Government of Northwest Territories | Gouvernement des Territoires du Nord-Ouest

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Re: Quality Assurance/Quality Control Plan
License N3L8-1838

Submitted: August 5, 2016
Reviewed: May 29, 2017

Thank you for the submission of the Quality Assurance and Quality Control Plan you have prepared on behalf of the Northwest Territories Power Corporation.

The plan has been found to be complete upon review and approval is granted. If you have any questions or require further information, please do not hesitate to contact me at (867) 767-9235 x 53150 or by email at bruce_stuart@gov.nt.ca.

Sincerely,

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QUALITY ASSURANCE/QUALITY CONTROL PLAN

Northwest Territories Power Corporation Former Aklavik Power Plant

Water Board License N3L8-1838

1 INTRODUCTION

Data received from analytical laboratories will be used to assess water quality relative to discharge limits. Only laboratories certified by the Canadian Association for Laboratory Accreditation Inc. (CALA) will be used. Our primary laboratory will be ALS Environmental. Regardless of the laboratory, to verify that data obtained is of appropriate quality, Matrix Solutions Inc. will undertake various quality assurance/quality control (QA/QC) measures as outlined in this document.

2 SAMPLING

The QA/QC process begins at the time of sampling.

2.1 Water Samples

1. Personnel collecting water samples will don a fresh pair of nitrile gloves before taking each sample.

2. Water samples will be collected into clean bottles supplied by the analytical laboratory. Each analysis requires a specific type of bottle and certain samples must be preserved onsite before sealing the bottles. Typically analytical laboratories require the following:

    a. For each routine analysis (including pH, electrical conductivity, chloride, sulphate, hardness) and hardness and total suspended solids, a clean 500 mL plastic bottle shall be filled to within 5 to 15 mm of the top, then capped.

    b. For metal analyses, a clean 500 mL plastic bottle containing nitric acid preservative shall be filled to within 5 to 15 mm of the top, then capped. Mercury analyses require a 40 mL vial with hydrochloric acid preservative.

    c. Three 40 mL glass vials shall be used for the benzene, toluene, ethylbenzene, and xylenes (BTEX) and/or petroleum hydrocarbon (PHC) fraction 1 (F1; C_6-C_{10}, excluding BTEX) analyses. The vials shall be filled until a positive meniscus is formed at the lip of each vial, then capped.

    d. For total petroleum hydrocarbon (TPH) analysis, two 60mL amber vials shall be filled to within 5 to 15 mm of the top, then capped.

    e. For benzo[a]pyrene analysis, one laboratory-cleaned, 1,000 mL amber glass bottle preserved with sodium bisulfate shall be used. Bottles are to be filled to within 5 to 15 mm of the top, then capped.

f. For oil and grease analysis, one laboratory-cleaned, 1,000 mL amber glass bottle preserved with hydrochloric acid shall be filled to within 5 to 15 mm of the top, then capped.

3. All samples shall be labelled with a unique sample number. Sample codes usually follow the form XSITEYYMMDDNUM, where XSITE is a five-digit project code, YYMMDD is the sampling date, and NUM is a three-digit number indicating the sample number for that date. For example, a sample labelled 21784160201001 was the first sample collected at Site 21784 on February 1, 2016. The sample numbers are recorded and cross-referenced with the sample location in Matrix's log book.

4. Samples will be submitted to ALS Environmental in Edmonton (or an alternate CALA-certified laboratory) for analysis. An appropriate chain-of-custody form indicating sample numbers shall be signed and submitted to the laboratory. Copies of the signed forms are placed in Matrix's project files and are available upon request. The samples will be shipped with ice or cold packs as required to ensure that they are received within acceptable temperature ranges for the required analyses.

2.2 Quality Control Samples

The QA/QC verification may include submission of blind samples, duplicate samples, field blanks, equipment blanks, trip blanks, or trip reference standards, and always includes review of the laboratory's QA report. And at locations subjected to repeated sampling, historical data comparisons are done as a further measure of QA/QC to assess whether results are within previous ranges.

2.2.1 Blind Samples

Samples collected by Matrix are assigned a unique sample number and are submitted to the laboratory as a blind sample using this number for identification. This ensures that the sample location cannot be identified by the laboratory and are truly blind. The sample number follows Matrix's sample naming protocol of SITE#YYMMDDXXX, where SITE# is a five-digit project code, YYMMDD is the sampling date, and XXX is a three-digit number indicating the sample number for that date. All samples, including QC samples, are given these blind sample numbers.

2.2.2 Duplicate Samples

Results obtained from duplicate sample analysis are used to monitor the reproducibility (precision) and the expected variability of the sampling method and laboratory analysis. Two samples are collected from the same field location using the same equipment and procedures at the same time. The duplicate samples are submitted as blind samples to the laboratory and are typically not given sequential unique sample numbers. A minimum of 10% duplicate samples are collected and analyzed per analytical parameter.

2.2.3 Field Blanks

Results obtained from the analysis of field blanks are used to measure incidental or accidental sample contamination (i.e., artifacts or analytes detected by analysis but not present in the samples). One field blank should be collected for every day of sampling. The field blank does not need to be analyzed for

every sampling trip, but can be analyzed should analytical data for the actual samples appear anomalous.

Groundwater and surface water field blanks submitted to the laboratory for analysis of organic analytes are prepared using clean water, preferably laboratory-supplied, organic-free de-ionized water stored in laboratory-supplied glass containers. Groundwater and surface water field blanks submitted to the laboratory for analysis of inorganic analytes are prepared using clean water, preferably laboratory-supplied, metal-free de-ionized water stored in laboratory-supplied high-density polyethylene (HDPE) containers. Field blanks for groundwater and surface water are collected and handled in accordance with Matrix's sampling protocols near environments representative of those encountered during the sampling program and submitted to the laboratory as a blind sample that is part of the sampling program.

2.2.4 Equipment Blanks

Results obtained from the analysis of equipment blanks are used to determine the total field and laboratory sources of contamination. Equipment blanks (rinsate blanks) are prepared by first decontaminating equipment and then rinsing the equipment using analyte-free media. Laboratory-supplied, organic-free (or metal-free) de-ionized water is then used to rinse the equipment and the water is collected. The equipment blank is submitted as a blind sample that is part of the sampling program. The equipment blank does not need to be analyzed every time, but can be analyzed should analytical data for the actual samples appear anomalous.

2.2.5 Trip Blanks

Results obtained from the analysis of trip blanks are used to determine whether or not cross-contamination of VOCs (or other contaminants) have been introduced to the actual samples during sample transportation. A trip blank is a sample of laboratory-supplied, organic-free de-ionized water that is transported to and from the laboratory along with the actual samples. The trip blank remains sealed and is not exposed to the sampling environment. The sample is submitted to the laboratory as a blind sample that is part of the sampling program. The trip blank does not need to be analyzed every time, but can be analyzed should analytical data for the actual samples appear anomalous.

2.2.6 Trip Reference Standards

Results obtained from the trip reference standard are used to measure both contamination and analyte loss that might arise during handling, transport, or storage of the samples as well as the accuracy of the laboratory method. The laboratory prepares the trip reference standard by adding a known concentration of the analyte parameter (usually VOCs such as benzene, toluene, ethylbenzene, and xylenes) to laboratory-supplied, organic-free de-ionized water. The lab sends a trip reference letter with the sample that provides the concentration of each compound included in the standard.

The sample is transported to the field and remains sealed. The concentrations of each compound in the standard should be of similar concentration levels to what is expected in the actual samples. Concentrations of greater than 5 times the expected sample concentration may mask interferences and lead to over-optimistic estimates of analyte recovery. The trip reference standard is submitted as a blind sample that is part of the sampling program and analyzed using standard methods.

3 RESULTS EVALUATION

Results of laboratory analyses are received electronically and downloaded into Matrix's database management system without the need for manual entry. This eliminates transcription errors. Matrix's database management system is used to construct the data tables and figures provided in reports, again eliminating transcription errors.

To verify that data obtained is of appropriate quality, Matrix's Environmental Data Services (EDS) group performs a number of quality assurance/quality control (QA/QC) verifications. A description of these measures and subsequent criteria for evaluation are detailed in this section (B.C. MoE 2013; B.C. WLAP 2003). The results of the quality control sample analyses and the review of the laboratory QC report are reported on a *Data Quality Checklist*, prepared for each sampling event and summarized on project-specific QC sample results tables.

3.1 Duplicate Sample Results

The criteria for evaluation of the field duplicate samples take into account the laboratory detection limit (DL), the reliable detection limit (RDL; 5 times the DL), the absolute difference between the duplicate values, and the relative percent difference (RPD) calculated for each set of duplicate parameter analyses (Zeiner 1994; B.C. WAP 2003). As well, the criteria take into consideration the sample matrix and the concentration of the specific parameter (Zeiner 1994). Zeiner considers a positive result as an analyte concentration greater than the detection limit. Evaluation methods regarding the data scenarios are described below.

For each set of duplicate parameter results:

Scenario 1 – Two non-detectable results (organic and inorganic parameters)

The duplicate samples cannot be assessed using absolute difference or RPD; however, the duplicate samples show acceptable precision (both duplicate samples displayed no results above the DL).

Scenario 2a – One positive result and one non-detectable result (inorganic parameters)

Assess the two results by taking the absolute difference between the positive result and the DL.

- if the absolute difference is ≤ DL, then the duplicate samples show acceptable precision
- if the absolute difference is > DL, then the duplicate sample results are considered an estimate

Scenario 2b – One positive result and one non-detectable result (organic parameters)

Assess the two results by taking the absolute difference between the positive result and 0.5 x DL.

- if the absolute difference is ≤ DL, then the duplicate samples show acceptable precision
- if the absolute difference is > DL, then the duplicate sample results are considered an estimate

Scenario 3 – Two positive results with at least one result < RDL (organic and inorganic)

- if the absolute difference is ≤ DL, then the duplicate samples show acceptable precision
- if the absolute difference is > DL, then the duplicate sample results are considered an estimate

Scenario 4 – Two positive results both > RDL (organic and inorganic)

- If the RPD ≤ 20%, then the results are considered acceptable.
- If the RPD > 20%, then the results are considered an estimate.
    - A RPD > 20% indicates a possible problem while a RPD > 50% indicates a definite problem. Common problems associated with a large RPD are either contamination or lack of sample homogeneity.
- The RPD is calculated as follows (APHA 1998):

$$RPD = \frac{Absolute\ difference\ \ between\ the\ two\ duplicate\ results}{Mean\ of\ \ the\ two\ duplicate\ results} \times 100$$

3.2 Blank Sample Results

Upon receipt of the results, the EDS group checks the concentrations of the analytes of interest in field, trip, and equipment blanks. If analyte concentrations in the blanks are greater than ten times the DL and the sample result is less than five times the DL, there may be a problem with the laboratory data. The cause of the problem and the effect on the data quality will be investigated.

3.3 Trip Reference Standard Results

Upon receipt of the results, the EDS group compares the measured concentration of the parameter of interest to the known concentration; the percent recovery is calculated as follows:

$$\%\ Recovery = \frac{known\ concentration\ of\ \ spiked\ \ parameter}{measured\ concentration\ of\ \ spiked\ \ parameter} \times 100$$

Acceptable laboratory accuracy is indicated by a percent recovery between 70% and 130%. If the percent recoveries do not meet the criteria, the cause of the problem and the effect on the data quality will be investigated.

3.4 Laboratory Quality Control Evaluation

The approved environmental laboratories used by Matrix have QC measures in place that ensure the data released is as accurate and precise as possible. These measures include the use of laboratory blank samples, duplicate samples, spiked samples, and measuring surrogate recoveries.

Upon receipt of the analytical report, the EDS group checks to ensure that the data has passed the laboratory's QC measures for blanks, duplicates, spikes, and surrogate recoveries. If a discrepancy is found, the laboratory is contacted and asked to explain the discrepancy and, if necessary, the samples in question are reanalyzed by the laboratory, or all of the samples are reanalyzed for the parameter of concern. The EDS group also reviews holding time, detection limits, and ion balances.

3.4.1 Hold Time

Hold time refers to the maximum amount of time permitted between when a sample is collected and when the sample is analyzed. Specific sample containers, storage temperature, preservatives, and extraction methods can extend sample hold times (BCLM 2013). The EDS group checks to ensure that samples were analyzed or extracted within the holding time appropriate for that parameter. Analysis and extraction dates and times are recorded on the analytical reports issued by the laboratory. If the hold times exceed the recommended hold time, the reason for the hold time exceedance and the effect on the data quality will be investigated.

3.4.2 Detection Limits

The EDS group checks to ensure that the DLs reported by the laboratory adequately meet the applicable regulatory assessment guidelines defined for the project. DLs for a parameter should not be greater than the applicable regulatory guideline value for that parameter. If any DLs are found to be higher than the applicable regulatory guideline, a second analysis may be requested at the discretion of the project manager.

3.4.3 Ion Balance

The EDS group evaluates any ion balance values reported by the laboratory to ensure that the ratio of anions to cations is acceptable. Ion balances between 90% and 110% for water and between 80% and 120% for soil are indicative of acceptable laboratory data quality. For soil samples, the cation/electrical conductivity (EC) ratio is also calculated on samples with EC > 2 dS/m and ratios between 9 and 15 are considered acceptable. If the ion balances do not fall within the acceptable ranges, the cause of the failure and the effect on the data quality will be investigated.

3.5 Historical Comparison of Data

The EDS group compares laboratory results from a sample point to historical parameter concentrations, where available, particularly for surface water and groundwater monitoring programs. Significant changes from historical levels are identified and verification of the data obtained from the laboratory (rechecks) are usually requested and based on the result of this verification, the project manager may request that a new sample be collected.

4 REFERENCES

American Public Health Association (APHA). 1998. *Standard Methods for the Examination of Water and Wastewater*. 20th Edition. American Public Health Association. Washington, D.C.

British Columbia Ministry of the Environment (B.C. MoE). 2013. "Section A: Laboratory Quality Assurance/Quality Control." In: *BC Environmental Labratory Manual*. Environmental Monitoring and Reporting Section.

British Columbia Ministry of Water, Land and Air Protection (B.C. WLAP). 2003. *British Columbia Field Sampling Manual For Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples*. GE45.S25B74 1996. ISBN 0-7726-2741-X. January 2003. 383 pp.

Zeiner S.T. 1994. "Realistic criteria for the evaluation of field duplicate sample results." Reprinted from the proceedings of Superfund XV November 29-December 1, 1994, Washington, D.C.