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QUALITY ASSURANCE PLAN for the Kenai Peninsula Ground-Water Study Phase IIIA, Pilot Project, West Nikiski, Alaska

By

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QUALITY ASSURANCE PLAN

for the Kenai Peninsula Ground-Water Study Phase IIIA Pilot Project, West Nikiski, Alaska

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Approved:

Mary A. Maurer	7/3/91	James A. Munter	7/3/91
Mary A. Maurer Quality Assurance Officer	Date	James A. Munter Project Manager	Date

INTRODUCTION

A comprehensive ground-water study of the Kenai Peninsula was initiated in 1990 by the Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys (DGGS), Alaska Oil and Gas Association, and U.S. Geological Survey. Work is conducted under the oversight of the Kenai Peninsula Ground-Water Task Force (KPGWTF). The study is intended to resolve ground-water issues that have been identified by task force members (KPGWTF, 1990a). The task force has established a four-phased project approach for the ground-water study. The phase II project is a regional analysis of ground-water flow directions and ground-water quality encompassing the entire Kenai Peninsula (KPGWTF, 1990b). The phase II project is not expected to resolve some issues that are important at the subregional scale because of the large size of the study area and the subregional and local variability of geologic conditions.

Phase III of the ground-water study is intended to address ground-water issues at a subregional scale (KPGWTF, undated). The phase III pilot project will consist of detailed subsurface geologic, water-table, and water-quality mapping based on a more intensive data collection and evaluation than can be accomplished in phase II.

The task force has selected the Nikiski area as the phase III pilot project area because of the relatively high number of unresolved ground-water issues in that area. As a result of funding limitations only a portion of the phase III pilot project, phase IIIA, will be done in 1991. The phase IIIA pilot project area, encompasses only the west Nikiski area (fig. 1). Phase IIIA will begin in July 1991 and be conducted by DGGS. The overall objective of

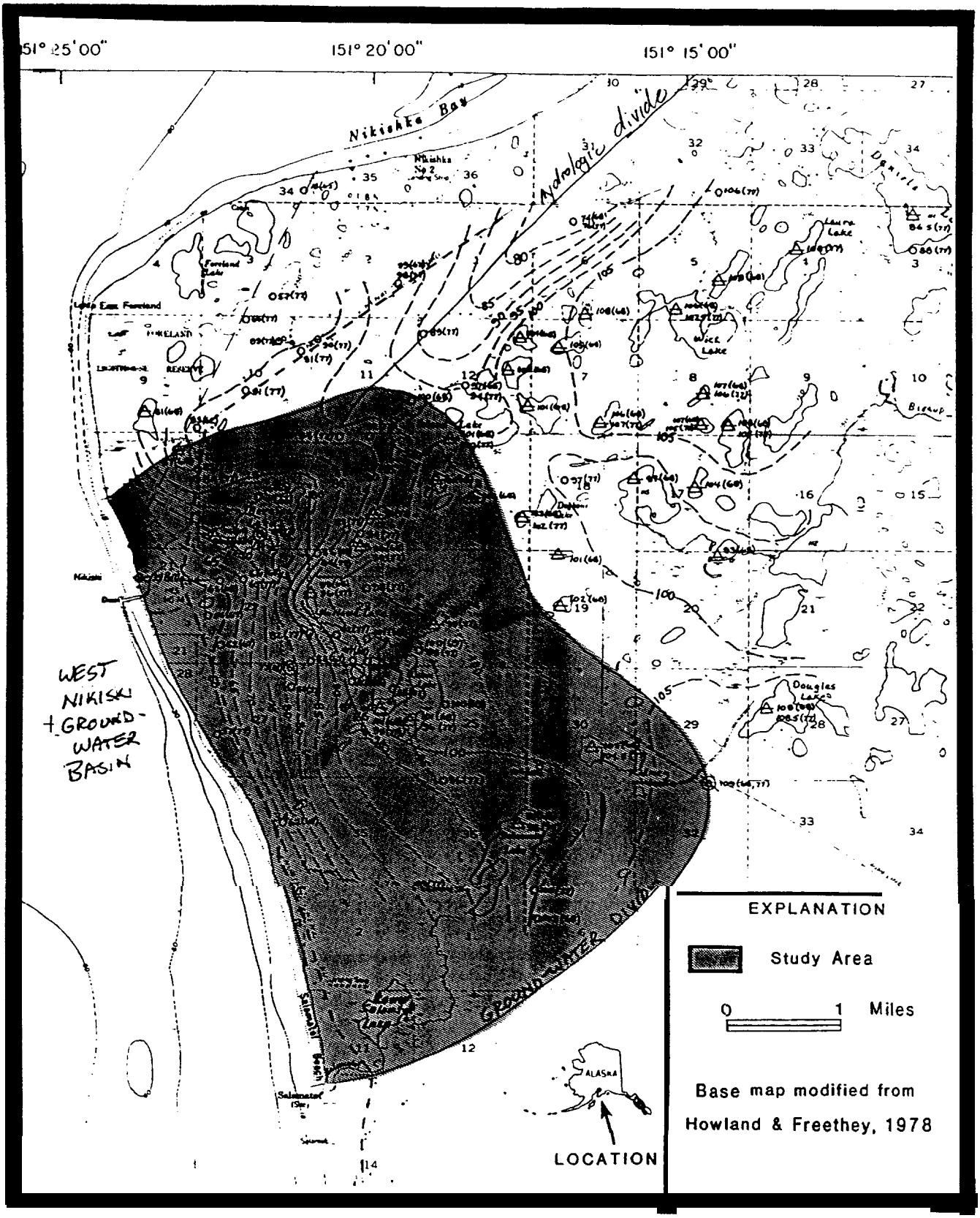


Figure 1. Location of the west Nikiski ground-water basin, Alaska.

DGGS's phase IIIA pilot project is to resolve as many ground-water issues as possible in a one-year period using existing public and private drinking water wells.

This quality assurance plan describes the field and laboratory procedures that DGGS will follow to investigate ground-water quality in the Nikiski area as part of the phase IIIA pilot project. This plan has been prepared according to Alaska Department of Environmental Conservation (ADEC, 1989) guidelines.

SCOPE OF WORK

The scope of work includes the following tasks:

1. Reconnoiter areal ground-water quality by conducting on-site measurements of key parameters.

2. Obtain water samples for laboratory analysis of selected inorganic, organic, and radioactive constituents.

3. Map ground-water quality constituents of concern.

4. Plot and interpret ground-water geochemistry.

APPROACH

The phase IIIA project will be conducted in a one-year time frame. DGGS will advertize the field investigation at the Kenai Peninsula Ground-Water Task Force Meeting and in the local newspaper to obtain a list of homeowners and businesses who would like their well measured and sampled. If the response is great, DGGS will select a subgroup of wells to sample.

Approximately 60 wells will be sampled to accomplish task 1, the reconnaissance-level testing. Wells will be spatially distributed to obtain representative sampling of areal water quality. Preference will be given to wells that have well log or well depth information and a well pump in place. Water temperature, conductivity, pH, total iron, nitrate, and hardness will be determined on-site with field instruments and Hach kits.

About 30 water samples will be collected for laboratory analysis of dissolved ions and dissolved trace metals to accomplish task 2. The wells selected for sampling will be spatially distributed to characterize groundwater geochemistry in the study area.

About 10 of these wells will be also be sampled for volatile organic compounds and radioactive constituents. DGGS will rely on homeowner information, on-site measurements, DGGS's Phase II water quality database for the Nikiski area, the Kenai Peninsula Borough's waste disposal site inventory report (Harding Lawson Associates, 1989), and the Alaska Department of Environmental Conservation's consolidated contaminated sites database to select wells for sampling.

PROJECT ORGANIZATION AND RESPONSIBILITIES

The organization chart for the project is shown on figure 2. The project manager is responsible for overall project design, performance, and reporting. He is the primary project contact person. The quality assurance officer is responsible for identifying and conducting appropriate field methods and laboratory analyses, ensuring that quality control and quality assurance procedures are being adhered to in the field, overseeing commercial laboratory contracts, and reviewing field and laboratory results. The field supervisor is responsible for organizing field work, maintaining equipment and supplies, calibrating field instruments and directing field staff activities. The DGGS laboratory director is responsible for maintaining appropriate DGGS laboratory capabilities, directing the laboratory analyst's activities, and ensuring that laboratory quality control and quality assurance procedures specified in this document are followed.

QUALITY ASSURANCE OBJECTIVES

The data quality objectives for precision, accuracy and completeness are shown on Table 1.

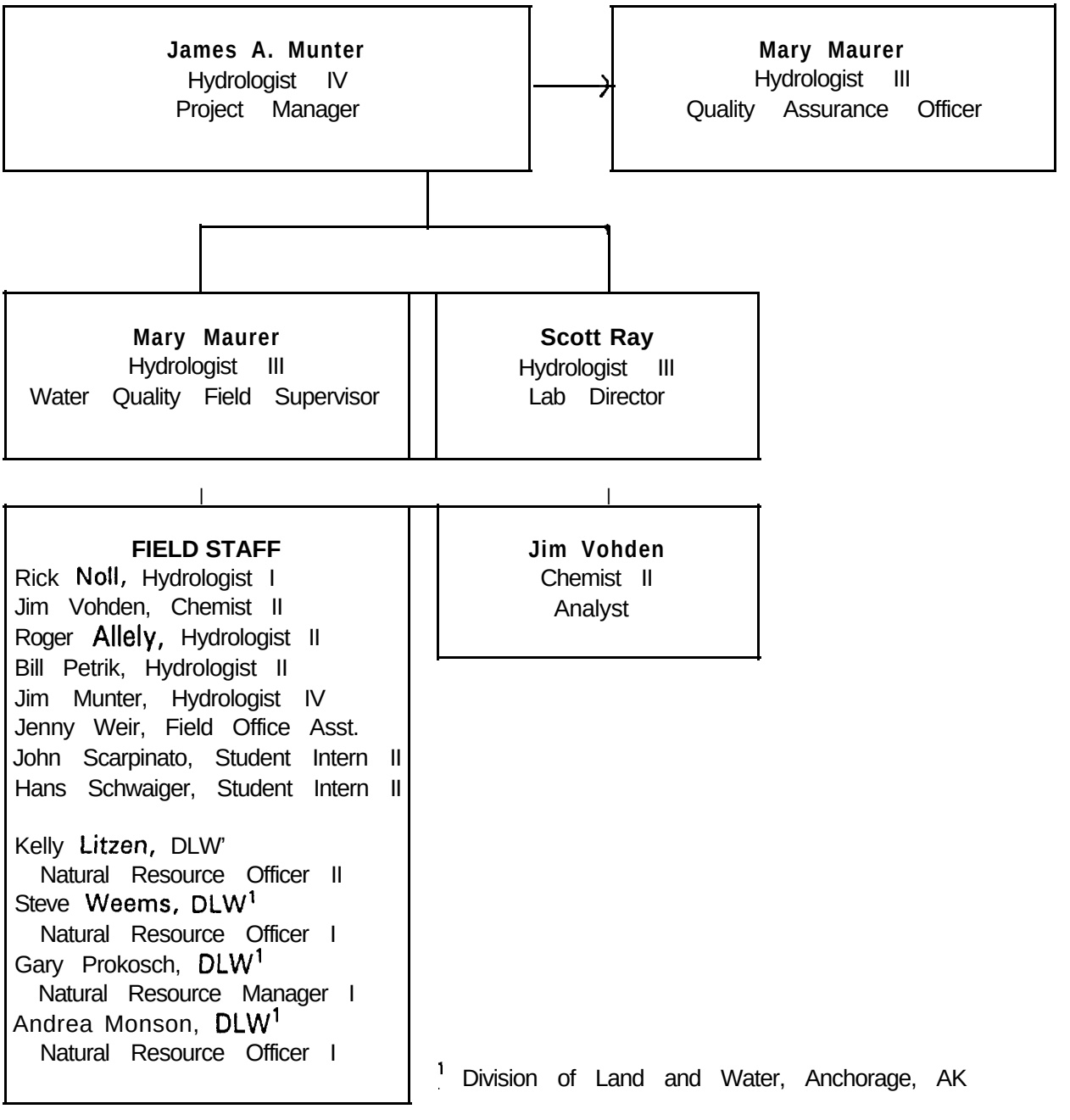
SAMPLING PROCEDURES

All field data and notes will be recorded on field forms shown in Appendix A. Onsite water quality measurements, field instruments, and field kits are listed in Table 2. Well water levels will be measured prior to well purging. Conductivity, pH, and water temperature will be monitored with field instruments while purging. The volume of water purged from wells will depend on the configuration of each system, such as the presence of a pressure tank, storage tank, or reservoir. In such cases, the volume in the tanks will be purged in addition to the well casing volume. Water storage tanks will be bypassed if possible. Normally, four well casing volumes will be purged from shallow wells. For wells deeper than 100 feet, the volume purged may be as small as one casing volume if conductivity, pH, and water temperature readings are stable over a 15 minute period. The standard operating procedure will vary at each well depending on the well depth and storage system in place. Water treatment systems will be bypassed. After purging, water for samples will be collected in a churn splitter when conductivity, pH, and water temperature readings fluctuate less than 10 percent. The preferred collection point will be an outside spigot, but samples may be collected at an inside faucet.

Water samples will be collected according to the procedures listed in Table 3. Containers, preservation techniques, and holding times are in accordance with U.S. Environmental Protection Agency guidelines (40 CFS Part 136.3, p. 286-288, 1990), unless otherwise noted.

Bottles of filtered water will be collected for dissolved metal, mercury and major ion analysis. The filtration unit consists of silicone tubing, a portable MASTERFLEX peristaltic sampling pump, and an inline GEOTECH backflushing filterhead with a 0.45 micron membrane filter. The sample water in the churn splitter is drawn through the tubing by pump suction into the filterhead assembly and discharged into the sample bottle. The first

Figure 2. DGGS organizational chart for the phase IIIA (west Nikiski) pilot project.



filtration step at each site will be to pump about 1 liter of sample water through the filtration unit to rinse the tubing and purge any residual deionized water. Between sites, the churn splitter and filter head will be triple-rinsed with deionized water, and a new filter installed.

Sampling vials for volatile organic compounds will be filled carefully to eliminate air bubbles inside the vial. Duplicate vials will be collected to guard against breakage.

SAMPLE HANDLING

Sample containers furnished by the DGGS laboratory will be new or cleaned according to U.S. Environmental Protection Agency (1982) methods. Sample containers provided by the contract laboratories are cleaned according to procedures described in the laboratory's quality assurance document (Appendices B and C). Sample bottles will be under chain of custody (COC) procedures from the time bottles are received from the supplier or laboratory until the analysis is completed. The field sampler is responsible for filling out the COC record, and signing and placing custody seals across the closures of each sample bottle and shipping cooler. When samples are shipped the sampler will sign, date, and note time and method of shipment on the COC record. A copy of the COC record is shown in Appendix A. Each laboratory receiving samples will receive a COC record. Mailed shipments are certified with return receipt requested. All sample bottles and samples not in direct possession or in view of the field crew will be kept in secured locked areas until shipping.

ANALYTICAL PROCEDURES

The DGGS Water Quality Laboratory in Fairbanks, Alaska, will analyze samples for nitrate + nitrite, total iron, dissolved mercury, and the major ions and trace metals shown on Table 3. DGGS's laboratory analytical method and detection limit for each analyte are listed in Table 4.

Core Laboratories in Laramie, Wyoming, will analyze samples for gross alpha and gross beta radioactivity. The analytical method and detection limits are listed in Table 4.

Volatile organic compound samples will be analyzed at Northern Testing Laboratories in Anchorage, Alaska. The analytical method and range of detection limits are listed in Table 4.

The following sections of this plan refer specifically to the laboratory procedures of the DGGS Water Quality Lab, unless otherwise noted. The quality control document of the contract laboratories contains detailed descriptions of laboratory procedures and checks (Appendices B and C).

CALIBRATION PROCEDURES AND STANDARDS

Laboratory instruments, calibration frequency, and reference manuals are listed in Table 5.

DATA REDUCTION, VALIDATION, AND REPORTING

The DGGS analyst obtains the raw data 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 described previously. Accuracy, precision, and completeness will be calculated using the formulas on page 7.

An analytical report will be produced upon completion of the chemical analyses. The report will include the site identifier, the concentration or value of the parameter, relative percent difference, percent recovery, method code, and detection limits for each parameter.

The accuracy of major dissolved constituent values will be checked by following the procedures in Hem (1 985, p. 164-l 65), which include calculating cation-anion balances, concentration relationships among major cations, and the relationship of conductivity to dissolved solids.

Data collected during this project be compared to Alaska drinking water standards (ADEC, 1982). Data comparisons among sampling sites will be made using various statistical, graphical or tabular methods (Hem, 1985).

INTERNAL QUALITY CONTROL CHECKS

Field Checks

Field Blanks One set of field blanks for each sample type will be collected to evaluate field cleaning procedures and identify possible cross-contamination between sampling sites. The field blank sample, which consists of deionized water, is processed on site through the same collection equipment and treatment procedures as all other field samples. Field blanks will represent ten percent of the total of each sample type collected.

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 of each sample type collected.

Trio Blanks Trip blanks, consisting of organic-free water provided by Northern Testing Laboratories, will be included with each set of volatile organic compound samples.

Duplicate samples pertain to all sample types, including those analyzed by contract laboratories. Field blanks pertain only to inorganic and radioactive samples. Trip blanks are processed with volatile organic compound samples only.

Laboratory Checks

Reaaent 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.

Qualitv control samples Standard reference samples of known composition from the USEPA laboratory (Cincinnati, Ohio) or 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 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 (see Table 5) 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 INDICATORS

Standard operating procedures for assessing data quality indicators for precision are based on expected precision figures listed in Standard Methods (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_1 = 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. The project manager will be responsible for initiating all corrective actions with the approval of the quality assurance officer.

QUALITY ASSURANCE REPORTING PROCEDURES

The quality assurance officer will submit a written report on the data quality objective performance of each analytical laboratory to the project manager after the final analytical reports are received.

REFERENCES CITED

Alaska Department of Environmental Conservation, 1982, State of Alaska, Drinking water regulations: ADEC, Juneau, 20 p.

_____ 1989, Guidelines for preparing quality assurance project plans: unpublished report ADEC-QA-006/88, Revision No. 2, 5/1 9/89, 11 p.

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.

Harding Lawson Associates,1 989, Comprehensive inventory report, potential waste disposal sites and other reports/complaints, Kenai Peninsula Borough, Alaska: Harding Lawson Associates, Anchorage, Alaska. Report prepared for Alaska Department of Environmental Conservation, Juneau, Alaska, December 1989.

Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water, Third Edition: U.S. Geological Survey Water-Supply Paper 2254, 263 p.

Howland, M., and Freethey, G.W., 1978, Selected hydrologic data related to the water-table aquifer of the north Kenai area, Alaska: Alaska Division of Geological and Geophysical Surveys, Open-File Report 112, scale 1:63,360, 1 sheet.

Kenai Peninsula Ground-Water Task Force, 1990a, Overview of plans for an areawide ground-water study, Kenai Peninsula, Alaska: Prepared by Kenai Peninsula Ground-Water Task Force, unpublished document, August 15, 1990, 6 p.

_____ 1990b, Regional hydrogeologic study Kenai Peninsula Phase II project plan: Prepared by Kenai Peninsula Ground-Water Task Force, unpublished document, August 15, 1990, lo p.

_____ undated, Kenai Peninsula Ground-Water Study Phase III Pilot Project: Prepared by Kenai Peninsula Ground-Water Task Force, unpublished document, unpaginated.

National Archives and Records Administration, 1990, Code of Federal Regulations Title 40, Chapter 1 - Environmental Protection Agency (Continued) (Parts 100-149): U.S. Government Printing Office, Washington DC, 1990, 969 p.

U.S. Environmental Protection Agency, 1982, Handbook for sampling and sample preservation of water and wastewater: U.S. Environmental Protection Agency, EPA-600/4-82-029 September 1982.

Table 1. Data quality objectives.

LABORATORY

Constituent	Precision (%RPD)	Accuracy (%R)	Completeness (%)
Common Ions (F, Cl, NO,+ NO,, SO,)	10	90-l 10	95
Metals (Ca, Mg, Na, K, Fe, Mn)	20	80-120	95
Trace Metals (Al, As, Ba, Cd, Cu, Cr, Pb, Hg, Ni, Zn)	20	80-120	95
Radioactivity (Gross alpha, Gross beta)	20	90-l 10	95
Volatile Organic Compounds	40[1]; 20[2]	70-130	95

FIELD

Constituent	Calibrated Accuracy
Water Temperature	± 0.2°C
pH	± 0.1 unit
Conductivity	± 1.0 %

[1] RPD for duplicates <20 Method Detection Limit
[2] RPD for duplicates >20 Method Detection Limit

Table 2. On-site water quality measurements and instrument calibration frequency.

Constituent	Instrument or method	Calibration and freauencv
Water temperature	Hydrolab Model 4041 or VWR thermometer	Compared against ERTCO precision-grade thermometer, complies with NBS; weekly
pH	Hydrolab Model 4041 or Beckman pHl 1 1 meter	Beckman pH 4.0, pH 7.0, pH 10.0 buffer solutions; Hydrolab--daily; Beckman meter--on-site
Conductivity	Hydrolab Model 4041 or Cole Parmer digital conductivity meter no. 0 1500-30	KCI standard solutions, ranging from 0.0005 Molar to 0.05 Molar; daily
Alkalinity'	Gran technique[2]; potentiometric titration with Digital Titrator on untreated water	Beckman pH meter calibrated on-site with pH 4.0 and pH 7.0 Beckman buffers prior to each titration
Total Iron	HACH kit, model IR-18B; color disc/l ,10 Phenanthroline	Not applicable
Hardness, total as $CaCO_3$	HACH kit, model HA-DT; Digital Titrator/EDTA	Hardness standard solution and calcium standard solution; weekly
Nitrate, as NO,-N	HACH kit, model NI-14; color disc/cadmium reduction	Not applicable

[1] Measured at sites where major ion samples are collected.
[2] Titration method according to "Marine Chemistry Volume I Analytical Methods", by D.F. Martin, Marcel Dekker, Inc. New York, p. 57-68, 1972.

Table 3. Sampling, preservation, and handling procedures for Nikiski water quality sampling.

Constituent	Sampling method	Sample treatment	Bottle	Preservation method	Maximum holding time
Metals (As,Al,Ba,Cd,Cr, Cu,Fe,Mn,Pb,Ni,Zn) Major Ions (Ca,Mg,K,Na)	Pumped water collectedin a churn splitter near wellhead or at tap	Water filtered with a 0.45 μm membrane filter	250ml plastic	Precharged at lab with 2ml ULTREX HNO,	6 months
Mercury'	same as above	same as above	125ml glass	Precharged at lab with a 6ml ULTREX HNO, + 0.01% $K_2 Cr_2 O_7$	28 days
Major Ions (F,Cl,SO_4)	same as above	same as above	250ml plastic	cool to 4°C	28 days
Nitrate + Nitrite	same as above	same as above	250ml plastic	Precharged at lab H_2SO_4 to pH<2; cool to 4°C	28 days
Iron, total	same as above	none	250ml plastic	Precharged at lab with a 2ml ULTREX HNO,	6 months
Gross alpha[2]/gross beta[2]	same as above	none	1 L plastic	Precharged at lab with 4ml HNO,	6 months
Volatile organic compounds[2]	fill bottle at tap or wellhead; no bubbles	none	40 ml glass septum vial	Precharged at lab with HCI; cool to 4°C; keep in dark	14 days

[1] Preservation method according to "Preservation of samples for dissolved mercury", by S.N. Hamlin, Water Resources Bulletin, American Water Resources Association, Volume 25, No. 2, pp. 255-262, 1989.

[2] Selected wells only.

Table 4. Analytical methods and detection limits.

Constituent	EPA Method	Detection Limit[1]
Alkalinity (lab)	310.1	--
pH (lab)	150.1	--
Conductivity (lab)	120.1	--
Fluoride	300.0	0.01
Chloride	300.0	0.01
Nitrate + Nitrite	353.2	0.1
Sulfate	300.0	0.01
Calcium	AES 0029	0.01
Magnesium	AES 0029	0.01
Sodium	273.1	0.1
Potassium	258.1	0.01
Iron	AES 0029	0.03
Manganese	AES 0029	0.005
Aluminum	AES 0029	0.005
Arsenic	206.2	0.001
Barium	AES 0029	0.005
Cadmium	213.2	0.001
Copper	220.2	0.001
Chromium	218.2	0.001
Lead	239.2	0.001
Mercury	Hydride	0.001
Nickel	249.2	0.001
Zinc	AES 0029	0.02
Gross alpha	900.0	0.5 pCi/l
Gross beta	900.0	0.3 pCi/l
Volatile organics compounds	502.2	0.0002-0.002[2]

[1] Milligrams per liter unless otherwise noted
[2] Detection limit will vary depending on the compound analyzed

Table 5. Calibration frequency, instrumentation, and reference manuals used by the DGGS water quality Laboratory.

Constituent	Calibration Freauencr	Instrument	Reference Manual
Alkalinity	pH meter calibrated each titration, acid calibrated each month	Beckman pHI 11 meter	1
pH	calibrated before every measurement	Beckman pHI 11 meter	1
Conductivity	daily	Cole-Parmer meter no. 01500-20	2
F, Cl, $NO_3 + NO_2$, SO,	every 6 samples	DIONEX Ion Chromatograph	3
Na, K	every 6 samples	Perkin-Elmer Flame Atomic absorption Spectrophotometer (AA)	4, 5
Hg	every 10 samples	Perkin-Elmer AA, MHS-1 Mercury/ Hydride System	4, 6, 7
As, Cd, Cr, Cu, Ni, Pb	every 5 samples	Perkin-Elmer AA 400 HGA Graphite Furnace	4, 8, 9
Al, Ba, Ca, Fe, Mg, Mn, Zn	every 6 samples	ARL DCP Plasma Spectrophotometer	10

Reference Manuals

1 Beckman pHI 11 pH meters, instruction and maintenance; Beckman Instruments, Inc., Irvine, CA 92713.

2 Cole Parmer conductivity meter, instruction and maintenance, Cole-Parmer Instrument Co., 7425 North Oak Park Avenue, Chicago, IL 60648.

3 DIONEX ION CHROMATOGRAPHY COOKBOOK, A Practical Guide to Quantitative Analysis by Ion Chromatography, DIONEX Corp., 1228 Titan Way, Sunnyvale, CA 94088-3603, 1987

4 Perkin-Elmer Model 4000 Atomic Absorption Spectrophotometer, Perkin-Elmer Corp., Norwalk, Connecticut, USA; Revised April 1979.

5 Analytical Methods for Atomic Absorption Spectrophotometry, Perkin-Elmer Corp., printed in West Germany, January 1982.

6 Perkin-Elmer MHS-1 Mercury/Hydride System Operator's Manual: Perkin-Elmer Corp., Printed in West Germany, August 1977.

7 Analytical Methods using the MHS Mercury/Hydride System, Perkin-Elmer Corp., printed in West Germany, revised October 1978.

8 Perkin-Elmer HGA-400 Graphite Furnace Operator's Manual, Perkin-Elmer Corp., Printed in West Germany, April 15, 1979.

9 Analytical Methods for Furnace Atomic Absorption Spectroscopy, Perkin-Elmer Corp., Printed in West Germany, Revised February 1980.

10 ARL SpectrSpan VI Rapid Scanning High Resolution Spectraphotometer Operator's Manual and Tutorial, Applied Research Laboratories, 3080 Enterprise Blvd., Brea, CA 92621, July 1987.

Appendix A. Field forms and Chain of Custody forms

FORM NO. 9-1904-E
Revised September 1980

U.S. DEPT. OF INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL NO. ____________
MP HEIGHT ____________

WATER-LEVEL DATA

Site Ident. No. 5 ... 19 | R = 234 * | T = A *

DATE		WATER LEVEL (BELOW LSD)		STATUS		METHOD		CUT	DEPTH BELOW MP	REMARKS	DATE PUNCHED	DATE ENTERED
235 # / /	*	237 = •	*	238 =	*	239 =	*					
235 # / /	*	237 = •	*	238 =	*	239 =	*					
235 # / /	*	237 = •	*	238 =	*	239 =	*					
235 # / /	*	237 = •	*	238 =	*	239 =	*					
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235 # / /	*	237 = •	*	238 =	*	239 =	*					

Method of Measurement 239 =

A	B	C	E	G	H	L	M	N	R	S	T	V	Z
airline	analog	calibrated airline	estimated	pressure gage	calibrated pressure gage	geophysical logs	manometer	non-recording gage	reported	steel tape	electric tape	calibrated electric tape	other

Site Status 238 =

D	E	F	G	H	I	J	N	Ø	P	R	S	T	V	W	X	Z
dry	recently flowing	flowing	nearby flowing	nearby recently flowing	injector	injector or site monitor	discontinued measuring	obstruction	pumping	recently pumped	nearby pumping	nearby recently pumping	foreign matter on water	well destroyed	affected by surface water site	other

MEASURING POINT

R = 320 * | T = A D M * (add, delete, modify)

M.P. Begin Date 321 # / / *
M.P. End Date 322 = / / *
M.P. Height 323 = • *
M.P. Remark 324 *

STATE OF ALASKA • DEPARTMENT OF NATURAL RESOURCES
Division of Geological & Geophysical Surveys
PO BOX 772116, Eagle River AK 99577-2116 • Ph. (907) 696-0070

WATER QUALITY FIELD NOTES - GROUND WATER

Location/Project: _____ Date: _____ Collected by: _____

Well Owner: _____ Weather conditions: _____

Use of well: _____ Well name: _____

Sampling equipment (for measuring water level, purging, sampling and filtering • include model if appropriate): _____

_____

Casing material: _____ Time sample withdrawn: _____

Casing diameter: _____ Field water temperature (°C)/time: _____

Casing condition: _____ Field conductivity (uncorrected)/time: _____

Total depth to water (ft): _____ Field conductivity (slope corrected): _____

Depth to bottom of well (ft): _____ Field pH (standard units)/time: _____

Volume of H_2O in well (gal): _____ Turbidity (Y/N): _____

Pressure tank volume (gal): _____ Color (Y/N): _____ Odor (Y/N): _____

Volume to be purged (4 x vol. in well): _____ Hach Iron: _____ mg/l Hach Nitrate: _____ mg/l

lime purging began: _____ Time purging completed: _____ Hach Hardness: _____ mg/l as $CaCO_3$

Purged Dry? (Y/N): _____ Well cap and lock replaced? ((Y/N): _____

Bottle No:							
Analysis:							
Treatment:	unfiltered	filtered	filtered	filtered	filtered	unfiltered	unfiltered
volume (ml)							
preservative							

Alkalinity: Sample size _____ ml; H_2SO_4 _____ (factor) Instruments _____

TITER (digits)	pH	TITER (digits)	pH	TITER (digits)	pH	TITER (digits)	pH

COMMENTS: _____

WATER RESOURCES SECTION
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CHAIN OF CUSTODY RECORD

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL A"" GEOPHYSICAL SURVEYS

PROJECT NAME:

PROJECT MANAGER:

FIELD TEAM LEADER:

SAMPLER (signature please):

SEND RESULTS TO:

SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE GW	SW	S	G	C	ANALYSIS REQUESTED: Iron, total	Metals, diss.	Mercury, diss.	Ions, diss.	Nitrate+Nitrite, diss.	TURBIDITY	TOTAL ALPHA	TOTAL BETA	TRITIUM	Volatile Org.	NUMBER OF CONTAINERS 125 ml	250 ml	500 ml	1000 ml	REMARKS	STATION LOCATION	REMARKS

FIELD MEASUREMENTS

SAMPLE NUMBER	AIR TEMP (°C)	H_2O TEMP (°C)	pH	COND. umhos/cm uncor.	ALKAL. mg/L as $CaCO_3$	DISS. OXYGEN (mg/L)	TURBID (NTU)	

CODES, G N = GROUND WATER G = GRAB
S W = SURFACE WATER C = COMPOSITE
S = SPRING

RELINQUISHD BY:(signature)	DATE	TIME	RECEIVED BY: (signature)	DATE	TIME
RELINQUISHD BY:(signature)	DATE	TIME	RECEIVED BY: (signature)	DATE	TIME
RELINQUISHD BY:(signature)	DATE	TIME	RECEIVED BY: (signature)	DATE	TIME
RELINQUISHD BY:(signature)	DATE	TIME	RECEIVED BY: (signature)	DATE	TIME
RELINQUISHD BY:(signature)	DATE	TIME	RECEIVED BY: (signature)	DATE	TIME

METHOD OF SHIPMENT FROM LAB TO FIELD:

METHOD OF SHIPMENT FROM FIELD TO LAB:

CONDITION OF SAMPLES UPON RECEIPT AT FIELD: INTACT: YES( )NO( )

CONDITION OF SAMPLES DPON RECEIPT AT LAB: INTACT: YES( )NO( )

Appendix B. Core Laboratories quality control document

Western Atlas International

CORE LABORATORIES

CORE LABORATORIES

ANALYTICAL CHEMISTRY DMSION

SERVICE DESCRIPTION AND FEE SCHEDULE

Effective Date: April 1, 1990

Prices Subject to Change Without Notice

U.S. Price List

METHODOLOGY/SAMPLE CONTAINER REQUIREMENTS

Parameter	Method Reference	Volume (mL)	Bottle Type	Preservative(5)
Sodium (Na)				
Flame	273.1(1)/7770(2)	20	P,G	HNO3
ICP	200.7(1)/6010(2)	20	P,G	HNO3
Furnace	273.2(1)	20	P,G	HNO3
Strontium (Sr)				
Flame	303-A(3)	20	P,G	HNO3
ICP	200.7(1)/6010(2)	20	P,G	HNO3
Thallium (Tl)				
Flame	279.1(1)/7840(2)	20	P,G	HNO3
ICP	200.7(1)/6010(2)	20	P,G	HNO3
Furnace	279.2(1)/7841(2)	20	P,G	HNo3
Tin (Sn)				
Flame	282.1(1)/7870(2)	20	P,G	HNO3
ICP	200.7(1)/6010(2)	20	P,G	HNO3
Furnace	282.2(1)	20	P,G	HNo3
Titanium (Ti)				
Flame	283.1(1)	20	P,G	HNO3
ICP	200.7(1)/6010(2)	20	P,G	HNO3
Furnace	283.2(1)	20	P,G	HNO3
uranium (U3O8)				
ICP	200.7 (1)/6010(2)	20	P,G	HNO3
Fluorometric	908.1(4)	100	P,G	HNO3
vanadium (V)				
Flame	286.1(1)/7910(2)	20	P,G	HNO3
ICP	200.7(1)/6010(2)	20	P,G	HNO3
Furnace	286.2 (1)/7911(2)	20	P,G	HNO3
Zinc (Zn)				
Flame	289.1(1)/7950(2)	20	P,G	HNO3
ICP	200.7(1)/6010(2)	20	P,G	HNo3
Furnace	289.2(1)	20	P,G	HNo3
→ Gross Alpha/Beta	900.0(4)	250	P,G	HNO3
Total Radium	900.1(4)	1000	P,G	HNO3
Radium 226	903.1(4)	1000	P,G	HNO3
Radium 228	904.0(4)	1000	P,G	HNO3
Ignitability	1010(2)	100	P,G	Cool,4C
Corrosivity	1110(2)	100	P,G	Cool,4C
Reactivity	7.3(2)	500	P,G	Cool,4C
EP Toxicity	1310(2)	1000	P,G	Cool,4C
Purg. Halocarbons	601(5)/8010(2)	40(NHS)	G/TFE	Cool,4C
Purg. Aromatics	602(5)/8020(2)	40(NHS)	G/TFE	HCl,Cool,4C
Acrolein/Acrylonitrile	603(5)/8030(2)	40(NHS)	G/TFE	Cool,4C
Phenols	604(5)/8040(2)	1000	G/Amber/TFE	Cool,4C
Benzidines	605(5)	1000	G/Amber/TFE	Cool,4C
Phthalate Esters	606(5)/8060(2)	1000	G/Amber/TFE	Cool,4C
Nitrosamines	607(5)	1000	G/Amber/TFE	Cool,4C
Pesticides/PCB's	608(5)/8080(2)	1000	G/Amber/TFE	Cool,4C

METHODOLOGY/SAMPLE CONTAINER REQUIREMENTS

Parameter	Method Reference	Volume (mL)	Bottle Type	Preservative(5)
Nitroaromatics	609(5)/8090(2)	1000	G/Amber/TFE	Cool,4C
Polynuclear Aromatics	610(5)/8100(2)	1000	G/Amber/TFE	Cool,4C
Haloethers	611(5)	1000	G/Amber/TFE	Cool,4C
Chlorinated HC	612(5)/8120(2)	1000	G/Amber/TFE	Cool,4C
Dioxin	613(5)/8280(2)	1000	G/Amber/TFE	Cool,4C
Volatiles	624(5)/8240(2)	40(NHS)	G/TFE	HCl,Cool,4C
Semi-Volatiles	625(5)/8270(2)	2000	G/Amber/TFE	Cool,4C
Pesticides/PCB's	608(5)/8080(2)	1000	G/Amber/TFE	Cool,4C
BTX/BETX	602,624(5)/8020,8240(2)	40(NHS)	G/TFE	HCl,Cool,4C
Trihalomethanes	601(5)/8010(2)	40(NHS)	G/TFE	Cool,4C
EPA VOC's	EPA 524	3X40(NHS)	G/TFE	HCl,Cool,4C

References:

(1) EPA-600/4-79-020, Methods for the Analysis of Water and Wastes, March 1983.

(2) EPA-SW-846, Test Methods for Evaluating Solid Waste, Third Edition, Nov 1986.

(3) APHA, Standard Methods for the Examination of Water and Wastewater, 16th Ed, 1985.

(4) EPA-600/4-80-032, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, August 1980.

(5) Federal Register, Friday, October 26, 1984 (40 CFR Part 136).

(6) EPA-600/8-78-017, Microbiological Methods for Monitoring the Environment, Dec 1978.

(NHS = No Head Space)

CORPORATE QUALITY PROCESS

ADMINISTRATIVE POLICIES AND PROCEDURES

ADMINISTRATIVE POLICIES AND PROCEDURES

Western Atlas International

CORE LABORATORIES

CORPORATE QUALITY PROCESS		Subject-title: ADMINISTRATIVE POLICIES AND PROCEDURES	
Dote issued: Feb. 1, 1989	Approved by: Dare K. Keelan	Revision Dote:	Poge: 1 of 67

ADMINISTRATIVE POLICIES AND **PROCEDURES**

INTRODUCTION

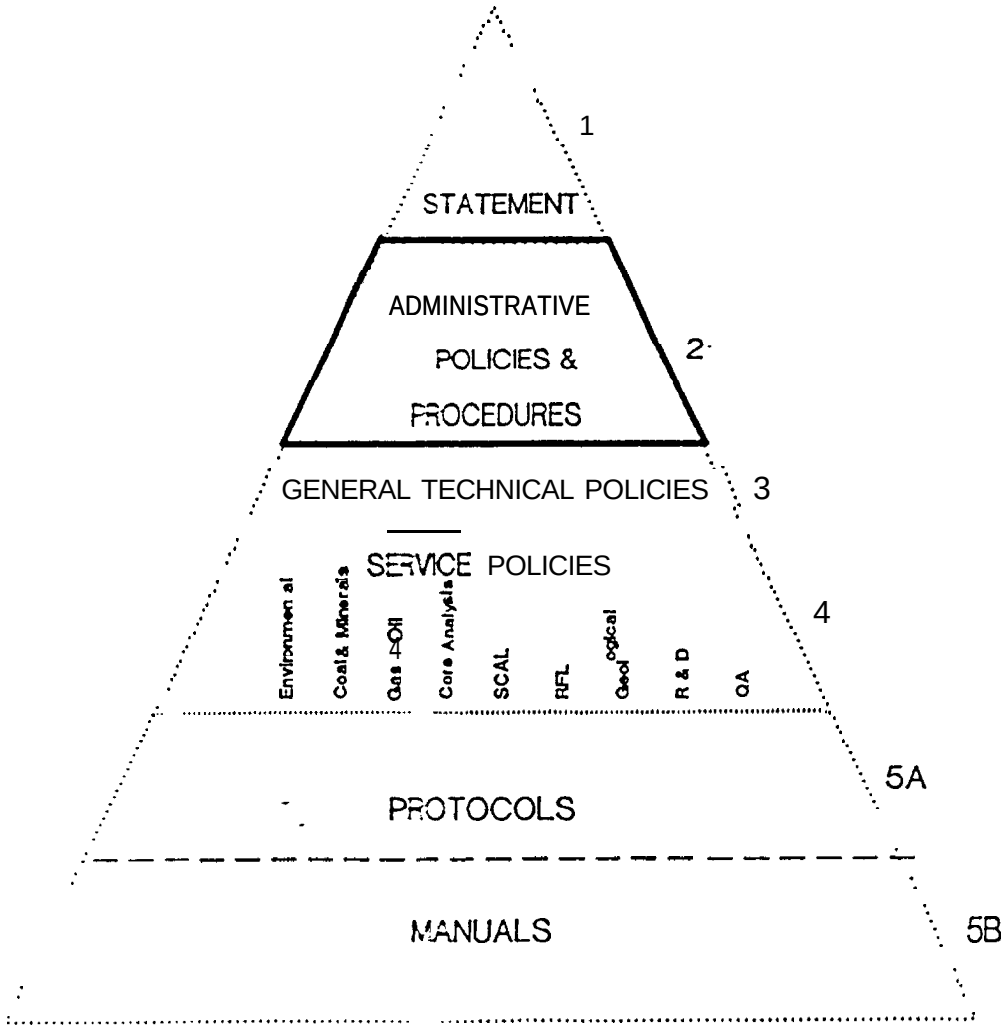
This document comprises Tier 2 cf the Corporate Quality Process Documentation Hierarchy, illustrated in figure 1. It concisely describes Core Laboratories policy on basic laboratory management. It does not deal with general management policy (employee relations, accounting, finance, legal functions etc.). This document is used as supporting and explanatory material for the laboratory administrative audit. Forms use-d in this audit are included as an Appendix.

As an aid in understanding the inter relationships between succeeding tiers of documentation in the hierarchy, figure 2 is provided.

Tiers 1, 2 and 3 comprise overall corporate policy applicable to all laboratories. Tiers 4, 5A and 5B will be discipline specific.

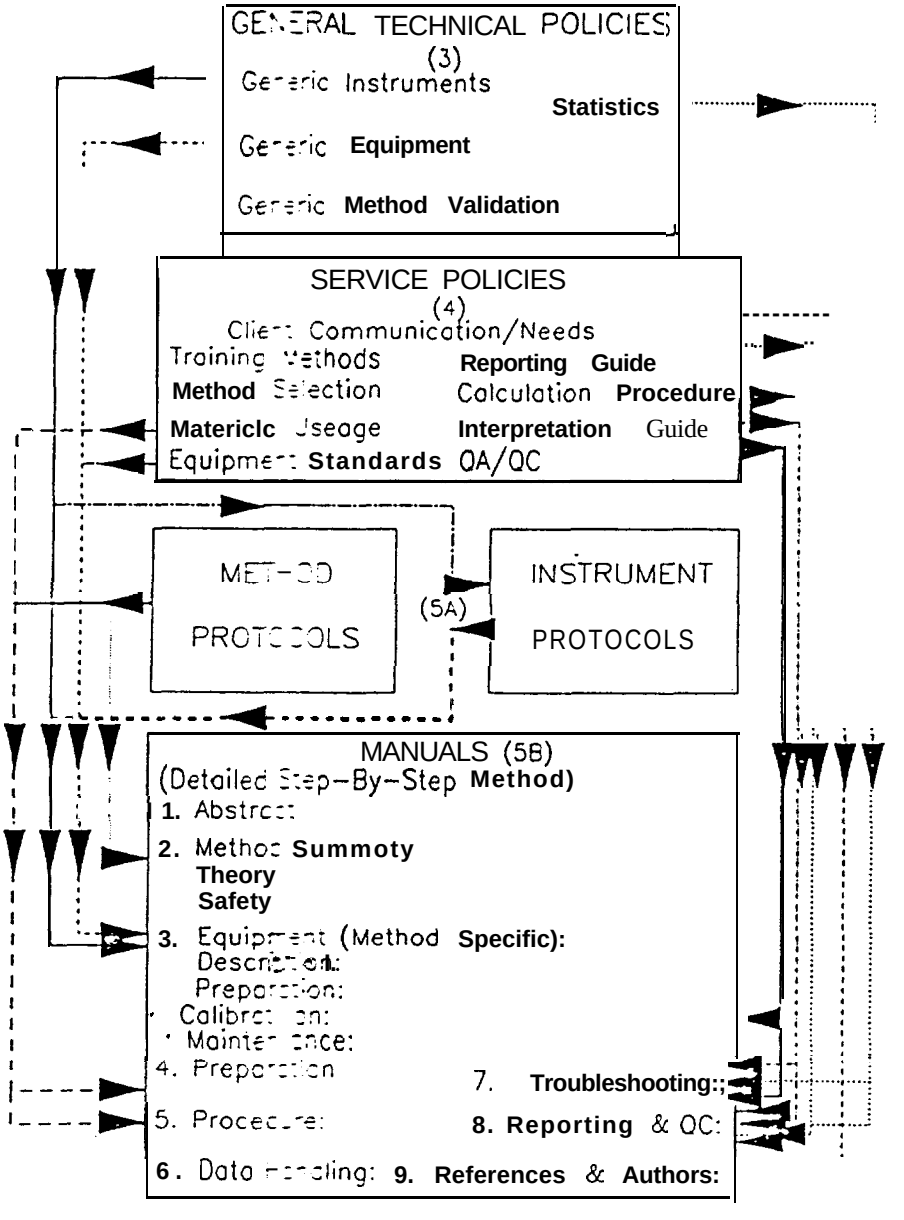
CORPORATE QUALITY PROCESS		Subject-title: ADMINISTRATIVE POLICIES AND PROCEDURES	
Dote issued: Feb. 1, 1989	Approved by: Dare K. Keelan	Revision Dote:	Poge: 2 of 67

DOCUMENTATION HIERARCHY



CDB/WL/01-89

Figure 1


GENERAL TECHNICAL POLICIES
(3)
Generic Instruments
Statistics
Generic Equipment
Generic Method Validation
SERVICE POLICIES
(4)
Client Communication/Needs
Training Methods
Reporting Guide
Method Selection
Calculation Procedure
Matericlc Jseage
Interpretation Guide
Equipment Standards
QA/QC
METHOD PROTOCOLS
(5A)
INSTRUMENT PROTOCOLS
MANUALS (5B)
(Detailed Step-By-Step Method)
1. Abstract
2. Method Summoty
Theory
Safety
3. Equipment (Method Specific):
Description:
Preparation:
Calibration:
Maintenance:
4. Preparation
5. Procedure:
6. Data handling:
7. Troubleshooting:
8. Reporting & QC:
9. References & Authors:

A

Figure 2

9.0 GENERAL LABORATORY QUALITY CONTROL ADMINISTRATION

9.1 GENERAL POLICY

9.1.1 Our goal is to produce impeccable service that will satisfy Client Requirements.

9.1.2 As a guideline, total quality control efforts will consume not less than 10% and "typically" not more than 20% of all employee effort.

9.1.3 All data that is produced at a laboratory shall be verified with quality control documentation.

9.2 ON-SITE QUALITY CONTROL OFFICER

Each location is to assign an on-site Quality Control Specialist (QC officer), reporting directly to the Lab Manager or Lab Supervisor, to be in charge of administering the Quality Control Program. This person must be technically astute and capable of training laboratory analysts. At locations where there are only a small number of employees, the supervisor might double as the QC officer; in slightly larger locations, the role of QC officer might be combined with other responsibilities.

9.2.1 Quality Control Officer Responsibilities

9.2.1.1 Be knowledgeable to communicate company policy for laboratory operation and to disseminate policy updates (Alert Hemos) as they become avail able.

9.2.1.2 Administer policies for proper maintenance and cal ibration of laboratory utilities, instruments, equipment and reagents.

9.2.1.3 Ensure rhat all quality control activities and records are maintained and current.

9.2.1.4 Assist the Laboratory Supervisor or Manager in training and associated documentation.

9.2.1.5 Properly maintain reference material and standards for calibration and verification.

9.2.1.6 Coordinate all Round Robin and Random Recall program participation, whether within or outside the company.

9.2.1.7 Follow-up problems that are identified by any of the Round Robins with written responses -and corrective measures.

9.2.1.8 Be familiar with the LIMS, Lotus 123, and Word Perfect and utilize these for documentation.

9.2.1.9 Conduct Quarterly Audits and provide summaries for corrective action and numerical evaluations.

9.2.1.10 Identify and delegate appropriate QC tasks.

9.2.1.11 Write succinct, monthly status reports to the Lab Manager and Quality Assurance Manager. These should include documentation of corrective action of any identified problem that is found by audit, round robin, random recall or Client.

9.2.1.12 Maintain close contact with the Corporate Quality Assurance Department.

9.2.2 Qualifications

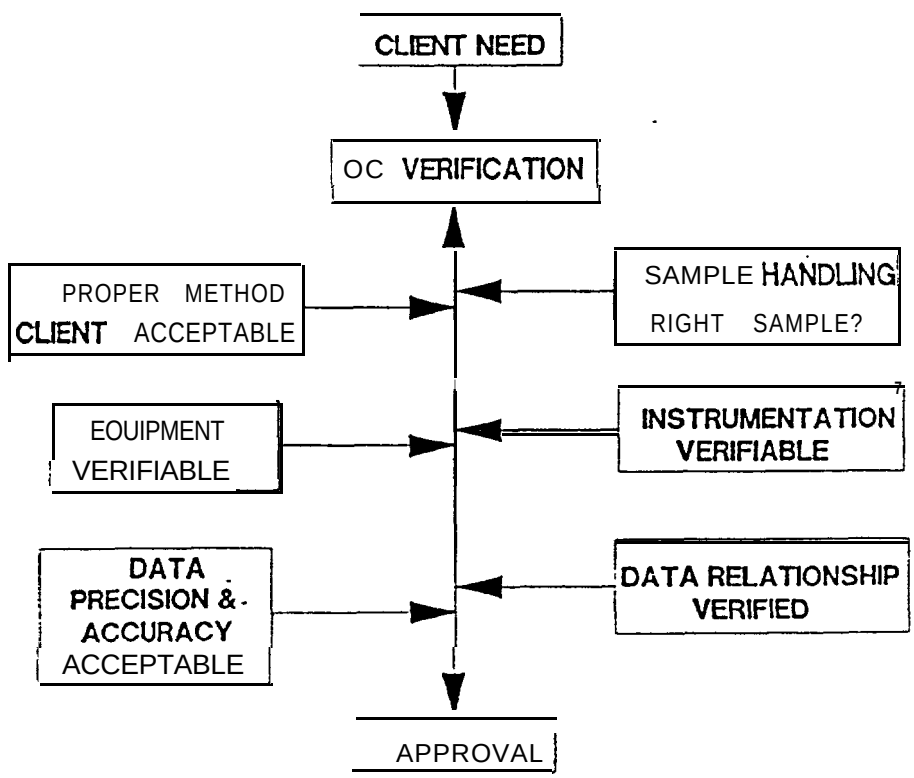
Must be an employee with a bachelor's degree in science or engineering and a minimum of 5 years experience. Exceptions may be granted by the Corporate Quality Assurance Department.

9.3 GENERAL QUALITY CONTROL VERIFICATION

Verification of proper instrument and equipment operation, calibration, precision and accuracy are the responsibility of each analyst.

These fundamental QC components are always to be done at the bench before and during the testing or analysis.

The following schematic illustrates the quality verification process as shown here.



9.3.1 Instrument Verification

9.3.1.1 Any instrument used to produce data should have documentation available that verifies proper operation and calibration for all time periods during which the samples were tested or analyzed. Any result that is reported should be verifiable in terms of proper instrumfnt operation.

9.3.1.2 Calibration and maintenance protocols (and frequencies) should be posted on or by the instrument along with a record (log book or sheet).

9.3.2 Equipment Verification

9.3.2.1 Any device that HELPS in data production should have documentation available that verifies proper operation and calibration for all time periods during which the device is in service.

9.3.2.2 Included are items such as thermometers, transducers, pressure gauges, automatic pipets and dispensers, balances, ovens or specialized glassware. Class A volumetric glassware does not require specific verification except in certain cases (i.e. when used for density).

9.3.2.3 Calibration and maintenance protocols and record books should be accessible at all times.

9.3.3 Data Verification

For each analytical batch of samples, the following Quality Measurement sampirs should be analyzed. Repeatability (precision), percent recovery (accuracy) and blank verifications

should be within tte control limits (found in Method Protocols and Statistical Summaries) at all times.

9.3.3.1 Acceptable Data -- If no outliers are detected, the data is judged to be acceptable.

9.3.3.2 Unacceptable Data -- If statistical outliers are detected, it is the analyst's responsibility to:

A) Immediately discontinue data production.

B) Inform their immediate supervisor or QC Officer.

C) Investigate and identify the cause of the problem.

D) Take remedial action to correct the damage, once confirmation of the problem has been made with the appropriate authority:

E) Reanalyze all samples that are in question, along with extra quality measurement samples as specified in the Service Area Protocols.

9.3.4 Quality Control Samples

The following Quality Control Samples will be analyzed with each batch of analytical samples to measure data quality at the time of analysis. Data derived from these analyses should be organized, retained and accessible.

9.3.4.1 Duplicate Samples -- shall be analyzed as a minimum (as is possible) at least once per batch of samples or at a rate of 10% within each batch of sample analysis. Preferably, duplicates will consist of samples that are analyze: from batch to batch, but will at least consist of maximized time and order differences within a batch.

9.3.4.2 Reference Materials -- shall be analyzed at least once per sample batch and/or not less than a rate of 10% of the total work load. These will consist of Spikes where applicable and Reference Materials of similar matrix to the samples being analyzed.

9.3.4.3 Calibration Confirmation -- Calibration standards of any comparative type analysis (such as Atomic Adsorption Spectrophotcsetry) must be confirmed to be accurate by the use of a secondary source of standard which is termed a Laboratory Control Sample (LCS). Specifically, the LCS's are for immediate feedback for the analyst in order to detect problems as soon as possible. These must be traceable to NBS, EPA, or other recognized governing body.

9.3.4.4 Blank Confirmation -- Where applicable, a blank analysis will be done for each set of samples. For instruments which autofeed multiple samples, there should be at least one check sample/blank per instrument run. Any type of trace contaminate analysis will require blank determination as a part of the QC protocol.

9.3.5 Client Need and Data Relationship Verification

9.3.5.1 Data Relationships -- Techniques are listed within each of the Service Areas or Analytical Disciplines along with control limits where applicable to identify problems. It is Company Policy to use these to judge overall acceptability of the data by senior technical personnel in the laboratory.

9.3.5.2 Historical Data Review -- Whenever possible, background information on sample series should be compared against the current analyses that are to be reported. If possible, Client-imposed or In-house Control Limits should be used to

judge data acceptability. Otherwise, senior level personnel at the laboratory should make judgments as to the quality.

9.3.5.3 Client Need -- Client communicated data criteria should be compared against the measured data to ensure that his/her needs are met.

9.4 METHOD SELECTION

9.4.1 Method selection criteria for each discipline:

9.4.1.1 Client need or Client specification

9.4.1.2 Approved industrial or governmental standards such as ASTM, GPA, API EPA and other recognized agencies

9.4.1.3 When a variety of standard methods exist and the client has no preference or specification, or if no standard method is available, Core Lab staff experts will specify the method of choice. Experts are designated by Quality Assurance and Division Management.

9.4.1.4 Methods in Core Lab are standardized by Technical Expert Committees. Deviations from these methods are not allowed except for circumstances where Client needs run counter to the "Core Lab Approved" methodology. In this case, deviations must be documented in the submittal form within the job folder and in the final report.

9.4.2 Method documentrtion

It is Core Lab policy to fully document those methods that are:

Literature

9.4.2.2 Efficiency improvements for routine industrial or governmental procedures

Anv method documentation is to be oerformed by senior technical personnel, evaluated throush the Quality Assurance Department, and approved at the Corporate Level before placing the method into routine production.

The site Quality Control Officer should be notified as well as Quality Assurance Management that a certain procedure is to be documented.

The procedure will need to be tested for sensitivity to interferences, accuracy and precision by a method specified by Quality Control.

9.4.3 Method Format

The following is the format that is to be used for step-by-step methodology description:

(1.0) Abstract: Very short, general description of the procedure and its uses (applications).

(2.0) Summary of Method:
(2.1) General Discussion/Theory
(2.2) Precautions/Safety
(2.3) Interferences
(2.4) Sensitivities

(3.0) Equipment:
(3.1) Description
(3.2) Preparation

(3.3) Calibration
(3.4) Maintainrnce

(4.0) Preparation (Samples, Reagents and Standards):

(5.0) Procedure:
This section can be formatted as needed
(5.1) Standardization and Calibration
(5.2) Misc. Preliminary Preparations
(5.3) Special Sample Preparation
(5.4) Sample Analysis

(6.0) Data Handling:
(6.1) Data Recording
(6.2) Calculations
(6.3) Interpretation

(7.0) Troubleshooting (Correlatidns and Crosschecks):

(8.0) Reporting and Quality Control:

(9.0) References and Author(s)
Credit should be given to the person writing the procedure. All pertinent references should be listed in bibliographical form.

9.4.4 Method Protocol Format

9.4.4.1 Methods protocols shall be used for all procedures'or groups of procedures in order to communicate Core Lab Policy and expectations. They are used as checklists whenever laboratory staff perform tests (as self audits), by supervisors to ensure compliance with corporate standards and by auditors to verify methodology in use at the location. They summarize the key steps or headings described in detaii in the step-by-step method manuals, are brief and are prepared in the following form:

1.0 Scope
2.0 Summary cf the Method
3.0 Significance and Use
4.0 Safety
5.0 Calibration
a) Daily Calibration and Operational Control
b) Periodic Confirmation of Calibration
6.0 Precision, Accuracy and Reporting Controls
7.0 References

9.4.4.2 Each of these will be no more than one or two pages in length and are not intended to be "how-to documents" but solely policy statements and summaries. Documentation of these protocols is cone by senior technical personnel designated by Division and Quality Assurance Management.

9.4.4.2 Quality performance criteria, method application and reporting requirements are stressed in the method protocols so that the analyst can focus on the potential client objectives. Control limits are an integral part of these documents, are spelled out clearly and are to be enforced by the analysts and their supervisors. Lastly, each method protocol is to be documented as a decision making guide so that company policy is clear and concise. For example, if there are requirements for a certain sample preparation prior to the test or for certain minimum equilibration periods, these will be specified.

9.4.5 Equipment Protocol Format

9.4.5.1 Every instrument and major piece of equipment shall have nearby (preferably beside or hung on) a laminated plastic covered-sheet detailing the following subjects:

1.0 Manufacturers Specifications, Name and Model number

2.0 Calibration Frequency
3.0 Operating Limits
4.0 Optimum Operating Conditions
5.0 Maintainance Requirements and Frequency
6.0 Supplier Contact Information for Spare Parts and Service

9.4.5.2 The objective of ensuring easy availability of equipment information is the same as for method protocols. That is to provide the laboratory staff with the tools necessary for self-checking and self auditing and to provide the external auditors with a consistent reference point.

10.0 SAMPLE TRACKING AND INFORMATION SYSTEM

10.1 CHAIN-OF-CUSTODY/SAMPLE RECEIVING

Sample receiving policies are designed to meet the needs of every situation. Most clients do not submit official Chain-of-Custody documents, but instead include paperwork which describes the desired service. Others will demand Chain-of-Custody documents to be filled out because the samples may be used as legal evidence.

Regardless of Client needs, Chain-of-Custody records will be maintained throughout the lab until the final disposition of the sample (i.e. properly documented disposal).

The following policies shoult suffice to meet all the needs of the client. If not, it is the responsibility of the sampling or sample receiving employees to comply with any reasonable client demand.

Sample Receiving and Log In -- are part of the same process and should be done in consecutive order. Neither is complete until both are finished.

10.1.1 General Policies

10.1.1.1 Record all information in blue or black ink.

10.1.1.2 Any perishable samples, with limited holding times or easily damaged samples, are given top priority for analysis.

10.1.1.3 Receiving Clerks and others assigned to accept samples from carriers and Clients must be made aware of Company Policy as well as client agreements on Chain-of-Custody rules and how to properly receive samples.

Warning -- Violation of Chain-of-Custody rules can void even the most careful analysis if the data should happen to go to Court.

10.1.1.4 A sample is under laboratory custody if:

A) An employee has signed a delivery receipt, or
B) It is in your actual possession, or
C) It is in your view, after being in your physical possession, or
D) It was in your possession and then you locked or sealed it up to prevent tampering, or
E) It is in a secure area (i.e. inside the laboratory).

10.1.1.5 Sample Receiving and Log-In shall be done by qualified individuals who are specifically trained in sample log in, client communication, and the capabilities of the laboratory.

10.1.1.6 Where applicable, Clients should be encouraged to include written sample submittal information which itemizes the sample ID's, parameters and other important information. Labs should provide sample transmittal forms to aid in the handling process.

10.1.2 Sample Accounting and Laboratory Submittal Forms

10.1.2.1 High priority is placed upon proper log-in-of samples because errors can be propagated into very expensive problems. There are three important types of documents that are used in this process:

A) Chain-of-Custody Document - usually client generated for important samples. Used for legal traceability and integrity purposes, illustrated below.

CHAIN OF CUSTODY --SAMPLES

Proj. No.	Project Name					No. of Con-tainers						Remarks
Samplers:												
Station #	Date	Time	Complete	Type	Station Location							

Relinquished by:	Date/Time	Received by:	Relinquished by:	Date/Time	Received by:
Relinquished by:	Date/Time	Received by:	Relinquished by:	Date/Time	Received by:
Relinquished by:	Date/Time	Received for Laboratory by:	Date/Time	Remarks	

B) Client Paperwork - Ideally will be submitted for all samples; describes the desired services and supporting information.

C) Laboratory Sample Submittal Form - This is generated by the laboratory either manually or with the aid of a LIMS. Includes the testing codes and all important information that is required to perform analysis.

LOG-IN SHEET

FILE NO. _____ COMPANY NAME _____

OF SAMPLES _____ PROJECT NAME _____

Sample Number	Client I.D.	Date Sampled	Time Sampled	Date Rec'd	Time Rec'd	Rec'd By	Sample Pkg/ Preservation	Sample Condition

10.1.2.2 **Upon receipt** of samples in custody, the package/container and/or cooler should be inspected and any damage to the sealing tape or custody seals noted. The Chain-of-Custody form should be marked that the seals, packaging or locks were intact upon receipt if no tampering or damage appears to have occurred.

10.1.2.3 The package/ccntainer and/or cooler should be opened to verify that each item listed on the sheet is present and correctly identified. if all data and samples are correct, the next "Received By' box on the Chain-of-Custody record should be signed and da-led.

10.1.2.4 Notes on errcrs and inconsistencies are to be made on the Laboratory Sample Submittal Form/Chain-of-Custody as to the condition. Each set of comments must be initialled and dated.

10.1.2.5 Accounting for all received samples is to be completed **prior** to Sample Leg-In and compared against client supplied information (i.e. client documents, Chain-of-Custody or verbal order).

10.1.2.6 A Laboratory sample submittal form is to be used for each set of samples received by the laboratory. This is an internal hard copy that should include the following:

A) Client name, address, contact
B) Date and time received
C) Information described above on condition of custody seals/tape/locks/etc.
D) Discrepancies **(if any)** as described in (2) above
E) Client Sample ID's
F) Parameters for measurement verses verified laboratory procedures
G) Any special Client requests or precautions highlighted

H) Initials of person performing the log-in
I) Hazardous characteristics of samples, (i.e. MSDS)

10.1.2.7 The Laboratory Sample Submittal Form should be rechecked for accuracy prior to final entry into the LIMS.

10.1.3 Verbal Communication with Submitter

Any verbal discussions with the client on the integrity of the samples should be recorded in ink in a Phone Log or in a laboratory notebook. Copies of these notes should be included with the sample paperwork in the job folder.

10.2 SAMPLE LOG-IN

10.2.1 General Policy

10.2.1.1 All samples that are received during normal operating hours shall be logged-in by the end of the working day.

10.2.1.2 Sample Log-in is to be performed before any analyses are run.

10.2.1.3 Top priority shall be given to perishable or volatile samples which must be logged-in immediately.

10.2.1.4 Log-in is to be as complete as possible the first tine to maximize efficiency and accuracy.

10.2.2 Job Number and Job Folder

10.2.2.1 An ascending value Job Number (i.e. 89---- which is usually computer generated) shall be assigned to each sample series consisting of one or more samples. Where practical, for example, with multiple submittals of samples at different times from the same well, the same discreet job number may

be used for several sample submittals. The practicality of this option will depend on local practice and invoicing procedures.

Each Job Number will include a two digit year code and four digits for consecutive numbering. Similar job numbers from separate locations are distinguished by the location code.

10.2.2.2 Individual Sample Numbers will be assigned using consecutive, ascending values plus the Job Number.

i.e., 891242-22 is the 22nd sample in a job

10.2.2.3 A Job folder shall be prepared consisting of a letter or legal size manila folder with the job number and client name on tab and the following items included and fastened in:

A) Completed field data form (if applicable)
B) Log-in sheet
C) Complete5 Laboratory Sample Submittal Sheet (computer generated if possible)
D) All written client correspondence specific to those samples
E) Any significant notes made during conversations with the client about the integrity of the samples
F) All billing information

During progression of the job through the laboratory, all raw data sheets/computer generated hard copies, graphs etc., are added- to the folder. Ultimately the lab copy of the final report'and invoice also reside here.

10.2.3 Logbook

Each laboratory is to maintain a logbook to record receipt of all jobs.

10.2.3.1 The Logbook shall be one of the following:

A) A bound ledger
B) A bound notebook
C) A three ring binder filled with pages of computer generated hard copies of log-in information. Paper used should be reinforced so that the holes do not pull out.

10.2.3.2 The following information is to be included as a minimum:

A) The Job number and the number of samples in the Job
B) Client ID number from'the LIMS
C) Client Name
D) Date of receipt
E) Type of samples (i.e. Environmental Water Samples, RAD, WAT, etc.)
F) Initials of the log-in person
G) Invoice number

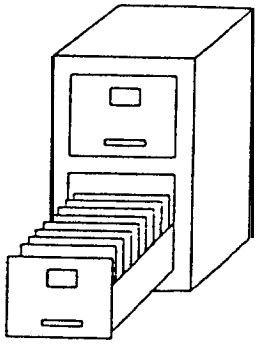
10.2.3.3 An entry into the Logbook is to be made each time samples are to to logged-in without exception, regardless of whether the LIMS is being used or not.

10.2.4 Job Billing Work Sheet and Pricing

Job pricing-should be completed at the time of Log In to maximize efficiency and accuracy.

An estimated total amount to be billed shall be tallied into one of the following, LIMS, Sample Logbook, other appropriate ledger and be readily available. Final revision of this total is made upon completion of the job.

10.2.5 Filing Configuration



There are two categories of files which contain Job Folders and are described below:

10.2.5.1 ACTIVE JOB FILES contain the following:

Incoming Jobs -- Consisting of those newly logged-in jobs where the samples and work assignments have not yet been distributed.

Note: Newly logged-in jobs are to be reviewed for accuracy, initialled and dated by an experienced person prior to placing in the active file.

Active **Jobs --** Incomplete jobs that are in progress where samples and paperwork have been distributed to the analysts.

Approval Pending Jobs -- Data complete Jobs that await final QC inspection for analytical quality, historical and data relationship comparisons, and Client worthiness inspection. For some laboratory disciplines this would be the point at which the written interpretative report and covering letter would be prepared.

Note:

1) Once all written material has been added, the final report and job folder are to be approved by the Laboratory Supervisor and/or QC Officer, signed and dated.

2) After signature, final reports and invoices are issued to the client (see paragraphs 10.8.2 and 10.8.3).

10.2.5.4 JOB ARCHIVE FILE -- Completed jobs which have been reported, billed, and filed sequentially according to Job Number. The Job Archive File is to be kept for a minimum cf 5 years. Storage duration will vary among the various laboratory disciplines according to the likely legal time limit for such records to be subpoened as evidence. There is precedent where oilfield ownership is disputed *or* in unitization cases for raw laboratory records older than 20 years to be called for.

10.3 SAMPLE LABELS AND SAMPLE DISTRIBUTION

10.3.1 Labels with Laboratory Job numbers and Sample numbers are to be fixed to each sample bag, bottle, wrapper, packet, cylinder or container without exception. Preferably, these should be computer generated. Core samples, after preparation, are to be identified by writing the number in India ink along the side.

10.3.2 Samples are to be distributed to appropriate active sample holding areas, refrigerators, etc., depending upon the service area protocols and sample perishability.

10.3.3 Lab work/LIMS generated bench sheets, with appropriate parameter codes indicated (special detection limits also noted) shall be distributed to analysts. All QA/QC forms must be stapled to these data sheets (see example).

10.3.4 The manila job folder is to be kept in the Active Job File. The manila folder must contain a completed Chain of Custody record, plus any shipping records, client correspondence, etc. applicable to that project.

10.3.5 All data sheets should be distributed to the appropriate person or location in the laboratory.

10.4 WORK FLOW AND SAMPLE FRIORITY ANALYSIS

10.4.1 Work is delegated according to holding times, and other priorities as determined by the Supervisor and Service Area Protocols.

10.4.2 When possible, work is delegated with the aid of a LIMS.

10.4.3 Where applicable, LIMS generated bench sheets will be prepared to make assignments. Bench sheets will also serve as data recording forms and must be dated and initialled by the user.

10.4.4 The Laboratory Suprrvisor or his assistant is to review the active samples and assign work to appropriate analysts according to their training and responsibilities.

10.4.5 Work assignments are made in order to complete the oldest work first.

10.4.6 A system should be set up so that the analysts can clearly indicate which samples are being analyzed to avoid confusion and duplication.

10.4.7 All analyses are to be completed on or before the due date and/or holding times.

10.4.8 To avoid confusion, analysts are required to enter results into the computer and bench work sheets (and notebooks for ACD) as soon as analysis is complete.

10.4.9 A LIMS should be utilized for status reports prior to beginning each analysis.

10.5 DATA RECORDING

10.5.1 General Policy

10.5.1.1 It is the policy of *Core* Lab to strive for error-free performance in all efforts. That is, all tasks should be performed "right the first time". In addition, it is the responsibility of the person performing the analysis to detect any errors that are generated by them or the processes that they are using to generate the data.

10.5.1.2 All entries into logbooks, lab notebooks and similar documents must be in ink. They should be rechecked for transcription accuracy, frequently.

10.5.1.3 A LIMS and other computer programs are to be used wherever possible torecord, assimilate and report data.

10.5.1.4 Each analyst is responsible for entering correct data into the LIMS immediately after each analysis.

10.5.1.5 Each analyst is responsible for detecting any errors in the data and in the event of an error, taking corrective action and notifvina the proper authority.

10.5.1.6 Corrections of errors in a personal notebook or on bench work sheets should be made by crossing a single line through the error and entering the correct information. No information should be erased. Changes made subsequently are dated and initialed.

10.5.1.7 Changes made to other data records on sample logbooks, Chain of Custody documents and Laboratory Sample Submittal Forms are made by crossing a single line through the error, dating and initialling.

10.5.1.8 It is essential that all data sheets and forms are correctlv and completely filled out, including names and dates. Quite often raw laboratory records are subpoened as evidence and must be complete 'to be accepted as evidence.

UNDER NO CIRCUMSTANCES IS CORRECTION FLUID TO BE USED DURING ANY PROCESS OF SAMPLE HANDLING, DATA PROCESSING, CALCULATIONS OR REPORT PREPARATION.

10.5.2 Lab Notebooks (ACD)

10.5.2.1 All notebooks and logbooks should have identification numbers and all should have pre-printed page numbers.

10.5.2.2 All analysts will be issued notebooks. This a mandatory possession and must be used at a minimum for

recording any nonroutine activity such as the preparation of a calibration stock solution.

10.5.2.3 Entries should be made in a legible format, clearly labeled for the type of work being performed, signed and dated at the top of each page.

10.5.2.4 Type of information to be recorded: Sample I.D., Absorbrncies, Concentrations, Standards, Blanks, Duplicates, Spikes, Standard Additions, any Anomalies, etc.

10.5.2.5 If inserts are included (computer tapes, chromatograms, etc.), they must be stapled securely to the page and signed across the insert edge and the page.

10.5.2.6 Notebook format - Copies of the analyst's lab notebook may need to be included with the final report; presentable formats are mandatory. In concept, information with respect to sample ID's, dates, and all information that would allow reconstruction 0f calculations should be evident in the notebook page. The format should include:

Page Number
Analyst's Name
Date
Procedure

a) Notes and Observations About the Samples.
b) Parameter(s)
c) Method employed
d) Job number(s)
e) Data columns-(accurately designated with dilutions, if needed)

f) Standards used (if made up fresh, reagent used, weight, etc.)
g) Quality control data
h) Instrument printout, if applicable, attached to page
i) Comments on procedure, suggestions for improvements, general observations.
j) The starting time of analysis for time sensitive parameters.
k) Atmospheric pressure and room temperature, where applicable.

Example Notebook:

33

Total Residual Chlorine 5/3/88 EPA QAs

Sample	Aliquot	Normality $N_2S_2O_3$	Titrant	Residual Chlorine mg/L	
EPA WS786	300mls	.0248 N	0.665-1.784=1.119mls	3.279	81.8 R%
1.0ppm x 4	300mls		1.784-2.936=1.152mls	3.376	84.4 %
=4.00ppm	300mls		2.936-4.113=1.177mls	3.449	86.2 %
EPA WS579					
Conc.#1055	300mls		0.161-0.874=0.713	2.089	95.0%
ppm x 4	300mls		0.874-1.623=0.749	2.195	99.8%
=2.20ppm	300mls		1.623-2.394=0.771	2.259	102.3%

The EPAs above were made up in groups of 3 and then titrated. NOTE: EPA WS 786 was not protected from light during storage - WS579 was stored in a cardboard cylinder. These EPAs were made up 4X stronger than the directions called for.

					mg/L	
335-25QA	300mls	.0248N	1.538-1.843=0.305mls	0.894	.447	
20mls/1000	300mls		1.843-2.181=0.338	0.990	÷2 .495	
=X2	300mls		2.181-2.461=0.280	0.820	.410	
Recorded the average = .451						
335-26QA	300mls		1.641-2.532=0.891mls	2.611	1.306	
20mls/1000	300mls		2.532-3.402=0.870	2.550	÷2 1.275	
=X2	300mls		3.402-4.291=0.889	2.605	1.302	

NOTE: Samples were made up 2X stronger than directions called for.

Recorded the average = 1.294

409-1 500mls .0248N None-sample was clear.

10.5.3 Computerized Bench Sheets

These can be used in place of notebooks under certain conditions if all of the calibration and quality control data is included.

The analyst will be responsible for recording the data into the LIMS program under the job number and parameter name together with Quality Control information.

(L413) TESTS WORKSHEET V1.1

TECHNICIAN NAME: Dennis Smith
QA BATCH NUMBER:
WORKSHEET DATE :02/07/89

WORKSHEET TEST :W145 Total Solids (TS)

BLANK ID	BLANK VALUE

STANDARD ID	STANDARD VALUE	ANALYZED VALUE

SPIKE JOB #	SPIKE SAMPLE #	KNOWN VALUE	SPIKE VALUE	MEASURED VALUE

DUPLICATE JOB #	DUP. SAMPLE #	SAMPLE ANAL.	DUP. ANALYSIS

JCB #	SMP#	TEST METHOD	LIMITS	MALYSIS RESULT	UNITS OF MEASURE
890C32	0001	EPA-600 160.3	10		mg/l

10.5.4 Data Entry into the LIMS

The analyst is expected to notify the supervisor of any problems with QC samples prior to entry of data into LIMS! Identified problems are to be corrected before recording in the computer.

The analyst is to ensure that the data is correctly entered into the computer by proof reading, paying special attention to transposition errors. All data entry will be initialled by the Analyst.

If the LIMS identifies further QC problems, the analyst is to immediately notify his/her supervisor and take steps to correct the problems. See section 9.3.3 of this document.

10.6 RECORD KEEPING

All completed job files (folders) should be kept in a secure Job Archive File storage area to prevent tampering. Storage time is 5 years or more. (See paragraph 10.2.5.4)

Client correspondence (initial project notes, quotations, etc.) specific to a Sample Job or similar projects should be maintained in the job folder. Miscellaneous client correspondence should be kept in Personal Files, Lab Notebooks, or in a Phone Log for a minimum of 2 years.

10.7 DATA REVIEW

The following components have been summarized to ensure that the report is presentable to the client. Please refer to section 9.3, "General Quality Control Verification" in this document.

10.7.1 Review of QC Records for precision, accuracy, instrumentation and equipment

10.7.2 Review of data relationships and data consistency

10.7.3 Review of historical records, compatibility of data with client needs and relevant regulations.

10.7.4 Review of client izposed restrictions on the data and/or QC data

Once the above activities are complete, a finalized report can be printed out.

Formal approval by the Laboratory Supervisor or in their absence, Site Quality Assurance Officer, shall be given to each report document by signature and date.

10.8 REPORTING REQUIREMENTS

10.8.1 General Policies

10.8.1.1 Reports should be consistent with Corporate Standards, accepted Industry formats and with the Service Area Protocols.

10.8.1.2 Data should be reported in Industry recognized units with consistency in reporting precision.

10.8.1.3 LIMS generated QC data should be reported as standard practice. Other QC data (i.e. equipment calibration) should be easily identifiable retrievable, regardless of whether that data is to be included with the final report.

10.8.1.4 It is Company Policy to not report data IF errors are suspected. If delays are expected due to errors or because of the particular nature of the samples or analyses, communication should be made with the client to explain the delay before the fact. (If data is demanded, a disclaimer should be attached indicating the problems encountered and that the data does not meet Core Lab Quality Standards.)

10.8.1.5 Any modification to specified or standard procedure should be qualified in the final report.

10.8.1.6 All efforts should be made to produce the report by the due date.

10.8.2 Final Report

10.8.2.1 The Final Report is our "Product", therefore, the highest priority should be given by laboratory management to ensure quality, accuracy, appearance and compatibility with client needs. The following criteria should be met:

instruments and equipment used to generate it. Policy on the inclusion of this data with the final report routinely will be specified under the individual service policies (Tier 4 of the Corporate Documentation Hierarchy).

B) Format and content should correspond to Client requests.

C) Date and initials of approval from the QC Officer or Lab Supervisor should be on the job folder indicating that accuracy and completeness have been achieved.

D) Appearance should be neat, professional and well organized.

E) Following the title page of the report should be a page signed by everyone (where realistic) that worked on the job. This new policy is to encourage "ownership" of the product and to inspire added confidence in the product by the "buyer" (client).

F) All supporting documentation for Quality, Chain of Custody and Invoice stould accompany the report.

G) Names of persons within the Client company to receive the report should be clearly indicated, and reports for each shall be made. Names must be spelled correctly. The Company standard is to provide three (3) copies of the final report and to charge for subsequent copies. Implementation of this policy will be in accordance with individual service policies and local market conditions.

H) One original of the report shall be retained in the job folder, One copy (excluding ACD) should be sent to the Records Department in Dallas for corporate filing.

10.8.2.2 Reports shall only be submitted to the Client Company that purchased the services. Reports are to be held in the strictest confidence. The client retains sole ownership.

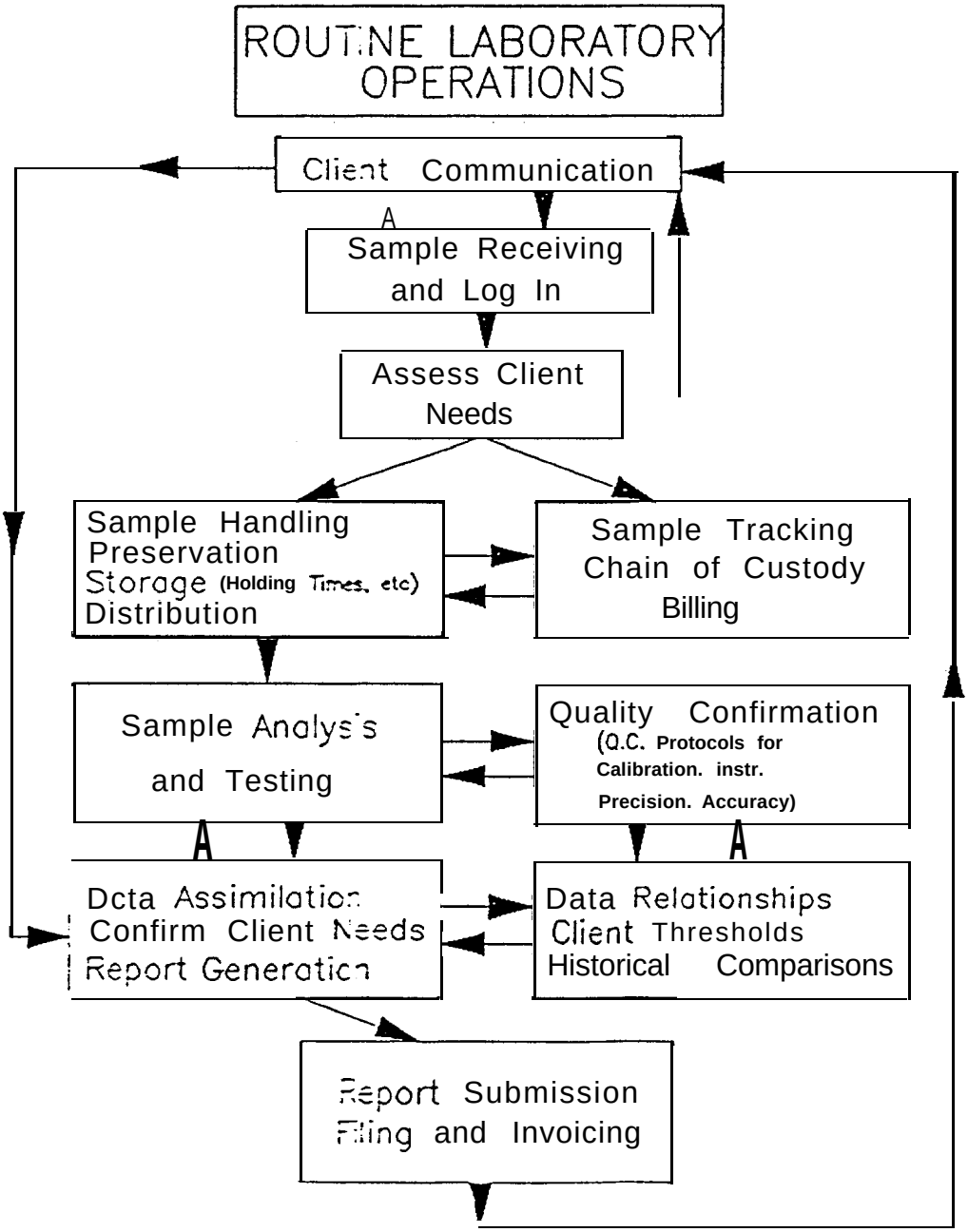
10.8.2.3 Unauthorized distribution of data to someone other than the Client will result in suspension or dismissal.

10.8.2.4 Reports can be distributed to establishments other than the client only after written authorization is given by the client.

10.8.3 Invoicing

10.8.3.1 Each final report must be accompanied by an invoice. Details must be carefully checked to ensure that all chargable expenses are included.

10.8.3.2 It is the responsibility of each supervisor and manager to follow-up on payments for services rendered (in close ccoperation with the accounting department). The job is not complete until the money is in the bank!


ROUTINE LABORATORY OPERATIONS
Client Communication
Sample Receiving and Log In
Assess Client Needs
Sample Handling Preservation Storage (Holding Times, etc) Distribution
Sample Tracking Chain of Custody Billing
Sample Analysis and Testing
Quality Confirmation (Q.C. Protocols for Calibration. instr. Precision. Accuracy)
Dcta Assimilation Confirm Client Needs Report Generation
Data Relationships Client Thresholds Historical Comparisons
Report Submission Filing and Invoicing

Appendix C. Northern Testing Laboratories, Inc., Quality Assurance Quality Control Program

NORTHERN TESTING LABORATORIES, INC.

QUALITY ASSURANCE
QUALITY CONTROL PROGRAM
GENERAL INFORMATION

"ALASKA'S WATER QUALITY PROFESSIONALS"

March 1, 1991

NORTHERN TESTING LABORATORIES, INC.

3330 Industrial Avenue
Fairbanks, Alaska 99701
(907) 456-3116
FAX 456-3125

2505 Fairbanks Street
Anchorage, Alaska 99503
(907) 277-8378
FAX 274-9645

FAIRBANKS: **Michael R. Pollen, President**

ANCHORAGE : **William E. Buchan, Manager, Anchorage Operations**

"Quality is **like** *buying oats.*
If you want nice, clean fresh oats, you pay the price.
If you don't mind oats that have been through the horse already, that's a little cheaper."

When a sample is received at the laboratory, the date and time received are recorded on the reporting form and the sample is stored in the refrigerator at 4 °C until analysis. Water samples should reach the laboratory as quickly as possible, within 24 hours after collection. Samples received between 30 and 48 hours, will be qualified to read that "results may not be reliable due to sample age". Samples over 48 hours will not be analyzed.

Sample information recorded in a microbiology log-in book includes the following:

Client name
Lab reference number
Source of sample
Sample date and time
Date and time of analysis
Plate or tube number
Sample volume

Each sample bottle is assigned a number from the log book prior to analysis. The sample date of public water supply clients is logged into a public water supply log, maintained for the purpose of recording sample dates for routine samples from PWS clients.

After 24 hour incubation, samples are examined and the results are entered in the sample log book and on the reporting forms. Unsatisfactory results are entered into a log book designated for unsatisfactory samples along with the client name, sample date and lab reference number. Unsatisfactory results are also immediately reported to client by phone and, for public water supplies, to Alaska Department of Environmental Conservation. A verification procedure is run on unsatisfactory samples and results reported after 48 hours incubation. The results of verifications are entered in the sample log book and reported verbally to the client. The client is mailed a copy of the reporting form and copies are also sent to ADEC if the sample is a public water supply. NTL retains a copy of the reporting form for its records.

CHAIN OF CUSTODY PROCEDURE

As with any activity that may be used to provide information for use in litigation, the sample collector must be able to provide documentation of the chain of possession and evidence of the continued custody of any samples for which results are offered for evidence. Written procedures must be available and followed whenever evidentiary samples are collected, transferred, stored, analyzed or destroyed. The primary objective of these procedures is to create an accurate written record which can be used to trace the possession and handling of the sample from the moment of its collection through its analysis and to its introduction as evidence.

Definition of Chain-of-Custody: A sample is in someone's "Custody" if:

notebooks, chromatograms or printouts files. The bound notebooks, chromatograms and printouts contain:

- Laboratory sample identification number
- Type of analysis
- Date run
- Analysts initials
- All pertinent test data such as absorbances, millivolts, sample volume, averages, standard deviations, etc.
- QC data (reference standards, spike, surrogates, calibration curves, detection limit checks, etc.)
- Values of method blanks analyzed with the sample
- Dilution (if any) done on client's sample

For each analysis, data entry is done by the analyst and is reviewed by the supervisor for the following information:

- Data transcription
- Accurate and complete calculations
- Appropriate units
- Detection limits
- Quality controls

Upon completion of all requested analyses, the transmittal is given to the laboratory supervisor to be checked for the following:

- Significant figures .
- Comparability (reporting units, standardized methods, standardized data format, etc.)
- Accuracy, precision and completeness
- QC cross correlation checks (TDS vs. conductivity, ion balances, etc.)

A final signed copy is sent to the client and a copy is filed in the main office. The completed samples are stored at least 30 days after transmission of the results and then disposed of according to the individual sample matrix, and applicable local, state and federal laws. At the client's request, storage time may be extended.

Microbiology: Sample bottles are sterilized, prepared and assigned a lab reference number at the laboratory and given to clients together with a reporting form and sampling instructions. The client is responsible for providing the following information:

- Client name and address to which results will be sent
- Sample date
- Client phone number
- ample type (routine, treated water, untreated water, etc.)
- Sample location
- Time collected
- Name of sampler
- Signature of client

SAMPLE HANDLING - LABORATORY

The laboratory provides sample containers either by mail or pick-up when the client requests our services. Sample containers are pre-cleaned and receive full QA/QC in accordance to EPA recommendations. Sample container volumes and type are in accordance with methods from EPA-600 and SW846 (See Appendix A). The client is responsible for filling in labels on the sample containers with the following information:

Client's name
Client sample identification/location
Sample date and time
Initials of the sample collector

Upon receipt at the laboratory, a work order is completed with the followinginformation:

Client's name and address
Sampledate, time, source and other client identification information
Time and date received at the laboratory
Laboratory sample identification number
List of analyses to be performed
Special notes concerning person to notify, special instructions for completion, etc.
Client signature and credit approval by Administrative Department

Samples are logged into a bound notebook and assigned a sample identificationnumber. The computer (LIMS) system assigns 6 digit numbers in chronological order following either an A (Anchorage office} or F (Fairbanks office).

Samples are logged into a notebook reserved for that purpose which contains the following information:

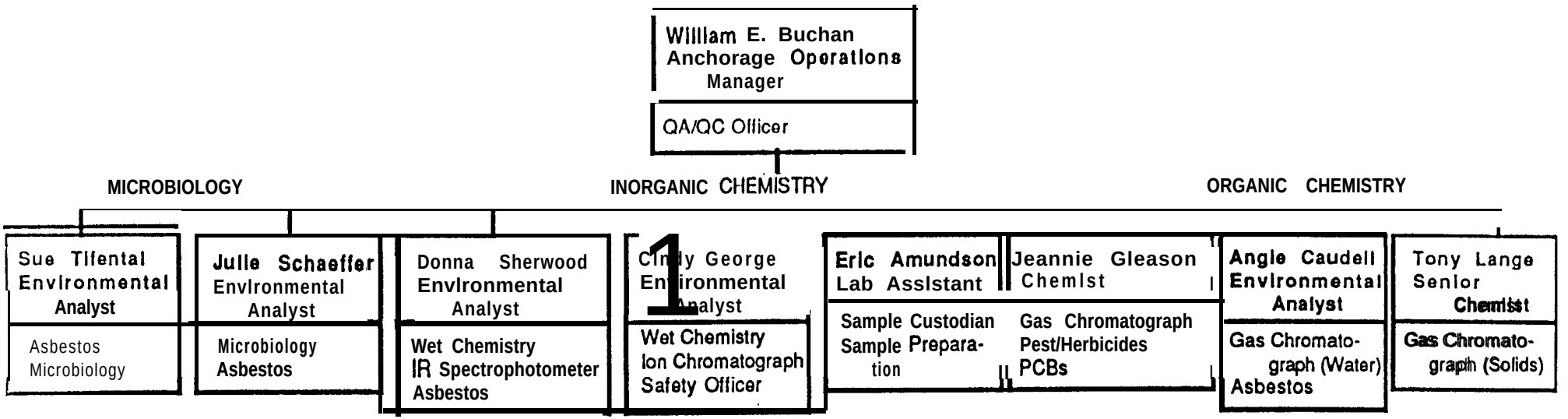
- Date received at laboratory
- Laboratory sample identification number
- Client's name and agent
- Sample date and time
- Sample identification and location/project
- Sample matrix
- Initials of sample collector
- Number of bottles received
- Requested analyses

Immediately after samples are checked in the sample custodian preserves and stores the samples in accordance with **EPA-600** and SW846 methods. (See Appendix A). After preservation, samples for analyses to be completed in other offices of NTL or at subcontract labs are shipped with a copy of the work order and/or a purchase **order.**

Individual **test results and calculations are recorded in bound**

ANCHORAGE ORGANIZATIONAL CHART

(Technical Staff)

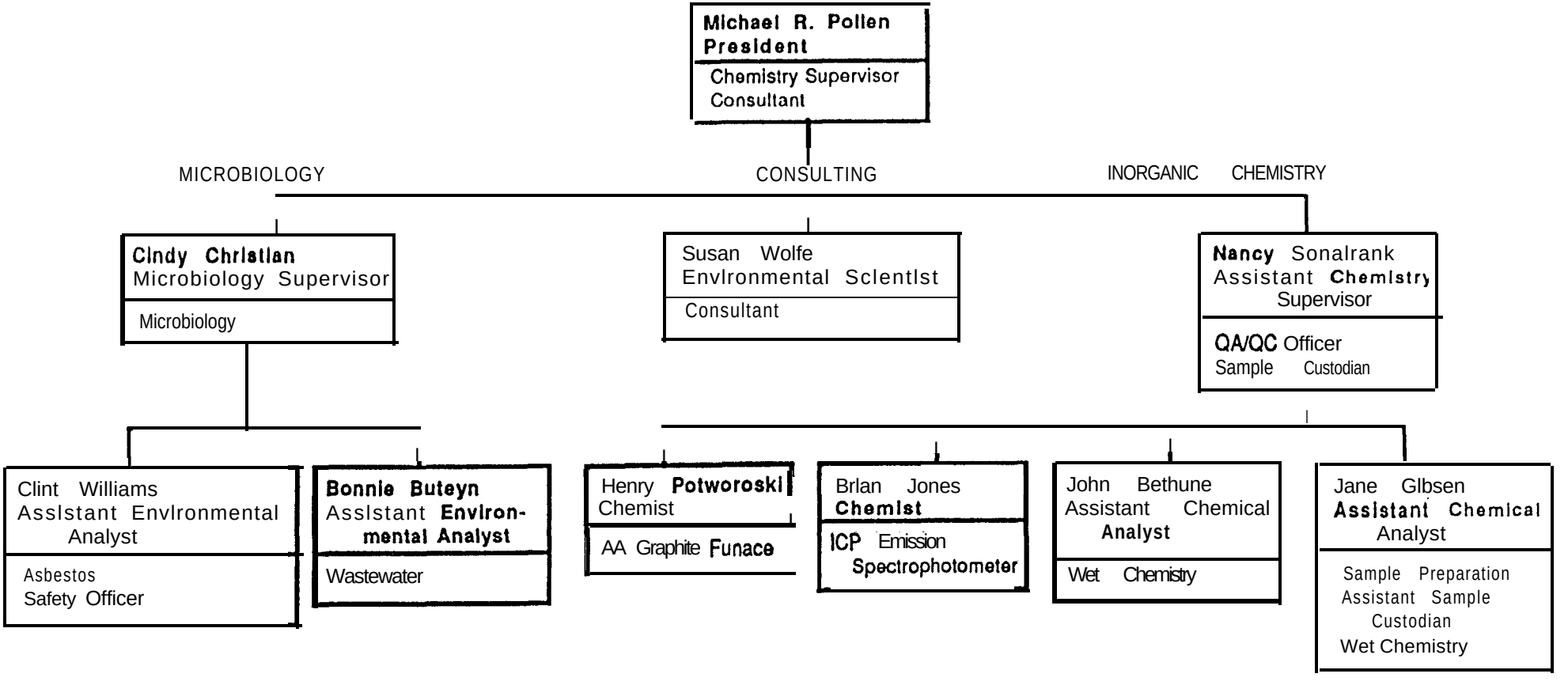


LABORATORY PROFESSIONAL PERSONNEL - ANCHORAGE

DISCIPLINE	ANALYST	EDUCATION	YEARS EXPERIENCE
Laboratory Administration	William E. Buchan	B.S. Chemical Engineering M.S. Meteorology	4.0
Inorganic Analysis	Cindy George	B.S. Microbiology Graduate Work in Biology	1.0
	Donna Sherwood	B.S. Zoology	1.0
	Eric Amundson	University Student	1.5
Organic & Hazardous Wastes Analysis	Tony Lange	Chemistry - 4 years	2.5
	Jeannie Gleason	B.S. Chemistry	1.0
	Angie Caudell	1 Year College	5.0
Microbiology	Susan Tifental	B.S. Biology	2.0
Asbestos Analysis	Julie Schaeffer	B.S. Biology	0.5

FAIRBANKS ORGANIZATIONAL CHART

(Technical Staff)



LABORATORY PROFESSIONAL PERSONNEL - FAIRBANKS

DISCIPLINE	ANALYST	EDUCATION	YEARS EXPERIENCE
Laboratory Administration	Michael **R. Pollen**	B.S. Biology	16.0
	Nancy Sonafrank	B.S. Biology **M.S.** Marine Biology M.A. Chemistry	6.0
	Cindy Christian	B.A. Biology M.A. Public Administration	3.0
Inorganic Analysis	Henry **Potworowski**	B.S. Chemistry	10.0
	Brian Jones	B.S. Chemistry	1.0
	John Bethune	University Student	2.5
	Jane Gibson	University Student	**0.5**
Consulting	Michael R. Pollen	B.S. Biology	19.5
	Susan Wolfe	**B.S.** Environmental Technology	2.5
Microbiology	**Cindy Christian**	**B.A. Biology** M.A. Public Administration	3.0
	Bonnie Buteyn	B.S. Biology M.A. Teaching	11.0
Asbestos Analysis	Clint Williams	B.S. Geology	0.5

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

Quality assurance (QA) is a system for ensuring that all information, data, and resulting decisions compiled under a specific task are technically sound, statistically valid, and properly documented. Quality control (QC) is the mechanism through which quality assurance achieves its goals. Quality control programs define the frequency and methods of checks, audits, and reviews necessary to identify problems and dictate corrective action, thus verifying product quality.

There are five data quality objectives which a laboratory quality assurance/quality control program must address in order to be valid:

Accuracy relates to the difference between **a measured quantity and its true value.** NTL addresses this objective by the calculation of in-house spike recoveries on sample matrices and external **performance audits** which compare **NTLs** data with other laboratories.

Precision relates to the reproducibility of the data which is estimated by duplicate samples and the use of significant figures.

Completeness is the percent usable data which should be a minimum of 95%.

Representativeness refers to separating an **aliquot** for analysis which is typical of the sample **as a** whole. NTL analytical procedures are designed to maximize the **representativeness** of the analysis for any given sample matrix.

Comparability is the ability to compare any two or more datums which have been collected exactly the same way using exactly the same methods. NTL provides comparability with analyses done at different times and/or different labs by the use of published analytical procedures.

At Northern Testing Laboratories, Inc. (NTL) we maintain a high standard of quality assurance and quality control in all services provided to our clientele. **Our laboratories are** designed to be professional and safe facilities equipped with modern laboratory instrumentation and staffed by well **trained professionals. We** strive to be knowledgeable and technically current in the fields of services offered by the company so we can assist our clients in interpreting their data and so we will intuitively know that the selected analytical methods are applicable to the type of samples provided by the client.

The first premise of **QA/QC** is knowledge. The second is the use of proper tools by **a** person with proper training. The third is common sense. We endeavor to practice all three.

It is in one's actual physical possession, or
It is in one's view, after being in one's physical possession, or
It is in one's physical possession and then locked up so that no one can tamper with it, or
It is kept in a secured area, restricted to authorized and accountable personnel only.

Sample Collection and Identification Procedure: The number of persons involved in collecting and handling samples should be kept to a safe minimum. Field records should be completed at the time the sample is collected and should be signed or initialled, including the date and time, by sample collector(s). Field records should contain the following information:

Unique sampling number or log number
Custody form numbers, if supplied
Preservative used
Name of collector(s)
Copies of field data sheets, chain-of-custody documentation, analysis requested, airbill or waybill documents if shipped by common carrier

It should be confirmed by the sampler writing in their field log that each sample is identified by a proper label on the container, and if the individual container is sealed. The sample container should then be placed in a transportation case, along with the shipping copies of chain-of-custody record forms, pertinent field records, and analysis request forms as needed. The transportation case should be sealed or locked. A locked or sealed. ice chest eliminates the need for close oversight of the individual samples. However, on those occasions when the use of an ice chest is inconvenient, the collector should seal the cap of the individual sample container in such a way that any tampering would be easy to detect.

The sample collector is responsible for the care and custody of the collected samples until they are properly dispatched to the receiving laboratory, or turned over to an assigned custodian. The sample collector should verify that each container is in their physical possession or in their sight at all times, or is locked so that no one can tamper with it.

Transfer of Custody and Shipment: When transferring the samples, the transferee must sign and record the date and time in the chain-of-custody record. Custody transfers in the field should be documented and account for each sample, although samples may be transferred as a group (as long as each individual sample in the group is identified). Every person who takes custody must note if the individual samples or the sealed shipping container is correctly sealed and in the sample condition as noted by the previous custodian, and must fill in the appropriate section of the chain-of-custody record. To minimize custody records, the number of custodians should be kept to the minimum practical level.

All packages sent to the laboratory should be accompanied by the chain-of-custody record and other pertinent forms. A copy of these forms should be retained by the originating person. Have the designated agent of the common carrier sign and date the field copy of the chain-of custody form. Mailed packages should be sent by registered mail, return receipt requested. For packages sent by common carrier, receipts , bills of lading, airbills or way-bills must be retained as part of the permanent chain-of-custody documentation. If the originals of such documents must be used for other purposes such as accounts payable, be sure to keep a true copy for the chain-of-custody documentation.

> Definition of "True Copy": A true copy is an accurate reproduction (such as a photocopy of the original document, made by the custodian and signed and dated in permanent ink in the following format: "True copy of original. Made by John Doe, April 1, 1991."

Samples to be shipped must be packaged to prevent breakage and should be sealed or locked so that any tampering can be readily detected. Both the shipping and receiving custodian should note the condition of the container seals (broken or unbroken) each time possession is exchanged. Acceptable procedures for sealing containers include the use of a custody seal wrapped across filament tape that is wrapped around the package at least twice. The custody seal is then folded over and sealed to itself so that the only access to the package is by cutting the filament tape or breaking the seal to unwrap the tape. The seal is then signed by the shipping custodian. Alternatively, tamper proof tape can be used to seal across the filament tape. If samples are shipped by mail or other common carrier, all applicable DOT regulations must be complied with. (Note that most water samples are exempt unless quantities of preservatives used are greater than certain levels.),

Laboratory Custody Procedures: Only the laboratory chain-of-custody sample custodian or their designated alternates will receive chain-of-custody samples. The sample custodian will ensure that the chain-of-custody is maintained while the samples are in their possession. The chain-of-custody sample custodian will maintain the chain-of-custody storage facilities to ensure safe and secure storage of the chain-of-custody samples.

Upon receiving the sample container the laboratory chain-of-custody sample custodian will have the person transferring the samples to the lab sign the chain-of-custody form, and ensure that all documentation (chain-of-custody sample log, shipping documents, work order forms) are present. The chain-of-custody sample custodian will then verify the integrity of the custody seals by writing on the chain-of-custody record either of the following: "Seals Intact" or "Seals Broken," depending on the condition of the seals, the chain-of-custody sample custodian will do one of the following:

If the samples are received in a sealed container and the

ITEM	QUANTITIY	MAKE	MODEL	DATE
ANALYTICAL BALANCES	1	Mettler	H35AR	1981
	1	Mettler	PC160	1985
	1	Sartorius	Digital	1990
ASBESTOS FUME HOOD	1	CRSI		1986
AUTOCLAVE	1	Market Forge	Sterilmatic	1985
COMPUTER	3	Apple	IIe	1985-7
	1	Apple	MacIntosh	1987
	1	HP Vectra	RS-20C/337MB	1990
	2	HP Vectra	QS-16S/40MB	1990
	2	Epson	386SX Plus/40MB	1990
CONDUCTIVITY METER	1	Balsbaugh	100	1982
DATA STATION	1	IBM PS2 Model 70 Winner 386		1990
DRYING OVEN	1	Blue M	Gravity	1985
	1	Thermolyne	Gravity	1990
DESSICATOR	1	Boekel		1985
FILTER MANIFOLD	1	Millipore	6-Place	1985
FLASH POINT TESTER	1	Boekel		1986
FUME HOODS	2	Curtin Scientific	Rebuilt	1986
FUME HOOD / EXPLOSION PROOF	1	Labconco		1986
GAS CHROMATOGRAPHS				
ECD DETECTOR	1	Varian	3740	1981
PID & FID DETECTORS	1	Varian	3400	1986
PID & HALL ECD DETECTORS	1	Varian	3400	1987
PURGE & TRAP APPARATUS	2	Tekmar	LSC-2	1987,1988
AUTOSAMPLERS	2	Tekmar	ALS	1987,1990
GLASSWARE		Kimax, Pyrex		
HOT PLATE	1	VWR	320	1985
INCUBATOR	2	VWR	1540	1985, 1986
INCUBATOR, WATER TYPE	1	Blue M	MW1120A1	1985
IR SPECTROPHOTOMETER	1	Perkin-Elmer	1310	1987
INTEGRATOR	3	Spectraphysics	4270	1986-1987
	1	Hewlett-Packard		1989
ION CHROMATOGRAPH	1	Dionex	Cond. Detector	1989
MICROSCOPE, COMPOUND	1	Nikon	Labphot	1985
MICROSCOPE, DISSECTING	1	A/O		1985
pH/SPECIFIC ION METER	1	Orion	801	1977
pH METER	1	Orion	231	1985
PLASTICWARE		Nalgene PE, PP & Teflon		
PRESSURE FILTER				
RECORDER	1	Varian	Chart	1981
REFRIGERATORS	5	Various Manufacturers		1982-9
SALINITY / CONDUCTIVITY METER	1	YSI	33	1983
SONIFIER	1	Branson	250	1989
SPECTROPHOTOMETER	1	Bausch & Lomb	100	1978
STIRRING PLATES	1	VWR	Magnestir	1985
	1	Corning		1990
TCLP EXTRACTORS	2	Millipore	ZHE	1990
	1	Millipore	Rotary Ext.	1990
TURBIDIMETER	1	Turner Designs		1985

	2	Millipore	3-Place	1977
FLASH POINT TESTER	2	Boekel		1986,1990
FUME HOODS	2	Labconco		1977
	2	U.S. Testing		1983
GLASSWARE		Kimax, Pyrex		
GRAPHITE FURNACES	1	Perkin Elmer	HGA 400	1985
	1	Perkin Elmer	HGA 600	1990
GRAPHITE FURNACE AUTOSAMPLER	1	Perkin Elmer	AS60	1990
HOT PLATE	1	Lindberg		1977
	1	VWR	"DylaDual"	1977
ICP EMMISION SPECT.	1	Leeman Labs	PS 1000	1989
INCUBATOR	1	Precision		1977
INCUBATOR, WATER TYPE	1	Blue M		1977
JAR TEST APPARATUS	1	Phipps & Bird	6-Paddle	1978
MERCURY ANALYZER	1	Bacharach/Coleman	Cold Vapor	1990
MICROSCOPE	1	Nikon	Labphot	1987
MICROSCOPE, COMPOUND	1	A/O		1986
MICROSCOPE, DISSECTING	1	A/O	Forty	1977
NITROGEN ANALYZER	1	Buchi	321 Digester	1989
	1	Buchi	425 Distiller	1989
OXYGEN BOMB W/ QUARTZ LINER	2	Parr Instruments		1987, 1989
pH/SPECIFIC ION METER	1	Altex	PHI 71	1981
	1	Altex	5000	1982
	1	Hach		1982
	1	Orion	231	1985
PLASTICWARE		Nalgene	PE, PP & Teflon	
PRESSURE FILTER				
RECORDERS	1	Fisher	Chart	1982
	1	Kipp & Zonen	Chart	1990
	2	VWR	320	1982
REFRIGERATOR	2	Wards	12	1981
	1	Westinghouse	-	1981
	2	Commercial	Lg. Capacity	1989
SONIFIER	1	Branson		1987
SPECTROPHOTOMETER	1	Bausch & Lomb	21 WD	1982
	1	Beckman	DB-GT	1985
STIRRING PLATES	1	VWR	-	1977
	4	VWR	"Magnestir"	1977
WATER BATH	2	Blue M	MW1120A	1977, 1990
	1	Thelco	83	1977
	1	Lauda	B1	1981
	1	VWR	1120	1982
TURBIDIMETER	1	Turner Designs		1981
	1	Hach	"Ratio"	1983
ULTRASONIC CLEANER	1	Brandson	2200	1990
ULTRAVIOLET STERILIZER	1	Millipore		1980
VACUUM PUMP	4	Gast		1982

LABORATORY EQUIPMENT - ANCHORAGE

PURCH.

restandardized if significant deviation from the known reference standards is observed.

10. Pensky-Martens Flash Point Tester: The tester is calibrated daily using p-xylene.

11. pH Meter: Calibrated daily using pH 7 buffer and a second buffer (usually pH 4 or 10) bracketing the anticipated range of the samples being analyzed. The temperature of each buffer solution is measured and is either manually or automatically adjusted depending on the type of meter being used. Combination reference electrode is cleaned weekly according to the manufacturer's instructions. Laboratory pH meters are checked periodically against another meter for accuracy.

12. Refrigerators: Temperatures are checked twice daily and recorded on attached logsheets.

13. Spectrophotometers: NIST traceable calibration standards are used quarterly to check % transmittance, wavelength accuracy, stray light, linearity, precision and optical alignment.

14. Thermometers: All thermometers are calibrated yearly against an NIST certified thermometer.

LABORATORY EQUIPMENT - FAIRBANKS

ITEM	QUANTITY	MAKE	MODEL	PURCH. DATE
AGITATOR	1	LabLine	Jr. Orbital	1988
ANALYTICAL BALANCES	2	Mettler	H35AR	1977
	1	Mettler	AC100	1982
	1	Mettler	PC180	1981
ASBESTOS FUME HOOD	1	CRSI		1987
ATOMIC ABSORPTION	1	Perkin Elmer	2380	1990
SPECTROPHOTOMETERS	1	Perkin Elmer	3100	1990
AUTOCLAVE	1	Market Forge	Sterilmatic	1981
COD REACTOR	1	Hach	Aluminum	1982
COMPUTER	2	Apple	IIe	1983,1985
	5	Apple	MacIntosh	1985-91
	1	HP Vectra	RS-20C/337MB	1990
	2	HP Vectra	QS-16S/40MB	1990
	2	Epson	386SX Plus/40MB	1990
CONDUCTIVITY METER	2	YSI	SCT	1977,1982
	1	Hach	16300	1983
DESSICATOR	4	Boekel		1977, 1982
DILUTER	1	Hamilton	Digital	1985
DISTILLATION APPARATUS	1	Corning	TM11	1990
DIST. COLLECTION SYSTEM	1	Corning	ACS	1989
DRYING OVEN	2	Blue M	Gravity	1977, 1982
	1	Grieve	FAE-270	1984
FILTER MANIFOLDS	1	Gelman	6-Place	1982

PREVENTIVE MAINTENANCE - INSTRUMENTS AND EQUIPMENT

Instrument calibration is absolutely essential to ensure quality analytical results. Instruments and equipment are calibrated and maintained as follows:

1. Analytical Balances: Each analytical balance is cleaned and calibrated annually by the authorized factory service engineer. The balances are checked daily with Class S or S-l weights and the results recorded in a permanent log book.

2. Atomic Absorption (AA) and ICP Spectrophotometers: All AA and ICP equipment is on an annual or warranty "full service" maintenance contract with the manufacturer. Each instrument is calibrated daily using at least 3 standard reference solutions to establish linearity and an external standard to verify detection limits. A routine maintenance log is kept for all service performed on each instrument.

3. Autoclave: Temperature, time in and out, date and contents are recorded with each cycle. A maximum registering thermometer is used weekly to measure operating temperature. Heat sensitive tape is used to identify all supplies and materials that have been sterilized. Diack controls or spore strips are used bi-monthly to check for complete sterilization. Autoclave timer is checked with two stopwatches annually. Autoclave is cleaned weekly with germicide. Periodic maintenance is performed by a local service agent.

4. Conductivity Meters: Each meter is calibrated quarterly using freshly prepared potassium chloride solutions (0.01 and 0.001 N).

5. Deionized Water: Laboratory deionized water is checked daily for conductivity, and the results recorded in a permanent log. When the specific conductance exceeds 1 Ìmhos/cm, the DI cartridges are changed. Deionized water also is checked quarterly for microbiological quality using SPC.

6. Drying Ovens: Temperatures are checked twice daily and recorded on attached logsheets,

7. Gas Chromatographs (GC's): ECD Detector is checked yearly for leaks. Baseline frequency checks are done for each analytical run. All columns are conditioned prior to running standards and samples. Calibration standards are run daily.

a. Incubators: Temperatures are checked twice daily and recorded on log sheets attached to the incubators.

9. Nephelometer: (Turner Designs) Calibrated daily using a 20 NTU standard provided by the instrument manufacturer. AMCO Polymerics certified standards are used daily to verify calibration, (Hach Ratio Turbidimeter) Calibration is verified daily with AMCO Polymerics certified standards, and

ciency Analytical Testing (PAT) and NIST/EPA NVLAP Bulk Asbestos Accreditation. In the AIHA/NIOSH program, PAT samples for the identification of asbestos fibers in air are analyzed quarterly. NTL also has full accreditation for bulk asbestos analysis by polarized light microscopy through the National Volutary Laboratory Accreditation Program (NVLAP). To maintain accreditation, NTL participates in semiannual NVLAP Qualification Rounds for bulk asbestos samples. In addition, NTL asbestos analysts complete an intensive course in the Microscopical Identification of Asbestos at the McCrone Research Institute.

LABORATORY CERTIFICATIONS AND EXTERNAL QUALITY CONTROL AUDITS

NTL undergoes several certification processes on a regular basis. Our present laboratory certifications and accreditations include: (1) ADEC Public Water Supply Laboratory for microbiology, inorganic chemicalcontaminants, turbidity, organic chemical contaminants (pesticides and herbicides), regulated volatile organic compounds, totaltrihalomethanes, and vinyl chloride; (2) U.S. Army Corps of Engineers (North Pacific Division) Contract Laboratory for heavy metals in water and sediment, and polychorinated biphenyls (PCB's) in water; and (3) AIHA/NIOSH Proficiency Analytical Testing (PAT) and NIST/EPA NVLAP Bulk Asbestos Accreditation for asbestos programs.

As a certified drinking water laboratory, NTL must meet several requirements.

- NTL must satisfactorily analyze performance evaluation (PE) samples (EPA water supply studies) twice annually for each analysis for which certification has been granted. The PE samples will be analyzed by the person(s) who routinely analyzes routine drinking water compliance samples for that particular test.

- In order to qualify for drinking water certification NTL must use methodologies specified by the drinking water regulation (40CFR 141.21-141.30, 141.41, 141.42).

- NTL must notify the ADEC certification officer in writing, within 30 days of major changes in personnel, equipment, or laboratory location which might impair analytical capability.

- Normally, ADEC conducts an on-site inspection of NTL facilities every three years. If NTL undergoes a major change or fails a PE sample, ADEC may schedule an on-site evaluation sooner.

- For the microbiology department, ADEC also conducts on-site inspections every three years for review of laboratory facilities and procedures. NTL microbiologists are certified by ADEC after completing a water microbiology training course at the ADEC Palmer laboratory.

The U.S. Army Corps of Engineers certification for RCRA heavy metals in water and sediment requires a yearly on-site inspection plus the following information: (1) a copy of NTL's QA/QC Plan; (2) the resumes of supervisors and staff involved in water testing; (3) a list of analytical equipment, including purchase date and maintenance records; and (4) a list of methods for certified analyses. NTL's results for EPA Water Pollution Studies are also submitted to the Corps of Engineers.

For asbestos analysis, NTL participates in both AIHA/NIOSH Profi-

surrogate Spikes: Each blank, standard, matrix spike, and sample are spiked with a surrogate compound. The following table lists the surrogates used for each series of analyses:

EPA Method Number	Surrogate Used
501.1/502.1/502.2/503.1	1-chloro,2-fluorobenzene
601/602/8010/8020	4-chlorotoluene
608/8080	dibromooctafluorobiphenyl

Blanks: An organic-free water sample is run at the beginning of each batch to ensure that the system is contamination free. If methanol extractions are performed on solid samples, then a methanol blank is run at the beginning of each batch which serves the same function as an organic-free water sample.

Log Books: Analytical bound log books will be kept for each gas chromatograph. Each day the following information will be entered into this book:

- Integrator and computer run numbers
- Laboratory sample identification number
- Dilution performed if any
- If the sample is a solid, the amount of solid extracted and how much extraction solvent was used
- Amount of sample injected into the G.C.
- All calibration information including results and calculations
- Entries are made in the order in which the samples and standards are run
- Date of analysis
- Analysts' initials

Calibration Log Book: A three ring binder will be kept in the instrument room containing copies of all of the following chromatograms:

- Calibration runs
- Continuing calibration check samples
- Quality control check samples
- Initial surrogate spike runs
- Method blanks

tics are peaked after every 10 samples or every 20 minutes.

Digestion: Total metals water sample digests and soil digests (EPA Method 3050) are prepared with matrix spikes and duplicates at least every 1 in 20 samples. Spike recoveries within 80-120% for water samples and 70-130% for soil samples are accepted. Precision is ensured by the analysis of duplicate samples and maintaining RPD within 10% for values >20 times the MDL and within 25% for values <20 times the MDL for water samples, and within 35% for soil samples with values >5 times the MDL. Reagent blanks are made at a frequency of one blank with every 20 samples or at least one with every batch. Blanks are analyzed to verify the absence of contamination or interferences. Sample preservation and digestion is done with Ultrex or trace metals grade acids to ensure minimal trace metals contamination of the sample.

QUALITY CONTROL PROGRAM OVERVIEW - ORGANIC ANALYSIS

Calibration: An initial calibration curve of at least five points is generated with one of the standards being at or below the detection limit for the test. The working standards are prepared from a primary solution containing all of the analytes included in the test. The calibration curve is checked daily with a continuing calibration check sample. The calibration check must fall within 20% of the sample's true value. If not, the curve is regenerated. Either the calibration curve or a calibration factor will be used for calculating the sample concentration. If the response for a sample exceeds the working range of the calibration curve, a dilution is prepared and re-analysis performed. When necessary, the method detection limits are recalculated for the dilution,

Quality Control Check Samples: When available, an EPA known reference standard is run on a daily basis to verify the accuracy of the calibration curve. If an EPA standard is not available, a reference solution from a different commercial source is used. The results from these analyses must fall either within the 95% confidence interval determined by EPA for their standard, or within the confidence intervals specified in each individual method. If the quality control check sample fails to meet these criteria, the calibration curve is regenerated and the check sample is run again. If the check sample falls within the acceptable range, a repeat check will be run after 20 samples have been analyzed, if this occurs before the beginning of the next analytical day.

Replication: A duplicate sample is run 10% of the time. Either every 10 samples, or if less than 10 samples are run, at least once per batch. The relative percent difference between the duplicates must be within 15%. The duplicate chromatograms are filed with the clients' data.

Matrix Spikes: A matrix spike is run 10% of the time. Either every 10 samples, or if less than 10 samples are run, at least once per batch. The matrix spike chromatograms will be kept with the clients' data package.

and cooled in a desiccator before use. Sample containers are weighed to the nearest 0.1 mg on a calibrated analytical balance. The balance is calibrated using two or more class S-l weights.

Ion Chromatograph: A blank and five standards are used to set the calibration. The calibration is usually stable over at least 6 months and is recalibrated only when daily calibration checks become unacceptable. Daily calibration checks include an EPA reference standard run before sample analysis and a mid-range standard. Both of these standards must be within 10% of true value for analytical results to be valid,

Nephelometric Analysis: Calibration is done with a air blank and 2 pre-prepared polymer standards. The calibration is stable for up to six months or whenever the daily mid-range calibration check is unacceptable. The calibration check must be within 0.1 NTU of true value. After every 10 samples an external reference standard is also checked which must be with 10% of true value. Note: turbidity analyses are not amenable to spiking procedures.

Titrimetric Analysis: Titrants are standardized using primary standard solutions created from stable anhydrous primary standards which are dried and stored in a desiccator until used. An external reference standard is analyzed after every 10 samples.

METALS ANALYSIS:

Spike and duplicate analyses are run for 5% of the samples or at least one sample in every analytical run. Detection limits checks are made using low range standards (see detection limit procedure in Instrument Calibration section) and reported detection limits are updated quarterly.

Atomic Absorption Spectrophotometer: A blank and a minimum of three known reference standards are used to set the daily calibration in the atomic absorption spectrophotometer. A low range standard is run to verify the method detection limit, and a traceable reference standard is run to verify accuracy within. The known reference standard must fall within 10% of the true value prior to and immediately following analysis of unknown samples. Other variables such as instrument sensitivity and lamp energy are monitored to ensure that the analysis is within acceptable physical performance of the equipment.

ICP: A blank and a minimum of three known reference standards are used for the calibration procedure. Calibration is made every six months or when QCs are out of control limits. A standardization is made daily for each element and checked with a external reference standard which must fall within 10% of the true value. The detection limit is verified once a week by analysis of a low range standard. An interference check standard is run once a week to check for the presence of physical or chemical interferences and to check any interelement correction factors being used. A method blank is run with every 20 samples (or once an hour - whichever is more-frequent) to ensure the absence of baseline drift. ICP op-

standard plate count procedures are checked with a blank, an air count control and a positive Psuedomonas control. Samples are run in duplicate and results are averaged.

QUALITY CONTROL PROGRAM OVERVIEW - INORGANIC ANALYSIS

WET CHEMISTRY:
Spike and duplicate analyses are run for at least 5% of the samples or at least one sample in every analytical run. Detection limits are determined by the lowest standard in the calibration curve or by the minimum reproducible analyte concentration. Blanks are made for any analysis which involves addition of reagents or treatment before analysis. Data for each analytical method is kept in a lab bench book which contains the full analytical procedure secured in the front of the book or is available in a wet chemistry procedures manual and the following information:

- The date and method of analysis
- The initials of the analyst
- The lab ID of each sample analyzed
- Any raw data used to calculate analytical results (e.g. Sample volume, dilutions, normality and volume of titrant used)
- Final analytical result
- Data and results for any QC analyzed
- Analytical run number

Colorimetric/Spectrophotometric Analysis: At least a four point calibration curve is prepared (a reagent blank plus three known standards). For those procedures which do not include a daily calibration, a mid-range calibration check sample is run which must agree within 10% of the initial calibration curve. A externally-supplied reference standard is run daily prior to the analysis of the samples. The reference standard must be within 10% of the true value or within the control limits developed by the laboratory. If the reference standard is not acceptable, a new calibration curve is prepared.

Electrodes:
pH meters are calibrated daily using two buffer solutions. The calibration is validated with an EPA pH reference sample or a mid-range buffer which must read within 0.05 pH units of its true value. Note: pH analysis is not amenable to a spiking procedure.

Specific ion electrodes are calibrated using a blank and three or more calibration standards. Before sample analyses, the calibration is checked using a midrange EPA reference standard which must read within 10% of the true value. A mid-range standard is run as a continuing calibration check after every 10 samples and at the end of the run. The midrange standard must be within 10% of true value or the electrode should be recalibrated.

Gravimetric Analysis: Dishes and glassware are dried in an oven

seal is broken or there is other evidence that the samples have been tampered with, the chain-of-custody sample custodian will immediately notify the shipping custodian, and any special instructions for handling of those samples will be obtained.

If the samples are received as a group in a properly sealed package, the seals are intact, the chain-of-custody sample custodian will then sign the chain-of-custody log as the receiving custodian, and the person transferring the samples may then leave.

- If the samples are received in an unsealed container, the chain-of-custody sample custodian must inspect each sample for tampering and to verify that it is correctly identified on the chain-of-custody log. Once all of the samples have been verified, the chain-of-custody sample custodian will then sign the chain-of-custody log as the receiving custodian, and the person transferring the samples may then leave.

The chain-of-custody sample custodian will then complete the sample check in procedure, properly preserving the samples as required by standard receiving protocol, and will transfer the samples to the chain-of-custody storage facility. The chain-of-custody sample custodian will then complete all required documentation in the chain-of custody sample log book (see chain-of-custody log section below). It is important that the chain-of-custody sample custodian keep the samples in their custody at all times while the check in procedure is in progress.

During the final week of each calendar month, the chain-of-custody sample custodian will verify the accuracy of the chain-of-custody log against the chain-of-custody samples in storage. He or she will then prepare a list of those samples (by client project number and number of samples) remaining in chain-of-custody storage and present the list to accounts receivable for client invoicing. The chain-of-custody sample custodian will be responsible for communicating with the clients who have samples in chain-of-custody storage to determine when and how the samples are to be disposed of. He or she then will arrange for disposal and certify on the chain-of-custody log and on the respective samples' chain-of-custody forms that disposal is complete.

The chain-of-custody sample custodian will ensure that all relevant documentation is forwarded to the project files for archiving with the completed work orders.

Chain-of-Custody Storage: The laboratory will be maintained as a secured area. Only authorized personnel or accompanied visitors will be allowed access to the laboratory. The chain-of-custody storage room or lockers will remain locked at all times except when chain-of-custody samples are being added, removed or checked by the designated chain-of-custody sample custodian or their alternate. When a sample is to be removed for analysis or returned

from being analyzed, the designated chain-of-custody sample custodian or their alternate will unlock the chain-of-custody storage facility and personally handle the samples. Transfer of the samples . within the laboratory to or from the possession of the designated chain-of-custody sample custodian or their alternate will be recorded in the chain-of custody log book. Analysts receiving chain-of-custody samples are responsible for maintaining chain-of-custody protocol until the sample is returned to the custodian.

Chain of Custody Log: The chain-of-custody sample custodian will maintain a permanent log book to record, for each sample:

Laboratory sample identification number
Client
The person delivering the sample
The person receiving the sample
Date and time received
Client sample identification
Sample date and time
How it was shipped to the laboratory
Condition in which it was received (sealed, unsealed, Broken container or other pertinent remarks)

The log also shows the movement of each sample within the laboratory: i.e. who removed the sample from the custody area, when it was removed, when it was returned and when it was disposed of.

CALIBRATION PROCEDURES AND FREQUENCY

All instruments in the laboratory require calibration relating the response of the instrument to the concentration of the analyte. Requirements for establishing calibration curves which are accurate and precise include the frequency of calibration, the number and accuracy of standards, and the range and linearity of the curve.

Instruments are calibrated at a frequency consistent with the stability of the instrument. Calibration curves are verified at the beginning of each day of analyses by analyzing at least a reagent blank and one standard in the expected concentration range of the samples to be analyzed that day. Instruments which are not calibrated daily may require standardization. Standardization is a process whereby the intercept and slope of the calibration curve are modified by a response factor calculated from the analysis of a reagent blank and the high standard.

Calibration curves are created by the analysis of a reagent blank plus a minimum of three to five standards (depending on the requirements specified in the method) within the linear working range of the instrument. A calibration curve normally has a *correlation coefficient* $\geq$ 0.9990 and the calculated concentrations for all of the standards used for the curve is within $\pm$10% of their true value. The accuracy of the calibration is checked using a reference standard, preferably an EPA QC sample when available. The calibration standards are prepared from a source different from the reference standard used to check the calibration curve. A continuing calibration check, which must be within $\pm$10% of the true value, is run after every ten samples and at the end of the analytical run. If QC criteria for calibration are not met at any time during the analysis run, a recalibration is made and analysis continues from the last acceptable QC.

If the expected sample concentrations are within the linear working range of the instrument, the calibration curve is designed to bracket the expected sample concentrations. Any sample which is more concentrated than the highest standard is diluted such that it will fall within the range of the calibration curve. If the expected sample concentrations are within the linear working range of the instrument, the calibration curve is designed to bracket the expected sample concentrations. Any sample which is more concentrated than the highest standard is diluted with class A volumetric glassware such that it will fall within the range of the calibration curve.

NTL will establish and periodically reevaluate its own method detection limits (MDL) for each sample matrix type routinely run, and for each analytical method. The MDL is determined for an analytical method by the analysis of seven or more replicates of a spiked reagent blank with an analyte concentration of 1 to 5 times the estimated detection limit. The standard deviation of the responses (s_m), in concentration units, is used to calculate the MDL as follows.

$$MDL = s_m (t_{.99})$$

$t_{.99}$ = "Student's t value" appropriate for a one-tailed test at the 99% confidence level and a standard deviation estimate with n-l degrees of freedom (see Table 8.8.1).

MDL checks will be made periodically and a running average and standard deviation of the last 20 check samples will be used to calculate current MDLs. MDLs will be updated quarterly and should be changed in the LIMS system and in lab bench books by the QA officer. Records will be maintained for MDLs showing calculations and how the values were determined.

In reporting data, values found below the MDL will be indicated in the laboratory bench book and reported on the data transmittal as MDL U (i.e. the MDL value is reported, followed by the data qualifier flag U).

ANALYTICAL PROCEDURES

Analytical methods used by NTL are taken from the following, unless otherwise stated:

1. ***Methods for Chemical Analysis of Water and Wastes,*** EPA-600/4-79-020, ORD Publications, CERI, EPA, Cincinatti, Ohio, ***45268*** (1983)

2. ***Standard Methods for Examination of Water and*** **Wastewater,** 17th ed., **American Public Health Association, American Water Works** Association, Water Pollution Control Federation (1989)

3. EPA procedures published in the Federal Register and/or available from EPA.

4. ***Test Methods for the Evaluation of Solid Wastes,*** Physical/Chemical Methods, 2nd edition, SW-846, U.S.E.P.A., Office of Solid Waste, Washington D.C., 20460 (1986)

5. ***Microbiological Methods for Monitoring the Environment,*** EPA-600/ 8-78-017, ORD Publications, CERI, EPA, Cincinnati, Ohio, ***45268*** (1978).

6. ***Annual Book of ASTM Standards,*** Section 11, American Society for Testing and Materials, Philadelphia, PA (1984).

DATA REDUCTION, VALIDATION AND REPORTING

Data will be reported to three significant figures or to the decimal'place at which the value first becomes uncertain (i.e. in the value reported only the last number is uncertain). The number of decimal places reported is determined by the analytical method and the sample matrix.

Rounding off is done after computations are completed, in order to keep results substantially free from computational errors. Data is entered into the lab bench books and the LIMS computer with 3 or 4 significant figures for the initial result. When the computer rounds off decimal places, it retains the last number if the next decimal place is less than 5 and the LIMS increases the last number by 1 if the next decimal place contains a number greater than or equal to 5.

Analytical test results are calculated by the analyst using equations described in the analytical method which is entered at the beginning of the lab bench book. All raw data used in these computations, as well as the calculated values should be recorded in the bench book for that analytical method. The lab bench book also should contain the date of analysis, the analyst's initials, the units for all data, tables and graphs for calibration curves, and observations and problems encountered in the analysis. Any modifications to the analytical method should be completely documented and validated with QC measurements.

Some instruments that are direct reading provide a paper printout of the data. Data from these printouts will be entered on the computer and filed by analysis method, the computer run number and analysis date. All raw data will be kept for a period of 3 years.

All data undergoes initial validation by review of the analyst. Once results are calculated and recorded in the lab bench book, at least 10% of the calculations should be cross-checked and initialled by another analyst or by a supervisor. If errors are determined in the calculations then all data in that set will be recomputed by the data validator.

Once the data is entered on the computer, it is reviewed by the QA/QC officer or other data validator independent of the analysis. The review includes an examination of equations used, calculations, use of tables and graphs, agreement between the lab bench book and LIMS data entry, any weight, volume or dilution factors, entry of % solids where appropriate, acceptability of QCs, correctness of units, and any problems with the analysis. If corrections must be made, the validator will use a single pen line to mark-out incorrect entries and initial changes made. Initials of the data validator are attached to the run in the computer under the approval record.

When the data is printed out by the computer, the data transmittal is attached to the work order and given to the laboratory supervisor. He or she checks the data transmittal against the work order

for completeness, method numbers, analytical values, reporting units, appropriateness of any qualifiers and QC cross correlation checks (e.g. TDS vs. conductivity, ion balances). Once the data transmittal is satisfactory, the lab supervisor signs the data transmittal and it is ready for release.

No data will be released either verbally or in writing without proper review and validation. only the supervisors *or* above are authorized to verbally release preliminary data. This should be done accompanied by the statement that any data that has been released first verbally is tentative and subject to change.

Due to our policy of client confidentiality, only the client's designated representatives and NTL's staff are permitted access to test results. Public water supply data is the only exception to this rule. We are required as an ADEC approved laboratory to report public water supply test results listed under 18 AAC 80.060 to both the client and ADEC.

A log book is kept of all data transmittals in order to verify when and to whom the data transmittal was sent. Transmittals are normally mailed, but can also be transmitted by fax or picked-up by the client. The client, public water supply number (if any), lab ID number, parameters and the date the transmittal was sent are recorded in a log book.

INTERNAL QUALITY CONTROL

NTL has implemented a systematic quality control program to assure that reported data meets acceptable levels of precision and accuracy. All analyses are validated through the application of six key elements of QC:

1) Initial calibration control requirements
2) Continuing calibration checks
3) Blank analyses
4) Spiked sample analyses
5) Duplicate sample analyses
6) External performance evaluation analyses (see Performance and System Audits section)

An initial calibration check sample is run at the beginning of the analysis to validate the calibration curve. The continuing calibration check is run after every 10 samples and at the end of the run. One sample in every 20 or at least one sample in every analytical run should be run in duplicate and with a matrix spike in order to document precision, accuracy and the absence of any sample matrix effects. If the spike or duplicate fails to come within acceptable ranges, a spike-duplicate should be run. If spike recoveries for a sample continue to be unacceptable, the analytical results are reported as an estimated value and analysis by standard additions is recommended. Any of these QCs may be varied in frequency by the clients request.

For some measurements (e.g. microbiological, asbestos etc.) not every key element may be applicable and each procedure may have special QC instructions in addition to the general ones. However, for most instrumental chemical methods, analyses will be validated using the quality controls outlined above. Initially the control limits on these QCs may be set by recommended limits from EPA and *Standard* Methods, 17th ed. (see table below), but after sufficient QC data is accumulated, control charts will be used to determine appropriate QC limits for NTL analyses.

Acceptance Limits for % Spike Recoveries and Relative % Differences to Water and Wastewater

Analysis	%Recovery	RPD for Duplicates < 20 MDL*	RPD for Duplicates > 20 MDL*
Metals	80-120	<25	<10
Volatile organics	70-130	<40	<20
Base/neutrals	70-130	<40	<20
Acids	60-140	<40	<20
Anions	80-120	<25	<10
Nutrients	80-120	<25	<10
Other inorganics	80-120	<25	<10

*MDL - method detection limit

Analysis	%Recovery	RPD for Duplicates < 20 MDL*	RPD for Duplicates > 20 MDL*
Total organic halogens	80-120	<25	<15
Herbicides	40-160	<40	<20
Organochlorine pesticides	50-140	<40	<20
Captan	20-130	<40	<20
Endosulfans	25-140	<40	<20
Endrin aldehyde	25-140	<40	<20

*MDL - method detection limit

All chemicals are analytical reagent grade (AR) or better and are dated upon arrival at the lab, and again when opened. Chemicals with a known shelf life are discarded after reaching their expiration date. Other chemicals are kept for three years before being replaced. Reagents and solutions are dated and initialed when prepared. They are stored and disposed of according to the individual method, and applicable local, state and federal laws.

Known reference standards from EPA, NIST or from some other traceable source are used whenever possible to ensure accuracy of calibration curves and analytical methodology. Calibration standards are traceable to National Bureau of Standards (NBS) standards, or EPA standards, where available. If these standards are not available, other primary standards are used. Records showing calibration procedures, and standard preparation and traceability are maintained.

QUALITY CONTROL PROGRAM OVERVIEW - MICROBIOLOGY

Both the Fairbanks and Anchorage laboratories are certified by the ADEC for microbiological analysis of potable water for Public Water Supplies. A thorough program of documentation of the performance of the equipment and media, verification of sterility and utilization of aseptic procedures is practiced in both laboratories. Major elements of the microbiology quality control program are:

Sample collection, Bandling and Preservation: Presterilized polypropylene bottles preserved with sodium thiosulfate are supplied to clients for collection of samples for microbiological analysis. Sample instructions and report forms are supplied with each bottle. Upon receipt of a sample by the laboratory, the arrival date and time are noted on the report form. The sample is kept refrigerated until analysis.

Clients are advised both verbally and in the prepared instructions that samples must be received within 24 hours of collection for optimum results. Samples received between 30 and 48 hours after collection will be analyzed, but are qualified on the final data transmittal that the results may not be reliable due to the sample

age. No analyses are performed on samples over 48 hours old. When specified, chain-of-custody procedures are followed.

Sterilization of Equipment, Media and Sample Containers: Autoclaved at 121 ½C and 15 psi for 15 minutes; temperature is verified by the use of maximum registering thermometers and by the use of heat sensitive tape. One sample bottle from each autoclaved batch is checked for sterility by adding a non-selective broth and incubating for 24 hours. Funnels and supports are autoclaved daily and sterilized between each sample using a *W* sterilizer. All containers of partially used buffered water are re-autoclaved between runs to prevent contamination.

Media: Nutrient media is prepared fresh every 96 hours and checked for correct pH prior to use. Both positive and negative controls are run with each set of samples to ensure the media is sustaining the correct bacterial growth and is not contaminated. The positive and negative controls are prepared fresh weekly from stabilized, water-soluble, disks containing derivatives of American Type Culture Collection live bacterial cultures.

Membrane Filter Procedures (Total and Fecal Coliform Bacteria): Once a month all analysts count typical colonies on the same membrane from one positive sample. Counts are compared and should agree within 10% and the results are recorded. Once a month one of each morphological type of non-sheen-producing bacteria is verified to determine that false negative reactions do not occur. Results are recorded in a coliform log book.

All total coliform green-sheen colonies are verified with lauryl sulfate broth and brilliant green bile broth. Controls used for both total and fecal coliform membrane filter methods are:

Positive Control: Escherichia *coli*
Negative Control: *Pseudomonas aeruginosa*

MPN Method Procedures: MPN media tubes are checked for sterility of media, dilution water and glassware by running blanks. Positive and negative controls verify media performance.

Colilert: Each batch is checked for performance using *E. coli, P. aeruginosa* and *K. pneumoniae.*

Special Procedures: Enterococci bacteria are confirmed in EIA agar. Controls used for Enterocci bacteria are:

Positive Control: Streptococcus *faecalis*
Negative Control: *Escherichia coli*

E. Coli - Thermotolerant: Presumed E. *Coli* bacteria are confirmed in an urease substrate solution. E. *Coli* - Thermotolerant controls are:

Positive Control: *Escherichia coli*
Negative Control: *Pseudomonas*

VACUUM PUMP	Hach Ratio Gast		1989 1985, 1990

CORRECTIVE ACTION

For any measurement system there will occasionally be times when either the precision or accuracy may go "out-of-control" (i.e. QC measurements or conditions are out of acceptance limits). When out-of-control situations occur, it is important to have a system in place within the laboratory for promptly identifying and responding to these occurrences. Timely detection of out-of-control events allows for immediate appropriate actions to be taken to ensure that questionable results are not reported.

While timeliness is important in responding to out-of-control events, it is equally important to employ appropriate corrective actions and to verify that the actions taken were successful. For all out-of-control events, all related procedures, standards, reagents and instrumentation should be evaluated in an effort to determine the problem source. The analysis should not resume until all problems have been corrected. All actions taken while determining the reason for the out-of-control event should be fully documented.

Sample Containers, Holding Times and Storage: Samples received in inappropriate containers or with holding times expired for the analysis requested may be rejected or the reported data qualified to reflect the condition of the sample. Samples which are stored under inappropriate conditions (i.e. high temperatures) before analysis may require resampling. Resampling will also be requested for samples that arrive at the lab with broken containers or evidence of contamination.

Initial and Continuing Calibration Checks: If external reference standards or midrange calibration checks are unacceptable at any time during analyses, the instrument will be recalibrated and the new calibration verified with an externally-supplied reference standard. If the reference standard continues to be unacceptable, it must be determined whether the problem lies with the standard, reagent or instrumentation. Once a valid calibration is obtained, the analysis run continues from the last acceptable calibration check. All actions taken and maintenance performed is documented.

Method Blanks: All method blanks should be evaluated for interferences and to verify that target analytes, if present, are below acceptable levels (usually 5 times the detection limit). If interferences or target analytes are present in the method blank, the method blank must be reanalyzed and the source of contamination identified prior to sample analysis. All findings and actions taken should be fully documented.

Spiked Sample Analyses: All matrix spike recoveries should fall within the specified control limits (see Internal Quality Control section). While EPA CLP protocols do not specify reanalysis of matrix spikes that do not meet criteria, the results are analyzed collectively to identify any existing problems. When a spike recovery is out of acceptable limits, a second spiked sample may be prepared and analyzed and if the second spike recovery is also

unacceptable, the analytical result is reported as an estimated value due to evidence of matrix effects in the sample. For these samples it is recommended to the client that reanalysis be done using a standard additions procedure to ensure better accuracy. If many or all spike recoveries in an analytical run are unacceptable, a blank is spiked to check for correct spiking procedure, sample preparation and analysis.

Duplicate Analysis: RPD (relative percent difference) values between samples analyzed in duplicate should be within specified control limits (see Internal Quality Control section). If RPDs are unacceptable, precision problems may exist with sample preparation or analytical procedures. The sample itself should be evaluated to determine if the poor precision is a result of matrix interferences. A third replicate may be analyzed to judge if the poor precision is an isolated incident. All actions taken are fully documented.

Surrogate Recoveries: Surrogate recoveries that do not meet requirements will be checked first for correct guantitation and calculation. Chromatography of highly contaminated samples may affect chromatography which in turn affects q-uantitated surrogate amounts. Consistently unacceptable surrogate recoveries indicate problems with the measurement system (e.g. extraction, instrumental condition) and will be investigated and corrected. All actions and instrumental maintenance will be documented.

If a sample matrix effect is suspected, the sample may be rerun. If the second analysis is unacceptable, the sample data will be reported as an estimate due to possible matrix effects.

QUALITY ASSURANCE REPORTING PROCEDURES

NTL's QA/QC officer is responsible for a quarterly report to NTL management regarding the application of the quality control program including detection limits, accuracy and precision estimates and the review of performance evaluation studies results. Summaries of any on-site inspections and recommendations will also be reported. This QA manual is updated every six month or less.

SAMPLE CONTAINER PRESERVATION AND HOLDING TIME

DESCRIPTION (Parameter)	(Method)	WATER & WASTEWATER METHOD EPA 600/4-79-020	SOLID WASTE METHOD SW-846	CONTAINER TYPE Water	Solid	PRESERVATIVE (Water Samples)	HOLDING TIME
wET CHEMISTRY							
Acidity	Tiirimetric	EPA 305.1		250 ml Plastic		Cool 4 C	14 Days
Alkalinity	Titrimetric	EPA 310.1		250 ml Plastic		Cool 4 C	14 Days
Biological Oxygen Demad, total	5-day	EPA 405.1		1 L plastic		Cool 4 C	48 Hours
Biological Oxygen Demad, sol	5-day	EPA 405.1		1 L Plastic		Cool 4 C	48 Hours
Bromide	Ion Chromatograph	EPA 320.1		250 ml Plastic		None	28 Days
Carbon dioxide free	Titrimetric	SM 406B		500 ml plastic		None	28 Days
Chloride	Ion Chromatagraph	EPA 300.0	EPA 9250	125 ml Plastic	4 oz CWM	None	28 Days
Chlorine Residual	DPD	EPA 330.5		125 ml Plastic		None	24 Hours
	Iodometric			lic		None	24 Hours
Chlorine Demand	SM409	SM 409		1 L Plastic		Cool 4 C	Immediate
Chlorophyll	Colorimetric	SM 1002G		Filter		Cool 4 C, Dark	14 Days
Chemical Oxygen Demand	Closed Reflux Reac...	EPA 410.1		125 ml Plastic		Cool 4 C, H2SO4	7 Days
Color Apparent	Visual Comparison	EPA 110.2		125 ml Plastic		Cool 4 C	48 Hours
Color, True	Vis. Comparison, Fil...	EPA 110.2		125 ml Plastic		Cool 4 C	48 Hours
Corrosion Coupons		ASTM					
Cyanide, Free	Colorimetric	ASTM D4282		1 L Plastic		NaOH, pH>12	14 Days
Cyanide, Acid Dissoc	SM412H	SM 412H		1 L Plastic		NaOH pH>12	14 Days
Cyanide, Total	Distillation,Colorime...	EPA 335.2		1 L Plastic		NaOH pH>12	14 Days
Fluoride	Ion Selective Electr...	EPA 340.2		250 ml Plastic		None	28 Days
Glycol Screening	Refractometer			250 ml Plastic		None	28 Days
Grease & Oil Water	Gravimetrb	EPA 413 1		1 L Glass		Cool 4 c, H2SO4	28 Days
Grease & Oil Soil	Gravimetric	tjPA413.1			8 oz Glass	Freeze	28 Days
Hardness	EDTA Method	EPA 130 2		250 ml Plastic		HNO3 pH<2	180 Days
Iodide	Titrimetric	EPA 345.1		200 ml Plastic		Cool 4 C	24 Hours
Karl Fischer Titration	Titrimetric		ASTM D1744	125 ml Plastic		Cool 4 C	14 Days
Langlier Index	SM203	SM203		1 L Plastic		Cool 4 C	
Nitrogen, Ammonia	Distillation-Titrimetric	EPA 350.2		1 L Plastic		Cool 4 C, H2SO4	28 Days
Nitrogen, Nitrate	Brucine	EPA 352.1		1 L Plastic		Cool 4 C, H2SO4	28 Days
	Cadmium Reduction	EPA 352.3		1 L Plastic		Cool 4 C, H2SO4	28 Days
Nitrogen Nitrate Kit	Hach Kit			1 L Plastic		Cool 4 C, H2SO4	28 Days

SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME

DESCRIPTION (Parameter)	(Method)	WATER & WASTEWATER METHOD EPA 60014-79-020	SOLID WASTE METHOD SW-846	CONTAINER TYPE Water	Solid	PRESERVATIVE (Water Samples)	HOLDING TIME
Nitrogen, Nitrite	Spectrophotometric	EPA 354.1		1 L Plastic.		Cool 4 C, H2SO4	28 Days
Nitrogen, TKN	Digest/Distill/Titrim.	EPA 351.3		1 L Plastic		Cool 4 C H2SO4	28 Days
Nitrogen, Total	Devarda's Alloy	SM 418E		1 L Plastic		Cool 4 C H2SO4	28 Days
Nitrogen Series				1 L Plastic		Cool 4 C H2SO4	28 Days
Normality	Std Strength Titration	EPA 310.1					
Odor	Threshold Odor	EPA 140.1		500 ml Glass		Cool 4 C	24 Hours
Oxygen, Dissolved	Electrode	EPA 360.1		1 L Glass		None	Immediate
	Winkler	EPA 360.2		1 L Br Glass		None	Immediate
Total Petroleum Hydrocarbons	IR Spectrophotometer	EPA 418.1	EPA 418.1	1 L Br. Glass	8 oz Glass	Cool 4 C, H2SO4	28 Days/14 Days
pH	Electrode	EPA 150.1	EPA 9045	125 ml Plastic	4 oz Glass	Cool 4C	24 Hours
Phenolics	AAP Spctrophotom	EPA 420.1		1 L Glass		Cool 4 C, H2SO4	28 Days
Phosphate, Ortho	Colorimetric	EPA. 365. 2		125 ml Plastic		Cool 4 C	48 Hours
Phosphate, Total	Colorimetric	EPA 305.2		125 ml Plastic		Cool 4 C, H2SO4	28 Days
Reserve Alkalinity	Tiirimetric	A S T M D1121-78		250 ml Plastic		None	14 Days
Salinity, Water	S-C-T Meter	210AtC	SM210A	125 ml Plastic	4 oz Glass	Cool 4 C	24 Hours
	Argentometric			125 ml Plastic		Cool 4 C	24 Hours
Solids, TDS	Gravimetric	EPA 160.1		250 ml Plastic		Cool 4 C	7 Days
Solids, TSS	Gravimetric	EPA 160.2		250 ml Plastic		Cool 4 C	7 Days
Solids, Total	Gravimetric	EPA 160.3		250 ml Plastic		Cool 4 C	7 Days
Solids, w/ Volatiles	Gravimetric	EPA 160.4		250 ml Plastic		Cool 4 C	7 Days
Solids, Settleable	Volumetric	EPA 160.5		1 L Plastic		Cool 4 C	46 Hours
	Gravimetric	SM290Eb		1 L Plastic		Cool 4 C	46 Hours
Sp. Conductance	S-C-T Meter	EPA 120.1	EPA 9050	125 ml Plastic	8 oz Glass	Cool 4 C	28 Days
Specific Gravity	Gravimetric	SM 213E		125 ml Plastic	125 ml Glass	None	28 Days
Sulfate	Ion Chromatograph	EPA 300.0		125 ml Plastic		Cool 4 C	28 Days
Sulfide	Titrimetric	EPA 376.1		1 L Plastic		ZnOAc, NaOH pH>9	
Sulfite	Iodometric	EPA 377.1		125 ml Plastic		None	Immediate
Surfactants	MBAS-Colorimetrii	EPA 425 1		500 ml Plastic		Cool 4 C	48 Hours
Tannin and Lignin	Colorimetric	SM513		250 ml Plastic		Cool 4 C	28 Days
Turbidity	Nephelometric	EPA 1 8 0 . 1		125 ml Plastic		Cool 4 C	48 Hours
METALS							

SAMPLE CONTAINER PRESERVATION, AND HOLDING TIME

DESCRIPTION (Parameter)	(Method)	WATER & WASTEWATER METHOD EPA 600/4-79-020	SOLID WASTE METHOD SW-846	CONTAINER TYPE Water	Solid	PRESERVATIVE (Water Samples)	HOLDING TIME
METALS							
Metals (except Hg and Cr VI)	Atomic Absorption	EPA 200 Series	EPA 7000 Series	125 ml Plastic	4 oz Glass	HNO3, pH<2	180 Days
	ICP Emission	EPA 200.7	EPA 6010	125 ml Plastic	4 oz Glass	HNO3, pH<2	180 Days
Mercury	Cold Vapor AA	EPA 245.1	EPA 7470	500 ml Plastic	4 oz Glass	HNO3, pH<2	28 Days
Chromium, Hexavalent	Coprecipitation/ICP		EPA 7195	250 ml Plastic	4 oz Glass	Cool 4 C	24 Hours
ORGANIC CHEMICALS							
Chlorinated Herbicides	Gas Chromatograph		EPA 8150	2 - 1 L Br. G...	8 oz Glass	Cool 4 C	7 Days until ex
							40 Days after ex
FID Fuel Scan	Gas Chomatograph	Modified EPA 8015	Mod. EPA 8015	40 ml Glass	4 oz Glass	Cool 4 C	14 Days
TEPH	Gas Chomatograph		EPA 3550/8015		4 oz Glass	Cool 4 C	14 Days
TVPH	Gas Chomatograph		EPA 5030/8015		4 oz Glass	Cool 4 C	14 Days
Glycol (Ethylene & Propylene1	Gas Chromatograph	EPA 8015		40 ml Glass		None	
Organic Chemical Contaminants (Pesticides and Herbicides)	Gas Chromatograph	EPA 508 and 515.1		2 - 1 L Br. Glass		Cool 4 C	7 Days until ex
							40 Days after ex
Pesticides, Chlorinated	Gas Chromatograph	EPA 608	EPA 8080	2 - 1 L Br. G...	8 oz Glass	Cool 4 C	7 Days until ex
							40 Days after ex
Purgeable Aromatics	Gas Chromatograph	EPA 602	EPA 8020	2 - 40 ml Gl...	4 oz Glass	Na2S2O3 for tre...	14 Days
						HCL for untreated	
Purgeable Halocarbons	Gas Chromatograph	EPA 601	EPA 8010	2 - 40 ml Gl...	4 oz Glass	Na2S2O3 for tre...	14 Days
						HCL for untreated	
PCB's	Gas Chromatograph	EPA 608	EPA 8080	2 - 1 L Br. G...	40 ml Glass	Cool 4 C	7 Days until ex
							40 Days after ex
Semi-volatile Organics	GC/Mass Spectrom...	EPA 625	EPA 8270	2 - 1 L Br. G...	2 - 8 oz Glass	Cool 4 C	7 Days until ex
							40 Days after ex
Total Trihalomethanes	Gas Chromatograph	EPA 501.1		2 - 40 ml Glass		Na2S2O3	14 Days
Volatile Halogenated Organics	Gas Chromatograph	EPA 502.1		2 - 40 ml Glass		Na2S2O3 for tre...	14 Days
						HCl for untreated	
Volatile Organic Compounds	Gas Chromatograph	EPA 502.2	EPA 8010/8020	2 - 40 ml Gl...	8 oz Glass	Na2S2O3 for tre...	14 Days
			plus MEK			HCl for untreated	
	GC/ Mass Spectro...	EPA 624	EPA 8240	2 - 40 ml Gl...	4 oz Glass	Cool 4 C	14 Days

SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIME

DESCRIPTION (Parameter)	(Method)	WATER & WASTEWATER METHOD EPA 600/4-79-020	SOLID WASTE METHOD SW-846	CONTAINER TYPE Water	Solid	PRESERVATIVE (Water Samples)	HOLDING TIME
Volatile Aromatic and Unsaturated Organics	Gas Chromatograph	EPA 503.1		2 - 40 ml Glass		Na2S2O3 for tre... HCl for untreated	14 Days
HAZARDOUS WASTE							
Corrosivity	pH Electrode		EPA 1110				
Ignitability	P-M Closed Cup		EPA 1010		125 ml Glass	None	14 Days
Lead in Paint	Ashed/ICP		ASTM D3335		40 ml Glass	None	180 Days
Sulfur in Waste Oil	O2-Bomb/Spectroph.		ASTMD129		40 ml Glass	None	14 Days
Reactivity			EPA SW846 7.3				
TCLP Extraction				2 - 1 L Plastic 1 L Br. Glass	2 - 8 oz Glass	Cool 4 C	7 Days
Total Halogens	O2-Bomb/Merc. Nitr...	EPA 325.3	ASTM D808		4 oz Glass	None	7 Days
Total Organic Halogens	O2-Bomb/Merc. Nitr...	EPA 325.3	ASTM D808		4 oz Glass	None	7 Days
MICROBIOLOGY							
Total Coliform	Membrane Filter or Colilert	SM909.A		Sterile 125 ml Plastic		Na2S2O3	24 Hours
Fecal Coliform	Membrane Filter	SM909.C		Sterile 50 ml Plastic		Na2S2O3	24 Hours