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

Quality Assurance Project Plan (QAPP)

For

Whole Effluent Toxicity (WET) 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 / DEC	Alaska Department of Environmental Conservation
APDES	Alaska Pollutant Discharge Elimination System
CCEC	Chronic Critical Effluent Concentration
COC	Chain of Custody
DMR	Discharge Monitoring Report
DQO	Data Quality Objective
DO	Dissolved Oxygen
DOW	Division of Water
EC	Effect Concentration
EPA	Environmental Protection Agency
EPS	Environmental Program Specialist
GPS	Global Positioning System
IC	Inhibition Concentration
IDL	Instrument Detection Limit
LC	Lethal Concentration
LOEC	Lowest Observed Effect 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
NOEC	No Observed Effect Concentration
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
QMP	Quality Management Plan
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SOP	Standard Operating Procedure
TMDL	Total Maximum Daily Load
TUa	Toxic Unit (Acute)
TUc	Toxic Unit (Chronic)
VOC	Volatile Organic Compounds
VSSP	Vessel Specific Sampling Plan
WA DOE	Washington State Department of Ecology
WET	Whole Effluent Toxicity
WQS	Water Quality Standards

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A. PROJECT MANAGEMENT ELEMENTS

A.1__TITLE AND APPROVALS:

Title: Quality Assurance Project Plan (QAPP) For Whole Effluent Toxicity Testing

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Signatures on File with ADEC

A.2__DISTRIBUTION LIST

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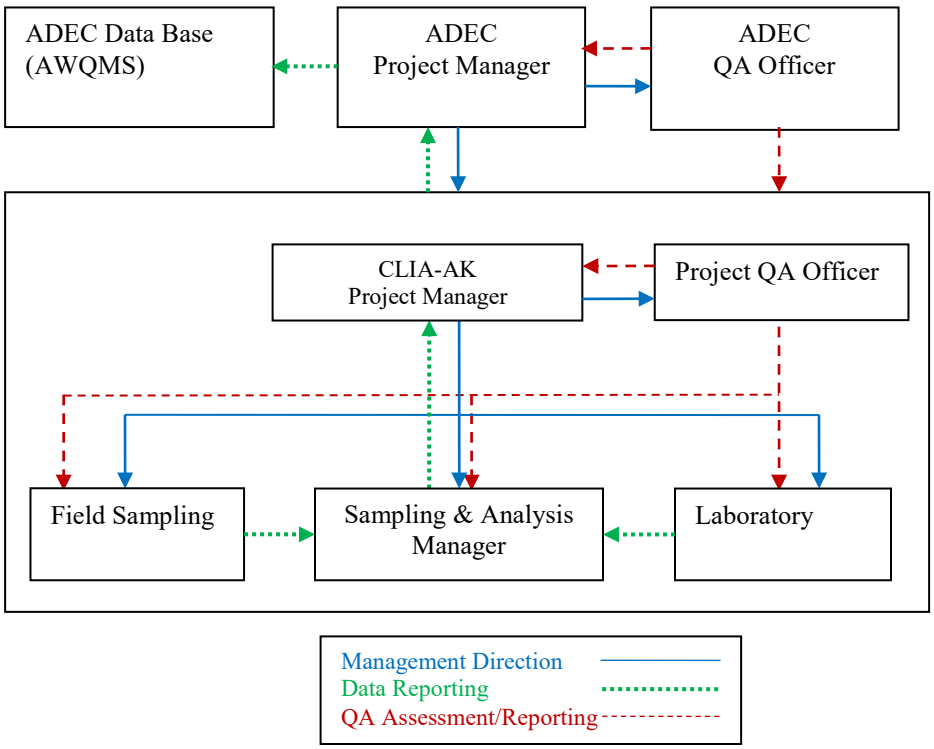
A.3__PROJECT TASK/ORGANIZATION

Position Title	Company / Agency	Responsibilities
Project Manager	CLIA-Alaska	[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* (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	Enthalpy Analytical	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.
DEC 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 *Large Commercial Passenger Vessel Wastewater Discharge General Permit* #2013DB0004 ("2014 ADEC General Permit") on August 29, 2014. This ADEC General Permit states that a discharge may not impart chronic toxicity, expressed as 1.0 chronic toxicity units (TUc), to aquatic organisms at the boundaries of the mixing zone (IAW 18 AAC 70.030). Toxicity units will be calculated as TUc = 100/IC25.

Project Background

According to the 2014 ADEC General Permit, the permitees shall conduct acute and chronic toxicity tests on effluent samples once per month in the third year of the Permit (2017) or in the first year of operation thereafter. Samples must be collected in every calendar month when there is a discharge to an authorized mixing zone while at speeds under 6 knots. The permittee must conduct tests on grab effluent samples with one vertebrate and one invertebrate species. Sample

collection must comply with Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to West Coast Marine and Estuarine Organisms (EPA/600/R-95/136).

Historical sampling of cruise ship effluents for whole effluent toxicity (WET) testing was undertaken on ships in Alaska between 2002 and 2006. No observable effect concentrations (NOEC) for vertebrates and invertebrates ranged from 12.5% to >50%. See the *Alaska Department of Environmental Conservation Commercial Passenger Vessel Environmental Compliance Program 2003 Whole Effluent Toxicity Test Results for Commercial Passenger Vessels in Alaska* for reference. The conclusion published from this study states that "most of tested wastewater effluent is not expected to cause acute toxicity to marine organisms, even at the worst-case scenario dilutions that occur during neap tides."

Project Objective(s)

All large cruise ship vessels operating under the 2014 ADEC General Permit and authorized to discharge at speeds less than 6 knots with a mixing zone will have WET samples collected once in every month a discharge occurs, in the third year of permit coverage (2017), or in the first year of operation thereafter. The sampling and testing of WET samples will follow the guidelines outlined in the 2014 ADEC General Permit and this plan.

The data produced by this project will be used by the department (ADEC) to determine if an effluent has reasonable potential to cause or contribute to exceedance of the whole effluent toxicity limit (18 AAC 70.030).

A.5__PROJECT/TASK DESCRIPTION AND SCHEDULE

Project Description

A sampling schedule for WET sampling events will be agreed by the sampling team leader and CLIA-Alaska Project Manager and provided to the vessel owner and ADEC at least 36 hours prior to the event. Sampling events will be coordinated to occur while the vessel is actively discharging overboard (this is confirmed by ship staff) at the sampling location described in the vessel's approved VSSP.
The WET sample will be collected as four individual grab sample fractions at the rate of one sample every 30 minutes over at least a 90 minute period. Grab samples will be composited into one sample upon laboratory receipt.

The sampler will complete tests for temperature, pH, and total residual chlorine for each grab sample in the field. Toxicity tests will be completed from the composited sample in the WET testing laboratory. A sample that fails to provide valid results for the parameters below may not be counted as an acceptable sample. Re-sampling options will be evaluated and determined on a case-by-case basis by the CLIA-Alaska Project Manager and Project QA Officer.

Sampling and field tests will be completed by Admiralty Environmental, LLC. WET testing will be completed by Enthalpy Analytical, a Washington State DOE accredited laboratory (Lab ID C552).

Table 1. Parameters to be Measured	
Field Measurements	Laboratory Measurements
Temperature	Vertebrate toxicity
pH	Invertebrate toxicity
Total residual chlorine	Dissolved Oxygen
	pH
	Conductivity
	Salinity
	Alkalinity
	Hardness
	Total Chlorine
	Total Ammonia

Table 2. Project Implementation Schedule				
Product	Measurement/ Parameter(s)	Sampling Site	Sampling Frequency	Time Frame
QAPP Preparation				Annually prior to March
Field Sampling	pH, Temp, Total residual chlorine	VSSP approved effluent overboard sampling port	1/month	May - Sept
Lab Analysis	Vertebrate and Invertebrate toxicity testing	VSSP approved effluent overboard sampling port	1/month	May - Sept
Data Analysis	All parameters as per lab QA/QC guidelines	N/A	N/A	Within EPA and State of Alaska recommended holding times
Data Review	All parameters as per lab QA/QC guidelines	N/A	N/A	Prior to issuing data reports
Data Report	All parameters as per lab QA/QC guidelines	N/A	N/A	Due by the 21st day of the month following the month in which samples were collected.

A.6__DATA QUALITY OBJECTIES AND CRITERIA FOR MEASUREMENT DATA

Data Quality Objectives (DQOs)

Data Quality Objectives are qualitative and quantitative statements derived from the DQO Process 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.

Not all DOQs apply to all parameters of this project, but all are defined in the section below.

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 ADEC WQS 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:

$$RSD = 100 * \sigma / mean$$

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

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, internal standards, sample blank measurements [field and lab blanks], external standards), performance audit samples (DMRQA, blind Water Supply or Water Pollution PE samples from American

Association for Laboratory Accreditation (A2LA) 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 (MQOs)

Group	Analyte	Method	MDL (µg/L)	PQL (µg/L)	Alaska WQS		Precision (RPD)	Accuracy (% Recovered)
					Aquatic Life	Recreation/ Drinking Water		
Water Quality	Temperature	EPA 170.1	NA	0.1°C	<20°C Migration routes < 15°C Spawning areas < 13°C Rearing areas < 15°C Egg /fry incubation < 13°C	<30°C	±0.2°C	±0.2°C
	pH	EPA 150.1	NA	±0.01 pH units	6.5 - 8.5; not vary by 0.5 from natural condition	6.5 - 8.5	±0.1 pH units	±0.1 pH units
	Total Residual Chlorine	SM 4500-Cl(G)	0.05	0.1	0.0075mgL chronic; 0.013 mg/L acute[a]	NA	<20%	NA
Toxicity	Vertebrate toxicity (*Atherinops affinis)*	EPA/600/R-95/136	NA	NA	<1.0 chronic toxic unit at or beyond the mixing zone boundary, based on the minimum effluent dilution achieved in the mixing zone.	NA	Reference toxicant tests within ±2 standard deviations of last 20 reference toxicant test results.	Mean Survival >80% and mean dry biomass ≥0.85mg per organism in the control
	Invertebrate toxicity (*Mytilus* sp.*)*	EPA/600/R-95/136	NA	NA		NA		Mean Survival in controls ≥50% and mean normal shell development must be ≥90%

Notes
NA = None available
a. Due to MDL limitations on commercially available chlorine meters, an MDL of 0.1mg/L will be accepted for total residual chlorine measurements.

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 WET sample collection. Samples will be collected in accordance with the stipulations provided in the VSSPs, the CLIA-Alaska QAPP, and this QAPP. The WET testing laboratory must be accredited by the Washington State Department of Ecology (DOE) for the toxicity tests outlined in the 2014 ADEC General Permit. 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.

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 PROCESS DESIGN (Experimental Design)

To satisfy the requirements of the 2014 ADEC General Permit, acute and chronic toxicity testing must be performed once per month in every calendar month when a vessel discharges treated wastewaters (effluent) to an authorized mixing zone while at speeds under 6 knots. Sampling will occur while the vessel is docked/moored and discharging in-port. The samples will be collected from the effluent sampling port or ports specified in the vessel's approved VSSP.

Each sampling event will include collection of four individual grab samples spaced at least 30 minutes apart. Every grab sample will have field tests for temperature, total residual chlorine, and pH measured by field sampling staff, and a volume of 4L of sample collected for toxicity testing. The 4L fractions of sample will be composited into one, 15L certified clean container upon receipt at the Admiralty Environmental laboratory.

From this 15L sample, WET testing for survival and growth will be conducted on one vertebrate species (*Atherinops affinis,* topsmelt) and larval development will be tested on one invertebrate species (*Mytilus sp.*, mussel), along with the laboratory parameters outlined in Table 1.

Monitoring Objectives and Data Quality Objectives

The data produced by this project will be used by ADEC to determine if an effluent has reasonable potential to impart chronic toxicity, defined as 1.0 TUc, at the boundary of the authorized mixing zone. Testing completed by ADEC from 2002-2006 on large and small commercial passenger vessels, concluded that "most wastewater effluent is not expected to cause acute toxicity to marine

organisms" (*Alaska Department of Environmental Conservation Commercial Passenger Vessel Environmental Compliance Program 2003 Whole Effluent Toxicity Test Results from Commercial Passenger Vessels in Alaska*). More recent data is deemed necessary by the department. Wastewater samples collected shall be representative of the effluent(s) that the vessel is discharging into marine waters of the state. All toxicity tests will conform to methods described in USEPA Short-Term Methods for Estimating the Chronic Toxicity of Effluent and Receiving Water to West Coast Marine and Estuarine Organisms (EPA/600/R-95/136).

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

Wastewater samples collected shall be representative of the effluent that the vessel is discharging into marine waters of the state. To achieve this, sample collection will occur only at the vessel's approved sampling location(s) as specified in their VSSP, and only when the vessel is discharging overboard. Field samplers will confirm with ship staff that the effluent is being discharged overboard before sample collection commences, and will rely on ship staff to inform them when the effluent stops discharging overboard. The field sampling staff will record on the field notes the port identification of the sampling point where sampling takes place (e.g., "Overboard Discharge Port F"). If the vessel being sampled utilizes a variable combination of advanced wastewater treatment units depending on the operating conditions of the vessel, the sampler will record the identity of the specific treatment units in operation at the time of sample collection. This information will be provided by ship staff, and recorded on the field sampling notes.

The sample port will be allowed to flush prior to sample collection as outlined in the CLIA-Alaska QAPP and vessel's VSSP. Samples will be collected as four individual grab samples, collected at a rate of one grab sample every 30 minutes over at least a 90 minute period. All grab samples will be collected into one 4L cubitainer and one 125mL field test bottle. The separate cubitainer fractions will be composited upon laboratory receipt. Samples will be placed in an ice bath after collection. In order to minimize the loss of toxicity due to volatilization of toxic constituents, all sample containers will be completely filled, or purged of air space immediately following collection.

The sampler will take a photograph of the sampling port, which will include date, time, and sample point ID.

Temperature, total residual chlorine, and pH will be measured in the field immediately following each grab sample. WET testing for survival and growth will be conducted on one vertebrate species (*Atherinops affinis,* topsmelt) and larval development will be tested on one invertebrate species (*Mytilus sp.*, mussel) in the laboratory.

Table 4. Sampling Schedule (Parameters, Sample Type, Frequency)					
Site ID	Parameters to be measured	Sample Type (I, G, C, etc.)	Sampling Frequency	Sample Time	Total number measurements
VSSP specified overboard discharge sample point	Temperature, total residual chlorine, and pH	G	1 per grab sample (4 grabs per WET sampling event)	TBA. Dependent on ship's sailing calendar	4/ship/month
VSSP specified overboard discharge sample point	Acute and chronic toxicity tests with one vertebrate species (Topsmelt), and one invertebrate species (Pacific Oyster or Mytilus)	C	1/month	TBA. Dependent on ship's sailing calendar	1/month
I ≡ In Situ Measurement		G ≡ Grab Sample		C ≡ Composite Sample	

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 listed as "grab" on field data sheets and "composite" on the Chain-of- Custody (COC) form.

Sample Containers and Equipment

Sample containers for WET testing will be supplied by Enthalpy Analytical. This includes 4L cubitainers for collecting individual grab samples, and 15L cubitainers for compositing of sample fractions. Field test bottles will be supplied by Admiralty Environmental. All containers will be certified as contaminant-free and will not contain any preservative.

Field test bottles may be re-used for each grab sample within one WET sampling event, so long as the bottle is rinsed three times with effluent sample before filling. The 4L and 15L cubitainers will be rinsed three times with effluent prior to sampling, and will not be re-used. Following compositing, the emptied 4L cubitainers will be punctured and disposed of to prevent reuse.

All grab samples will be stored on ice in-between and until completion of sample collection. A small temperature blank will accompany the cooler used to transport the samples from the vessel. Temperature will be measured and recorded as outlined in the CLIA-Alaska QAPP.

Once composited, the 15L sample will be stored at 4 +/-2°C until shipment. A temperature blank is not required to accompany each cooler shipping the 15L WET sample(s). Enthalpy Analytical will dispense a portion of the sample upon arrival to the laboratory in order to measure receipt temperature. This will be recorded on the chain of custody.

Field testing equipment for WET sampling events will be calibrated as per instrument specific guidelines and will be maintained as outlined in the "Instrument/Equipment Testing, Inspection, and Maintenance Requirements; Calibration and Frequency" section of the CLIA-Alaska QAPP.

Table 5. Preservation and Holding Times for the Analysis of Samples

Analyte	Matrix	Container	Necessary Volume	Preservation and Filtration	Maximum Holding Time
Temperature	Effluent	P, FP, G	100 mL	None	ASAP in the field
pH	Effluent	P, FP, G	100 mL	None	<15 min. in the field
Total Residual Chlorine	Effluent	P, FP, G	100 mL	None	ASAP in the field
Vertebrate and Invertebrate toxicity	Effluent	P	10L	None	36 hours

P = polyethylene, FP = fluoropolymer, G = glass, PA = autoclavable plastic

Sampling Methods

Grab samples will be collected as outlined in the CLIA-Alaska QAPP except for the sample portions collected into cubitainers. These containers will be filled completely, in order to minimize the loss of toxicity due to volatilization of toxic constituents. All grab sample bottles will be stored in an ice bath until compositing occurs. The time that the last grab sample is collected will be recorded on the COC as the sample collection time, and will be considered the beginning of the sample holding time

B.3__SAMPLE HANDLING AND CHAIN OF 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.

Samples shall be shipped on gel ice to the WET testing laboratory as soon as possible following 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 samples must be below 6°C upon receipt. The lab shall begin the toxicity testing as soon as possible but no later than 36 hours after the sampling time. The lab shall store samples at 4°C in the dark from receipt until completion of the test.

B.4__ANALYTICAL METHODS AND REQUIREMENTS

Sampling personnel will perform testing of temperature, residual chlorine, and pH as field tests at the time of sampling as part of the general guidelines for the 2014 ADEC General Permit, and these tests will conform to the quality assurance guidelines in the CLIA-Alaska QAPP as required by ADEC. All WET laboratory analyses will be performed by a Washington State DOE accredited laboratory, and will conform to methods described in USEPA Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to West Coast Marine and Estuarine Organisms (EPA/600/R-95/136). All laboratory QAPs and SOPs are available upon request. The WET laboratory must conduct tests on the effluent samples with one vertebrate and one invertebrate species, as follows:
Vertebrate (survival and growth): *Atherinops affinis* (topsmelt). In the event that topsmelt is not available, *Menidia beryllina* (inland silverside) may be used as a substitute. In that case, the permittee shall document the substitute species in the next DMR.

Invertebrate: For larval development tests, the laboratory must conduct tests with a bivalve species, *Mytilus* sp. (mussel) or *Crassostrea gigas*, (Pacific oyster).

A series of at least five dilutions and a control must be tested. Test series should be designed to bracket toxicity endpoints from previous tests to provide meaningful toxicity information during the next permit reissuance. At a minimum, the dilution series must include the following effluent concentrations: (12.5%, 6.25%, 3.12%, 1.56%, and 0.78%). Tests at higher concentrations (25% and 50%) may be warranted in order to adequately bracket toxicity endpoints from previous test results. All tests will be analyzed from the single composited 15L sample, and any renewal water used in the test will be derived from this single sample. The invertebrate test will be run at 15°C. The vertebrate tests shall be run at 20°C. 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.

The whole effluent toxicity tests shall be run on an unmodified sample of final effluent unless chlorine is present. If chlorine is present, the final effluent samples for whole effluent toxicity testing will be chemically dechlorinated with sodium thiosulfate just prior to test initiation. No more sodium thiosulfate will be added than is necessary to neutralize the chlorine. Calculations to determine the appropriate amount of sodium thiosulfate shall be included in the test report.

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 from the WET testing project will follow the data quality objectives, laboratory quality assurance guidelines, method-specific quality control limits, and general guidelines outlined in the CLIA-Alaska QAPP, laboratory specific QAPs and SOPs and as outlined below.

Field Quality Control Measures

Refer to the CLIA-Alaska QAPP "Table 4: Field QC Samples" for temperature, pH, and chlorine QC measures.

Field documentation for each WET sampling event will include:

- Date of sampling
- Time of each grab sample (final grab sample will be recorded as sample time on the COC)
- Vessel ID
- Discharge port location (VSSP specified port ID)
- Discharge flow rate and type of discharge (GW/BW/mixed)
- Name and title of person providing discharge flow information
- Laboratory ID
- Ship's location
- Sampler initials
- Photograph
- Field instrument calibration information
- Field test results for each grab sample (temperature, pH, and total residual chlorine)

Laboratory Quality Control Measures

Contracted laboratories will provide analytical results after verification and validation by the laboratory QA Officer/Laboratory QA Manager. The laboratory must provide all relevant QC information with its summary of data results so that the CLIA-Alaska Project Manager and Project QA Officer can perform field data verification and validation and review the laboratory reports. The CLIA-Alaska Project Manager reviews these data to ensure that the required QC measurement criteria have been met. If a QC concern is identified in the review process, the CLIA-Alaska Project Manager and Project QA Officer will seek additional information from the contracted laboratory to resolve the issue and pursue appropriate corrective action.

As outlined in the 2014 ADEC General Permit, if organisms are not cultured by the WET testing laboratory for toxicity testing, concurrent testing with reference toxicants must be conducted, unless the test organism supplier provides control chart data from at least the previous five months of reference toxicant testing. Where organisms are cultured by the testing laboratory, monthly reference toxicant testing is sufficient.

If either of the reference toxicant tests or the effluent tests does not meet all test acceptability criteria as specified in the test methods manual, then the report shall note this.

Control and dilution water should be receiving water, or salinity adjusted lab water. If the dilution water used is different from the culture water, a second control using culture water must also be used.

Table 6. Field/Laboratory Quality Control Samples

Field/Lab Quality Control Sample	Measurement Parameter	Frequency		QC Acceptance Criteria Limits
		Frequency of Occurrence	Total # of QC Type Samples	
Calibration Verification Check Standard	Total residual chlorine	Weekly	1	Accuracy as defined by individual check standards
Calibration Verification Check Standard	pH	Each day of use	1	+/- 0.1 S.U.
Laboratory Control, Pacific Topsmelt	Survival and Growth	Concurrently	1	Mean survival ≥80% and mean dry biomass ≥0.85mg per organism
Laboratory Control, Mussel	Development	Concurrently	1	Mean survival ≥50% and mean normal shell development must be ≥90%
Laboratory Control Water (Vertebrate and Invertebrate toxicity)	Salinity	Daily		30 ±2 ppt
Reference Toxicant, Pacific Topsmelt	Survival and Growth	Monthly or concurrently	1	±2 standard deviations of last 20 reference toxicant test results
Reference Toxicant, Mussel	Development	Monthly or concurrently	1	±2 standard deviations of last 20 reference toxicant test results

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 standards (thermometers, barometers, etc.) are calibrated appropriately and within stated certification periods prior to use.

Monitoring staff should document that required acceptance testing, inspection and maintenance have been performed. Records of this documentation should be kept with the instrument/equipment kit in bound logbooks or data sheets.

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. For example, pH meters must be calibrated according to the manufacturer's specifications using pH buffers at 4.0, 7.0 (mid-range) and 10.0 that are within their certification period (expiration date has not lapsed). If equipment and/or kits require 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 CLIA-Alaska Project Manager will delegate a field project team member or the sampling team leader 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 their 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 (such as total chlorine reagent vials) 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 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 their laboratory's QAP and SOPs for inspection/acceptance of supplies and consumables.

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

Historical data for this project includes only one year of monitoring, so data acceptance criteria will not be required for historical data acceptance.

Onboard ship data to be recorded 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 team.

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.

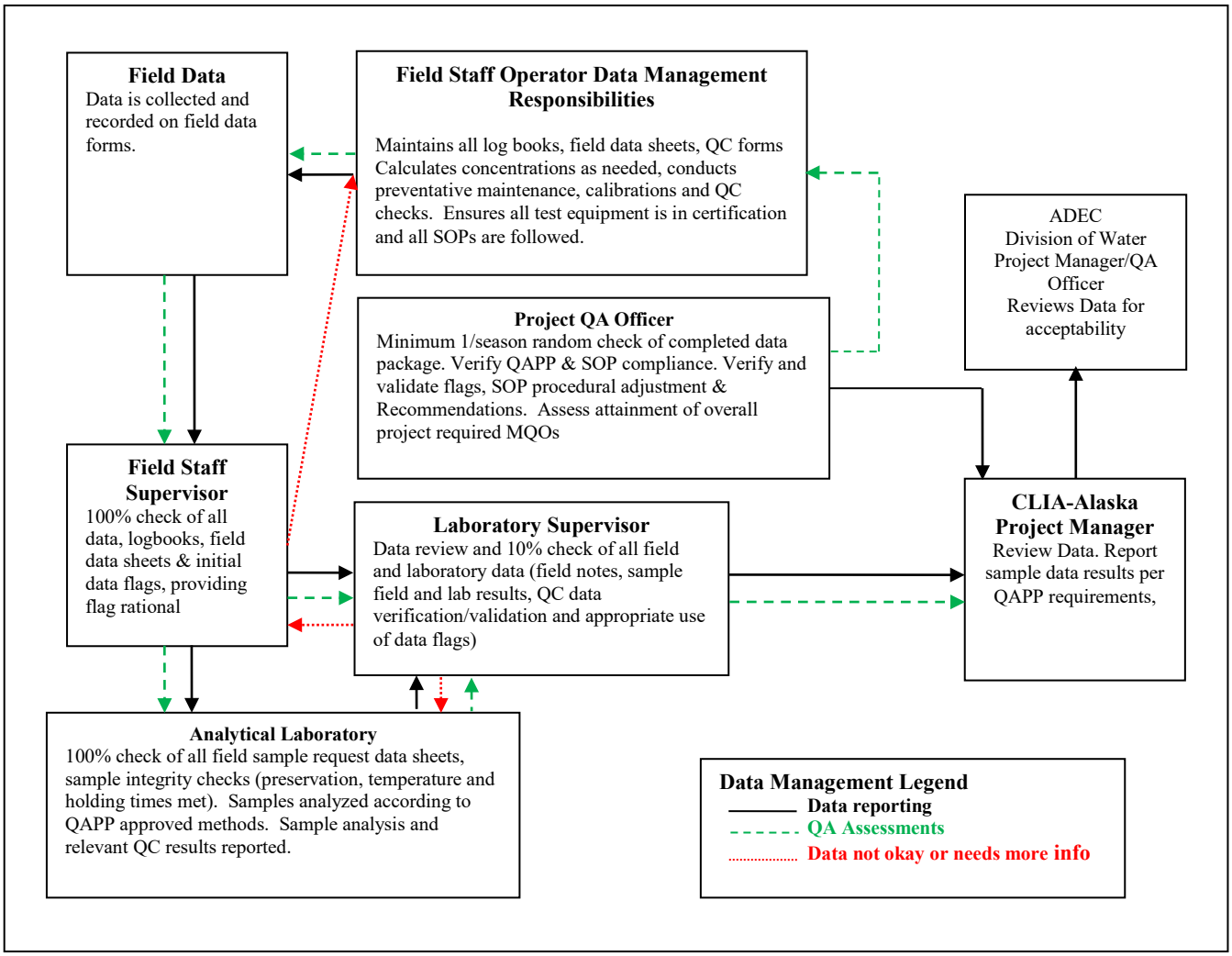
Data management encompasses and traces the path of the data from their generation to their final use or storage (e.g., from field measurements and sample collection/recording through transfer of data to computers [laptops, data acquisition systems, etc.], laboratory analysis, data validation/verification, 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 format.
- 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 CLIA-Alaska 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 Flow Chart



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, preferably longer. Site location and retention period for stored data is specified in the CLIA-Alaska QAPP (Table 3: Project Documents and Records).

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 WET 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 QA 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 all Project Managers 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 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 7. Project Assessments

Assessment Type	Measurement Parameters		Frequency	Acceptance Criteria Limits
	Analyte	Method		
On-site Field Audit/Inspection	pH, Temperature, Chlorine	See 40 CFR 136.3	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	All	All	end of project (at least 1/year)	Defined in Section A6 and Table 3

C.2__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 manager, 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.

C.3__QA REPORTS TO MANAGEMENT

The distributions of project QA assessments from Table 7 are outlined in Table 8, below.

Table 8. 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	CLIA-Alaska 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 QAO will review data and field notes to verify that this QAPP was followed. Items reviewed will include:

- Comparison of dated VSSPs with the QAPP to ensure that the correct samples were taken.
- Comparison of dated sampling plans 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. Remaining data review(s) may be spaced evenly throughout the season.

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 their 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 CLIA-Alaska Project Manager with the data results. Completed COC or

transmission forms (if required) will be sent back from the laboratory to the CLIA-Alaska 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, flagged appropriately and data use clearly delimited and justified. 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 CLIA-Alaska 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 CLIA-Alaska 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 CLIA-Alaska Project Manager and justified in the final data report. The CLIA-Alaska 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 CLIA-Alaska 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.

ADEC CPVEC. *2003 Whole Effluent Toxicity Test Results for Commercial Passenger Vessels in Alaska.* Alaska Department of Environmental Conservation. Commercial Passenger Vessel Environmental Compliance Program.

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.

USEPA. 1995. *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms*. EPA/600/R-95/136.

APPENDIX A. Cruise Ship WET Testing Sampling Checklist

2018 Cruise Ship WET 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

☐ WET sampling, 1/month

III. Sampling Notes (to include:)

- ☐ Vessel name
- ☐ Names of sampling personnel
- ☐ Names of shipboard assistants
- ☐ Signature, or initials, and date by the vessel crew indicating that the sample port is correct (VSSP)
- ☐ Sample ID clearly stating where the sample was taken (VSSP specified collection point)
- ☐ Sample ports within 50 feet of the point of overboard discharge
- ☐ Sample date and times recorded on COC
- ☐ Field measurements: pH, chlorine residual, and temp 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 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)
- ☐ Chain of custody properly completed
- ☐ Photograph of sample collection point taken during event, incl. date, time, sample ID
- ☐ Samples delivered to laboratory within holding times for analyses