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QUALITY ASSURANCE PLAN
for the Alaska Soil and Water Conservation Board's Ground-water Quality Assessment Project in the Matanuska-Susitna Borough

By

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CONTENTS

TABLES

QUALITY ASSURANCE PLAN

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INTRODUCTION

This quality assurance plan describes the field instrument calibration and laboratory services that the Alaska Division of Geological and Geophysical Surveys (DGGS) will provide the Alaska Soil and Water Conservation Board's (ASWCB) project to assess private well ground-water quality in the Matanuska-Susitna Borough. DGGS will provide ASWCB with a Hydrolab for measuring pH and conductivity in the field. The DGGS Water Quality Laboratory in Fairbanks will analyze water samples for total arsenic, total iron, and nitrate-nitrogen.

FIELD INSTRUMENT CALIBRATION

The Hydrolab Model 4041 is a portable, multi-probe, field instrument that measures water temperature, dissolved oxygen, pH, and conductivity. The conductivity and pH probes will be calibrated before and after each field session at the DGGS Eagle River office, according to the manufacturer's operation and maintenance instructions (Hydrolab Corporation, 1981). At least four potassium chloride solutions will be used to calibrate the conductivity probe. Freshly prepared Beckman buffer solutions, of pH 7, pH 4, and pH 10 will be used to calibrate the pH probe. The pre-and post-calibration readings will be recorded in a Hydrolab records notebook.

BOTTLE PREPARATION AND SAMPLE HANDLING

All sample containers will be cleaned according to U.S. Environmental Protection Agency (USEPA) methods (USEPA, 1982). The bottles will be sequentially numbered and color-coded to facilitate field sampling. Green tape will be used to mark bottles for nitrate-nitrite analysis, and red tape used to mark bottles for arsenic and iron analysis. In addition, the arsenic/iron bottles will be precharged with 2 milliliters of ULTREX nitric acid at the DGGS Laboratory. Sample preservation and holding times are given in Table 1.

The field sampler is responsible for the sample bottles and samples collected from the time of receipt of bottles until they are returned to the laboratory.

Laboratory personnel will accept responsibility for the samples upon receipt. All samples and analytical reports will be stored in a locked area accessible only to DGGS Laboratory personnel.

Table 1. Sampling and preservation of samples.

Parameter	Volume (mL)	Container	Preservative	Holding Time
Arsenic	500	plastic	HNO, to pH < 2	6 months
Iron	500	plastic	HNO, to pH < 2	6 months
Nitrate	500	plastic	cool, 4°C	48 hours

ANALYTICAL PROCEDURES

Laboratory analytical procedures and data quality objectives are listed in Table 2. Instrument calibration frequency and references are given in Table 3.

Table 2. Analytical procedures and data quality objectives.

Parameter	EPA Method	Detection Limit	Precision	Accuracy
Arsenic	206.3	0.004 mg/L	+/-20%	80-120%
Iron	AES 0029	0.03 mg/L	+/-20%	80-120%
Nitrate	300.0	0.02 mg/L	+/-20%	80-120%

Table 3. Analytical instrumentation summary.

Parameter	Instrument	Calibration Freauencv	Reference Manual
Arsenic	Perkin Elmer AA	every 10 samples	1
Iron	Beckman/ARL DCP	every 8 samples	2
Nitrate	DIONEX IC	every 10 samples	3

Reference Manuals:

1 Perkin Elmer Model 4000 Atomic Absorption Spectrophotometer, Perkin Elmer Corp., Norwalk, Connecticut; revised April 1979.

2 ARL SpectrSpan VI Rapid Scanning High Resolution Spectrophotometer Operator's Manual and Tutorial, Applied Research Laboratories, 3080 Enterprise Blvd., Brea, California; July 1987.

3 DIONEX Ion Chromatography Cookbook, A Practical Guide to Quantitative Analysis by Ion Chromatography, Dionex Corp., 1228 Titan Way, Sunnyvale, California; 1987

DATA REDUCTION, VALIDATION, AND REPORTING

Once raw data are received from analytical instrumentation readouts, final component concentrations are calculated by the analyst from computer generated regression equations derived from multiple standard analyses. General data reduction procedures are described in Standard Methods (APHA, 1989).

The quality control and the sample analytical data will be validated by comparing the actual values obtained with the data quality objectives listed in Table 2. Accuracy, precision, and completeness will be calculated using the formulas on page 5 of this report.

An analytical report will be produced upon completion of the five weekly sampling events, and again after each of the two secondary sampling events to be scheduled during the summer of 1991. Reports will include the DGGS laboratory number, the concentration of the parameter, relative percent difference (precision), percent recovery (accuracy), method code, and detection limits for each parameter. Nitrate-nitrogen concentrations will be reported in milligrams per liter as nitrogen.

INTERNAL QUALITY CONTROL CHECKS

Trip Blanks One set of trip blanks for each sample type will be collected to evaluate bottle cleaning procedures. The trip blank sample, which consists of deionized water, will be processed in the field.

Duplicate Samples Blind duplicate samples and identified duplicate samples will be used to assess the precision and reproducibility of field and laboratory procedures. Duplicates will represent ten percent of the total samples taken. At least one blind duplicate sample set will be taken during each sampling event.

The following laboratory checks will be performed by the DGGS Water Quality Laboratory:

Reagent Blank A distilled, deionized water sample will be analyzed along with field samples.

Standards Standards in the concentration range of samples to be analyzed will be prepared daily from concentrated standards obtained from commercial sources which have been tested against National Bureau of Standards (NBS) Reference Standards and expiration dated.

Quality control samples Standard reference samples of known composition from the USEPA laboratory (Cincinnati, Ohio) or U. S. Geological Survey (USGS) will be included in each analytical procedure when applicable to assure accuracy of the analytical system.

Duplicate samples Two aliquots split from a single bottle of sample will be taken from ten percent of the field samples and treated exactly the same throughout the laboratory procedures and analytical method.

Spikes Matrix spike samples and matrix spike duplicates will be used on ten percent of the field samples to evaluate the performance of analytical instrumentation.

Performance Audits The DGGS Water Quality Laboratory participates in two quality assurance performance evaluations, one conducted by the USGS and one by the USEPA. Both involve the analysis of blind samples distributed twice a year to participating labs. Performance evaluations for these two programs during this project will be available upon request.

PREVENTATIVE MAINTENANCE

The main instruments involved in the analytical process for this project at the DGGS Water Quality Laboratory include a DIONEX ion chromatograph, a Perkin Elmer Atomic Absorption Spectrophotometer, and a Beckman/ARL direct current argon plasma spectrophotometer (DCP). All instruments receive the proper routine maintenance outlined in their operator manuals and there is a modest supply of components which require routine replacement such as columns for the ion chromatograph and anodes for the DCP.

ASSESSMENT OF DATA QUALITY OBJECTIVES

Standard operating procedures for assessing data quality objectives for precision are based on expected precision figures listed with methods in published references (APHA, 1989). Sample duplicates will allow actual precision to be calculated for parameters using the following equation:

$$\text{precision} = \text{relative percent difference} = \frac{/D2 - D1/}{(D1 + D2)/2} \times 100$$

where: D, = first sample result
D_2 = second sample result

Matrix spike samples will allow accuracy to be calculated for analytes using the following formula:

$$\text{accuracy} = \text{percent recovery} = \frac{(SSR - SR)}{SA} \times 100$$

where: SSR = spiked sample result
SR = sample result
SA = spike amount added

Completeness will be calculated after the project has been finalized using the following formula:

$$\text{completeness} = \text{percent useable data} = \frac{\text{useable data} \times 100}{\text{total possible data}}$$

CORRECTIVE ACTION PROCEDURES

Corrective action procedures will be implemented as soon as any measurement system is found to be out of control. Out of control situations are defined as unacceptable quality control measurements such as contamination of blanks, poor precision or low accuracy (based on data quality objectives), or improper sample storage or preservation. Corrective actions will include either reanalyzing or resampling the affected samples. Out of control data will be discarded or used with appropriate cautionary notes.

REFERENCES CITED

American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1989, Standard Methods for the Examination of Water And Wastewater, 17th edition: APHA, AWWA, WPCF, Washington, DC.

Hydrolab Corporation, 1981, Operation and Maintenance Instructions Hydrolab Digital 4041: Hydrolab Corporation, P.O. Box 50116, Austin, Texas 78763-0116.

U.S. Environmental Protection Agency, 1982, Handbook for sampling and sample preservation of water and wastewater: U.S. Environmental Protection Agency, EPA-6--14-82-029, September 1982.