

QUALITY ASSURANCE PLAN

**FOR THE RED DOG MINE
WATER QUALITY MONITORING PROGRAM
NPDES AK-003865-2**

**RED DOG MINE
TECK COMINCO ALASKA INC.
3105 LAKESHORE DRIVE, BLDG. A, SUITE 101
ANCHORAGE, ALASKA 99517**

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PROJECT DESCRIPTION

Red Dog Mine, located approximately 90 miles north of Kotzebue, Alaska in the DeLong Mountains, is a zinc-lead mine that has been in operation since 1989. The major activities at the mine include removing and storing waste rock, extracting ore, processing ore into concentrate and transporting concentrate to a port facility.

The Red Dog Mine includes the mine pit, mill, personnel accommodations complex (PAC), water treatment system, construction camp, airport and supporting facilities. Water treatment systems include a sewage treatment plant and industrial water treatment plant.

The industrial water treatment plant consists of a tailings impoundment, water treatment tanks, a clarifier, and sandfilters. Wastewater is pumped from the mill to the tailings impoundment where it is homogenized. Tailings impoundment water is in turn pumped to the water treatment tanks where the solution is raised to an approximate pH of 10 and mixed with flocculent. The solution, now containing metal-hydroxide precipitates is pumped to a high-density sludge clarifier, and finally through sand filters before being discharged at Outfall 001 to the Middle Fork of Red Dog Creek.

Domestic sewage from the mine/mill personnel accommodations complex (PAC) is first treated in the sewage treatment plant, and then pumped to the tailings impoundment where the BOD is chemically degraded in reduced pH conditions. Ultimately, it is then treated in the industrial water treatment plant.

NPDES permit Outfall 002 is the effluent from the construction camp personnel accommodations complex (ConPAC) domestic sewage treatment plant (STP). Discharge from Outfall 002 is infrequent, and is generally only utilized during large construction projects.

The US Environmental Protection Agency (USEPA) issued NPDES permit AK-003865-2 on 29 July, 1998. The permit became effective on 28 August 1998 and the permit modification became effective 22 August, 2003. The Alaska Department of Environmental Conservation (ADEC) issued 401 certification of the permit on 22 July, 1998.

This document is the Mine Site *Quality Assurance Project Plan* (QAPP). Management of all sampling, sample analysis, data management, and reporting is conducted in accordance with this document. This document was developed with guidance from the following: *EPA Guidance for Quality Assurance Project Plans*, EPA QA/G-5, December 2002, and *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/R-5, March 2001.

1.1 PROJECT ORGANIZATION

Project organization defines the responsibilities of project management, sampling personnel, and QA/QC managers. Teck Cominco Alaska (TCAK) develops and directs all aspects of the project (except for the contract laboratory duties) with guidance from EPA protocols. The contract laboratories conduct all analyses and QA/QC within the laboratory under the direction of TCAK and in accordance with EPA guidance for analytical methodologies. Each position and its duties are described below.

Environmental Superintendent: The Environmental Superintendent directs all aspects of the project.

Environmental Coordinators: The Environmental Coordinators are responsible for monitoring permit compliance, communicating with the EPA concerning permit compliance, checking the final data package that is provided by the laboratory and submitting sample results to the EPA and other appropriate agencies.

Environmental Coordinator - Data Quality: The Environmental Coordinator – Data Quality is responsible for importing contact laboratory results into the database, checking the final data package that is provided by the laboratory and submitting sample results to the EPA and other appropriate agencies.

Environmental Technical Supervisor and Technicians: The Environmental Technical Supervisor and Technicians are responsible for planning sampling events, identifying sampling locations in accordance with the NPDES permits or other applicable permits or projects, implementing all sampling events, shipping samples and entering the data into the database.

Wastewater Treatment Operators: The Wastewater Treatment Operators are responsible for sampling the waste water treatment plant (Outfall 002) with guidance from the Environmental Coordinators and Environmental Technical Supervisor.

Laboratories/Chemists: The laboratories listed below are responsible for analyzing the samples in accordance with EPA requirements.

- Pace Analytical (PACE) – Minneapolis, Minnesota (888) 990-7223 with affiliates in Seattle, Washington (206) 767-5060 performs some for the inorganic analysis as well as all short hold time samples (e.g., BOD₅).
- ACZ Laboratories (ACZ) in Steamboat Springs, CO, 1-800-334-5493 performs some of the inorganic analysis.
- ENSR Laboratory in Fort Collins, Colorado (970) 416-0916 is the primary toxicology lab.
- CH2M Hill Toxicological Laboratory in Corvallis, Oregon (541) 758-0235 is the secondary toxicology lab.
- Teck Cominco Alaska, Inc. located at the mine (907) 426-9109 site performs the fecal coliform analysis and Total Residual Chlorine analysis.

Laboratory Personnel: Contract laboratories have a laboratory director, a QA/QC officer, and a project manager assigned to TCAK. The laboratory personnel ensure that all analytical data generated and reported is scientifically sound, legally defensible, of known and documented quality, and accurately reflects the material being tested.

2.0 DATA QUALITY OBJECTIVES

2.1 PROJECT DATA QUALITY OBJECTIVES

The objective of this project is to accurately determine the chemical constituents and selected physical parameters of effluent at Outfalls 001 and 002, and ambient and receiving streams, and submit this data to the proper agencies. Based on the project objective, the primary data quality objectives (DQO) of this project are as follows:

- Provide procedures for quality control beginning with sample collection and proceeding through data interpretation,
- Provide procedures to ensure that data are of known or acceptable precision, accuracy, representativeness, completeness, and comparability,
- Collect samples in accordance with relevant sampling methodologies,
- Package and ship samples to an outside laboratory,
- Analyze samples using strict QC procedures as outlined in EPA guidance for analytical methodologies,
- Scrutinize and qualify data under the laboratory's QA/QC program, and
- Submit data, fully qualified, to the EPA and ADEC, or other stakeholders as needed,
- Obtain effluent data representative of operations and to identify changes in effluent characteristics due to process variations.

2.2 TRAINING REQUIREMENTS

Environmental Technicians receive extensive on-the-job instruction and training in proper sampling techniques based on EPA protocols. The training is supplemented by written sampling standard operating procedures (SOP). Wastewater Treatment Operators are certified or in a training program to become certified by the State of Alaska for wastewater treatment operation. State certification and training requires self study and on-the-job experience.

Each individual tasked with sample collection will sign a statement that the individual has read, understands, and will follow the sampling procedures outlined in this plan.

The Environmental Technical Supervisor is responsible for the implementation and adherence to the QAPP. Furthermore, the Environmental Technical Supervisor is responsible for the proper training of the Environmental Technicians and Wastewater Treatment Operators in sample collection, handling and shipping.

TCAK requires that all contract laboratories analyzing data for the monitoring program have current EPA certification and have participated in the previous year's DMR QA Study. This ensures that the laboratory can meet the testing and evaluation guideline requirements and standards of the Environmental Protection Agency.

2.3 DOCUMENTATION AND RECORDS

The Environmental Coordinator – Data Quality, is responsible for updating, revising and distributing the *Quality Assurance Project Plan* as necessary. The QAPP will be updated and amended as procedures are added or changed from the existing plan.

Field log books are filed or archived indefinitely at the mine site. Final hard copy and/or electronic laboratory analytical results packages are filed, stored electronically, and/or archived for at least three years at the mine site. Electronic analytical results data are stored indefinitely in the TCAK database. Analytical QA/QC packages are maintained for a minimum five years at the laboratory facility.

Records of all monitoring information associated with the NPDES permit, including, but not limited to, all calibration and maintenance records, strip chart recordings, raw data logger files, copies of all reports, copies of DMRs, a copy of the permit, and all data associated with the application for and compliance with the permit shall be filed or archived at the mine site for a period of at least three years after the information was generated.

3.0 SAMPLING AND SHIPPING PROCEDURES

3.1 SAMPLE COLLECTION

3.1.1 Sampling Locations and Frequencies

Compliance based sampling required by the NPDES permit is for Outfalls 001 and 002. The sampling locations for both outfalls are located after the last treatment step but before mixing with the receiving water bodies. The sampling location for Outfall 001 is in a fixed location in the sand filter building. The sampling location for Outfall 002 is in a fixed location in the STP tent at the construction camp site.

For ambient and receiving stream water sampling, a specific sampling site or Station is selected based on the requirements of representative sampling, which is described in Appendix A of this plan. It is preferred to sample at the same location for each sampling event, but at times this is not practical or representative of the flow being sampled, in which case the sample location is adjusted. For example, a specific sampling site may change by tens of feet if the channel morphology changes or as stream stage alters flow characteristics. Temporary changes in sample locations are noted in field log books.

Stream sampling sites which contain nearby upstream tributaries may prove difficult to collect a representative sample. The influx from upstream tributaries or point discharges result in a chemically-heterogeneous stream for a short distance downstream of the confluence. Eventually, the different sources of water are mixed downstream to produce a chemically-homogeneous stream. A stream sample should be collected at a point where the waters are well mixed. Permanent sampling stations were established at well-mixed reaches of streams and are located at Stations 140, 20, 12, 10, 9, 150, 151, 160 and 2.

Other site selection factors which may affect the representativeness of a sample or influence selections of a sampling location are: single or multiple channels, sloughing banks, structures affecting hydraulics, low flow to high flow continuity, debris, aquatic growth, springs, groundwater influences, ice, depth, turbulence, sediment, historical records, accessibility and safety considerations.

Sampling sites will be located in generally straight reaches of the channel where the flow is relatively uniform. Sites just above or below confluences or point sources will be avoided to minimize problems caused by backwater effects or poorly mixed flows. To obtain a representative sample from Stations 140, 20, 12, 10, 9, 150, 160, 2, and the edge of the mixing zone in Main Stem Red Dog Creek (Station 151) a grab will be collected from a section of the creek which is well mixed and representative of the total flow in the creek. If necessary, the sample will be composited across the stream to form one grab sample. Observations of any factors that may have affected the samples will be recorded and kept on file.

Samples are collected at locations known to be representative of the entire flow. If for any reason the sampling event has caused disturbed conditions such as increased turbidity, the sampling event is postponed until normal conditions are reestablished.

The type and frequency of sampling is in accordance with the NPDES permit (See NPDES Permit AK-003865-2, Section I.). Table 3-1, is a summary of the NPDES required water sampling requirements. The permit requires the following types of sampling: 24-hour composite, grab, and recorder. A 24-hour composite indicates a flow-proportioned mixture of not less than eight discrete aliquots in 24 hours. Each aliquot shall be a grab sample of not less than 100 ml. The date and time associated with a 24-hour composite sample is equal to the date and time that the last sample aliquot was collected (e.g., a sample collected from 7:00 a.m. on 7/1/01 to 7:00 a.m. 7/2/01 is labeled as 7:00 a.m. 7/2/01). A grab sample is a single sample or measurement taken at a specific time or over a short a period of time as is feasible. An instrument recorder, datalogger, totalizer or process database is utilized to continuously record the flow of discharge from Outfalls 001 and 002.

Table 3-1

Red Dog Mine NPDES AK-003865-2: Sampling Schedule

LOCATION	FREQUENCY	TYPE	ANALYSIS
Outfall 001	Continuously	Grab	Cumulative Flow
Outfall 001	Daily	Grab	Temperature
Outfall 001	1/WK	Grab	TDS, CN(T), pH, cond.
Outfall 001	1/WK	24 hr. Comp.	Cd, Cu, Cr, Pb, Se, Zn, Mn, Ni, TSS, hardness
Outfall 001	1/MO	24 hr. Comp.	Al, Ag, Hg, Fe (add to above bottle)
Outfall 001	1/WK	24 hr. Comp.	NH3-N
Outfall 001	1/WK	24 hr. Comp.	Turbidity
Outfall 001	1/May, July, Sept.	24 hr. Comp.	Organic Priority Pollutant Scan
Outfall 001	1/2MO	Grab	Fecal Coliform
Outfall 001	1/MO	24 hr. Comp.	BOD
Outfall 001	1/MO	Grab	Total Residual Chlorine (in house)
Outfall 001	1/MO	Grab	Carbonates, Chlorides, Sulfates, Ca, K, Mg, Na
Station 151	2/WK	Grab	TDS, Cond.
Station 151	1/MO	Grab	Carbonates, Chlorides, Sulfates, Ca, K, Mg, Na
Station 150	2/WK	Grab	TDS, Cond.
Station 150	2/MO	Grab	Cd, Cu, Cr, Pb, Se, Zn, Al, Ag, Fe, Ni, Mn, hardness
Station 150	2/MO	Grab	pH, temp, specific conductance
Station 150	2/MO	Grab	NH3-N
Station 150	1/MO	Grab	Carbonates, Chlorides, Sulfates, Ca, K, Mg, Na
Sta 2	1/MO	Grab	Cd, Cu, Cr, Pb, Se, Zn, Al, Ag, Fe, Mn, Ni, hardness
Sta 2	1/MO	Grab	TDS
Sta 2	1/MO	Grab	CN(T)
Sta 2	1/MO	Grab	NH3-N
Sta 2	1/MO	Grab	pH, temp, specific conductance
Sta 2	3/MO	Grab	DO from October 1 to May 31 if T>25 deg. F
Sta 2	3/MO	Grab	hydrogen sulfide under ice if discharging
Sta 20	2/MO	Grab	CN(WAD)
Sta 140	2/MO	Grab	Cd, Cu, Cr, Pb, Se, Zn, Al, Ag, Fe, Ni, Mn, hardness
Sta 140	2/MO	Grab	TDS
Sta 140	2/MO	Grab	NH3-N
Sta 140	2/MO	Grab	pH, temp, specific conductance
Sta 140	3/MO	Grab	Turbidity

Table 3-1

Red Dog Mine NPDES AK-003865-2: Sampling Schedule

LOCATION	FREQUENCY	TYPE	ANALYSIS
Sta 12	2/MO	Grab	Cd, Cu, Cr, Pb, Se, Zn, Al, Ag, Fe, Ni, Mn, hardness
Sta 12	2/MO	Grab	TDS
Sta 12	2/MO	Grab	NH3-N
Sta 12	2/MO	Grab	pH, temp, specific conductance
Sta 12	3/MO	Grab	Turbidity
Sta 9	2/MO	Grab	Cd, Cu, Cr, Pb, Se, Zn, Al, Ag, Fe, Ni, Mn, hardness
Sta 9	2/MO	Grab	TDS
Sta 9	2/MO	Grab	NH3-N
Sta 9	2/MO	Grab	pH, temp, specific conductance
Sta 10	1/WK	Grab	TDS, Cond.
Sta 10	1/MO	Grab	Carbonates, Chlorides, Sulfates, Ca, K, Mg, Na
Sta 10	2/MO	Grab	Cd, Cu, Cr, Pb, Se, Zn, Al, Ag, Fe, Ni, Mn, hardness
Sta 10	2/MO	Grab	CN(T)
Sta 10	2/MO	Grab	NH3-N
Sta 10	2/MO	Grab	pH, temp, specific conductance
Sta 10	3/MO	Grab	DO from October 1 to May 31 if T>25 deg. F
Sta 10	3/MO	Grab	hydrogen sulfide under ice if discharging
Station 160	1/WK	Grab	TDS, Cond.
Station 160	1/MO	Grab	Carbonates, Chlorides, Sulfates, Ca, K, Mg, Na
Outfall 001	1/MO	24 hr.comp	Whole Effluent Toxicity + Chemistry
Station 9, 12	1/MO	Grab	Ambient Toxicity + Chemistry
Sulfur creek	1/MO	Grab	Al, Cd, Cr, Cu, Fe, Pb ,NI, Mn, Zn
Shelly Creek	1/MO	Grab	Al, Cd, Cr, Cu, Fe, Pb ,NI, Mn, Zn
Connie Creek	1/MO	Grab	Al, Cd, Cr, Cu, Fe, Pb ,NI, Mn, Zn
Rachel Creek	1/MO	Grab	Al, Cd, Cr, Cu, Fe, Pb ,NI, Mn, Zn
Station 145	1/MO	Grab	Al, Cd, Cr, Cu, Fe, Pb ,NI, Mn, Zn
Precipitation/Evaporation	1/MO		Report of daily values
Sta.140	daily		Flow by recorder and stilling well float
Sta. 9, 12, 151, 150, 160, 2, 10	daily		Flow by recorder and pressure transducer

3.1.2 Sampling Methods

Preventing direct or cross contamination of the sample is of primary importance and all reasonable precautions are taken to avoid contamination. The sample container is used for sample collection of grab samples to avoid cross-contamination that could result from a collection device. For composite samples, a Sigma Sampler is used. In this case, a collection container may be used and the sample is then agitated to homogenize and transferred into the sample container.

The Sigma collection bottle used for Outfall 001 is rinsed with a 10% nitric acid solution followed by three distilled water rinses after each sample collection. There is a common logbook located at the sigma sampler for the sampler to record information about the sampling event. The common logbook is a bound, all-weather field notebook with pre-numbered pages and no missing pages. Only indelible ink should be used to record entries in the logbook. The logbook should contain the following information:

- Start and stop times for composite sample
- Time sample was collected
- How many aliquots were taken
- Size of aliquots and approximate total volume
- Count setting for flow proportionate samples
- Cabinet temperature
- Note that collection jug was cleaned
- Note when equipment bland was collected
- Note when tubes were changed

For sample bottles containing preservative, it is imperative the sample container is not overfilled.

A new pair of disposable powder-free latex gloves is worn at each sampling site. Samplers do not touch the lip of the container or the inside of the cap or container with their hands. Manage the container caps so they do not get contaminated. After sampling, the cap is securely placed onto the container and transported back to the mine site where it is stored at <6°C until shipped.

When transferring sample from a collection container to a sample container, the collection container does not touch the lip of the sample container.

All field measurements are taken directly in the effluent or stream flow. If a sample is needed for a laboratory analysis of pH, total residual chlorine or turbidity, it is collected or an aliquot is split out in a separate clean container and discarded after use. An instrument probe is never placed into a sample that will be used later for another analysis.

3.1.3 Sampling Containers

Sample containers are provided by the laboratory which conducts the analyses. Sample containers should be shipped by the laboratory or supplier in custody sealed containers. Environmental personnel receiving sampling bottles should ensure seals have not been broken or document otherwise. The sample containers that are provided by the laboratories come with the appropriate preservatives in them and are pre-labeled accordingly. A permanent marker is used to identify each sample by location, date and time of sample collection, project, and TCAK sample number. It is also appropriate to indicate the sample was filtered by indicating the pore size of the filter used. Writing "dissolved" on the bottle indicates the sample was filtered through a 0.45um filter.

3.1.4 Field QA/QC Sample Collection

Trip blanks are used for volatile hydrocarbon samples or organic priority pollutant scan samples. Trip blank samples accompany the sample containers from the lab to the sample collection site and back to laboratory, and are used to determine the presence of potential contamination of the samples through shipping and sample collection. They are never opened by samplers. One trip blank is utilized for each group of samples, provided that all samples are maintained as a group at all times.

Field blank control samples are taken by carrying a bottle of de-ionized (DI) water to the sample collection site and transferring the DI water to a sample container at the sample collection site. The transfer utilizes the same sample collection techniques that were used to collect the actual sample. Field blank samples are used to determine the presence of potential contamination from sample management, sample collection techniques, and/or some form of ambient contamination. At a minimum, 5% of all NPDES samples collected are field blanks (i.e., 1 field blank per 20 actual samples), and are analyzed for the same suite of analytes that is requested for analysis from the

sample location where the field blank was collected (e.g., a field blank collected at Outfall 001 will be analyzed for all parameters that the actual Outfall 001 sample is being analyzed for).

At a minimum, 5% of all NPDES samples collected (i.e., 1 per 20 actual samples) are field duplicate samples (field splits). A field split is intended to identify potential bias after sample collection through sample analysis. Duplicate samples are collected in a single container from which equal aliquots are transferred into two separate sample containers. This process is repeated until both sample containers have been filled to the appropriate volume. Field duplicates are analyzed for the same suite of analytes that is requested for analysis from the sample location where the duplicate was collected (e.g., a field duplicate collected at Outfall 001 will be analyzed for all parameters that the actual Outfall 001 sample is being analyzed for).

Equipment blanks are collected at locations that utilize a Sigma sampler or other sample collection equipment. Equipment blanks identify potential sample contamination from the equipment used to collect the samples such as Sigma samplers, pumps, and bailers. For the Sigma samplers, a simulated grab sample of DI water is collected utilizing the Sigma collection tubing and a clean sample collection container. At least 5% of samples at locations that use sample collection equipment are equipment blanks (i.e., 1 equipment blank per 20 actual samples), and are analyzed for the same suite of analytes that is requested for analysis from the sample location where the equipment blank was collected (e.g., an equipment blank collected at Outfall 001 will be analyzed for all parameters that the actual Outfall 001 sample is being analyzed for).

Field QA/QC samples are never identified as such to the laboratory providing analytical services. Laboratory bias may result if samples are identified as blanks or splits. Field QA/QC samples should only be identified by sample numbers, date and time of sampling, project and TCAK.

3.1.5 Sample Preservation and Holding Times

Sample preservation methods include storing at $<6^{\circ}\text{C}$, exclusion of air, chemical preservative and choice of proper container and prescribed holding time prior to analysis. Preservation, container and holding time requirements are specific for each analyte dependent upon EPA-approved analytical method requirements as presented in

Table 3-2. Preservation methods and holding times are in accordance with 40 CFR Part 136 or EPA and ADEC approved variances.

Samples are preserved to prevent chemical, physical and/or biological processes from changing the actual concentration of an analyte present at the time of sampling. These processes include oxidation, reduction, precipitation, ion exchange, co-precipitation, volatilization, gas exchange, biological metabolism, and cell growth or lysis. In order to preserve sample integrity until the time of analysis, various preservatives are added to the sample depending on the type of analysis required.

Some properties or constituents may change significantly within a few minutes or hours regardless of preservation techniques. Therefore immediate analysis in the field is required for parameters such as temperature, conductivity, and dissolved oxygen.

3.1.6 Storage of Samples

Samples are stored under the direct control of the Environmental department until relinquished to the shipper. Samples being stored after sample collection but before being shipped to the analytical lab are refrigerated at $<6^{\circ}\text{C}$. The temperature of the refrigerator is monitored and recorded on the log-sheet located on the refrigerator. If the temperature is found to be $>6^{\circ}\text{C}$, the maintenance department is notified and the samples are moved to another refrigerator where the temperature is monitored and recorded to ensure storage is $<6^{\circ}\text{C}$. Samples are shipped to the laboratory in insulated coolers with sufficient ice packs to maintain sample temperatures at $<6^{\circ}\text{C}$. A temperature blank should be placed in each cooler shipped so temperature can be confirmed by laboratory.

3.1.7 Samples with Special Requirements

Metals Analysis: Unless specifically noted otherwise, all samples that request metals analysis are requesting a total recoverable metal analysis. Certain samples will request a dissolved metals analysis, but they are clearly identified as “dissolved”. The “dissolved” notation indicates the sample was filtered through a 0.45um filter prior to chemical preservation.

Whole Effluent Toxicity (WET): The NPDES permit requires chronic toxicity tests for *Ceriodaphnia dubia* and *Pimephales promelas* be conducted on Outfall 001, Station 9 and Station 12. EPA guidance for chronic WET tests requires daily renewal of test

solution with a new sample being used every other day for effluent samples (i.e., Outfall 001). This necessitates the collection and shipment of three sample aliquots (the initial sample and two refresh aliquots) over a five day period. The WET test date and sample number are associated with the first WET sample aliquot collected. The Aliquot size is dictated by the laboratory for each aliquot. With the first aliquot, a split sample is collected for analytical lab analysis for all permit required analytes. Due to the remoteness, weather conditions and shipping logistics associated with the Red Dog mine, EPA allows a 36-hour sample holding time, which can be extended to 48-hours with EPA notification, or longer with approval from EPA provided the sample aliquots are maintained at $<6^{\circ}\text{C}$. Additionally, with approval from EPA, a WET test can be completed without one or both of the refresh aliquots. Ambient monitoring stations (i.e., Station 9 and Station 12) can be conducted with a single aliquot grab sample according to section 8.4.1 of the EPA 2002 guidelines (fourth edition).

With the exceptions noted above, all WET tests are conducted in accordance with EPA 2002 Guidelines (fourth edition).

Cyanide Samples: Samples collected for total and/or WAD cyanide analysis are screened for the presence of sulfides. A sulfide scan is conducted by placing a drop of unpreserved grab sample (125 ml collected for field tests) on lead acetate test paper previously moistened with acetic acid buffer solution, pH 4. Darkening or blackening of the paper indicates presence of sulfides. Each time the sulfide test is performed, it is recorded in the technicians field book along with the results of the test. Sulfides have never been detected in Red Dog samples; however, if they are discovered the following procedure is completed: another one liter grab sample is immediately collected, but the sample is not preserved. Lead acetate is added to the sample and the sample is retested on lead acetate test paper. This process is repeated until a drop of treated sample no longer darkens the acidified lead acetate test paper. The sample is filtered before raising pH to above 12 with sodium hydroxide for stabilization.

Total Residual Chlorine: Analysis of total residual chlorine (TRC) is conducted as soon after sample collection as possible but within 15 minutes of sample collection. Sample collection time and analysis time should be noted in logbook to verify that the sample was analyzed within 15 minutes of sample collection.

Table 3-2

ANALYTE	ACZ			Pace			Sample Preservation	Holding Time	Sample Bottle Volume/Type
	METHOD	Method Detection Limit	Method Reporting Limit	METHOD	Method Detection Limit	Practical Quantification Limit			
Hardness as CaCO ₃ (mg/l)	SM 2340B	Calculation		SM 2340B	0.04	1	HNO ₃ , <6C	6 months	1L plastic
Total Dissolved Solids (mg/l)	SM 2540C	10	50	SM 2540C	2.83	10.0	<6C	7 days	1L plastic
Total Suspended Solids (mg/l)	SM 2540D	5	20	SM 2540D	2.38	10.0	<6C	7 days	1L plastic
Ammonia as N, Total (mg/l)	SM 4500 NH3	0.1	0.5	SM 4500 NH3	0.00493	0.0100	H ₂ SO ₄ , <6C	28 days	1L plastic
Cyanide, Total (ug/l)	SM 4500CNH	3	10	SM 4500CNH	0.62	3	NaOH, <6C	14 days	1L plastic
	SM4500-CN-C-E	3	10	SM4500-CN-C-E	0.6	3	NaOH, <6C	14 days	1L plastic
Selenium, Total Recoverable (ug/l)	EPA 200.8	1	5	EPA 200.8	0.00589	0.5	HNO ₃ , <6C	6 months	1L plastic
Aluminum, Total Recoverable (ug/l)	EPA 200.8	1	5	EPA 200.8	0.977	20	HNO ₃ , <6C	6 months	1L plastic
Cadmium, Total Recoverable (ug/l)	EPA 200.8	0.1	0.5	EPA 200.8	0.017	0.1	HNO ₃ , <6C	6 months	1L plastic
Chromium, Total Recoverable (ug/l)	EPA 200.8	0.1	0.5	EPA 200.8	0.0349	2	HNO ₃ , <6C	6 months	1L plastic
Copper, Total Recoverable (ug/l)	EPA 200.8	0.5	3	EPA 200.8	0.0785	1	HNO ₃ , <6C	6 months	1L plastic
Iron, Total Recoverable (ug/l)	EPA 200.7	20	50	EPA 200.7	3.37	10	HNO ₃ , <6C	6 months	1L plastic
Lead, Total Recoverable (ug/l)	EPA 200.8	0.1	0.5	EPA 200.8	0.0553	0.1	HNO ₃ , <6C	6 months	1L plastic
Manganese, Total Recoverable (ug/l)	EPA 200.8	0.1	0.5	EPA 200.8	0.0361	1	HNO ₃ , <6C	6 months	1L plastic
Nickel, Total Recoverable (ug/l)	EPA 200.8	0.6	3	EPA 200.8	0.0823	2	HNO ₃ , <6C	6 months	1L plastic
Mercury, Total Recoverable (ug/l)	EPA 245.1	0.2	1	EPA 245.1	0.0637	0.2	HNO ₃ , <6C	28 days	1L plastic
Silver, Total Recoverable (ug/l)	EPA 200.8	0.05	0.3	EPA 200.8	0.0117	0.1	HNO ₃ , <6C	6 months	1L plastic
Zinc, Total Recoverable (ug/l)	EPA 200.8	2	10	EPA 200.8	0.469	5	HNO ₃ , <6C	6 months	1L plastic
Biological Oxygen Demand (mg/l)	N/A	N/A	N/A	SM 5210B	0.307	4	<6C	48 Hours	1L plastic
Arsenic, Total Recoverable (ug/l)	EPA 200.8	0.1	0.5	EPA 200.8	0.035	0.5	HNO ₃ , <6C	6 months	1L plastic
Calcium, Total Recoverable (ug/l)	EPA 200.7	200	1000	EPA 200.7	5.22	100	HNO ₃ , <6C	6 months	1L plastic
Magnesium, Total Recoverable (ug/l)	EPA 200.7	200	1000	EPA 200.7	19.3	100	HNO ₃ , <6C	6 months	1L plastic
Potassium, Total Recoverable (ug/l)	EPA 200.7	300	1000	EPA 200.7	40.4	1000	HNO ₃ , <6C	6 months	1L plastic
Sodium, Total Recoverable (ug/l)	EPA 200.7	300	1000	EPA 200.7	5.18	1000	HNO ₃ , <6C	6 months	1L plastic
Silicon, Total Recoverable (ug/l)	EPA 200.7	200	1000	EPA 200.7	79.3	1000	HNO ₃ , <6C	6 months	1L plastic
Alkalinity (mg/l)	SM 2320B	2	20	SM 2320B	0.307	5	<6C	14 days	1L plastic
Acidity (mg/l)	SM 2310B	2	20	SM 2310B	0.35	10	<6C	14 days	1L plastic
Chloride (mg/l)	EPA 300.0 Rev. 2.1	1	5	EPA 300.0 Rev. 2.1	0.015	0.5	<6C	28 days	1L plastic
Sulfate (mg/l)	EPA 300.0 Rev. 2.1	10	50	EPA 300.0 Rev. 2.1	0.088	1	<6C	28 days	1L plastic
Total Nitrate/Nitrite (mg/l)	EPA 300.0 Rev. 2.1	0.02	0.1	EPA 300.0 Rev. 2.1	0.292	4	H ₂ SO ₄ , <6C	28 days	1L plastic
Total Organic Carbon (mg/l)	SM 5310	1	5	SM 5310	0.409	1	H ₂ SO ₄ , <6C	28 days	1L plastic
Total Purgeable Organics	N/A	N/A	N/A	EPA 624	Various	Various	HCl, <6C	14 days	40 ml VOAs
Base Neutral & Acids	N/A	N/A	N/A	EPA 625	Various	Various	<6C	7 days	1L amber glass

Minimum Detection levels for Outfall 001 NPDES Permit

ANALYSIS	Minimum Detection Limit	Interim Minimum Level
Aluminum (ug/l)	20	N/A
Cadmium (ug/l)	0.1	N/A
Chromium (ug/l)	1	N/A
Copper (ug/l)	1	N/A
Iron (ug/l)	30	N/A
Total Cyanide (ug/l)	3	9
Lead (ug/l)	0.08	N/A
Manganese (ug/l)	1	N/A
Mercury (ug/l)	0.2	0.5
Nickel (ug/l)	5	N/A
Selenium (ug/l)	2	6
Silver (ug/l)	2	N/A
Zinc (ug/l)	2	N/A
Biological Oxygen Demand (mg/l)	8	N/A
Total Residual Chlorine (ug/l)	10	N/A
Ammonia as N, Total (ug/l)	10	N/A

3.1.8 Field Notes

Thorough documentation of findings and observations in the field is absolutely necessary. This information is useful for explaining data anomalies, legal use, archiving, analyzing records and describing unusual phenomena. Notes are kept in a bound, all-weather field notebook with pre-numbered pages and no missing pages. Only indelible ink should be used to record entries in the logbook. Field notes include water quality measurements, sampling times, technicians' names, sampling condition changes, ice thickness, specific site location, weather conditions, and/or any unusual circumstance. In addition, entries include dates and times for all sampling related activities: sample collection, field measurements, instrumentation readings, calibrations and observations. See Figure 3-3 for an example of a field log page.

At a minimum the following items need to be recorded in the field logbook:

- Dates and sampling times
- Samples collected including any QA/QC samples
- Names of all present
- ID number of the hand held meter
- Water quality measurements – instrument readings
- Specific site location – note if different from designated location
- Mode of transportation used to get to the site
- Unusual circumstances such as turbid water, low or high flow, discoloration, dead fish, etc.
- Weather and other conditions such as ice thickness
- Note if photos are taken.

This field log book is necessary to provide a record of data and observations to enable participants to reconstruct events that occurred during sampling and to refresh the memory of the samplers if called upon to give testimony during legal proceedings. Logbook entries should be made in real-time and not after returning from the field. All entries are initialed and dated and no pages are removed for any reason. Entries in the log book are deleted by drawing a single line through the text desired to be deleted, and dating and initialing the deletion. Under no circumstances is information erased or rendered illegible. There should be no blank lines or blank pages between logbook entries. Blank lines or pages should be "X"d or lined out and initialed and dated. A

camera is also available to photograph any unusual circumstances. If photographs are taken, it should be noted in the field book.

Each field team should have only one person making logbook entries in one logbook. The duties and notes of each field team member should be recorded in the book.

3.1.9 Field Equipment

Prior to sampling, field personnel determine the types of samples to be collected and field measurements required in order to assemble the proper sampling equipment. Equipment is checked for proper operation; maintenance work and calibrations are performed if necessary. Types of field equipment used include a Sigma composite sampler, conductivity meters, dissolved oxygen meters, pH meters, velocity meters, ice augers, snowmobiles, discreet interval samplers, dredges, temperature probes and tape measures. All equipment is operated and maintained according to manufacturers' instruction manuals.

Figure 3-3

May 27th 2006 -
 Station 140 @ 9:45
 Reset stage + off + monitor stage
 @ 11:21 @ 11:17
 2D just below gage is ~~2~~ -5.10 to 4.60
 STA + signal @ P1 + set
 Multiple Brown game of console
 that Island cleaning
 Station 2 @ 15:35
 40 mins stop and little to the Ice to
 Curved but some longy coming
 down. Less Boiling just
 Temp 5.15
 Cond 74
 DO 13.26
 pH 7.77

 May 28th 2006 - 2 year anniversary
 - temp in lower 30s in morning but
 almost equal temp to almost
 60 today.
 - Sta 151 v Probe Chances @ 8:30
 Rem. More shall ice underneath
 15-20' and Ice has fallen out
 Probe →
 Cond adjusted from 200 → 192
 And flow change to match
 451 of
 '06 SEB + 2011 RZ - 400e AS

 Sta 2 v f. flow est @ 9:23
 Temp change in place 21? + 2C' from
 11:00 at Stage @ 5:40
 Water temp w/ 1.1? Boiling 1340

3.2 SAMPLE CUSTODY, DOCUMENTATION, and SHIPPING

3.2.1 Labels

Each sample container is labeled with a sample identification number. The sample identification number is generated by the TCAK database. Other information, such as the sample location, date and time of sample collection, project, TCAK and preservative are also be included on the label.

3.2.2 Sample Log

The TCAK computer database (Envista) maintains records of all samples collected for analysis. Included are the sample number, sample location, date, time, sampler, analysis required, preservative, shipping destination and results of field or in-house tests (i.e., pH, temperature, conductivity, D.O., and turbidity).

Environmental personnel are responsible for maintaining the database, entering information and making changes. Only environmental personnel have access to this function of the database. The information is entered into the database at the earliest available time after the samples have been taken. Lab analytical results are also imported into the database.

3.2.3 Chain of Custody

The objective of the chain-of-custody (COC) is to provide an accurate written record that can be used to trace the possession and handling of a sample from the moment of its collection through its analysis. A true COC contains signature blocks for everyone that handles the samples or package (cooler) containing the samples. TCAK uses a modified COC format. The person preparing the cooler for shipment, which is most often one of the samplers, will sign the COC, place it inside the cooler and attach a custody seal to the cooler. The person at the lab who breaks the custody seal then also signs the COC. The custody seal ensures that the samplers preparing the samples for shipment and the analytical lab personnel are the only people that have accessed the samples.

The COC record includes complete sample and project information and is fully completed by the sampling personnel. One copy is retained by TCAK, another is retained by the laboratory and a copy of or the original is returned to TCAK from the

laboratory along with the final data package. The modified COC form is generated by Envista. See Figure 3-4 for an example of the form.

Figure 3-4

CAK Assay Lab - Request for Lab Analysis Summary

Sample Number	Location	Organization, Project	Medium	Sample Date/Time	Sampled By
06-2701	Port STP Effluent	RDOG, STP	Water	2005.09.05 05:00:00	JHARBKE
Activity: CAK - Monthly - Fecal Coliform					
		Shipped By: <u>JDA</u>	Date: <u>9/5/04</u>	Comments:	
Chain of Custody					
Relinquished:	<u>JDA</u>	<u>9/5/04 - 8:00</u>	No. of Containers:	<u>1</u>	
Received:	Name	Signature	Lab Sample Number:		

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Figure 3-4

CAK Assay Lab - Request for Lab Analysis

CAK Inhouse Lab

Special Instructions

Sample Information

Sample Number:	06-2701	Organization:	Red Dog Mine
Date Sampled From:	2006.09.05 05:00:00	Project:	Sewage Treatment Plants
Date Sampled To:	2006.09.05 05:00:00	Location:	Port STP Effluent
Sampled By:	JHARBKE	Medium:	Water
Type:	Grab	Volume:	100 ml
Matrix:	Effluent	Mass:	0 g
Field Pretreatment:			
Activity Name:	CAK - Monthly - Fecal Coliform		
Sample Comments:			

Analytes

Miscellaneous

Fecal Coliform

Issued 2006.09.05 by JHARBKE

Distribution: Original - Return to Conino, Alaska

Copy - Retain at Contract Laboratory

The individual who fills out the COC and packages the samples for shipment is responsible for reviewing the COC for accuracy and completeness, signing the form and completing and attaching the custody seal prior to delivering the samples to the TCAK warehouse shippers. The TCAK warehouse personnel prepare the shipping paperwork and ensure that the package is properly shipped off site. Shipping documents are kept in warehouse file cabinets for a minimum of three years.

3.2.4 Packaging and Shipping

Sample containers are checked for complete and correct labels and secure caps. They are then placed in a cooler with ice packs and COC forms. The cooler is filled with packing material and taped or banded securely shut. A signed and dated custody seal or custody tape is secured across at least one side of the cooler lid to indicate if cooler has been opened. Drains on coolers, if present, should be taped shut.

The coolers are brought to the TCAK warehouse where the required shipping paperwork is completed. Typically, the coolers are shipped to Anchorage via Northern Air Cargo (NAC). For samples going to laboratories outside of Anchorage Alaska, a freight forwarding company transfers them from NAC to a commercial airline flight. The coolers are shipped to the appropriate city where freight couriers deliver the samples to the laboratory (e.g. ACZ Laboratories). Local laboratories or laboratories that have a local presence in Anchorage pick up samples directly from NAC. There are several alternate means of shipping samples, which are used for short hold time samples or when weather conditions do not allow for the normal routes.

4.0 FIELD MEASUREMENTS

4.1 FLOW MEASURING

4.1.1 Outfall 001 and 002

Discharge flow is measured continuously from Outfall 001 by a 24-inch Rosemount Mag-Meter Model 8712H High Resolution. The flow meter is routinely maintained and inspected for operational malfunctions. Daily discharge flow (7:00 AM - 6:59 AM) is electronically recorded in the mill process system database (Procon or PI).

Discharge flow is measured continuously from Outfall 002. The flow meter is routinely maintained and inspected for operational malfunctions. Daily discharge flow (approximately 7:00 AM - 6:59 AM) is manually recorded by the wastewater technician at approximately 7:00 AM each day.

4.1.2 Stream Flow Measuring

Stations 140, 12, 9, 10, 150, 151, 160, and 2 are equipped with dataloggers and instruments to determine stage (water elevation) which is recorded every 30 minutes. The stage is converted to stream flow by establishing a rating equation for each site. The rating equation is developed by relating actual stream flow measurements to stream stage at various times throughout the season.

Table 4.1 illustrates the equipment at each Station.

Table 4.1

	Stage Determination*	Datalogger	Telemetry
Station 140	Stilling Well / Float	Sutron 8210	N/A
Station 12	Bubbler – Pressure Transducer	Sutron 8210	N/A
Station 9	Bubbler - Pressure Transducer	Sutron 8210	N/A
Station 10	Bubbler – Pressure Transducer	Campbell Scientific CR-10	Spread Spectrum modem & Meteorburst
Station 151	Bubbler - Pressure	Campbell	Spread Spectrum

	Transducer	Scientific CR-10	modem
Station 150	Bubbler - Pressure Transducer	Campbell Scientific CR-10	Spread Sectrum modem & Meteorburst
Station 160	Bubbler - Pressure Transducer	Campbell Scientific CR-10	Spread Sectrum modem & Meteorburst
Station 2	Bubbler - Pressure Transducer	Sutron 8210	GOES Satellite

* A Submerged Pressure Transducer may be used as backup stage determination at any station.

All stream flow measurements, calibrations, and calculations are conducted according to U.S. Geological Survey standard operating procedures as defined in *Measurement and Computation of Streamflow: Volumes 1 and 2*, Geological Survey Water-Supply Paper 2175, 1982.

Typically, each Station is inspected weekly or bimonthly. During the inspections the overall condition of the Station and equipment is assessed, and a manual measurement of the water surface elevation is recorded (tape down). The tape down is compared to the datalogger reading and transducer drift, if any, is corrected. At a minimum, an actual stream flow measurement is conducted monthly at each Station. All activity at the Station is documented in field log books and/or gauge house sheets. Gauge house sheets should have notes on tape down's, datalogger changes, nitrogen status, conductivity readings, calibration, changes, date, time, and initials.

4.2 TOTAL DISSOLVED SOLIDS ESTIMATIONS

Total dissolved solids (TDS) can be estimated from conductivity and temperature data. Based on temperature, raw conductivity data is converted into specific conductivity (SC), which can then be related to TDS concentrations. The following equations are used for this purpose:

Equation 1.0

$$SC = \text{Conductivity} / (1 + T_f (\text{temperature} - 25))$$

Where T_f is a temperature coefficient that has been empirically derived.

Equation 2.0

$$\text{TDS} = m * \text{SC} + b$$

Where m and b are the slope and Y-intercept of a linear relationship between measured SC and laboratory analyzed TDS.

Estimates of TDS concentrations at Stations 151, 10, 150, and 160 are used to control the discharge rate from Outfall 001 based on in-stream TDS limits (See EPA and ADEC Compliance Orders by Consent). The coefficients and variables from Equations 1.0 and 2.0 have been well established for Stations 10 and 160, and are periodically updated with new data.

TDS concentrations at the Stations can be related to adjustments to the discharge flow rate from Outfall 001 through the following equation:

Equation 3.0

$$Q_{\text{adj}} = Q_E + (Q_{\text{Sta}}(C_{\text{limit}} - C_{\text{Sta}})) / (C_E - C_{\text{limit}})$$

where,

- Q_{adj} = Suggested new discharge flow rate from Outfall 001.
- Q_E = Discharge flow rate from Outfall 001 at the time the data was collected.
- Q_{Sta} = Stream flow at Station.
- C_{limit} = Maximum allowable TDS concentration at Station (i.e., 1500 mg/l at Station 10 or 500 mg/l at Station 160).
- C_{Sta} = Estimated TDS Concentration at Station.
- C_E = TDS concentration of effluent (3600 mg/l).

Estimated TDS concentrations and stream flows are calculated by the dataloggers at Stations 151, 10, 150, and 160. Every 15 minutes, the TDS and Stream flow estimates are transmitted to the process control system at the mill facility via spread spectrum modem or meteorburst telemetry. Using equation 3.0, the process control system automatically calculates a new suggested discharge flow rate for Outfall 001. All parameters are electronically stored in the process control database (Procon or PI). The new suggested discharge flow rate as well as the estimated TDS concentration and stream flow for Stations 151, 10, 150, and 160 are displayed on a computer screen in the mill control room. The control room operator can then make adjustments to the discharge flow rate from Outfall 001 accordingly. Additionally, audio alarms are

automatically triggered when the estimated TDS at a Station approaches the compliance limits.

Stations 151, 10, 150, and 160 are fitted with a Great Lakes Instruments Model 3600E electrodeless conductivity sensor and a Dryden Instrumentation bi-metal thermistor type temperature probe. The conductivity probes are checked weekly for accuracy against a calibrated hand held non-temperature compensated conductivity meter. The temperature probes are checked monthly in an ice water solution.

4.3 EVAPORATION AND PRECIPITATION

Daily evaporation and precipitation data are collected in accordance with the requirements outlined in the NPDES permit. A meteorological station is located between the airport and Bons Reservoir. Operation and calibration procedures for Red Dog's meteorological stations are outlined in the attached Meteorological Monitoring and Quality Assurance Plan.

The meteorological stations are operated to meet stringent requirements for PSD-quality data for air modeling. Evaporation was not included in that document as it was not a required parameter. It is, however, part of the same data collection system and is collected to meet the same standards. Data is kept in the same database and goes through equivalent QA/QC process.

Calibrations on the evaporation gauge (NovaLynx Model 255-100) are performed per manufacturer's recommendations. Attached is a copy of the manufacturer's instruction manual.

4.4 FIELD INSTRUMENT MAINTENANCE

All instruments and equipment used during field operations and analysis are operated, calibrated and maintained according to the manufacturer's guidelines and recommendations. They also follow criteria set forth in the applicable analytical methodology references.

For on-site or field measurements, The Environmental Technical Supervisor is responsible for determining if instruments and equipment used are calibrated and are of the proper range, accuracy and type for the test performed. All routine and special maintenance/calibrations are documented in a logbook or reference file for each instrument and are available for inspection.

The following table lists the instruments and their calibration frequencies that are used on site or in the field to collect measurements of chemical or physical properties:

Instrument	Calibration Frequency
pH Meter	Daily – Replace probe annually
Temperature Probes	Monthly (Zero in ice water)
Dissolved Oxygen Meter	Daily or each use
Turbidimeter	Monthly
Total Residual Chlorine Analyzer	Zero each sample – Accuracy check annually
Conductivity Meter	Weekly

Calibrations are recorded and solution standards are documented by lot numbers and expiration dates. The calibrations are recorded in a calibration logbook. The logbook is a bound, all-weather field notebook with pre-numbered pages and no missing pages. Only indelible ink should be used to record entries in the logbook. The logbook contains:

- Calibrator's name
- Instrument name and model
- Date and time of calibration
- Standard lot numbers used and their source
- Temperature (if appropriate)
- Results of calibration
- Calibration acceptance criteria
- Corrective actions if any taken

Written calibration SOPs have been developed for each specific instrument based on the manufacturer's operating manual and recommendations.

Field sampling and measuring equipment is inspected at the start and finish of each day to ensure proper operating conditions. Malfunctions or irregularities in operating function are noted and the necessary repairs are made. Back-up instruments are available in case of unexpected malfunctions and are also used as a check to verify that equipment is functioning properly. Manufacturers' manuals and recommendations are followed in the use of field sampling and measuring equipment.

5.0 ANALYTICAL PROCEDURES

Analyses and associated analytical methods are presented in the QA plan of the individual laboratory doing the analysis. These documents are available on request from the laboratory or from the TCAK Environmental Superintendent. The laboratory may substitute alternative methods for those specified in the permit or this QA plan provided they are properly validated, standardized, referenced and approved for waste waters, in writing, by the EPA and ADEC. This includes sample preparation and preservation methods. The laboratory will meet or exceed established control limits for the methods as published by the EPA for accuracy, precision, and sensitivity. Analysis of laboratory method blanks, spiked samples, duplicate samples and reference standard are used to assess these parameters. Approximately five percent of the total number of samples should be devoted to internal laboratory QA checks. Appropriate corrective measures, as outlined in the analytical methods, will be required when QC results fall outside established control limits.

5.1 QUALITY CONTROL REQUIREMENTS

The primary Data Quality Objectives (DQOs) of the project laboratories are to ensure the accuracy, precision and comparability of all analytical results. The laboratories developed QC objectives for precision and accuracy to determine the acceptability of the data. The QC limits are either specified in the methodology or are statistically derived and are based on the laboratory's actual historical data for each analytical method. QA/QC methods follow guidance contained in U.S. EPA, Methods for Chemical Analysis for Water & Wastes, EPA 600/4-79-020, revised March 1983, and Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Fourth Edition, 2002. Definitions of DQO parameters are contained in Appendix A.

5.2 CALIBRATION PROCEDURES AND FREQUENCY

The analytical laboratory documents calibration procedures and frequency as specified in the manufacturer's guidelines and recommended by EPA methods. Temperature control devices, analytical balances and water purification systems as well as the analytical instruments themselves are calibrated. Calibration standards will be used to

demonstrate that instrument performance does not cause excessive error or bias in the analysis. This calibration will indicate instrument linearity, stability, and sensitivity of instrument conditions prior to and during analysis.

5.3 DATA REDUCTION, VALIDATION, AND REPORTING

All data generated by the laboratory are reviewed by the laboratory in comparison to guidelines established in US EPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846, 2nd Edition (1982) with Updates I (April 1984) and II (April 1985) and 3rd Edition (November 1986) with Revision I (December 1987) and Revision II (December 1996). Analytical protocols are in accordance with 40 CFR 503.8 and 40 CFR 136.3. All analytical data generated are reviewed by comparing calibration, accuracy, and precision to the QC criteria listed in the method description. Integrity of data is assessed through the use of method blanks, matrix spikes, laboratory duplicates, laboratory control standards, and laboratory control standard duplicates. In addition, linearity of calibrations curves, system sensitivity and QC standards are checked.

All laboratory data calculations and reductions are performed as described in the applicable method references. Raw data including laboratory worksheets, notebooks, sample tracking records, instrument logs, standard and sample preparation logs, calibration data, and associated quality control records is retained by the laboratory for a minimum of five years, and available for inspection if necessary.

Laboratory reports contain the project title, name and date of report, name, address, and telephone number of laboratory, sample identification number and matrix, and date of analysis, to ensure that analysis results can be correlated with sampling information. Comments relevant for interpretation of data should be included on the laboratory report. Analyst and lab approval signature should be included; the report should be signed by the laboratory manager, quality assurance manager, or project manager. Laboratory reports include the analysis results and a QC report.

Data for each parameter analyzed are recorded including the parameter name, analytical result with reporting limit, units associated with the result, and reference to the

analytical method employed. In addition, results of associated quality control analyses, including laboratory method blanks, spike recoveries, and duplicate samples are submitted with each report.

Additionally, the laboratory director of each laboratory providing measurement results in support of the NPDES discharge permit (AK-003865-2) is required to sign the following statement:

“I certify that the measurement results in support of this permit, NPDES permit, No. AK-003865-2, are in compliance with requirements under 40 CFR 136 and other analytical requirements specified in this permit.

Signature: _____ Date: _____”

5.4 QUALITY CONTROL CHECKS

Laboratory quality control will comprise at least five percent of each data set generated and will consist of blanks, duplicates, standards, spikes, and quality control check samples. Depending upon the particular method used, a minimum of one spike or laboratory replicate per twenty samples is analyzed for every analytical run.

5.4.1 Laboratory Blanks, Fortified and Replicated Samples

A method blank is analyte-free water that is subjected to the analytical process to demonstrate that the analytical system is not contaminated. A method blank is included with either every batch of samples in the laboratory, every twenty samples, or as stated in the method requirements, whichever is more frequent.

Analytical precision is measured by comparing laboratory duplicate data. The laboratory will duplicate an analyte in every batch of samples. Equations for calculating precision in duplicate samples are listed in Appendix I.

A matrix spike is a known amount of analyte which is added to a sample. Spike recovery measures the effects of interferences on the accuracy of the analysis. A _____

matrix spiked sample is prepared for every twenty samples run in a batch, or for every batch, whichever is more frequent. The relative percent difference between matrix spike (MS) samples and matrix spike duplicates (MSD) is a measure of the batch precision for a particular analytical method. Some matrix spike samples are duplicated. Equations for calculating relative percent difference are given in Appendix A.

6.0 REPORTING - DATA MANAGEMENT

All Wastewater Treatment Plant operators record data daily and submit it to the Environmental Department on a monthly basis. All applicable data obtained in the field are entered into the Envista database. Data entered include sample information and meter readings that are conducted "in-house," such as pH and temperature.

Data is faxed or emailed from the laboratory to the Environmental Coordinators or Environmental Technical Supervisor, as soon as it is available. Coordinators or the Technical Supervisor, or in their absence, the Environmental Technicians, check the data against permit limits the same day as it is received. Generally, the laboratory will immediately notify the Environmental Department if a violation of the NPDES permit limits has occurred. Violations are noted and reported to the US EPA, ADF&G, ADEC and other agencies, as appropriate.

Faxed data is usually preliminary data that has not been reviewed by the contract laboratory QA officer. The contract laboratories e-mail final data packages in an electronic format that can be directly imported into the Envista database.

Environmental Coordinators are responsible for managing data and ensuring it is imported into the database, and submitting monthly reports to the appropriate agencies.

All data required by NPDES permit AK-003865-2 is reported to the EPA, ADEC and Alaska Department of Fish and Game (ADF&G) by the 15th day of the following month.

7.0 ASSESSMENT AND RESPONSE

7.1 NON-VALID DATA

Data which are found to be non-valid after review procedures may require corrective action. Non-valid data exists when accuracy and precision requirements are not met, or when analysis, sampling and operating problems or reporting errors are present. Non-valid data also occurs when samples are not received by the lab within the allowable holding time or when they are improperly preserved. Other examples are a non-representative sample, mislabeling of containers, malfunction of the Sigma composite sampler, and sampling the wrong location.

Data that are determined to be invalid are flagged and/or removed from the active database population. Within the laboratory, corrective action may involve a review of the calculations, check of the instrument maintenance and operation, review of analytical techniques and methodology, and reanalysis of quality control and field samples.

7.2 FIELD EQUIPMENT

If field equipment is found to be inoperable or functioning outside of acceptable performance limits, it is repaired or replaced prior to continued use. Data collected from the instrument immediately prior to the repair or replacement are identified as questionable and appropriate actions will be taken including repeating measurements or sampling, if appropriate.

7.3 MISSING OR DESTROYED SAMPLES

In the case of missing samples, samples that exceed holding times, or broken sample containers, the sample is collected again, if possible. Recollected samples that can be resampled within the permit sample frequency requirements are not considered to be "missed" samples. All missing or destroyed samples that cannot be recollected are noted in the database sample log and are reported to EPA and ADEC.

APPENDIX A

A.1 DATA QUALITY OBJECTIVES: DEFINITIONS

A.1.1 Precision

Precision is the measure of agreement among repetitive measurements of the same sample. It is a measure of the variability, or random error, in sampling, sample handling and in laboratory analysis. There are two measures of precision: reproducibility and repeatability. Repeatability is the measure of error produced by a single person or situation on identical material. Reproducibility is the measure of random error produced by different people on identical samples of material.

Precision is calculated as relative percent difference (RPD) in comparison with duplicate samples. Duplicates collected in the field and analyzed in the laboratory account for both the sample matrix variability and variability in sampling and analytical practices. Duplicates prepared in the laboratory account for analytical variability only. Precision is calculated as follows:

$$RPD = \frac{|(C_1 - C_d)|}{(C_1 + C_d)/2} \times 100$$

where: RPD = relative percent difference,
 C_1 = Concentration of first sample, and
 C_d = Concentration of duplicate sample.

Acceptable precision values are presented in the attached table for methods of concern.

A.1.2 Accuracy

Accuracy is the degree of agreement between a measurement and the true value or accepted reference. Accuracy in the laboratory is determined by calculating the mean value of results from ongoing analyses of standard reference materials, standard solutions, laboratory blanks and matrix spiked samples. Accuracy is expressed as percent recovery of the measured value, relative to the true or expected value.

Accuracy is measured as follows:

$$\% \text{ Recovery} = \frac{(C_s - C_1)}{S} \times 100$$

where: C_S = Concentration of analyte in spiked sample,
 C_1 = Concentration of analyte in original sample,
 S = Concentration of analyte added as spike

Acceptable accuracy values are presented in the attached table for methods of concern.

A.1.3. Representativeness

Representative sampling is to sample a matrix in less than its entirety but to describe the entirety (either physically or chemically) at the desired level of accuracy. Obtaining a representative sample in the field is achieved through careful, informed selection of the sampling site and through proper collection and handling of samples to avoid interferences and prevent contamination and analytical loss.

Stream sampling sites which contain nearby upstream tributaries may prove difficult to collect a representative sample. The influx from upstream tributaries or point discharges result in a chemically-heterogeneous stream for a short distance downstream of the confluence. Eventually, the different sources of water are mixed downstream to produce a chemically-homogeneous stream. A stream sample should be collected at a point where the waters are well mixed. Permanent sampling stations were established at well-mixed stretches of streams and are located at Stations 140, 20, 12, 10, 9, 150, 73, 151, 160 and 2.

Other site selection factors which may affect the representativeness of a sample are: single or multiple channels, sloughing banks, structures affecting hydraulics, low flow to high flow continuity, debris, aquatic growth, springs, ice, depth, turbulence, sediment, historical records, accessibility and safety considerations.

Sampling sites will be located in generally straight reaches of the channel where the flow is relatively uniform. Sites just above or below confluences or point sources will be avoided to minimize problems caused by backwater effects or poorly mixed flows. To obtain a representative sample from Stations 140, 20, 12, 10, 9, 150, 73, 151, 160 and 2, a grab will be collected from a section of the creek which is well mixed and representative of the total flow in the creek. If necessary, the sample will be composited across the stream to form one grab sample. Observations of any factors that may have affected the samples will be recorded and kept on file.

A.1.4. Completeness

Completeness is the amount of valid data obtained compared to the amount required in the permit. The data quantity must be sufficient to prevent misinterpretation, to detect patterns and trends, and to achieve the objectives of the study. Minimum sampling frequency is dictated by the NPDES permit and is summarized in the attached table. Adverse weather is the main uncontrollable factor which may interfere with sampling. Sampling sites may be inaccessible due to the following:

1. Snow conditions in the spring and fall may not be suitable for the Terra Track, snowmobiling or hiking;
2. High-flowing streams during spring breakup and during periods of high rainfall may be un-crossable and therefore may block access to other streams;
3. Storms and fog may prevent access to sampling stations by aircraft or other means; and
4. Mechanical breakdowns of aircraft, snowmobiles, or the Terra Track can also affect sampling progress.

In addition to the above sampling obstacles, cargo plane delays and cancellations may delay shipment of samples. For those samples with a short holding time, a shipping delay could result in expiration of the sample holding time. Completeness for this project is defined as the valid return of the minimum number of required samples collected and analyzed. To prevent an incomplete data set, monthly samples will be collected early in the month and weekly samples will be collected early in the week so that re-sampling can be conducted, if necessary.

A.1.5. Comparability

Comparability is the extent to which comparisons among different measurements of the same quantity or quality will yield valid conclusions. Comparability will be achieved through the use of standard procedures and accepted standard analytical procedures (EPA methods and American Standard Testing Methodologies).

A.1.6 Traceability

Traceability is the extent to which data can be substantiated by hard-copy documentation. Traceability documentation exists in two essential forms: that which

links quantification to an authoritative standard, and that which explicitly describes the history of each sample from collection to analysis. Chain-of-custody forms follow each batch of samples from the Red Dog sample preparation room to the contract laboratory and then are returned to Red Dog in the final data package.