direction and velocity	Total ammonia
Dissolved Oxygen	
pH	
Conductivity	

Additional Data Collection

Additional data collection on each sampling date will include the ship's berth identification and the tidal stage. At each sampling location, field sampling staff will record the time of sampling, latitude, longitude, and distance perpendicular to the hull of the vessel. Samplers will also take a site photograph at each sampling location.

Logistics

The Admiralty Environmental Project Manager, or their designee, will arrange all logistics and perform sampling from their location in Juneau, AK. Sampling logistics will include coordinating sample timing and shipping schedules as necessary to get water samples for dissolved copper and total ammonia to the subcontract analytical laboratories in Seattle, WA and Merrillville, IN. Admiralty Environmental will provide the sampling schedule to the ADEC Project Manager so that ADEC representatives have the option to observe field sampling.

Sampling

The field sampling staff will conduct the field sampling as described within this QAPP, referenced EPA approved methods, and applicable safety plans. Water samples will be collected using a peristaltic pump connected to tubing submerged to the 1 meter sampling depth. Sample tubing will be flushed thoroughly prior to dispensing water to sample bottles. Measures of water pH, specific conductivity, and dissolved oxygen will be obtained using field analytical meters.

All meters will be calibrated prior to field sampling. Water samples for dissolved metals will be field filtered. One field blank will be collected with every sample event. Replicate samples will be collected for QA analyses in addition to laboratory quality assurance procedures. The Sampling Project Manager will ensure that all samples are properly preserved and submitted to the analytical laboratory within sample holding times.

Results

Laboratory analytical reports will be submitted to the ADEC Project Manager and vessel owners upon review and acceptance by the CLIA-Alaska Project Manager.

A.6__DATA QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Data Quality Objectives (DQOs)

Data Quality Objectives are qualitative and quantitative statements that:

- Clarify the monitoring objectives (i.e., determine water/wastewater pollutant concentrations of interest and how these values compare to water quality standards regulatory limits).
- Define the appropriate type of data needed. In order to accomplish the monitoring objectives, the appropriate type of data needed is defined by the respective AWQS. For pollutants, compliance with the AWQS is determined by specific measurement requirements. The measurement system is designed to produce water pollutant concentration data that are of the appropriate quantity and quality to assess compliance.

Measurement Quality Objectives (MQOs)

Measurement Quality Objectives (MQOs) are a subset of DQOs. MQOs are derived from the monitoring project's DQOs. MQOs are designed to evaluate and control various phases (sampling, preparation, and analysis) of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the project's DQOs. MQOs define the acceptable quality (data validity) of field and laboratory data for the project. MQOs are defined in terms of the following data quality indicators:

- Detectability
- Precision
- Bias/Accuracy
- Completeness
- Representativeness
- Comparability

Detectability

The ability of the method to reliably measure a pollutant concentration above background. ADEC DOW uses two components to define detectability: method detection limit (MDL) and practical quantification limit (PQL) or reporting limit (RL).

- The MDL is the minimum value which the instrument can discern above background but with no certainty to the accuracy of the measured value. For field measurements, the manufacturer's listed instrument detection limit (IDL) can be used.
- The PQL or RL is the minimum value that can be reported with confidence (usually some multiple of the MDL).

Note: The measurement method of choice should at a minimum have a practical quantification limit or reporting limit 3 times more sensitive than the respective AWQS and/or permitted pollutant level (for permitted facilities).

Sample data measured below the MDL is reported as ND or non-detect. Sample data measured ≥ MDL but ≤ PQL or RL is reported as estimated data. Sample data measured above the PQL or RL is reported as reliable data unless otherwise qualified per the specific sample analysis.

Precision

The degree of agreement among repeated measurements of the same parameter and provides information about the consistency of methods. Precision is expressed in terms of the relative percent difference (RPD) between two measurements (A and B).

For field measurements, precision is assessed by measuring replicate (paired) samples at the same locations and as soon as possible to limit temporal variance in sample results. Overall project precision is measured by collecting blind (to the laboratory) field replicate samples. Laboratory precision is determined similarly via analysis of laboratory duplicate samples. For paired and small data sets, project precision is calculated using the following formula:

$$RPD = 100 * \frac{(A - B)}{\left({(A + B)}/{2} \right)}$$

Where: RPD = relative percent difference
A = primary sample
B = replicate field sample or laboratory duplicate sample

For larger paired precision data sets (e.g., overall project precision) or multiple replicate precision data, use the following formula:

RSD = 100*σ/mean

$$\sigma = \int \frac{\Sigma d^2}{2k}$$

Where: RSD = relative standard deviation
σ = standard deviation
k = number of paired replicate samples (A and B)
d = A - B
A = primary sample
B = replicate field sample or laboratory duplicate sample

Bias (Accuracy)
A measure of confidence that describes how close a measurement is to its "true" value. Methods to determine and assess accuracy of field and laboratory measurements include, instrument calibrations, various types of QC checks (e.g., sample split measurements, sample spike recoveries, matrix spike duplicates, continuing calibration verification checks, etc.), and performance audit samples (DMRQA, blind Water Supply or Water Pollution PE samples from American Association for Laboratory Accreditation certified, etc.). Bias/Accuracy is usually assessed using the following formula:

$$Accuracy = \frac{MeasuredValue}{TrueValue} \times 100$$

Completeness
A measure of the percentage of valid samples collected and analyzed to yield sufficient information to make informed decisions with statistical confidence. As with representativeness, data completeness is determined during project development and specified in the QAPP. Project completeness is determined for each pollutant parameter using the following formula:

$$\frac{T - (I+NC)}{T} \times (100\%) = \text{Completeness}$$

Where T = Total number of expected sample measurements.
I = Number of invalid sample measured results.
NC = Number of sample measurements not completed (e.g., spilled sample, etc.).

The objective for completeness for this project is 80%.

Representativeness
Determined during project development. Representativeness assigns what parameters to sample for, where to sample, type of sample (grab, continuous, composite, etc.) and frequency of sample collection. Refer to the CLIA Alaska QAPP and the individual VSSP for description of representative samples.

Comparability
A measure that shows how data can be compared to other data collected by using standardized methods of sampling and analysis. Refer to the CLIA Alaska QAPP, the individual VSSPs and the analytical methods outlined in Table 3, below.

Table 3. Project measurement quality objectives (MQO's).

Group	Analyte	Method	MDL (µg/L)	PQL (µg/L)	Alaska WQS Marine Water		Precision (RSD)	Accuracy (% Rec)
					Aquatic Life	Contact Recreation		
					<4.0 mg/L or > 17mg/L	NA		
	pH	EPA 150.1	NA	±0.01 pH units	6.5 - 8.5; not vary by 0.2 from natural condition	NA	±0.1 pH units	±0.1 pH units
	Temperature	EPA 170.1	NA	0.1°C	<15.0 C Rate of change <0.5 C/hour and <1C/week	<30°C	±0.2°C	±0.2°C
	Conductivity	EPA 120.1	NA	0-1: 0.001 1-10: 0.01 10-100: 0.1 (mS/cm)	NA	NA	± 10%	± 10%
Dissolved Inorganics	Copper	EPA1640	0.024	0.10	4.8 µg/L acute; 3.1 µg/L chronic	NA	±20%	80-120
Nutrients	Ammonia-N	EPA 350.1	112	400	pH, salinity, and temperature dependent at a pH of 7.4, 20 ppt salinity and temperature of 15C acute = 30.5 mg/L; chronic = 4.4 mg/L	NA	±20%	80 - 120

NA = None available.

A.7__SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

Samplers will be trained on the specific sampling requirements contained in this QAPP. Samplers that are qualified for regular compliance sampling under the CLIA-Alaska QAPP will not require additional certifications for receiving water sample collection. Samples will be collected in accordance with the stipulations provided in the VSSPs, the CLIA-Alaska QAPP, and this QAPP. Information on the sampling and laboratory staff competence is outlined in respective laboratory QAPs.

The CLIA-Alaska Project Manager is responsible to ensure that the contracted lab maintains on file with the ADEC DOW QA Officer a current copy (electronic preferred) of the laboratory's QAP and applicable SOPs.

Refer to the "Special Training Requirements/Certification" section of the CLIA-Alaska QAPP for additional information and table summary.

Table 4. Training for project field and laboratory staff.

Specialized Training/Certification	Field Staff	Lab Staff	Monitoring Supervisor	Lab Supervisor	Project QA Officer
Safety training	X	X	X	X	X
Water sampling techniques	X		X		X
Instrument calibration and QC for field work	X		X		X
Instrument calibration and QC for lab work		X		X	X
QA principles			X	X	X
QA for water monitoring systems			X		X
Chain of Custody procedures for samples/ data	X	X	X	X	X
Specific EPA Field Measurement Training	X		X		X
Specific EPA Approved Lab Analytical Training		X		X	X

A.8__DOCUMENTS AND RECORDS

Refer to "Table 3: Project Documents and Records" in the CLIA-Alaska QAPP.

B. DATA GENERATION AND ACQUISITION

B.1__SAMPLING DESIGN

To satisfy the requirements of the 2014 ADEC General Permit, receiving water monitoring must occur twice per year when an authorized vessel is actively discharging into marine waters of the state at speeds under 6 knots with a mixing zone. Sampling will occur while the vessel is docked and actively discharging in-port. The sampling locations will be determined relative to the effluent sampling discharge point on the hull of the vessel, as specified in the VSSP and by ship staff.

Each sampling event will include current set and drift determination (measured at the point of discharge), and subsequent sample collection from two locations (one under the potential influence of the discharge at 83 meters downstream of the vessel and one in the opposite direction 83 meters). Field tests will occur in the field at each sampling location. Ammonia and dissolved copper analyses will be conducted in the laboratory.

Monitoring Objectives and Data Quality Objectives

The objective of this project is to obtain ambient measures of water quality in order to evaluate the permitted mixing zone for discharge of treated water from commercial passenger vessels. Water samples will be collected in the Juneau harbor and analyzed to determine ambient concentrations of total ammonia and dissolved copper. These are the parameters that, based on ADEC analyses of cruise ship discharges, have the potential to exceed Alaska water quality standards. Measures of water temperature, current direction and velocity, pH, specific conductivity, and dissolved oxygen will be measured in the field.

Characterize the General Monitoring Locations

Water samples will be collected from ambient receiving water locations within the Juneau harbor (Figure 2). Exact locations within these figures will be determined on the day of sampling due to the variability of discharge point locations and cruise ship docking schedules for vessels operating under this QAPP. Potential sampling locations include the areas surrounding the AJ Dock, South Franklin Dock, Cruise Ship Terminal, and Steamship Dock (outlined in orange).

Figure 1. Potential sampling locations for the Juneau harbor

Site-Specific Sample Collection Locations, Parameters, & Sampling Frequency

Water sampling will be conducted during time periods when cruise ships are actively discharging into receiving waters in the Juneau harbor. These time periods occur during the months of May - September (the cruise ship season). Water samples for will be collected during a single sampling event (day) twice per season for vessels that discharge at <1 mile from shore and traveling at <6 knots.

Receiving water current direction, velocity, and sample collection will occur 1 m below the water's surface. Samples will be collected at locations 83 meters upstream and downstream of the vessel's discharge point in the Juneau harbor during each sampling event. One field blank for dissolved copper will be collected at each sampling event. One field duplicate of dissolved copper will be collected at each event (see Table 5).

Table 5. Sample parameters, type, and frequency for each sampling location.				
Site ID	Parameters to be measured	Sample Type (I, G, C, etc.)	Sampling Frequency	Sample Time
Upstream	NH3-N, Diss. Cu	G	Once/Event	Dependent on ship's arrival in port
Upstream	Temperature, pH, specific conductivity, DO	G	Once/Event	
OB Discharge Point	Current direction and velocity	I	Once/Event	
Downstream	NH3-N, Diss. Cu	G	Once/Event	
Downstream	Temperature, pH, specific conductivity, DO	G	Once/Event	
Field Duplicate	Diss. Cu	G	Once/Event	
Field Blank	Diss. Cu	G	Once/Event	
Event Duplicate	Temperature, pH, specific conductivity, DO, NH3-N	G	10% of the total number of events/season	

B.2__SAMPLING METHOD REQUIREMENTS

Project sampling staff will follow sampling method requirements and procedures as outlined in the CLIA-Alaska QAPP, and the procedures below.

Sample Types

Samples will be a combination of *in situ* measurement and grab samples (see section B.1). *In situ* measurement of current set and drift will be obtained by suspending a drogue to the required depth and measuring current speed and direction. Samples collected for laboratory and field analyses will be obtained by pumping water from the required depth using a peristaltic pump and will be labelled as grab samples.

Sample Containers and Equipment

Containers Sample bottles will be provided by the analytical laboratories. All bottles will be certified clean. Field tests for temperature, pH, and conductivity will be collected into one 125 ml plastic bottle with no preservative. Sample to be measured for dissolved oxygen will be collected into one 300 ml unpreserved plastic bottle with a "turtleneck." Sample for ammonia analysis will be collected into one 250 ml plastic bottle, pre-preserved with sulfuric acid (H_2SO_4). Dissolved copper sample containers will be certified trace metals clean 60 ml polypropylene bottles, double bagged in sealable plastic bags.

Each event will contain the following bottles:

- Upstream sample – 1 ea. field test bottle, DO bottle, ammonia bottle, and dissolved copper bottle
- Downstream sample – 1 ea. field test bottle, DO bottle, ammonia bottle, and dissolved copper bottle
- Field Duplicate – 1 dissolved copper bottle
- Field Blank – 2 dissolved copper bottles, (1 pre-filled with reagent water, 1 empty)

All dissolved copper sample bottles will be stored in a pre-cleaned plastic cooler, which will be sealed until transfer to a pre-cleaned field sampling cooler on the day of sample collection.

Equipment Pre-cleaned plastic coolers will be used to transport and store trace metals clean sampling bottles and equipment. Trace metals clean FEP tubing will be used to draw sample from the designated depth, up to the peristaltic pump. A connection of trace metals clean silicon tubing will be connected to the FEP tubing and locked into the peristaltic pump. A trace metals clean filter capsule (0.45 um) is attached to the outlet of the silicon tubing. All tubing and connections that come in contact with the sample will be trace metals clean. A clean work area will be set-up on the sampling boat prior to sample collection. The sampling boat will not be cleaned as described in EPA 1669 Section 6.13.

Field testing instruments includes:

- Portable multi-meter with probes to measure dissolved oxygen and conductivity
- Digital, portable thermometer
- Waterproof portable pH meter

Following sample collection (see B.2 for sample collection procedures), sample bottles will be placed in a second pre-cleaned cooler that contains frozen gel ice and a temperature blank. A chain of custody form will be completed for each sampling event that identifies each sample location, sampling date and time, and requested analyses including the analytical method. The chain of custody form will accompany samples at all times. Sample bottles requiring transfer to contracted laboratories will be shipped in custody sealed container(s) via FedEx standard overnight service. Upon receipt, the analytical laboratory will measure the cooler temperature (to 0.1°C) and record receipt date and time. Sample preservation and holding times are provided in Table 6.

Table 6. Preservation and holding times for laboratory analyses.

Analyte	Matrix	Container	Necessary Volume	Preservation and Filtration	Maximum Holding Time
Cu (Dissolved)	Surface Water	P, FP	60 mL	Filtered within 15 minutes of collection using a 0.45 µm filter; HNO_3 to pH < 2	14 days to preservation, 6 months until analysis
NH_3-N	Surface Water	P, FP, G	250 mL	Do not freeze, Cool <4°C; H_2SO_4 to pH < 2	28 Days
P = polyethylene, FP = flouropolymer, G = glass, PA = autoclavable plastic					

Sampling Methods

Sample locations will be determined by first measuring current direction and velocity. Field sampling for ambient concentrations of dissolved copper will follow the "clean hands" methods described in EPA method 1669, "Sampling ambient water for trace metals at EPA water quality criteria levels."

A sampling boat operated by cruise line agencies will be used to transport samplers and equipment to the side of the cruise ship being sampled. The sampling boat will position itself in a fixed position at the point of discharge (as designated in the VSSP and marked by ship staff on the side of the vessel). Current direction and velocity will be measured from this point at a depth of 1m with a submersible drogue. Compass heading of the direction the drogue travelled will be observed and recorded as the current direction.

The two sampling locations (upstream and downstream) are determined based on the current direction and location of the vessel's discharge point. According to the 2014 General Permit, the location potentially under the influence of discharge is 83m downstream of the vessel in the direction of the prevailing tidal current (current direction). This is referred to as the "downstream" sample location in this plan. The other location not under the influence of the discharge is on the same side of the ship in the opposite direction of the prevailing tidal current. This sample location is referred to as "upstream" in this plan. Sample collection will move from least suspected contamination to most. The sampling staff will use a digital rangefinder to measure 83 meters from the discharge point, and the compass to determine the correct sample location. Upstream samples will be collected. The sampling boat will move to the downstream sampling location, determined using the same method. Downstream samples will be collected next. The sampling boat will turn off its motor once each sampling location has been reached.

Prior to beginning sample collection, a clean work area will be set-up on the sampling boat. Samples will be collected using continuous flow sampling through pumping methods as described in EPA 1669 Section 8.2.8. Both dirty hands (DH) and clean hands (CH) will wear clean powder-free vinyl exam gloves, replaced as need between tasks and/or suspected contamination. A field blank is prepared once the clean work area is ready. A dissolved copper bottle filled with trace clean reagent water is opened and poured into another, empty, dissolved copper bottle in the field using CH/DH protocols outlined in EPA 1669.

Following sample collection, both samplers will coordinate the measurement and recording of field parameters, photographs, GPS coordinates, and measuring the distance perpendicular to the hull of the ship. Specific conductivity, temperature and pH will be measured with a meter from the field test bottle. Dissolved oxygen will be measured from the DO bottle.

B.3__SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Sampling Procedures

See Section B.2 of this QAPP – Sampling Method Requirements

Sample Custody Procedures

Sample custody procedures will follow the CLIA-Alaska QAPP "Chain of Custody" procedures.

Shipping Requirements

Packaging, marking, labeling, and shipping of samples will comply with all regulations promulgated by the U. S. Department of Transportation in 49 CFR 171-177. Staff should receive the necessary training for shipping samples or consult with the laboratory for shipping instructions.

Temperature sensitive samples shall be shipped on gel ice to the testing laboratories as soon as possible following sample collection. All sample shipment procedures will be conducted in accordance with the CLIA-Alaska QAPP. A chain of custody form will accompany samples at all times, including during shipment of sample to subcontract laboratories. All temperature dependent samples must be below 6°C upon receipt.

B.4__ANALYTICAL METHODS AND REQUIREMENTS

Monitoring shall be conducted in accordance with EPA-approved analytical procedures and in compliance with 40 CFR Part 136, *Guidelines Establishing Test Procedures for Analysis of Pollutants*. Reference the Project's MQO table (section A6) of this QAPP for list of parameters of concern, approved analytical methods, method-specific detection and reporting limits, accuracy and precision values applicable to this project. 40 CFR, Part 136.6 lists other regulated pollutant parameters not listed in the MQO table (section A6).

Under direction of the CLIA-Alaska Project Manager, project staff will ensure that all equipment and sampling kits used in the field meet EPA-approved methods.

B.5__QUALITY CONTROL REQUIREMENTS

Quality Control (QC) is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the monitoring project's data quality objectives.

Data measurements that do not meet the limits described in A.7 may or may not be used in the final reports depending on the degree to which limits are not met. If there are any issues regarding data quality, the report will clearly state what they are.

Field Quality Control Measures

Field meters will be calibrated according to manufacture and laboratory's SOP guidelines. If accuracy and precision are not met for analyses the field samplers are conducting, the field meters will be recalibrated and measures will be repeated. Meters and probes that cannot achieve the accuracy and precision criteria required for this project will be replaced.

Quality Control measures in the field include but are not limited to:

- Proper cleaning of sample containers and sampling equipment.
- Maintenance, cleaning and calibration of field equipment per the manufacturers and/or laboratory's specifications, and field SOPs.
- Use of chemical reagents and standard reference materials prior to expiration dates.
- Proper field sample collection and analysis techniques.
- Correct sample labeling and data entry.
- Proper sample handling and shipping/transport techniques.
- Event duplicate (blind to the laboratory) samples.
- Field duplicate collected for dissolved copper
- Field blank collected for dissolved copper.

Field duplicate samples for dissolved copper will be collected at a rate of 1/sampling event. Event duplicate samples for all parameters will be collected at a rate of 10%.

Table 7. Field quality control samples.

Field Quality Control Sample	Measurement Parameter	Frequency		QC Acceptance Criteria Limits
		Frequency of Occurrence	Total # of QC Type Samples	
Field Blank	Dissolved Cu	Once/sampling event	1	<MDL
Field Duplicate (Blind to Lab)	Dissolved Cu	Once/sampling event	1	Precision/ Table 3
Event Duplicate	Temperature, pH, EC, DO, NH3-N	10% of total number of events/season	Dependent on number of events	RPD ±20%
Calibration Verification Check Standard	pH, EC	Prior to field sampling	1	Accuracy/ Table 3

Laboratory Quality Control Measures

For laboratory analyses, contract laboratories will submit quality control results along with sample analytical results. Laboratory quality control will include duplicates, matrix spikes, reference standards, and blanks. Laboratory accuracy and precision criteria must be equal to or greater than project criteria provided in Section A.6. Duplicate laboratory analyses will be conducted on one of every 10 samples analyzed (10%). The analytical laboratories' QA procedures including duplicates, matrix spikes, matrix spike duplicates, reference standards, and blanks are described within those quality assurance manuals.

B.6__INSTRUMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Instrument/equipment testing, inspection, and maintenance requirements will be followed as outlined in the CLIA-Alaska QAPP, and as described below.

Prior to a sampling event, all sampling instruments and equipment are to be tested and inspected in accordance with the manufacturers' specifications. All equipment (thermometers, pH meter, etc.) are calibrated appropriately and within stated certification periods prior to use.

Field sampling staff will document that required acceptance testing, inspection and maintenance have been performed. Records of this documentation will be kept with the instrument/equipment and/or on field sampling notes.

Contracted and sub-contracted laboratories will follow the testing, inspection and maintenance procedures required by EPA Clean Water Act approved methods and as stated in the respective laboratory's QAP and SOPs.

B.7__INSTRUMENT CALIBRATION AND FREQUENCY

Field instruments must be calibrated where appropriate prior to using the instruments. If equipment requires calibration immediately prior to the sampling event, the calibration date will be recorded in the operator's field logbook or field data sheets. When field instruments require only periodic calibration, the record of this calibration should be kept with the instrument. The sampling team leader will delegate a field project team member to ensure that instruments are calibrated correctly and appropriate documents recorded and retained.

Contracted and sub-contracted laboratories will follow the calibration procedures found in the respective QAP and SOPs. Specific calibration procedures for regulated pollutants will be in agreement with the respective EPA approved CWA method of analysis. Field and/or laboratory calibration records will be made available to ADEC upon request.

B.8__INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

All reagents, calibration standards, and kit chemicals are to be inspected to ensure that expiration dates are not exceeded prior to use in the monitoring project. This is done by the field sampling staff prior to the sampling event.

All sample collection devices and equipment will be appropriately cleaned prior to use in the monitoring project. Sample containers are purchased/provided contaminant free, but equipment will be cleaned and inspected by field sampling staff prior to each sampling event.

No standard solutions, buffers, or other chemical additives shall be used if the expiration date has passed. The sampling team leader or their designee is responsible to maintain appropriate records (e.g., logbook entries, checklists, etc.), to verify inspection/acceptance of supplies and consumables, and restock these supplies and consumables when necessary.

Contracted and sub-contracted laboratories will follow procedures in respective laboratory's QAP and SOPs for inspection/acceptance of supplies and consumables.

B.9__DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

Onboard ship data to be recorded by the field sampling staff collecting the concurrent effluent sample includes tank volume and pumping rate data from ship tracking systems and any documented occurrence of sea water influx. The data will be recorded as reported by shipboard staff in the graywater and blackwater discharge record book and through direct observation by the sampling staff.

B.10__DATA MANAGEMENT

The success of a monitoring project relies on data and their interpretation. It is critical that data be available to users and that these data are:

- Of known quality,
- Reliable,
- Aggregated in a manner consistent with their prime use, and
- Accessible to a variety of users.

Quality Assurance/Quality Control (QA/QC) of data management begins with the raw data and ends with a defensible report, preferably through the computerized messaging of raw data.

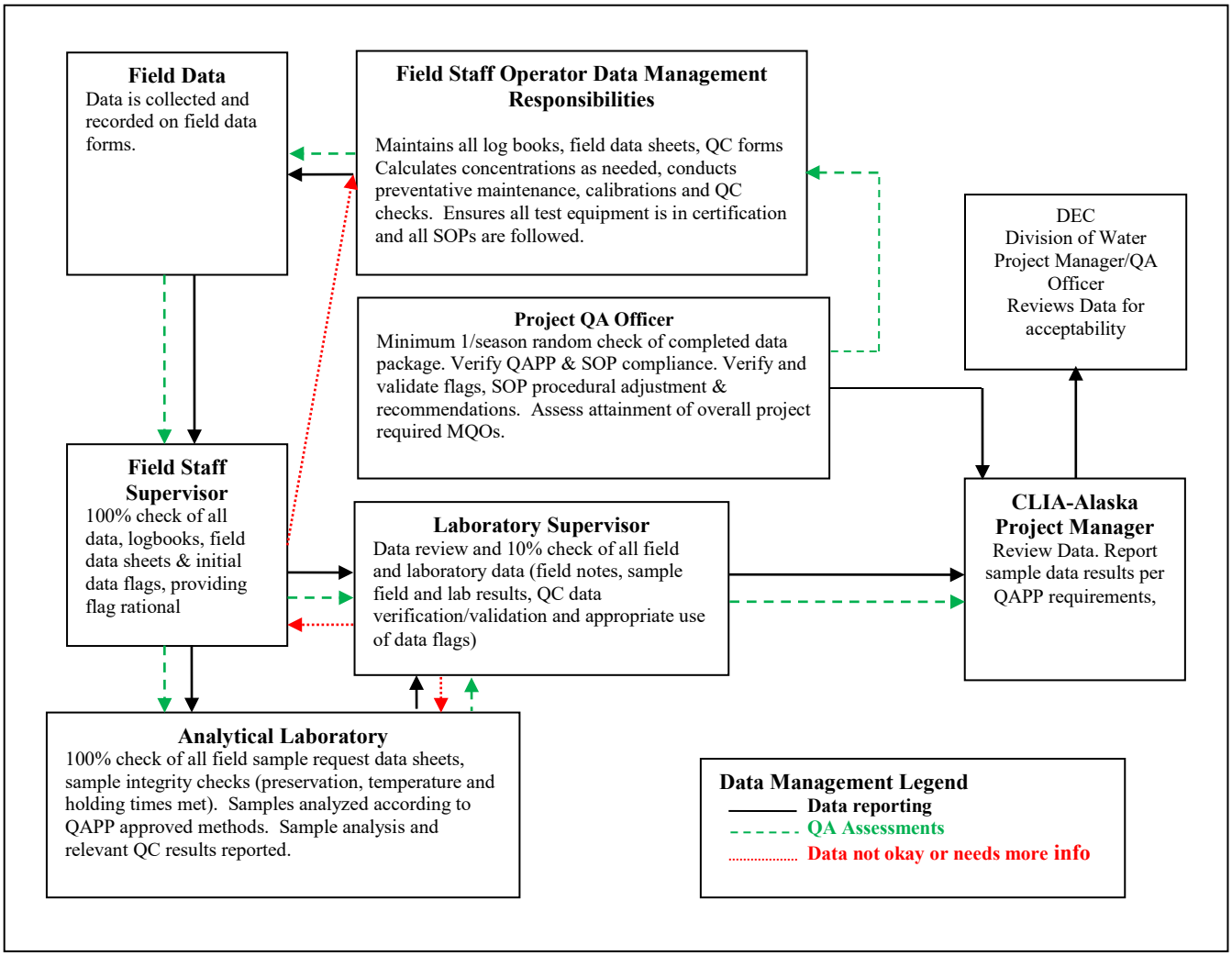
Data management encompasses and traces the path of the data from their generation to their final use or storage (e.g., from field measurements and sample collection/recording through transfer of data to computers [laptops, data acquisition systems, etc.], laboratory analysis, data validation/verification, QA assessments and reporting of data of known quality to the ADEC DOW). Data management also includes/discusses the control mechanism for detecting and correcting errors.

Various people are responsible for separate or discrete parts of the data management process:

- The sampling team is responsible for field measurements/sample collection and recording of data and subsequent shipment of samples to laboratories for analyses. The team assembles data files, which include raw data, calibration information and certificates, QC checks (routine checks), data flags, sampler comments and meta data where available. These files are assembled and forwarded for secondary data review by the sampling team leader.
- Laboratories are responsible to comply with the data quality objectives specified in the QAPP and as specified in the laboratory QAP and method specific SOPs. Validated sample laboratory data results with respective analytical method QA/QC results and acceptance criteria are reported to the sampling manager and the CLIA-Alaska Project Manager. Analytical data is submitted in PDF and as an electronic data deliverable.

- Secondary reviewers (sampling team leader/project supervisor) are responsible for QA/QC review, verification and validation of field and laboratory data and data reformatting as appropriate for reporting validated data to the Project Manager.
- The project QA Officer is responsible for performing independent reviews of data to ensure the monitoring projects data quality objectives are being met. Findings and recommended corrective actions (as appropriate) are reported directly to project management.
- The CLIA-Alaska Project Manager is responsible for final data certification.

Figure 2. Data management flowchart.



B.11 DATA STORAGE AND RETENTION

Data management files will be stored on a secure computer or on a removable hard drive that can be secured. Laboratory records must be retained by the contract laboratory for a minimum of five years. Project records must be retained by the lead organization conducting the monitoring operations for a minimum of five years. Site location and retention period for the stored data is specified in "Table 3: Project Documents and Records" of the CLIA-Alaska QAPP.

C. ASSESSMENTS

C.1__ASSESSMENTS AND RESPONSE ACTIONS

Assessments are independent (of management) evaluations of the monitoring project that are performed by the Project's QA Officer or designee. Assessments may include any of the following: on-site field surveillance, on-site laboratory audits, performance evaluation samples, DMRQA samples, data quality audits, and data reviews. The number and types of assessments are dependent upon the monitoring project's intended data uses and applicability.

Monitoring Data Assessment

QA assessments that will be undertaken for this receiving water testing project include:

Field samples collected for subsequent laboratory analysis (each pollutant)

- Third party performance evaluation samples (PE samples, also called performance test (PT) samples) for wastewater analytes of interest must be completed annually by any laboratory undertaking analyses for this project. PT water/wastewater sample participation is at a frequency of one per year from a NELAC certified vendor. For APDES permit monitoring, these are called DMRQA samples. PT results must be mailed to both the ADEC Water Quality Assurance Officer and the Project Quality Assurance Officer.

On-Site Assessments

- ADEC and/or the QA Officer may perform a field sampling audit at any time during the season in order to evaluate the performance of the samplers. Audits will concentrate on adherence to the project's QAPP. Audit reports will be made available to the Project Manager within 14 days of the audit. These reports will include corrective actions, if necessary.
- Laboratories are subject to periodic and extensive audits by regulatory agency personnel as part of their certification(s). Reports of these audits will be made available upon request. The QA Officer and ADEC Project Manager may review any recent and pertinent technical systems audit reports of the analytical laboratories involved in this project.

Project Data Assessments

- Audits of Monitoring Data for reproducibility of results from recalculation/reconstruction of field/lab-unprocessed data will occur at a rate of one per monitoring season.

- Calculation of monitoring project's overall achieved precision, accuracy and data completeness compared to QAPP defined precision, accuracy and data completeness goals will be completed by the QA Officer at the end of each monitoring season.

Table 8. Project Assessments

Assessment Type	Measurement Parameters		Frequency	Acceptance Criteria Limits
	Analyte	Method		
On-site Field Audit/Inspection	All	See 40 CFR 136.3, and EPA 1669	1/monitoring season/if determined necessary by QA Officer	Site technicians in compliance with QAPP sampling protocols, sample sites meet sample design criteria
3rd Party Blind PT/DMR QA Sample (Lab)	All	All	Annually	Analytes within PT study limits
On-site Technical System Lab Audit	All	All	If determined necessary by ADEC	
Independent Data Review Audit	All	All	1 per season	
Project Precision, Accuracy and Data Completeness Assessment	All	All	End of project (1/year)	Defined in Section A6

REVISIONS TO QAPP

The QAPP will be reviewed and revised as needed by the CLIA-Alaska Project Manager and the project QA Officer. Minor revisions may be made without formal comment. Such minor revisions may include changes to identified project staff (but not lead project staff: QA project officer, Project Manager, sampling team leader, contracted laboratories), QAPP distribution list and/or minor editorial changes.

Revisions to the QAPP that affect stated monitoring DQOs, MQOs, method specific data validation and/or inclusion of new monitoring methods must be reviewed and pre-approved by ADEC DOW QA Officer/ADEC Project Management before being implemented.

QA REPORTS TO MANAGEMENT

The distributions of project QA assessments from Table 8 are outlined in Table 9, below.

Table 9. QA Reports to Management

QA Report Type	Contents	Presentation Method	Report Issued by	Reporting Frequency	
				As Required	Year
On-site Field Inspection Audit Report	Description of audit results, audit methods and standards/equipment used and any recommendations	Written text and tables, charts, graphs displaying results	Project QA Officer/auditor	✔	
3rd Party PT (DMRQA, etc.) Audit Report	Description of audit results, methods of analysis and any recommendations	Written text and charts, graphs displaying results	Project QA Officer/auditor	✔	✔
Corrective Action Recommendation	Description of problem(s), recommended corrective action(s), time frame for feedback on resolution of problem(s)	Written text/table	QA Officer/auditor	✔	
Response to Corrective Action Report	Description of problem(s), description/date corrective action(s) implemented and/or scheduled to be implemented	Written text/table	Project Manager overseeing sampling and analysis	✔	
Data Quality Audit	Independent review and recalculation of sample collection/analysis (including calculations, etc) to determine sample result. Summary of data audit results; findings; and any recommendations	Written text and charts, graphs displaying results	Project QA Officer	✔	✔
Quality Assurance Report to Management	Project executive summary: data completeness, precision, bias/accuracy	Written text and charts, graphs displaying results	Project QA Officer	✔	✔

D. DATA VALIDATION AND USABILITY

D.1__DATA REVIEW, VERIFICATIONAND VALIDATION REQUIREMENTS

The purpose of this section is to define the criteria used to review and validate monitoring data--that is, accept, reject or qualify data in an objective and consistent manner. Data review, verification and validation are ways to decide the degree to which each data item has met its quality specifications (i.e., analyte specific QC criteria and overall project measurement quality objectives).

Data validation

Data validation means determining if data satisfy QAPP-defined user requirements, that is, that the data refer back to the overall data quality objectives. Data validation is an analyte and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific

data set to ensure that the reported data values meet the quality goals of the environmental data operations (analyte and method specific data validation criteria).

Upon receipt of completed data packages (at a rate of 1/monitoring season) from this project, the QA Officer will review data and field notes to verify that this QAPP was followed. Items reviewed will include:

- Comparison of sample schedule with field notes and COC forms to ensure that planned samples were collected.
- Review of field notes and data to ensure that information specified in the QAPP has been recorded.
- Review of laboratory data packages.

Data Verification

Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements.

Data Review

Data review is the process that evaluates the overall data package to ensure procedures were followed and that reported data is reasonable and consistent with associated QA/QC results. The Project QA Officer will review one completed data package per monitoring season. Review will include verification of correct sample collection, analysis and reporting; summary of data audit results; findings; and any recommendations. The data review must be submitted before July 1 of each year in order to correct any system problems as early in the season as possible.

D.2__VERIFICATION AND VALIDATION METHODS

Validation Methods

All data generated shall be validated in accordance with the QA/QC requirements specified in the methods and the technical specification outlined in this QAPP. Raw sample data will be maintained by the agency or company responsible for the monitoring project. Raw laboratory data shall be maintained by the laboratory. The laboratory may archive the analytical data into a laboratory data management system.

Field documentation will include a sampling checklist that will be used to verify field sampling and analysis requirements have been met. See Appendix A.

The summary of all laboratory analytical results will be reported to the CLIA-Alaska Project Manager. Data validation will be performed by the laboratory for all analyses prior to the release of data. All laboratory data will be validated according to the laboratory's QAP and SOPs and this QAPP. The rationale for any anomalies in the QA/QC of the laboratory data will be provided to the Project Manager with the data results. Completed COC or transmission forms (if required) will be sent back from the laboratory to the Project Manager.

Data will be qualified as necessary. Unacceptable data (i.e., data that do not meet the QA measurement criteria of precision, accuracy, representativeness, comparability and completeness) will not be used or if used, the problems with the data will be clearly defined and flagged appropriately. Any actions taken to correct QA/QC problems in sampling, sample handling, and analysis must be noted. Under the direction of the CLIA-Alaska Project Manager, project staff will document any QA/QC problems and the respective QA/QC corrective actions taken.

The Project Manager/monitoring supervisor or designee is responsible for reviewing field log notebooks and field data sheets for accuracy and completeness as soon as possible following each sample collection activity. Sample results provided by the laboratory will be verified and validated by the laboratory QA Officer or their designee prior to issuing the laboratory report. Laboratory results will include the results of all QA/QC results as part of the sample data report. The laboratory report will become part of the permanent file for the monitoring project. The Project Manager or designee will compare the sample information in the field log notebooks and/or data field sheets with the laboratory analytical results to ensure that no transcription errors have occurred and to verify project QA/QC criteria have been met.

Analyte-specific precision, accuracy and data completeness results greater than project MQOs will be noted by the Project Manager and justified in the final data report. The Project Manager, along with the Project QA Officer, if necessary, will decide if any QA/QC corrective action is necessary if the precision, accuracy (bias) and data completeness values exceed the project's MQO goals.

Verification Methods

The primary goal of verification is to document that applicable method, procedural and contractual requirements were met in field sampling and laboratory analysis. Verification checks to see if the data is complete, if sampling and analysis matched QAPP requirements, and if Standard Operating Procedures (SOPs) were followed. Verification of data is the responsibility of the Project QA Officer.

D.3__RECONCILIATION WITH USER REQUIREMENTS

The Project Manager and/or the Project QA Officer will review and validate data against the project's defined MQOs prior to final reporting stages. If there are any problems with quality sampling and analysis, these issues will be addressed immediately and methods will be modified to ensure that data quality objectives are being met. Modifications to monitoring that affect the quality of reported data will require notification to and pre-approval by ADEC as well as subsequent edits to the approved QAPP.

Only data that have been validated, verified and qualified, as necessary, shall be submitted to ADEC.

References

ADEC. 2014. *Large Commercial Passenger Vessel Wastewater Discharge General Permit (General Permit# 2013DB0004).* Alaska Department of Environmental Conservation. Division of Water. Commercial Passenger Vessel Environmental Compliance Program. 410 Willoughby Ave. PO Box 111800. Juneau, Alaska 99811-1800.

CLIA-AK. 2019. *CLIA-Alaska Discharge of Effluents in Alaska Waters by Cruise Vessel Operations QAPP for Sampling and Analysis of Treated Sewage and Graywater.* February 2019.

ARRI. 2015. *CPVEC Ambient Water Quality Monitoring Juneau and Skagway Harbors Quality Assurance Project Plan for Water Quality Monitoring Sampling and Analysis Activities.* June 2015.

APPENDIX A. Cruise Ship Receiving Water Sampling Checklist

Cruise Ship Receiving Water Sampling Checklist

Vessel Name: _____
Sampler Name: _____
Date: _____
Sampling Event ID #: _____

I. Notification

- ☐ ADEC project manager notified 36 hours prior to the sampling event

II. Type of Sampling

- ☐ Receiving water sampling, 1st event/season
- ☐ Receiving water sampling, 2nd event/season

III. Sampling Notes (to include:)

- ☐ Vessel name
- ☐ Names of sampling personnel
- ☐ Names of shipboard assistants
- ☐ Current direction and velocity measured at VSSP identified vessel discharge point
- ☐ Upstream and Downstream samples collected 83m from overboard discharge point
- ☐ GPS coordinates, photograph, and distance perpendicular to hull measured at each sample location
- ☐ Sample date and times recorded on COC
- ☐ Field measurements: pH, temp, DO, and EC recorded on field notes
- ☐ Field instrument calibration information
- ☐ Records collected on discharge flow rates and holding tank volumes
- ☐ Copy of the Discharge record for the sampled discharge included
- ☐ Nature of sample recorded (composite or grab)
- ☐ Waste type of concurrent effluent sample recorded (blackwater, graywater, or mixed)
- ☐ If deviations from VSSP and/or QA/QCP noted, reported date and time to ADEC
- ☐ Ship's location (e.g. Juneau, AK), and ship's berth
- ☐ Chain of custody properly completed
- ☐ Samples delivered to laboratory within holding times for analyses