TRC

Customer-Focused Solutions

Brownfields Program Quality Assurance Project Plan
City of Middletown

Middletown Waste Water Treatment Facility
River Road, Middletown, Connecticut
Peterson Oil
River Road, Middletown, Connecticut

March 2000

Prepared By:

TRC Environmental Corporation
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Windsor, CT 06095
(860) 289-8631

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Lowell -
978-970-5600

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Appendix A

1. Title and Approval Page

Middletown Quality Assurance Project Plan

Sarah J. Trombetta, LEP TRC

TRC Environmental Corporation
5 Waterside Crossing
Windsor, CT 06095
860-298-6219

03/30/00

Project Manager: ______________________
Signature

Sarah J. Trombetta, LEP 03/30/2000

Project QA Officer: ______________________
Signature

Dale Weiss, P.G. 03/30/2000

U.S. EPA Project Manager Approval:
Signature

Printed Name/Date

Appendix B

2. Project Organization and Responsibility

The following chart presents the organizational structure for this project.

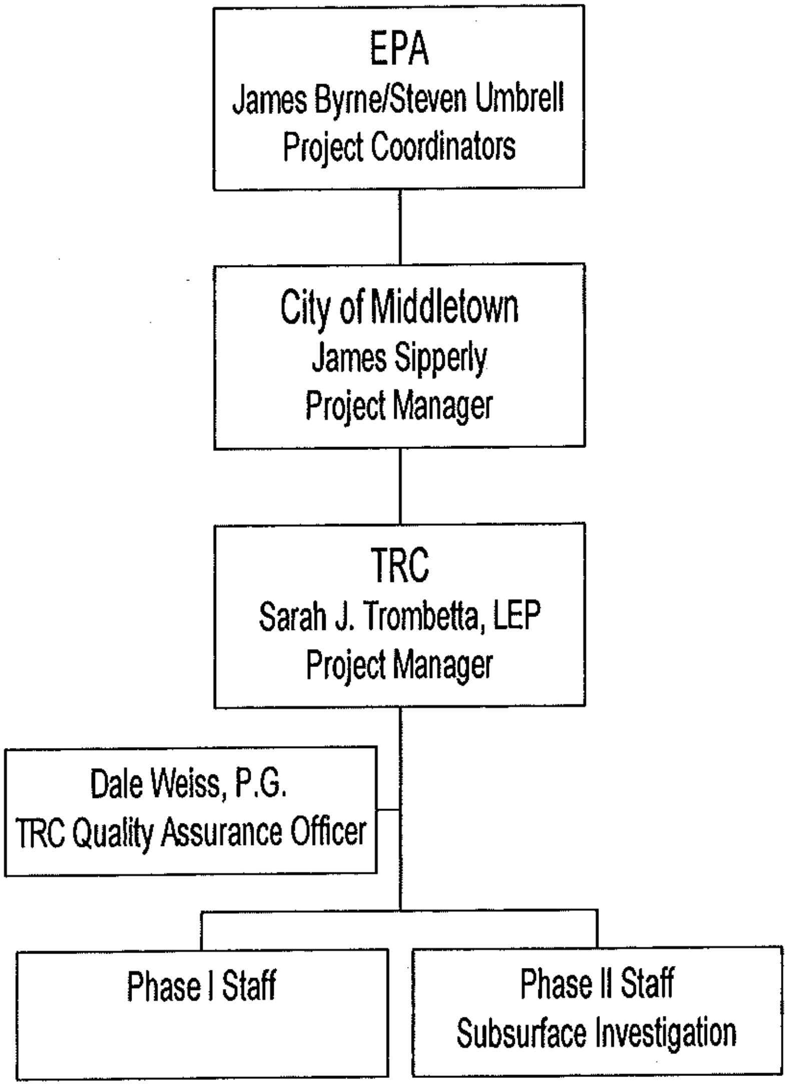
EPA Project Coordinator: James Byrne and Steven Umbrell have been assigned by EPA to oversee the project for EPA. Mr. Byrne and Mr. Umbrell will determine whether activities proposed by the City are within the scope of the cooperative agreement.

Middletown Project Manager: James Sipperly will direct all aspects of the program for the City of Middletown. He will coordinate all contractor activities and provide managerial support during the field investigation, and is ultimately responsible for successful project completion. Mr. Sipperly will seek all necessary approvals for all activities under this program from Mr. Byrne and/or Mr. Umbrell.

TRC Project Manager: TRC is the environmental firm who will be conducting the site assessment and community outreach aspects of this project. The TRC Project Manager, Sarah Trombetta, will provide overall direction to the field investigation team including both the sampling crew and drillers. The Project Manager will be the primary contact for the City of Middletown's Project Manager.

TRC Quality Assurance Officer: TRC's QA officer, Dale Weiss, will monitor compliance of the project with this plan, and perform any necessary formal corrective actions. He will assist in preparing QA/QC project summaries for the Final Report, including analysis precision, accuracy and completeness of data collected, with the assistance of TRC QC staff.

Field Staff: A Field QC Coordinator will be selected for this project. They will be in charge of the field investigation. This individual will also serve as the Field Team Leader. The Field QC Coordinator will work with the field crew to prepare for field activities and conduct investigations. They will be on-site to: 1) ensure that required QC procedures are followed for sample collection and drilling; 2) initiate informal and/or formal corrective actions, as necessary; and 3) maintain and report QC records (i.e. Chain–of–Custody) and reports to the Project Manager and QA Officer.


EPA
James Byrne/Steven Umbrell
Project Coordinators
City of Middletown
James Sipperly
Project Manager
TRC
Sarah J. Trombetta, LEP
Project Manager
Dale Weiss, P.G.
TRC Quality Assurance Officer
Phase I Staff
Phase II Staff
Subsurface Investigation

Appendix C

3. Problem Definition

Subject Properties:

The subject properties are two parcels located on River Road and are occupied by the City's Waste Water Treatment Facility (WWTF) and a former fuel oil distribution center, known as Peterson Oil, respectively. The City owns both properties, and would like to determine 1) if any environmental cleanup is needed, and 2) the costs associated with the cleanup. The City is interested in revitalizing both sites as part of the City's Riverfront Redevelopment Initiative, as they are two of the key sites (and the two direct waterfront properties) within the Riverfront Redevelopment Area. The general site location is shown on Figure 1.

Phase I and Phase II Environmental Site Assessments (ESAs) of the Peterson property were completed by Marin Environmental in 1998. A Phase I ESA was completed for the WWTF by TRC as part of the Brownfields Program in February 2000. The report indicated that the WWTF site contains a large amount of fill of unknown origin, was the site of a PCB–containing oil spill and has two underground storage tanks (USTs) currently abandoned in place. The Peterson property has known contamination (as identified in the Phase II ESA) related to an unknown source of lead in the ground water, the release of fuel oil as well as potential solvents in the septic tank/leaching field area. The area around the septic tank and leaching field has not been adequately investigated.

Consequently, the information gathered from both TRC and Marin's investigation indicates that there are several potential source areas for environmental contamination at the WWTF property and at least one area on the Peterson property that requires additional investigation and remedial feasibilities evaluated The City plans to conduct a Phase II Site Investigation at the WWTF property and a Phase III at the Peterson property to assess the cost (of any), or design limitations for future development that might be imposed by site contamination

To assess re-use options for the site, the brownfields team will assess the site conditions, and make the following decisions: Is the site and/or building clean enough to allow for unrestricted site re-use? If clean up is necessary, what activities and cost estimation procedures are needed to successfully market the site to developers?

These site assessments are the **first two** of **15** new projects under the City of Middletown's Brownfields Redevelopment Initiative as funded under the EPA Brownfields Demonstration Pilot Program.

Other Sites: As part of the Brownfields Program, the City will select additional Phase II Site Assessment project sites that are a priority for redevelopment. As these properties are identified this QAPjP will be modified per QAPjP Addenda, detailing site conditions, sampling plans, and testing methods and procedures to be used.

Appendix D

4. Project Description

The City of Middletown is currently implementing a Brownfields Demonstration Pilot Program for EPA. Portions of this program include environmental sampling of various media at some sites that have been identified, and other sites that have not yet been identified. This Quality Assurance Project Plan (QAPjP), which is required as part of the City's Grant Agreement with EPA, documents the sampling and monitoring activities to be implemented during the Brownfields Program. The plan described the quality assurance/quality control (QA/QC) procedures to be employed to ensure the integrity, validity, and usability of the analytical results to be provided in support of this project.

This document was prepared in accordance with the EPA documents entitled *Quality Assurance Guidance for Conducting Brownfields Site Assessments (EPA-R-98-038)* dated September 1998 and *QA/R-5, EPA Requirements for Quality Assurance Project Plans*, dated November 1997. This plan defines sampling strategies, methods, and locations, analytical methods, data handling and tracking procedures, and specific QC procedures and QA mechanisms that will be utilized for the Brownfields Program in Middletown, Connecticut. The purpose of the QAPjP is to establish procedures to ascertain the precision, accuracy and representativeness of the collected data.

WWTF property: Previous testing has not been performed at the site. Potential source areas identified in the Phase I Site Assessment are summarized below, and are indicated on Figure 2.

No.	Potential Source Area	Location	Contaminant(s) of Concern
1	Fill of unknown origin	Entire Site	Metals, VOCs/Solvents, Petroleum constituents
2	PCB-oil spill	Western side of the southern-most building	PCBs
3	Abandoned 10,000-gallon UST	Northeast corner of the northern-most building	Petroleum Hydrocarbons, VOCs, PAHs
4	Abandoned 1,000-gallon UST	Western side of the southern-most building	Petroleum Hydrocarbons, VOCs, PAHs

Peterson property: Previous Phase II testing has been performed at the site. The Phase II investigation (Marin 1998) included the installation of fourteen (14) borings, eight of which were completed as monitoring wells. Soil and ground water samples were taken and analyzed to determine the impacts, if any, on the soil and groundwater as a result of the underground/ aboveground storage tanks that were formerly located on the site and the septic system which is currently still serving the site. This investigation concluded that elevated levels of dissolved lead, total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs) were present in the ground water and surface and subsurface soils. The levels of dissolved lead in the groundwater at three locations equaled or exceeded the applicable Connecticut Remediation Standards Regulations (RSRs). Benzene was also detected in the ground water at levels exceeding residential volatilization criteria. The full extent of the contamination was not determined.

Potential source areas identified in the Phase I Site Assessment are summarized below, and are indicated on Figure 2.

No.	Potential Source Area	Location	Contaminant(s) of Concern
1	Unknown source of lead	Entire Site	Lead and other metals,
2	Septic Tank and leaching fields	Northern side of building adjacent to Sumner Brook	Chlorinated and aromatic hydrocarbons
3	Eastern end of the former tank farm	Southern part of the site	Petroleum Hydrocarbons, VOCs, PAHs
4	Former loading racks	West-central portion of the site	Petroleum Hydrocarbons, VOCs, PAHs

The following activities are planned on both sites as part of the site investigation.

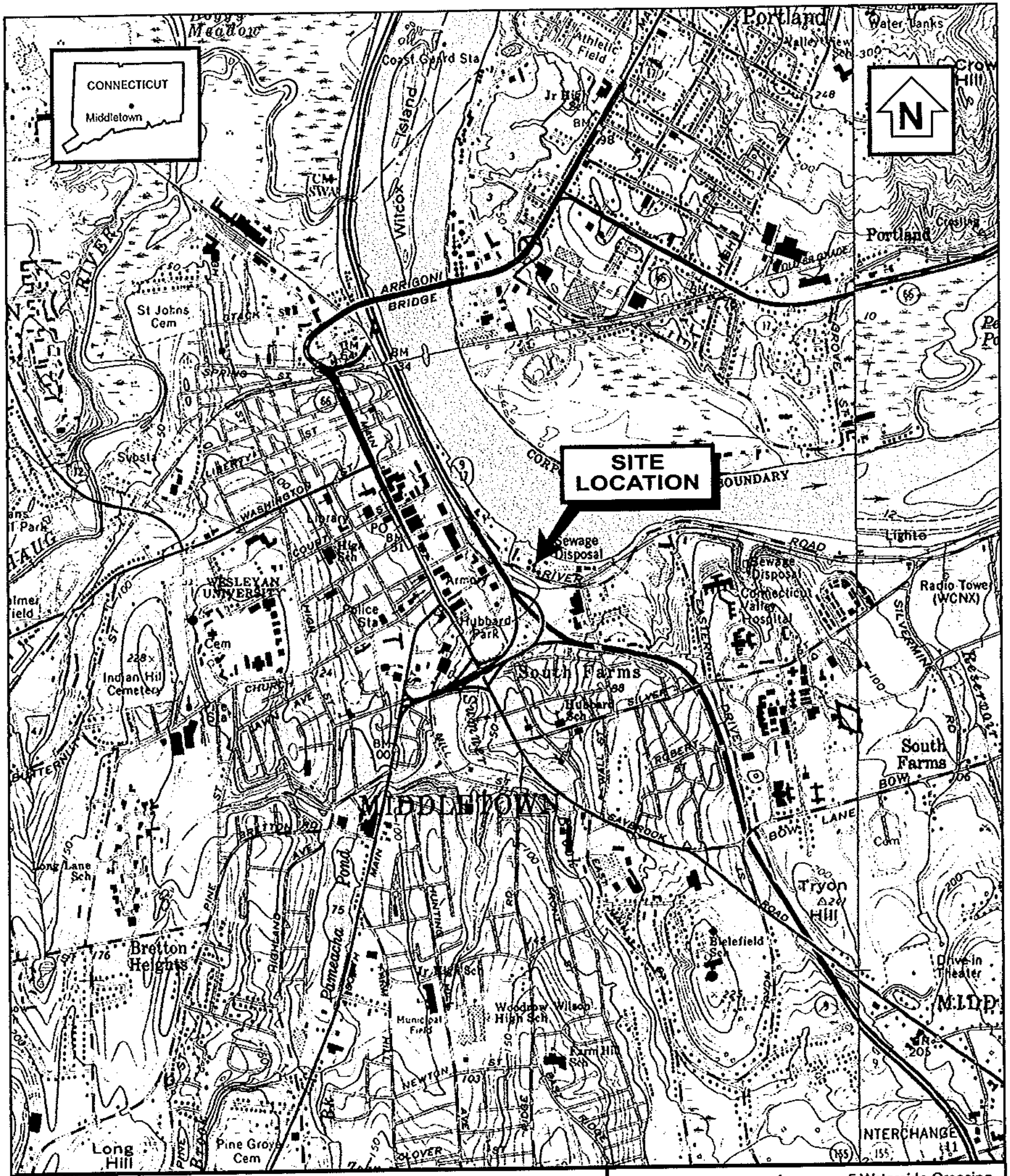
Based on the information from the Phase II report on the Peterson property and the proximity of the Connecticut River to both sites, the approximate elevation of the ground water table is known. Therefore, soil and ground water samples will be collected at both sites in order to assess the nature and extent of contamination (if any) introduced from the potential areas of concern. The resulting data will be used to determine if there are any site conditions on either property that 1) require notification to the Connecticut Department of Environmental Protection (DEP), 2) require remediation, or 3) would preclude redevelopment of the property.

Surface and subsurface soil and ground water samples will be obtained from suspected on-site source areas and in the case of the WWTF, generally over the site to evaluate possible impact from the fill. Soil samples will be obtained from the surface and subsurface via hollow-stem auger drilling. Monitoring wells will be installed at selected locations across the WWTF site. At the Peterson property, existing wells will be resampled and three additional wells will be installed.

All subsurface soil samples will be screened in the field for volatile organic compounds (VOCs) using a jar headspace method. Split-spoon samples will be obtained continuously at 2-foot intervals in all borings. Immediately upon collecting the sample, an OVA will pass over the surface of the sample to note any organic vapor readings above background. Next a sample of soil will be carefully placed (in a manner to minimize volatilization) into appropriate sample containers and placed on ice. Following this, another sample will be placed into a jar (>8oz.) and capped with foil. After at least 30 minutes, the sample cap will be removed from the jar and an

OVA probe will be inserted through the foil to measure the organic vapor concentration in the headspace. All screening readings will be recorded on field notes, and these data will be used to determine which samples will be sent to an off-site laboratory. Soil samples will be analyzed in the laboratory for chemical parameters as described in Appendices E and F.

At the locations identified on the figure, ground water monitoring wells will be installed and developed. Ground water samples will be obtained by low-flow pump and placed directly into appropriate containers for the same analyses as the soil samples from the same location.



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SCALE FEET

0 1
SCALE MILE
1:24000

BASE CREATED WITH TOPO™ © 1996 WILDFLOWERS PRODUCTIONS, www.topo.com
MIDDLETOWN AND MIDDLE HADDAM, CT - 7.5' USGS TOPOGRAPHIC MAPS

TRC *Environmental Corporation*

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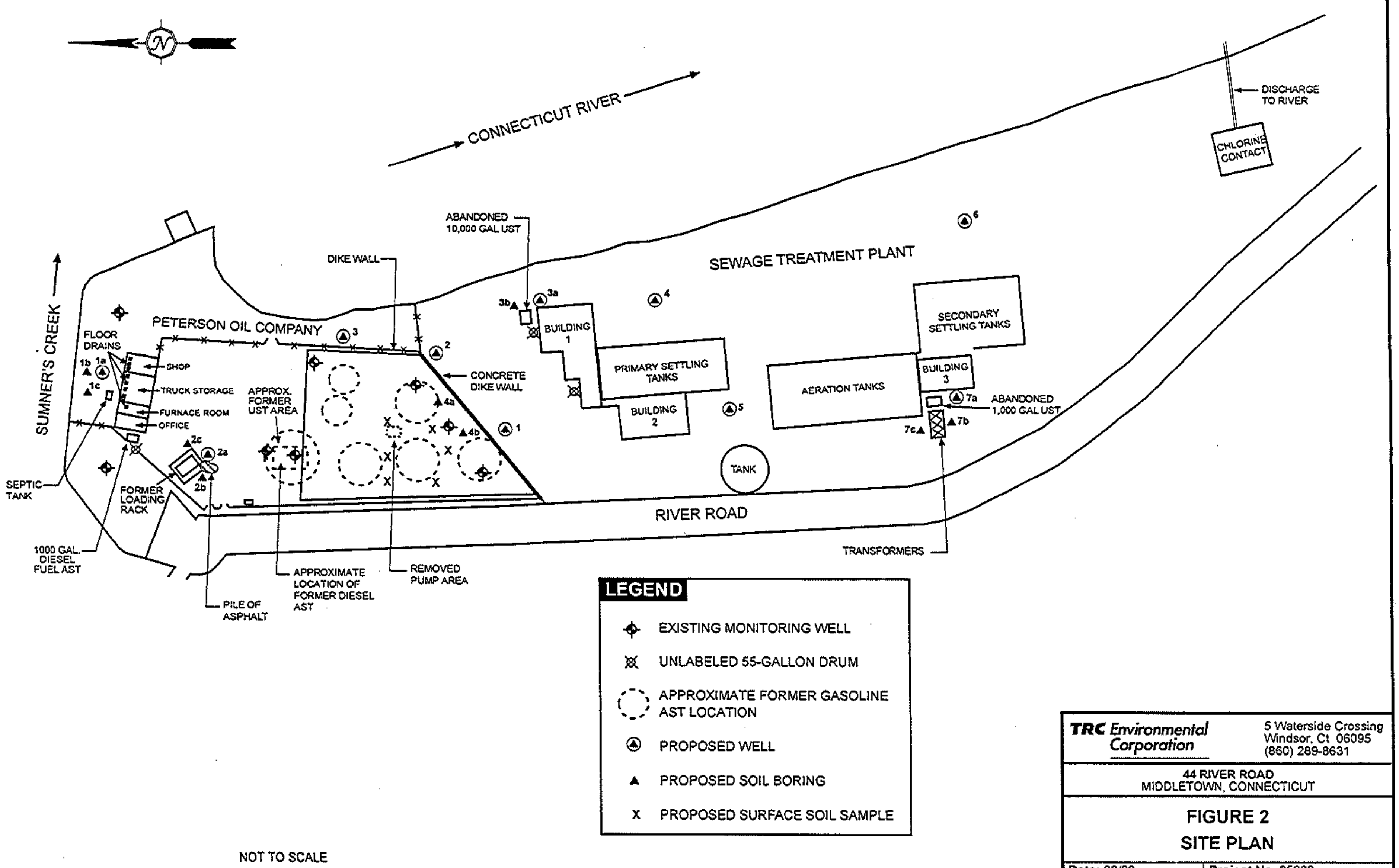
44 RIVER ROAD
MIDDLETOWN, CONNECTICUT

FIGURE 1
SITE LOCATION MAP

Date: 03/00 | Project No. 25863



TRC *Environmental Corporation*

5 Waterside Crossing
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44 RIVER ROAD
MIDDLETOWN, CONNECTICUT

FIGURE 2
SITE PLAN

Date: 03/00 | Project No. 25863

25863.FH8

Appendix D (Cont.)

4a. Project Timeline

Activities (List Products)	Project Start	Project End
QAPP Submission	3/1/00	3/31/00
EPA Approval	4/3/00	4/21/00
Site Testing	4/28/00	5/12/00
WWTF Phase II Report	5/12/00	5/31/00
Peterson Phase III Report	5/12/00	6/5/00

Appendix E

5. Sampling Design

Based on existing knowledge of the properties, TRC will drill borings, install monitoring wells and collect soil and ground water samples from both sites. At the WWTF, this sampling will determine whether there are any on-site or adjacent off-site (Peterson) source of RCRA metals, PCBs, TPH, VOCs and SVOCs. At the Peterson site, the data will be used to further define the nature and extent of the known contamination and characterize the other potential source areas.

As indicated on the Site Map that shows both sites (Figure 1), borings and wells will be installed at the WWTF as follows:

Locations 1 & 2:	Upgradient of the site along the Peterson property line.
Location 3:	Downgradient of abandoned 10,000 gallon UST
Locations 4 & 6:	Generally downgradient
Location 5:	Central site location
Location 7:	Downgradient of PCB spill and abandoned 1000 gallon UST.

At these locations, hollow-stem auger split-spoon sampling will be used to collect soil samples. Two-inch diameter monitoring wells will be installed within each boring location described above. In addition to these locations, three other borings (one at Location 3 and two at Location 7) will be completed for soil sampling.

All soil samples will be screened using an Organic Vapor Analyzer (OVA) or equivalent, and any odors or visual indication of petroleum contamination noted. All equipment will be decontaminated between test pits to minimize the possibility of cross-contamination.

Based on the screening observations, one soil sample from each of the borings (10) will be selected for laboratory analysis. If no indications of possible contamination are observed, the sample at the ground water table surface, or at the bottom of each boring if ground water is not encountered, will be selected for analysis. Soil samples will be analyzed for ETPH by the CTDEP ETPH method, volatile organic compounds (VOCs) by EPA Method 5035/8260, Semi-Volatile Compounds (SVOCs) by EPA Method 8270, PCBs by Method 8082, and the RCRA 8 metals by SPLP. The breakdown of analyses is as follows:

Boring B-1: ETPH, VOCs, SVOCs, Metals
Boring B-2: ETPH, VOCs, SVOCs, Metals
Boring B-3a: ETPH, VOCs, SVOCs, Metals

Boring B-3b: ETPH, SVOCs,
Boring B-4: VOCs, SVOCs, Metals

Boring B-5: VOCs, SVOCs, Metals
Boring B-6: VOCs, SVOCs, Metals
Boring B-7a: ETPH, PCBs, VOCs, SVOCs, Metals
Boring B-7b: ETPH, PCBs, SVOCs
Boring B-7c: ETPH, PCBs, SVOCs

Following the completion of seven of the borings, TRC will direct the drilling contractor in the process of installing a ground water monitoring well in those boreholes. Following the installation and development process, TRC will collect ground water samples from each monitoring well to determine whether past site use has impacted the ground water conditions at the property. TRC will submit the ground water samples to a laboratory for chemical analysis. The analyses will be as follows:

Well B-1: VOCs, Metals
Well B-2: VOCs, Metals
Well B-3: ETPH, VOCs, Metals
Well B-4: VOCs, Metals
Well B-5: VOCs, Metals
Well B-6: VOCs, Metals
Well B-7: ETPH, PCBs, VOCs, Metals

All soil and ground water samples, including blind duplicates, rinsate blanks and a trip blank will be placed on ice, kept cool (approximately 4 degrees Centigrade) and will be delivered to a Connecticut state-certified laboratory, following proper chain-of-custody procedures.

As indicated on the Site Map that shows both sites (Figure 1), borings and wells will be installed at the Peterson property as follows:

Location 1: Septic tank area will have one well and two borings
Location 2: Former loading rack area will have one well and two borings
Location 3: Downgradient site location near the Connecticut River
Location 4: Removed tank area will have four borings and six surface soil samples.

At the boring and well locations, hollow-stem auger split-spoon sampling will be used to collect soil samples. Two-inch diameter monitoring wells will be installed within each well location described above. The surface soil samples will be obtained around the areas of the previous surface soil samples at 0 to 2 feet in depth.

All soil samples will be screened using an Organic Vapor Analyzer (OVA) or equivalent, and any odors or visual indication of petroleum contamination noted. All equipment will be decontaminated between test pits to minimize the possibility of cross-contamination.

Based on the screening observations, one soil sample from each of the borings (9) will be selected for laboratory analysis. If no indications of possible contamination are observed, the sample at the ground water table surface, or at the bottom of each boring if ground water is not encountered, will be selected for analysis. Soil samples will be analyzed for ETPH by the CTDEP ETPH method, volatile organic compounds (VOCs) by EPA Method 5035/8260, Semi-Volatile Compounds (SVOCs) by EPA Method 8270, and the RCRA 8 metals by SPLP. The breakdown of analyses is as follows:

Boring B-1a: ETPH, VOCs, Metals
Boring B-1b: ETPH, VOCs, Metals
Boring B-1c: ETPH, VOCs, Metals
Boring B-2a: ETPH, SVOCs, VOCs, Metals
Boring B-2b: VOCs, ETPH, Metals
Boring B-3: VOCs, ETPH, Metals
Boring B-4a: ETPH, VOCs, SVOCs, Metals
Boring B-4b: TPH, PCBs, SVOCs

Following the completion of three of the borings, TRC will direct the drilling contractor in the process of installing a ground water monitoring well in those boreholes. Following the installation and development process, TRC will collect ground water samples from each new monitoring well, as well as the existing monitoring wells to determine whether past site use has impacted the ground water conditions at the property. TRC will submit the ground water samples to a laboratory for chemical analysis. The analyses will be as follows:

Well B-1a: VOCs, Metals
Well B-2a: VOCs, Metals, TPH
Well B-3: VOCs, Metals
All existing Monitoring wells: VOCs and Metals

Grab surface soil samples will be collected from the areas identified in the Phase II Investigation indicated TPH contamination over the RSRs. As indicated on Figure 1, these soils are located in the former tank areas. Samples will be collected from 0-2 feet in depth using decontaminated split spoons and placed in appropriate containers. Surface soil samples will be analyzed for ETPH and the RCRA 8 metals by SPLP.

All soil and ground water samples, including blind duplicates, rinsate blanks and a trip blank will be placed on ice, kept cool (approximately 4 degrees Centigrade) and will be delivered to a Connecticut state-certified laboratory, following proper chain-of-custody procedures.

TABLE F-1: WWTF PROPERTY SAMPLING AND QA SUMMARY

Field Sample Matrix	Parameter	Sample Type	Number of Samples	Analytical Method Reference	Sample Preservation	Holding Time from Collection	Container
Soil	RCRA-8 Metals by SPLP	Field Duplicate	1	SW846 Method 1312/6010B Method 1312/7471A	Cool to 4°C	180 days Mercury: 28 days	1-8 oz. Polyethylene/glass bottle and cap
Soil	PCBs	Field Duplicate	1	SW-846 Method 8082	Cool to 4°C	14 days	1-8 oz glass jar w/Teflon lined cap
Soil	Semi-volatile Organics	Field Duplicate	1	SW-846 Method 8270C	Cool to 4°C	14 days to extraction, 40 days to analysis	1-8 oz glass jar w/Teflon lined cap
Water	Extractable Total Petroleum Hydrocarbons	Rinsate	1	CT ETPH Rev. 0	Cool to 4°C	28 days	1000 ml glass jar w/Teflon lined cap
Water	Volatile Organics	Field Samples	7	SW-846 Method 8260B	Cool to 4°C$^{(B)}$	14 days to analysis	2-40ml glass vial w/Teflon septa
Water	RCRA 8 Metals	Field Sample	7	SW-846 Method 6010B 7471A	Cool to 4°C	180 days: Mercury: 28 days	1-1 liter polyethylene bottle and cap
Water	Extractable Total Petroleum Hydrocarbons	Field Sample	2	CT ETPH Rev. 0	Cool to 4°C	28 days	1000 ml glass jar w/Teflon lined cap
Water	PCBs	Field Sample	1	SW-846 Method 8082	Cool to 4°C	7 days to extraction; 40 days to analysis	1-1liter amber glass jar w/Teflon lined cap

TABLE F-1: WWTF PROPERTY
SAMPLING AND QA SUMMARY

Field Sample Matrix	Parameter	Sample Type	Number of Samples	Analytical Method Reference	Sample Preservation	Holding Time from Collection	Container
Water	Volatile Organics	Field Duplicate	1	SW-846 Method 8260B	Cool to 4°C$^{(B)}$	14 days to analysis	2-40ml glass vial w/Teflon septa
Water	RCRA 8 Metals	Field Duplicate	1	SW-846 Method 6010B 7471A	Cool to 4°C	180 days: Mercury: 28 days	1-1 liter polyethylene bottle and cap
Water	Extractable Total Petroleum Hydrocarbons	Field Duplicate	1	CT ETPH Rev. 0	Cool to 4°C	28 days	1000 ml glass jar w/Teflon lined cap
Water	PCBs	Field Duplicate	1	SW-846 Method 8082	Cool to 4°C	7 days to extraction; 40 days to analysis	1-1liter amber glass jar w/Teflon lined cap
Water	Volatile Organics	Trip Blank	1	SW-846 Method 8260B	Cool to 4°C$^{(B)}$	14 days to analysis	2-40ml glass vial w/Teflon septa
Water	RCRA 8 Metals	Field Rinsate	1	SW-846 Method 6010B 7471A	Cool to 4°C	180 days: Mercury: 28 days	1-1 liter polyethylene bottle and cap

(A) One field sample per sampling event will be collected at triple volume to provide laboratory with sufficient sample volume to perform MS/MSD analyses.

(B) Preservation of water sample: Adjust the pH to <2 by carefully adding 1:1 HCl drop by drop to required sample container. The number of drops of HCl required should be determined on a separate sample of equal volume. Cool to 4°C.

TABLE F-2: PETERSON PROPERTY SAMPLING AND QA SUMMARY							
Field Sample Matrix	**Parameter**	**Sample Type**	**Number of Samples**	**Analytical Method Reference**	**Sample Preservation**	**Holding Time from Collection**	**Container**
Soil	Volatile Organics	Field Sample	9 (A)	SW-846 Method 5035/8260B	Methanol and sodium bisulfate preserved in the field Cool to 4°C	14 days to analysis	1-40 ml methanol preserved and 2-40ml sodium bisulfate preserved 4 oz glass jars w/Teflon lined cap
Soil	Extractable Total Petroleum Hydrocarbons	Field Sample	15	CT ETPH Rev. 0	Cool to 4°C	28 days to extraction, 40 days to analysis	1-4 oz glass jar w/Teflon lined cap
Soil	RCRA-8 Metals by SPLP	Field Sample	15	SW846 Method 1312/6010B Method 1312/7471A	Cool to 4°C	180 days Mercury: 28 days	1-8 oz. Polyethylene/glass bottle and cap
Soil	Semi-volatile Organics	Field Sample	3	SW-846 Method 8270C	Cool to 4°C	14 days to extraction, 40 days to analysis	1-8 oz glass jar w/Teflon lined cap
Soil	Volatile Organics	Field Duplicate	1	SW-846 Method 5035/8260B	Methanol and sodium bisulfate preserved in the field Cool to 4°C	14 days to analysis	1-40 ml methanol preserved and 2-40ml sodium bisulfate preserved 4 oz glass jars w/Teflon
Soil	Extractable Total Petroleum Hydrocarbons	Field Duplicate	1	CT ETPH Rev. 0	Cool to 4°C	28 days to extraction, 40 days to analysis	1-4 oz glass jar w/Teflon lined cap
Soil	Semi-volatile Organics	Field Duplicate	1	SW-846 Method 8270C	Cool to 4°C	14 days to extraction, 40 days to	1-8 oz glass jar w/Teflon lined cap
Soil	RCRA-8 Metals by SPLP	Field Duplicate	1	SW846 Method 1312/6010B Method 1312/7471A	Cool to 4°C	180 days Mercury: 28 days	1-8 oz. Polyethylene/glass bottle and cap

TABLE F-2: PETERSON PROPERTY
SAMPLING AND QA SUMMARY

Field Sample Matrix	**Parameter**	**Sample Type**	**Number of Samples**	**Analytical Method Reference**	**Sample Preservation**	**Holding Time from Collection**	**Container**
Water	Extractable Total Petroleum Hydrocarbons	Rinsate	1	CT ETPH Rev. 0	Cool to 4°C	28 days	1000 ml glass jar w/Teflon lined cap
Water	Volatile Organics	Field Samples	11	SW-846 Method 8260B	Cool to 4°C$^{(B)}$	14 days to analysis	2-40ml glass vial w/Teflon septa
Water	RCRA 8 Metals	Field Sample	11	SW-846 Method 6010B 7471A	Cool to 4°C	180 days: Mercury: 28 days	1-1 liter polyethylene bottle and cap
Water	Extractable Total Petroleum Hydrocarbons	Field Sample	1	CT ETPH Rev. 0	Cool to 4°C	28 days	1000 ml glass jar w/Teflon lined cap
Water	Volatile Organics	Field Duplicate	1	SW-846 Method 8260B	Cool to 4°C$^{(B)}$	14 days to analysis	2-40ml glass vial w/Teflon septa
Water	RCRA 8 Metals	Field Duplicate	1	SW-846 Method 6010B 7471A	Cool to 4°C	180 days: Mercury: 28 days	1-1 liter polyethylene bottle and cap
Water	Extractable Total Petroleum Hydrocarbons	Field Duplicate	1	CT ETPH Rev. 0	Cool to 4°C	28 days	1000 ml glass jar w/Teflon lined cap
Water	Volatile Organics	Trip Blank	1	SW-846 Method 8260B	Cool to 4°C$^{(B)}$	14 days to analysis	2-40ml glass vial w/Teflon septa

TABLE F-2: PETERSON PROPERTY SAMPLING AND QA SUMMARY

Field Sample Matrix	Parameter	Sample Type	Number of Samples	Analytical Method Reference	Sample Preservation	Holding Time from Collection	Container
Water	RCRA 8 Metals	Field Rinsate	1	SW-846 Method 6010B 7471A	Cool to 4°C	180 days: Mercury: 28 days	1-1 liter polyethylene bottle and cap

(A) One field sample per sampling event will be collected at triple volume to provide laboratory with sufficient sample volume to perform MS/MSD analyses.

(B) Preservation of water sample: Adjust the pH to <2 by carefully adding 1:1 HCl drop by drop to required sample container. The number of drops of HCl required should be determined on a separate sample of equal volume. Cool to 4°C.

Analytical Method Reference: Include document title, method name/number, revision number, date	Project Analytical SOPs: Include document title, date, revision number, and originator's name
1a. 40 CFR 136.3e Required containers, preservative techniques, and holding times	1b. See the Lab QA Plan (Attachment A).
2a. Wagner, R.E., Kotas, W.A., Hotaling, I.C., Hynes, T.C., Daly, J. and McTague, M.F. (eds.). Guide to Environmental Analytical Methods, 4th ed. Genium Publishing Corporation, Schenectady, NY. 1998. Reference for SW-846 information on method validation, calibration guidelines, and QC checks.	2b. Same as above
3a. USEPA. Methods for the Determination of Metals in Environmental Samples, Supplement I [to EPA/600-4-91-010]. EPA/600/R-91-011. May 1994.	3b. Same as above
4a. USEPA. Method for the Determination of Total Petroleum Hydrocarbons, Total Recoverable. Method 418. 1978.	4b. Same as above
5a. USEPA. Method for the Determination of Polychlorinated Biphenyls (PCB) by Gas Chromatography. SW846 Method 8082, Revision 0. December 1996.	5b. Same as above
6a. USEPA. Method for the Determination of Volatile Organic Compounds by Gas Chromatography. SW846 Method 8260B, Revision 2. December 1996.	6b. Same as above
7a. USEPA. Method for the Determination of Semi-volatile Organic Compounds by Gas Chromatography/Mass Spectrometry. SW846 Method 8270, Revision 3. December 1996.	7b. Same as above.
8a. USEPA. Method for the Determination of Metals, SW-846 Method 6010B, Revision 2. December 1996.	8b. Same as above
9a. USEPA. Method for the Determination of Mercury, SW846 Method 7471A, Revision 1. September 1994.	9b. Same as above

Appendix G

7. Preventive Maintenance - Field Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. The calibration and internal standards shall meet all criteria specified in the referenced analytical method.

For all analyses for which EPA or DEP approved methods exist, the laboratory will employ such methods and follow the calibration procedures and frequencies specified.

Calibration of field instruments and equipment will be performed as specified by the manufacturer or more frequently as conditions dictate. The minimum calibration of field Instrumentation is once at the beginning of each day, and as necessary. Calibration standards used as reference standards will be traceable to the National Institute of Standards and Technology, when existent.

Records of calibration, repair, or replacement will be filled and maintained by the designated laboratory personnel performing quality control activities. Calibration records of assigned laboratories will be filed and maintained at the laboratory location where the work is performed and subject to QA audit.

Instrument	Activity	Frequency	SOP Ref.*
OVA/PID Meter	Field Sample Screening	Daily	Per TRC SOP

*** Insert the appropriate reference number/letter from Appendix F, Method and SOP Reference Table.**

Appendix H

8. Calibrations and Corrective Action - Field Equipment

Instrument	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref.*
OVA/PID Meter	Check calibration with span gas	Beginning and end of day	± 10%	Re-calibrate using manufacturer's instructions and re-check with span gas	Per TRC SOPs

*** Insert the appropriate reference number/letter from Appendix F, Method and SOP Reference Table.**

Appendix I

9. Preventive Maintenance - Laboratory Equipment

Instrument	Activity	Frequency	SOP Ref.*
GC/MS	Maintain per manufacturer's instructions	Per manufacturer's instructions	2a, 6a, 7a
ICP	Maintain per manufacturer's instructions	Per manufacturer's instructions	2a, 3a, 8a, 9a
Infrared Spectrophotometer	Maintain per manufacturer's instructions	Per manufacturer's instructions	4a
GC/ECD	Maintain per manufacturer's instructions	Per manufacturer's instructions	*5a*

*** Insert the appropriate reference number/letter from Appendix F, Method and SOP Reference Table.**

Appendix J

10. Calibration and Corrective Action - Laboratory Equipment

Instrument	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref.*
GC/MS	Initial calibration – 5 levels one near minimum detection limit (MDL) plus blank	Initiating service of instrument	RF>0.03 %RSD <30%	Service Instrument	2a, 6a, 7a
GC/MS	Continuing calibration – 5 levels same as initial calibration	Once every 12 hours of service	RF must be <25% difference from initial calibration	Service Instrument	2a, 6a, 7a
GC/MS	Internal standards – compound dependent upon analyte	Every sample	RT must be ± 30 seconds from last calibration, area must be 50-200%	Service Instrument	2a, 6a, 7a
ICP	Per instrument manufacturer's specifications – 3 levels and a blank	Initiating service of instrument	Per manufacturer's specifications	Service Instrument	2a, 3a, 8a
ICP	Continuing calibration – analyze midlevel standard (as above)	Once every 10 samples	%R=91-110	Service Instrument	2a, 3a, 8a, 9a
ICP	Internal standards	Not applicable			
Infrared Spectrophotometer	Initial calibration – 5 levels one at reporting limit	Initial service of instrument	CF-%RSD≤25%	Service Instrument	4a
Infrared Spectrophotometer	Continuing calibration – mid-level calibration – calibration standards	Once per day of service or every 20 samples	RF must be ±25% difference from initial calibration	Run new calibration curve (5 standards) and/or service instrument	4a
GC/ECD	Initial calibration Aroclors –	Initiating service of	CF - % RSD ≤25%	Service Instrument	*5a*

Instrument	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref.*
	5 levels of standard containing mixture of Aroclors 1016 and 1260 – Bracket Linear range of detection. Midpoint concentration of other 5 Aroclors	instrument			
GC/ECD	Continuing calibration	1 standard per 10 samples	RF – within 15% of initial calibration	Run new calibration curve and/or service instrument	*5a*

*** Insert the appropriate reference number/letter from Appendix F, Method and SOP Reference Table.**

Appendix K

11. Sample Handling and Custody Requirements (use multiple pages if needed)

The purpose of chain-of-custody procedures is to document the identity of the sample and it's handling from its first existence as a sample until analysis and data reduction are completed. Custody records trace a sample from its collection through all transfers of custody until it is transferred to the analytical laboratory. Internal laboratory records then document the custody of the sample through its final disposition.

All materials such as field and laboratory notebooks and logbooks, field and laboratory data records, correspondence, reports, sample tags, chain-of-custody records and instrument printouts will be clearly labeled with the project number and become a permanent part of the project file.

Field Sampling Operations

Preprinted sample identification tags will be used to ensure that the required information is entered in the field. Each collected sample shall have a completely filled-in sample tag securely attached. In addition, the sample identification number will be marked on the container with a permanent marker so that the sample can be properly identified even if the tag is separated from the sample.

Figure 7-1 shows the general sample tag and custody seal that will be used to identify and seal samples in the field. Figure 7-2 shows a general use chain-of-custody record. This two-part carbonless copy form is based on EPA's NEIC format and will be used to document sample transfer in the field, from sampling personnel to the analytical laboratory.

The Field Team Leader will coordinate the packing and shipment of all samples.

TRC intends to ship all samples within 24 hours of collection by an overnight delivery service.

Sample Identification

Each separate sample will be identified using the sample label shown in Figure 4. The sampler will complete all information, using a black waterproof pen, as follows:

A. The sample ID number will be the number assigned to the particular sampling station, including the depth of sampling, if relevant.
B. Example:
    Sample "B-2-4" indicates that the sample was taken from Boring No. 2 at the 2-4 foot interval.

Job No. ____________________

Client: ____________________

Sample Number ____________________

Pen./Rec. ____________________

Date ____________________ Sample Time ____________________

Sample Matrix ____________________

Grab or Composite (explain) ____________________

Preservations ____________________

Final pH ____________________

Analyses ____________________

Sampler Signature ____________________

TRC TRC Environmental Corporation **Chain of Custody Sample Seal**	FIELD SAMPLE NO.	DATE	SEALERS INITIAL
	RUN #	SAMPLE DESCRIPTION	
	SEALERS NAME (PRINT)	SEAL BROKEN BY & DATE	

TRC *Environmental Corporation*

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

CITY OF MIDDLETOWN

FIGURE 4

SAMPLE TAG AND
CHAIN-OF-CUSTODY SEAL

Date: 03/00 Project No. 25863

TRC Environmental Corporation

CHAIN-OF-CUSTODY RECORD

CONTRACT NO.

SAMPLERS: *(Signatures)*

Sample Code	Date	Source Description	Containers		ANALYSES								
			Size	G/P	Volatile Organics	Extractable Organics	Pesticide/PCBs	Trace Metals	Cyanide	Phenols			COMMENTS

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	REMARKS		

TRC Environmental Corporation

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

CITY OF MIDDLETOWN

FIGURE 5

CHAIN-OF-CUSTODY RECORD

Date: 03/00 | Project No. 25863

Sample "MW-1" indicates that the sample is a ground water sample taken from Well Location No. 1.

C. The job number will be the number assigned to the particular site.

Example: 01113-5396

D. The analysis required will be indicated for each sample.

Example: MEK

E. Date taken will be the date the sample was collected, using the format: MM-DD-YY.

Example: 09-29-98

Job No. ____________________

Client: ____________________

Sample Number ____________________

Pen./Rec. ____________________

Date ______________ Sample Time ______________

Sample Matrix ____________________

Grab or Composite (explain) ____________________

Preservations ____________________

Final pH ____________________

Analyses ____________________

Sampler Signature ____________________

F. Time will be the time the sample was collected, using military time.

Example: 1335

G. The sampler's name will be printed in the "Sampled By" section.

H. Other information relevant to the sample.

Example: Field Blank

An example sample label is presented below:

JOB NO:	01045-????
CLIENT:	City of Middletown
SAMPLE #:	B-2-4
MATRIX:	Soil
DATE TAKEN:	05-15-96
TIME TAKEN:	14:30
SAMPLER:	Charles Foster
ANALYSES:	MEK

Prior to going to the field, this sample identification procedure will be further refined (if necessary), so that a sample is accurately and easily identified.

This sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing from the field personnel collecting samples.

All samples analyzed by the laboratory are to be considered to be of an evidentiary nature. The possession of samples must be traceable from the time samples are collected in the field until the analysis is completed and the data are entered as evidence. The tracing of the samples is accomplished by "chain-of-custody" procedures as follows:

1) A chain-of-custody record (Figure 5) will be completed for each set of samples.

2) Samples will not leave custody of the field investigator until relinquished to another party.

Custody is defined as:

1) In actual physical possession of field personnel.

2) In the field personnel's view after being in physical possession.

3) In a locked area after being in physical possession.

4) In a designated, locked storage area.

Laboratory Operations

All samples submitted to the analytical laboratory selected for the project will be brought to the sample bank manager, who will continue the chain-of-custody by assigning a unique control number to each sample on receipt; this number identifies the sample through all further handling. The sample will be recorded in Master Sample Log under its control number. Each sample entry in the Master Log has the following information:

- Laboratory Control Number;
- Sample description;
- Sample condition;
- Signature of person completing sample record; and
- Date of sample receipt.

Samples shall be stored in locked storage areas with provision for hazardous material storage. The sample bank manager will store each sample in the appropriate area under the laboratory's Control Number.

The sample bank manager will initiate a log entry for each sample in the Custody Log and ensure that each handling of the sample is appropriately documented. Each analyst working with the sample will first go to the sample bank manager and record in the Master Sample Log actions taken on the sample, thereby maintaining the chain-of-custody of the original sample.

Project samples will be disposed of in an appropriate manner by the subcontractor.

Appendix L

12. Analytical Precision and Accuracy

Analyte	Analytical Method	Detection Limit (water/soil) (units)	Quantitation Limit (water/soil) (units)	Precision (water/soil)	Accuracy (water/soil)
VOCs	8260	See first table below		See second table below	
Petroleum Hydrocarbons	418.1				
PCBs	8082				
ICP metals	6010B/7470				
SVOCs	8270				

Laboratory Analysis Parameter Table

Parameter	Quantitation Limit Objective	
	Aqueous ug/L	Soil/Sediment ug/kg
Volatile Organics		
Acetone	10	50
Benzene	1	2.5
Bromodichloromethane	1	2.5
Bromoform	1	2.5
Bromomethane	2	5
2-Butanone (MEK)	10	50
Carbon Tetrachloride	1	2.5
Chlorobenzene	1	2.5
Chloroethane	2	5
Chloroform	1	2.5
Chloromethane	2	5
1,2-Dichlorobenzene	1	2.5
1,3-Dichlorobenzene	1	2.5

Laboratory Analysis Parameter Table

1,4-Dichlorobenzene	1	2.5
1,1-Dichloroethane	1	2.5
1,2-Dichloroethane	1	2.5
1,1-Dichloroethene	1	2.5
1,2-Dichloroethene (Total)	1	2.5
1,2-Dichloropropane	1	2.5
cis-1,3-Dichloropropene	0.5	2.5
trans-1,3-Dichloropropene	0.5	2.5
Ethylbenzene	1	2.5
2-Hexanone	10	10
4-Methyl-2-pentanone	10	10
Styrene	1	2.5
1,1,2,2-Tetrachloroethane	1	2.5
Tetrachloroethene	1	2.5
Toluene	1	2.5
1,1,1-Trichloroethane	1	2.5
1,1,2-Trichloroethane	1	2.5
Trichloroethene	1	2.5
Vinyl chloride	2	5
Xylenes (Total)	1.0	2.5
Bromobenzene	1.0	2.5
Bromochloromethane	1.0	2.5
Chlorodibromomethane	1.0	2.5
2-Chlorotoluene	1.0	2.5
4-Chlorotolune	1.0	2.5
cis-1,2-Dichloroethene	1.0	2.5
trans-1,2-Dichloroethene	1.0	2.5
Dibromomethane	1.0	2.5
1,2-Dibromo-3-chloropropane	1.0	2.5
1,3-Dichloropropane	1.0	2.5
2,2-Dichloropropane	1.0	2.5

Laboratory Analysis Parameter Table		
1,1-Dichloropropane	1.0	2.5
Ethylenedibromide	1.0	2.5
Fluorotrichlaromethane	1.0	2.5
Hexachlorobutadiene	1.0	2.5
Isopropylbenzene	1.0	2.5
Methylene chloride	1.0	2.5
Methyl-t-butyl-ether	1.0	2.5
n-Butylbenzene	1.0	2.5
n-Propylbenzene	1.0	2.5
Naphthalene	5.0	25.0
m+p-Xylene	1.0	2.5
p-Isopropyltolene	1.0	2.5
o-Xylene	1.0	2.5
Sec-Butylbenzene	1.0	2.5
Tert-Butylbenzene	1.0	2.5
1,1,1,2-Tetrachloroethane	1.0	2.5
1,2,3-Trichlorobenzene	1.0	2.5
1,2,4-Trichlorobenzene	1.0	2.5
1,2,3-Trichloropropane	1.0	2.5
1,2,4-Trimethylbenzene	1.0	2.5
1,2,5-Trimethylbenzene	1.0	2.5

Laboratory Analysis Parameter Table		
Parameter	**Quantitation Limit Objective**	
	Aqueous ug/L	**Soil/Sediment mg/kg**
Semivolatile Organics		
Acenaphthylene	10	0.33
Anthracene	10	0.33
Benzo(a)anthracene	10	0.33
Benzo(b)fluoranthene	10	0.33

Benzo(k)fluoranthene	10	0.33
Benzo(a)pyrene	10	0.33
Bis(2-chloroethyl)ether	10	0.33
Bis(2-chloroisopropyl)ether	10	0.33
Bis(2-ethyl hexyl)phthalate	10	0.33
Butyl benzl phthalate	10	0.33
2-chlorophenol	10	0.33
Di-n-octyl phthalate	10	0.33
2,4-Dichlorophenol	10	0.33
Fluoranthene	10	0.33
Fluorene	10	0.33
Hexachlorobenzene	10	0.33
Naphthalene	10	0.33
Pentachlorophenol	50	1.7
Phenanthrene	10	0.33
Phenol	10	0.33
Pyrene	10	0.33
Acenapthene	10	0.33
Anilene	50	1.70
Benzoic Acid	50	1.70
Benzo(g,h,i)perylene	10	0.33
Benzyl Alcohol	20	0.67
Bis (Z-Chloroethoxy) methane	10	0.33
4-Bromophenyl phenyl ether	10	0.33
4-Chloroaniline	20	0.67
2-Chloronaphthalene	10	0.33
4-Chloro-3-methylphenol	20	0.67
4-Chlorophenyl phenyl ether	10	0.33
Chrysene	10	0.33
Dibenzo(a,h)anthracene	10	0.33
Di-n-butyl-phthalate	10	0.33
Dibenzofuran	10	0.33

1,3-Dichlorobenzene	10	0.33
1,4- Dichlorobenzene	10	0.33
1,2- Dichlorobenzene	10	0.33
1,2-Diphenylhydrazine	10	0.33
3,3-Dichlorobenzidine	20	0.67
Diethyl phthalate	10	0.33
2,4 Dimethylphenol	10	0.33
Dimethyl phthalate	10	0.33
2-Methyl-4,6-dinitrophenol	50	1.7
2,4-Dinitrophenol	50	1.7
2,4-Dinitrotoluene	10	0.33
2,6- Dinitrotoluene	10	0.33
Hexachlorobutadiene	10	0.33
Hexachlorocyclopentadiene	10	0.33
Hexachloroethane	10	0.33
Indeno (1,2,3-cd)pyrene	10	0.33
Isophorane	10	0.33
2-Methylnapthalene	10	0.33
2-Methylphenol (o-cresol)	10	0.33
4-Methylphenol (p-cresol)	10	0.33
2-Nitrophenol	10	0.33
4-Nitrophenol	50	1.7
2-Nitroaniline	50	1.7
3-Nitroaniline	50	1.7
4- Nitroaniline	50	1.7
Nitrobenzene	10	0.33
N-Nitroso-di-u-propylamine	10	0.33
N-Nitrosocliphenylamine	10	0.33
1,2,4-Trichlorophenol	10	0.33
2,4,5-Trichlorophenol	10	0.33
2,4,5- Trichlorophenol	10	0.33

Inorganics		
	Quantitation Limit Objective	
	Aqueous ug/L	Soil by TCLP mg/L
Arsenic	10	2
Barium	10	2
Cadmium	2	0.4
Chromium	10	2
Lead	10	2
Mercury	.2	0.05
Selenium	10	2
Silver	10	2
	Quantitation Limit Objective	
	Aqueous ug/L	Soil /Sediment mg/kg
Polychlorinated Biphenyls (PCBs)	0.6	0.1
Extractable Total Petroleum Hydrocarbons (EPH)	10	0.4

Parameter	Reference	Accuracy Objectives			Precision Objectives		
Metals	SW-846 Method 6010B		%Rec. Water	%Rec. Soil	**Field Duplicates**	**RPD Water**	**RPD Soil**
					All metals	30	50
		Matrix Spikes	%Rec. Water	%Rec. Soil	**Lab Duplicates**	**RPD Water**	**RPD Soil**
		All metals	75-125	75-125	All metals	20	20
VOCs	SW-846 Method 8260B	**Surrogates**	%Rec. Water	%Rec. Soil	**Field Duplicates**	**RPD Water**	**RPD Soil**
		Toluene-d8	88-110	70-130	All compounds	30	50
		Bromofluorobenzene	86-115	70-130			
		1,2-Dicloroethane-d4	76-114	70-130			
		Matrix Spikes	%Rec. Water	%Rec. Soil	**Blank Spikes**	**RSD Water**	**RSD Soil**
		1,1 Dichloroethene	61-145	70-130	1,1 Dichloroethene	14	25
		Trichloroethene	71-120	70-130	Trichloroethene	14	25
		Benzene	76-127	70-130	Benzene	11	25
		Toluene	76-125	70-130	Toluene	13	25
		Chlorobenzene	75-130	70-130	Chlorobenzene	13	25
PCBs	SW-846 Method 8082	**Surrogates**	%Rec. Water	%Rec. Soil	**Field Duplicates**	**RPD Water**	**RPD Soil**
		Decachlorobiphenyl	60-150	60-150	All Compounds	30	50
		Tetrachloro-meta-xylene	60-150	60-150		30	50
		Matrix Spikes	%Rec. Water	%Rec. Soil	**Blank Spikes**	**RSD Water**	**RSD Soil**
		Arolclor-1260	60-150	60-150	Compounds of interest	25	25
SVOCs	SW-846		%Rec.	%Rec.		RPD	RPD

Parameter	Reference	Accuracy Objectives			Precision Objectives		
	Method 8270C	**Surrogates**	**Water**	**Soil**	**Field Duplicates**	**Water**	**Soil**
		Nitrobenzene-d5	35-114	23-130	All compounds	30	100
		2-Fluorobiphenyl	43-116	30-115			
		p-Terphenyl-d14	33-141	18-137			
		Matrix Spikes	**%Rec. Water**	**%Rec. Soil**	**Blank Spikes**	**RSD Water**	**RSD Soil**
		1,2,4-Trichlorobenzene	39-98	38-107	1,2,4-Trichlorobenzene	28	23
		Acenapthene	46-118	31-137	Acenapthene	31	19
		2,4-Dinitrotoluene	24-96	28-89	2,4-Dinitrotoluene	38	47
		Pyrene	26-127	35-142	Pyrene	31	36
		N-Nitroso-di-n-propylamine	41-116	41-126	N-Nitroso-di-n-propylamine	38	38
		1,4-Diclorobenzene	36-97	28-104	1,4-Diclorobenzene	28	27

Appendix M

13. Field Quality Control Requirements

QC Sample	Frequency	Acceptance Criteria	Corrective Action
Trip Blank	___Daily Or 1 for each shipping container of aqueous VOC samples	*No compounds detected*	*Re-sample if cross contamination is suspected.*
Field Rinseate Blank	___5% per parameter per matrix Or _1 per day per type of sampling method	*No compounds detected*	Re-sample if cross contamination is suspected.
Field Duplicate	_X_5% per parameter per matrix Or	Per EPA Data validation guidelines for comparison of field duplicates	Compare to appropriate action level (e.g. reportable concentration, Upper Concentration Limit, etc.) and determine need for re-sampling or re-analysis.
Matrix Spike	_X_5% per parameter per matrix Or	*Per EPA data validation guidelines for matrix spike recovery criteria.*	Compare to appropriate action level (e.g. reportable concentration, Upper Concentration Limit, etc.) and determine need for re-sampling or re-analysis.
Performance Evaluation (PE) Sample	*NA*	NA	NA
Other			

Appendix N

14. Data Management and Documentation

Field Log Book Records

All information pertinent to sampling (including instrument calibration data) will be recorded in logbook. This book will be bound, preferably with consecutively numbered pages. Entries in the log book will be made in black ink and will include, at a minimum, a description of all activities, individuals involved (sampling and oversight), date and time of sampling, weather conditions, any problems, and all field measurements.

Sufficient information will be recorded during the sampling trip to permit reconstruction of the sampling without reliance on the collector's memory. Shelf life, lot numbers, manufacturer, and expiration dates of buffer and standard solutions used for field instrumentation will be recorded.

Equipment Decontamination Procedures

All major decontamination of downhole and excavation equipment will be conducted at a designated decontamination area(s). When appropriate, drill rigs will be steam cleaned and drilling equipment will be decontaminated prior to moving. Drilling equipment used for multiple boreholes will be decontaminated by steam cleaning prior to beginning each boring. (Split-spoons should be made of stainless steel, but carbon steel is acceptable if it is rust-free.)

Minor decontamination such as cleaning of sampling equipment will be performed at each sampling site. Rinsates will be collected and managed by City of Middletown. Smaller sampling equipment such as split spoons, stainless steel or Teflon spatulas and stainless steel mixing pans will be decontaminated using the following procedures:

- Wash and scrub with low-phosphate detergent in tap water;
- Rinse with deionized water,
- Air dry - on clean polyethylene sheeting; and
- Wrap in aluminum foil, shiny side out for transport.
- Clean equipment may rest on—but never be wrapped in—clean polyethylene sheeting.

Soils and excavation materials will be returned to their place of origin (either placed inside of the boreholes or dispersed near the borehole location). The HNu and visual observations will be used to determine if residuals require further handling and disposal (e.g., offsite disposal as RCRA wastes). Residuals screened for disposal as a hazardous material will be properly disposed of by the City of Middletown.

Appendix O

15. Assessment and Response Actions

The project Quality Assurance Program includes both performance and system audits as independent checks on the quality of data obtained from sampling, analysis, and data gathering activities. Either type of audit may show the need for corrective action.

Performance Audits: The sampling, analysis, and data handling segments of a project are checked in performance audits.

EPA Quality Control Concentrates and NIST Standard Reference Materials will be used to assess the analytical work. The laboratory QC Coordinator will direct the inclusion in the sample load of QC samples appropriate to the analyses performed in each batch of 20 or fewer samples. In addition, any appropriate interlaboratory study samples, which are available during this program, will be analyzed to further audit the analytical work.

System Audits: A system audit is a qualitative review to ensure that the quality measures outlined in this QAPjP are in place. *TRC randomly selects projects to be audited and occasionally conducts targeted audits of specific projects.* If this project is internally audited by the TRC QA Officer, a written audit report will be submitted to City of Middletown.

The acceptance limits for the sampling and analyses to be conducted in this program will be those stated in the method or defined by other means in the QAPjP. Corrective actions are likely to be immediate in nature and most often will be implemented by the contracted laboratory analyst or the TRC Program Manager. The corrective action will usually involve recalculation, reanalysis, or repeating a sample run.

Immediate Corrective Action: Corrective action for analytical work will include recalibration of instruments, reanalysis of known QC samples and, if necessary, of actual field samples. Specific QC procedures and checklists will be in use by the analytical laboratory, designed to help analysts detect the need for corrective action. Often the person's experience will be valuable in alerting the operator to suspicious data or malfunctioning equipment.

If an immediate corrective action can be taken, as part of normal operating procedures, the collection of poor quality data can be avoided. Instrument and equipment malfunctions are amenable to this type of action and the QC procedures include troubleshooting guides and corrective action suggestions. The actions taken will be noted in field or laboratory notebooks, but no other formal documentation is required, unless further corrective action is necessary. These on-the-spot corrective actions are an everyday part of the QA/QC system.

Corrective action during the field-sampling portion of a program is most often a result of equipment failure or an operator oversight and may require repeating a run. Operator oversight is best avoided by having field crew members audit each other's work before and after a test. Every effort will be made by the field team leader to ensure that all QC procedures are followed.

If potential problems are not solved as an immediate corrective action, the contractor will apply formalized long-term corrective action if necessary.

Long-Term Corrective Action: The need for long-term corrective action may be identified by standard QC procedures, control charts, performance or system audits. Any quality problem which cannot be solved by immediate corrective action falls into the long-term category. *The* City and its contractor, TRC, will use a system to ensure that the quality problem is reported to a person responsible for correcting it, and who is part of a closed-loop action and follow-up plan.

The essential steps in the closed-loop corrective action system are listed below.

- Identify and define the problem.
- Assign responsibility for investigating the problem.
- Investigate and determine the cause of the problem.
- Determine a corrective action to eliminate the problem.
- Assign and accept responsibility for implementing the corrective action.
- Establish effectiveness of the corrective action and implement it.
- Verify that the corrective action has eliminated the problem.

Documentation of the problem is important to the system. A Corrective Action Request Form will be filled out by the person finding the quality problem. This form identifies the problem, possible causes and the person responsible for action on the problem. The responsible person may be a laboratory analyst, field team leader, laboratory QC coordinator or the QA Officer. If no person is identified as responsible for action, the QA Officer investigates the situation and determines who is responsible in each case.

The Corrective Action Request Form includes a description of the corrective action planned and the date it was taken, and space for follow-up. The TRC QA Officer checks to be sure that initial action has been taken and appears effective and, at an appropriate later date, checks again to see if the problem has been fully solved. The QA Officer receives a copy of all Corrective Action Forms and then enters them in the Corrective Action Log. This permanent record aids the QA Officer in follow-up and makes any quality problems visible to management; the log may also prove valuable in listing a similar problem and its solution.

Appendix P

16. Project Reports

The work conducted for this program will be presented in a report *prepared by the City's contractor (TRC),* containing figures and tables depicting site conditions, and recommendations for further actions. The report will include a statement regarding data quality and the impact of data problems on the usability of the data. This will include quality problems found, corrective actions taken and system audits conducted. The Final Report will also include a discussion of QA/QC activities on the project. *A copy of the report will be provided to the City's Project Manager.*

Appendix Q

12. Data Validation

a. Data Review Process

Field sampling data will be evaluated by the Field Team Leader and/or the Field QC Coordinator, based on their judgment of the representativeness of the sample, maintenance and cleanliness of sampling equipment, and adherence to the approved, written sample collection procedure.

The following criteria will be used to evaluate the field sampling data:

- Use of approved sampling procedures;
- Use of reagents that have conformed to QC specified criteria; and
- Proper chain-of-custody maintained.

Laboratory data will be validated in accordance with the Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses, dated July 1996. The validation will be performed by TRC, who is a contractor experienced in performing data validation. Quality control summary statements and conclusions will be included in the Brownfield Pilot Program Report.

b. Data Validation Tier (check one): ____Tier I __X__Tier II ____Tier III
Is the check Data Validation Tier applicable to all parameters/matrices analyzed during this project?
(check one) __X__Yes ____No
If no, document the Validation Tier per parameter/matrix below.
Have the data validation procedures been modified? (check one) __X__Yes ____No
If yes, document modifications below.

Data Package to be reviewed for completeness.

Form R

13. Data Usability (use multiple pages if needed)

Precision: Precision will be determined by the analysis of duplicate samples and will be expressed as the relative percent difference, (RPD) which is determined according to the following equation:

$$\text{Relative \% difference} = \frac{\text{Value 1 - Value 2}}{\text{Arithmetic Mean of Value 1 and 2}} \text{ x } 100$$

Accuracy: Accuracy will be estimated from the analysis of laboratory control samples whose true values are known to the analyst. Accuracy will be expressed as percent recovery. The formulas to calculate these values are:

$$\text{Percent Recovery} = 100 \text{ x } \frac{\text{Measured Value}}{\text{True Value}}$$

$$\text{Matrix Spike Percent Recovery} = 100 \text{ x } \frac{\text{(Sample conc.} + \text{spike conc.) - sample conc.}}{\text{spike conc.}}$$

Completeness: Completeness will be reported as the percentage of all measurements made whose results are judged to be valid. The procedures to be used for evaluating data and determination of outliers are contained in Section 10.3 of this QAPP. The following formula will

$$C = 100\frac{V}{T}$$

be used to estimate completeness:
where:

C = percent completeness
V = number of measurements judged valid
T = total number of measurement

ATTACHMENT A

TRC SOPs

TRC STANDARD OPERATING PROCEDURE NO. 001

GROUND WATER SAMPLING

Coordinated by: Dale
Dale Weiss, P.G., Manager of Geosciences Services,
TRC Lowell Operations

10/4/96
Date

Approved by: Laura
Laura Lefebvre, QA Officer, TRC Lowell Operations

10/17/96
Date

Approved by:
Charles Anderson, Vice President, TRC Lowell Operations

10/4/96
Date

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Section **Page**

TRC STANDARD OPERATING PROCEDURE NO. 001
GROUND WATER SAMPLING

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in ground water sampling activities. This SOP details equipment and sampling procedures for sampling from monitoring wells, residential drinking water wells, and industrial water supply wells. This SOP conforms to "A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001)," and other pertinent technical publications.

1.1 Objective

The objective of ground water sampling is to obtain a representative sample of water from the ground water aquifer. This requires that sufficient water be purged from the sampling well to ensure that the water sample being collected is representative of true ground water as opposed to stagnant water which is contained in the well casing and associated plumbing.

1.2 Equipment

The following equipment should be used when sampling a monitoring well. Site specific conditions may warrant the use of additional equipment.

- Water level measuring device
- Bailer
- Sampling rope or wire
- Pumps (if applicable)
- Sample containers
- Field Logbook and/or Field Data Record for ground water
- Traffic Reports
- Chain of Custody forms
- Custody seals
- Measured bucket
- pH meter
- Thermometer
- Turbidity meter
- Conductivity meter
- Sample preservative kit (includes preservatives for each specific analysis)
- Sample labels
- Sample tags

- Packing tape
- Zip-lock bags
- Packing materials
- Shipping coolers
- Trip blanks (if applicable)
- Ice or "blue ice"

2.0 PROCEDURES

Equipment and procedures for sampling three types of wells are described below, including

- Monitoring wells;
- Residential drinking water wells; and
- Industrial water supply wells.

2.1 Ground Water Sampling of Monitoring Wells

The following procedure should be used for collecting a ground water sample from a monitoring well.

1. Prior to collecting water samples, place a waterproof sample label on each sample container. Include the following information on each label:

    a. TRC Project No.: __________ (e.g., 2850-N61-22)

    b. Project Name: __________ (e.g., XYZ Corporation)

    c. Sample ID.: X-GW-MW10-41893

    Where X - Site initials (e.g., XYZ Site)
    GW - Ground Water Sample
    MW10 - Well Designation
    41893 - Sampling Date

    d. Analysis required: ________ (e.g., TOC)

    e. Preservative: _________ (e.g. ICED, pH<2 H_2SO_4)

10. Wrap the sample containers in a resealable plastic bag, place them into a shipping container, cool to ______ with ice packs and complete the chain-of-custody form. Pad the samples with bubble wrap and/or vermiculite packing as necessary.

11. Detail in the field logbook the sample location, ID, and time. The TRC field data record for ground water (attached) should be used to record the following:

    - Sample identification Number
    - Sample location
    - Time and date sample was taken
    - Personnel performing the task
    - Volume of water removed
    - Purging time
    - Field parameters such as pH, temperature, conductivity and turbidity
    - Sampling method
    - Analytical parameters
    - Preservation method and amount of preservative added
    - Chain-of-custody information such as laboratory contract number or CLP number

2.2 Ground Water Sampling of Residential Drinking Water Wells and Industrial Supply Wells

The following procedure should be used for collecting a ground water sample from a residential well.

1. Every effort should be made to locate a suitable sampling point which is not positioned after any type of filtration or water treatment system. This will typically be an outside tap. If such a non-filtered or non-treated sample cannot be obtained, an effort will be made to disconnect the filtration/treatment system prior to sample collection after owner permission is received. If the sampling tap has an aerator device, the aerator will be removed prior to sampling.

2. The amount of static water volume contained in the well system (i.e., inside well casing, storage tank, plumbing) will be calculated. The volume of the static water column will be calculated using the following equation.

6. Wrap the sample containers in a resealable plastic bag, place them into a shipping container, cool with ice packs to 4°C, and complete the chain-of-custody form. Pad the samples with bubble wrap and/or vermiculite packing as necessary.

7. Detail in the field logbook or ground water sample collection form, the following information:

   - Sample identification Number
   - Sample location
   - Volume of water removed
   - Purging time
   - Field parameters such as pH, temperature, conductivity and turbidity
   - Sampling method
   - Analytical parameters
   - Preservation method and amount of preservative added
   - Chain-of-custody information such as laboratory contract number or CLP number

TRC

Field Data Record
Ground Water

Project:
Project No.:
Date/Time:
Sheet ___ of ___
Contractor Personnel:
TRC Personnel:

Sample No.:
Well Location:

WELL INTEGRITY

	YES	NO
Protect. Casing Secure	☐	☐
Concrete Collar Intact	☐	☐
PVC Stick-up Intact	☐	☐
Well Cap Present	☐	☐
Security Lock Present	☐	☐

Protective Casing Stick-up (from ground) ______ ft.

Riser Stick-up (from ground) ______ ft.

WELL DIAMETER
☐ 2 inch
☐ 4 inch
☐ 6 inch
☐ ______

Well Depth ____ ft. ☐ top of riser ☐ top of casing ☐ ______ ☐ measured ☐ historical

Water Depth ____ ft.

Height of Water Column ____ ft. x ☐ .16 gal/ft (2 in.) ☐ .65 gal/ft (4 in.) ☐ 1.5 gal/ft (6 in.) ☐ ___ gal/ft (__ in.)

Volume of Water in Well = ______ gallon(s)

[Vol. = $r^2h(0.163)$] ______ Total gallons to purge

PID SCREENING MEAS.

Background	
Well Mouth	

WELL MATERIAL
☐ PVC ☐ SS ☐ ___

FIELD WATER QUALITY MEASUREMENTS

Purge Volume (gal)							
pH (Std. Units)							
Eh (millivolts)							
Conduct. (µmhos/cm)							
Temp. (C)							
Turb. (NTU)							
DO (mg/l)							

Sample Description

Clear ☐ Turbid ☐
Color ______
Odor ______
Other ______

SAMPLE EQUIP./DECON.	PURGE	SAMPLE
Peristaltic Pump	☐	☐
Submersible Pump	☐	☐
Bailer	☐	☐
Waterra	☐	☐
PVC/Silicon Tubing	☐	☐
Teflon/Silicon Tubing	☐	☐
Air Lift	☐	☐
In-line Filter	☐	☐
Pressure Vacuum Filter	☐	☐
Measuring Tape	☐	☐
______	☐	☐

EQUIPMENT ID
______
______
______
______

DESCRIPTION OF DECON. PROC.

DECON. FLUID USED
Tap Water ☐
Alconox ☐
Tap Water ☐
HNO_3 (1 or 10%) ☐
Tap Water ☐
Methanol ☐
Hexane ☐
Acetone ☐
Air Dry ☐
DI Water ☐
Air Dry ☐
None ☐

ANALYTICAL PARAMETERS	Filtered (circle)	Preservation Method	Volume Required	Time of Collection	CLP Sample #	CLP Case #
☐ TCL Volatiles	YES NO	4° C	2x40 mL			
☐ BNA Extractables	YES NO	4° C	4x1 L Amb GL			
☐ PCBs/Pesticides	YES NO	4° C				
☐ TAL Metals	YES NO	HNO_3/4° C	1 L PL			
☐ Cyanide	YES NO	NaOH/4° C	1 L PL			
☐ ______	YES NO					

AF-206

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Signed: ______________

TRC STANDARD OPERATING PROCEDURE NO. 002

SURFACE SOIL SAMPLING

Coordinated by: Dale 10/4/96
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Date

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Laura Lefebvre, QA Officer, TRC Lowell Operations
Date

Approved by: 10/4/96
Charles Anderson, Vice President, TRC Lowell Operations
Date

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Section **Page**

TRC STANDARD OPERATING PROCEDURE NO. 002
SURFACE SOIL SAMPLING

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in the logistics, collection techniques, and documentation requirements for collecting surface soil samples. The SOP conforms to "A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001)," and other pertinent technical publications.

1.1 Objective

The objective of surface soil sampling is to obtain a representative sample of soil for laboratory analysis of contaminants of concern at a given site. This objective requires that the sample be both free of unsuitable material and be of sufficient quantity and quality for analysis by the selected analytical method.

1.2 Equipment

The following equipment is needed for surface soil sampling:

- Boots, latex gloves, chemical resistant gloves, appropriate level of personal protection.
- Sample containers - one (1) liter glass jar with a Teflon lined cap or two (2) 8 oz. glass jars with Teflon lined caps (per sample).
- Teflon coated or stainless steel spoon or spatula.
- Wooden stakes and spray paint (highly visible).
- Field logbook and/or TRC Sample Log Form (Form AF-212).
- Sample bottle labels (TRC or EPA, as necessary).
- Chain-of-custody forms (TRC or EPA, as necessary).
- Hand auger.
- Stainless steel trowel.

- Stainless steel mixing bowl.
- Indelible marking pens.

2.0 PROCEDURES

2.1 Selection of Sampling Locations

The selection of sampling locations in and around a site must be based on a review of existing site data, site topography and surface features, results from preliminary site surveys using geophysical and air monitoring equipment, and the initial estimates as to the extent of the waste present. At the start of an investigation, the number and location of surface soil samples should be tentatively identified. After the initial field reconnaissance, the location and number of samples should be finalized. At a minimum, the following should be included as sampling locations:

- Upgradient surface soil to determine background levels.
- Surface soil within the immediate area of contamination.
- Downgradient surface soil to determine any contamination from storm water runoff.

"Upgradient" and "downgradient" are in reference to site topography and prevailing wind directions.

Sampling locations may be selected in the following areas at the site:

- Areas where chemicals may have been stored, handled, or disposed.
- Areas where motor vehicles hauling chemicals may have traveled on the site.
- Areas where water may have ponded during storm events.

2.2 Order of Samples

The upgradient samples must be collected first, followed by samples from areas with increasingly higher suspected contamination.

2.3 Sampling Procedure

All surface debris should be removed prior to sampling including wood, paper, sod, gravel, and trash. A pre-cleaned stainless steel or teflon coated spoon or spatula should be used to take the soil sample and fill the sample containers. Care should be taken to avoid sampling anything but soil. Stones, gravel, or vegetation should be removed from the sample since these materials will not be analyzed.

Sample for VOC must always be collected first. VOC samples should never be homogenized or composited. Samples will be scooped into the sample bottles using the appropriate tool. The bottle must be filled to the top, leaving no head space.

In the event that a duplicate or split sample is required, a composite soil sample for all parameters except VOCs will be collected. The following procedure should be used to collect composite surface soil samples:

1) Identify three areas for obtaining composite fractions of sample for analysis. The three areas should be spaced 3 to 10 feet apart, equidistant from each other. Mark the areas to be sampled with a stake, flagging, or similar markers.

2) Collect the soil using a stainless steel shovel, hand auger, trowel and/or spatula. Avoid collection of larger pieces of material (cobbles, larger rocks).

3) Fill the VOC sample containers progressively in three increments. Fill one third of the sample container from the first location, the next third from the second location, and the final portion from the last location. Transfer sample material directly from each sample location to the sample container with minimal disturbance.

4) Collect additional material for the remaining parameters by transferring the soil into a stainless steel bowl. Homogenize the sample prior to filling the remaining sample containers.

5) Record the sample location, ID and time in the field logbook. Complete the TRC Sample Log Sheet (attached) with the following:

    - Sample identification number
    - Sample location (sketch of the sample point)
    - Time and date sample was taken
    - Personnel performing the task
    - Visual or sensory description of the sample
    - Brief sediment descriptions (color, texture, appearance)
    - Weather conditions during sampling
    - Runoff conditions
    - Other pertinent observations

6) Label each sample container with the following information:

a. TRC Project No.:________(e.g., 2850-N61-22)

b. Project Name:____(e.g., XYZ Corporation)

c. Sample ID.: X-SS 12 - 41884 - 3"-6"

Where:
X - site initials (e.g., XYZ Site)
SS - Surface Soil
12 - Sampling Location
41884 - Date
3"-6" - Depth of Sample

d. Analysis Required:________(e.g., METALS)

e. Preservative:_______(e.g., ICED)

f. Collection time:______(e.g., 1415)

g. Collection date:______(e.g., 4-18-84)

h. Initials of collector:_______(e.g., FWJ)

After the samples have been collected, the sampling location will be marked with wooden stakes colored with highly visible spray paint in order to identify the sample location for surveying purposes.

Wrap the sample containers in a resealable plastic bag, place them into a shipping container, cool with ice packs and complete the chain-of-custody form. Pad the samples with bubble wrap and/or vermiculite packing as necessary.

TRC

Sample Log Sheet

Project:

Project No.:

Date/Time:

Sheet ___ of ___

Contractor Personnel:

Alliance Personnel:

Sample No.: ____________________

Depth/Interval Sampled: ____________

Sample Type: Grab, Composite or Both
(circle)

Media: (circle)
Surface Soil
Subsurface Soil
Other ___________
Sediment
Surface Water
Ground Water

Sketch of Sample Location

Field Screening Information:

Type of Meter:

Other Field Measurements:

Observations:

SAMPLE COLLECTION EQUIPMENT:

- Hand Auger ☐
- Core Sampler ☐
- Spatula/Spoon ☐
- Bowl (stainless) ☐
- Split-spoon (2" or 3") ☐

OTHER:

- Trowel ☐
- Shelby Tube ☐
- Dredge Sampler ☐
- Kemmerer ☐
- Extended Arm ☐
- Bailer ☐
- Backhoe ☐
- Van Dorn Bottle ☐

DECONTAMINATION PROCEDURE:

DECON. FLUID	USED	DESCRIPTION:
Tap water	☐	
Alconox	☐	
Tap water	☐	
HNO_3 (1 or10%)	☐	
Tap Water	☐	
Methanol	☐	
Hexane	☐	
Acetone	☐	
Air Dry	☐	
DI Water	☐	
Air Dry	☐	
None	☐	

ANALYTICAL PARAMETERS	Filtered (circle)	Preservation Method	Volume Required	Time of Collection	CLP Sample	CLP Case#
☐ TCL Volatiles	YES NO					
☐ BNA Extractables	YES NO					
☐ PCBs/Pesticides	YES NO					
☐ TAL Metals	YES NO					
☐ Cyanide	YES NO					
☐ ________	YES NO					

AF-212

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Signed: ____________________

TRC STANDARD OPERATING PROCEDURE NO. 004

EQUIPMENT DECONTAMINATION PROCEDURES

Coordinated by: Dale 10/4/96
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Date

Approved by: 10/4/96
Charles Anderson, Vice President, TRC Lowell Operations
Date

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TRC STANDARD OPERATING PROCEDURE NO. 004
EQUIPMENT DECONTAMINATION PROCEDURES

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in the methods for decontamination of field equipment used in hazardous waste investigations. The SOP conforms to "A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001)," and other pertinent technical publications.

1.1 Objective

The objective of equipment decontamination is to remove potential contaminants from a sampling device or item of field equipment prior to and between collection of samples for laboratory analysis and limit personnel exposure to residual contamination that may be present on used field equipment.

1.2 Equipment

The following equipment may be utilized when decontaminating equipment. Site-specific conditions may warrant the use or deletion of items from this list.

- Alconox, liquinox or other non-phosphate concentrated laboratory grade soap;
- Deionized Water;
- Pump Sprayer;
- 1-Pint Squeeze bottle filled with pesticide-grade hexane;
- 1-Pint Squeeze bottle filled with pesticide-grade methanol;
- 1-Pint Squeeze bottle filled with pesticide-grade isopropanol;
- 1-Pint Squeeze bottle filled with pesticide-grade acetone;
- 1-Pint Squeeze bottle filled with ten (10) percent nitric acid;
- 1-Pint Squeeze bottle filled with one (1) percent nitric acid;
- Five large plastic wash basins (24 inches by 30 inches by 6 inches deep);
- Two coarse scrub brushes;
- Small wire brush;
- Aluminum foil;
- Polyethylene sheeting;
- Two large capacity barrels;
- All necessary personal protective equipment (gloves, eyewear, tyveks);
- Extra quantities of above listed liquids.

2.0 PROCEDURES

2.1 General

The following procedures should be used for decontaminating field equipment. Procedures will vary with equipment used and potential contaminants present at the site.

2.2 Procedure for Soil Sampling Equipment

Soil sampling equipment, such as split spoon samplers, shovels, augers, trowels, spoons, and spatulas will be cleaned using the following procedure:

1. Lay out sufficient polyethylene sheeting on the ground or floor to allow placement of the five plastic wash basins and an air drying area. Place wash basins on the polyethylene sheeting.

2. Fill the first wash basin with potable tap water. Add sufficient soap powder or solution to cause suds to form in the basin. Do not use an excessive amount of the soap or rinsing the soap residue off the equipment will be difficult.

3. Using a clean coarse scrub brush, wash the sampling equipment in the soap solution in the first basin, removing all dirt. Allow excess soap to drain off the equipment when finished.

4. Rinse the equipment with tap water in the second basin, using a coarse scrub brush or pressure sprayer to aid in the rinse, if necessary.

5. If the equipment is being used to sample for metals, rinse the equipment with nitric acid in the third basin. A 10 percent solution is used on stainless steel equipment. A one percent solution is used on all other equipment. If no metals sampling is being performed, this step may be omitted.

6. Spray down the equipment in the third basin, using deionized water.

7. Spray down the equipment in the fourth basin, using pesticide-grade isopropanol or acetone, if sampling for organic compounds is to be performed. If oily, a two-step process using methanol, followed by hexane should be used to remove both water soluble and non-soluble compounds.

If no samples for organic compounds are being collected, this step may be omitted.

8. Allow the equipment to completely air dry on clean polyethylene sheeting.

9. Rinse the equipment in the fifth basin, using deionized water.

10. Allow the equipment to completely air dry on clean polyethylene sheeting.

11. Reassemble equipment, if necessary, and wrap completely in clean, unused aluminum foil, shiny side out for transport. Re-use of equipment on the same day without wrapping in foil is acceptable.

12. Allow spent cleaning solutions in the trays to evaporate into the air. If evaporation is not possible, all spent cleaning solutions shall be drummed for disposal along with any other contaminated fluids generated during the field investigation.

13. Record the decontamination procedure in the field logbook or on appropriate field form.

14. If step 8, rinsing with organic solvents, was performed, check the equipment for the presence of residual solvents with a photoionization or flame ionization detector prior to use. If a detection occurs, disassemble the equipment and allow to air dry until no readings are observed, then re-rerinse with deionized water.

Note that if temperature or humidity conditions preclude air drying equipment, sufficient spares should be available so that no item of sampling equipment need be used more than once. Alternatively, the inability to air dry equipment completely prior to reuse should be noted in the field logbook. In this case, additional rinses with deionized water should be used and recorded.

2.3 Procedure for Ground Water Sampling Equipment

Ground water sampling equipment, such as bailers and stainless steel cord will be cleaned using the following procedure:

1. Lay out sufficient polyethylene sheeting on the ground or floor to allow placement of the five plastic wash basins and room for air drying and place wash basins on the sheeting.

2. Fill the first wash basin with potable tap water. Add sufficient soap powder or solution to cause suds to form in the basin. Do not use an excessive amount of soap or rinsing the soap residue off the equipment will be difficult.

3. Wash the sampling equipment in the soap solution in the first basin, removing all residues. Allow excess soap to drain off the equipment when finished.

4. Rinse the equipment with tap water in the second basin.

5. If the equipment is being used to sample for metals, rinse the equipment with nitric acid in the third basin. A 10 percent solution is used on stainless steel equipment. A one percent solution is used on all other equipment. If no metals sampling is being performed, this step may be omitted.

6. Spray down the equipment in the third basin, using deionized water.

7. Spray down the equipment in the fourth basin, using pesticide-grade isopropanol or acetone, if sampling for organic compounds is to be performed. If oily, a two-step process using methanol, followed by hexane should be used to remove both water soluble and non-soluble compounds. If no organic compounds sampling is being performed, this step may be omitted.

8. Allow the equipment to completely air dry on clean polyethylene sheeting.

9. Rinse the equipment in the fifth basin, using deionized water.

10. Allow the equipment to completely air dry on clean polyethylene sheeting.

11. Reassemble equipment, if necessary, and wrap completely in clean, unused aluminum foil, shiny side out for transport. Re-use of equipment on the same day without wrapping in foil is acceptable.

12. Allow spent cleaning solutions in the trays to evaporate into the air. If evaporation is not possible, all spent cleaning solutions shall be drummed for disposal along with any other contaminated fluids generated during the field investigation.

13. Record the decontamination procedure in the field logbook or appropriate field form.

14. If step 8, rinsing with organic solvents, was performed, check the equipment for the presence of residual solvents with a photoionization or flame ionization detector prior to use. If a detection occurs, disassemble the equipment and allow to air dry until no readings are observed. Re-rinse with deionized water.

Note that if temperature or humidity conditions preclude air drying equipment, sufficient spares should be available so that no item of sampling equipment need be used more than once. Alternatively, the inability to air dry equipment completely prior to reuse should be noted in the field log. In this case, additional rinses with deionized water should be used and recorded.

2.4 Procedure for Outsized Equipment

Outsized equipment, such as submersible pumps, will be cleaned using the following procedure:

1. Fill two clean barrels with tap water.
2. Add sufficient concentrated soap to one barrel to form a thin layer of soap suds.
3. Immerse the pump in the soap containing barrel and start pump. Circulate the soap solution through the pump and feed discharge into a waste disposal drum or into the municipal sewage disposal system.
4. Immerse the pump in the barrel filled with clean tap water and start pump. Circulate the water through the pump and feed discharge into a waste disposal drum. Run the pump until no soap residue is visible in the discharge.
5. Deionized water should then be run through the pump and used to rinse all submersible parts and hoses.
6. Record the decontamination procedure in the field logbook or appropriate field form.

2.5 Procedure for Measuring Equipment

Measuring equipment, such as pressure transducers or water level indicators, will be cleaned using the following procedure:

1. Fill two clean basins with tap water.
2. Add sufficient concentrated soap to one basin to form a thin layer of soap suds.
3. Immerse the device in the soap containing basin and gently agitate. Scrub device if it is soiled. Do not submerse any electrical connectors or take up reels, only that portion of the device in contact with potentially contaminated water.

4. Immerse the device in the basin containing the rinse water and gently agitate. Do not submerse any electrical connectors or take up reels, only that portion of the device in contact with contaminated water.

6. Spray rinse equipment with deionized water.

6. Allow the equipment to air dry.

7. Record the decontamination procedure in the field logbook or appropriate field form.

TRC STANDARD OPERATING PROCEDURE NO. 005

SOIL DESCRIPTION PROCEDURE

Coordinated by: ______________________ 10/4/96

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Date

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Laura Lefebvre, QA Officer, TRC Lowell Operations
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Approved by: ______________________ 10/4/96

Charles Anderson, Vice President, TRC Lowell Operations
Date

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TRC STANDARD OPERATING PROCEDURE NO. 005
SOIL DESCRIPTION PROCEDURE

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in the method for describing soil samples in test pits, soil borings, and soil grab samples. The SOP conforms to "A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001)," and other pertinent technical publications.

1.1 Objective

The objective of soil sample description is to provide geological information useful for the purpose of hydrogeological or geotechnical evaluation of a site. This objective requires a soil description method that is based upon widely accepted geological criteria.

1.2 Equipment

The following equipment may be necessary during soil description activities:

- Sand grading chart
- Field logbook
- Folding Ruler or Yard Stick
- Portable table
- Polyethylene sheeting
- Hand lens
- Deionized water in squeeze bottle
- Required personal protective equipment (gloves, boot, eye wear, hard hat, etc.)
- Air monitoring equipment (as required)
- Duct tape
- Boring logs (if applicable)

2.0 PROCEDURES

2.1 General

The general description of a soil sample should be in the following order:

1. Color

2. Density
3. Moisture content
4. Geologic modifiers or classifications
5. Major constituent - capitalized
6. Minor Constituent
7. Geologic description (in parentheses)

Example: Tan, loose wet stratified medium SAND, little fine sand, trace coarse sand, trace silt (glacial outwash)

When logging a soil sample collected from a split spoon when more than one soil material is present in the split spoon, describe each one separately, using an additional line(s) on the boring log form. Start the description from the top of the split spoon, and log each change in stratigraphy in sequence to the bottom of the spoon. Provide an interval or length (i.e., 0-5 ft.:) at the beginning of each separate sequence description, followed by a colon. Draw a line below the bottom of the complete sample description.

2.2 Color

The main color value should be stated, along with an appropriate modifier. For example

- light brown
- dark brown
- reddish brown
- brown

The presence of mottling should be included in the description, where present. For example:

- Gray, slightly mottled, dense, damp, poorly sorted angular fine to medium SAND, some silt, trace angular coarse sand, trace clay (lodgement glacial till).

2.3 Density

In borings, density should be based on the sum of the middle two 6-inch blow counts of a two foot split spoon or the last two 6-inch blow counts of an 18-inch split spoon. Professional judgement should be used when applying the density modifier. If high blow counts are due to the presence of a cobble, boulder or large piece of gravel that impedes forward progress of the split spoon, density should based upon the character of the material in the split spoon, if any, or omitted from the description. A notation should be made in the sample description when this situation occurs. Appropriate modifiers are described below:

Granular Soils		Cohesive Soils	
Blows/ft	Density	Blows/ft	Density
0-4	very loose	<2	very soft
4-10	loose	2-4	soft
10-30	medium dense	4-8	medium stiff
30-50	dense	8-15	stiff
>50	very dense	15-30 >30	very stiff hard

In test pits, density is subjective and should be based upon the ease of excavation. The above adjectives for granular and cohesive soils should be used in the description.

2.4 Moisture content

Moisture content should be described using the following modifiers:

- **Dry** - no moisture.
- **Moist** - very slight moisture content, no visible water droplets.
- **Wet** - saturated.

2.5 Geologic Modifiers

Sedimentological descriptions aid in the geologic classification of a soil material. Appropriate modifiers include:

- **Stratification** - the presence of alternating layers of non-cohesive materials of different grain sizes.
- **Lamination or varves** - the presence of alternating very thin layers of fine materials, such as silt and clay.

- **Sorting** - A geological term used to describe how close in size the grains in a sample are to each other. For example, a well sorted sample contains grains of similar size; a poorly sorted sample contains grains of many sizes.

- **Grading** - An engineering term used to describe the range in grain sizes present in a sample. For example, a narrowly graded sample contains grains of similar size; a widely graded sample contains grains of different sizes.

- **Angularity or rounding** - Geological terms that are used to describe the general appearance of visible grains in the soil sample. Useful in determining the origin and depositional environment of a material. Water transported materials may be rounded. Glacial tills will be more angular.

2.6 Grain-size scales

Grain size classification should be based on an accepted classification system such as, the Unified System.

Boulder	> 300 mm	> 12 inches
Cobble:	75 - 300 mm,	3 - 12 inches
C. Gravel:	19 - 75 mm,	3/4 - 3 inches
F. Gravel:	4.75 - 19 mm,	3/16 - 3/4 inches
C. Sand:	2.0 - 4.75 mm,	5/64 - 3/16 inches
M. Sand:	0.425 - 2.0 mm,	1/64 - 5/64 inches
F. Sand:	0.075 - 0.425 mm	
Silt:	0.002 - 0.075 mm	
Clay:	<0.002 mm	

2.7 Proportions

For geologic description, proportions of grain sizes will be based upon the following nomenclature:

- Trace: 0-10%
- Little: 10-20%
- Some: 20-35%
- And: 35-50%

The major soil sample constituent is always capitalized and listed first.

Minor constituents also include ancillary materials such as mica flakes, dark minerals, or naturally occurring organic matter, such as humus, peat, or other vegetative material.

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TRC STANDARD OPERATING PROCEDURE NO. 006
SOIL BORING LOGGING

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in the methods for recording subsurface conditions in soil borings during site hydrogeological and geotechnical investigations. The SOP conforms to "A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001)," and other pertinent technical publications.

1.1 Objective

The objective of soil borings is to provide samples for description and characterization of subsurface conditions, and obtain samples for geotechnical and chemical analyses, often prior to installation of a monitoring well. This objective requires the use of consistent procedures for documenting observations and collecting samples.

2.0 PROCEDURES

2.1 Predrilling Requirements

When conducting borings in an industrial facility, TRC will contact all utilities or industrial facility personnel necessary to receive clearance to drill at specified locations. The names of the personnel authorizing clearance will be documented in the field logbook. The exact location of each boring shall also be reviewed by responsible plant personnel to ensure that the area is free of the facility-owned buried utilities.

Dig-safe will be contacted prior to drilling in public areas. Drilling locations shall be no closer than 25 feet to overhead utilities. The appropriate utility companies will be contacted to provide insulation of utility lines prior to commencement of drilling activities.

The supervising geologist/engineer shall record the name of the drilling firm and the names of the driller and his assistant(s). The date, project location, project number, and weather conditions shall be recorded as well.

An accurate time log of drilling activities shall be kept. This log shall be kept in the field logbook and shall include at a minimum, the following:

- Time driller and rig arrive on site

- Time drilling begins
- Any delays in the drilling activities and the cause of such delays
- Time drillers go off site
- Down time (those periods when drilling activities cease due to equipment malfunctions, weather, ordered stoppages)

2.2 Test Borings and Well Drilling Subsurface Sampling Methods

Test borings and monitoring well drilling can be conducted by a variety of drilling methods. The drilling method, drill rig type, soil and rock sampling methods shall be documented. It is critical to the documentation of subsurface conditions that the soil and rock sampling techniques be recorded in the field logbook.

Where details of subsurface conditions are necessary, soil sampling shall be conducted using a split-spoon penetration sampler, driven with a 140 pound hammer with a free-fall of 30 inches. This is a standard method of soil sampling as described in ASTM Designation D 1586. If necessary, the length of the hammer shaft will be measured and marked, to ensure a minimum drop of 30 inches.

The supervising geologist/engineer shall record, at a minimum, the weight of the hammer, the length of the split spoon sampler, and the number of hammer blows on the spoon per 6 inches of penetration. Upon removal of the sampler, the earth materials shall be logged in accordance with TRC SOP No. 005, Soil Sample Description, and Section 2.3.

Rock sampling will be conducted using a double barrel core sampler. The supervising geologist/engineer shall record the length of the core barrel, the diameter of the barrel, the rate of penetration, the down pressure torque, and rotation of the sampler.

2.3 Soil Logging and Sampling

Vertical measurements in a boring shall be made from the ground surface. Split-spoon samples are typically taken at either 5-foot intervals or continuously through unconsolidated materials. The sampling interval shall be determined in the project scope of work.

Record the number of hammer blows required to effect each 6 inches of penetration and the depth from which the sample was collected. When the number of blow counts exceeds 50 per 6 inches, the split spoon sampling shall be terminated and the number of blow per tenths of foot (for the last one-half foot) shall be recorded and noted as sampler refusal. Upon extraction of the sampler, moisture conditions on the drill rods shall be noted. Upon opening the sampler, the percent recovery shall be recorded as the length of sample retained over the length of sampler penetration. Changes in lithology, color, moisture conditions, and texture in the spoon are measured and recorded prior to emptying the spoon.

If a sample is to be retained, a pre-cleaned stainless steel or teflon coated spoon will be used to take the soil sample and fill the sample containers. In the event that a duplicate or split sample is required, the soil will be composited. Compositing will be performed by collecting enough sample for two containers and then placing the sample into a precleaned stainless steel basin, and mixing it thoroughly with a stainless steel spoon. After mixing the sample, it should be equally divided between sample containers. Samples for VOCs shall never be composited.

Each sample container will be labeled with the following information:

1. TRC Project No.: ___________ (e.g., 2850-N61-22)
2. Project Name: ___________ (e.g., XYZ Corporation)
3. Sample ID. - X-B 12 - X - 12-14

   Where X - site initials (e.g., XYZ Site)

   B - Boring

   12 - sample location
   12-14 - depth of sample (feet)
4. Analysis Required: ___________ (e.g., METALS)
5. Preservative: ___________ (e.g., ICED)
6. Collection time: ___________ (e.g., 1415)
7. Collection date: ___________ (e.g., 4-18-94)
8. Initials of collector: ___________ (e.g., FWJ)

The supervising geologist/engineer will log the soil sample on the soil boring log (TRC form AF-280) according to TRC SOP No. 005, Soil Description Procedure.

2.5 Photographing Soil and Rock Samples from Borings

If soil samples are to be photographed this should occur while still in the split spoon. If smearing of the sample has occurred, a fresh exposure can be made by scraping with a pen knife or other similar object. The spoon and sample should be placed in a good light, preferably against a solid colored background. A ruler for scale and a tag identifying the sample should be placed in the picture. The identifier tag must have the sample number, depth and project name or number written so as to be legible in the photograph. Any photographs taken must be recorded in the field logbook.

Rock core samples are photographed in the wooden core box. The rock should be wetted to enhance the color and textural changes in the rock. Due to the relatively large size of most core boxes, the photographer (when possible) should stand up on a chair, tail gate, car bumper or other perch in order to photograph the box from directly above, and get the entire box in the camera's field of view. The photograph must include a ruler for scale and an identifier tag indicating the project name and number, the boring number, the date, and the depths of the various core runs.

6. Backfill and return the excavated area to the original grade. Make certain the subcontractor packs down the backfilled soil and does not leave any surface holes or other hazards when completed.

7. Stake, label, and flag the test pit location for future reference or surveying.

8. If segregation of contaminated soil has occurred, the disposition of these soils should be in accordance with the site-specific work plan and applicable guidance. Frequently these are not backfilled into the original pit, but the pit is backfilled with DOT approved fill. In addition, lining of the pit with polyethylene sheeting, mounding, covering of the excavation, and surrounding the excavation with gravel to direct surface runoff away may be required.

Test Pit Log

Client	Location	Contractor/Equipment	TRC Personnel:

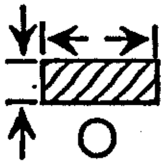
Location Sketch

N

Depth to Ground Water	Weather

Depth	Sample Number	Stratigraphic Description

TEST PIT PLAN



Vol. = ____ cu. yd.

PROPORTIONS USED

Trace (TR).	0 - 10%
Little (LI.)	10 - 20%
Some (SO.)	20 - 35%
And	35 - 50%

AF-007

TRC **Sample Log Sheet**	Project:	Project No.:	Date/Time:	Sheet ___ of ___
	Contractor Personnel:		TRC Personnel:	

Sample No.: ____________________

Depth/Interval Sampled: ____________

Sample Type: Grab, Composite or Both (circle)

Media: (circle)	Surface Soil	Sediment
	Subsurface Soil	Surface Water
	Other ________	Ground Water

Sketch of Sample Location

Field Screening Information:

Type of Meter:

Other Field Measurements:

Observations:

SAMPLE COLLECTION EQUIPMENT:

Hand Auger	☐	Trowel	☐
Core Sampler	☐	Shelby Tube	☐
Spatula/Spoon	☐	Dredge Sampler	☐
Bowl (stainless)	☐	Kemmerer	☐
Split-spoon (2" or 3")	☐	Extended Arm	☐
OTHER:		Bailer	☐
		Backhoe	☐
		Van Dorn Bottle	☐

DECONTAMINATION PROCEDURE:

DECON. FLUID	USED	DESCRIPTION:
Tap water	☐	
Alconox	☐	
Tap water	☐	
HNO_3 (1 or10%)	☐	
Tap Water	☐	
Methanol	☐	
Hexane	☐	
Acetone	☐	
Air Dry	☐	
DI Water	☐	
Air Dry	☐	
None	☐	

NALYTICAL PARAMETERS	Filtered (circle)	Preservation Method	Volume Required	Time of Collection	CLP Sample	CLP Case#
☐ TCL Volatiles	YES NO					
☐ BNA Extractables	YES NO					
☐ PCBs/Pesticides	YES NO					
☐ TAL Metals	YES NO					
☐ Cyanide	YES NO					
☐ ________	YES NO					

Signed: ____________________

Rev: 6 July 1991

TRC STANDARD OPERATING PROCEDURE NO. 009

GROUND WATER MONITORING WELL INSTALLATION

Coordinated by: Dale W 10/4/96

Dale Weiss, P.G., Manager of Geosciences Services,
TRC Lowell Operations
Date

Approved by: Laura Lefebvre 10/17/96

Laura Lefebvre, QA Officer, TRC Lowell Operations
Date

Approved by: 10/4/96

Charles Anderson, Vice President, TRC Lowell Operations
Date

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TRC STANDARD OPERATING PROCEDURE NO. 009
GROUND WATER MONITORING WELL INSTALLATION

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in the construction, installation, and development of ground water monitoring wells. The SOP conforms to "A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001)," and other pertinent technical publications.

1.1 Objective

The objective of a ground water monitoring well is to collect representative ground water samples and obtain information on aquifer hydraulic head. A secondary objective is to obtain aquifer hydrologic data from the well. These objectives require that the well be installed and developed using suitable materials, equipment, and procedures.

2.0 PROCEDURES

2.1 Preparation

Prior to the initiation of field work the project manager, field hydrogeologist, or field technical lead (site manager) will secure the services of a qualified drilling contractor. A contract between TRC and the drilling contractor will be executed before mobilization. The drilling contractor must meet the following requirements:

- have the appropriate licenses and registrations;
- have the proper equipment available to perform the type of drilling required; and
- have personnel who are OSHA-trained to work on hazardous waste sites and are willing to participate in the appropriate medical monitoring for the site.

Before the start of field tasks, the field hydrogeologist or field technical lead is responsible for coordinating the following items with the drilling contractor personnel:

- familiarizing the contractor with the objectives of the investigation;
- providing and reviewing of a copy of the project work plan with the contractor;

- providing and reviewing of a copy of the project health and safety plan with the contractor; and
- performing a daily health and safety review with the contractor.

Compliance with all state and federal requirements is required prior to the installation of monitoring wells. The field hydrogeologist or project manager is responsible for obtaining all required permits. These permits may include, but are not limited to the following:

- notification and approval to drill/install a monitoring well;
- registration of the well;
- permit for water withdrawals;
- well abandonment when the project is completed; and
- State specified dig-safe permits.

2.2 Materials

In general, all well materials (other than filter sand, seals, and grout) will be cleaned with a high pressure, hot water wash, rinsed with deionized water, and sealed in plastic bags. Decontamination and bagging can be conducted by the manufacturer, prior to delivery to the site. Alternatively, the contractor or TRC may decontaminate the materials at an off-site location and deliver them to the site in a protective wrap.

2.2.1 Well Screens

Monitoring well screens will typically consist of two-inch diameter, flush-threaded, schedule 40, polyvinyl chloride (PVC), machine-cut slotted screen. Other materials or sizes may be specified in the work plan as required by site conditions or local regulations. If the well is to be used for in-situ hydraulic conductivity testing as well as ground water sampling, wire-wrap type screen construction is recommended over machine-slotted screen, to increase screen open area and ensure that the screen does not inhibit the flow of water into or out of the well. The screen slot size should be selected to retain a minimum of 90 percent of the filter pack material.

2.2.2 Riser and End Caps

Monitoring well riser and end caps will consist of two-inch diameter, flush-threaded, schedule 40, poly vinyl chloride (PVC). Other materials or sizes may be specified in the work plan as required by site conditions or local regulations. The top cap will have a small hole drilled through it to allow the passage of air, unless the well is to be installed at ground level. In that case, the top of the well shall be sealed with an expansion cap, to prevent the inflow of runoff into the well.

2.2.3 Filter Pack

A filter pack will be required in any formation other than coarse sand and gravels containing less than ten percent fines (silts and clays) by weight. In such formations, the use of an artificial sand pack is optional. The purpose of the filter pack is to inhibit the flow of fines into the well screen, allowing production of ground water optimal for ground water quality analyses.

Where an artificial filter pack is required the filter material shall be composed of a washed, graded, commercially-produced silica sand. The uniformity coefficient (C_u) of the filter pack will be no less than one and no more than two, to prevent segregation of the filter material when it is installed in the well. The grain size of the filter pack shall be no less than 3 and no more than 6 times the D_{30} (passing) of the finest geologic unit in which the well is to be screened. A multiplier of 3 shall be used if the formation is fine and uniform and 6 if the formation is coarse and non-uniform. The D_{30} grain size of the formation should be determined by laboratory sieve grain-size analysis. If laboratory grain-size analysis cannot be performed, a variety of sand packs should be available, based upon known geological information of the site. Based upon field estimates of grain size distribution, a sand pack will be selected that matches the above criteria.

2.2.4 Seal

The seal will consist of bentonite clay pellets, chips, donut or slurry, sufficient to form a two foot thick seal above the filter pack. The selection of the form of bentonite clay will depend upon the project budget, location of the top of the filter pack relative to the water table. The seal will be hydrated with potable analyte-free water.

2.2.5 Grout

The annular space above the bentonite seal and the ground surface shall be grouted with a mixture of 95 percent Portland concrete or equivalent, and 5 percent bentonite grout, mixed with potable water to the specifications of the concrete manufacturer.

2.2.6 Surface Protective Casing

The surface casing shall consist of galvanized steel or steel coated with a rust-proofing coating. The surface casing shall have a hinged cap with provision for a lock. The base of the casing, at the point where it shall extend above the concrete pad, shall have a small weep hole drilled through the casing to prevent the build-up of precipitation or ice between the steel casing and well riser.

2.3 Monitoring Well Installation

Boreholes to be completed as monitoring wells will be advanced and logged in accordance with TRC SOPs No. 005 (Soil Description Procedure) and No. 006 (Soil Boring Logging). Equipment used to advance the boring and install the monitoring well will be decontaminated prior to the start of the boring using the procedures in SOP No. 004. All well materials that do not appear to be factory cleaned and sealed or those that have become open during shipment to the site will be steam cleaned prior to use at the site.

2.3.1 Procedures

Monitoring wells will be installed by the drilling subcontractor under the direction of a qualified TRC geologist or engineer. Monitoring wells will be installed using the following general procedures which may be dependent on the site specific requirements.

1. The construction details of the well to be installed will be provided to the driller, including well material, screen length, slot size, riser length, depth of the well, sandpack, bentonite seal, grouting requirements, and surface well completion.

2. All well materials will be inspected to ensure that they are clean prior to installation.

3. Sections of screen and riser will be threaded together and lowered into the borehole. Centralizers may be used in deeper wells to ensure proper well placement within the borehole.

4. The selected well packing materials will be introduced into the annulus in a manner so as to ensure an adequate well pack and seal. The thickness of each layer of well pack material will be measured with a weighted string and recorded. All augers or casing will be removed sequentially during sand pack installation and the well will remain at the desired depth during auger or casing withdrawal.

5. The bentonite seal installation technique will vary with the depth of the water table. The appropriate type of bentonite (pellets, chips, or slurry) will be selected to suit the objectives of the installation program. In general, the seal will be installed above the sandpack so that a thickness of two to three feet is installed. Bentonite seals in shallow wells installed across the water table will be hydrated and allowed to swell prior to the emplacement of a cement-bentonite grout mixture.

6. A cement-bentonite grout will be emplaced to fill the annulus of the boring. Dependent on the depth of the well and water table, the grout may be tremied into the desired location. The grout mixture (percentage of cement to bentonite) will be recorded and will be in accordance with the work plan or recommended guidance and Section 2.2.5 of this SOP. The grout will be pumped into the boring around the well materials to the surface. If necessary, after solidification of the grout and settling occurs, the grout may need to be topped of with additional grout mixture. The need for additional grout will be based on the intended surface completion for the well.

7. Depending on the location of the well, flush mounted road boxes or steel protective casings with locking cap will be recommended and cemented in place as described in Section 2.2.6 above. Once completed, the well will be locked and allowed to settle prior to well development.

8. All information concerning the well installation details will be recorded on a well construction diagram (attached).

TRC

Monitoring Well Construction Summary

MW-

Project: ____________________ **No.:** ____________

Client: ____________________ **Date Completed:** ________

Location: ________________________________

Boring Contractor: ____________ **Method:** ____________

TRC Geologist: ____________________

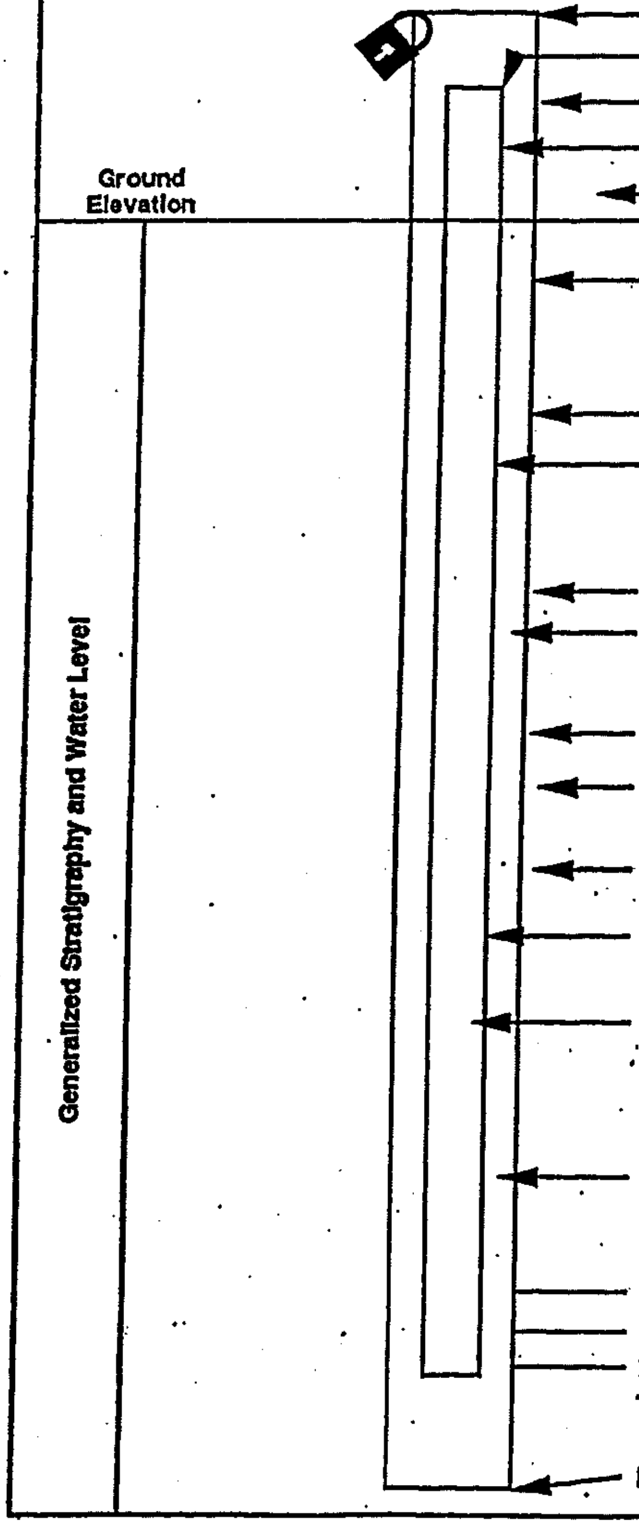
Reference Elevation: ____________

Elev. Ground Surface: ____________

Depth to Ground Water: ____________

Development Date: ____________

Development Method: ____________



Elevation top of protective casing: ____________

Elevation of top riser pipe: ____________

Stick-up of protective casing: ____________

Stick-up of riser pipe: ____________

Type of surface seal: ____________
____

I.D. of protective casing: ____________

Type of protective casing: ____________
____

Depth bottom of protective casing ____________

Riser pipe I.D. ____________

Type of riser pipe: ____________
____

Borehole diameter: ____________

Type of backfill: ____________
____

Elevation/depth top of seal: ____________

Type and thickness of seal: ____________
____

Depth top of filter pack: ____________

Elevation/Depth top of screen: ____________

Type of screen: ____________

Slot size: ____________

I.D. of screen ____________

Type of filter/sand pack: ____________
____

Elevation/depth bottom of screen: ____________

Elevation/depth bottom of well: ____________

Elevation/depth bottom of filter pack: ____________

Type of backfill below observation well: ____________
____

Elevation/depth of borehole: ____________

TRC STANDARD OPERATING PROCEDURE NO. 010

GROUND WATER MONITORING WELL DEVELOPMENT

Coordinated by: ______________________ 10/4/96
Dale Weiss, P.G., Manager of Geosciences Services, TRC Lowell Operations — Date

Approved by: Laura Lefebvre ______________________ 10/17/96
Laura Lefebvre, QA Officer, TRC Lowell Operations — Date

Approved by: ______________________ 10/17/96
Charles Anderson, Vice President, TRC Lowell Operations — Date

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TRC STANDARD OPERATING PROCEDURE NO. 010
GROUND WATER MONITORING WELL DEVELOPMENT

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in the development of ground water monitoring wells. The SOP conforms to "A Compendium of Superfund Field Operations Methods (EPA/540/P-87/0001)," and other pertinent technical publications.

1.1 Objectives

Monitoring well development is completed in order to establish a good hydraulic connection between the well screen and the surrounding aquifer, settle the sandpack and formation from drilling, and removal of the fine particles (silt) from the water column and sandpack in order to obtain ground water samples that are representative of the aquifer in which the well is installed.

1.2 Equipment

The complete list of required equipment is presented below. Site specific conditions may warrant the addition or deletion of some equipment.

- Watterra system
- Centrifugal pump and hosing
- pH Meter
- Conductivity meter
- Turbidity meter
- Plastic beaker or jar
- Bailer and cord
- Field logbook
- Well development logsheet
- Large capacity DOT-approved containers (if required)
- Two, five-gallon buckets
- Deionized water spray bottle
- Surge-block
- Submersible pump

1.3 Procedures

Well development will be completed on monitoring wells after the grout, annular seals, and protective casings are stable (i.e., 48 hours after installation).

1. Consult the monitoring well completion diagram and boring logs to determine the well construction geometry (depth and length of screen), air monitoring results, material screened, and depth to water. If potable water has been used during well installation, the estimated amount of water lost to the formation during the drilling process should be removed prior to the initiation of well development to ensure the removal of fresh formation water during the development process.

2. Select the appropriate device and tubing to complete development. The apparatus selected should be capable of surging the entire length of the well screen and be equipped with enough discharge tubing and water withdrawal capability to complete well evacuation to the surface and into containers if required.

3. Measure the static water level in the well using SOP No. 012, and determine the amount of standing water in the well (well volume). Record the air readings, water level, and calculated single well volume.

4. Using the appropriate length of dedicated or decontaminated hosing/tubing and the selected pumping apparatus, insert the equipment into the well.

5. Initiate water removal from the well and record the initial field water quality measurements of pH, temperature, conductivity, and turbidity on the well development form. Record any odors, water color, increases in air monitoring results or other observations in the field log book or on the well development form.

6. Continue to evacuate the well while surging the water in the well screen into and out of the sandpack. Using a plastic beaker or jar to collect purged water, conduct and record the field water quality parameters as in No. 5 above with each successive well volume as well as any additional observations. Rinse measurements probes with deionized water between successive measurements and rinse with the purged water prior to the measurement of each well volume. Water should be withdrawn from the well until three (3) successive measurements of field water quality measurements vary by less than ten (10) percent of the instrument's scale. During this procedure, the water clarity and turbidity should be closely monitored. Typically, following initially turbid results, turbidity values will decrease with the removal of subsequent well volumes; however,

stabilization of the turbidity values in silty aquifers may be difficult. Well development should proceed until turbidity values have stabilized to within ten (10) percent.

7. Once all the development criteria have been satisfied, remove the apparatus from the well and complete decontamination of the apparatus and probes using SOP No. 004.

TRC STANDARD OPERATING PROCEDURE NO. 012

WATER LEVEL MEASUREMENT PROCEDURES

Coordinated by: 10/4/96

Dale Weiss, P.G., Manager of Geosciences Services,
TRC Lowell Operations
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Approved by: Laura Lefebvre 10/17/96

Laura Lefebvre, QA Officer, TRC Lowell Operations
Date

Approved by: 10/18/96

Charles Anderson, Vice President, TRC Lowell Operations
Date

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TRC STANDARD OPERATING PROCEDURE NO. 012
WATER LEVEL MEASUREMENT PROCEDURES

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in the methods for conducting water level measurements in monitoring wells during field investigations at hazardous and non-hazardous waste sites. This procedure is consistent with "A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001)," and other pertinent technical publications.

1.1 Objective

The objective of water level measurements is to gain accurate measurements of the depth of ground water for use during well installation, in the recording of data for the preparation of ground water elevation contour maps, purge volume calculations during ground water sampling, slug tests, packer tests, and pump tests.

1.2 Equipment

The following list of equipment may be utilized during the conduct of water level measurements. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Electronic water level indicators
- Steel tape and chalk
- Tap Water
- Alconox, liquinox or other non-phosphate concentrated laboratory grade soap
- Deionized Water
- Pump Sprayer
- Pint Squeeze bottles
- Any necessary personal protective equipment (gloves, eyewear, tyvek suits)
- Air Monitoring instruments as required (Hnu, OVM, etc.)
- Field logbook and monitoring form
- Well keys
- Previous measurement data (if available)
- Oil/water interface probe
- Precision ruler
- Plunker on tape

2.0 PROCEDURES

The following procedures should be followed during the conduct of water level measurements. Procedures may vary depending on the equipment used and contaminants present at the site.

Site specific conditions may warrant the use of stringent air monitoring and potentially more significant decontamination scenarios.

1. Record the condition of the well (protective casing, concrete collar, lock in place etc.).
2. Put on latex or other sterile gloves. Stand upwind of the well; unlock and open the well. If a vented cap is present, conduct well mouth air monitoring from the vent. If a non-vented well cap is present, remove the cap and monitor the well mouth immediately. Record all pertinent air monitoring results (sustained, dissipating, background, odor).
3. Identify the previous measuring point marking or notch on the riser or casing (if present). Record this location in the field logbook or on the water level monitoring form.
4. Using a previously decontaminated water level indicator, turn on the meter, check the audible indicator, reel the electronic probe into the well riser (with the increments visible) slowly until the meter sounds, grasp the tape with hand, withdraw the tape and lower it again slowly until the sound is again audible. Check the depth to water on the tape and make a mental note of the depth to within .01 feet. Lower the probe again slowly and repeat the measurement for accuracy. Record the depth to water from the measuring point in the field logbook or on the water level monitoring form.
5. Decontaminate the probe and any obviously soiled tape with the procedures identified in SOP No. 4.

NOTES:

A. Procedures utilized during water level measurements where free phase petroleum products are floating on the water table should be modified to include the use of the oil/water interface probe. The procedures during the use of this probe should be implemented similarly and by manufacturers' specifications. Through the use of this probe, product thickness can be determined.

B. The steel chalk and tape method can be used to identify product thickness and water table depth should either of the other methods not be available.

C. The use of a weighted, hollow-ended plunker on a tape reel can be used to gain slightly less accurate water levels (during well installation).

TRC STANDARD OPERATING PROCEDURE NO. 013

GENERAL SURVEY PROCEDURES

Coordinated by: ______________________________ 10/4/96
Dale Weiss, P.G., Manager of Geosciences Services,
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Date

Approved by: ______________________________ 10/12/96
Laura Lefebvre, QA Officer, TRC Lowell Operations
Date

Approved by: ______________________________ 12/10/96
Charles Anderson, Vice President, TRC Lowell Operations
Date

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TRC STANDARD OPERATING PROCEDURE NO. 013
GENERAL SURVEY PROCEDURES

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in the methods for conducting general surveys of monitoring wells and site features during field investigations at hazardous and non-hazardous waste sites. This procedure is consistent with "A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001)," and other pertinent technical publications.

1.1 Objective

The objective of conducting surveys is to obtain accurate locations and elevations for incorporation into the preparation of ground water elevation contour maps, site contour maps, and site plans or figures. Horizontal locations should be accurate to one foot and vertical locations should be accurate to .01 foot. All traverse loops should close within a ratio of 1:30,000.

1.2 Equipment

The following list of equipment may be utilized during site surveys. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Theodolite
- Automatic Level
- Tripod
- Stadia Rod (graduated in 0.01 feet)
- Electronic distance meter (EDM)
- Prisms and targets
- Compass
- Plum-bob
- Folding engineers rule (graduated in 0.01 feet)
- Steel tape (graduated in 0.01 feet)
- Any necessary personal protective equipment (boots, gloves, eyewear, tyvek suits)
- Air Monitoring instruments as required (Hnu, OVM, etc.)
- Field log book
- Calculator
- Local bench mark datum

- Previous measurement data (if available)
- Surveying nails (PKs)
- Stakes and tacks
- Flagging and/or marking paint
- Permanent markers and/or lumber crayons
- Portable radios
- Traffic cones, safety vests
- Hammer, chisel, axe, knife, saw, shovel

2.0 PROCEDURES

2.1 Procedures for conducting relative elevation surveys (level loop)

The following procedures should be utilized during the conduct of relative elevation surveys. Procedures may vary depending on the equipment used, features to be surveyed, and contaminants present at the site. Site specific conditions may warrant modifications to these procedures and certain sites will require a licensed surveying subcontractor. This SOP is intended for use on small areas where only relative elevations are required and can be conducted by qualified TRC personnel.

1. For monitoring well elevation surveys, follow the map or plan of locations in a logical order.

2. Record the condition of the well (protective casing, concrete collar, lock in place etc.).

3. Identify the previous measuring point marking or notch on the riser or casing (if present). Record this location in the field logbook and provide it to the subcontractor or other rod person.

4. Set-up and level the instruments to be used during the survey.

5. Measure the instrument height above the bench mark elevation (temporary or permanent).

6. Begin the level-loop to the desired locations and record all measurements in the field book. Instruct the subcontractor (or other) to record the elevation of the top of the protective casing, the top of PVC riser at the measuring point notch or marking (if present) and the ground surface to within 0.01 foot. Shots which are greater than 500 feet in distance should be avoided due to the potential for error. To promote accuracy, the stadia rod should be swayed back and forth slowly by the rod person and the

surveyor should record the lowest measurement. The loop should be closed at the starting point (bench mark) within +/- 0.05 feet of the original elevation per foot of length of level loop not exceeding +/- 1.0 foot.

7. Replace the vented cap, lock the well and continue the level loop.

2.2 Relative Traverse Surveys

The following procedures should be utilized during the conduct of traverse surveys. Procedures may vary depending on the equipment used and the features to be surveyed. Site specific conditions may warrant modifications to these procedures. This SOP is intended for use on small areas where only relative locations of site features are required and can be conducted by qualified TRC personnel.

1. Establish the traverse loop to be surveyed.

2. Set-up and level the surveying instrument (transit, theodolite) over a reference stake and center cross-hairs of the optical plumb on a tack in the center of the stake. Set the internal verniers to zero degrees. Conduct a back-sight on an established benchmark. Measure the instrument height above the bench mark elevation, unlock the horizontal vernier and turn the instrument clock-wise (towards a positive angle) to the desired location. Record the measurements in the field book. The prism mounted on a tripod, staff or a stadia rod should be set and held by the rod person in the middle of the object of interest. After all shots are completed at this location, set a stake (hub) or PK nail (if in asphalt or concrete) in the ground at the next desired survey station. Avoid shots which are greater than 500 feet in distance unless an electronic distance meter is being utilized.

3. Set-up and level the instrument over the next station and center the cross-hairs of the optical plumb on a tack in the center of the stake. Repeat step No. 2 except the back sight will be to the former reference station stake instead of a bench mark. The final station should be sighted into the original bench mark. The traverse should close within a ratio of 1:30,000 feet. Horizontal locations should be accurate to within +/- one (1) foot.

ATTACHMENT B

KATAHDIN LABORATORY QA PLAN

QUALITY ASSURANCE MANUAL
QAM-001

KATAHDIN ANALYTICAL SERVICES, INC.
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Analytical Laboratory Quality Assurance Manual

TITLE: Katahdin Analytical Services, Inc. Quality Assurance Manual

Prepared By/Date: Deborah Nadeau March/April 1999

Approved By/Date:

Deborah J. Nadeau 4·15·99
Deborah Nadeau, QA Officer Date

Burton 4/15/99
John Burton, Laboratory Operations Manager Date

4/15/99
Deborah F. McGrath, General Manager Date

Section	Revision No.	Date
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1.0 INTRODUCTION

1.1 Purpose and Scope

This manual details the quality assurance program in effect at Katahdin Analytical Services, Inc. It is meant to be a teaching tool and source of information for laboratory personnel and clients. The Manual is divided into sections, each dealing with a different phase of laboratory operation, yet all sections overlap and function together to form a complete quality assurance program. The Manual is based on Good Laboratory Practices, technical knowledge, industry-accepted standard analytical practices and common sense.

The Manual must be read and understood by all laboratory personnel as part of their training program. The Manual should also be referred to regularly as a source of information. A system of continuous updating is built into the Manual to allow it to change as laboratory conditions change or as new regulations are promulgated. This manual is a controlled document, which means that its identity, development, distribution, and status must be known and traceable at all times. All Katahdin permanent laboratory personnel are assigned a controlled copy. Temporary personnel are expected to read and understand the QA Manual.

Whenever a technician or analyst is in doubt as to proper procedures in a specific circumstance, the Manual should be consulted. Omissions or errors should be immediately reported to the Quality Assurance Officer for corrective action. **IT IS THE RESPONSIBILITY OF EACH LABORATORY WORKER TO ENSURE THAT THE PROVISIONS OF THIS MANUAL ARE FOLLOWED.** Disagreement with specific requirements or knowledge of changes causing deviation from the procedures should be discussed with the immediate supervisor before further work is completed. Laboratory personnel are encouraged to comment on the Manual and make recommendations for more efficient procedures.

The latest revision of each section of the Manual is the applicable rule. Therefore, revisions will be announced to all laboratory personnel. An uncontrolled copy of the Manual is offered to clients and regulatory agencies as the definitive quality assurance program used at Katahdin.

1.2 QA Policy and Objectives of the Program

Katahdin is committed to quality as priority number one. Katahdin's quality assurance policy is based on the definition of quality as conformance to requirements governed by company policies, government regulations and standard operating procedures. This commitment recognizes the need for data to be representative of the environmental conditions under investigation supported by measurements generated within a system that is designed to address applicable regulatory compliance criteria. Katahdin's Quality Assurance (QA) Manual and QA Program have been developed to fulfill this commitment. Our Quality Assurance Program contains provisions for establishing, maintaining and executing protocols to produce data of known quality and defensibility through the proper documentation of all measurement activities. No other concerns will be permitted to interfere with the execution of the elements of this QA Program and the quality of the data generated and delivered.

This manual describes the set of policies and principles, which guide day-to-day operations. Specific protocols are included by reference and are contained in a series of volumes cited in Section 8.0 of this document.

1.3 Quality Assurance Documents

1.3.1 QA Manual

This document describes management policies related to operation of the analytical laboratories. It provides overall guidance regarding acceptable practices and discusses each element of the Quality Assurance Program. It functions as the Project QA Manual where no other Quality Assurance Project Plan, Statement of Work or other contractually mandated project plan has been specified. Adherence to the practices described in this manual is required of all employees. This manual may be revised and/or superseded only with the written authority of the Katahdin General Manager. The QA Department administers distribution of controlled copies of this manual.

1.3.2 Standard Operating Procedures Manuals

All procedures related to sample collection, storage, preparation, analysis, disposal, data validation, data reporting and employee training and safety shall be contained in written Standard Operating Procedures (SOPs) Manuals. Each SOP shall contain the elements outlined in the current revision of SOP QA-800, Preparation of SOPs. All sections shall be structured in a step-wise manner using numbered sections. All record-keeping requirements shall be described at each step in the SOP. Examples of forms used shall be included as tables or figures and referenced within the text. Preparation of SOPs shall be the responsibility of each department under the guidance of and review by the appropriate Supervisor. SOPs shall be assigned a number from the inventory list for SOPs maintained by the Quality Assurance Department. This number shall become part of the document control number when the SOP is accepted for implementation by Katahdin management. SOPs shall be reviewed and approved by the appropriate Supervisor, Manager (e.g., the Operations Manager for all SOPs related to analytical procedures) and the QA Officer(s), and submitted by the QA Department to the Operations Manager and the General Manager for approval prior to implementation.

1.3.3 Project QA Plans

Project QA Plans shall be implemented as required. These shall include such documents as Quality Assurance Project Plans (QAPPs). For those projects, which require specific QA/QC criteria, the client provides a QAPP that has been approved by a regulatory agency (i.e. EPA) to Katahdin. Often, Katahdin works in conjunction with the client to write the analytical section of a QAPP. In this instance the QAPP is reviewed and approved by the Katahdin Quality Assurance Officer, the Katahdin Operations Manager, the Katahdin General Manager and/or Field Services Manager as appropriate.

1.3.4 Document Control, Distribution and Revision

In order that this document achieves the goals outlined in Section 1.2, it is necessary that each Katahdin laboratory employee be familiar with the current provisions of this document. It is also necessary that this document represent agreement among Katahdin management and operational personnel as to the quality level desired and the means to that end.

Prior to its publication as a controlled document, this manual must be approved by the Katahdin Quality Assurance Officer(s), Laboratory Operations Manager, and the Katahdin General Manager. To obtain such approval, the document proceeds through an iterative process of review and revision, involving the affected managers and their designated representatives. The signature page at the beginning of the manual represents acceptance.

Each time a revision is made to this manual, it must also be approved. The Quality Assurance Officer(s) must approve each revision. If the revision constitutes a complete rewrite of the document, then review and approval by the Quality Assurance Officer(s), Laboratory Operation Manager, and the General Manager becomes necessary. The Quality Assurance Officer(s) will decide the appropriate approval process in each case.

1.4 Terms and Definitions

Accuracy:	The closeness of agreement between an observed value and an accepted reference value. When applied to a set of observed values, accuracy will be a combination of a random component and of a common systematic error (or bias) component.
Aliquot:	A measured portion of a sample taken for analysis.
Analyte:	The specific component or constituent that the analytical measurement seeks to determine.
Batch:	A group of samples which are treated similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group [first] is greater then 20, then each group [successive] of 20 samples or less will all be handled as a separate batch.
Blank:	See Equipment Rinsate, Method Blank, Trip Blank, Field Blank, Calibration Blank.
Blind Sample:	A sample submitted for analysis whose composition is known to the submitter but unknown to the analyst.
Calibration:	The process of establishing the relationship between instrumental response and known traceable quantities of analytes of interest.
Calibration Blank:	A quality control sample prepared in the same manner as calibration standards with the exception of the addition of the analytes of interest. A calibration blank is used to establish solvent/reagent and system contributions to the analytical result.
Comparability:	Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.
Completeness:	Measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions
Continuing Calibration:	The process of analyzing standards periodically to verify the maintenance of calibration of the analytical system.
Control Chart:	A graphical plot of test results with respect to time or sequence of measurement, together with limits within which they are expected to lie when the system is in a state of statistical control.

Control Limit:	A range within which specified measurement results must fall to signify statistical control. A process is considered in control if data falls within the prescribed limits. A process is considered "out-of-control" if data falls outside the established control limits. These data are considered suspect and require corrective action including, but not limited to, qualification of the data.
Data Validation:	The internal process of review by which data are shown to be valid as evidenced by the soundness of the analytical system and successful meeting of the Data Quality Objectives (DQOs). Refer to QAM-002, Section 8.4.
Dry Weight:	The weight of a sample based on percent solids. The weight after drying in an oven. Refer to Katahdin Analytical Services SOP, CA-717, Total Solids (% Moisture).
Duplicate Analysis:	A second measurement made on the same sample, sample extract or sample digestate to assist in the evaluation of precision of analysis.
Duplicate Sample:	See Field Duplicate, Matrix Duplicate, and Matrix Spike Duplicate.
Equipment Blank:	A field blank used to verify the effectiveness of equipment decontamination procedures. Laboratory deionized water is passed over sampling equipment after decontamination, collected, and analyzed by the lab.
Field Blank:	Samples of analyte-free media (generally water) taken from the laboratory to the field as: 1) distinct aliquots in the same containers used to collect samples with the appropriate preservative reagents added, or; 2) a single reserve to be aliquoted in the field into the appropriate containers with the appropriate preservatives for the parameters of interest. The intent of the field blank is to ascertain and document any contamination attributable to shipping, field handling procedures and potentially to ambient conditions.
Field Duplicate:	Independent samples which are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers and analyzed independently. These duplicates are useful in documenting the precision of the sampling process.
Field Sample:	A portion of material received by the laboratory to be analyzed, that is contained in single or multiple containers and identified by a unique field ID number.
Holding Time:	The elapsed time expressed in days (except for parameters requiring analysis in $\leq$ 48 hours) from the date of sample collection by the field personnel until the

	date of its processing/analysis. Holding time requirements are dictated by the EPA Federal Register 40CFR Part 136, Table II, or other appropriate method references, QAPPs, State regulation, or specific agency programs (i.e. AFCEE, NFESC, etc.).
Homogeneity:	The degree to which a property or substance is evenly distributed throughout a material.
Instrument Detection Limit:	The Smallest signal above background noise that an instrument can detect at a 99% confidence level. The IDL does not consider any effects that the sample matrix, handling or preparation may have.
Initial Calibration:	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response, linearity and dynamic range of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a continuing calibration do not conform to the requirements of the method in use or at a frequency specified in the method.
Internal Standards:	Analytes, selected as non-targets or in a deuterated state, which are added to all standards and samples at the time of instrumental analysis. Internal standard quantitation takes into account the variability of the instrumental components at the discrete time of standard or sample analysis. The quantitation of the internal standard provides the evaluation of the influence upon the analysis and provides for the application to final sample data.
Lab Control Sample:	A control sample whose matrix is of known composition or analyte-free matrix spiked with a known concentration of analytes of interest. Laboratory control samples are handled using the same preparation, reagents, and analytical methods employed for field samples. Laboratory Control Samples are utilized as indicators of the accuracy of the analysis.
LIMS:	Laboratory Information Management System
Lot:	A quantity of bulk material of similar composition processed or manufactured at the same time.
Matrix:	The component or substrate (e.g. surface water, drinking water) which contains the analyte of interest.
Matrix Duplicate:	An intralaboratory split sample which is used to document the precision of a method in a given sample matrix.

Matrix Spike:	Aliquot of sample fortified (spiked) with known quantities of specified analytes and processed through the entire procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.
Matrix Spike Duplicate:	Intralaboratory split samples spiked with identical concentrations of target analyte (s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Blank:	An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. The method blank is used to document analyte contribution resulting from the analytical process. Acceptable levels of contamination are defined in individual SOPs and/or by project specific data quality objectives.
Method Detection Limit:	The statistically derived minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Method detection limits are determined using replicate spike samples prepared by the lab and taken through all preparation and analysis steps of the method. The method detection limit is calculated using the appropriate Student's t parameter times the standard deviation of a series of spiked samples.
Performance Audit:	A process to evaluate the compliance of actual laboratory practices with relevant project requirements, regulations, contract specifications or internally stated standard operating procedures and practices.
Performance Evaluation:	A process to evaluate the proficiency of an analyst or laboratory by evaluation of the results obtained on known test materials.
Precision:	The agreement among a set of replicate measurements without assumption of knowledge of the true value. Precision is estimated by means of duplicate/replicate analyses. These samples should contain concentrations of analyte above the MDL, and may involve the use of matrix spikes. The most commonly used estimates of precision are the relative standard deviation (RSD), when two or more samples are available and the relative percent difference (RPD), when only two samples are available.
Protocol:	A stated plan that clearly defines the objectives, methods and procedures for accomplishing a task.

PQL:	Practical Quantitation Limit; a value three to five times the Method Detection Limit.
QAPP:	A Quality Assurance Project Plan or QAPP is a project specific document that describes the policies, organization, objectives, functional activities, and specific QA and QC activities designed to achieve the data quality goals of a specific project.
Quality Assurance Program:	A system of policies and procedures whose purpose is to ensure, confirm and document that the product or service rendered fulfills the requirements of Katahdin and its client. Quality Assurance includes quality planning, quality control, quality assessment (auditing), quality reporting and corrective action.
Quality Control:	A system of checks and corrective measures, integrated with the activities that directly generate the product or service, that serves to monitor and adjust the process to maintain conformance to predetermined requirements.
Reporting Limit:	The level at which method, permit, regulatory and client specific objectives are met. The reporting limit may never be lower than the statistically determined MDL, but may be higher based on any of the above considerations. Reporting limits are corrected for sample amounts, the dry weight of solids, and instrument dilution factors, unless otherwise specified.
Rounding Rules:	If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. If the figure following those to be retained is greater than 5, the figure is dropped, and the last retained figure is raised by 1. If the figure following those to be retained is 5, the figure 5 is dropped and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number. If a series of multiple operations is to be performed (add, subtract, divide, multiply), all figures are carried through the calculations. Then the final answer is rounded to the proper number of significant figures.

Original #	Rounded To
11.443	11.44
11.446	11.45
11.435	11.44
11.425	11.42

Sensitivity:	Capability of methodology or instrumentation to discriminate between samples having different concentrations or containing differing amounts of an analyte.

Significant Figures	The number of digits in a value that are justified by the accuracy and precision of the method being used. A value is made up of significant figures when it contains all digits known to be true and one last digit in doubt.
Split Sample:	Aliquots of sample taken from the same container and analyzed independently. In cases where aliquots of samples are impossible to obtain, field duplicate samples should be taken for the matrix duplicate analysis. These are usually taken after mixing or compositing and are used to document intra- or interlaboratory precision.
Standard:	A substance or material the properties of which are known with sufficient accuracy to permit its use to evaluate the same property in a sample.
Standard Operating Procedure:	A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps that outline expected limits of achievement and will produce consistent performance with repetitive use. This document must be officially approved as the method for performing certain routine or repetitive tasks.
Surrogates:	A compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. When employed, these compounds are added to every field and quality control sample prior to processing or preparation. Surrogate compounds are used to evaluate analytical efficiency by measuring recovery. Surrogates are generally utilized for organic analyses.
Systems Audit:	An on-site inspection or assessment of a laboratory's quality system or one of its components.
Traceability:	The ability to trace the source and accuracy of a material (i.e., standard) to a recognized primary reference source such as the National Institute of Standards and Technology (NIST) or USEPA. Also, the ability to independently reconstruct and review all aspects of the measurement system through available documentation.
Trip Blank:	A sample of analyte-free media taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organics samples.
Validation:	The internal process of review by which data are shown to be valid as evidenced by the soundness of the analytical system and successful meeting of the DQOs (not to be confused with data validation by an outside independent source).

Verified Time of Sample Receipt:	VTSR is the time that the laboratory accepts samples into its custody as documented by Sample Management signature and record of time of receipt on the chain-of-custody accompanying the samples. VTSR includes the inspection and resolution of any inconsistencies or issues regarding sample status, condition, or analytical request. VTSR begins at the time of final resolution
Warning Limits:	The limits (typically 2 standard deviations either side of the mean) within which most analytical results are expected to lie with a 95% probability while the system remains in a state of statistical control.

TABLE 1-1

ACRONYMS

AA	Atomic Absorption
ACOE	Army Corps of Engineers
AFCEE	Air Force Center for Environmental Excellence
CCB	Continuing Calibration Blank
CCC	Calibration Check Compounds
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
CRADA	Cooperative Research and Development Agreement
CRDL	Contract Required Detection Limit
DQO	Data Quality Objectives
GC	Gas Chromatograph
GCMS	Gas Chromatograph Mass Spectrometer
GFAA	Graphite Furnace Atomic Absorption
GLP	Good Laboratory Practices
IC	Ion Chromatography
ICP	Inductively Coupled Plasma (Spectrophotometer)
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
LRS	Linear Range Standard
MCP	Massachusetts Contingency Plan
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NBS	National Bureau of Standards
NFESC	Naval Facilities Engineering Service Center
NJDEP	New Jersey Department of Environmental Protection
PE	Performance Evaluation
PQL	Practical Quantitation Limit
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation & Recovery Act
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SD	Sample Duplicate
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SPCC	System Performance Check Compound
SRCR	Sample Receipt Condition Report
VTSR	Verified Time of Sample Receipt

2.0 QA ORGANIZATION AND PERSONNEL

Katahdin Analytical Services, Incorporated is a privately held, full service environmental testing firm. The company consists of analytical services, field sampling and measurement services, accounting, business development, financial management, human resources development, information systems, marketing and quality activities. The organizational structure of the company is provided in Figure 2-1.

It is important for efficient laboratory operation that all laboratory employees understand the operational structure, specific areas of responsibility and lines of authority within the organization. It is equally important for laboratory personnel to understand that the structures of the Quality Organization may be separate from other laboratory operations but that the quality function is totally integrated into every aspect of laboratory operation. All laboratory personnel are responsible for knowing and following proper methods and standard operating procedures; recording quality control information required by those procedures in the proper location; and suspending analyses when quality control criteria are not met.

2.1 Laboratory Organization

The laboratory is managed by the General Manager. The Quality Assurance Officer reports directly to the General Manager.

The General Manager is also responsible for the following functional groups:

Sample Management
Project Management
Laboratory Operations
Management Information Systems
Field Operations
Sales & Marketing Department

Under the direction of the laboratory Operations Manager, the technical staff is further organized into the following functional laboratory groups:

Wet Chemistry
Metals Preparation and Analysis
Organic Extractions (Sample Preparation)
GC Analysis
GC/MS Volatiles and Semivolatiles Analysis
Report/Data Management

Each group is led by a Supervisor who is responsible for operations on a daily basis. Environmental chemists, analysts, laboratory technicians and laboratory assistants report to the Supervisors. All field personnel report directly to the Field Services Manager. See Appendix A for resumes of all key personnel employed at Katahdin Analytical Services, Inc.

2.2 Responsibilities

It is the individual responsibility of all analysts and technicians to perform their assigned tasks according to the this QA Manual, applicable SOPs, QA Project Plans, Study Protocols, Scope of Work, and Work Plans. This includes responsibility for performing quality control analyses as specified in the method SOP and for entering the QC data in the appropriate logbook, electronic database, or method control file system.

Supervisors shall assure that analysts and technicians are instructed in the requirements of the Laboratory QA Manual, study-specific QA Project Plans, SOPs, Protocols, and Work Plans for the analytical method or other procedure. Supervisors shall review sample QC data to assure that QC analyses are being performed at the required frequency, that data are documented in the appropriate logbook, electronic database, or method control file system, and that established corrective action procedures for out-of-control situations are followed and the results documented. It is the responsibility of the Supervisor to assure that data have been validated and reported to the Reporting/Data Management Group or Operations Manager as appropriate. Supervisors shall report to the laboratory Operations Manager.

In the absence of the Supervisor, it shall be the responsibility of a designated senior analyst, other department supervisor, other qualified individual or the Operations Manager to carry on his/her duties.

The Operations Manager shall take overall responsibility for technical conduct, evaluation and reporting of all tasks associated with analytical work performed by the laboratory. The Operations Manager assures that approved procedures are documented and followed, that all data are recorded and verified and that all deviations from approved procedures are documented. The Operations Manager shall assure that Supervisors are instructed in the requirements of the Laboratory QA Manual, study-specific QA Project Plans, SOPs, Protocols, and Work Plans. The Operations Manager provides guidance and assistance in the development of laboratory quality control procedures, approves quality control limits for methods, works with Supervisors to bring out-of-control methods back to within established acceptance limits, and assists Supervisors in correcting analytical problems revealed by QA audits. The Operations Manager shall report to the General Manager.

In the absence of the Operations Manager, it shall be the responsibility of his/her designee, who may be a senior technical person, supervisor or the General Manager, to carry on his/her duties.

The Quality Assurance Department shall be responsible for conducting systems audits and inspections for compliance with this manual, SOPs and QA Project Plans or other project-specific protocols, maintaining historical files of all QA documents, reviewing QC charts, documenting findings and corrective actions, reviewing training records, managing PEs, maintaining conformance with certification requirements and reporting findings related to all of the above to management. The Quality Assurance Officer shall report directly to the General Manager.

In the absence of the Quality Assurance Officer, it shall be the responsibility of his/her designee, who shall not be involved in the direct production of the work in the area of concern, to carry out his/her duties.

The General Manager shall designate the Operations Manager and is responsible for managing all activities related to laboratory services, including the Quality Assurance Program. The General Manager shall assure that there is a Quality Assurance Department, that personnel and other resources are adequate, that personnel have been informed of their responsibilities, that deficiencies are reported to the Operations Manager, that corrective actions are taken and documented and that the quality assurance program is effective in accomplishing the underlying goals. Any significant changes to written SOPs shall be authorized in writing by the General Manager.

In the absence of the General Manager, it shall be the responsibility of his/her designee, who shall not be responsible for the direct production of the work in the area of concern, to carry on his/her duties.

2.3 Training and Orientation

2.3.1 Initial Demonstration of Training

Each new permanent employee receives a four part orientation: a human resources orientation, a safety department orientation, a quality assurance department orientation, and a supervisory orientation. The human resources orientation involves matters of immediate personal concern such as benefits, salary, and company policies. The safety department orientation is an in-depth examination of the laboratory Chemical Hygiene Plan and safety program, which are consistent with the requirements of OSHA's Hazard Communication Program (29 CFR 1910.1200). The quality assurance orientation provides the new employee with information on the Katahdin Analytical Services QA program through a brief introduction to the QA manual and SOPs, acceptable recordkeeping practices, and the individual's responsibility with respect to the quality assurance program. The new employee's Supervisor provides the employee with a basic understanding of the role of the laboratory and the basic elements of that individual's position within the laboratory. Temporary employees receive the same orientation as permanent staff with the exception of the human resources orientation. A form documenting the completion of the new employee orientation and date is maintained in the employee's individual training documentation file.

The training of a new employee concentrates on his/her scientific background and work experience to provide the employee with a level of competence so that the individual will be able to function within the defined responsibilities of his/her position as soon as possible. Training techniques utilized may include any of the following:

- on-the-job training
- lectures
- programmed learning
- conferences and seminars
- short courses
- specialized training by instrument manufacturers
- participation in check-sample or proficiency sample programs.

Supervisors shall be responsible for providing documentation of training and proficiency in accordance with Katahdin Analytical Services SOP QA-805, Laboratory Technical Personnel Training, for each employee under their supervision. The training documentation file indicates what procedures (SOPs) an analyst or technician is capable of performing either independently or with supervision. Employees must complete an Initial Demonstration of Proficiency (IDP) that meets the requirements of the method. Please refer to Katahdin SOP QA-807, Method Performance / Precision & Accuracy Requirements, and individual methods for IDP requirements. Completion of these analyses is documented on the Katahdin Technical Method Training Checklist. A summary of results and documentation of the applicable raw data files is maintained in the employee's training file. The Supervisor is responsible for maintaining an updated and current training documentation file for each person under their supervision.

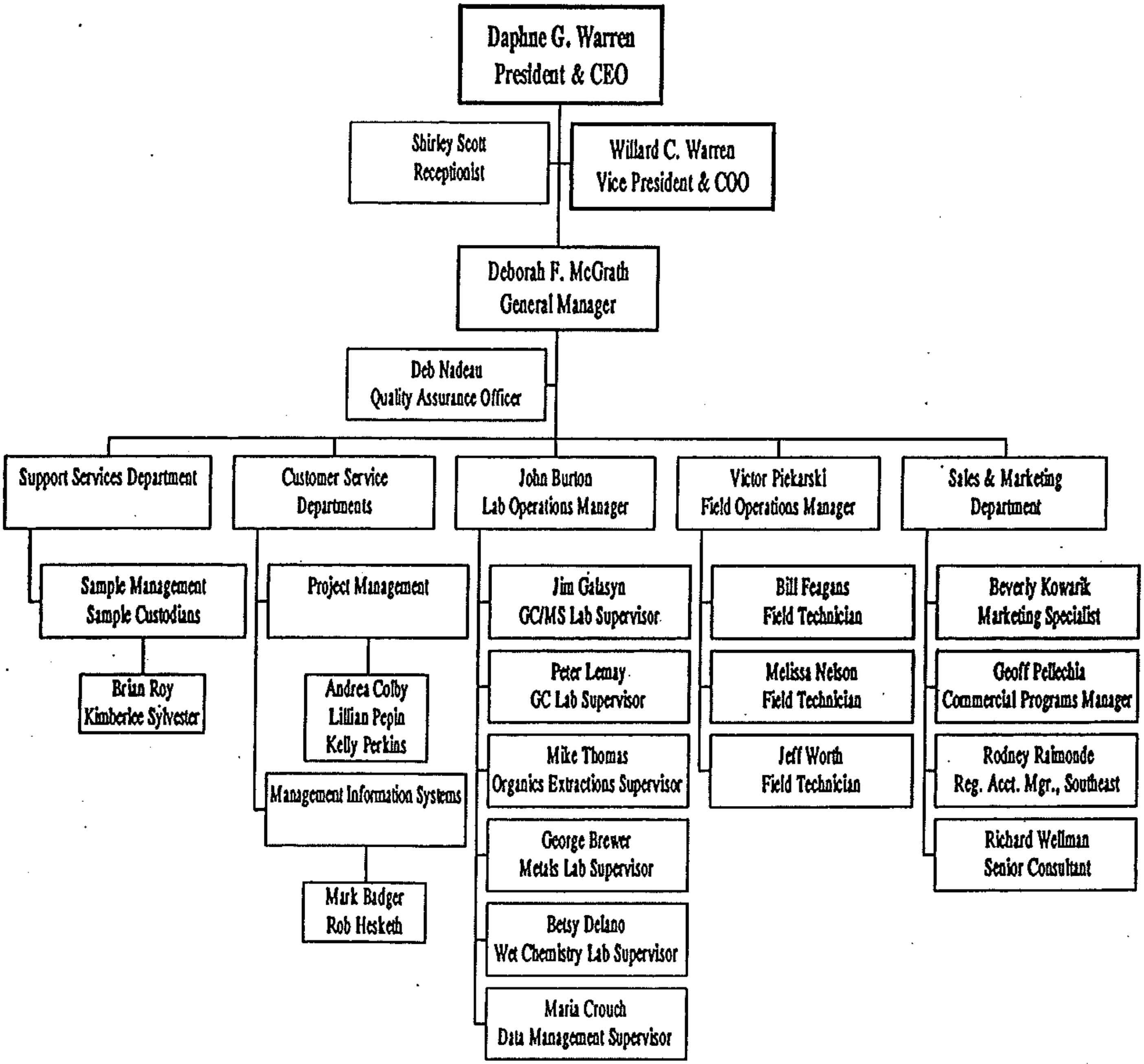
2.3.2 Continuing Demonstration of Training

Employees must document training in new SOP revisions where changes are deemed significant by the QAO, General Manager or Operations Manager. Training in new SOP revisions shall be documented as applicable on Katahdin Analytical Services Retraining Form. This form should also be used to document refresher training for employees who have not performed a method for greater than 18 months. In addition, if a supervisor, manager, QAO or other auditor observes non-conformance, this form may used to document retraining of the personnel involved.

Continued Demonstration of Proficiency (CDP) may be documented annually within each employee's training files. This may be accomplished by comparing the results of four LCSs to laboratory or method limits. CDP is also accomplished through the continuous implementation of Katahdin's QA program. QA/QC elements such as LCSs, blanks, matrix spikes, MDLs, performance evaluations, sample duplicates and surrogates are all functions of the QA Program. Evaluation of these elements on a daily or routine basis can reveal where additional training may need to occur.

Figure 2-1

Katahdin Analytical Services, Incorporated
Organizational Structure



APPENDIX A

Katahdin Analytical Services, Incorporated
Resumes For Key Personnel

DAPHNE G. WARREN, President and Chief Executive Officer

PRESENT QUALIFICATIONS SUMMARY

As President and Chief Executive Officer of Katahdin Analytical Services, Ms. Warren brings over 18 years of financial and managerial experience to Katahdin, having worked for Maine's largest banks. This expertise allows Ms. Warren to place the emphasis on the analytical processes of the company while maintaining administrative overhead at a minimum. Ms. Warren is responsible for the management of all aspects of Katahdin Analytical Services, Inc.

EDUCATION

Liberal Arts, University of Southern Maine, 1975

PROFESSIONAL EXPERIENCE

11/95-Present - President and Chief Executive Officer, Katahdin Analytical Services, Inc., Westbrook, ME

9/94-11/95 - Branch Manager, Atlantic Bank, So. Portland, ME -- Ms. Warren was responsible for the administration of one of Maine's largest bank branches. With a deposit base of over $ 30 million, Ms. Warren interacted with the institution's largest clients which included both locally-based and international corporate accounts. Ms. Warren was also responsible for the training in the operation of banking sales, client service, and staff.

4/90-9/94 - Branch Manager, Citibank, Falmouth, ME -- Ms. Warren was responsible for the operations of this branch office. Ms. Warren conducted business primarily with small business clients of this $ 34 million deposit base office. In addition to directing a staff, Ms. Warren also was in charge of consumer lending and sales.

9/89-4/90 - Assistant Branch Manager, Citibank, Falmouth, ME -- Ms. Warren was responsible for sales of deposits with emphasis on lending. She also directed teller activities, both operations and audit.

6/78-8/89 - Consumer Loan Administrator, Sun Savings & Loan Assoc., Portland, ME -- Ms. Warren was responsible for processing and approval of consumer loans, introduction of customer accounts, and client service.

PROFESSIONAL MEMBERSHIPS / COMMUNITY ACTIVITIES

1988-Present -- Board Member, Falmouth-Cumberland, ME Chamber of Commerce
1985-1988 -- Board Member, Greater Portland Council of Governments, Portland, ME
1987-1988 -- Chairperson of Town Council, Cumberland, ME
1983-1988 -- Member of Town Council, Cumberland, ME

updated: 1/96

WILLARD C. WARREN, Vice President and Chief Operating Officer

QUALIFICATIONS SUMMARY

As Vice President and Chief Operating Officer, Mr. Warren is primarily responsible for sales & marketing, and technical operations. In this function, Mr. Warren directs the sales force in targeting opportunities, writing technical proposals, and negotiating contracts. Mr. Warren also works with operational personnel to ensure project requirements are understood and expectations are met. Mr. Warren has operated the present day Katahdin laboratory for prior owners for over ten years.

EDUCATION

B.S./Civil Engineering, 1971, Northeastern University, Boston, MA

PROFESSIONAL EXPERIENCE

11/95-Present - Vice President and Chief Operating Officer

8/94-11/95 - Group Vice President, PACE, Incorporated, Minneapolis, MN -- Mr. Warren was responsible for eight laboratory operations of the eighteen PACE Incorporated Divisions. Mr. Warren had overall financial accounting and operational development of his group which generated over $ 25 million annually. As a Group Vice President, Mr. Warren worked with laboratory General Managers in developing sales and marketing programs, evaluating costs, and implementation of quality assurance standards at each of the laboratories.

1/92-8/94 - President, Northern Division, Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Mr. Warren was responsible for the management of CCAS's Northern Division with overall responsibility for its laboratory operations, including sales & marketing, quality assurance, and financial performance. Mr. Warren also served as project manager for several large scale Federal Program analytical projects within AFCEE and COE. Through his experience, he developed a working knowledge of Federal and State regulations including those promulgated under the Clean Water Act, SARA, CERCLA and RCRA.

1988-1/92 - Director of Laboratory Services, ABB Environmental Services, Inc., Westbrook, ME -- Mr. Warren had overall responsibility for ABB-ES's Westbrook, ME environmental laboratory. Under his direction, Mr. Warren designed ABB's new laboratory which led to the successful move of ABB's laboratory operations to Westbrook. The new lab layout and emphasis on TQM led to an increase in operational efficiency by over 40% within six months.

1971-1988 - Assistant Division Manager/Project Manager, ABB Environmental Services, Inc., Portland, ME -- Mr. Warren was responsible for several ABB-ES technical departments including the environmental laboratory, civil engineering, wastewater engineering, and special studies. Mr. Warren also managed ABB's technical assistance contract with EPA.

WILLARD C. WARREN, Vice President and Chief Operating Officer - Continued

PROFESSIONAL LICENSES

Professional Engineer - Maine

PROFESSIONAL AFFILIATIONS

TAPPI, Chairman, Environmental Division

COMMUNITY ACTIVITIES

Cumberland - North Yarmouth Lions Club - Past Treasurer

\updated: 1/96

DEBORAH F. MCGRATH, General Manager

PRESENT QUALIFICATIONS SUMMARY

As General Manager, Ms. McGrath is responsible for the overall management of the Laboratory, which includes the oversight and coordination of the Laboratory and Field Operations, Quality Assurance, Administrative, Support Services, Customer Service, and Sales and Marketing departments.

EDUCATION

B.S. Chemistry, Simmons College, Boston, MA 1971

PROFESSIONAL EXPERIENCE

11/95-Present - General Manager, Katahdin Analytical Services, Inc., Westbrook, ME

3/93-11/95 - General Manager, PACE - Maine Laboratory, Westbrook, ME – Ms. McGrath was responsible for the overall management of PACE New England's Westbrook, ME and Hampton, NH locations, which included the oversight and coordination of Laboratory and Field Operations, Quality Assurance, Support Systems, Administrative, and Sales/Marketing departments.

1989-3/93 - Vice President and Division Manager, NET Inc., Cambridge Division, in Bedford, MA (formerly Cambridge Analytical Associates, Inc.) – from 1989-1993 where her responsibilities included oversight of the technical operations and business development of the division. She was Vice President of Environmental Services for one year and Director of Analytical Services for two while employed by Cambridge Analytical Associates, Inc. from 1986-1989.

1986-1989 – Vice President of Environmental Services, Cambridge Analytical Association, in Boston, MA

1981-1986 - Manager of the Laboratory Analysis Department and Inorganics Section, GCA Technology Division, Bedford, MA

1971-1981 - Analytical Chemist, Kennecott Copper Ledgemont Laboratory, Lexington, MA

PUBLICATIONS

Ms. McGrath is the author/co-author of over 15 publications on methods development and comparison studies, waste oil and biota analysis, combustion assessments and waste minimization.

CONTINUING EDUCATION

USEPA Training Program – Quality Systems, PBMS and NELAC: Putting It All Together, - 1998
USEPA Training Program – Analytical Strategy For the RCRA Program – 1998
National Laboratory Training Network – Gearing Up For NELAP - 1998

updated: 4/99

JOHN C. BURTON, Laboratory Operations Manager

PRESENT QUALIFICATIONS SUMMARY

As Laboratory Operations Manager, Mr. Burton oversees management of both inorganics and organics laboratory sections providing pesticides/PCB, volatiles, semivolatiles, wet chemistry, metals preparation, and metals analysis.

Mr. Burton has extensive experience in the environmental analytical chemistry field. Mr. Burton has over nine years of experience in Gas Chromatography, Mass Spectrometry, HPLC, and IR. Mr. Burton also has experience using GC/MS-SIM for various special projects including Love Canal.

EDUCATION

M.S. Forensic Chemistry, Northeastern University, Boston, MA, 1987
B.A. Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA, 1982

PROFESSIONAL EXPERIENCE

11/95-Present - Laboratory Operations Manager, Katahdin Analytical Services, Inc., Westbrook, ME

10/94-11/95 - Laboratory Operations Manager, PACE - Maine Laboratory, Westbrook, ME -- Mr. Burton managed both the inorganics and organics laboratory sections providing pesticides/PCB, volatiles, semivolatiles, wet chemistry, metals preparation, and metals analysis.

1/93-10/94 - Laboratory Operations Manager, NET - Thorofare, Thorofare, NJ -- Mr. Burton, was responsible for oversight management of both the inorganics and organics laboratory sections providing pesticides/PCB, volatiles, semivolatiles, wet chemistry, metals preparation, and metals analysis.

3/91-12/92 - Organic Section Manager, NET-Thorofare, Thorofare, NJ

6/89-3/91 - GC/MS Supervisor, Cambridge Analytical Assoc./NET Cambridge, Cambridge, MA

6/87-6/89 - GC/MS Chemist, Cambridge Analytical Associates, Boston, MA

5/86-6/87 - Analytical Toxicologist, New England Pathology Services, Woburn, MA

Summer 1985 - Chemist, Bureau of Alcohol Tobacco & Firearms, Rockville, MD

CONTINUING EDUCATION

NET Professional Development Series TQM, 1991
NET Professional Development Series, 1990
Hewlett Packard System Manager Course, 1989
Hewlett Packard Aquarius User Course, 1988

updated: 1/96

DEBORAH NADEAU, Quality Assurance Officer

PRESENT QUALIFICATIONS SUMMARY

As Quality Assurance Officer, Ms. Nadeau is responsible for direction of the laboratory quality assurance program. Primary responsibilities include development and ongoing evaluation of laboratory quality assurance/quality control (QA/QC) procedures, review of quality control data, and performance of internal audits to assess conformance to the laboratory quality assurance program. Additional responsibilities include reviewing and implementing standard operating procedures (SOPs), maintaining laboratory certification programs, overseeing laboratory performance evaluation analyses, reviewing and revising the Laboratory Quality Assurance Manual as necessary and preparing QAPs as directed by the General Manager.

EDUCATION

B.A./Biochemistry, 1989, Brandeis University, Waltham, MA

PROFESSIONAL EXPERIENCE

10/97-Present - Quality Assurance Officer, Katahdin Analytical Services, Inc. , Westbrook, ME

11/95-10/97 - Data Management Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME -- Ms. Nadeau was responsible for coordinating the workload of the Data Management Group and overseeing such daily functions as data entry, checking and secondary technical review of organics and inorganics results and compilation and production of final client reports. Her responsibilities also included working with data collection software and supervising forms generation and data package production for projects requiring special protocols such as CLP. Ms. Nadeau communicated with the operations manager, project managers, and laboratory supervisors on the daily status and reporting requirements of projects.

5/95-11/95 - Data Management Coordinator, PACE - Maine Laboratory, Westbrook, ME -- Ms. Nadeau was responsible for coordinating tasks for the Data Management Group. Additional responsibilities included data review and data entry for data packages compilation for EPA.

8/92-4/95 - Lab Analyst, PACE - Maine Laboratory, Westbrook, ME -- Ms. Nadeau was responsible for inorganic analysis using ICP, graphite furnace, flame AA and cold vapor AA, data review of metals and wet lab data, the compilation of CLP protocol data packages through Ward software, training of new personnel in laboratory skills, and maintenance of elemental instrumentation.

12/89-8/92 - Lab Analyst, Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Ms. Nadeau was responsible for inorganic analysis using ICP, graphite furnace, flame AA and cold vapor AA, data review of metals and wet lab data, the compilation of CLP protocol data packages through Ward software, training of new personnel in laboratory skills, and maintenance of elemental instrumentation.

5/89-12/89 - Inorganic Analyst, Northeast Laboratory, Winslow, Maine -- Ms. Nadeau's responsibilities included elemental analyses by flame AA and maintenance of the instrument.

CONTINUING EDUCATION

Thermo Jarrell Ash Corporation: Flameless Atomic Absorption Emission Spectroscopy course
USEPA Training Program – Quality Systems, PBMS and NELAC: Putting It All Together. - 1998
USEPA Training Program – Analytical Strategy For the RCRA Program – 1998
National Laboratory Training Network – Gearing Up For NELAP - 1998

updated: 4/99

JAMES F. GALASYN, Senior Chemist, GC/MS Laboratory Supervisor

PRESENT QUALIFICATIONS SUMMARY

Dr. Galasyn is supervisor of the GC/MS laboratory and as such is responsible for all GC/MS activities, including scheduling and tracking of samples, supervision of chemists within the group, and operation and maintenance of the GC/MS equipment. Dr. Galasyn authors all of the organic standard operating procedures.

EDUCATION

NSF Post-doctoral Fellowship in Analytical/Atmospheric Chemistry, 1984-1986, Colorado College, Colorado Springs, CO
Ph.D./Analytical/Environmental Chemistry, 1984, Dartmouth College, Hanover, NH
B.S./Chemistry, 1980, University of Connecticut, Storrs, CT

PROFESSIONAL EXPERIENCE

11/95-Present - GC/MS Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

8/94-11/95 - GC/MS Supervisor PACE - Maine Laboratory, Westbrook, ME -- Dr. Galasyn was responsible for the supervision of the GC/MS laboratory and as such was responsible for all GC/MS activities, including scheduling and tracking of samples, supervision of chemists within the group, and operation and maintenance of the GC/MS equipment. Dr. Galasyn authored all of the organic standard operating procedures.

6/87-8/94 - GC/MS Supervisor - Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Dr. Galasyn was responsible for the supervision of the GC/MS laboratory and as such was responsible for all GC/MS activities, including scheduling and tracking of samples, supervision of chemists within the group, and operation and maintenance of the GC/MS equipment. Dr. Galasyn authored all of the organic standard operating procedures.

2/86-6/87 - GC/MS Supervisor and Chemist, Confidential Laboratory, CT -- Served as GC/MS Supervisor and was responsible for the analysis of CLP and non-CLP extractable, base/neutral, and acid semivolatile target compound list and priority pollutant compounds. Instrumental responsibilities included the operation and maintenance of Hewlett-Packard GC/MS equipment.

9/82-6/84 - Graduate Student, Dartmouth College, Hanover, NH -- As a graduate student, Dr. Galasyn operated and maintained Finnigan GC/MS equipment for the environmental laboratory, which included analysis and interpretation of all organic intermediates for the chemistry department.

ADDITIONAL EXPERIENCE

Dr. Galasyn's Post-doctoral Fellowship research was in the field of atmospheric chemistry and was an investigation of the contribution that dry deposition made to the wet deposition normally associated with acid rain. Various locales were studied, including the remote free troposphere at the Mauna Loa Observatory in Hawaii. Ionic species monitored included nitric acid vapor, aerosol nitrate, sulfate, and various actions. Instrumental responsibilities included operation and maintenance of ion chromatographs, an atomic absorption (AA) spectrometer, and field equipment.

For his Doctoral thesis, entitled "Residential Indoor and Outdoor Air Pollution," Dr. Galasyn examined the ambient air at various indoor and outdoor locations, and especially focused upon indoor air quality in the vicinity of woodstoves, fireplaces, and kerosene heaters. Pollutants monitored included polycyclic aromatic hydrocarbons, carbon monoxide, nitrogen dioxide, and total and respirable suspended particulates. Instrumentation employed included Finnigan GC/MS, various GC's, and HPLC.

PUBLICATIONS AND PRESENTATIONS

J.F. Galasyn, K.L. Tschudy, and B.J. Huebert, "Daily and Seasonal Variability of Nitric Acid Concentrations in the Remote Free Troposphere at Mauna Loa, Hawaii," Journal of Geophysical Research, Vol. 92, No. 03, Pg. 3105-3113, March 20, 1987.

J.F. Galasyn and B.J. Huebert, "Daily and Seasonal Variability of Nitric Acid Concentrations in the Remote Free Troposphere at Mauna Loa," presented at the IAMAP/IAPSO Joint Assembly, Honolulu, Hawaii, August 5-16, 1985.

B.J. Huebert and J.F. Galasyn, "Measurements of the Dry Deposition of Nitric Acid to a Developing Winter Wheat Crop," presented at the Rocky Mountain conference - First Symposium on Atmospheric Chemistry, Denver, CO, July 14-18, 1985.

B.J. Huebert, J.F. Galasyn, and K.L. Tshudy, "Measurements of the Seasonal and Diurnal Variations of Nitric Acid Vapor at the Mauna Loa Observatory," presented at the Rocky Mountain Conference - First Symposium on Atmospheric Chemistry, July 14-18, 1985.

J.F. Galasyn, J.F. Hornig, and R.H Soderberg, "The Loss of PAH from Quartz Fiber High Volume Filters," J. Air Pollute. Control Assoc., 34, 57 (1984).

J.F. Hornig, R.H. Soderberg, A.C. Barefoot, and J.F. Galasyn, "Woodsmoke Analysis: Vaporization Losses of PAH from Filters and Levoglucosan as a Distinctive Marker for Woodsmoke," in Polynuclear Aromatic Hydrocarbons, ed. by Cooke, Battelle Press, Columbus, Ohio (1984).

CONTINUING EDUCATION

Member, EPA Air Toxics Workgroup, 1990 - 1991
Hewlett-Packard 5988/96 RTE System Manager Course; Paramus, New Jersey, December 1986
American Chemical Society Short Course, "Effective Management of Chemical
Analysis Laboratories," June 1986

PROFESSIONAL AFFILIATIONS

American Chemical Society
Air and Waste Management Association
American Society for Mass Spectrometry
Phi Beta Kappa

updated: 1/96

PETER LEMAY, GC Group Supervisor/GC Operator

PRESENT QUALIFICATIONS SUMMARY

As GC Group Supervisor/GC Operator, Mr. Lemay is responsible for coordinating daily operations of the GC laboratory section. His activities include training of personnel, scheduling equipment and staff, prioritizing analytical work to meet holdtime requirements, ensuring that quality control criteria are met and performing data review. Mr. Lemay's responsibilities include oversight of analysis of samples for GC volatiles, pesticides, PCBs, PNAs, and PHCs, DROs/GROs by methods 601/602, 8010/8020, 608/8080A, 8015 mod. He has experience in the performance of herbicide analysis as well as the above methods and is trained in the operation of the following GCs and detectors: HP 5890, HP5880, HP 5840, Tracon and Waters Dimension; ECD, ELCD, NPD, FID, FPD with either packed or capillary columns.

As a GC Operator, he is responsible for the analysis of solid and aqueous sample extracts for detection of pesticides, PCBs, PNAs, and PHCs. Mr. Lemay has more than eight years experience in GC analysis and nine years of supervisory experience.

EDUCATION

B.A., Chemistry, University of Maine, Orono, ME, 1985

PROFESSIONAL EXPERIENCE

11/95-Present - GC Group Supervisor/GC Operator, Katahdin Analytical Services, Inc., Westbrook, ME

6/92-11/95 - GC Group Supervisor/GC Operator, PACE - New Hampshire Laboratory, Hampton, NH -- Mr. Lemay was responsible for the supervision of three analysts and the daily operations of the GC section performing pesticide, PCB, PNA, PHC, and herbicide analysis.

1987-6/92 - GC Group Supervisor/GC Operator, Resource Analysts, Inc., Hampton, NH -- Mr. Lemay was responsible for the supervision of three analysts and the daily operations of the GC section performing pesticide, PCB, PNA, PHC, and herbicide analysis.

1985-1987 - Chemist, Burgess Analytical Laboratory -- Mr. Lemay was responsible for performing chemical analyses on a variety of materials, sample preparation, instrument operation, data review and evaluation, and training new employees.

1977-1981 - Medical Laboratory Specialist, United States Air Force

CONTINUING EDUCATION

Introduction to GC/MS, Hewlett Packard, 1988

"Frontline Leadership," Managerial Training by Zenger-Miller, Millipore Corp., Bedford, MA, 9/90 - 10/90

Occupational and Environmental Radiation Protection, Harvard School of Public Health, August 1991

"Waste Testing and Quality Assurance," Washington DC, July 1993

updated: 4/98

MICHAEL F. THOMAS, Organic Extractions Supervisor

PRESENT QUALIFICATIONS SUMMARY

As Organic Extractions Supervisor, Mr. Thomas is responsible for coordinating the daily operations of the extractions laboratory. Mr. Thomas is also responsible for coordinating sample preparation for BNA, PCB, pesticide, PHC, PNA, and other analyses. He is responsible for scheduling the work load such that hold times are met and sample preparation turn-around time goals are routinely achieved. Mr. Thomas interfaces with managers, supervisors, and analysts to coordinate extraction lab activities with those of the instrumental analysis groups. He also ensures sample preparation documentation is current and complete. Mr. Thomas oversees the initial training of extraction analysts, as well as on-going technical support and direction to maximize individual analysts' efficiency and the overall productivity of the group. Mr. Thomas also initiates cross-training measures to improve versatility within the group.

EDUCATION

A.A.S., Chemical Technology, Community College of Rhode Island, 1979.

PROFESSIONAL EXPERIENCE

5/96-Present - Organic Extractions Laboratory Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

1989--5/96 - Organic Extractions Laboratory Supervisor, NET Inc., Cambridge Division, Bedford, MA -- Mr. Thomas was responsible for the supervision of the organic extraction laboratory. Mr. Thomas was experienced in the preparation of wastewater, soil, sludge, oil and leachate matrices for the analyses of such parameters as pesticides and polychlorinated biphenyls, semi-volatile and volatile organic compounds, herbicides and other environmental pollutants. Mr. Thomas was the primary extraction analyst for the Method 515.1 Method Validation Study for chlorinated acid herbicides.

1988-1989 - Organic Extractions Laboratory Supervisor, Cambridge Analytical Associates, Inc., Boston, MA -- Mr. Thomas was responsible for the supervision of the organic extraction laboratory.

1987-1988 - Organic Extractions Laboratory Chemist, Cambridge Analytical Associates, Inc., Boston, MA -- Mr. Thomas performed routine extraction and concentration procedures with attendant clean-up of extracts on various types of environmental samples using EPA Sample Management Office/Contract Laboratory Program and other agency protocols. Mr. Thomas prepared wastewater, soil, sludge, oil and leachate matrices for the following parameters: pesticides, PCBs, BNAs, VOCs, herbicides and other environmental pollutants.

1979-1987 - Organic Extraction Laboratory Chemist, Alliance Technologies Division (formerly GCA/Technology Division), Bedford, MA -- Mr. Thomas assisted in the development of preparative methodologies for samples from a variety of local government and commercial clients. He collaborated in the recovery, extraction, concentration and gravimetric analysis of stack gases and ambient air monitoring samples from toxic waste sites and other generators such as boilers and kilns.

updated: 5/96

GEORGE BREWER, Metals Laboratory Supervisor

PRESENT QUALIFICATIONS SUMMARY

As Metals Laboratory Supervisor, Mr. Brewer is responsible for the direction and daily operation of the metals laboratory including scheduling of analyses, performing sample analysis, maintenance of instrumentation and maintenance of SOPs for method compliance. His responsibilities include the preparation and analysis of water and wastewater, soil, sludge and other solid waste matrices, particularly ash, for elemental parameters. In addition, he is responsible for equipment maintenance and training of laboratory personnel. Mr. Brewer has extensive experience in the operation of atomic absorption and inductively coupled plasma (ICP) spectroscopy equipment.

EDUCATION

M.S./Geological Sciences, 1986, University Of Maine At Orono, Orono, ME
B.S./Geology, 1979, Yale University, New Haven, CT

PROFESSIONAL EXPERIENCE

11/95-Present - Metals Laboratory Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

8/94-11/95 - Metals Laboratory Supervisor, PACE - Maine Laboratory, Westbrook, ME -- Mr. Brewer was responsible for supervision of the metals instrumentation laboratory including scheduling of analyses, performing sample analysis, maintenance of instrumentation and maintenance of SOPs for method compliance.

1/94-8/94 - Metals Laboratory Supervisor, Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Mr. Brewer was responsible for supervision of the metals instrumentation laboratory including scheduling of analyses, performing sample analysis, maintenance of instrumentation and maintenance of SOPs for method compliance.

Chief Chemist, Millipore Corp., Bedford, MA -- Mr. Brewer was involved in all aspects of the lab's work including sample log-in through analysis to report generation and customer service. He was also responsible for initiating a quality control program at the lab, and oversaw analyses of all EPA WP and WS performance evaluation samples.

Senior Atomic Spectroscopist, Clean Harbors Analytical Services, Inc., Braintree, MA -- Mr. Brewer's responsibilities included training and supervising new analysts, scheduling trace metals in complex matrices such as wastewater, soil, ash, and oil. He was responsible for bringing the laboratory's first ICP on line and developing all ICP methods used by the lab. He also assumed managing responsibility for the successful completion of analyses on EPA CLP inorganic performance evaluation samples during the 1987 bid period.

ADDITIONAL EXPERIENCE

Mr. Brewer's background has provided him with extensive experience in flame and graphite furnace atomic absorption spectrophotometry, plasma emission spectrometry, ion chromatography, and several other instrumental and wet chemical inorganic analytical techniques.

Mr. Brewer's graduate work involved the study of the history of acidification and heavy metal loading in a Maine watershed through the analyses of sediment cores and water samples by atomic absorption spectrophotometry and ion chromatography.

PROFESSIONAL AFFILIATIONS

American Chemical Society
Society for Applied Spectroscopy

updated: 4/99

BETSY A. DELANO, Wet Chemistry Laboratory Supervisor

PRESENT QUALIFICATIONS SUMMARY

As Wet Chemistry Laboratory Supervisor, Ms. Delano is responsible for coordinating daily operations of the Wet Chemistry laboratory section. Her activities include training of personnel, scheduling equipment and staff, prioritizing analytical work to meet holdtime requirements, ensuring that quality control criteria are met and performing data review. Ms. Delano oversees the preparation and analysis of solid and aqueous samples by standard inorganic wet chemistry methods. Ms. Delano has more than nine years of experience in wet chemistry procedures.

EDUCATION

B.S./Marine Biology, 1989, Gordon College, Wenham, MA

PROFESSIONAL EXPERIENCE

11/95-Present - Wet Chemistry Laboratory Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

8/92-11/95 - Analytical Chemist, PACE - Maine Laboratory, Westbrook, ME -- Performed wet chemistry analyses, including cyanide, chloride, total organic carbon, chemical oxygen demand, total dissolved solids, total suspended solids, fluoride, sulfide, and sulfite. She also prepared ASTM extractions of soils/solid samples for wet chemistry analyses, and was responsible for PM-10 and total suspended particulate testing of air monitoring projects. In the Elements Group, she was involved in sample digestion and analysis by atomic absorption (both furnace and flame) and atomic emission (ICP) for the detection of various metals.

1990-8/92 - Analytical Chemist, PACE - Maine Laboratory, Westbrook, ME -- Performed wet chemistry analyses, including cyanide, chloride, total organic carbon, chemical oxygen demand, total dissolved solids, total suspended solids, fluoride, sulfide, and sulfite.

MARIA CROUCH, Data Management Supervisor

PRESENT QUALIFICATIONS SUMMARY

As Data Management Supervisor, Ms. Crouch is responsible for coordinating the workload of the Data Management Group and overseeing such daily functions as data entry, checking and secondary technical review of organics and inorganics results and compilation and production of final client reports. Her responsibilities also include working with data collection software and supervising forms generation and data package production for projects requiring special protocols such as CLP. Ms. Crouch communicates with the operations manager, project managers, and laboratory supervisors on the daily status and reporting requirements of projects.

EDUCATION

B.A./Chemistry, summa cum laude, University of Southern Maine, Portland, ME 1993

PROFESSIONAL EXPERIENCE

10/97-Present - Data Management Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

1/97-10/97- Data Specialist II, Katahdin Analytical Services, Inc., Westbrook, ME -- As Data Specialist II, Ms. Crouch oversaw the preparation of data package deliverables. Also responsible for the assurance that the deliverable packages meet criteria for technical compliance and completeness.

1993-1996 - Data Validator, ABB Environmental Services, Inc., Portland, ME -- As Data Validator, Ms. Crouch was responsible for the review of analytical data for the USEPA Contract Laboratory Program (Superfund) and private clients. Other duties included, writing fate and transport chemical profiles for use in report appendix, assistance in the preparation of data quality reports for presentation to clients, participation in the evaluation and process of improvement of validation SOPs and training of new data validation employees.

1986-1988 - Office Manager, Mangino, Inc., Windham, ME

ADDITIONAL EXPERIENCE

Taught the laboratory section of introductory level chemistry courses at the University of Southern Maine, Spring and Fall 1996.

updated: 4/99

ANDREA COLBY, Project Manager

PRESENT QUALIFICATIONS SUMMARY

As Project Manager, Ms. Colby is responsible for managing analytical projects from initiation to completion. Ms. Colby is the point of contact for client projects, priorities, preliminary data, bottle orders and price quotes for commercial work and work by special protocol such as CLP. Negotiates project specifications with clients, insures specifications are met by the lab and delivered to the client in the required time frame. Maintains communications channels with the Sales Department and the Laboratory Staff.

EDUCATION

B.A. Biology, 1987, University of California, Santa Cruz

PROFESSIONAL EXPERIENCE

11/95-Present - Project Manager, Katahdin Analytical Services, Inc. , Westbrook, ME

8/94-11/95 - GC/MS Chemist, PACE - Maine Laboratory, Westbrook, ME - Ms. Colby was responsible for the analysis of extractable, base/neutral, and acid semivolatile target compound list and priority pollutant compounds. Instrumental responsibilities included the operation and maintenance of Hewlett-Packard GC/MS equipment.

1/92-8/94 - Elements Group Chemist, Coast-to-Coast Analytical Services, Inc., Westbrook, ME - Ms. Colby was responsible for inorganic analysis using ICP, graphite furnace, flame AA and cold vapor AA, data review of metals and wet lab data, training of new personnel in laboratory skills, and maintenance of elemental instrumentation.

1991-1/92 - Elements Group Chemist, ABB, Westbrook, ME - Ms. Colby was responsible for inorganic analysis using ICP, graphite furnace, flame AA and cold vapor AA, data review of metals and wet lab data, training of new personnel in laboratory skills, and maintenance of elemental instrumentation.

1988-1991 - Wet Chemistry Laboratory Associate Chemist, ABB, Westbrook, ME – Ms. Colby performed wet chemistry analyses, including cyanide, chloride, total organic carbon, chemical oxygen demand, total dissolved solids, total suspended solids, fluoride, sulfide, and sulfite. Additional responsibilities included review of wet lab data.

1987-1988 - Extractions Laboratory Assistant, E.C. Jordan, Westbrook, ME – Ms. Colby performed routine extraction and concentration procedures with attendant clean-up of extracts on various types of environmental samples using EPA Sample Management Office/Contract Laboratory Program and other agency protocols. Ms. Colby prepared wastewater, soil, sludge, oil and leachate matrices for the following parameters: pesticides, PCBs, and BNAs,

updated: 4/99

KELLY A. PERKINS, Project Manager

PRESENT QUALIFICATIONS SUMMARY

As Project Manager, Ms. Perkins is responsible for managing analytical projects from initiation to completion. Point of contact for client projects, priorities, preliminary data, bottle orders and price quotes for commercial work and work by special protocol such as CLP. Negotiates project specifications with clients, insures specifications are met by the lab and delivered to the client in the required time frame. Maintains communications channels with the Sales Department and the Laboratory Staff.

EDUCATION

B.S./Chemistry, 1984, Muhlenberg College, Allentown, PA

PROFESSIONAL EXPERIENCE

11/95-Present - Project Manager, Katahdin Analytical Services, Inc., Westbrook, ME

8/94-11/95 - GC Section Supervisor, PACE - Maine Laboratory, Westbrook, ME -- Ms. Perkins performed Gas Chromatographic analysis for pesticides and Polychlorinated Biphenyls by SW846 and CLP methods. She was responsible for the daily supervision of section chemists. She interpreted and reviewed technical data to ensure compliance with established procedures and laboratory QA program. She scheduled the completion of analyses to meet contractual agreements and analyzed environmental samples for routine and non-routine analyses. She was responsible for meeting acceptable performance criteria, for performance evaluations, and laboratory audits. She was responsible for the Pesticides/PCB fraction for EPA CLP program work.

9/91-8/94 - GC Section Supervisor, Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Ms. Perkins performed Gas Chromatographic analysis for pesticides and Polychlorinated Biphenyls by SW846 and CLP methods. She was responsible for the daily supervision of section chemists. She interpreted and reviewed technical data to ensure compliance with established procedures and laboratory QA program. She scheduled the completion of analyses to meet contractual agreements and analyzed environmental samples for routine and non-routine analyses. She was responsible for meeting acceptable performance criteria, for performance evaluations, and laboratory audits. She was responsible for the Pesticides/PCB fraction for EPA CLP program work.

8/89-9/91 - Chemist/Bench Supervisor Chemist, State of Maine Public Health Laboratory, Augusta, ME -- Ms. Perkins worked in the Pesticide Department. Her duties included sample preparation and extraction, standard preparation, Gas Chromatographic and High Performance Liquid Chromatographic analysis, data reduction and review, client consultation, and scheduling the completion of analyses to meet client and method criteria. Analytical methods used ranged from EPA drinking water methods to FDA Pesticide Analytical Methods for pesticide residue analysis in soils, tissues and vegetative material. She participated in AOAC Method Evaluation Studies and EPA, FDA and NEIC Performance Evaluation Studies. She also researched and validated new methods for use by the Public Health Laboratory.

Ms. Perkins also supervised a program for the State of Maine Department of Agriculture that analyzed feed and fertilizer samples for micro and macro nutrients. She scheduled completion of analyses, performed data review and formatted the yearly summary of results that is published by the Maine Department of Agriculture.

8/88-8/89 - Pesticide Residue Analysis, State of Maine Public Health Laboratory, Augusta, ME --Ms. Perkins supervised the analysis of Pesticide/PCB residues in a variety of matrices including water, soil, vegetation and tissues. She trained other chemists to perform these analyses.

8/87-8/88 - Fyrol FR-2 Analysis, State of Maine Public Health Laboratory, Augusta, ME -- Ms. Perkins performed method development for Gas Chromatographic Analysis for residues of Fyrol-FR2 in drinking waters, river and mill effluents.

CONTINUING EDUCATION

High Performance Liquid Chromatographic Analysis, Waters, Milford, MA, 1989

updated: 1/96

PETER CARTER, Project Manager

PRESENT QUALIFICATIONS SUMMARY

As Project Manager, Mr. Carter is responsible for managing analytical projects from initiation to completion. Mr. Carter is the point of contact for client projects, priorities, preliminary data, bottle orders and price quotes for commercial work. Negotiates project specifications with clients, insures specifications are met by the lab and delivered to the client in the required time frame. Maintains communications channels with the Sales Department and the Laboratory Staff.

EDUCATION

B.A., Biology with a minor in Education, University of Southern Maine, Gorham, ME, 1995
George Stevens Academy, Blue Hill, ME, 1998

PROFESSIONAL EXPERIENCE

3/99-Present - Project Manager, Katahdin Analytical Services, Inc. , Westbrook, ME

10/96-3/99 - Sample Prep Technician/ Mercury Analyzer, Katahdin Analytical Services, Inc. , Westbrook, ME- Mr. Carter was responsible for the digestion of aqueous and soil samples for subsequent inorganic analysis using ICP, graphite furnace, flame AA and cold vapor AA. Additional responsibilities included analysis of inorganic samples using cold vapor AA.

3/96-10/96 - Sample Custodian/Chain-of-Custody Clerk, Katahdin Analytical Services, Inc., Westbrook, ME - As Sample Custodian/Chain-of-Custody Clerk, Mr. Carter was responsible for receiving and processing all samples which come to Katahdin laboratories for analysis. This included checking samples for acceptable condition at receipt, accepting custody of samples, coordinating with the Client Services Department to assure that client shipments are accurate and complete, storing samples appropriately to preserve their integrity, entering sample and project information into the Laboratory Information System (LIMS), and distributing sample receipt forms and materials to initiate scheduling of analysis by the laboratories. Other responsibilities included disposing of samples, assembling and shipping bottle orders, and maintaining the sample staging area and the supply of sample containers for client and laboratory needs.

VOLUNTEER WORK

1995 – Narragansett School, Gorham, ME – Volunteer Teaching Assistant
1991 – Peninsula Ambulance Corps, Blue Hill, ME – Licensed Ambulance Attendant
1991 – Sedgwick Volunteer Fire Department, Sedgwick, ME – Firefighter

Updated: 4/99

MARK BADGER, Management Information Specialist

PRESENT QUALIFICATIONS SUMMARY

As Management Information Specialist, Mr. Badger is responsible for the management and quality control of all computing systems (hardware, software, documentation and procedures), generating, updating, and controlling quality of automated deliverables. Mr. Badger is also responsible for maintaining archives of electronic data including software. Mr. Badger is responsible for the operations and maintenance of all PC based computer systems and for integration with the LIMS and CLP software. He is responsible for managing databases, developing macros and required programs as well as providing electronic data in various formats such as Access, ASCII, dBase, Excel, Monitor and GISKey.

EDUCATION

B.S., Physics, University of New Hampshire, Durham, NH
May 1990 minor in Electrical Engineering

PROFESSIONAL EXPERIENCE

2/97-Present, Information Specialist, Katahdin Analytical Services, Inc., Westbrook, ME

4/96- 2/97, GC/MS Laboratory Chemist, Katahdin Analytical Services, Inc., Westbrook, ME – Mr. Badger analyzed a wide variety of analytes in different matrices using common instrumentation and standardized methods. Coordinated and executed sample analyses and provided appropriate interpretation of results and insured quality control criteria were met.

11/95-4/96, Wet Chemistry Laboratory Chemist, Katahdin Analytical Services, Inc., Westbrook, ME – Mr. Badger analyzed a wide variety of analytes in different matrices using common instrumentation and standardized methods. Coordinated and executed sample analyses and provided appropriate interpretation of results and insured quality control criteria were met.

1/93-11/95, Wet Chemistry Laboratory Technician, PACE - New Hampshire Laboratory, Hampton, NH – Mr. Badger was responsible for the analysis of samples for Cyanide and for other analyses as assigned.

ADDITIONAL EXPERIENCE

Laboratory Experience, Space Science Group, University of New Hampshire.

updated: 7/98

ROB HESKETH, Management Information Specialist

PRESENT QUALIFICATIONS SUMMARY

As Management Information Specialist, Mr. Hesketh is responsible for the management and quality control of all computing systems (hardware, software, documentation and procedures), generating, updating, and controlling quality of automated deliverables. Mr. Hesketh is also responsible for maintaining archives of electronic data including software. Mr. Hesketh is responsible for the operations and maintenance of all PC based computer systems and for integration with the LIMS and CLP software. He is responsible for managing databases, developing macros and required programs as well as providing electronic data in various formats such as Access, ASCII, dBase, Excel, Monitor and GISKey.

EDUCATION

B.S./Biochemistry, 1992, State University of New York, Binghamton, NY

PROFESSIONAL EXPERIENCE

7/98-Present, Information Specialist, Katahdin Analytical Services, Inc., Westbrook, ME

4/96-7/98, GC Chemist, Katahdin Analytical Services, Inc., Westbrook, ME -- Mr. Hesketh analyzed a wide variety of analytes in different matrices using common instrumentation and standardized methods. Coordinated and executed sample analyses and provided appropriate interpretation of results and insured quality control criteria were met. Mr. Hesketh also acted as the MIS liaison for the GC Department.

9/92-9/95, Research Support Specialist, State University of New York at Stony Brook, NY -- Managed the daily business of the lab, including ordering of supplies and equipment; training graduate students and technicians; as well as, trouble shooting experiments, techniques, and instruments. Functioned as the Radiation Safety Officer for the laboratory., Established and maintained a home page on the Internet for technical assistance with a scanning densitometer. Implemented the use of a scanning densitometer for the department, including developing protocols and training personnel. Performed independent research on the characterization of the structure of the 7S particle in *Xenopus laevis*.

11/90-5/92, Central Supply Technician, Lourdes Hospital, NY -- Decontaminated equipment, surgical instruments and trays. Assembled O.R. trays for sterilization. Set up A-lines with proper instruments, sutures, linen , and trays for surgical procedures. Learned aseptic and antiseptic principles and techniques. Became familiar with many medical supplies and surgical instruments.

ADDITIONAL EXPERIENCE

Emergency Medical Technician (EMT) on Harpur's Ferry Volunteer Ambulance Service, 9/89-5/92

updated: 7/98

BRIAN ROY, Sample Custodian/Chain-of-Custody Clerk

PRESENT QUALIFICATIONS SUMMARY

As Sample Custodian/Chain-of-Custody Clerk, Mr. Roy is responsible for receiving and processing all samples which come to Katahdin laboratories for analysis. This includes checking samples for acceptable condition at receipt, accepting custody of samples, coordinating with the Client Services Department to assure that client shipments are accurate and complete, storing samples appropriately to preserve their integrity, entering sample and project information into the Laboratory Information System (LIMS), and distributing sample receipt forms and materials to initiate scheduling of analysis by the laboratories. Other responsibilities include disposing of samples, assembling and shipping bottle orders, and maintaining the sample staging area and the supply of sample containers for client and laboratory needs.

EDUCATION

B.S./Environmental Science and Policy, 1998, University of Southern Maine, Gorham, ME

PROFESSIONAL EXPERIENCE

10/98-Present - Sample Custodian/Chain-of-Custody Clerk, Katahdin Analytical Services, Inc., Westbrook, ME

Summer 1996 - Quality Assurance Technician, Poland Spring Bottling Inc. -- Performed daily procedures of water quality analysis. Gained continued experience with water treatment procedures. Further assistance with MSDS updating and filing.

Summer 1995 - Quality Assurance Internship, Poland Spring Bottling Inc. -- Development of a procedural training program. Construction and editing of standard operating procedures within sanitation, quality control, maintenance, manufacturing and warehouse procedures. Assisted with quality assurance laboratory procedures. Completed orders for laboratory supplies as needed. Updated MSDS books, and increased their distribution within the facility. Many requirements met, were for the compliance of corporation, National Sanitation Foundation (NSF), and the Food and Drug Administration (FDA) audits. Continuous involvement with Microsoft desktop procedures; utilizing Microsoft Word and Excel.

updated: 10/98

KIMBERLEE SYLVESTER, Sample Custodian/Chain-of-Custody Clerk

PRESENT QUALIFICATIONS SUMMARY

As Sample Custodian/Chain-of-Custody Clerk, Ms. Sylvester is responsible for receiving and processing all samples which come to Katahdin laboratories for analysis. This includes checking samples for acceptable condition at receipt, accepting custody of samples, coordinating with the Client Services Department to assure that client shipments are accurate and complete, storing samples appropriately to preserve their integrity, entering sample and project information into the Laboratory Information System (LIMS), and distributing sample receipt forms and materials to initiate scheduling of analysis by the laboratories. Other responsibilities include disposing of samples, assembling and shipping bottle orders, and maintaining the sample staging area and the supply of sample containers for client and laboratory needs.

EDUCATION

A.A.S./Marine Biology and Oceanography, 1997, Southern Maine Technical College, South Portland, ME

PROFESSIONAL EXPERIENCE

10/97-Present - Sample Custodian/Chain-of-Custody Clerk, Katahdin Analytical Services, Inc., Westbrook, ME

updated: 11/97

VICTOR PIEKARSKI, Field Services Manager

PRESENT QUALIFICATIONS SUMMARY

As Field Services Manager, Mr. Piekarski is responsible for the daily operations of the Field Services Department. Mr. Piekarski has extensive experience in on-site operations and management of groundwater monitoring projects. In the field of wastewater treatment, Mr. Piekarski supervises NPDES collection programs and has considerable experience in the operations of flow monitoring projects.

Additionally, Mr. Piekarski has over 7 years experience in the sampling design and collection techniques of marine sediments, invertebrate and fishery studies.

EDUCATION

B.S., Natural Resource Management, University of Alaska, Fairbanks, 1982
A.A.S., Conservation Technology, Essex Agricultural and Technical Institute, Danvers, MA, 1980

PROFESSIONAL EXPERIENCE

11/95-Present - Field Services Manager, Katahdin Analytical Services, Inc. , Westbrook, ME

6/92-11/95 - Field Services Manager, PACE - New Hampshire Laboratory, Hampton, NH -- Mr. Piekarski was responsible for the operations of the Field Services Office. He had extensive experience in on-site operations and management of groundwater monitoring projects. In the field of wastewater treatment, Mr. Piekarski supervised NPDES collection programs and was experienced in the operations of flow monitoring projects.

3/92-6/92 - Director of Field Operations, Environmental Field Services, Inc. (EFSI), a Division of Resource Analysts, Inc., Hampton, NH -- Mr. Piekarski was responsible for the operations of EFSI. He had extensive experience in on-site operations and management of groundwater monitoring projects. In the field of wastewater treatment, Mr. Piekarski supervised NPDES collection programs and was experienced in the operations of flow monitoring projects.

7/88-3/92 - Field Supervisor, Environmental Field Services, Inc. (EFSI), a Division of Resource Analysts, Inc., Hampton, NH

1987-7/88 - Field Technician, Environmental Field Services, Inc. (EFSI), a Division of Resource Analysts, Inc., Hampton, NH

1981-1985 - Fisheries Biologist I, Alaska Department of Fish and Game, Anchorage, Alaska

1984 - Laboratory Technician, IWR-EES University of Alaska, Fairbanks, Alaska

1982-1983 - Laboratory Technician, Institute of Marine Sciences, Fairbanks, Alaska

Accuracy and precision are assessed through the analysis of several types of quality control (QC) samples. Laboratory generated QC samples, such as method blanks, laboratory control samples (LCSs), and sample duplicates, are used to assess the accuracy and precision of measurements due to laboratory activities. Surrogate spikes, matrix spike/matrix spike duplicates (MS/MSDs), and sample duplicates are used to monitor the effects of the sample matrix on precision and accuracy. Field blanks, field duplicates and trip blanks are used to assess the accuracy and precision of both sampling and laboratory activities. Accuracy and precision goals for the laboratory are based on laboratory historical data, specific method requirements and the requirements of each specific project. A more detailed discussion of these goals is provided in Section 11.0.

3.4 Comparability

Comparability is the extent to which comparisons among different measurements of the same quantity or quality will yield valid conclusions. Comparability is a qualitative objective that is attained by utilizing standard techniques for sample analysis and by reporting analytical data in appropriate units. Comparability between Katahdin's analytical results and those obtained by other environmental analytical laboratories will be ensured through the use of EPA, ASTM, and other recognized methods.

3.5 Traceability

Traceability is the extent to which results can be substantiated by hard-copy and/or electronic documentation. Traceability documentation exists in two forms: that which links final numerical results to authoritative measurement standards, and that which explicitly describes the history of each sample from collection to analysis. Refer to Sections 6.0 and 10.0 for more specifics on Katahdin Analytical Services procedures

4.0 FACILITIES

4.1 General Information

Katahdin has separate areas for sample receiving, sample disposal, sample preparation, GC and GC/MS analyses, metals, inorganics, and administrative functions. The laboratory occupies 16,800 square feet of which approximately 7,000 square feet is occupied as administrative space. Floor plans are provided in Figure 4-1.

4.2 Laboratory Safety

Sample receiving areas and laboratories shall be equipped with suitable hoods, respirators, protective clothing and eye wear, gloves and/or other measures to prevent or minimize staff contact with hazardous substances. Safety equipment such as eyewash stations, drench showers, spill adsorbents and neutralizers, fire extinguishers, first aid materials, and breathing oxygen shall be available.

As a matter of policy, Katahdin Analytical Services shall not accept known initiator explosives, known dioxin-contaminated materials, unusual biohazard materials or radioactive materials containing greater than background levels of radiation.

The General Manager shall designate a laboratory staff member as Safety Manager. The Safety Manager prepares and maintains safety-related SOPs, conducts safety and occupational health orientation, training and review sessions as required, and maintains up to date familiarity with safety and occupational health issues pertinent to the laboratory.

The Safety Manager prepares and maintains educational programs as required to comply with state and federal "right to know" legislation.

The Safety Manager or his/her designee shall conduct an orientation session with each new staff member to familiarize him/her with routine and emergency safety procedures and equipment. Eye protection and a lab coat shall be issued to the employee. A respirator will be issued, as required, after respiratory protection training. Refer to the current revision of Katahdin Analytical Services SOP AD-002, Respiratory Protection. A tour of the laboratory shall be conducted. During the tour, needs for eye, skin, and respiratory protection shall be discussed as well as the use of safety glasses, face shields, goggles, partial and full-face respirators, ventilated work areas, fume hoods, gloves and Tyvek coveralls. The location of eye wash stations, drench showers, fire extinguishers, and first aid equipment shall be shown to the employee and their use shall be described or demonstrated. Fire and spill notification, emergency procedures, and evacuation stations shall be taught during this session. Refer to the current revision of Katahdin Analytical Services SOP AD-003, Employee Training Safety Tours. The orientation concludes with an introduction to potential chemical hazards and the Material Safety Data Sheets (MSDS). MSDS shall be made available for review.

Employees shall be responsible for their own safety. The Operations Manager and Supervisors may require that certain levels of protective equipment be worn when in their judgment it is appropriate. Failure of an employee to wear required protective equipment will result in immediate disciplinary action.

4.3 Security and Confidentiality

Two tiers of security shall be maintained within the Katahdin Analytical Services laboratory for the purpose of controlling external influences on samples, analytical processes, and data. This helps assure the completeness, representativeness, accuracy, and precision of analytical results.

The first tier of security maintained shall be controlled access to the laboratory building. Exterior doors to the laboratory building shall remain either locked or continuously monitored by a Katahdin Analytical Services staff member. All keys issued to an employee shall be relinquished to laboratory management at the time an employee terminates employment at Katahdin Analytical Services. All visitors to the facilities must sign the Visitors' Logbook maintained by the receptionist. All visitors shall be accompanied by a staff member during the duration of their stay on the premises. The staff member shall escort the visitor back to the reception area at the end of their visit where they shall sign out in the Visitor's Logbook. Refer to the current revision of Katahdin Analytical Services SOP AD-004, Laboratory Facility Security and Confidentiality for more information. At the close of each day, all doors shall be checked and locked by the last staff member leaving the building.

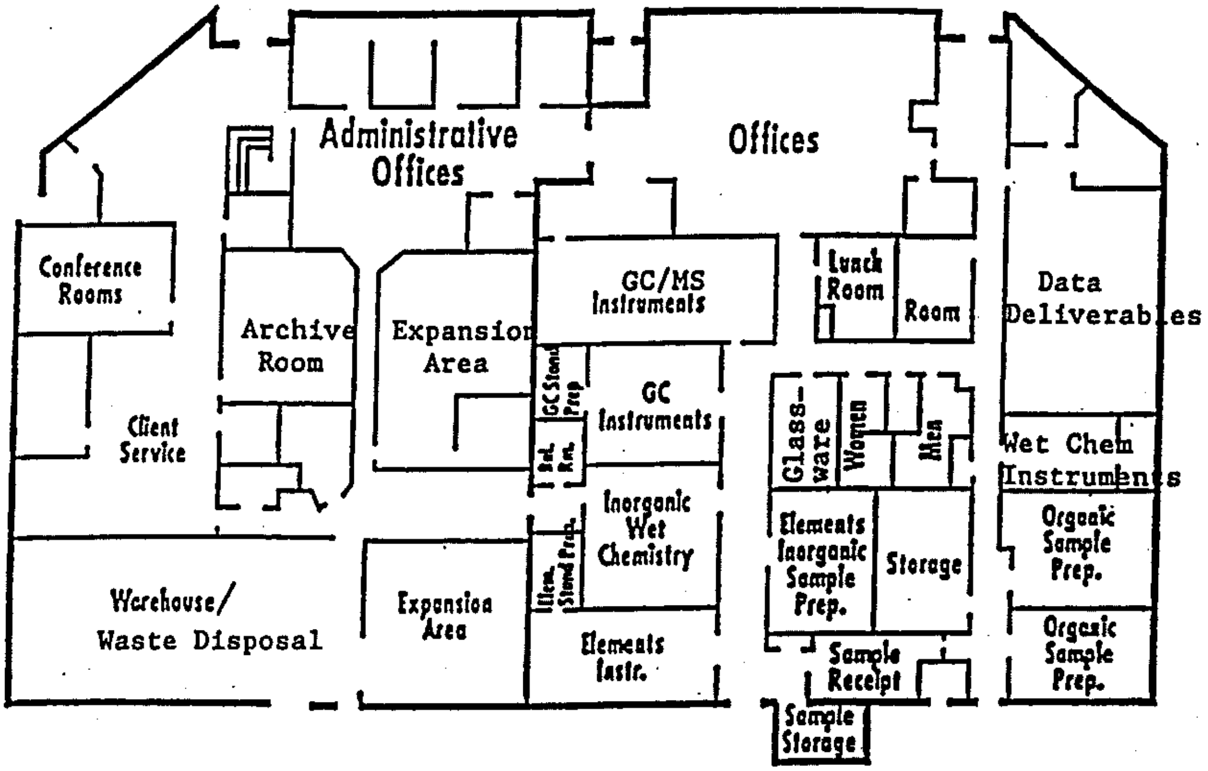
The second tier of security may involve specific secure areas for sample, data and client report storage which shall be lockable within the facilities, and to which access may be limited to specific individuals or their designees. No samples are to be removed without filling out the associated chain-of-custody records. Security of client report archives shall be the responsibility of the Quality Assurance Officer or Reporting/Data Management Group Supervisor.

Periodically, reports and raw data are sent to secure, confidential off-site storage to be archived. This material is retained for a period of time dependent on the state, client or specific program regulations attached to it and may only be retrieved by designated personnel. A list of designees is maintained by the laboratory and a copy by the storage company.

Standard business practices of confidentiality shall apply to all documents and information regarding client analyses. Specific protocols for handling confidential documents are described in the current revision of Katahdin Analytical Services SOP AD-004, Laboratory Facility Security and Confidentiality. Additional protocols for internal identification of samples and data by number only shall be implemented as required under contract-specific Quality Assurance Project Plans.

Figure 4-1

Katahdin Analytical Services, Incorporated
Facilities Floor Plan



OFFICE SPACE	3500 square feet
RECORD SPACE	700 sf
RECEPTION AREA	300 sf
CONFERENCE ROOM	350 sf
LABORATORY ROOM #1 Wet Chemistry Instruments	200 sf
LABORATORY ROOM #2 Organic Extractions	350 sf
LABORATORY ROOM #3 Organic Extractions	400 sf
LABORATORY ROOM #4 Metals Sample Prep	300 sf
LABORATORY ROOM #5 Metals Instrumentation	450 sf
LABORATORY ROOM #6 Wet Chemistry	550 sf
LABORATORY ROOM #7 GC Instruments	480 sf
LABORATORY ROOM #8 GC/MS Instruments	780 sf
STORAGE AREA	2000 sf

5.0 MATERIALS AND APPARATUS

5.1 Reagents, Solvents and Gases

Chemical reagents, solvents, gases, and standards, supplied by reputable chemical suppliers, are used in the laboratories. All chemical reagents used for analyses shall be at least "Analytical Reagent Grade". Individual method references may indicate specific reagent requirements.

Materials are dated upon receipt in the laboratories. Solvents are checked for purity before use (Section 5.2.2, Solvent Lot Checks). Filters are placed on gas lines supplying instruments as an extra precaution.

All solvents and gases used shall be chosen to assure compliance with specific method and SOP requirements. Storage of solvents and chemical reagents shall comply with the current revision of Katahdin Analytical Service's Chemical Hygiene Plan and Safety Manual.

5.2 Laboratory Equipment

5.2.1 Refrigerator/Freezer Temperature Logs

Refrigerators and freezers are checked every weekday to ensure that they are operating properly and within established temperature ranges. All information is recorded in bound logbooks. Routine maintenance such as defrosting is performed as needed. Refer to the current revision of Katahdin Analytical Services SOP QA-803, Laboratory QA: Self-Inspection System. Responsibility for performing the checks is assigned within the laboratory section where the units are located. The QA Department is responsible for ascertaining that checks have been performed and that necessary corrective actions have been instituted when needed. The QA Department is responsible for archiving all historical temperature logsheets and/or logbooks.

5.2.2 Solvent Lot Checks

Solvents are checked for trace contaminants on a lot-by-lot basis. When a new lot is opened, the chromatogram for a concentrated volume of the new solvent lot is checked for any contamination. All information relevant to the check is recorded and maintained in a solvent check file. Responsibility for performing the checks and maintaining the records is assigned to the Extractions Laboratory Supervisor.

5.3 Glassware

All glassware used in the laboratory must be maintained in good condition, cleaned, properly stored, and separated according to its specific laboratory application. Cracked, excessively chipped or otherwise defective glassware is either discarded or repaired. Katahdin Analytical Services purchases all glassware from recognized commercial laboratory glassware suppliers such as Fisher Scientific and Baxter. All volumetric glassware utilized is class "A" certified.

Each laboratory maintains its own set of glassware, completely independent from the other laboratories. Glassware is segregated for cleaning either within each preparation laboratory or within the glassware cleaning laboratory to ensure that the glassware remains dedicated for use by specific laboratories.

5.4 Glassware Cleaning

Laboratory glassware is cleaned in accordance with its intended use at the end of the analytical process. Different cleaning procedures exist for different types of analyses and glassware. Refer to the current revision of Katahdin Analytical Services SOP CA-100, Lab Ware Cleaning.

5.5 Sample Containers

Please refer to Section 6.2.1 of this manual for Katahdin's standard practices concerning sample containers.

5.6 Instruments

Laboratory instrumentation used shall be as specified in the protocol for the analytical method. Table 5-1 lists the major analytical instrumentation currently in use in by Katahdin Analytical Services.

Preventive maintenance is performed for each instrument by manufacturers, analysts and field service technicians on an ongoing basis and the activities documented in a bound instrument maintenance logbook or in the instrument runlogs as described in the current revision of Katahdin Analytical Services SOP CA-101, Equipment Maintenance, and section 14 of this manual.

Corrective maintenance shall be provided as required for all instruments and equipment and documented in appropriate logbooks. Factory replacement parts, trained service technicians and first quality materials shall be used whenever necessary. It is Katahdin Analytical Services' policy to conduct repairs at the lowest level of complexity necessary and to obtain parts directly from primary manufacturers where critical. The purpose of this policy is to maintain efficiency, economy and reliability of quality maintenance.

5.7 Stock Standards

Analytical standards are prepared from pure compounds or are purchased prepared from reputable vendors. These standards provide the stock used to prepare serial dilutions for calibration and spiking standards. Katahdin Analytical Services strives to purchase only the highest quality materials. To that end, reference materials shall be NIST traceable, EPA certified (CRADA), or American Association for Laboratory Accreditation (A2LA) certified whenever possible. Other standards may be analyzed and compared to certified reference material in order to be considered traceable. If assayed materials are unavailable, the material of highest purity available shall be obtained.

Each laboratory section is responsible for the preparation, storage and disposal of its standards. Pertinent standards preparation information is recorded into laboratory specific standards logbooks in order to document traceability of prepared standards to their source material(s). Lot information is kept within each department. Manufacturers may keep purity records on file at their facilities. Refer to the current revision of Katahdin SOP CA-106, Standard Preparation, Documentation and Traceability.

TABLE 5-1

ANALYTICAL INSTRUMENTATION

KEY INSTRUMENTATION	DATE IN SERVICE
Hewlett Packard 5972 GC/MS with EPC and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap concentrator equipped with sample heating assembly.	1993
Hewlett Packard 5970 GC/MS with a Tekmar LSC 2000 purge and trap concentrator and Tekmar ALS 2016 autosampler and heating unit.	1988/1998
Hewlett Packard 5972 GC/MS with EPC and Tekmar LCS-3000 Purge and Trap concentrator Archon autosampler capable of low soils per method 5035.	1998
Hewlett Packard 5972 GC/MS with EPC and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap sampler. Available 7673A autosampler.	1996
Hewlett Packard 5970 GC/MS and a model 7673A autosampler.	1989/1998
Hewlett Packard 5970 GC/MS with EPC and Model 7673A autosampler	1989/1996
Hewlett Packard 5972 GC/MS with EPC and Tekmar LSC 3000 Purge and Trap concentrator Archon autosampler capable of low soils per method 5035.	1995
Hewlett Packard 5970 GC/MS with EPC and Model 7673A autosampler	1988/1996
Hewlett Packard Model 5890 gas chromatograph with microcoulometric (Hall) and photoionization detectors and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap sampler equipped with sample heating assembly	1991
Hewlett Packard Model 5890 gas chromatograph with microcoulometric (Hall) and photoionization detectors and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap sampler equipped with sample heating assembly	1986
Hewlett Packard Model 5890 gas chromatograph with EPC and dual electron capture detectors(ECD), and Hewlett Packard Model 7673 autosamplers	1993
Hewlett Packard Model 5890 gas chromatograph with EPC and dual electron capture detectors(ECD), and Hewlett Packard Model 7673 autosamplers	1993

KEY INSTRUMENTATION	DATE IN SERVICE
Hewlett Packard Model 5890 gas chromatograph with EPC and dual electron capture detectors(ECD), and Hewlett Packard Model 7673 autosamplers	1989
Hewlett Packard Model 5890 gas chromatograph with dual electron capture detectors(ECD), and Hewlett Packard Model 7673A autosamplers	1988
Hewlett Packard Model 5890 gas chromatograph with EPC and dual flame ionization detectors and Hewlett Packard Model 7673 autosamplers	1993/1996
Hewlett Packard Model 5890 gas chromatograph with dual flame ionization detectors and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap	1991
Hewlett Packard Model 5890 gas chromatograph with flame ionization detector and photo ionization detector, and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap	1988
Hewlett Packard Model 5890 gas chromatograph with dual flame ionization or nitrogen-phosphorous detectors, and Hewlett Packard Model 7673 autosamplers	1992/1996
Hewlett Packard Model 5890 gas chromatograph with dual flame ionization detectors and Hewlett Packard Model 7673A autosampler	1987
Waters HPLC system with 486 uv/visible detector and 474 scanning fluorescence detector and autosampler	1997
Waters HPLC 490E detector, WISP712 autosampler and Foxy JR	1994/1998
ABC Autoprep 1000 GPC with UVD-1 ultraviolet detector, and chart recorder	1994
OI Analytical Soxtherm	1998
Thermo Jarrell Ash 61E "Super trace" axial ICAP with autosampler	1994
Thermo Jarrell Ash 61 simultaneous ICAP with autosampler	1991
Perkin-Elmer Model 5100 atomic absorption spectrophotometer with Model AS-60 autosampler, and Model HGA-600 graphite furnace.	1989

KEY INSTRUMENTATION	DATE IN SERVICE
Perkin-Elmer Model 4100 atomic absorption spectrophotometer with zeeman graphite furnace, and Model AS-70 autosampler	1991
Leeman Labs PS200 Automated Mercury Analyzer with autosampler	1994
LACHAT Quickchem AE Ion Analyzer, and autosampler	1992
LACHAT Quickchem AE Ion Analyzer, and autosampler	1992
Dionex Ion Chromatograph	1991
Dohrmann DC80 carbon analyzer with infrared gas analyzer and autosampler	1987
Dohrmann DC80 carbon analyzer with infrared gas analyzer, Dohrmann solids furnace.	1994
Mitsubishi TOX-10E	1997
10 position Lab Crest Cyanide Midi-Distillation system	1998
Bausch and Lomb Spectronic 601, UV-visible spectrophotometer	1991
Milton Roy Spectronic 301 spectrophotometer	1987
Mattson Galaxy Model 2020 FT-IR spectrometer equipped with FIRST software package	1991

6.0 SAMPLE CUSTODY

Chain-of-Custody encompasses three major elements: field sampling, laboratory analysis and final data file. A Chain-of-Custody (COC) documents possession of a sample from time of receipt through the analytical process. Katahdin Analytical Services has implemented standard operating procedures to ensure that sample custody objectives of traceability and responsibility are achieved for every project. This section covers quality related activities from the receipt of samples at the laboratory through the issuance of final analytical data and the storage of data in its final data file.

All areas of the laboratory in which samples are received, stored, processed, or analyzed shall be kept in a condition that minimizes the risk of samples becoming lost or accidentally destroyed, contaminated, degraded, mis-identified, improperly handled or otherwise compromised.

6.1 Chain-of-Custody

The National Enforcement Investigations Center (NEIC) of EPA defines evidence of custody in the following manner:

- It is in your actual possession, or
- It is in your view, after being in your physical possession, or
- It was in your possession and then you locked or sealed it up to prevent tampering, or
- It is in a secure area.

Katahdin Analytical Services sample custody and sample control procedures ensure that:

- All samples are uniquely identified;
- Samples are analyzed as requested and are traceable to their records;
- Important sample characteristics are preserved;
- Samples are protected from loss or damage;
- Any alteration of samples (e.g., filtration, preservation) is documented; and
- A record of sample integrity is established for legal purposes.

Samples may be physical evidence and should be handled according to certain procedural safeguards. In order to facilitate documentation of sample monitoring from collection through analysis, several forms are used by Katahdin Analytical Services personnel. Field personnel document field activities on standardized field data records and laboratory personnel record sample handling activities on internal chain-of-custody forms and/or sample control records.

A Chain-of-Custody Form (Figure 6-1) is completed by field personnel or client representatives for all samples received by the laboratory; the form accompanies the samples received by the laboratory. The completed Chain-of-Custody Form should include the following information:

- Client and project name
- Project location
- Field sample number/identification
- Number and type of containers
- Date and time sampled
- Sample matrix
- Preservative
- Analysis requested
- Sampler signature
- Signature of person relinquishing samples
- Date and time relinquished
- Sampler remarks
- Custody Seal Number (if applicable)

The record is filled out completely and legibly. Errors are corrected by drawing a single line through and initialing and dating the error. The correct information is then recorded with indelible ink. All transfers of samples except to and from commercial couriers must be recorded on the Chain-of-Custody via the "relinquished" and "received by" sections. All information except signatures may be printed.

When samples are received by the laboratory (refer to Section 6.3), Sample Management Personnel sign and note date/time received on the accompanying airbill, if present. The Chain-of-Custody is signed after Sample Management Personnel have verified the contents of the sample shipment. Sample Management Personnel verify the integrity of samples as they are unpacked, ascertain whether a Custody Seal is present and intact, whether the samples are received intact or broken, whether the samples are appropriately preserved and properly identified, what packing material was present in the shipping container, the temperature of the container, and any other notable observations. This information is explicitly documented on the Sample Receipt Condition Report (SRCR) and the project manager is notified if any discrepancies or problems are found. The PM then contacts the client to receive further instructions pertaining to the affected samples. If the integrity requirements are met or after any discrepancies are resolved, the sample is assigned a unique laboratory identification number and transferred to the appropriate storage location for storage until preparation and analysis. Pertinent information concerning each sample is entered into the Laboratory Information Management System (LIMS); refer to Section 6.3 for more information on log-in procedures.

Once samples are in the laboratory, an internal custody record is generated to track the transport and status of each sample from storage to the laboratory and back to storage. After sample log-in, a project file containing the external Chain-of-Custody record and all sample receipt documentation is started by a client services representative. Further detail on internal laboratory custody procedures is provided in subsequent subsections.

6.2 Sampling Kits

In general, sampling kits are comprised of the following:

- Sampling containers
- Preservatives (upon request) and appropriate MSDSs
- Chain-of-Custody forms
- Custody Seals (upon request)
- Sample labels
- Packing Material
- Shipping containers
- Ice Packs (upon request), although ice is preferred
- Temperature blanks

Sample kit requests are received by the laboratory personnel from a project manager or sampling team members via telephone request, memo, or facsimile.

Based upon the specific request, the Sample Custodian or Project Manager determines the appropriate containers, preservatives and the necessary volume/quantity to specify for the analysis. This information is outlined in Table 6-1. The pertinent information is recorded on a Container Request Form. Refer to the current revision of Katahdin Analytical Services SOP QA-901, Sample Container Preparation and Shipping, for further information on this form.

6.2.1 Sample Containers

All volatile organic analysis (VOA) vials (40 mL) and sample containers for other analyses are purchased pre-cleaned from a commercial source. In some cases pre-cleaned containers are received with certificates of analysis documenting the concentration levels of applicable analytes for each container type and lot. Certificates of analysis accompanying container lots are maintained by the laboratory, and a record is kept of sample container lot numbers utilized for each project. All sample containers are purchased from reputable suppliers with products meeting project or protocol requirements.

Under no circumstances are used bottles sent out to the field.

Sampling containers are stored in an area of the Katahdin Analytical Services laboratory designated for staging sampling events and separate from the analytical laboratories. The containers are stored by lot number in the boxes in which they are received. Refer to the current revision of Katahdin Analytical Services SOP QA-901, Sample Container Preparation and Shipment, for more information.

6.2.2 Assembling Kits

All glass containers are surrounded with packing material to prevent damage.

All preservatives are stored in 10 - 20 mL plastic squeeze bottles, contained within 250 mL plastic wide mouth jars which are appropriately labeled or, alternatively, containers may be pre-charged.

The appropriate number of labels and COCs are affixed to the ziplock plastic bag that is included with the kit.

All the above contents are placed inside a cooler with an appropriate cooling medium (if requested) and a temperature blank. Field personnel are responsible for packing the shipping container to maintain the proper temperature. Ice packs may be provided upon request, however, ice is preferred for shipment of samples back to the lab. Sample containers are secured for shipment using appropriate packing materials.

Sample kits are delivered to the sampling team via the appropriate courier or personally picked up by the sampling team.

Refer to current revision of Katahdin Analytical Services SOP QA-901, Sample Container Preparation and Shipment, for further information on sampling kits.

6.3 Sample Receipt and Log-In

Refer to the current revision of Katahdin Analytical Services SOP SD-902, Sample Receipt and Internal Control.

Typically, samples are received by the laboratories during normal business hours (8:00 am to 6:00 pm), Monday through Friday and, when known in advance, from 8:00 am to noon on Saturday.

Shipments for after hours and Sunday delivery are prearranged with laboratory personnel to ensure that personnel will be available to sign the airbill, record the date and time of sample receipt and place the cooler in the (appropriate location in the) sample management area (under refrigeration) until the next business day.

Upon sample receipt, the coolers are inspected for the general condition of the Custody Seal, if present. The coolers are then opened and each sample is inspected for damage. The sample containers are removed from the packing material and identities are verified against the Chain-of-Custody. All information regarding sample condition upon receipt is documented on the Sample Receipt Condition Report (SRCR). The report documents:

- Name of person if hand delivered;
- Presence/Absence of COC forms and Custody Seals;
- Condition of the custody seals if present;
- Discrepancies noted;
- Holding times;
- Proper preservation (i.e. pH of all samples, except volatiles samples, is verified). The pH of volatile samples is checked at analysis and recorded in the analytical run log.
- Proper sample containers, properly labeled according to the COC and unbroken;
- Appropriate sample volume; and
- Cooler temperature

The Sample Receipt Condition Report is completed by signing and recording the date and time of sample receipt. If there are any discrepancies or problems with the samples or accompanying documentation, the Sample Custodian immediately notifies the client or the appropriate Katahdin Analytical Services project manager for resolution.

The samples are logged into the Katahdin Analytical Services Laboratory Information Management System (LIMS) by the Sample Custodian or Project Manager. Each group of samples received is assigned a unique laboratory number (work order number) at log-in. Each sample within the group is assigned a unique Sample Number by appending to the work order number a numerical suffix serialized to account for the number of samples in the sample group. All pertinent sample information, as detailed on the Chain-of-Custody, SCRC, and other project related documentation, is entered into the LIMS and dispatched to the analytical groups for LIMS generation of preparation and analysis worklists. Upon completion of the log-in process, samples are placed into the appropriate storage area. Transfer of the samples from the Sample Custodian to each storage location is documented by the Sample Custodian on internal chain-of-custody records. Refer to the current revision of Katahdin Analytical Services SOP SD-902, Sample Receipt and Internal Control, for more information.

6.4 Sample Preservation and Storage

Samples are preserved according to the EPA's recommendations (refer to Table 6.1), unless there are overriding considerations, e.g. QAPP, and stored to minimize sample contamination and degradation. The laboratory must rely upon information supplied by the sampling team to document any known hazards. If it is known from past experience that samples contain high levels of contamination, those samples are segregated. For sample log-in procedures and supporting documentation, see Section 6.0 and the current revision of Katahdin Analytical Services SOP SD-902, Sample Receipt and Internal Control.

A holding blank comprised of deionized (DI) water is placed into the volatiles storage refrigerators in the sample receiving area to monitor the ambient concentration of analytes of concern in that storage unit. The Sample Custodian creates holding blanks on a weekly basis. The QAO is responsible for dispatching holding blanks for weekly analysis of volatile organics by GC or GC/MS. Holding blank reports are monitored and maintained by the QA department.

6.5 Initiation of Testing Program

Once samples have been logged into the laboratory system, the external Chain-of-Custody, Sample Receipt Condition Report, and other related documentation are assembled into a project file. If a sample group is a priority or rush order, or if samples have short holding times, Sample Management Personnel will immediately provide notification to the appropriate laboratory personnel that samples have arrived and are ready for processing; the Sample Custodian may deliver the samples directly to the lab. LIMS-generated worklists for each laboratory section list all samples requiring preparation and analysis, the type of quality control samples required, the priority status, and test(s) required.

A system for tracking the status and chain-of-custody of samples within the laboratory is in place once sample processing begins. Internal chain-of-custody records are used by sample preparation and analysis (as applicable) personnel to document the transfer of samples from storage locations to the preparation/analysis lab. These records also document the transfer of prepared sample extracts from sample preparation through analysis. Each internal chain-of-custody record documents the following:

- Who removed the sample or extract from storage;
- When the sample or extract was removed from storage;
- Which sample(s) was removed from storage;
- If the sample was entirely consumed; and
- When and by whom the remainder of the sample was returned to storage.

Completed internal chain-of-custody records are archived by the Quality Assurance department.

The second system for tracking samples is the LIMS generated worklist. The worklist is generated daily (at minimum) and lists the status for each sample batch/project within each analytical section. The worklist is distributed to or generated within each laboratory section. To update the worklist status of each sample or sample batch/project, pertinent information is entered into the LIMS once sample preparation and/or analysis has been completed.

6.6 Sample Disposal

After completion of sample analysis and submission of the analytical report, unused portions of samples are retained by the laboratory for a minimum of two weeks. Unless otherwise specified by the client or analytical program, a minimum of two weeks after submission of the data report, samples will be moved from the refrigerators to the disposal area for subsequent disposal according to the nature of the samples. The designated hazardous waste manager generates a LIMS sample disposal summary (created from analytical data report entries accessed through LIMS) and uses that information to select the appropriate waste stream for the samples. Samples determined to be hazardous waste are handled by state and federally licensed hazardous waste disposal firms.

Upon disposal of samples, a record is generated by the hazardous waste manager listing the sample number, inherent waste stream and date disposed. This record is maintained by Sample Management. Please refer to the current revision of SOP SD-903, Sample Disposal, for further information.

6.7 Subcontracting Analytical Services

Every effort is made to perform all requested chemical analyses at Katahdin Analytical Services for our clients. There are, however, instances where subcontracting of analytical services is necessary. Currently, the following analyses require subcontracting by Katahdin Analytical Services:

- Bacteriological (other than total and fecal coliforms)
- Asbestos
- Dioxins
- Radiological
- Surfactants (MBAS)
- Air analyses
- Grain Size
- % Carbon
- TOX for soils

When subcontracting becomes necessary, a preliminary verbal communication with an appropriate laboratory is undertaken. Work performed under specific protocols may involve special consideration; for instance, work involving NFESC samples may be subcontracted only to NFESC approved laboratories. The contact and preliminary arrangements and terms of agreement are made between the Katahdin Analytical Services Project Manager and the appropriate subcontract laboratory personnel (i.e., laboratory manager, client services contact, or the appropriate laboratory section manager). The specific terms of the subcontract laboratory agreement should include (when applicable):

- Method of analysis (including method reference, e.g., EPA SW-846, APHA, etc.);
- Target analyte list required;
- Number and type of samples expected;
- Project specific QA/QC requirements (including reporting limit considerations);
- Deliverables required (including electronic deliverable if applicable);
- Applicable laboratory certification status;
- Price per analysis; and
- Turn around time requirements.

Chain-of-Custody forms shall be generated for samples that require subcontracting to other laboratories. The sample management personnel repackage the samples for shipment, create a transfer chain-of-custody form and record the following information:

- Katahdin Analytical Services Sample Number(s);
- Sample matrix;
- Requested analysis;
- Special instructions (quick turn around, required detection limits, unusual information about the samples or analytical procedure); and
- Signature in "Relinquished By".

All subcontracted sample data reports are reviewed for completeness after receipt by Katahdin Analytical Services. The subcontracted data results may be reported through Katahdin Analytical Service's LIMS or the subcontracted data report may be appended in whole to Katahdin Analytical Service's analytical data report. The final report format is determined through communication between the Katahdin Analytical Services Project Manager, Data Management/Reporting Group, and the client.

TABLE 6-1

SAMPLING AND PRESERVATION REQUIREMENTS - AQUEOUS MATRICES

PARAMETER	METHOD	QUANTITY	CONTAINER	PRESERV	HOLD TIME
GENERAL CHEMICAL ANALYSES					
Acidity	305.1	100 mL	P,G	1,2	14 days
Alkalinity-Manual Titrimetric	310.1	100 mL	P,G	1,2	14 days
Bicarbonate, Carbonate (see pH & alkalinity)	calc.				
Biochemical Oxygen Demand-Carbonaceous	405.1	500 mL	P,G	1	48 hours
Biochemical Oxygen Demand-Total	405.1	500 mL	P,G	1	48 hours
Bromide	320.1	500 mL	P,G	1	28 days
Chemical Oxygen Demand-Manual Colorimetric	410.1/410.2	250 mL	P,G	1,3	28 days
Chloride-Automated Ferricyanide	325.2/325.3	100 mL	P,G	1	28 days
Chlorine, Residual	330.1, Field	100 mL	P,G	1,9	ASAP
Chromium, Hexavalent	7196	200 mL	P,G	1,9	24 hours
Coliform, Fecal	SM 9222D	100 mL	P,G	1,6	6 or 30 hours
Coliform, Total	SM 9222B	100 mL	P,G	1,6	6 or 30 hours
Color, True	110.3	100 mL	P,G	1,2	48 hours
Color, Apparent	110.2	100 mL	P,G	1,2	48 hours
Cyanide, Total-Spectrophotometric	335.4	500 mL	P,G	1,5	14 days
Cyanide, Amenable-Spectrophotometric	335.1	500 mL	P,G	1,5	14 days
Dissolved Oxygen(Lab)-Membrane Electrode	360.1	500 mL	G	1	ASAP
Fluoride, Potentiometric ISE	340.2	200 mL	P only	1	28 days
Fluoride with distillation, Potentiometric ISE	340.1/340.2	500 mL	P only	1	28 days
Ferrous Iron - Colorimetric	3500-Fe D	250mL	P	1	24 hrs
Free CO_2	4500-CO_2 C	250mL	P	1	24 hrs.
Hardness, Total-Manual Titrimetric	130.2,SM2340B	250 mL	P,G	4	6 months
MBAS, Extraction-Colorimetric	425.1	250 mL	P,G	1	48 hours
Ammonia-Nitrogen-Automated Phenate	350.1, 350.2	250 mL	P,G	1,3	28 days
Ammonia-Nitrogen with distill-Auto. Phenate	350.1	1000 mL	P,G	1,3	28 days
Anions (Cl, Br, SO4, NO2, NO3)	300.0	250 mL	P, G	1	48hr/28days
Organic Nitrogen-Auto. Block Digest.,Spectro.	350.3	100 mL	P,G	1,3	28 days
TKN-Auto Block Digest, Spect.	351.2/351.3	100 mL	P,G	1,3	28 days
Nitrate+Nitrite-Automated Cadmium Reduction	353.2	100 mL	P,G	1,3	28 days
Nitrate-Automated Cadmium Red./Diazotization	353.2	100 mL	P,G	1	48 hours
Nitrite-Automated Diazotization	353.2	100 mL	P,G	1	48 hours
Oil & Grease-Total Recoverable, Gravimetric	413.1	1000 mL	glass only	1,11	28 days
Oil & Grease-Total Recoverable, Infrared	413.2	1000 mL	glass only	1,11	28 days
Oil & Grease-Hydrocarbons,Grav./Solvent Extrt	APHA 503E	(2)1000 mL	glass only	1,11	28 days
pH (Laboratory)	150.1	100 mL	P,G	1,2	24 hours
Phenolics, Total Recoverable-Manual 4AAP	420.1	1000 mL	glass only	1,3	28 days
Phosphate,Total	365.1/365.2	100 mL	P,G	1,3	28 days
Phosphate, Ortho- Ascorbic Acid	365.1/365.2	100 mL	P,G	1	48 hours

TABLE 6-1, AQUEOUS continued

PARAMETER	METHOD	QUANTITY	CONTAINER	PRESERV	HOLD TIME
GENERAL CHEMICAL ANALYSES (CONT'D)					
Silica-Manual Molybdosilicate	370.1	100 mL	P,G	1	28 days
Solids-Nonfilterable Residue (TSS)	160.2	100 mL	P,G	1	7 days
Solids-Volatile Nonfilterable Residue (VSS)	SM 2540 F	100 mL	P,G	1	7 days
Solids-Filterable Residue (TDS),Gravimetric180	160.1	100 mL	P,G	1	7 days
Solids-Volatile Filterable Residue (VDS)	160.1/160.4	100 mL	P,G	1	7 days
Solids-Total Volatile (TVS)	160.4	100mL	P,G	1	7 days
Solids-Settleable Solids (SS)	160.5	1000 mL	P,G	1	48 hours
Solids-Total Solids	160.3	100 mL	P,G	1	7 days
Specific Conductance-Wheatstone Bridge	120.1	100 mL	P,G	1,2	28 days
Sulfate-Turbidimetric	375.4	100 mL	P,G	1	28 days
Sulfite-Titrimetric	377.1	500 mL	P,G	1,9	ASAP
Sulfide-Iodometric	376.1	500 mL	P,G	1,7	7 days
Sulfide-Monier-Williams	40CFR-425	300 mL	P,G	1,7	7 days
Tannin/Lignin-Colorimetric	SM 5550 B	100 mL	P,G	1	7 days
Total Organic Carbon-Oxidation	415.1	100 mL	glass vial	1,3	28 days
Total Inorganic Carbon	415.1	100 mL	glass vial	1	28 days
Total Inorganic Carbon if with TOC	415.1	100 mL	glass vial	1	28 days
Total Organic Halogen	450.1/9020	500 mL	Amber Glass	1,3	28 days
TPH-Extraction, IR	418.1	1000 mL	glass only	1,11	28 days
Turbidity	180.1	100 mL	P,G	1	48 hours
ELEMENTAL ANALYSES					
Any ICP Elements	200.7/6010	500 mL	P,G	4	6 months
Any GFAA(Furnace) Elements	SM 3113/ 200 series	500 mL	P,G	4	6 months
Mercury	245.1/7470	500 mL	P,G	4	28 days
Chromium, Hexavalent	7195/6010	500 mL	P,G	1,9	24 hrs/24 hrs
GC ORGANIC ANALYSES					
Purgeable Halocarbons	601 & 8021	(2)40 mL	VOA vial	1,8,9	14 days
Purgeable Aromatics	602 & 8021	(2)40 mL	VOA vial	1,8,9	14 days
Purgeables, Total	601 & 602	(2)40 mL	VOA vial	1,8,9	14 days
Purgeables, Total	8010 & 8021	(2)40 mL	VOA vial	1,8,9	14 days
BTEX & MTBE	602 & 8021	(2)40 mL	VOA vial	1,8,9	14 days
Pesticides and PCB's	608 & 8081/8082	(2)1000 mL	Amber Glass	1	7days/40days
PCB's	608 & 8082	(2)1000 mL	Amber Glass	1	7days/40days
Pesticides	608 & 8081	(2)1000 mL	Amber Glass	1	7days/40days

TABLE 6-1, A1

PARAMETER	METHOD	QUANTITY	CONTAINER	PRESERVE	HOLD TIME
GC ORGANIC ANALYSES (CONT.)					
Herbicides	8151	(2)1000 mL	Amber Glass	1	7days/40days
Polynuclear Aromatic Hydrocarbons	8310	(2)1000 mL	Amber Glass	1	7days/40days
Solvents (Direct Injection)	8015M	(2)40 mL	VOA vial	1	14 days
HPLC-Explosives	8330	(2)1000 mL	Amber Glass	1	7days/40days
Extractable Petroleum Hydrocarbons	MADEP/EPH	(2)1000 mL	Amber Glass	12	14days/40days
Volatile Petroleum Hydrocarbons	MADEP/VPH	(2)40 mL	VOA vial	11	14days
Gasoline in Water	8015Modified	(2)40 mL	VOA vial	1,8	14 days
Fuel Oil in Water	8015Modified	(2)1000 mL	Amber Glass	1,8	7days/40days
Gasoline in Water	ME HETL 4.2.17	(2)40 mL	VOA vial	1,8	14 days
Fuel Oil in Water	ME HETL 4.1.25	(2)1000 mL	Amber Glass	1,8	7days/40days
GC/MS ANALYSES					
Volatile Organics-Priority Pollutants	624	(2)40 mL	VOA vial	1,8,9	14 days
SemiVOA Extractables-Priority Pollutants	625	(2)1000 mL	Amber Glass	1	7days/40days
Acid Extractables-Priority Pollutants	625	(2)1000 mL	Amber Glass	1	7days/40days
Base Neutral Extract.-Priority Pollutants	625	(2)1000 mL	Amber Glass	1	7days/40days
Volatile Organics	8260	(2)40 mL	VOA vial	1,8,9	14 days
Volatile Organics, Low Level	8260	(3)40 mL	VOA vial	1,8,9	14 days
Semivolatile Extractables-TCL	8270	(2)1000 mL	Amber Glass	1	7days/40days
Acid Extractables-TCL	8270	(2)1000 mL	Amber Glass	1	7days/40days
Base Neutral Extractables-TCL	8270	(2)1000 mL	Amber Glass	1	7days/40days
Drinking Water VOAs - Low Level	524.2	(3)40 mL	VOA vial	1,8,9,10	14 days

CLP ORGANIC SAMPLE HOLDING TIME REQUIREMENTS, OLM03.1

Parameter	Preservation	Holding Time (days)
Volatiles Waters and Solids	dark; 4°C ± 2°C	10[a]
ABN Liquid-Liquid Procedures	"	5
ABN Soil/Sed. Extractions by Sonication	"	10
ABN Analysis	"	40[b]
Pesticides - Water Extraction by Sep. Funnel	"	5
Pesticides - Water Extraction Liquid-Liquid Cont.	"	5
Pesticides - Soils/Sed. Extraction by Sonication	"	10
Pesticides - Analysis of Extracts	"	40[b]

[a] Holding times are all "days from VTSR" (Validated Time of Sample Receipt)

[b] Days from time of extraction

TABLE 6-1, continued

SAMPLING AND PRESERVATION REQUIREMENTS - SOLID MATRICES

PARAMETER	METHOD	QUANTITY	CONTAINER	PRESERV.	HOLD TIME
GENERAL CHEMICAL ANALYSES		4 oz = 100 g			
% Carbon	ASTM	10 g	Soil Jar	1	28 days
Chloride-Automated Ferricyanide	9251/9252	70 g *	Soil Jar	1	7days/28days
Cyanide, Total-Spectrophotometric	9012	50 g	Soil Jar	1	14 days
Cyanide, Amenable-Spectrophotometric	9012	10 g	Soil Jar	1	14 days
Fluoride, Potentiometric ISE	ASTM D3987/340.2	70 g *	Soil Jar	1	28 days
Anions	9056	50g	Soil Jar	1	48hrs/28 days
Ammonia-Nitrogen-Automated Phenate	350.1, SM 4500-N_{org}B	10 g	Soil Jar	1	28 days
Organic Nitrogen-Auto. Block Digest.,Spectro.	350.1/351.2	10 g	Soil Jar	1	28 days
TKN-Auto Block Digest,Spectro.	351.2/ SM 4500-N_{org}B	10 g	Soil Jar	1	28 days
Nitrate+Nitrite-Automated Cadmium Reduction	ASTM D3987/353.2	70 g *	Soil Jar	1	28 days
Nitrate-Automated Cadmium Red./Diazotization	353.2/354.1, 9200	70 g *	Soil Jar	1	7 days/48 hrs
Nitrite-Automated Diazotization	ASTM D3987/354.1	70 g *	Soil Jar	1	7 days/48 hrs
Oil & Grease-Total Recoverable, Gravimetric	9070/9071	50 g	Soil Jar	1	28 days
Oil & Grease-Total Recoverable, Infrared	9071/413.2	50 g	Soil Jar	1	28 days
O & G-Hydrocarbons,Grav./Solvent Extract	SM 5520 F	50 g	Soil Jar	1	28 days
pH (Laboratory)	9040/9041/9045	30 g	Soil Jar	1	24 hours
Phenolics, Total Recoverable-Manual 4AAP	Mod. 9065	10 g	Soil Jar	1	28 days
Phosphate,Tot.-Auto Ascorbic Acid/Block Dig.	Mod. 365.4	10 g	Soil Jar	1	28 days
Phosphate, Tot.-Man. Dig./Auto Ascorbic Acid	Mod. 365.4	10 g	Soil Jar	1	28 days
Phosphate, Ortho- Ascorbic Acid	ASTM D3987/365.1	70 g *	Soil Jar	1	7 days/48 hrs
Solids-Total Solids	CLP-CIP	10 g	Soil Jar	1	28 days
Solids-Ash	SM 2540 F	10 g	Soil Jar	1	28 days
Solids-Volatile Solids	SM 2540 F	10 g	Soil Jar	1	28 days
Specific Conductance-Wheatstone Bridge	Mod. 9050	30 g	Soil Jar	1	28 days
Sulfate-Turbidimetric	9036/9038	70 g *	Soil Jar	1	7days/28days
Sulfite-Titrimetric	ASTM D3987/377.1	70 g *	Soil Jar	1	7 days/24 hrs
Sulfide-Iodometric	9030	70 g *	Soil Jar	1	7days/7days
Sulfide-Monier-Williams	40CFR-425	30 g	Soil Jar	1	28 days
Total Organic Halogen	9020/9021	50 g	Soil Jar	1	28 days
Total Petroleum Hydrocarbons-Extraction, IR	9071/418.1	30 g	Soil Jar	1	28 days
Cation Exchange Capacity	9081	15 g	Soil Jar	1	14days/7days
Heat of Combustion (BTU)	ASTM D240/D2382	10 g	Soil Jar	1	28 days
Lime Equivalency	Special Procedure	25 g	Soil Jar	1	28 days

TABLE 6-1, SOLIDS continued

PARAMETER	METHOD	QUANTITY	CONTAINER	PRESERV	HOLD TIME
ELEMENTAL ANALYSES					
Any ICP Elements	6010	50 g	Soil Jar	1	6 months
Any GFAA(Furnace) Elements	7000series	50 g	Soil Jar	1	6 months
Mercury	7471	50 g	Soil Jar	1	28 days
Chromium, Hexavalent	3060/7195/6010	40 g	Soil Jar	1	5dys/24hrs/28dys
GC ORGANIC ANALYSES					
Purgeable Halocarbons	601 & 8021	(2) 40 mL	VOA Vial	1	14 days
Petroleum Hydrocarbons (Fingerprint)	ASTM 03328-78	30 g	Soil Jar	1	N/A
Purgeable Aromatics	602 & 8021	(2) 40 mL	VOA Vial	1	14 days
Purgeables, Total	601& 602/8021	(2) 40 mL	VOA Vial	1	14 days
BTEX & MTBE	602 & 8021	(2) 40 mL	VOA Vial	1	14 days
Pesticides and PCB's	608 & 8081/8082	100 g	Soil Jar	1	14days/40days
PCB's	608 & 8082	100 g	Soil Jar	1	14days/40days
Pesticides	608 & 8081	100 g	Soil Jar	1	14days/40days
Herbicides	8151	100g	Soil Jar	1	14days/40days
PCB's in Oil	8082	10 g	VOA Vial	1	40 days
Polynuclear Aromatic Hydrocarbons	8310	100 g	Soil Jar	1	14days/40days
Solvents (Direct Injection)	8015M	(2) 40 mL	VOA Vial	1	14 days
PCB's (Screening Technique)	Spittler	10 g	Soil Jar	1	14days/40days
Extractable Petroleum Hydrocarbons	MADEP/EPH	4 oz	Soil Jar	1	7days/40days
Volatile Petroleum Hydrocarbons	MADEP/VPH	(2)40 mL	VOA vial	13	28days
HPLC-Explosives	8330	4 oz	Soil Jar	1	14days/40days
Gasoline in Soils	8015Modified	(2) 40 mL	VOA Vial	1	14 days
Fule Oil in Soils	8015Modified	100 g	Soil Jar	1	14days/40days
Gasoline in Soil	ME HETL 4.2.17	(2) 40 mL	VOA Vial	1	14 days
Fuel Oil in Soil	ME HETL 4.1.25	100 g	Soil Jar	1	14days/40days
GC/MS ANALYSES					
Volatile Organics-Priority Pollutants	8260	(2) 40 mL	VOA Vial	1	14 days
Volatile Organics-TCL	8260	(3) 50 mL	VOA Vial	1	14 days
Volatile Organics - Low Soil (<200 ug/kg) (Please refer to Figure 6-2 for details on collection and preservation)	5035/8260	Please refer to Figure 6-2	Encore or similar sampler or VOA Vial	14 or 15	Extruded w/in 48 hrs. - analyzed w/in 14 days
Volatile Organics - High Soil (>200 ug/kg) (Please refer to Figure 6-2 for details on collection and preservation)	5035/8260	Please refer to Figure 6-2	Encore or similar sampler or VOA Vial or soil jar	14	Extruded w/in 48 hrs. - analyzed w/in 14 days
Semivolatile Extractables-Priority Pollutants	8270	100 g	Soil Jar	1	14 days/40 days
Acid Extractables-Priority Pollutants	8270	100 g	Soil Jar	1	14 days/40 days
Base Neutral Extractables-Priority Pollutants	8270	100 g	Soil Jar	1	14 days/40 days
Semivolatile Extractables-TCL	8270	100 g	Soil Jar	1	14 days/40 days
Acid Extractables-TCL	8270	100 g	Soil Jar	1	14 days/40 days
Base Neutral Extractables-TCL	8270	100 g	Soil Jar	1	14 days/40 days

TABLE 6-1, SOLIDS continued

PARAMETER	METHOD	QUANTITY	CONTAINER	PRESERV	HOLD TIME
RCRA-HAZARDOUS WASTE CHARAC					
Corrosivity-pH	9045	30 g	Soil Jar	1	24 hours
Corrosivity-NACE Standard TM-01-69	1110	100 g	Soil Jar	1	24 hours
Ignitability-Flash Point (closed cup)	1010	25 g	Soil Jar	1	14 days
Reactivity-Reactive Cyanide	7.3.3.2	20 g	Soil Jar	1	14 days
Reactivity-Reactive Sulfide	7.3.4.1	20 g	Soil Jar	1	7 days
TCLP					
TCLP Extraction-Volatile Organics	1311	100 g	Soil Jar	1	14 days
TCLP Extraction-Semivolatiles	1311	200 g	Soil Jar	1	14 days
TCLP Extraction-Pesticides & Herbicides	1311	400 g	Soil Jar	1	14 days
TCLP Extraction-Metals	1311	200 g	Soil Jar	1	28 days
TCLP Analysis-Volatile Organics	1311/8260	see above	Soil Jar	1	14 days
TCLP Analysis-Metals	1311/various	see above	Soil Jar	1	180 days
TCLP Analysis-Mercury	1311/7470	see above	Soil Jar	1	28 days
TCLP Analysis-Semivolatiles	1311/8270	see above	Soil Jar	1	7 days/40 days
TCLP Analysis-Pesticides	1311/8081	see above	Soil Jar	1	7 days/40 days
TCLP Analysis-Herbicides	1311/8151	see above	Soil Jar	1	7 days/40 days

METHODS OF PRESERVATION

1 = Cool at 4 Degrees Celsius
2 = Settled
3 = H2SO4 to pH<2
4 = HNO3 to pH<2
5 = NaOH to pH>12
6 = 1 mL 0.1M Na2S2O3
7 = 1 m/L 2NZnAc/L & NaOH
8 = 2 drops 1:1 HCl
9 = No headspace
10 = Na2S2O3, if chlorinated
11 = HCl to pH < 2
12 = 5 mL of HCL
13 = 15 mL of methanol
14 = methanol
15 = sodium biosulfate

* A total of 70 g of samples will be needed for all parameter analyses requiring ASTM D3987 for sample preparation. Multiple parameters can be analyzed from the resulting prepared extract.

Project-specific (i.e. CLP, Hazwrap) hold times take precedence over these hold times as appropriate.

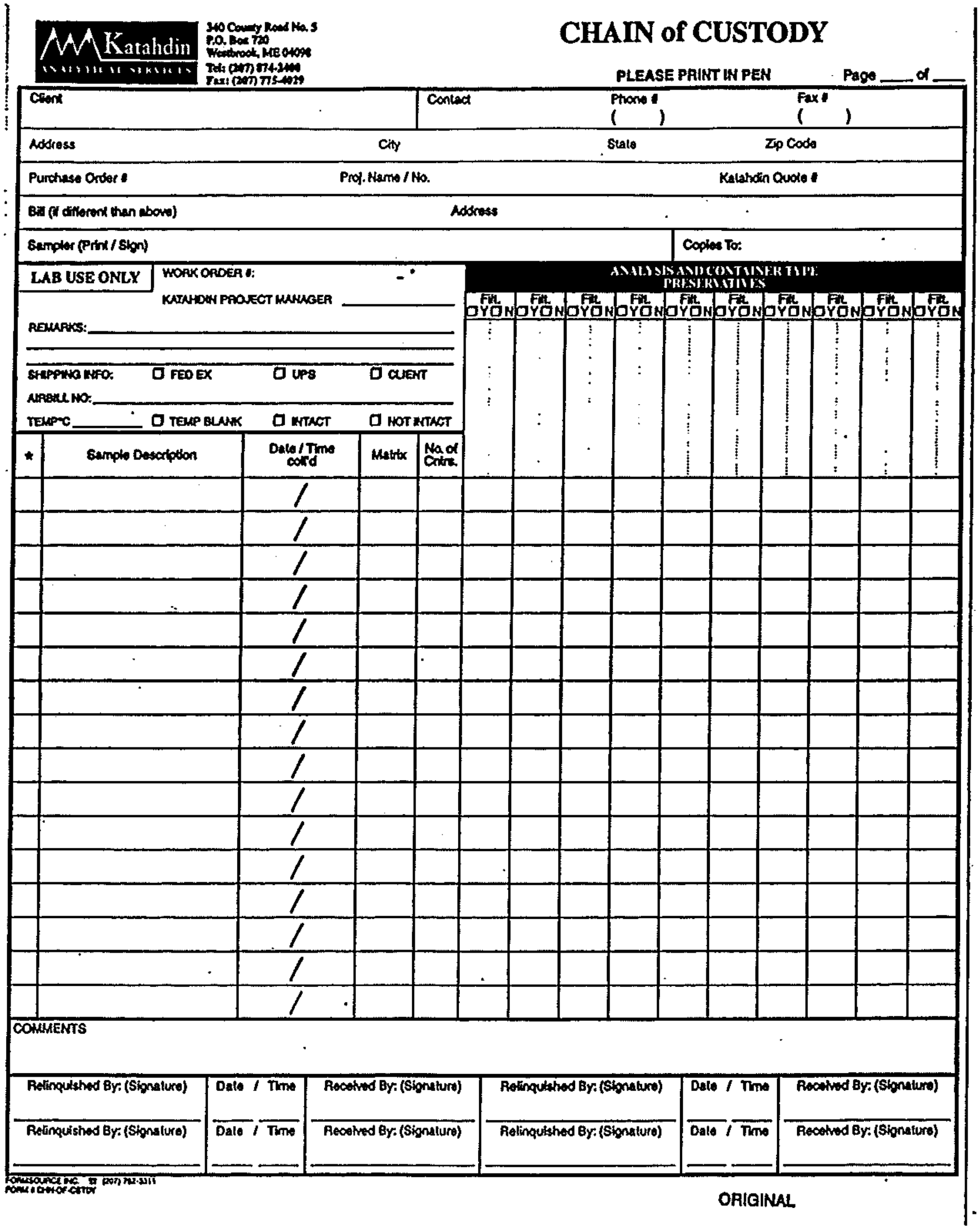
For solid samples, please place parameters of the same analytical group(ie. Wet Chemistry) in the same container whenever possible. Also, organic and inorganic parameters should be placed in separate containers. Volatile organics should always be placed in organic-free jars.

<u>References</u>:

EPA	= 40 CFR 136
SW846	= <u>Test Methods for Evaluating Solid Waste Physical/Chemical Methods</u>, US EPA SW846, 3rd edition, Final Update III, 1986, 1997
SM	= <u>Standard Methods For The Examination of Water and Wastewater</u>, 16th ed., 1985
APHA	= <u>Standard Methods For The Examination of Water and Wastewater</u>, 17th & 18th ed., 1989, 1992
ASTM	= American Society for Testing and Materials

FIGURE 6-1

Katahdin Analytical Services, Incorporated
Chain-of-Custody Record



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P.O. Box 720
Westbrook, ME 04098
Tel: (207) 874-2400
Fax: (207) 775-4029

CHAIN of CUSTODY

PLEASE PRINT IN PEN Page ____ of ____

Client
Contact
Phone # (   )
Fax # (   )
Address
City
State
Zip Code
Purchase Order #
Proj. Name / No.
Katahdin Quote #
Bill (if different than above)
Address
Sampler (Print / Sign)
Copies To:

LAB USE ONLY
WORK ORDER #:
KATAHDIN PROJECT MANAGER ____________
REMARKS: ____________
SHIPPING INFO: ☐ FED EX ☐ UPS ☐ CLIENT
AIRBILL NO: ____________
TEMP°C ________ ☐ TEMP BLANK ☐ INTACT ☐ NOT INTACT

					ANALYSIS AND CONTAINER TYPE PRESERVATIVES									
					Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N
*	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.										
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COMMENTS

Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
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ORIGINAL

FIGURE 6-2

Katahdin Analytical Services, Incorporated
Method 5035 Collection and Preservation

Method 5035 Closed System Purge & Trap

Summary

With the promulgation of SW-846 Update III, the traditional practice of volatile soil sample collection and analysis has become outdated. The new procedure for the preparation of solid samples for volatile analysis is Method 5035. This procedure requires that samples be weighed and preserved in the field and be analyzed with a new generation of closed system purge and trap instrument. With this method, the sample is never exposed to the atmosphere after sampling, thereby minimizing the loss of VOCs during shipping, handling, and analysis. The method is designed for use on low-level solid VOCs (0.5 ug/kg to 200ug/kg). Method 5035 also provides direction for sampling high concentration soils or wastes (> 200ug/kg). It is anticipated that many new work plans will require the use of method 5035 closed system purge and trap extraction for VOCs in soil and waste. Successful use of this new method will depend on cleanup goals, confidence levels, and anticipated levels of contamination. Method 5035 is available from Katahdin Analytical Services now. We would be happy to discuss your project needs at any time.

Procedure for low level soils (<200ug/kg)

40 ml VOA vials containing 5 ml of 20% sodium bisulfate, and a magnetic stirring bar are pre-weighed by the lab and shipped to the field. The field samplers collect a 5 gram sample, weighed in the field at the time of collection, and place the sample in the pre-weighed and preserved vial. The vial is then returned to the laboratory for analysis on a specially developed autosampler that heats, stirs, and purges the sample simultaneously without exposing the contents of the vial to the atmosphere. This procedure will help to minimize the loss of VOCs due to transport handling, and analysis and may help minimize ambient lab contribution. The expected detection limits are consistent with the traditional low soil technique from Method 5030. Method 5035 has very specific instructions on how to obtain representative soil samples. The use of EnCore or EnCore-like sampling devices may be appropriate. It is critical that the field-sampling representatives discuss their device choice with the lab at the time of project quotation.

Procedure for high level soils (>200 ug/kg)

High concentration soils may be sampled as either a bulk sample or field preserved with a water miscible solvent such as methanol.

Bulk Sample - A sample is placed in a glass jar or vial and returned to the lab for extraction and analysis. In this approach the lab takes an aliquot of soil and extracts with purge & trap grade methanol. A portion of the methanol is then analyzed for volatile analytes.

Methanol Field Preservation - A 5 gram sample is added to a VOA vial that was charged with 10 mls of purge and trap grade methanol and weighed in the lab prior to shipment to the field. If possible, the sealed vial should be weighed in the field to ensure that 5 ± 0.5 grams of sample were added.

Considerations

1. Low-level samples that require multiple analyses to confirm matrix interference or to perform sample specific QC (MS/MSD/Dups) will require submission of 3 – 6 vials since only one analysis is permitted per vial.
2. Low-level samples that contain individual VOCs over a wide range of concentrations may require additional vials with smaller amounts of sample to come from the field.
3. Separate aliquots are required for percent solids determinations for low level samples and high concentration samples that are field preserved with methanol.
4. The sodium bisulfate solution is acidic and may foam on contact with alkaline matrices or highly calcareous soils.
5. Vial weights should be measured in the field and verified in the lab. Samples must be well sealed and packaged so that vial weights are not affected by shipping conditions.
6. When resampling is prohibitive or samples are non-homogeneous, Katahdin suggests the following samples be taken at minimum: one 4 oz soil jar for solids, one methanol field preserved sample for high concentration analysis, and two field preserved samples for low-level analysis.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

All instruments and equipment used in Katahdin Analytical Services laboratories must follow a well defined calibration routine. All standards and instruments are designated by a unique identifier. This identifier shall be recorded in standards logbooks, run logs and all raw data that are pertinent. Calibration may be accomplished by laboratory personnel using certified reference materials traceable to NIST or EPA certified materials or by external calibration agencies or equipment manufacturers. The discussion presented here is general in nature because the requirements for calibration are instrument (or equipment) and method specific. Details of calibrations can be found in Katahdin Analytical Services Standard Operating Procedures, analytical methods, and operations manuals.

7.1 Standards and Traceability

Analytical standards are prepared from pure compounds or are purchased prepared from reputable vendors. These standards provide the stock used to prepare serial dilutions for calibration and spiking standards. Each laboratory section is responsible for the preparation, storage and disposal of its standards. Pertinent standards preparation information is recorded into laboratory specific standards logbooks in order to document traceability of prepared standards to their source material(s).

Each standard is given an internal identification number. The preparation of all stock standards shall be documented in a standards notebook which is used to record the date of preparation, analyst's initials, source of the reference material, standard components, amounts used, final volume, final concentration(s), solvent used, expiration date of prepared standard, and the assigned serial reference number (internal identification number) of the stock solution. All standards shall be labeled, at minimum, with a unique identifier for the prepared standard, preparation date and expiration date, and, if space permits, the reference number(s) of the stock standard(s), the name of the standard, concentration, and initials of the preparer. All diluted working standards not consumed during an analytical session shall be labeled fully, including the serial reference number of any stock standard used in its preparation. Working standards, which are consumed the same day that they are prepared, do not have to be labeled on the container itself.

If no expiration date has been assigned by the manufacturer, then an expiration date of one year from the date of preparation (or the date first opened in the case of sealed ampules) is generally reported unless degradation prior to this date is observed. The expiration date assigned to a prepared standard shall not exceed the expiration date of any individual component in the solution. To help determine if a standard has degraded, one must note inconsistencies. For instance, very poor recoveries from newly prepared quality control spikes or abnormally low instrument response to a specific standard are indications of possible standard degradation. However, for some standards, degradation is more easily noted. For instance, DDT breaks down to form DDD and DDE. Here one can visually note, on a chromatogram, the degradation of DDT by the increased concentrations of DDD and DDE. If degradation is observed before the default expiration date, it should be noted in the standards notebook for that standard entry and the standard removed from service. Refer to the current revision of Katahdin Analytical Services SOP CA-106, Standard Preparation , Documentation and Traceability for more information.

Reference standards must be traceable to national standards of measurement (e.g. NIST) whenever possible. Standards used for calibration must be traceable, when possible, to national standards of measurement, either directly through supplier documentation or by verification against a second source traceable reference standard. Lists of reference standards used are contained within individual analytical method SOPs.

7.2 Calibration Procedures

Calibration standards for each parameter are chosen to bracket the expected concentrations of those parameters in the sample, and to operate within the linear response range of the instrument. Sample concentrations that fall above calibration range are diluted and reanalyzed until they are within the calibration range. Calibration standards are prepared typically at a minimum of three concentration levels, usually chosen at approximately two times, three to five times, and five to ten times the estimated method detection limit plus a calibration blank, with the exception of most organic analyses which do not require a calibration blank. Either an internal standard or external standard quantification technique can be utilized. The reporting limit is verified by analysis of a standard at the reporting limit.

Instrumental responses to calibration standards for each parameter are subjected to an appropriate statistical test of fitness (least squares linear regression, quadratic equation, or relative standard deviation of response factors) or as required by the method or QAPP. The calibration must reflect an acceptable correlation of data points or linearity to be acceptable. In cases where the calibration data are outside of these criteria, the analyst must rerun the calibration standards (meeting the same criteria), changing instrumental conditions as necessary until appropriate acceptance limits for the method are achieved.

For analyses which are performed frequently and for which substantial calibration data are available, a complete recalibration is not required each time an analysis is performed providing that the following criterion is met: one calibration standard (Initial Calibration Verification - ICV) is analyzed at the beginning of the analysis which may vary from the expected response (based on the most recent initial calibration curve) by no more than ±25% or as specified by the method, SOP or QAPP, whichever is more stringent. If this criterion is not met, a complete recalibration is necessary.

During the course of analysis, calibration standards are routinely analyzed to ensure that the instrumental response has not exceeded the method acceptance limits. The continuing calibration criteria stipulated in each method or SOP are used by the analyst to determine whether the instrument must be recalibrated or the instrument conditions further optimized.

The accuracy of working standards is verified by comparison with a standard from an independent source.

All organic standards are refrigerated or frozen as specified in the applicable analytical methods. Inorganic standards are refrigerated as necessary.

7.2.1 Analytical Balances

Every six months, calibration of the entire analytical range shall be checked by a qualified service technician. The calibration of each balance is checked each day of use using weights traceable to the National Institute of Standards and Technology (NIST). Calibration weights are certified to ASTM Class 1 and are recertified every five years. If balances are calibrated by an external agency, verification of their weights shall be provided. All information pertaining to balance maintenance and calibration is found in the individual balance logbook and/or is maintained by the QA Department.

7.2.2 Thermometers

Certified, or reference, thermometers are maintained for checking calibration of working thermometers. Reference thermometers are provided with NIST traceability for initial calibration and are recertified every five years with equipment directly traceable to the NIST.

Each thermometer is individually numbered and tagged with the identification number. All working thermometers are compared with the reference thermometers on an annual basis except for digital working thermometers that are handled on a routine basis (i.e. those used in sample log-in). These are verified for accuracy on a quarterly frequency. In addition, working thermometers are visually inspected by laboratory personnel prior to use. Calibration temperatures and acceptance criteria are based upon the working range of the thermometer and the accuracy required for its use. An inventory of thermometers, their identification, calibration status and due date of next calibration is maintained by the QA Department or designated area.

7.2.3 pH/Electrometers

These meters are calibrated using buffer solutions before use each day, and once after each four hours of use. Refer to the current revision of Katahdin Analytical Services SOP CA-708, Hydrogen Ion Concentration Measurement (pH) in Aqueous Samples and Solutions.

7.2.4 Spectrophotometers

During use, spectrophotometer performance is checked against initial calibration verification standards (ICVs) and continuing calibration verification standards (CCVs). The instrument operating capability is also evaluated every year by an outside service. Wavelength verification occurs every six months.

7.2.5 Ovens

Oven temperatures are monitored using a mercury thermometer which is placed in a beaker of sand and kept inside the oven or by a high temperature range digital thermometer intended for oven monitoring. This thermometer is compared to a NIST traceable thermometer annually. Oven temperature is checked every day of use and recorded in the appropriate logbook.

7.3 GC/MS Calibration Procedures

Calibration procedures and acceptance criteria are method specific. Refer to the individual methods (see Tables 6-1 and 8-2) or Katahdin Analytical Services SOPs for method specific requirements in addition to the generic procedures outlined here.

The following are general minimum operations necessary to satisfy analytical requirements associated with the determination of organic compounds in water and soil/sediment samples. These operations should be performed routinely in the laboratory:

- Documentation of GC/MS mass calibration and abundance pattern
- Documentation of GC/MS response factor stability
- Internal standard response and retention time

Prior to initiating data collection, it is necessary to establish that a given GC/MS meets the standard mass spectral abundance criteria. This is accomplished through the analysis of decafluorotriphenylphosphine (DFTPP) for base/neutral and acid (BNA) semivolatile compounds or p-bromofluorobenzene (BFB) for volatile compounds. Each GC/MS system used for the analysis of semivolatile organic compounds or volatile organic compounds must be tuned to meet method or program specific ion abundance criteria before analysis of standards, blanks, or samples can proceed.

Prior to the analysis of samples and after tuning criteria have been met, the GC/MS system must be initially calibrated with the method specified number (typically three to five) of concentrations of each compound being analyzed to determine the linearity of response. USEPA methods typically specify the concentration levels to be used for initial calibration and the specific internal standard to be used on a compound-by-compound basis for quantification. The response factor (RF) for each compound at each concentration level is calculated using the following Equation 7.1:

$$RF = \frac{A_x}{A_{is}} * \frac{C_{is}}{C_x} \qquad (7.1)$$

where:
A_x = area of the characteristic ion for the compound to be measured.
A_{is} = area of the characteristic ion for the specific internal standards.
C_{is} = concentration of the internal standard
C_x = concentration of the compound to be measured

Using the RF from the initial calibration, the percent relative standard deviation (%RSD) for compounds identified as Calibration Check Compounds (CCCs) is calculated using Equation 7.2:

$$\%RSD = \frac{S}{X} \times 100 \qquad (7.2)$$

where:
RSD = relative standard deviation
S = std. deviation of initial 5 response factors (per compound).
X = mean of initial five response factors (per compound).

The %RSD for each individual CCC should be <u>less</u> than 25% or as specified by the method. This criteria must be met for the initial calibration to be valid.

A calibration check standard containing all compounds of interest as well as all required internal standards and surrogates, is performed each day of analysis. The RF data from the standard is compared each day against the average RF from the initial calibration for a specific instrument. If the response to a calibration check standard differs from the initial calibration by more than ±25% or as specified by the method, then investigation and corrective action must be performed, including a complete recalibration if necessary.

7.4 Non GC/MS Chromatography Calibration Procedures

Calibration procedures and acceptance criteria are method specific. Refer to the individual methods (see Tables 6-1 and 8-2) or Katahdin Analytical Services SOPs for method specific requirements in addition to the generic procedures outlined here.

Initially, a three or five point calibration curve, consisting of all compounds of interest plus a calibration blank, is established to define the usable range of the instrument. Calibration may be accomplished as best-fit line, quadratic equation, or average RF in accordance with the applicable method. The curve is determined to be acceptable if the correlation coefficient meets that perscribed in the applicable method (usually $\geq$ 0.990). Linearity may also be determined using response factors. Response factors are calculated for each compound at each concentration level. These RFs will be averaged to generate the mean RF for each compound over the range of the standard curve. The curve is determined to be linear if the RSD of the response factors is <25% or as specified in the method. The mean response factor will be used to calculate the sample concentration of the compound of interest. When sample responses exceed the range of the standard curve, the sample must be diluted to fall within the range of the standard curve and be reanalyzed. The results of the daily GC standardization are tabulated and filed with the corresponding sample analyses. Daily full calibration is not necessary if a calibration check standard verifies the initial calibration curve. If the response to a calibration check standard differs from the initial calibration by more than ±15% for any analyte being quantitated or as specified by the method, then investigation and corrective action will be performed, including complete recalibration, if necessary.

Continuing Calibration is checked as described in Katahdin Analytical Services SOPs or methods.

7.5 Calibration of Inductively Coupled Argon Plasma Spectrophotometer (ICP) and Atomic Absorption Spectrophotometer (AA)

Calibration procedures and acceptance criteria are method specific. Refer to the individual methods (see Tables 6-1 and 8-2) or Katahdin Analytical Services SOPs for method specific requirements in addition to the generic procedures outlined here.

ICP and AA instruments are standardized for the metal of interest by the analysis of a set of calibration standards prepared by diluting a stock solution of known concentration. For the AA, the concentrations of the calibration standards are chosen to cover the working range of the instrument. For ICP analysis, a linearity range standard (LRS) is run at the time of calibration to establish the upper limit of quantitation. Subsequently, all sample measurements are made within this working range. Once the working standards are prepared, they are analyzed on the ICP or AA and the instrument response is calibrated to provide a direct readout in concentration.

The calibration is accomplished by entering the metal concentration equivalent to the readout in absorbance units (or emission intensity) during analysis of the working standards.

Once the instrument has been initially calibrated, the analysis of a check standard is performed during sample analysis to verify calibration. A typical analysis sequence is presented below.

- Working standards are prepared by dilution of a stock standard solution of the metal of interest.
- A calibration curve within the working range of the instrument is established by analysis of three to five working standards.
- An independent standard is analyzed to confirm the calibration. If the calibration is not within acceptance limits, the instrument is recalibrated.
- The samples are analyzed for the metal of interest.
- During sample analysis, a check standard (Continuing Calibration Verification, CCV) is analyzed to monitor instrument stability. If the CCV indicates that instrument

calibration has changed by more than ±10% for ICP or AA, the instrument is recalibrated and the analysis is repeated.

- Following completion of the sample analyses, the check standard is reanalyzed to confirm calibration. If calibration verified, the analysis is completed. However, if the calibration is not verified, appropriate corrective action is taken and effected samples are reanalyzed.

Written records of all calibrations shall be kept with the raw data.

7.6 Classical (Wet) Chemistry Calibration Procedures

The minimum operations necessary to satisfy analytical requirements associated with the determination of classical wet chemistry parameters in water and soil/sediment samples is method dependent. Refer to individual methods (see Tables 6-1 and 8-2) or Katahdin Analytical Services SOPs for specific requirements.

Wet chemistry instruments are standardized for the parameter of interest by the analysis of a set of calibration standards prepared by diluting a stock solution of known concentration. The concentrations of the calibration standards are chosen to cover the working range of the instrument. Subsequently, all sample measurements are made within this working range.

Once the instrument has been initially calibrated, the analysis of a check standard is performed during sample analysis to verify calibration. A typical analysis sequence is presented below.

- Working standards are prepared by dilution of a stock standard solution of the parameter of interest.

- A calibration curve within the working range of the instrument is established by analysis of one to five working standards.

- An independent standard is analyzed to confirm the calibration. If the calibration is not within acceptance limits, the instrument is recalibrated.

- The samples are analyzed for the analyte of interest.

- During sample analysis, a check standard (Continuing Calibration Verification, CCV) is analyzed to monitor instrument stability. If the CCV indicates that instrument calibration has changed by more than the method specified acceptance limits, the instrument is recalibrated and the analysis is repeated.

- Following completion of the sample analyses, the check standard is reanalyzed to confirm calibration. If calibration verified, the analysis is completed. However, if the calibration is not verified, appropriate corrective action is taken and effected samples are reanalyzed.

A calibration curve is not prepared for titrations. Titrants are purchased or are prepared as standards and their use is recorded in the appropriate standards logbook.

Written records of all calibrations shall be kept with the raw data.

7.7 Manual Integration Policy

Manual integrations are to be performed when chromatographicconditions preclude the computer algorithm from correctly integrating the peak of concern. In no instance shall a manual integration be performed solely to bring a peak within criteria.

Each peak of concern is examined by the primary analyst to ensure that the peak was integrated properly by the computer algorithm. Should a manual integration be necessary (for instance, due to a split peak, peak tailing, or incomplete resolution of isomeric pairs), the peak before manual integration must be printed, followed by a copy of the peak after manual integration. The analyst must date and initial both pages. A "m" qualifier will automatically be printed on the quantitation report summary. The analyst must also date and initial in the spacenext to each of these qualifiers.

This manual integration package must then be submitted to the group supervisor or his/her designee, who will review each manual integration, and initial the hardcopy of the "after" manual integration.

Copies of the manual integrations will be sent to each client who requests a level IV QC package. In the event that this QC is not requested, the manual integrations will be fikled at the laboratory and will be available for review by the client if requested.

8.0 ANALYTICAL PROCEDURES

Katahdin Analytical Services is capable of analyzing a broad range of environmental samples from diverse media, including surface and groundwater, soil, sediment, tissue, and waste. Refer to Table 8-2 for a listing of specific analytical capabilities. Methodologies are employed with guidance from agencies such as EPA, ASTM, USGS, NIOSH and in certain instances, state regulatory agencies. In some situations, Katahdin Analytical Services develops and validates methodologies that are more applicable to a specific problem or objective.

Analytical procedures are detailed descriptions of any and all processing, preparation and analysis of samples in the laboratory. In some instances, data format, presentation and delivery are also described. All analytical procedures shall be conducted in strict adherence to the QA Manual and written Standard Operating Procedures that have been reviewed and approved by the Operations Manager, the QA Officer(s) and the General Manager. Documents from which SOPs are developed include the references listed in Table 8-1. Additional SOPs may be adapted from other sources or generated in-house as project needs require.

8.1 Analytical Methods

Numerous sources of information are available to offer guidance in analytical methods. Selection of the appropriate method is dependent upon data usage and/or regulatory, client or program requirements. Table 8-1 describes the analytical references routinely used by Katahdin Analytical Services. Katahdin Analytical Services may modify existing methods based on the following considerations: 1) in order to meet project specific objectives; 2) in order to incorporate modifications or improvements in analytical technology; 3) in order to comply with changing regulations and requirements; 4) in order to address unusual matrices not covered in available methods.

Katahdin Analytical Services will make every effort to disclose to its clients any instances in which modified methods are being used in the analysis of samples.

8.2 Method Validation

The laboratory demonstrates its capability of performing an analytical method through method validation. Please refer to the current revision of Katahdin SOP QA-807, Method Performance / Precision and Accuracy Requirements, for details on specific method validation. When non-promulgated methods (i.e., methods other than EPA, NIOSH, ASTM, AOAC, etc.) are required for specific projects or analytes of interest, or when the laboratory develops a method, the laboratory establishes the validity of the method prior to applying it to client samples. Method validity is established by meeting specified criteria for precision and accuracy or ascertaining the precision and accuracy, which is achievable.

8.3 Method Revisions

Revisions to existing methods are handled in the same manner as a new method. After review of the published method, Katahdin determines whether or not to incorporate the new version as a product offered by the laboratory. A number of issues must be considered in making this decision. The following questions may be asked:

- Do we have the resources to perform this method?
- Can we easily obtain the resources to perform this method?
- Is this method promulgated?
- Does this method replace an existing promulgated method?
- Is the laboratory getting requests for this method?
- How long will it take to bring the method on-line?

Sales and Marketing Representatives, Project Managers, the General Manager, the Operations Manager, the QAO, Analytical group supervisors and/or the Katahdin owners may be consulted in deciding whether or not to adopt a revision of a method. Once the decision is made to adopt a method revision, a new product code is initiated. The SOP is written or revised, and training is initiated.

For revisions, which replace an existing Katahdin product, training may be documented on a Katahdin Retraining form. For revisions that are new to Katahdin, training is initiated as described in Katahdin SOP CA-805, Laboratory Technical Personnel Training. In both cases, Initial Demonstration of Method Proficiency shall be documented.

It is the responsibility of the General Manager, the QAO, the Operations Manager and the Analytical Group Supervisors to inform MIS personnel, Project Managers, Sales and Marketing Representatives and analysts of any changes in methodology. MIS personnel will either retire obsolete product codes (i.e. obsolete methods) and/or add additional product codes (i.e. new versions of existing methods) dependent upon each individual case. Project Mangers and Sales will begin to sell the new product code. It is very important to ascertain which version of the method that clients are requesting. When clients request delisted methods, it is Katahdin's policy to inform them of this and the correct method that they should be requesting.

8.4 Method Detection Limits

Method detection limit (MDL) studies are performed annually at a minimum for each method in use; MDL studies are also performed after any significant procedural or instrument configuration change. Refer to Katahdin Analytical Services, Inc. SOP QA-806, Method Detection Limit and Instrument Detection Limit Studies.

Method detection limits are determined at Katahdin Analytical Services using replicate spiked analyte-free water samples. A minimum of seven replicates of a sample spiked with the analyte of interest is processed through the entire analytical method. The concentration of the detection limit sample should be between one and five times the anticipated detection limit.

The laboratory calculates the detection limit as the student's t (n-1, 1-∝ = 0.99) times the standard deviation (n-1) of the replicate spiked sample measurements. Refer to 40 CFR Part 136, Appendix B for further discussion. Detailed procedures and acceptance criteria for MDL studies are described in the current revision of Katahdin Analytical Services SOP QA-806, Method Detection Limit and Instrument Detection Limit Studies. Please refer to Appendix B for example MDLs for some routine methods.

IT IS IMPERATIVE TO NOTE THAT METHOD DETECTION LIMITS ARE HIGHLY MATRIX DEPENDENT. LIMITS DETERMINED BY KATAHDIN ANALYTICAL SERVICES MAY NOT BE ACHIEVABLE IN ALL MATRICES.

8.5 Compliance

8.5.1 Definition - Compliance is the proper execution of recognized, documented procedures that are either approved or required. Adherence to these procedures is required in order to provide data products acceptable to a regulatory body of competent jurisdiction in a specific regulatory context. Compliance is separate from, but not inconsistent with, technical scientific quality. Katahdin Analytical Services understands that the expectations of our clients commonly include the assumption that data and reports will satisfy a regulatory purpose and will be found acceptable *and compliant* with regulatory requirements for the performance of tests and generation of data.

8.5.2 Understanding the Regulatory Framework - Compliance is not likely to be achieved in the absence of an understanding of the regulatory framework. Katahdin Analytical Services will attempt to ascertain, prior to the initiation of a project, what regulatory jurisdiction (USEPA, state, etc.) pertains to a project; within the regulatory jurisdiction, what body of regulation is meant to be satisfied (RCRA, SDWA, MCP 21E, etc.); and finally, within this context, what protocols are required/expected (CLP, AFCEE, NFESC, etc.). Katahdin Analytical Services will work with its clients to come to a mutual understanding of all requirements, based on our best understanding of the information available.

8.5.3 Commitment - Clients may, but often do not, fully understand their compliance needs. Clients may sometimes fail to communicate their compliance requirements to Katahdin Analytical Services. Nevertheless, Katahdin Analytical Services, in defining quality as in 8.4.1 above, accepts much responsibility for compliance.

Katahdin Analytical Services makes the following commitments to its clients:

- Katahdin will proactively attempt to identify and understand the regulatory context of clients' needs.
- Katahdin will strive to be expert in understanding and executing the regulatory requirements for compliance.
- Katahdin will identify and disclose to clients instances of non-compliance in a forthright fashion.

8.5.4 Resolving Compliance Contradictions and Hierarchies - It is a common occurrence that multiple regulatory jurisdictions overlap in a specific case. This causes uncertainty or even contradictions to arise in a work plan. Katahdin Analytical Services will make every effort to detect such inconsistencies, and will communicate them to clients so that the client can make an informed decision regarding execution of the project. Similarly, methods and protocols will often be prescribed in a scope of work or QAPP which either will not achieve stated or implied data quality objectives (DQOs) or which are in conflict with the regulatory requirements. Katahdin Analytical Services will attempt to detect these inconsistencies, and upon detection, disclose them to our client. Katahdin Analytical Services voluntarily accepts a responsibility to provide advice to clients; however, **the primary responsibility for this issue remains with the client.**

8.5.5 Disclosure of Noncompliance - As stated previously, it is Katahdin Analytical Services' policy to disclose in a forthright manner any detected noncompliance that may affect the usability of data produced by Katahdin Analytical Services. It is not within our expertise to predict the manner in which a specific regulator or regulatory body will interpret the rules governing analysis; Katahdin Analytical Services is unable to guarantee compliance. It is Katahdin Analytical Services' policy that our responsibility begins with a bona fide and competent attempt to evaluate potential compliance issues and ends with disclosure of any findings that may be useful to our client in their making the final judgment.

TABLE 8-1
ANALYTICAL PROTOCOLS

- "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act." Federal Register, 40 CFR Part 136, October 26, 1984.
- "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846. 2nd edition, 1982 (revised 1984), 3rd edition, 1986, and Updates I, II, IIA, and III 1996, Office of Solid Waste and Emergency Response, U.S. EPA.
- "Methods for Chemical Analysis of Water and Wastes", EPA 600/4-79-020, 1979 Revised 1983, U.S. EPA.
- "Methods for the Determination of Inorganic Substances in Environmental Samples", EPA 600/R-93/100, August 1993.
- U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis, SOW 2/88, OLM01.8, 8/91, OLM01.9, OLM02.0, and OLM03.1.
- U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, SOW No. 788, ILM01.0, 3/90 through ILM04.0.
- "Standard Methods for the Examination of Water and Wastewater", 15th, 16th, 17th, 18th, and 19th editions, 1980, 1985, 1989, 1992, 1995. APHA-AWWA-WPCF.
- "Annual Book of ASTM Standards", Section 4: Construction, Volume 04.04: Soil and Rock; Building Stones, American Society for Testing and Materials, 1987.
- "Annual Book of ASTM Standards", Section 11: Water and Environmental Technology, American Society for Testing and Materials, 1987.
- "NIOSH Manual of Analytical Methods", Third Edition, 1984, U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health.
- "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water", U.S. EPA, Environmental Monitoring and Support Laboratory - Cincinnati (September 1986).
- New York State Department of Environmental Conservation. Analytical Services Protocol, October, 1995.

TABLE 8-2

ANALYTICAL CAPABILITIES

METALS ANALYSES

ANALYTE	REQUIRED DIGEST	EPA METHODS
ICP ANALYSES		
Aluminum	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Antimony	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Barium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Beryllium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Boron	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Cadmium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Calcium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Chromium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Cobalt	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Copper	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Iron	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Lead	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Magnesium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Manganese	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Molybdenum	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Nickel	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Potassium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Silver	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Sodium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Strontium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Tin	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Titanium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Vanadium	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
Zinc	EPA 200.7, SW 3010, 3050	EPA 200.7, SW 6010
GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSES		
Antimony	SW 3010, 3050	EPA 204.2, SW 7041, SM 3113B
Arsenic	SW 7060, 3050	EPA 206.2, SW 7060, SM 3113B
Cadmium	SW 3020, 3050	EPA 213.2, SW 7131, SM 3113B
Chromium	SW 3020, 3050	EPA 218.2, SW 7191, SM 3113B
Lead	SW 3020, 3050	EPA 239.2, SW 7421, SM 3113B
Selenium	SW 7740, 3050	EPA 270.2, SW 7740, SM 3113B
Thallium	SW 3020, 3050	EPA 279.1, SW 7841, SM 3113B
COLD VAPOR ATOMIC ABSORPTION (CVAA)		
Mercury	EPA 245.1, SW 7470, 7471	EPA 245.1, SW 7470, 7471
CALCULATION		
Hardness	EPA 200.7/SM 2340B	EPA 200.7/SM 2340B

INORGANIC ANALYSES

ANALYTE	METHODS
Acidity	EPA 305.1
Alkalinity	EPA 310.1/SM 2320B
Bicarbonate & Carbonate	SM 2320
Biochemical Oxygen Demand	EPA 405.1
Bromide	EPA 300.0, 320.1
Carbon - Total Inorganic (water)	EPA 415.1 modified
- Total Organic (water)	EPA 415.1
- Total (soil)	modified Lloyd Kahn
Chemical Oxygen Demand - Detection limit of 20 mg/L	EPA 410.4
- Detection limit of 5 mg/L	EPA 410.4
Chloride	EPA 325.2
Coliform Bacteria - Total	SM 9222B
- Fecal	SM 9222D
Color	EPA 110.2/SM 2120B
Chromium - Hexavalent	SW 7196
Cyanide - Total	SM 4500CN^--C, EPA 335.2/335.4, SW 9012
Cyanide - Total & Amenable	SM 4500CN^--C, SW 9012
Fluoride	EPA 340.2, SM 4500F^--C
Hardness (Titrimetric)	EPA 130.2
Halides, Total Organic (TOX) - Water	SW 9020
Lime Equivalence	University of Maine Method
Nitrogen - Ammonia	EPA 350.1
- Nitrate plus Nitrite (combined)	EPA 300.0, 353.2
- Nitrate	EPA 300.0, 353.2
- Nitrite	EPA 300.0, 353.2
- Total Kjeldahl	EPA 351.2
- Total Organic - TKN minus NH_3	EPA 351.2/350.1
Free Liquid Content (Paint Filter Test)	SW 9095
pH	EPA 150.1
Phenols - Total	EPA 420.1
Phosphorus - Total	EPA 365.4
- Ortho	EPA 365.2/SM 4500-P-E
Solids - Total	EPA 160.3
- Suspended	EPA 160.2
- Dissolved	EPA 160.1
- Volatile Aqueous	EPA 160.4
- Suspended Volatile	EPA 160.2, 160.4
- Settleable	EPA 160.5
Specific Conductance	EPA 120.1/SM 2510B
Specific Gravity	EPA/COE 1981
Sulfate	EPA 375.4
Sulfide	EPA 376.1
Sulfite	EPA 377.1
Surfactants - MBAS	EPA 425.1
Tannins and Lignins (as tannic acid)	SM 5550B
Total Organic Halogens	SW 9020
Adsorable Organic Halogens	SM 1650
Turbidity	EPA 180.1
Sample Prep: Compositing	
Filtration	SM 3030B

TCLP ANALYSES

ANALYTE	EPA METHODS
Extraction for Volatiles (ZHE)	SW 1311
Extraction for Metals, Semivolatiles, Pesticides & Herbicides	SW 1311
VOLATILES - TCLP LIST	SW 8260
benzene	
carbon tetrachloride	
chlorobenzene	
chloroform	
1,2-dichloroethane	
1,1-dichloroethylene	
methyl ethyl ketone	
tetrachloroethylene	
trichloroethylene	
vinyl chloride	
SEMI-VOLATILES - TCLP LIST	SW 8270
pyridine	
m-cresol (3-methyl phenol)	
o-cresol (2-methyl phenol)	
p-cresol (4-methyl phenol)	
1,4-dichlorobenzene	
2,4-dinitrotoluene	
hexachloro-1,3-butadiene	
hexachlorobenzene	
hexachloroethane	
nitrobenzene	
pentachlorophenol	
2,4,5-trichlorophenol	
2,4,6-trichlorophenol	
PESTICIDES - TCLP LIST	SW 8081
chlordane	
endrin	
heptachlor	
heptachlor epoxide	
lindane	
methoxychlor	
toxaphene	
HERBICIDES - TCLP LIST	SM 6640B, SW 8151
2,4-dichlorophenoxyacetic acid	
2,4-5-trichlorophenoxypropionic acid	
METALS - TCLP LIST	SW 6010
Arsenic	
Barium	
Cadmium	
Chromium	
Lead	
Mercury	
Selenium	
Silver	

WASTE CHARACTERIZATION

ANALYTE	EPA METHODS
CORROSIVITY	
pH	SW 9040, 9045
REACTIVITY	
Releasable Cyanide	SW 7.3.3.2
Releasable Sulfide	SW 7.3.4.2
IGNITABILITY	SW 1010

NON-ROUTINE ANALYSIS

Katahdin Analytical Services, Inc. has the capability to perform the following analyses upon request.

ANALYSIS	METHODS
Flash point	ASTM D 93-77
% Moisture	SM 2540G
EDB & DBCP by GC	EPA 504.1
EPTOX Extraction	SW 1310, 1330
Alcohols by GC-FID	
Non-routine Furnace or ICP Metals	
Method Development for Organic Compounds by HPLC, GC/MS or GC	
Ferrous Iron	SM 3500D
Low Level Vinyl Chloride	GC/MS SIM
Volatile Organics	SM 1624 Mod.
Semivolatile Organics	SM 1653

ORGANIC ANALYSES

ANALYTE	METHODS WATER	SOIL
GC/MS Drinking Water Volatiles	EPA 524.2, 524.2SAS	
GC/MS Wastewater/Solids Volatiles	EPA 624, SW 8260	SW 8260
Purgeable Halocarbons	EPA 601, SW 8021	SW 8021
Purgeable Aromatics	EPA 602, SW 8021	SW 8021
Combined Purgeables	EPA 601/602, SW 8021	SW 8021
CLP Volatiles Analysis and Deliverables	SOW OLM 03.1	SOW OLM 03.1
Gasoline Hydrocarbons - BTEX +MTBE	EPA 602, SW 8021	SW 8021
Gas Range Organics (GRO)	SW 8015 modified	SW 8015 modified
Diesel Range Organics (DRO)	SW 8015 mod/8100	SW 8015 mod/8100
GRO/DRO - Maine HETL	HETL 4.2.17, 4.1.25	HETL4.2.17, 4.1.25
GRO/DRO - Massachusetts Risk Assessment	MA DEP VPH/EPH	MA DEP VPH/EPH
Total Petroleum Hydrocarbons (TPH) aby IR	EPA 418.1	SW 9071/EPA 418.1
Oil & Grease (Gravimetric or IR)	EPA 413.1, 413.2, SM 1664	SW 9071 modified
Semivolatile Organics - Extractables	EPA 625, SW 8270	SW 8270
Acid Extractables Only	EPA 625, SW 8270	SW 8270
Base Neutral Extractables Only	EPA 625, SW 8270	SW 8270
CLP Semivolatiles Analysis and Deliverables	SOW OLM 03.1	SOW OLM 03.1
Polynuclear Aromatics (PAH) by GC/MS	EPA 625, SW 8270	SW 8270
Polynuclear Aromatics (PAH) by GC/MS SIM	EPA 625, SW 8270	SW 8270
Polynuclear Aromatics (PAH) by HPLC	SW 8310	SW 8310
Organochlorine Pesticides & PCBs	EPA 608, SW 8081/8082	SW 8081/8082
Organochlorine Pesticides & PCBs (Tissue)	EPA 608, SW 8081/8082	SW 8081/8082
Chlorinated Phenoxy Herbicides	SM 6640B, SW 8151	SW 8151
PCBs in oils		EPA 3580/SW 8082
PCBs wipes/filters		EPA 3580/SW 8082
CLP Organochlorine Pesticides & PCBs	SOW OLM 03.1	SOW OLM 03.1
HPLC-Explosives	SW 8330 modified	SW 8330 modified

FORM 2C ANALYSES FOR NPDES PERMITS

ANALYTE		METHODS
PART A	Biochemical Oxygen Demand	EPA 405.1
	Chemical Oxygen Demand	EPA 410.4
	Total Organic Carbon	EPA 415.1
	Total Suspended Solids	EPA 160.1
	Ammonia as Nitrogen	EPA 350.1
	pH	EPA 150.1
PART B	Color	EPA 110.2
	Fecal Coliform	SM 9222D
	Fluoride	EPA 340.2
	Nitrate	EPA 353.2
	Nitrite	EPA 353.2
	Total Organic Nitrogen	EPA 351.2/350.1
	Oil and Grease	EPA 413.1, 413.2
	Total Phosphorus	EPA 365.4
	Sulfate	EPA 375.4
	Sulfide	EPA 376.1
	Sulfite	EPA 377.1
	Aluminum	EPA 200.7
	Barium	EPA 200.7
	Boron	EPA 200.7
	Cobalt	EPA 200.7
	Iron	EPA 200.7
	Magnesium	EPA 200.7
	Molybdenum	EPA 200.7
	Manganese	EPA 200.7
	Tin	EPA 200.7
	Titanium	EPA 200.7
	Metals Digestion	EPA 200.7
PART C	Antimony	EPA 200.7
	Arsenic	EPA 200.7, 206.2
	Beryllium	EPA 200.7
	Cadmium	EPA 200.7
	Chromium	EPA 200.7
	Copper	EPA 200.7
	Lead	EPA 200.7, 239.2
	Mercury	EPA 245.1
	Nickel	EPA 200.7
	Selenium	EPA 200.7, 270.2
	Silver	EPA 200.7
	Thallium	EPA 200.7, 279.1
	Zinc	EPA 200.7
	Total Cyanide	EPA 335.2/335.4, SM 4500CN$^-$-C
	Total Phenols	EPA 420.1
	Volatile Organic Compounds	EPA 624
	Acid and Base Neutral Compounds	EPA 625
	Pesticides and PCBs	EPA 608
	Metals Digestions	EPA 200 methods

APPENDIX NINE ANALYSES

Appendix IX is derived from Appendix VIII Hazardous Constituents. These parameter lists are intended to apply to groundwater monitoring at hazardous waste storage and disposal sites and are applied to uncontrolled site investigations and remediations.

ANALYTE		EPA METHODS
Volatile Organics (extended list 19 Compounds)		SW 8260
Acid and Base Neutrals (extended list 48 Compounds)		SW 3510, 3520, 3540, 3541, 3550, 8270
Pesticides and PCBs		SW 3510, 3520, 3540, 3541, 3550, 8081, 8082
Herbicides		SW 8151
Total Cyanide		SW 9012
Hydrogen Sulfide		EPA 376.1
pH		EPA 150.1
17 Metals	Arsenic	SW 7060
	Antimony	SW 6010
	Barium	SW 6010
	Beryllium	SW 6010
	Cadmium	SW 6010
	Cobalt	SW 6010
	Chromium	SW 6010
	Copper	SW 6010
	Mercury	SW 7470
	Nickel	SW 6010
	Lead	SW 7421
	Selenium	SW 7740
	Silver	SW 6010
	Tin	SW 6010
	Thallium	SW 7841
	Vanadium	SW 6010
	Zinc	SW 6010
	Metals Digest	SW 3010, 3020, 7060, 7470

APPENDIX B

EXAMPLE MDLs for ROUTINE METHODS

Date: 2/11/99 7:42:49 AM

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MDL Study

Matrix:Aqueous

Compound List: 8260B

Instrument: 5972-S

Dates of Analysis	Spike	Data Files
2/10/99	0.5ug/ml	S3424-S3440
	5.0ug/ml	S3432-S3438

Analyst: DJP

Reviewed and Approved by: JB Date: 021799

S8260FIN.XLS

Compound	Spike	S3424	S3425	S3426	S3427	S3428	S3431	S3440	AVG	STD DEV	MDL
1,1,1,2-TETRACHLOROETHANE	0.50	0.30	0.46	0.45	0.46	0.39	0.37	0.31	0.39	0.07	0.22
1,1,1-TRICHLOROETHANE	0.50	0.37	0.50	0.55	0.57	0.36	0.39	0.53	0.47	0.09	0.29
1,1,2,2-TETRACHLOROETHANE	0.50	0.40	0.47	0.48	0.50	0.42	0.34	0.37	0.43	0.06	0.19
1,1,2-TRICHLOROETHANE	0.50	0.49	0.44	0.40	0.42	0.46	0.31	0.38	0.41	0.06	0.18
1,1-DICHLOROETHANE	0.50	0.42	0.58	0.55	0.56	0.43	0.52	0.51	0.51	0.06	0.20
1,1-DICHLOROETHENE	0.50	0.19	0.58	0.56	0.41	0.37	0.35	0.46	0.42	0.13	0.42
1,1-DICHLOROPROPENE	0.50	0.39	0.51	0.51	0.54	0.35	0.44	0.41	0.45	0.07	0.22
1,2,3-TRICHLOROBENZENE	0.50	0.54	0.37	0.49	0.46	0.22	0.32	0.38	0.40	0.11	0.34
1,2,3-TRICHLOROPROPANE	0.50	0.37	0.36	0.33	0.37	0.32	0.21	0.26	0.32	0.06	0.19
1,2,4-TRICHLOROBENZENE	0.50	0.49	0.41	0.43	0.46	0.38	0.24	0.47	0.41	0.08	0.27
1,2,4-TRIMETHYLBENZENE	0.50	0.45	0.55	0.55	0.44	0.44	0.41	0.41	0.46	0.06	0.19
1,2-DIBROMO-3-CHLOROPROPANE	5.00	2.57	3.70	3.48	3.28	4.39	4.05	3.57	3.58	0.58	1.82
1,2-DIBROMOETHANE	0.50	0.38	0.40	0.38	0.48	0.42	0.33	0.35	0.39	0.05	0.15
1,2-DICHLOROBENZENE	0.50	0.43	0.56	0.48	0.54	0.41	0.45	0.42	0.47	0.06	0.19
1,2-DICHLOROETHANE	0.50	0.72	0.75	0.68	0.89	0.71	0.72	0.75	0.75	0.07	0.21
1,2-DICHLOROETHENE (CIS)	0.50	0.51	0.54	0.49	0.48	0.47	0.49	0.46	0.49	0.03	0.08
1,2-DICHLOROETHENE (TRANS)	0.50	0.43	0.53	0.55	0.58	0.45	0.41	0.50	0.49	0.06	0.20
1,2-DICHLOROPROPANE	0.50	0.42	0.51	0.42	0.53	0.45	0.46	0.44	0.46	0.04	0.14
1,3,5-TRICHLOROBENZENE	0.50	0.34	0.36	0.31	0.43	0.17	0.31	0.18	0.30	0.09	0.30
1,3,5-TRIMETHYLBENZENE	0.50	0.40	0.52	0.45	0.44	0.45	0.37	0.39	0.43	0.05	0.16
1,3-DICHLOROBENZENE	0.50	0.41	0.52	0.48	0.55	0.41	0.47	0.48	0.47	0.05	0.16
1,3-DICHLOROPROPANE	0.50	0.41	0.50	0.59	0.54	0.51	0.40	0.37	0.47	0.08	0.26
1,4-DICHLOROBENZENE	0.50	0.47	0.64	0.57	0.60	0.53	0.47	0.54	0.55	0.06	0.20
2,2-DICHLOROPROPANE	0.50	0.38	0.58	0.55	0.47	0.40	0.46	0.38	0.46	0.08	0.25
2-BUTANONE	5.00	3.62	3.67	3.88	3.77	3.86	3.80	3.76	3.77	0.09	0.30
2-CHLOROETHYLVINYLETHER	5.00	2.66	2.77	3.11	2.85	2.79	3.10	3.05	2.90	0.18	0.57
2-CHLOROTOLUENE	0.50	0.45	0.59	0.53	0.50	0.44	0.42	0.41	0.48	0.07	0.21
2-HEXANONE	5.00	2.82	3.35	3.09	3.11	3.50	3.41	3.65	3.28	0.28	0.89
4-CHLOROTOLUENE	0.50	0.43	0.52	0.50	0.48	0.41	0.41	0.44	0.46	0.04	0.14
4-METHYL-2-PENTANONE	5.00	3.55	3.78	3.90	3.73	4.01	3.96	4.06	3.86	0.18	0.56
ACETONE	5.00	5.54	5.52	6.05	5.50	6.27	5.88	6.23	5.86	0.34	1.07
ACROLEIN	5.00	5.60	4.85	5.69	6.29	5.66	5.29	5.75	5.59	0.44	1.39
ACRYLONITRILE	5.00	3.70	3.68	4.11	3.91	4.16	4.15	3.76	3.92	0.22	0.68
BENZENE	0.50	0.48	0.56	0.56	0.56	0.50	0.49	0.49	0.52	0.04	0.12

Da. 1/99 9 AM

Matrix:Aqueous

Compound List: 8260B

Instrument: 5972-S

Katahdin Analytical Services
MDL Study

Dates of Analysis	Spike	Data Files
2/10/99	0.5ug/ml	S3424-S3440
	5.0ug/ml	S3432-S3438

Analyst: DJP

Reviewed and Approved by: JB Date: 021799

S8260FIN.XLS

Compound	Spike	S3424	S3425	S3426	S3427	S3428	S3431	S3440	AVG	STD DEV	MDL
BROMOBENZENE	0.50	0.29	0.59	0.37	0.42	0.41	0.36	0.36	0.40	0.09	0.29
BROMOCHLOROMETHANE	0.50	0.25	0.41	0.32	0.45	0.40	0.31	0.14	0.33	0.11	0.34
BROMODICHLOROMETHANE	0.50	0.38	0.47	0.44	0.53	0.47	0.46	0.57	0.47	0.06	0.19
BROMOFORM	0.50	0.30	0.32	0.18	0.36	0.13	0.14	0.26	0.24	0.09	0.29
BROMOMETHANE	0.50	0.61	0.62	0.55	0.58	0.60	0.79	0.62	0.62	0.08	0.24
CARBON DISULFIDE	0.50	0.44	0.65	0.60	0.60	0.47	0.50	0.47	0.53	0.08	0.26
CARBON TETRACHLORIDE	0.50	0.30	0.46	0.36	0.44	0.15	0.35	0.40	0.35	0.10	0.33
CHLOROBENZENE	0.50	0.44	0.55	0.55	0.56	0.45	0.44	0.50	0.50	0.06	0.17
CHLOROETHANE	0.50	0.35	0.44	0.35	0.50	0.38	0.29	0.14	0.35	0.11	0.36
CHLOROFORM	0.50	0.61	0.70	0.80	0.80	0.72	0.68	0.70	0.72	0.07	0.21
CHLOROMETHANE	0.50	0.32	0.52	0.44	0.52	0.45	0.43	0.43	0.44	0.07	0.21
CIS-1,3-DICHLOROPROPENE	0.50	0.49	0.44	0.52	0.52	0.51	0.44	0.41	0.48	0.05	0.14
DIBROMOCHLOROMETHANE	0.50	0.33	0.38	0.40	0.43	0.32	0.29	0.37	0.36	0.05	0.15
DIBROMOMETHANE	0.50	0.44	0.33	0.45	0.55	0.36	0.24	0.46	0.40	0.10	0.32
DICHLORODIFLUOROMETHANE	0.50	0.28	0.44	0.31	0.38	0.29	0.29	0.30	0.33	0.06	0.19
DIETHYL ETHER	0.50	0.43	0.43	0.44	0.58	0.46	0.39	0.27	0.43	0.09	0.29
ETHYLBENZENE	0.50	0.39	0.54	0.51	0.52	0.46	0.43	0.48	0.48	0.05	0.17
FREON-113	0.50	0.24	0.42	0.32	0.27	0.23	0.11	0.13	0.25	0.11	0.34
HEXACHLOROBUTADIENE	5.00	3.59	3.69	4.11	4.20	4.18	3.87	4.28	3.99	0.27	0.85
ISOPROPYLBENZENE	0.50	0.38	0.54	0.50	0.51	0.40	0.38	0.39	0.44	0.07	0.22
M+P-XYLENE	1.00	0.87	1.03	0.99	1.00	0.82	0.82	0.78	0.90	0.10	0.32
METHYLENE CHLORIDE	0.50	1.17	1.27	1.17	1.17	1.31	1.31	1.53	1.28	0.13	0.41
MTBE	0.50	0.49	0.46	0.49	0.58	0.48	0.44	0.47	0.49	0.04	0.14
N-BUTYLBENZENE	0.50	0.39	0.48	0.49	0.44	0.34	0.39	0.36	0.41	0.06	0.18
N-PROPYLBENZENE	0.50	0.42	0.53	0.53	0.52	0.40	0.43	0.43	0.47	0.06	0.18
NAPHTHALENE	0.50	0.53	0.48	0.52	0.53	0.42	0.40	0.45	0.48	0.05	0.17
O-XYLENE	0.50	0.39	0.53	0.49	0.47	0.38	0.36	0.39	0.43	0.07	0.21
P-ISOPROPYLTOLUENE	0.50	0.33	0.48	0.50	0.39	0.35	0.32	0.28	0.38	0.08	0.26
SEC-BUTYLBENZENE	0.50	0.39	0.57	0.51	0.48	0.35	0.40	0.39	0.44	0.08	0.25
STYRENE	0.50	0.37	0.42	0.42	0.42	0.38	0.39	0.38	0.40	0.02	0.07
TERT-BUTYLBENZENE	0.50	0.39	0.50	0.52	0.44	0.34	0.36	0.36	0.42	0.07	0.23
TETRACHLOROETHENE	0.50	0.31	0.43	0.57	0.51	0.24	0.34	0.43	0.40	0.12	0.36
TETRAHYDROFURAN	5.00	3.59	3.69	4.11	4.20	4.18	3.87	4.28	3.99	0.27	0.85
TOLUENE	0.50	0.44	0.56	0.58	0.55	0.45	0.49	0.49	0.51	0.06	0.17

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Matrix:Aqueous

Compound List: 8260B

Instrument: 5972-S

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MDL Study

Dates of Analysis	Spike	Data Files
2/10/99	0.5ug/ml	S3424-S3440
	5.0ug/ml	S3432-S3438

Analyst: DJP

Reviewed and Approved by:

Date: 021799

S8260FIN.XLS

Compound	Spike	S3424	S3425	S3426	S3427	S3428	S3431	S3440	AVG	STD DEV	MDL
TRANS-1,3-DICHLOROPROPENE	5.00	4.53	4.65	4.59	4.99	4.83	5.03	4.81	4.78	0.19	0.61
TRICHLOROETHENE	0.50	0.40	0.50	0.47	0.47	0.48	0.50	0.47	0.47	0.03	0.11
TRICHLOROFLUOROMETHANE	0.50	0.20	0.42	0.39	0.44	0.24	0.27	0.30	0.32	0.09	0.30
VINYL ACETATE	0.50	0.50	0.49	0.57	0.61	0.52	0.42	0.41	0.50	0.07	0.23
VINYL CHLORIDE	0.50	0.23	0.52	0.51	0.44	0.28	0.33	0.35	0.38	0.11	0.35

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MDL Study

Matrix: Aqueous, method 3520

Compound List: 8270C

Instrument: 5970-X

Dates of Analysis	Spike	Data Files
1/25/99, 2/8/99	2/4 ug/L	X0391-0395,0535,0537
2/9/99	10/20 ug/L	X0559-0562,0564,0570,0572

Benzidene

Analyst: SW

Reviewed and Approved by: Date:

File: X8270W20.XLS

		X0391	X0392	X0393	X0394	X0395	X0535	X0537			
Compound	Spike	X0559	X0560	X0561	X0562	X0564	X0570	X0572	AVG	STD DEV	MDL
1,2,4-TRICHLOROBENZENE	2.00	1.28	1.53	1.59	1.47	1.37	0.77	1.03	1.29	0.30	0.93
1,2-DICHLOROBENZENE	2.00	1.55	1.70	1.77	1.75	1.62	1.04	1.15	1.51	0.30	0.93
1,2-DIPHENYLHYDRAZINE	2.00	1.74	1.73	2.14	1.63	1.62	1.02	1.03	1.56	0.40	1.27
1,3-DICHLOROBENZENE	2.00	1.27	1.38	1.46	1.53	1.31	0.94	1.05	1.28	0.21	0.67
1,4-DICHLOROBENZENE	2.00	1.41	1.52	1.60	1.61	1.40	0.98	1.05	1.37	0.25	0.80
1,4-DIOXANE	2.00	1.57	1.54	1.91	1.44	1.30	0.84	0.97	1.37	0.37	1.16
2,2'-OXYBIS(1-CHLOROPROPANE)	2.00	2.01	2.09	2.61	1.91	1.77	1.24	1.22	1.84	0.49	1.54
2,4,5-TRICHLOROPHENOL	4.00	3.37	3.21	4.01	3.06	2.62	1.64	1.48	2.77	0.93	2.91
2,4,6-TRICHLOROPHENOL	4.00	3.04	3.00	3.81	3.01	2.38	1.50	1.49	2.60	0.86	2.71
2,4-DICHLOROPHENOL	4.00	3.29	3.13	4.03	2.91	2.20	1.70	1.18	2.63	0.99	3.11
2,4-DIMETHYLPHENOL	4.00	1.97	2.96	3.53	2.01	2.75	1.09	1.28	2.23	0.90	2.81
2,4-DINITROPHENOL	20.00	5.41	1.97	3.32	3.54	3.87	4.93	4.12	3.88	1.12	3.53
2,4-DINITROTOLUENE	2.00	1.13	1.08	1.26	1.04	1.07	0.41	0.29	0.90	0.38	1.20
2,6-DINITROTOLUENE	2.00	1.38	1.17	1.23	1.07	1.19	0.32	0.34	0.96	0.44	1.38
2-CHLORONAPHTHALENE	2.00	1.75	1.66	1.98	1.70	1.75	1.01	1.04	1.56	0.38	1.18
2-CHLOROPHENOL	4.00	3.42	3.41	4.09	2.68	1.91	2.01	1.53	2.72	0.95	2.99
2-METHYLNAPHTHALENE	2.00	1.76	1.72	1.92	1.77	1.73	0.97	0.96	1.55	0.40	1.27
2-METHYLPHENOL	4.00	3.29	3.48	4.33	2.86	2.81	1.78	1.45	2.86	0.99	3.11
2-NITROANILINE	2.00	1.38	1.31	1.57	1.15	1.23	0.58	0.37	1.08	0.44	1.38
2-NITROPHENOL	4.00	2.87	2.59	3.38	2.20	1.67	1.33	0.95	2.14	0.87	2.74
3,3'-DICHLOROBENZIDINE	2.00	0.38	0.55	0.52	0.27	0.55	0.30	0.34	0.42	0.12	0.38
3-NITROANILINE	2.00	1.05	1.09	1.36	0.81	1.14	0.41	0.14	0.86	0.44	1.37
4,6-DINITRO-2-METHYLPHENOL	4.00	0.72	0.63	0.68	0.33	0.49	0.49	0.22	0.51	0.18	0.58
4-BROMOPHENYL-PHENYLETHER	2.00	1.93	1.74	2.20	1.84	1.75	0.93	0.79	1.60	0.53	1.66
4-CHLORO-3-METHYLPHENOL	4.00	3.76	3.62	4.27	3.37	3.33	1.85	1.36	3.08	1.06	3.34
4-CHLOROANILINE	2.00	0.51	0.69	0.97	0.41	0.71	0.49	0.39	0.60	0.21	0.65
4-CHLOROPHENYL-PHENYLETHER	2.00	1.80	1.79	2.18	1.81	1.78	0.97	1.00	1.62	0.46	1.43
4-METHYLPHENOL	4.00	3.56	3.96	4.79	3.42	3.29	2.04	1.64	3.24	1.08	3.41
4-NITROANILINE	2.00	1.09	1.16	1.33	0.93	1.11	0.32	0.17	0.87	0.45	1.40
4-NITROPHENOL	4.00	2.52	2.10	2.31	1.93	1.94	0.66	0.26	1.67	0.86	2.71
ACENAPHTHENE	2.00	1.78	1.85	2.24	1.83	1.87	1.02	1.09	1.67	0.45	1.40
ACENAPHTHYLENE	2.00	1.75	1.74	2.15	1.73	1.73	0.90	0.98	1.57	0.46	1.43

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Matrix: Aqueous, method 3520

Compound List: 8270C

Instrument: 5970-X

Katahdin Analytical Services

MDL Study

Dates of Analysis	Spike	Data Files
1/25/99, 2/8/99	2/4 ug/L	X0391-0395,0535,0537
2/9/99	10/20 ug/L	X0559-0562,0564,0570,0572

Analyst: SW

Reviewed and Approved by: Date:

File: X8270W20.XLS

		X0391	X0392	X0393	X0394	X0395	X0535	X0537			
Compound	Spike	X0559	X0560	X0561	X0562	X0564	X0570	X0572	AVG	STD DEV	MDL
ANILINE	2.00	1.43	1.36	1.74	1.08	1.37	0.73	0.65	1.19	0.40	1.24
ANTHRACENE	2.00	1.76	1.83	2.16	1.84	1.74	0.98	0.96	1.61	0.46	1.44
BENZIDINE	10.00	0.00	0.83	0.31	0.43	0.85	0.00	0.24	0.38	0.35	1.10
BENZO[A]ANTHRACENE	2.00	1.72	1.72	2.01	1.75	1.65	1.00	1.14	1.57	0.36	1.14
BENZO[A]PYRENE	2.00	1.36	1.19	1.51	1.29	1.17	0.72	0.83	1.15	0.28	0.89
BENZO[B]FLUORANTHENE	2.00	1.49	1.49	1.87	1.47	1.42	0.88	0.89	1.36	0.36	1.12
BENZO[G,H,I]PERYLENE	2.00	1.32	1.32	1.11	1.11	0.89	0.87	0.89	1.07	0.20	0.62
BENZO[K]FLUORANTHENE	2.00	1.57	1.61	1.83	1.65	1.34	0.86	1.00	1.41	0.36	1.13
BENZOIC ACID	4.00	2.66	2.15	0.97	1.85	1.55	0.34	0.16	1.38	0.93	2.93
BENZYL ALCOHOL	2.00	2.63	2.11	2.57	2.23	2.09	1.50	1.34	2.07	0.49	1.54
BIS (2-ETHYLHEXYL) ADIPATE	2.00	1.93	1.61	2.04	1.78	1.64	0.62	0.55	1.45	0.61	1.92
BIS(2-CHLOROETHOXY)METHANE	2.00	1.91	1.90	2.30	1.65	1.70	1.02	1.09	1.65	0.46	1.44
BIS(2-CHLOROETHYL)ETHER	2.00	2.23	2.19	2.67	1.95	1.81	1.20	1.24	1.90	0.54	1.68
BIS(2-ETHYLHEXYL)PHTHALATE	2.00	2.03	3.56	5.39	4.06	2.38	1.53	2.43	3.05	1.35	4.24
BUTYLBENZYLPHTHALATE	2.00	1.83	1.66	1.90	1.84	1.53	0.74	0.90	1.49	0.47	1.49
CARBAZOLE	2.00	1.67	1.73	2.11	1.81	1.69	0.93	1.13	1.58	0.41	1.28
CHRYSENE	2.00	1.70	1.65	1.98	1.71	1.58	0.98	1.19	1.54	0.34	1.07
DI-N-BUTYLPHTHALATE	2.00	3.23	2.05	2.42	2.33	1.90	0.95	1.10	2.00	0.79	2.48
DI-N-OCTYLPHTHALATE	2.00	1.71	1.57	1.69	1.41	1.28	0.56	0.65	1.27	0.48	1.50
DIBENZ[A,H]ANTHRACENE	2.00	1.10	1.16	1.21	1.03	0.81	0.63	0.64	0.94	0.24	0.77
DIBENZOFURAN	2.00	1.91	1.74	2.18	1.87	1.84	1.01	1.00	1.65	0.46	1.45
DIETHYL ADIPATE	2.00	2.14	1.96	2.47	2.00	2.12	1.01	1.02	1.82	0.57	1.80
DIETHYLPHTHALATE	2.00	2.02	1.84	2.24	1.88	1.89	0.94	1.06	1.70	0.49	1.56
DIMETHYL PHTHALATE	2.00	1.79	1.77	2.16	1.75	1.86	1.06	0.99	1.63	0.43	1.36
FLUORANTHENE	2.00	1.81	1.69	2.10	1.75	1.57	0.93	1.20	1.58	0.39	1.24
FLUORENE	2.00	1.86	1.87	2.33	1.93	1.82	1.00	0.98	1.68	0.50	1.58
HEXACHLOROBENZENE	2.00	1.79	1.71	1.96	1.81	1.64	0.94	0.97	1.55	0.42	1.31
HEXACHLOROBUTADIENE	2.00	1.10	0.96	1.16	1.07	1.25	0.82	0.96	1.05	0.14	0.45
HEXACHLOROCYCLOPENTADIENE	10.00	0.47	0.37	0.54	0.69	0.53	2.79	0.97	0.91	0.85	2.68
HEXACHLOROETHANE	2.00	0.53	0.38	0.44	0.52	0.58	0.76	0.98	0.60	0.21	0.65
INDENO[1,2,3-CD]PYRENE	2.00	1.39	1.21	1.53	1.16	1.06	0.74	0.86	1.14	0.28	0.87
ISOPHORONE	2.00	1.62	1.62	2.00	1.40	1.52	1.03	1.02	1.46	0.35	1.10

Date: 3/8/99, 07:40

Matrix: Aqueous, method 3520

Compound List: 8270C

Instrument: 5970-X

Natalium Analytical Services

MDL Study

Dates of Analysis	Spike	Data Files
1/25/99, 2/8/99	2/4 ug/L	X0391-0395,0535,0537
2/9/99	10/20 ug/L	X0559-0562,0564,0570,0572

Analyst: SW

Reviewed and Approved by: Date:

File: X8270W20.XLS

		X0391	X0392	X0393	X0394	X0395	X0535	X0537			
Compound	Spike	X0559	X0560	X0561	X0562	X0564	X0570	X0572	AVG	STD DEV	MDL
N-NITROSO-DI-N-PROPYLAMINE	2.00	2.02	2.04	2.48	1.68	1.89	1.07	1.04	1.75	0.53	1.66
N-NITROSODIMETHYLAMINE	2.00	1.72	1.80	2.08	1.48	1.37	0.63	0.87	1.42	0.52	1.62
N-NITROSODIPHENYLAMINE	2.00	1.37	1.79	2.16	1.88	1.83	0.98	1.01	1.57	0.46	1.44
NAPHTHALENE	2.00	1.75	1.82	2.24	1.78	1.66	1.04	1.15	1.63	0.41	1.30
NITROBENZENE	2.00	1.94	2.04	2.42	1.76	1.76	1.09	1.26	1.75	0.46	1.43
PENTACHLOROPHENOL	4.00	2.01	1.43	1.29	1.38	1.11	0.67	0.50	1.20	0.50	1.59
PHENANTHRENE	2.00	2.02	2.00	2.42	2.03	1.90	1.13	1.20	1.81	0.47	1.49
PHENOL	4.00	3.60	3.48	4.24	2.94	2.44	2.09	1.53	2.90	0.95	2.97
PYRENE	2.00	1.70	1.74	2.13	1.82	1.66	0.97	1.06	1.58	0.42	1.31
PYRIDINE	2.00	1.20	1.03	1.46	0.94	0.97	0.26	0.17	0.86	0.48	1.50

METHOD DETECTION LIMIT STUDY

Method: SW846 Method 8081 | Matrix: Water
Prep Method: Seperatory Funnel 3510 | Sample Amount: 1 Liter
Instrument ID: GC08 | Channel A | Detector: ECD
Column ID: 193 | Phase: Rtx-CLPest. | Length: 30 Meters ID: 0.53 m Film Thickness: 0.50 um

Compound	SPIKE CONC. (ug/L)	#1 MDL 1 (ug/L)	#2 MDL 2 (ug/L)	#3 MDL 3 (ug/L)	#4 MDL 4 (ug/L)	#5 MDL 5 (ug/L)	#6 MDL 6 (ug/L)	#7 MDL 7 (ug/L)	#8 DL 8 (ug/L)	Average Conc. (ug/L)	Standard Deviation	MDL (ug/L)	PQL (ug/L)
ALPHA-BHC	0.050	0.0560	0.0565	0.0546	0.0564	0.0565	0.0575	0.0602	0.0583	.0.0570	0.0017	0.0050	0.050
BETA-BHC	0.050	0.0521	0.0516	0.0511	0.0525	0.0517	0.0534	0.0555	0.0542	0.0528	0.0015	0.0045	0.050
GAMMA-BHC(LINDANE)	0.050	0.0429	0.0396	0.0422	0.0426	0.0400	0.0432	0.0426	0.0423	0.0419	0.0014	0.0041	0.050
DELTA-BHC	0.050	0.0578	0.0567	0.0563	0.0572	0.0567	0.0578	0.0595	0.0587	0.0576	0.0011	0.0033	0.050
HEPTACHLOR	0.050	0.0477	0.0462	0.0483	0.0481	0.0466	0.0497	0.0491	0.0494	0.0481	0.0013	0.0038	0.050
ALDRIN	0.050	0.0457	0.0445	0.0455	0.0455	0.0447	0.0475	0.0482	0.0478	0.0462	0.0014	0.0043	0.050
HEPTACHLOR EPOXIDE	0.050	0.0434	0.0401	0.0430	0.0431	0.0407	0.0437	0.0436	0.0435	0.0426	0.0014	0.0042	0.050
GAMMA-CHLORDANE	0.050	0.0424	0.0391	0.0415	0.0417	0.0392	0.0424	0.0423	0.0420	0.0413	0.0014	0.0041	0.050
ENDOSULFAN I	0.050	0.0440	0.0406	0.0432	0.0430	0.0412	0.0437	0.0441	0.0440	0.0430	0.0013	0.0040	0.050
ALPHA-CHLORDANE	0.050	0.0419	0.0386	0.0410	0.0411	0.0390	0.0417	0.0421	0.0419	0.0409	0.0014	0.0041	0.050
DIELDRIN	0.050	0.0479	0.0451	0.0469	0.0475	0.0454	0.0479	0.0482	0.0479	0.0471	0.0012	0.0036	0.10
4,4'-DDE	0.050	0.0489	0.0459	0.0471	0.0468	0.0460	0.0475	0.0482	0.0483	0.0473	0.0011	0.0033	0.10
ENDRIN	0.050	0.0528	0.0493	0.0509	0.0522	0.0495	0.0523	0.0529	0.0527	0.0516	0.0015	0.0044	0.10
ENDOSULFAN II	0.050	0.0446	0.0413	0.0435	0.0441	0.0417	0.0449	0.0450	0.0445	0.0437	0.0014	0.0043	0.10
4,4'-DDD	0.050	0.0516	0.0495	0.0504	0.0510	0.0494	0.0518	0.0514	0.0516	0.0508	0.0010	0.0029	0.10
ENDRIN ALDEHYDE	0.050	0.0438	0.0408	0.0432	0.0426	0.0409	0.0441	0.0439	0.0437	0.0429	0.0013	0.0040	0.10
ENDOSULFAN SULFATE	0.050	0.0484	0.0454	0.0467	0.0483	0.0457	0.0487	0.0495	0.0489	0.0477	0.0016	0.0046	0.10
4,4'-DDT	0.050	0.0512	0.0487	0.0495	0.0501	0.0486	0.0508	0.0510	0.0505	0.0501	0.0010	0.0030	0.10
ENDRIN KETONE	0.050	0.0438	0.0406	0.0424	0.0433	0.0416	0.0440	0.0445	0.0438	0.0430	0.0013	0.0040	0.10
METHOXYCHLOR	0.050	0.0467	0.0441	0.0453	0.0453	0.0441	0.0465	0.0467	0.0462	0.0456	0.0011	0.0033	0.50
RESULT FILES		8PA1131.rst	8PA1132.rst	8PA1133.rst	8PA1134.rst	8PA1135.rst	8PA1136.rst	8PA1137.rst	8PA1138.rst				
Date Analyzed		1/26/99	1/26/99	1/26/99	1/26/99	1/26/99	1/26/99	1/26/99	1/26/99				
Analyst		PL	PL	PL	PL	PL	PL	PL	PL		t value =	2.9980	

On Server A in Drive GC-1...\MDL\GC08\PEST99.XLS

METHOD DETECTION LIMIT STUDY

Method: SW846 Method 8081
Prep Method: Seperatory Funnel 3510
Matrix: Water
Sample Amount: 1 Liter
Instrument ID: GC08
Channel B
Detector: ECD
Column ID: 194
Phase: Rtx-CLPest. I
Length: 30 Meters ID: 0.53 m Film Thickness: 0.50 um

Compound	SPIKE CONC. (ug/L)	#1 MDL 1 (ug/L)	#2 MDL 2 (ug/L)	#3 MDL 3 (ug/L)	#4 MDL 4 (ug/L)	#5 MDL 5 (ug/L)	#6 MDL 6 (ug/L)	#7 MDL 7 (ug/L)	#8 MDL 8 (ug/L)	Average Conc. (ug/L)	Standard Deviation	MDL (ug/L)	PQL (ug/L)
ALPHA-BHC	0.050	0.0608	0.0607	0.0601	0.0613	0.0611	0.0620	0.0642	0.0631	0.0617	0.0014	0.0041	0.050
GAMMA-BHC(LINDANE)	0.050	0.0563	0.0555	0.0559	0.0569	0.0561	0.0575	0.0587	0.0581	0.0569	0.0011	0.0034	0.050
HEPTACHLOR	0.050	0.0459	0.0443	0.0454	0.0467	0.0450	0.0487	0.0487	0.0476	0.0465	0.0017	0.0050	0.050
ALDRIN	0.050	0.0534	0.0502	0.0517	0.0529	0.0515	0.0546	0.0559	0.0614	0.0540	0.0035	0.0105	0.050
BETA-BUC	0.050	0.0473	0.0453	0.0467	0.0476	0.0459	0.0482	0.0488	0.0484	0.0473	0.0012	0.0037	0.050
DELTA-BHC	0.050	0.0602	0.0592	0.0589	0.0598	0.0589	0.0605	0.0618	0.0616	0.0601	0.0011	0.0034	0.050
HEPTACHLOR EPOXIDE	0.050	0.0482	0.0456	0.0475	0.0484	0.0463	0.0489	0.0488	0.0486	0.0478	0.0012	0.0037	0.050
ENDOSULFAN I	0.050	0.0478	0.0452	0.0472	0.0476	0.0454	0.0484	0.0482	0.0485	0.0473	0.0013	0.0039	0.050
GAMMA-CHLORDANE	0.050	0.0470	0.0437	0.0459	0.0466	0.0446	0.0475	0.0474	0.0474	0.0463	0.0014	0.0043	0.050
ALPHA-CHLORDANE	0.050	0.0456	0.0432	0.0448	0.0456	0.0431	0.0464	0.0462	0.0463	0.0452	0.0013	0.0040	0.050
4,4'-DDE	0.050	0.0516	0.0489	0.0505	0.0509	0.0498	0.0520	0.0525	0.0522	0.0511	0.0013	0.0038	0.10
DIELDRIN	0.050	0.0518	0.0498	0.0512	0.0520	0.0504	0.0526	0.0531	0.0526	0.0517	0.0011	0.0034	0.10
ENDRIN	0.050	0.0562	0.0534	0.0545	0.0562	0.0538	0.0562	0.0573	0.0569	0.0556	0.0015	0.0044	0.10
ENDOSULFAN II	0.050	0.0495	0.0471	0.0489	0.0497	0.0465	0.0502	0.0510	0.0492	0.0490	0.0015	0.0045	0.10
4,4'-DDD	0.050	0.0546	0.0523	0.0535	0.0544	0.0527	0.0549	0.0555	0.0549	0.0541	0.0011	0.0034	0.10
4,4'-DDT	0.050	0.0556	0.0529	0.0531	0.0543	0.0528	0.0550	0.0556	0.0548	0.0543	0.0012	0.0035	0.10
ENDRIN ALDEHYDE	0.050	0.0460	0.0432	0.0451	0.0452	0.0437	0.0467	0.0465	0.0461	0.0453	0.0013	0.0039	0.10
ENDOSULFAN SULFATE	0.050	0.0530	0.0500	0.0516	0.0526	0.0508	0.0533	0.0540	0.0536	0.0524	0.0014	0.0043	0.10
METHOXYCHLOR	0.050	0.0494	0.0462	0.0475	0.0485	0.0464	0.0494	0.0500	0.0488	0.0483	0.0014	0.0043	0.10
ENDRINE KETONE	0.050	0.0491	0.0464	0.0481	0.0486	0.0473	0.0493	0.0502	0.0494	0.0486	0.0012	0.0037	0.50
RESULT FILES		8PA2131.rst	8PA2132.rst	8PA2133.rst	8PA2134.rst	8PA2135.rst	8PA2136.rst	8PA2137.rst	8PA2138.rst				
Date Analyzed		1/26/99	1/26/99	1/26/99	1/26/99	1/26/99	1/26/99	1/26/99	1/26/99				
Analyst		PL	PL	PL	PL	PL	PL	PL	PL		t value =	2.9980	

Katahdin Analytical Services

Method Detection Limit Study

Method: 8082
Sample Prep. Method: 3510
Analyst: LAB
Date Analyzed: 2/15/1999
Instument I.D.: GC06
Analytical Column: SPB-608; 30m x 0.53 x 0.83
Detector: ECD

Matrix: Water
Sample Weight or Volume: 1L
Spike Conc. and Amount: 5.0 mg/L, 100uL
Student t value: 2.998

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AR1016	0.50	0.665	0.648	0.654	0.628	0.638	0.608	0.604	0.530	0.622	0.043	0.128	0.50
AR1260	0.50	0.630	0.670	0.681	0.635	0.638	0.607	0.591	0.513	0.621	0.053	0.158	0.50

Method: 8082
Sample Prep. Method: 3510
Analyst: LAB
Date: 2/15/1999
Instument I.D.: GC06
Analytical Column: SPB-1701; 30m x 0.53 x 0.50
Detector: ECD

Matrix: Water
Sample Weight or Volume: 1L
Spike Conc. and Amount: 5.0 mg/L, 100uL
Student t value: 2.998

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AR1016	0.50	0.694	0.646	0.652	0.622	0.638	0.598	0.590	0.517	0.619	0.053	0.158	0.50
AR1260	0.50	0.668	0.693	0.702	0.653	0.662	0.622	0.599	0.524	0.640	0.058	0.174	0.50

Katahdin Analytical Services

Method Detection Limit Study

Method: 8082
Sample Prep. Method: 3510
Analyst: LAB
Date Analyzed: 3/22/99
Instument I.D.: GC06
Analytical Column: SPB-608; 30m x 0.53 x 0.83
Detector: ECD

Matrix: Water
Sample Weight or Volume: 1L
Spike Conc. and Amount: 5.0 mg/L, 100uL
Student t value: 2.998

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AR1221	0.50	0.739	0.756	0.773	0.752	0.720	0.750	0.689	0.756	0.742	0.026	0.08	0.50
AR1254.	0.50	0.368	0.384	0.392	0.398	0.338	0.389	0.372	0.397	0.380	0.020	0.06	0.50

Method: 8082
Sample Prep. Method: 3510
Analyst: LAB
Date: 3/22/99
Instument I.D.: SPB-1701; 30m x 0.53 x 0.50
Analytical Column: ECD
Detector: ECD

Matrix: Water
Sample Weight or Volume: 1L
Spike Conc. and Amount: 5.0 mg/L, 100uL
Student t value: 2.998

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AR1221	0.50	0.655	0.678	0.674	0.672	0.657	0.669	0.623	0.674	0.663	0.018	0.05	0.50
AR1254	0.50	0.351	0.329	0.343	0.345	0.270	0.337	0.309	0.332	0.327	0.026	0.08	0.50

file names: 6PC1/2220-227

Katahdin Analytical Services

Method Detection Limit Study

Method: 8082
Sample Prep. Method: 3510
Analyst: PL
Date Analyzed: 3/23/99
Instument I.D.: GC06
Analytical Column: SPB-608; 30m x 0.53 x 0.83
Detector: ECD

Matrix: Water
Sample Weight or Volume: 1L
Spike Conc. and Amount: 5.0 mg/L, 100uL
Student t value: 2.998

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AROCLOR 1232	0.50	0.645	0.633	0.648	0.707	0.654	0.676	0.562	0.656	0.648	0.041	0.12	0.50

Method: 8082
Sample Prep. Method: 3510
Analyst: PL
Date: 3/23/99
Instument I.D.: GC06
Analytical Column: SPB-1701; 30m x 0.53 x 0.50
Detector: ECD

Matrix: Water
Sample Weight or Volume: 1L
Spike Conc. and Amount: 5.0 mg/L, 100uL
Student t value: 2.998

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AROCLOR 1232	0.50	0.662	0.647	0.662	0.734	0.689	0.685	0.584	0.662	0.666	0.043	0.13	0.50

file names: 6PC3/4009-016

Katahdin Analytical Services

Method Detection Limit Study

Method:	8082	Matrix:	Water
Sample Prep. Method:	3510	Sample Weight or Volume:	1L
Analyst:	PL	Spike Conc. and Amount:	5.0 mg/L, 100uL
Date Analyzed:	3/24/99	Student t value:	2.998
Instument I.D.:	GC06		
Analytical Column:	SPB-608; 30m x 0.53 x 0.83		
Detector:	ECD		

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AROCLOR 1248	0.50	0.823	0.813	0.841	0.808	0.826	0.803	0.831	0.754	0.812	0.027	0.08	0.50

Method:	8082	Matrix:	Water
Sample Prep. Method:	3510	Sample Weight or Volume:	1L
Analyst:	PL	Spike Conc. and Amount:	5.0 mg/L, 100uL
Date:	3/24/99	Student t value:	2.998
Instument I.D.:	GC06		
Analytical Column:	SPB-1701; 30m x 0.53 x 0.50		
Detector:	ECD		

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AROCLOR 1248	0.50	0.799	0.784	0.808	0.792	0.800	0.780	0.803	0.723	0.786	0.027	0.08	0.50

file names: 6PC3/4009-016

Katahdin Analytical Services

Method Detection Limit Study

Method: 8082
Sample Prep. Method: 3510
Analyst: LAB
Date Analyzed: 3/23/99
Instument I.D.: GC06
Analytical Column: SPB-608; 30m x 0.53 x 0.83
Detector: ECD

Matrix: Water
Sample Weight or Volume: 1L
Spike Conc. and Amount: 5.0 mg/L, 100uL
Student t value: 2.998

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AR1242	0.50	0.267	0.295	0.269	0.267	0.190	0.265	0.298	0.268	0.258	0.033	0.10	0.50

Method: 8082
Sample Prep. Method: 3510
Analyst: LAB
Date: 3/23/99
Instument I.D.: GC06
Analytical Column: SPB-1701; 30m x 0.53 x 0.50
Detector: ECD

Matrix: Water
Sample Weight or Volume: 1L
Spike Conc. and Amount: 5.0 mg/L, 100uL
Student t value: 2.998

Contaminant	Test Conc. (ug/L)	MDL Replicates (ug/L)								Average (ug/L)	Standard Deviation	Calc. MDL (ug/L)	PQL (ug/L)
		#1	#2	#3	#4	#5	#6	#7	#8				
AR1242	0.50	0.210	0.249	0.217	0.216	0.135	0.213	0.238	0.212	0.211	0.034	0.101	0.50

file names: 6PC1/2232-239

METALS MDL SUMMARY REPORT

INSTRUMENT ID: *A* *TJA TRACE ICP* *METHOD: 6010*

ELEMENT: *Ag* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA28A	01/28/1999	MDLAQA01R	0.00292	0.00286	0.00273	0.00267	0.00274	0.00315	0.00263	0.00330	0.00251	0.00216	0.003	0.00277	92.2%	0.00032	0.00091	OK

ELEMENT: *Al* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.01130	0.02263	0.02448	0.01887	0.02140	0.02490	0.04081	0.03063	0.03147	0.03793	0.04	0.02644	66.1%	0.00891	0.02513	OK

ELEMENT: *As* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA28A	01/28/1999	MDLAQA01R	0.00482	0.00562	0.00444	0.00622	0.00529	0.00477	0.00596	0.00432	0.00553	0.00581	0.006	0.00528	88.0%	0.00066	0.00186	OK

ELEMENT: *B* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA28A	01/28/1999	MDLAQA01R	0.08197	0.10596	0.10762	0.14125	0.16091	0.01417	0.00797	0.00842	0.01067	0.00683	0.004	0.06458	1614.4%	0.06161	0.17381	TOO LOW

ELEMENT: *Ba* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00049	0.00056	0.00042	0.00054	0.00051	0.00037	0.00058	0.00047	0.00049	0.00049	0.0004	0.00049	123.0%	0.00006	0.00018	OK

ELEMENT: *Be* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00051	0.00056	0.00080	0.00052	0.00050	0.00047	0.00055	0.00046	0.00036	0.00039	0.0004	0.00051	128.0%	0.00012	0.00034	OK

ELEMENT: *Ca* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00830	0.00732	-0.00535	0.00758	0.00467	-0.00077	0.01248	-0.00051	-0.00263	-0.00123	0.02	0.00299	14.9%	0.00583	0.01646	OK

ELEMENT: *Cd* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA28A	01/28/1999	MDLAQA01R	0.00060	0.00089	0.00053	0.00048	0.00076	0.00075	0.00055	0.00063	0.00067	0.00079	0.0006	0.00066	110.8%	0.00013	0.00037	OK

ELEMENT: *Co* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00058	0.00088	0.00078	0.00049	0.00101	0.00073	0.00089	0.00101	0.00083	0.00113	0.002	0.00083	41.6%	0.00020	0.00056	OK

METALS MDL SUMMARY REPORT

INSTRUMENT ID: *A* *TJA TRACE ICP* *METHOD: 6010*

ELEMENT: *Cr* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00216	0.00233	0.00235	0.00218	0.00227	0.00216	0.00232	0.00239	0.00201	0.00237	0.002	0.00225	112.7%	0.00012	0.00034	Too High

ELEMENT: *Cu* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00077	0.00075	0.00019	0.00049	0.00043	0.00056	0.00050	0.00038	0.00026	0.00049	0.002	0.00048	24.1%	0.00019	0.00052	OK

ELEMENT: *Fe* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.03789	0.05189	0.04539	0.05112	0.05462	0.04866	0.05258	0.05602	0.05340	0.04840	0.03	0.05000	166.7%	0.00530	0.01495	OK

ELEMENT: *Mg* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.02074	0.02176	0.01852	0.01874	0.02067	0.01887	0.01928	0.01926	0.01866	0.02290	0.02	0.01994	99.7%	0.00150	0.00425	OK

ELEMENT: *Mn* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00069	0.00070	0.00062	0.00070	0.00078	0.00080	0.00088	0.00076	0.00068	0.00067	0.0004	0.00073	182.0%	0.00008	0.00022	OK

ELEMENT: *Mo* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00354	0.00259	0.00281	0.00293	0.00279	0.00306	0.00330	0.00303	0.00299	0.00273	0.003	0.00298	99.2%	0.00028	0.00079	OK

ELEMENT: *Ni* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00269	0.00194	0.00154	0.00227	0.00188	0.00124	0.00241	0.00210	0.00212	0.00247	0.002	0.00207	103.3%	0.00044	0.00124	OK

ELEMENT: *Pb* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00691	0.00678	0.00729	0.00670	0.00714	0.00723	0.00708	0.01085	0.00657	0.00702	0.004	0.00736	183.9%	0.00125	0.00352	OK

ELEMENT: *Sb* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00670	0.00660	0.00504	0.00536	0.00599	0.00658	0.00735	0.00709	0.00547	0.00645	0.006	0.00626	104.4%	0.00077	0.00217	OK

METALS MDL SUMMARY REPORT

INSTRUMENT ID: *A* *TJA TRACE ICP* *METHOD: 6010*

ELEMENT: *Se* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00759	0.00606	0.00457	0.00425	0.00613	0.00489	0.00597	0.00491	0.00566	0.00677	0.008	0.00568	71.0%	0.00104	0.00294	OK

ELEMENT: *Sn* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00591	0.00680	0.00416	0.00489	0.00546	0.00437	0.00249	0.00348	0.00479	0.00328	0.006	0.00456	76.1%	0.00130	0.00365	OK

ELEMENT: *Sr* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00017	0.00017	0.00014	0.00017	0.00014	0.00013	0.00018	0.00016	0.00014	0.00016	0.0001	0.00016	156.0%	0.00002	0.00005	OK

ELEMENT: *Ti* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00029	0.00046	0.00043	0.00048	0.00043	0.00032	0.00040	0.00029	0.00054	0.00057	0.001	0.00042	42.1%	0.00010	0.00028	OK

ELEMENT: *Tl* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00327	0.00169	0.00182	0.00028	0.00209	0.00167	0.00218	0.00207	0.00228	0.00200	0.01	0.00193	19.3%	0.00074	0.00208	OK

ELEMENT: *V* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA28A	01/28/1999	MDLAQA01R	0.00191	0.00197	0.00193	0.00190	0.00219	0.00165	0.00166	0.00176	0.00212	0.00183	0.002	0.00189	94.6%	0.00018	0.00050	OK

ELEMENT: *Zn* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
APA12A	01/12/1999	MDLAQA01	0.00200	0.00128	0.00352	0.00310	0.00323	0.00123	0.00185	0.00150	0.00153	0.00165	0.001	0.00209	208.9%	0.00086	0.00243	TOO LOW

METALS MDL SUMMARY REPORT

INSTRUMENT ID: B *TJA 61 ICP* *METHOD: 6010*

ELEMENT: *Ag* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.00146	0.00051	0.00004	0.00098	0.00052	-0.00042	0.00053	0.00147	-0.00043	0.00099	0.009	0.00056	6.3%	0.00068	0.00193	OK

ELEMENT: *Al* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA20A	01/20/1999	MDLAQB01	0.05633	0.05685	0.06852	0.05987	0.06072	0.05930	0.05897	0.05834	0.05462	0.06592	0.05	0.05994	119.9%	0.00428	0.01207	OK

ELEMENT: *As* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.04267	0.04703	0.03154	0.03608	0.04563	0.03883	0.03625	0.03339	0.05241	0.03915	0.05	0.04030	80.6%	0.00657	0.01853	OK

ELEMENT: *B* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.03244	0.03336	0.04111	0.02903	0.02501	0.03200	0.03754	0.02582	0.02671	0.03266	0.02	0.03157	157.8%	0.00514	0.01451	OK

ELEMENT: *Ba* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.00199	0.00157	0.00164	0.00178	0.00165	0.00158	0.00188	0.00164	0.00129	0.00150	0.0015	0.00165	110.1%	0.00020	0.00056	OK

ELEMENT: *Be* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.00124	0.00094	0.00096	0.00123	0.00124	0.00111	0.00111	0.00124	0.00095	0.00109	0.001	0.00111	111.1%	0.00013	0.00035	OK

ELEMENT: *Ca* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.05614	0.04206	0.07946	0.07193	0.05893	0.04046	0.05249	0.06103	0.03900	0.05444	0.05	0.05559	111.2%	0.01323	0.03733	OK

ELEMENT: *Cd* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.00616	0.00401	0.00518	0.00540	0.00513	0.00518	0.00388	0.00600	0.00482	0.00569	0.005	0.00514	102.9%	0.00075	0.00213	OK

ELEMENT: *Co* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.01076	0.00991	0.00991	0.00988	0.01000	0.00943	0.00804	0.00938	0.00851	0.01113	0.01	0.00970	97.0%	0.00093	0.00261	OK

METALS MDL SUMMARY REPORT

INSTRUMENT ID: *B* *TJA 61 ICP* *METHOD: 6010*

ELEMENT: *Cr* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA20A	01/20/1999	MDLAQB01	0.01072	0.01167	0.01066	0.00810	0.01233	0.01264	0.01245	0.00989	0.01164	0.00798	0.01	0.01081	108.1%	0.00170	0.00480	OK

ELEMENT: *Cu* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA20A	01/20/1999	MDLAQB01	0.00444	0.00421	0.00386	0.00370	0.00382	0.00428	0.00284	0.00316	0.00315	0.00254	0.005	0.00360	72.0%	0.00065	0.00182	OK

ELEMENT: *Fe* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA20A	01/20/1999	MDLAQB01	0.08410	0.06129	0.08856	0.06498	0.06465	0.07501	0.05943	0.06594	0.05920	0.06001	0.015	0.06832	455.4%	0.01062	0.02995	TOO LOW

ELEMENT: *K* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.62368	0.62742	0.71847	0.75544	0.95415	0.65780	0.82003	0.79465	0.90771	0.79323	1	0.76526	76.5%	0.11230	0.31679	OK

ELEMENT: *Mg* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA20A	01/20/1999	MDLAQB01	0.05042	0.05726	0.06143	0.05738	0.06045	0.06527	0.05227	0.05024	0.05836	0.04751	0.05	0.05606	112.1%	0.00572	0.01614	OK

ELEMENT: *Mn* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.00255	0.00219	0.00256	0.00146	0.00221	0.00222	0.00149	0.00220	0.00221	0.00220	0.002	0.00213	106.4%	0.00037	0.00105	OK

ELEMENT: *Na* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.10486	0.08721	0.10661	0.10094	0.10292	0.09447	0.09895	0.10426	0.08354	0.09693	0.05	0.09807	196.1%	0.00770	0.02171	OK

ELEMENT: *Ni* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.01908	0.01684	0.02816	0.02511	0.01717	0.01941	0.01738	0.02226	0.02973	0.01978	0.02	0.02149	107.5%	0.00467	0.01318	OK

ELEMENT: *Pb* *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.03335	0.04253	0.05620	0.04065	0.05564	0.04024	0.04704	0.04549	0.04648	0.04913	0.05	0.04568	91.4%	0.00700	0.01975	OK

METALS MDL SUMMARY REPORT

INSTRUMENT ID: B TJA 61 ICP **METHOD: 6010**

ELEMENT: Sb *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.01289	0.02042	0.02048	0.01396	0.02271	0.02274	0.02293	0.02271	0.02275	0.02267	0.02	0.02043	102.1%	0.00382	0.01077	OK

ELEMENT: Se *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.05854	0.05869	0.04852	0.04250	0.04737	0.04903	0.05098	0.03107	0.02667	0.05163	0.05	0.04650	93.0%	0.01053	0.02971	OK

ELEMENT: Si *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA20A	01/20/1999	MDLAQB01	0.15707	0.12006	0.17962	0.10531	0.10252	0.09428	0.08746	0.12685	0.04998	0.11094	0.05	0.11341	226.8%	0.03616	0.10201	TOO LOW

ELEMENT: V *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA18A	01/18/1999	MDLAQB01	0.00990	0.01212	0.00994	0.01211	0.01222	0.01003	0.01236	0.01219	0.01110	0.01329	0.01	0.01153	115.3%	0.00120	0.00339	OK

ELEMENT: Zn *(mg/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
BPA20A	01/20/1999	MDLAQB01	0.00218	0.00321	0.00519	0.00456	0.00268	0.00127	0.00274	0.00436	0.00124	0.00463	0.003	0.00321	106.9%	0.00143	0.00402	TOO LOW

METALS MDL SUMMARY REPORT

INSTRUMENT ID: *D* *LEEMAN PS200* *METHOD: 7470*

ELEMENT: *Hg* *(ug/L)*

FILE	DATE	DIGEST	REP1	REP2	REP3	REP4	REP5	REP6	REP7	REP8	REP9	REP10	TV	AVG	% REC	STDEV	MDL	
DPA21B	01/21/1999	MDLAQD-01	0.01700	0.11400	0.10300	0.23700	0.12800	0.11200	0.11600	0.10900	0.12800	0.11600	0.1	0.11800	118.0%	0.05263	0.14847	TOO LOW

9.0 DATA REDUCTION, VALIDATION AND REPORTING

All analytical data generated within Katahdin Analytical Services laboratories undergo a well-defined, well-documented multi-tier review process before being reported to the client. (Refer to Figure 9-1)

Each department shall have written procedures incorporated into the working SOPs for data validation which incorporate the quality assurance goals of traceability, accountability, completeness, precision and accuracy.

No written reports shall be issued which have not undergone the data validation process. Refer to the current revision of Katahdin Analytical Services SOP SD-904, Data Reduction and Validation, for more information.

9.1 Data Reduction

Primary analytical data, otherwise known as "raw data", may be manually generated or captured in electronic format. When raw data are manually generated, they are recorded either in bound logbooks with numbered pages or on preprinted forms. Records of analysis indicate the method used, raw data, calculations, and final results. Entries are made in black ink and are initialed and dated by the individual making the entry. It is acceptable to initial and date once for an entire page. Errors are corrected by drawing a single line through the entry; corrections are initialed and dated by the individual making the change. An explanation for the change must be indicated on the raw data when possible. Errors may be coded using the descriptive codes listed in Figure 9-2. Raw data may not be obscured in any way. The use of white-out is prohibited on all raw data, including instrumental hardcopy.

The analyst who completes the analysis assembles all relevant raw data and results together with chromatograms, strip chart recordings, instrument settings and other information essential to data interpretation. For data which are reduced by manual calculations, the calculations are documented in a laboratory notebook or on an analyst's worksheet. The results are transferred to a standardized laboratory reporting form which has been approved by the appropriate Supervisor and Operations Manager. Reporting forms include at a minimum the sample identification number, the date analyzed, the result expressed per unit volume, the method reference and the analyst's initials.

9.2 Data Validation

Data validation is the internal process of review by which data are shown to be valid as evidenced by the soundness of the analytical system and successful meeting of the DQOs (not to be confused with data validation by an outside independent source). In this process, the Laboratory makes no judgment as to the usability of the data by the end-user except with respect to the methodology applied.

Analysts performing an analysis and subsequent data reduction have the primary responsibility for the quality of the data produced. The primary analyst initiates the data validation process by reviewing and accepting the data, provided the associated quality control criteria have been met for the samples being reported. All reduced data must be evaluated using the QA Acceptance Criteria tables found within individual analytical method SOPs (please refer to Appendix D of Section 11 of this manual for examples of these tables. These tables give acceptance criteria and corrective actions for criteria that are not met. Data review checklists may be used to document the data validation process (these checklists, if applicable, may be found within individual method SOPs).

Depending on the corrective action taken, data may or may not be flagged with the appropriate qualifier. For EPA Contract Laboratory Program (CLP) methodologies, data qualification and flagging procedures are employed in accordance with the applicable EPA CLP Statement of Work. For non-CLP analytical methodologies, quality control excursions and any analytical discrepancies and/or matrix-related problems discovered during sample preparation or analysis, are documented in the Report of Analysis through the use of data flags. A summary of data flags used by the laboratory for non-CLP analyses is included as Appendix C.

The completed data package is then sent to the Supervisor or designated senior technical data reviewer. The Supervisor or designated data reviewer provides a technical assessment of the data package and technical review for accuracy according to methods employed and laboratory protocols. The review includes a thorough evaluation of manual calculations. For data that are reduced via computer, calculations are checked by the analyst (or designee) assigned to this task at a frequency designed to assure that the final data generation is valid. This data validation step is documented by the analyst's initials on the hardcopy of the raw data. The results are either manually transferred to a standard reporting form or reported via computer generation of forms.

Once the data have been technically reviewed and approved, authorization for release of the data from the analytical section is indicated by initialing and dating the data review checklist or otherwise dating and initialing the data. The Supervisor or technical designee drafts any narrative comments if required by the Quality Assurance Project Plan. Any items noted during technical and QC review are included in the narrative if deemed to impact the quality of the data.

All analytical data segments and other relevant paperwork pertaining to a particular Katahdin Analytical Services data report are channeled to the Data Management Department for data entry and/or assembly into the final report format and generation of the analytical narrative.

9.3 Data Reporting

The Data Management Department assembles all data from a sample set, generates the final report, checks for transcription errors, and provides the final report to the Operations Manager for final signature. The Operations Manager may delegate the final review and signing of reports to qualified individuals as necessary.

The final reviewer examines the report for method appropriateness, detection limits, completeness and accuracy and whether or not QC criteria were satisfied. Any deviations from the referenced methods are checked for documentation and validity, and QC corrective actions are reviewed for successful resolution. The final reviewer signs the cover letter or authorization line within the report, indicating acceptance of the report prior to its release to the client.

The standard commercial report to the client consists of the following sections:

1. a cover letter
2. a technical narrative (when appropriate)
3. sample results
4. sample receipt condition report
5. Chain-of-Custody forms

The narrative briefly describes any issues or discrepancies relating to the condition of the samples upon receipt, sample holding time performance, instrument calibration information, or quality control results. Any corrective actions pertaining to the samples are also addressed.

The sample results are tabulated by sample number and parameter. Katahdin Analytical Services number, client identification, and dates of sample preparation and analysis are presented along with the concentrations detected for each parameter analyzed and corresponding reporting limits. Katahdin Analytical Services is also able to provide alternate report formats (e.g., CLP data package) and additional deliverables (e.g., quality control reports, electronic diskette deliverable). Please refer to Figure 9-3 for a list of Katahdin data deliverables. All reports are processed through the data validation and reporting steps described in Sections 9.2 and 9.3.

9.4 Data Archive

Once the final report has been approved, signed, and submitted to the client, one copy of the report remains with all the raw data and is stored in the data archive under the control of the Office Manager. The purpose of the data archive is to ensure the continued integrity of all documentation generated in support of laboratory analyses.

The archive room is a secure storage area with access to limited Katahdin personnel. Sign-out procedures are in place where every document removed from the archive room must be manually signed out for use by authorized personnel.

Periodically, reports and raw data are sent to secure, confidential off-site storage to be archived. This material is retained for a period of time dependent on the state, client or specific program regulations attached to it, generally no longer than seven years, and may only be retrieved by designated personnel. A list of designees is maintained by the laboratory and by the storage company.

FIGURE 9-1.

MUTLI-TIER REVIEW PROCESS

DATA FLOW CHART

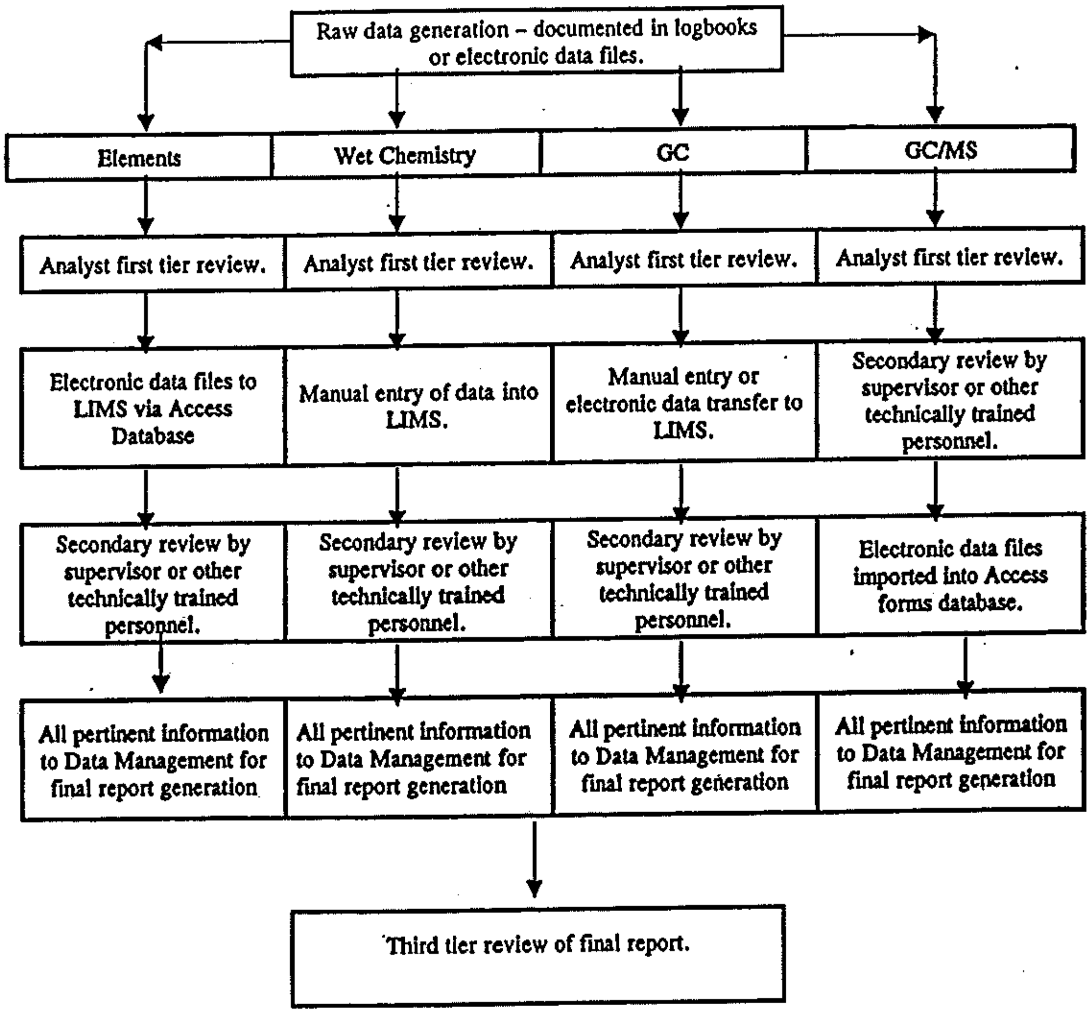


FIGURE 9-2

Error Codes

1	(or E1)	Misspelled
2	(or E2)	Mathematical Error
3	(or E3)	Wrong Entry
4	(or E4)	Transposition or Sequencing Error
5	(or E5)	Transcription Change (copy error)
6	(or E6)	Procedural Change
7	(or E7)	Wrong Conclusion
8	(or E8)	Illegible Entry
9	(or E9)	Unnecessary Entry
10	(or E10)	Footnoted Explanation
11	(or E11)	Additional Comment
12	(or E12)	Instrumentation Error/Failure

FIGURE 9-3

LEVELS OF DATA DELIVERABLES

HARDCOPY DATA DELIVERABLES

Deliverable	Data Reporting Level				
	I	II(+)	III	IV	CLP
Report of Analysis (Form 1 or equiv -- TICs optional)	✓	✓	✓	✓	1
External chains of custody	✓	✓	✓	✓	1
Blank Results (Org Form 1/Ino Form 3 or equiv)	▨	✓	✓	✓	1
Surrogate Recoveries (Org Form 2 or equiv)	▨	✓	✓	✓	1
Laboratory Control Sample Recovery (Org Form 3/Ino Form 7 or equiv)	▨	✓	✓	✓	1
Dup/MS/MSD if performed on client sample (Org Form 3/Ino Form 5A&6 or equiv)	▨	✓(+)	✓	✓	1
Blank Summary (Org Form 4 or equiv)	▨	▨	✓	✓	1
Tune Summary (Org Form 5 or equiv)	▨	▨	✓	✓	1
Initial Calibration (Org Form 6/Ino Form 2A&3 or equiv)	▨	▨	✓	✓	1
Continuing Calibration (Org Form 7/Ino Form 2A&3 or equiv)	▨	▨	✓	✓	1
Internal Standard Area Summary (Org Form 8 or equiv)	▨	▨	✓	✓	1
Run Logs	▨	▨	✓	✓	1
Sample Preparation logs	▨	▨	✓	✓	1
Raw data	▨	▨	▨	✓	1
Florisil cartridge check (Org Form 9A or equiv) - (<u>CLP only</u>)	▨	▨	▨	▨	1
GPC calibration if performed (Org Form 9B or equiv) - (<u>CLP only</u>)	▨	▨	▨	▨	1
Dual column ID summary (Pesticide Form 10 or equiv) - (<u>if requested</u>)	▨	▨	✓	✓	1
Instrument Sensitivity Check (Ino Form 2B or equiv)	▨	▨	✓	✓	1
Interference Check Sample (Ino Form 4 or equiv)	▨	▨	✓	✓	1
Post Digest Spike Sample -- if performed (Ino Form 5B)	▨	▨	✓	✓	1
Standard Addition Results Summary -- if performed (Ino Form 8 or equiv)	▨	▨	✓	✓	1
ICP Serial Dilutions -- if performed (Ino Form 9 or equiv)	▨	▨	✓	✓	1
IDLs (Ino Form 10 or equiv)	▨	▨	✓	✓	1
Interelement Correction Factors (Ino Form 11A&B or equiv)	▨	▨	✓	✓	1
ICP Linear Ranges (Ino Form 12 or equiv)	▨	▨	✓	✓	1
Standard Preparation logs - (<u>if requested</u>)	▨	▨	▨	✓	1
Internal chains of custody - (<u>if requested</u>)	▨	▨	▨	✓	1

✓ Data included in reporting level.
1 CLP is performed and reported according to the appropriate protocol.
▨ Data not included in reporting level.

APPENDIX C

NON-CLP DATA QUALIFIERS

Katahdin's Report Notes

#

'#' flag denotes surrogate compound recovery is out of criteria.

$

'$' flag denotes surrogate compound recovery is out of criteria. Re-extraction or re-analysis confirmed matrix interference.

****

** flag denotes surrogate recovery out of criteria; no action taken in accordance with method.

*****

*** flag denotes surrogate recovery out of criteria; reextraction met recovery criteria.

<1UG/KG

GC/MS results reported with a '<' qualifier indicate the analyte was not detected at a concentration greater than the laboratory's lower limit of quantitation. The lower limit of quantitation is approximately 1ug/kg.

<1UG/L

GC/MS results reported with a '<' qualifier indicate the analyte was not detected at a concentration greater than the laboratory's lower limit of quantitation. The lower limit of quantitation is approximately 1ug/L.

<33UG/KG

GC/MS results reported with a '<' qualifier indicate the analyte was not detected at a concentration greater than the laboratory's lower limit of quantitation. The lower limit of quantitation is approximately 33ug/kg.

^

'^' flag denotes surrogate recovery outside limits; Insufficient sample provided to reextract.

A

Absence of Escherichia coli.

A-1

Insufficient sample was provided to enable laboratory to achieve the laboratory's standard Practical Quantitation Level.

A-10

Analysis was performed by subcontracted laboratory.

A-11

Sample analysis was performed after expiration of the laboratory's internally established hold time. For this parameter no hold timerequirements are specified in the analytical methods or by appropriate regulators.

A-12

Results for the LCS and/or LCSD associated with this sample were outside laboratory acceptance criteria. The sample was not reanalyzed due to expiration of the extraction hold-time for this parameter.

A-13

Results for the ICV and/or CCV associated with this sample were outside laboratory acceptance criteria. The sample was not reanalyzed due to expiration of the analytical hold-time for this parameter.

A-14

Results for the LCS and/or LCSD associated with this sample were outside laboratory acceptance criteria. The sample was not reextracted due to insufficient sample volume.

A-15

Results for the LCS and/or LCSD associated with this sample were outside laboratory acceptance criteria. The sample was not reextracted due to expiration of the analytical hold-time for this parameter.

A-16

Chromatogram does not resemble a typical fuel oil pattern.

A-17

The pattern does not resemble any of the fuel products specified during ICAL.

A-18

The pattern does not match but most closely resembles product ~.

A-19

The pattern is consistent with product ~.

A-2

Upon receipt by the laboratory, sample pH was not within the range specified for preservation by the analytical method.

A-20

Standard PQL's based on 1 liter volume. The sample adjusted PQL reflects actual volume used in the analysis.

A-3

The laboratory was requested to perform this analysis after the expiration of the analytical hold-time.

A-4

Please refer to cover letter\ case narrative for additional information concerning this sample result.

A-5

Please refer to attached Quality Control Report for additional information concerning this sample result.

A-7

Results for the LCS and/or LCSD associated with this sample were outside laboratory acceptance criteria. The sample was not reanalyzed due to insufficient sample.

A-8

Results for the LCS and/or LCSD associated with this sample were outside laboratory acceptance criteria. The sample was not reanalyzed due to expiration of the analytical hold-time for this parameter.

A-9

The values listed in the PQL column actually represent MDLs (Method Detection Limits) for these compounds.

B

'B' flag denotes detection of this analyte in the laboratory method blank analyzed concurrently with the sample.

B-1

Confluent growth of atypical bacteria with coliforms.

B-2

Confluent growth of atypical bacteria without coliforms.

B-3

Value reported is based on the total volume of sample analyzed which meets the criteria of the analytical method for a countable plate.

B-4

The reported coliform density is an estimated value. The total number of coliform and non-coliform colonies was greater than 200 colonies per sample aliquot filtered.

B-5

The concentration in the method blank analyzed concurrently with the sample was ~.

B-6

'B' flag denotes detection of the analyte in the method blank at a concentration greater than the PQL. The concentration in the methodblank analyzed concurrently with the sample was ~ mg/kg.

BI

A result reported with a 'B' qualifier indicates the analyte was detected in the laboratory method blank analyzed concurrently with the sample. The concentration of ~ in the method blank was ~.

BQ

A result reported with a 'B' qualifier indicates the analytes were detected in the laboratory method blank analyzed concurrently with the sample. The concentrations of ~ in the method blank were ~ respectively.

D-1

As required by Method 5210B, APHA Standard Methods for the Examination of Water and Wastewater (18th edition), the BOD value reported for thissample is 'qualified' because the check standard run concurrently with the sample analysis did not meet the criteria specified in the method(198+/-30.5 mg/L). The actual check standard values were ~ and ~ mg/L.

D-2

Oxygen depletion exceeded the limiting value of 1 mg/L during incubation. Reported BOD result was calculated assuming a finaloxygen concentration equal to 1 mg/L.

D-3

Oxygen consumption was less than 2 mg/L after the 5-day incubation period. Reported BOD result was calculated assuming an oxygenconsumption of 2 mg/L.

D-4

Inhibition of BOD 'seed' indicated.

D-5

No value reported. The oxygen consumption of the dilution water used in the analysis exceeded the quality control criteria; therefore, the validity of sampledata is suspect.

D-6

No value reported.. The dilution scheme used to analyze the sample did not yield a reportable value for BOD.

D-7

The dilution water used to prepare this sample did not meet the criteria of less than 0.2 mg/L dissolved oxygen (DO) uptake over the five day period of incubation. The measured DO uptake for the dilution water was ~ mg/L for the sample. The BOD determination does not correct for DO uptake by the dilution water; therefore, when the dilution water uptake exceeds 0.2 mg/L, the dilution wa

D-8

The dilution water used to prepare this sample did not meet the criteria of less than 0.2 mg/L dissolved oxygen (DO) uptake over the five day period of incubation. The measured DO uptake for the dilution water was ~ mg/L for the sample. The BOD determination does not correct for DO uptake by the dilution water; therefore, when the dilution water uptake exceeds the absolute value of 0.2

DL

'DL' flag denotes inability to calculate surrogate recovery due to sample dilution.

E

'E' flag indicates an estimated value. The analyte was detected in the sample at a concentration greater than the standard calibration range.

E-1

Extracted outside of holding time

E-2

Received after expiration of extraction holding time

END

I-10

Sample required a larger volume of water for pH determination than specified in the method.

I-4

Due to sample matrix interferences, the reported value has been determined by the technique of standard additions (i.e., standards forthe analyte of interest added directly to an aliquot of the sample).

I-5

Due to laboratory error, the analysis was performed ~ day(s) after expiration of the analytical hold-time for this parameter.

I-6

Apparent color is a range, reported as lower limit.upper limit.

I-7

The laboratory's Practical Quantitation Level could not be achieved for this parameter due to sample composition, matrix effects,sample volume, or quantity used for analysis.

I-8

Matrix spike recovery could not be quantitated because of the presence of severe matrix interferences..

I-9

Duplicate analyses were performed on this sample for this parameter. The precision of the duplicate results is outside the laboratory'sacceptance range. Sample homogeneity may be a factor. The individual results were ~ and ~.

J

'J' flag denotes an estimated value less than the Laboratory's Practical Quantitation Level.

JI

'J' flag denotes an estimated value. The analyte was detected in the sample at a concentration greater thanthe measured detection limit but less than the laboratory's Practical Quantitation Level.

MI

'MI' denotes surrogate recovery out of criteria due to matrix interference.

N

'N' flag denotes presumptive evidence of the compound, where the identification is based on a mass spectral library search.

ND

'ND' indicates the compound was not detected during a manual search for the characteristic ions present in the mass spectrum for this compound.

NE

QC LIMITS HAVE NOT BEEN ESTABLISHED FOR COMPOUNDS WHICH HAVE NONE REPORTED.

NITROSO

n-Nitrosodiphenylamine cannot be resolved from diphenylamine.

NR

'NR' denotes data not reported

NS

NS = NOT SPIKED

O-1

Sample dilution required due to matrix interference, sample viscosity or other matrix-related problem; therefore, standard laboratory Practical Quantitation Level (PQL) could not be achieved.

O-10

Insufficient TCLP extract was generated by laboratory to achieve the laboratory's standard Practical Quantitation Level.

O-11

Head space observed in sample vials submitted for volatile organic analysis.

O-12

Due to laboratory error, the analysis was performed ~ days after the expiration of the analytical hold-time for this analysis.

O-13

Internal standard area(s) are out of criteria. Reanalysis confirmedmatrix interference.

O-14

Sample analyzed ~ day past expiration of holding time. See the cover letter for additional information.

O-15

Due to laboratory error, the extraction was performed ~ days after theexpiration of analytical hold time for this analysis.

O-16

Sample reextraction was required due to exceedance of surrogate recovery criteria. The original extraction was performed within hold time while reextraction was not within hold time. Results for the reextracted sample met all surrogate recovery criteria and are reported here.

O-17

Sample pH as determined at the time of analysis was ~ .

O-18

Internal standard area(s) are out of criteria.

O-2

Sample dilution required for quantitation of one or more target analytes; therefore, standard laboratory Practical Quantitation Level (PQL) could not be achieved.

O-3

Sample dilution required for quantitation of one or more target analytes; therefore, surrogate compound recovery could not be accuratelydetermined.

O-4

Surrogate compound recovery is out of criteria. Reextraction or reanalysis confirmed matrix interference.

O-6

Sample reextraction was required due to exceedance of quality control criteria. The original extraction was performed within hold time while reextraction was not within hold time. Results for the reextracted sample met all quality control criteria and are reported here.

O-7

Sample reextraction was required due to exceedance of quality control criteria. The original extraction was performed within hold time while reextraction was not within hold time. Results for the reextracted sample met all quality control criteria.

P

Presence of Escherichia coli.

TNC

Too numerous to count. Total number of coliform and non-coliform colonies was greater than 200 colonies per sample aliquot filtered.

VS

Very small; less than 1% of the total alkalinity.

W-1

The results for the analyses listed indicate that the parameters tested are within the standards set by the State of Maine, Department of Human Services - Division of Health Engineering, for a new or existing water supply.

W-2

The results for the analyses listed indicate that the parameters tested, with the exception of those listed below, are within thestandards set by the State of Maine, Department of Human Services, - Division of Health Engineering, for a new or existing watersupply.

W-3

Sodium levels in excess of 20 mg/L are satisfactory except persons affected with certain diseases may require a low sodium concentrationon the advice of their doctor.

W-4

Iron levels in excess of 0.30 mg/L and/or manganese levels in excess of 0.05 mg/L are satisfactory except such concentrations may impart anorange or brownish stain to plumbing fixtures and laundry and may produce a taste which is objectional to some individuals.

W-5

The pH of drinking water, in itself, has no effect on human health. The normal range is 6.5 to 8.5. Corrosion of plumbing fixtures hasbeen associated with low pH and scaling has been associated with high pH. Water may also have a sour taste if the pH is less than 4.0.

W-6

Although coliform bacteria may not cause illness, the presence of these bacteria indicates the possibility of contamination with other disease-causing bacteria or viruses originating from septic wastes.

W-7

Copper in excess of 0.30 mg/L may cause health effects in some individuals and may indicate corrosion in the water distribution system.

10.0 DOCUMENTATION & RECORDS MANAGEMENT

Records are the means by which an organization documents its operations and activities. They are an integral part of the Quality Assurance program since they provide documented evidence for program functionality and necessary information for performance evaluation and quality assurance audits. All information related to the quality assurance practices outlined in this manual shall be contained in records. This shall include, but not be limited to, standard operating procedures, results of instrument calibrations, analysis of quality control samples, analysis of samples, sample custody and disposal, preparation of standards, corrective action reports, audits and inspections.

10.1 General Recordkeeping

10.1.1 All documentation must be accurate, legible, complete and recorded in a timely manner using indelible ink.

10.1.2 If an error is made, a single line is used to cross out the incorrect entry. The original entry must remain readable. The correction must be initialed and dated and given an error code (see Figure 1) or explanation for the change. The use of white out is prohibited on all raw data, including instrumental hardcopy

10.1.3 When blank space is left after all information has been recorded on a logbook page or in other documentation, that blank space must be "Z'd" out. Use a single line through the space; initial and date the cross out.

10.1.4 All blocks must be filled in on pre-printed forms. Header information must be complete. All columns and units of measure must be identified.

10.2 Standard Operating Procedures

Standard Operating Procedures (SOPs) are written for specific procedures or operations. Complex tasks of inspection, testing, calibration, monitoring, maintenance, data handling, and quality control as well as methods utilized in the laboratory are specified and documented by SOPs.

As a minimum requirement, each SOP must include a title, the purpose or application, list of materials or references, and detailed procedures. SOPs are updated when necessary. Each has a Katahdin Analytical Services reference number and revision date at the upper right corner of each page. More detailed information regarding SOPs can be found in Section 12.0 and in the current revision of Katahdin Analytical Services SOP QA-800, Preparation of SOPs.

All personnel are required to follow SOPs when a specific operation or method is being utilized. It is the responsibility of the Supervisor to make sure that employees are aware of and follow the SOPs. Any suggestions for additional SOPs or changes to existing SOPs should be directed to the appropriate Supervisor, the Operations Manager or the QA Department.

10.3 Sample Tracking

Samples are tracked from the time they are received, through storage, preparation, analysis, and final disposition. More information on the following discussion can be found in the current revisions of Katahdin Analytical Services SOP SD-902, Sample Receipt and Internal Control.

Proper sample identification must be established during sample collection. This information must be clearly and permanently written on a label and attached to the sample. In addition, a Chain-of-Custody must be initiated with the appropriate information recorded. Samples should also be properly preserved and stored.

Sample Management personnel verify the samples' integrity as they are unpacked. The Katahdin Analytical Services Project Manager and/or the client are notified of samples that are received broken or have not been properly stored or preserved. The sample identification label must also be checked against Chain-of-Custody identification. Any discrepancies must be verified by the client or sampler. All these checks and any discrepancies or changes must be documented on the Sample Receipt Condition Report.

Sample Management Personnel assigns each group of samples, or job, a Work Order number and each sample within the job a sequential laboratory identification number, which is placed on the sample container. Samples are stored in the appropriate locations. A laboratory data file is initiated for the entire job.

Upon receipt the Sample Management Personnel also initiate an internal custody record for the sample set. These forms are used to document sample removal from and return to sample storage. The final disposition of a sample is documented on the hazardous waste disposal spreadsheet.

10.3.1 Chain-of-Custody

The Chain-of-Custody (COC) Form traces the possession of a sample from the time the sample is obtained in the field through receipt by and analysis in the laboratory. To initiate a Chain-of-Custody, the field sampler must fill in the appropriate information: Client or Project Name, Signature of Sampler, Sample Identification, Date and Time Sampled, Type of Sample, and Analysis Requested. After the sample is brought into the laboratory, sample integrity, preservation, and identification are checked. Any inconsistencies are noted in the sample management documentation. For samples accepted into the laboratory, the Sample Custodian verifies that the sample label IDs are consistent with the sample IDs provided on the Chain-of-Custody, signs in the space marked "Received for Laboratory" and records the date and time received.

10.3.2 Internal Sample Custody Record

The internal custody record is a mechanism for tracking samples from sample management (sample storage) to sample preparation and/or analysis and back to the appropriate storage location, unless the aliquot is depleted. When laboratory personnel remove samples from sample storage, the sample transfer is recorded on the internal custody record. Upon returning any remaining sample, the individual records the date in the "Returned By" box for the appropriate sample. For analyses that have an immediate analytical holding time (48 hours or less) or for rapid turn around work, the sample custodian will make a copy of the external COC and provide unlabelled bottles and the COC to laboratory departments prior to log-in and dispatch. Upon completion, the original internal custody records are archived by the QA Department.

10.4 Standards

Standards preparation is documented in the Katahdin Analytical Services laboratories in standards logbooks maintained by each laboratory section. All information needed to maintain proper traceability of standards is recorded in the appropriate standards logbook by the individual preparing the standard. More complete information regarding standards is provided in Section 7.1 and in the current revision of Katahdin Analytical Services SOP CA-106, Standard Preparation and Documentation.

10.5 Maintenance Logbooks

Maintenance logbooks are kept for each instrument. Each instrument has a unique maintenance logbook. In the logbook, an analyst records initial instrument setup, routine preventive maintenance, outside contractor services, instrumental malfunctions and repair performed, dates taken in and out of service, and resolutions. Instrument logs not only describe the instrument's history, but can be helpful when troubleshooting. Additionally, runlogs may describe problems noted, maintenance performed and return to control. Refer to the current revision of Katahdin Analytical Services SOP CA-101, Equipment Maintenance, for more information.

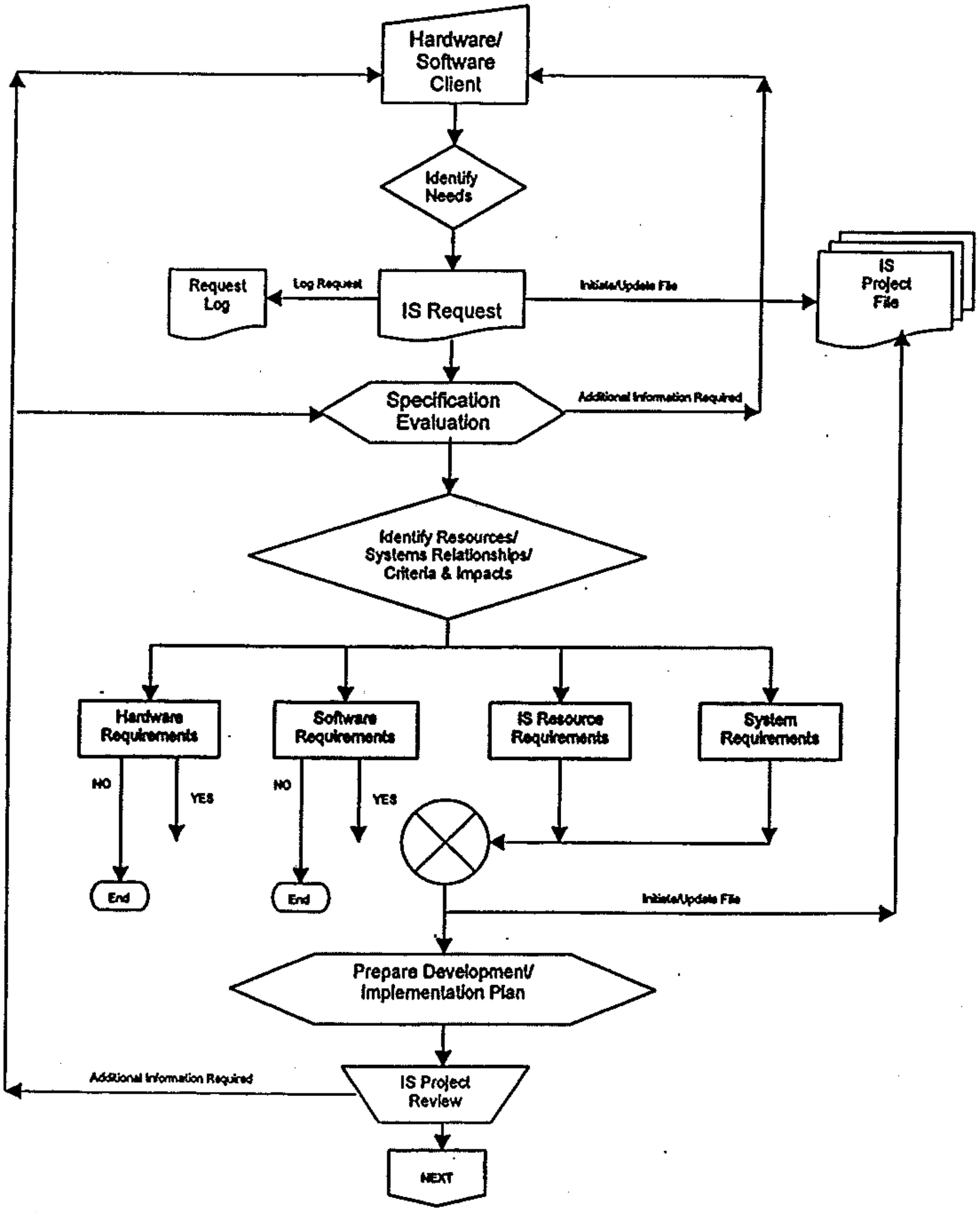
10.6 Preparation Logbooks

All data pertinent to sample preparation shall be recorded by the laboratory staff in bound notebooks with numbered pages and/or in the Laboratory Information Management System (LIMS). During the sample preparation process, a preparation record shall be prepared for the project by the preparation analyst. It shall contain the following information:

- Sample identification numbers
- Date of preparation
- Method reference
- Analyst's initials
- Preparation weights and/or volumes (initial and final)
- Reagent/solvents used including manufacturer and lot number
- Relevant blank
- Spike and surrogate data including the serial reference number
- Instrumental analysis to be performed on each extract
- Notable observations

FIGURE 10-1

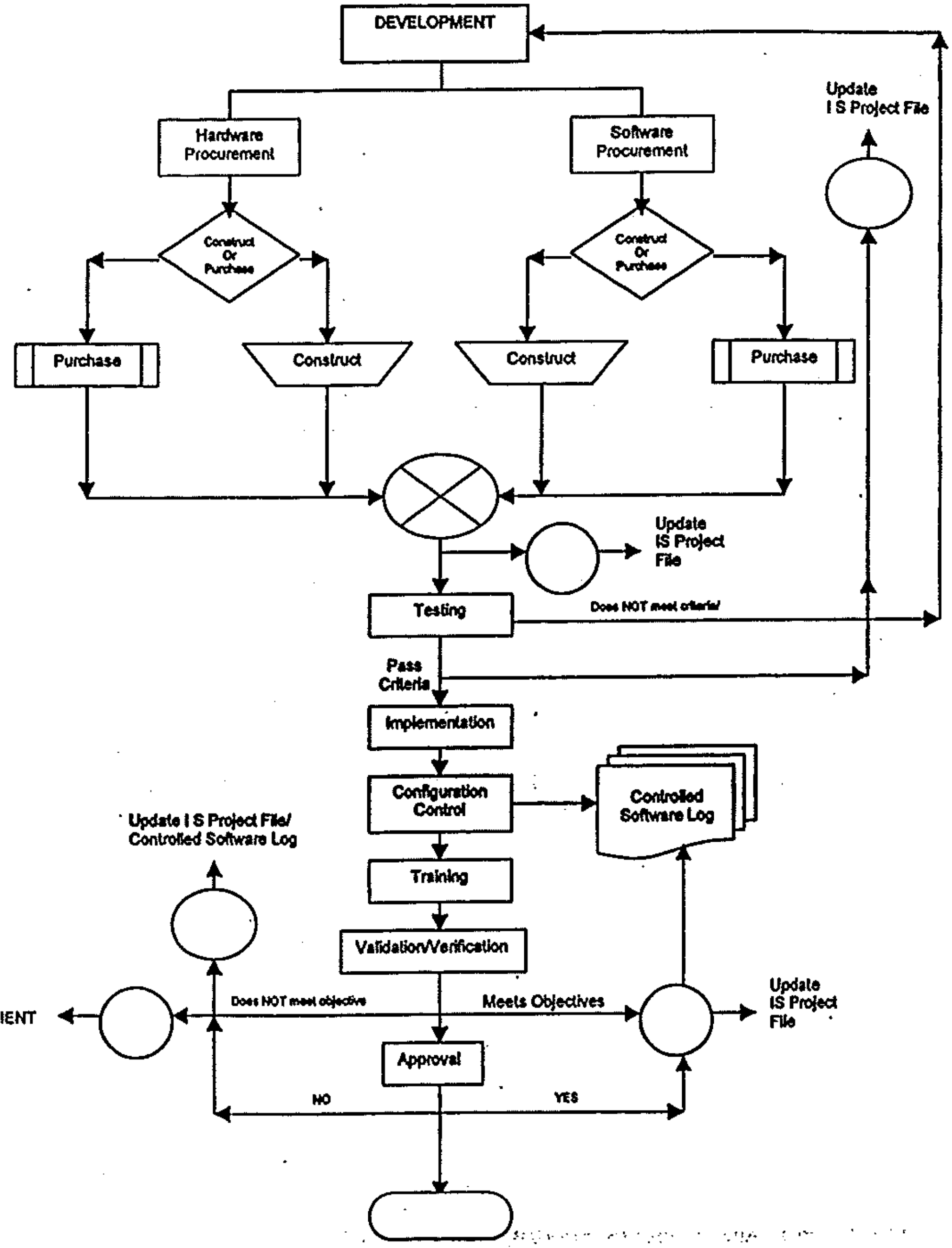
INFORMATION SYSTEMS LIFE CYCLE PROCESS



1 OF 2

FIGURE 10-1, continued

INFORMATION SYSTEMS LIFE CYCLE PROCESS



2 OF 2

Matrix Spikes/Matrix Spike Duplicates are similar to Laboratory Control Samples except the analytes used for spiking are added to a second and third separate aliquot from the client samples in a batch of analyses. They incorporate sample matrix effects and field conditions. Matrix spikes are routinely prepared at a frequency of one set (MS/MSD) per twenty samples for organic analyses and one MS per twenty samples for inorganic analyses when adequate sample volume is provided.

Surrogates provide an estimate of accuracy for each sample analyzed by GC/MS and most GC analyses. The accuracy measurement incorporates sample matrix effects and field conditions and is based on recovery of compounds similar to the target analytes, but not expected to be present in the sample as received. Surrogates are added to all samples analyzed by GC/MS, certain GC, and certain HPLC analyses prior to sample preparation.

An **Internal Standard** is an analyte that has the same characteristics as the analyte(s) of interest, but is added to each sample in a batch, just prior to analysis and is used for quantitation. It corrects for bias or change in instrument performance from sample to sample, incorporating effects associated with the analytical process only.

Accuracy is expressed as Percent Recovery (%R). For LCSs and surrogates, percent recovery (%R) is calculated using the following equation:

$$\%R = (SR / SA) * 100$$

where:
SR is the concentration determined
SA is the concentration spiked

For matrix spike samples, the percent recovery is calculated using the following equation:

$$\%R = (SSR-SR)/SA \times 100$$

where:
SSR is the spiked sample determined result
SR is the original sample determined result
SA is the amount of spike added (expected)

Precision Measurements

A **Sample Duplicate** is a sample that has been homogenized and split into two equal portions before the method specified sample preparation process. It measures sample precision associated with the preparation through analysis and is prepared and analyzed at a rate of one per batch or one per twenty samples (if a batch is less than twenty samples) in the inorganic laboratories. For organic analyses the MS/MSDs fill this function and provide an measure of overall precision.

The comparison of the values determined for a sample and its duplicate (S/DUP or MS/MSD) is expressed as relative percent difference (RPD). RPD is calculated using the following equation:

$$RPD = \frac{S-D}{[(S+D)/2]} \times 100$$

where: S is the determined result of the original sample
D is the determined result of the duplicate sample

The vertical bars in the above equation indicate the absolute value of the difference, hence RPD is always expressed as a positive value.

11.2 Statistical Control Limits

Statistically derived laboratory limits serve as a tool for evaluating method performance, for evaluating individual analyst performance and for monitoring the effects of changes to the analytical methods. Current lab policy states that statistically derived QC limits for Surrogates, Laboratory Control Samples and/or matrix spike/matrix spike duplicates are to be calculated as ± 3 standard deviations from the mean recovery of a minimum of twenty data points. This is typically done annually for those methods that are performed routinely. For methods that are not performed routinely, derived limits are only generated if enough data points are obtained. For methods that are not routinely run, all data points may be used in the determination as long as all routine applicable QC criteria have been met for the analysis. For methods that are routinely run, data points shall be chosen at random, either manually or through the applicable database. Again, all data points used in the determination must be taken from data where all routine applicable QC criteria have been met for the analysis.

The percent recovery is calculated for each spiked analyte. The average percent recovery (X) and the standard deviation (s) are calculated for the group of samples.

11.2.1 Limits

Both upper and lower warning limits and upper and lower control limits are established to interpret performance. Warning limits express a narrower confidence interval and are used to warn the analyst or supervisor of possible system inconsistencies or failures, before an out-of-control event occurs. Control limits express the outer limits of accepted method variability. Control limits and warning limits are reviewed periodically against performance. Based on statistical considerations, an evaluation is made to determine whether the control limits need to be revised.

Warning Limits

When not mandated by the method, Katahdin Analytical Services adopts warning limits to be the mean ±2 standard deviations or a 95% confidence interval, where:

Mean

$$\overline{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$$

Standard Deviation

$$S^2 = \frac{\sum_{i=1}^{n} x_i^2 - (1/n)\left(\sum_{i=1}^{n} x_i\right)^2}{n-1}$$

where: $\overline{X}$ = mean value
X = individual values
n = total number of values

Control Limits

Unless otherwise specified by the analytical method in use or by the project QA plan, Katahdin Analytical Services uses the 99% confidence interval as the control limits, which is defined as the mean ±3 standard deviations. Where the method specific ranges have been determined, Katahdin Analytical Services' goal is for their control limits to fall within the method limits.

The control limits and warning limits used to evaluate a sample should be those in place at the time that the sample was analyzed. Once limits are updated, the limits should apply to all subsequent analyses. It is the responsibility of the section supervisors, Operations Manager or General Manager to inform the QAO when new limits need to be derived. The QAO, or designated person, will derive the new limits, update the appropriate database and ensure that all associated personnel are aware of the updated limits.

11.3 Control Charts

Control charts are quality control tools that graphically display the QC parameters over time. The lab may generate control charts as a means to identify method or analyst performance issues.

11.3.1 Accuracy

Accuracy charts can be used for Surrogate and Laboratory Control Sample recovery. Each sample is identified by the date it was analyzed and its Katahdin Analytical Services sample number, where applicable.

The percent recovery is plotted onto the graph where:

- the x-axis is the sample ID; and
- the y-axis is the range of percent recoveries.

11.3.2 Precision

Precision charts can be used for LCS/LCSD and MS/MSD comparison. The relative percent difference is plotted on the graph where:

- the median, zero, represents 0% difference
- the x-axis is the number of data points per chart; and
- the y-axis is the range of relative percent differences.

Both samples are identified by the date(s) analyzed and their Katahdin Analytical Services number.

Control chart limits are established as described above in section 11.2.1. They may be evaluated using the following guidelines.

11.3.3 Suspicious/Out-of-Control Events

Plotting and connecting successive data points on control charts enables the laboratory to detect many types of suspicious and out-of-control situations. These events can be caught by monitoring the following: outliers (suspicious and out-of-control), runs (suspicious), trends (suspicious), and periodicity (suspicious).

11.3.4 Outliers

There are two types of outliers: any particular point that falls outside the control limits or any point that falls outside the warning limits. A point that falls outside the control limits is classified as an out-of-control event; a point that falls outside the warning limits is classified as a suspicious event.

11.3.5 Runs

A run is defined as a series of points that line up on one side of the central line (the mean). Any run that has a length of seven points is indicative of a potential abnormality in the process, a suspicious event. A run can suggest several potential problems such as a leak in the system, elevated contamination, or incorrect dilutions of standards.

11.3.6 Trends

A trend is defined as a series of points that are marked by an unbroken rise or fall. Any trend with a length of five points is classified as a suspicious event. A trend may indicate a change in instrument sensitivity due to a dirty source or injection port or standard degradation, to name a few.

11.3.7 Periodicity

Periodicity is a term used to describe a recurring pattern of change over equal intervals. This occurrence may be of any length or amplitude; thus, careful observation of the control chart is necessary.

11.4 Utilization of Quality Control Data

The purpose for preparing and analyzing quality control samples is to demonstrate, through the known entities, how accurate and precise the investigative sample data are. Appendix A summarizes the quality control assessment criteria by matrix for the methods most commonly used by the Katahdin Analytical Services laboratory. Different criteria may be dictated by different methods, programs or by project QA plans. Most Standard Operating Procedures for individual analytical methods contain QC requirements and corrective action tables similar to Appendix D.

APPENDIX D

Katahdin Analytical Services, Inc.
Typical Quality Control Criteria

TABLE 1
QC REQUIREMENTS - VOLATILE ORGANICS, METHOD 8260

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to the criteria listed inSection 7.4 of this SOP	Retune instrument, and verify
Five-point calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF ≥0.30, except chloromethane and 1,1-DCA ≥0.10 and bromoform >0.10; RSD for RFs ≤ 30 for CCCs	Repeat initial calibration
Calibration verification	Once per each 12 hours, prior to sample analysis	SPCCs minimum RF ≥0.30, except chloromethane and 1,1-DCA ≥0.10 and bromoform >0.10; RF for CCC analytes within 20% (%D) of average initial multipoint RF	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification
ISs	Immediately after or during data acquisition of calibration check standard	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS	Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning
Method Blank	One per batch of 20 or fewer samples	No analytes of interest detected > PQL	(1) Investigate source of contamination (2) Reanalyze method blank and all samples processed with the contaminated blank
LCS analytes spiked at 50 ppb	One LCS per batch of 20 or fewer samples	Statistically derived from lab data, otherwise nominal limits; Refer to Table 2	(1)Reanalyze all affected QC and field samples if statistical limits exceeded (2)Evaluate impact on sample data if nominal limits exceeded; reanalyze samples or narrate and document on CAR
Surrogate spike	Every sample, control, standard and method blank	70-130% recovery, until laboratory limits are calculated	(1) Check chromatogram for interference; if found, flag data (2) If not found, check instrument performance; if problem is found, correct and reanalyze (3) If still out reextract and analyze sample (4) If reanalysis is out, flag data
MS/MSD	One MS/MSD per every 20 samples	Statistically derived from lab data; Refer to Table 2	(1) If LCS in criteria and matrix interference indicated, no corrective action (2) Else, reanalyze
MDL Study	Once per year	Detection limits established shall be < the PQLs	Repeat MDL study

TABLE 1

QC REQUIREMENTS

Parameter/ Method	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
PCBs EPA 8082	Method blank	One per prep batch	No analyte detected >PQL	(1) Investigate source of contamination (2) Evaluate the samples and associated QC: i.e. If the blank results are above the PQL, report sample results which are <PQL or > 10X the blank concentration. Otherwise, reprep a blank and the remaining samples.
	LCS	One per prep batch	Statistically derived limits; see Figure 4.	(1) Evaluate the samples and associated QC: i.e. If an MS/MSD was performed and acceptable, narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, narrate. If the surrogate recoveries in the LCS are also low but are acceptable in the blank and samples, narrate. If the LCS recovery is high but the sample results are <PQL, narrate. Otherwise, reprep a blank and the remaining samples.
	CCV	One after every 20 samples(10 recommended): mid-point concentration	± 15% D	(1) Evaluate the samples: If the %D >+15% and sample results are <PQL, narrate. If %D >±15% only on one channel, narrate. If %D >±15% and is likely a result of matrix interference, narrate. Otherwise, reanalyze all samples back to last acceptable CCV.

TITLE: TRACE METALS ANALYSIS BY ICP-AES USING METHOD 6010B

TABLE 1

QC REQUIREMENTS

Method	QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action
6010B	Initial Calibration, minimum 1 point plus a calibration blank.	Daily prior to sample analysis.		
	Initial Calibration Verification (ICV), prepared from a second source.	Before beginning a sample run.	Recovery within ± 10% of true value.	Correct problem and repeat calibration.
	Initial Calibration Blank (ICB)	Before beginning a sample run.	Less than PQL.	Correct problem and repeat calibration.
	Interference Check Standard A (ICSA)	Before beginning a sample run.	For Al, Ca, Fe, and Mg, recovery within ± 20% of true value. For analytes not spiked, ± PQL, or, if PQL ≤ 0.01 mg/L, ± 2x PQL.	Correct problem (recalculate IECs if necessary) and repeat calibration. Reanalyze all affected samples.
	Interference Check Standard B (ICSAB)	Before beginning a sample run.	Recovery of each analyte within ± 20% of true value.	Correct problem (recalculate IECs if necessary) and repeat calibration. Reanalyze all affected samples.
	Continuing Calibration Verification (CCV)	After every 10 samples and at end of the run	Recovery within ± 10% of true value	Repeat calibration and reanalyze all samples analyzed since the last successful CCV.
	Continuing Calibration Blank (CCB)	After every 10 samples and at end of the run.	Less than PQL.	Repeat calibration and reanalyze samples if measured concentrations are > PQL and < 10x CCB value.

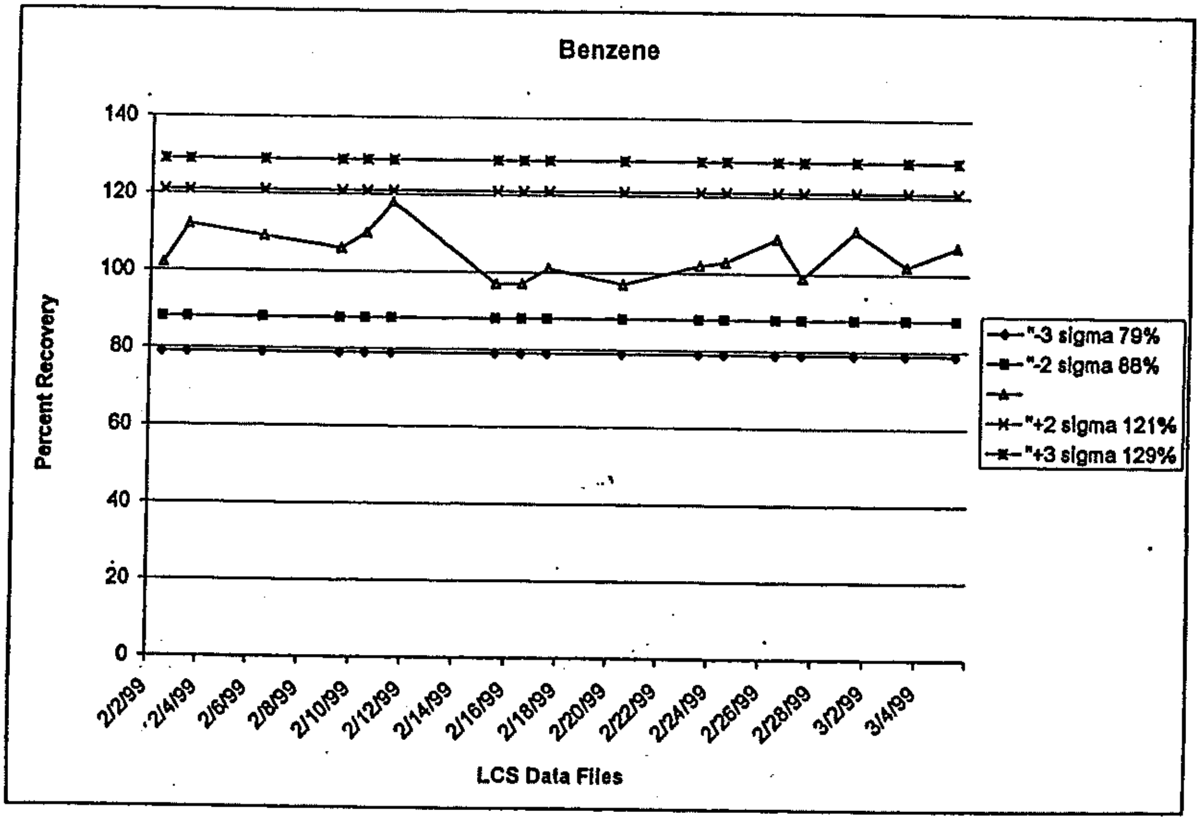
TABLE 1

QC REQUIREMENTS

Parameter/ Method	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Chloride EPA 325.2	Method blank	One per prep batch	No analyte detected >PQL	(1) Investigate source of contamination (2) Report all sample results <PQL. (3) Report sample results >10X the blank result and flag results with a "B". (4) Reanalyze all other samples associated with the failing blank.
	LCS/ICV	One per prep batch	80-120 %R; Statistically derived from lab data when able	(1) If the LCS fails high, report samples which are <PQL. (2) Recalibrate and/or reanalyze other samples.
	CCV	One after every 10 samples	90-110 %R; Statistically derived from lab data when available.	(1) If the LCS fails high, report samples which are <PQL. (2) Recalibrate and/or reanalyze other samples.
	Matrix Spike	One for every set of 10 samples	75-125 %R	(1) If lab QC in criteria and matrix interference suspected, flag data (2) Else, reanalyze
	Sample Duplicate	One sample duplicate per 20 samples	RPD ≤20%	(1) If lab QC in criteria and matrix interference suspected, flag data (2) Else, reanalyze
	Demonstration of analyst proficiency; accuracy and precision	One time demonstration by each analyst performing the method	Must pass all applicable QC for method	Repeat analysis until able to perform passing QC; document successful performance in personal training file
	MDL study	Once per year	MDL< the given PQLs	Repeat MDL

FIGURE 11-1

Example of Accuracy Control Chart



12.0 STANDARD OPERATING PROCEDURES

12.1 Purpose and General Provisions

Standard Operating Procedures (SOPs) are formal, revision-controlled documents that:

1. provide standard methods for execution and documentation of work, to maximize consistency, uniformity and reliability of products;

2. establish the basis for similar training of personnel and set a standard for assessment;

3. facilitate coordination among individuals performing separate, but interdependent tasks; and

4. define, to Katahdin Analytical Services' clients and to regulatory agencies, the methods used by Katahdin Analytical Services in the performance of tasks having an effect on the quality of data, findings or conclusions;

SOPs describe standard methodologies that may at times be inappropriate for a specific project. In such cases, exceptions to the SOPs are stated in the raw data or the analytical narrative with rationale.

12.2 Responsibilities

Supervisors and analysts are responsible for determining, through consultation with the Quality Assurance Officer and Management, the activities that require SOPs. Supervisors are also responsible for working with the appropriate technical personnel to develop the SOPs.

The Quality Assurance Department is responsible for obtaining technical review and approval of SOPs, for maintaining control of new SOPs and revisions, and for maintaining an up-to-date distribution list for SOPs.

Katahdin Analytical Services personnel are responsible for performing tasks in accordance with applicable SOPs, except as explicitly directed by a relevant Quality Assurance Project Plan, contract, or Health and Safety policy. Katahdin Analytical Services personnel are also responsible for assisting in designing accurate and practical SOPs and in keeping the SOPs up-to-date.

Technical reviewers of SOPs are responsible for providing review of drafts sent to them within the schedule indicated in the request.

12.3 Minimum Contents of SOPs

Each Standard Operating Procedure shall contain at a minimum, the following information:

<u>Title</u> - The name of the concerned task

SOP Number - The internal document control number assigned and tracked by the QA Department

Acceptance - The signature of the originator(s), Quality Assurance Officer and appropriate operations management authority to officially adopt the procedure

Date - Date of issue of most recent revision

Scope and Application - An explanation of the objectives of the procedure, typical applications and limitations

Definitions - A listing of any terms, expressions, or acronyms found in the procedure

Responsibilities - Identification of the individuals (by title or organizational position) and their responsibilities in performing and facilitating the tasks governed by the SOP

Health and Safety Considerations - A discussion of specific Health and Safety issues that must be considered prior to and during the performance of the procedure described.

Summary of Method - A short synopsis of the chemistry involved in the procedure.

Interferences - Any factors that may interfere with the proper performance and/or outcome of a procedure and that could compromise the results.

Apparatus and Materials - A complete list of the equipment, apparatus, etc. needed for the procedure

Reagents - A complete list of the reagents, standard solutions, solvents, etc. needed for the performance of this procedure

Sample Collection, Preservation and Handling - Any special considerations needed to assure the integrity of the sample and, consequently, the analytical process.

Method/Procedure - A clear description of the task on a step-by-step basis. The method description should be written clearly enough, and in sufficient detail, to ensure that any two persons performing the procedure will achieve equivalent results, and to provide clients and reviewing agencies with a thorough understanding of the procedure. Acceptable and equivalent alternatives should be addressed whenever possible, and described in the same detail. Where applicable to the SOP, the procedure should include a discussion of sample preparation and calibration requirements and also a summary of the automated and manual calculations performed as well as reporting requirements, including data flow charts as appropriate. The SOP should address differences between a published method and Katahdin Analytical's performance of that method if any exist.

Quality Control Requirements and Acceptance Criteria and Corrective Actions - An outline of quality control requirements, including procedures, frequency requirements, and acceptance criteria. Corrective actions include a description of what must be done, when and by whom in instances when the QC requirements are not met. This section may be in the form of a table.

Applicable Documents/References - A listing of pertinent, supporting procedure or reference documents such as methods, manuals and/or SOPs

12.4 SOP Development and Approval

Laboratory SOPs are developed by the laboratory's technical staff, working with the QA Department. The QA Department will also assist by assigning SOP numbers and by coordinating word processing, review and approval. Laboratory SOPs must be reviewed and approved by the management of the laboratory operations to which the SOPs apply. Thus, the following people must review and approve each laboratory SOP:

- the Supervisor of the specific operation to which the SOP pertains or the Operations Manager - This signature indicates that the written SOP reflects the current practice in the laboratory.
- the Laboratory Operations Manager - This signature indicates that the SOP is technically adequate to handle the analysis of environmental samples expected to be received at Katahdin Analytical Services and technically compliant within the framework given in Section 8.0 and with any known exceptions noted.
- the Quality Assurance Officer - This signature indicates that the SOP has been reviewed for compliance with the referenced methods and that discrepancies between the method and practice have been resolved.
- the General Manager - This signature signifies a management review and approval of the practices detailed in the SOP.

12.5 Numbering

Each SOP is assigned a unique Katahdin Analytical Services number from the inventory of Katahdin Analytical Services SOPs maintained by the QA Department.

12.6 Revisions

SOP revisions may be necessitated by regulatory requirements, technological advancements or other causes, but not by the requirements of a single project alone. Contradictions between standard procedures and the requirements of a specific project are resolved in the quality assurance plan for that project and are communicated internally through an incoming sample information sheet (Figure 12-1) or checklist, generally initiated by project management.

Revisions may be proposed initially by the Quality Assurance Department or they may be recommended by users. Recommendations for revisions must be sent to the Quality Assurance Department.

Technical changes to an SOP need to be made immediately, but revisions must not be made by an individual to only his/her personal copy. If there are changes to an SOP, they need the approval of the appropriate Supervisor, Operations Manager, and QA, and the changes, written up as a "Memo To File", must be appended to ALL copies of that SOP in use in the lab until a formal full revision is complete. A formal revision should be initiated ASAP. Recommendations for minor revisions will be accumulated by the QA Department until sufficient to warrant a document revision.

Revisions are accomplished by the preparation of a new typed draft with the changes incorporated and listed on the cover page. (The cover page is a permanent document and stays with the SOP despite revisions.) Approval of the revisions is signified by dated acceptance signatures adjacent to the listed revisions in the lower section of the cover page. The QA Officer is authorized to approve minor revisions. Revisions which affect the technical approach or content will also require review and approval by the Supervisor or Operations Manager. Once formally accepted, the revised document replaces the previous version and is distributed to controlled copy holders with instructions as to what document(s) it replaces. All out-dated copies of the SOP are retrieved by the QA Department or designee and destroyed.

Occasionally, revisions are significant enough to warrant a complete rewrite. In such cases, the changes are not listed on the cover page. Instead the words "complete rewrite" are entered and the new document must undergo review and approval as for a new SOP. The judgment as to whether a complete rewrite is required shall be made by the Quality Assurance Officer in cooperation with the Supervisor and/or Operations Manager.

Technical revisions and complete rewrites will necessitate training recertification for all personnel involved. The Supervisor or Operations Manager is responsible for ensuring that training is accomplished and documented. Required training documentation and instructions will be distributed with the SOPs by the QA Department.

12.7 Document Control and Distribution

SOPs must reflect current operating conditions and be compliant with applicable method and program requirements. To meet these needs, all Katahdin Analytical Services SOPs and SOP revisions used within the laboratory must be controlled documents which are administered by the QA Department. Each page of a controlled copy is marked as such in contrasting ink (typically red or blue) to prevent the use of un-controlled photocopies. The QA Department maintains an inventory of all SOPs developed by the laboratory and their revision status.

The QA Department distributes SOPs to technical staff as required, maintains distribution lists to ensure that revisions and new SOPs are distributed to all appropriate individuals, periodically verifies that SOPs in use in the lab are current, controlled copies and ensures that obsolete versions are removed from use and destroyed. A Receipt Acknowledgment Form is completed for each SOP for tracking and distributing updates of the documents. Refer to Katahdin Analytical Services SOP QA-804, Document Control for Standard Operating Procedures.

12.8 SOP Archive

An archive of all laboratory SOPs, in the form of both hard-copy and electronic masters of current revisions, is maintained by the Quality Assurance Department within Katahdin Analytical Services. The archive also contains a hard-copy master of all obsolete versions of each revised SOP.

SOPs are distributed from the archive. Access to originals is obtained through QA personnel.

FIGURE 12-1

INCOMING SAMPLE INFORMATION SHEET

Initials/Date: ____________

INCOMING SAMPLE INFORMATION SHEET

CLIENT NAME: ______________________ ROA CC: ____________
ATTENTION: ______________________
ADDRESS: ____
____
TELEPHONE NO: ____________________ FAX NO: ____________
OTHER CLIENT CONTACTS: ________________________________
____
PURCHASE ORDER NO: ____________________ CLIENT ID: ____________
QUOTATION NO: ____________________ MEANS OF DELIVERY: ________
PROJECT NAME: ____________________ SAMPLE RECEIPT DATE: ______
NUMBER/TYPE OF SAMPLE(S): ________________________________
____
PARAMETERS: ____
____
TURNAROUND TIME: ____________________ QC LEVEL: ____________
COST: ______________
GROUP: WC ____ AA ____ GC ____ GC/MS ____ Prep ____ Sub/Network ____ Sampling ____
PRIMARY LAB CONTACT: ______________

Please summarize pertinent and unusual information from the reverse.

**** PHOTOCOPY BOTH SIDES OF THIS SHEET. ATTACH TO QUOTE IF QUOTE IS*

FIGURE 12-1, continued

INCOMING SAMPLE INFORMATION SHEET

QUOTATION CHECKLIST

- Who is the client and what is the purpose of the analytical work? (Regulatory, Site Assessment)
- What is the specific project name/site name?
- Is this a proposal or project? If it's a proposal, what are the main considerations for award, and what is the probability of being awarded the work?
- What is the expected number, frequency and date of submittal of the samples in this program?
- What is/are the sample types? Please provide additional information if the matrix is non-standard (other than aqueous/soil/sediment).
- What sample analyte concentrations are available? What are the expected contamination levels?
- What are the parameters?
    - Are there specific method requirements guided by specific regulations?
    - Are there special or required reporting limits?
    - What are the sample handling plans- filtration, collection, field QC samples?
- What level of Quality Control Reporting is required? Is this guided by a regulatory program where specific quality control samples are needed (i.e. MS/MSDs)?
- Will the laboratory provide sample containers?
- What is the required turnaround time? Are there specific regulatory or report deadlines, late delivery penalties, or sample batching requirements?
- Are there any other special deliverables required (i.e. diskette deliverables, separate/additional copies of ROAs, verbal reporting, explanatory cover letters)?
- May the samples be returned to the client?
- Are there any unusual or new DETS to be used for login?

13.0 PERFORMANCE AND SYSTEM AUDITS

Katahdin Analytical Services participates in a variety of interlaboratory and intralaboratory tests and performance checks to provide periodic assessment of the effectiveness of the overall quality control program.

13.1 Interlaboratory Performance Surveys

Performance evaluations conducted by the USEPA constitute the bulk of interlaboratory comparisons.

- EPA Performance Evaluations(PE) - Water Supply - Semiannual
    * Trace Metals
    * Nitrate/Nitrite/Fluoride
    * Trihalomethanes (THMs)
    * Volatile Organic Compounds
    * Turbidity
    * Total Filterable Residue
    * Calcium (as $CaCO_3$)
    * pH
    * Alkalinity
    * Corrosivity
    * Sodium
    * Sulfate
    * Total Cyanide
- EPA Performance Evaluations(PE) - Water Pollution - Semiannual
    * Trace Metals
    * Minerals
    * Nutrients
    * Demand
    * PCBs
    * PCBs in Oil
    * Pesticides
    * Volatile Halocarbons
    * Volatile Aromatics
    * Total Cyanide
    * Non-Filterable Residue
    * Oil and Grease
    * Total Phenolics

The performance of each laboratory is evaluated by the respective agency after each round of testing and reported to the appropriate Laboratory Operations Manager. The Laboratory Operations Manager forwards the results to the QA Department in charge of certifications. The QA Department distributes copies of the results to Supervisors (if applicable).

In addition to the EPA WP/WS performance evaluation studies, Katahdin Analytical Services participates in a number of federal and state studies such as US Navy NFESC, US Army COE, US DOE HAZWRAP, US EPA DMR PE, California, New York and North Carolina studies. Katahdin may also participate in commercial studies when requested by a client. Please refer to the current revision of Katahdin Analytical Services Statement of Qualifications Manual for a comprehensive listing of approvals and certifications held by Katahdin. With the privitization of the USEPA PE program, Katahdin will be purchasing its WS and WP samples from an outside vendor beginning in the spring of 1999.

13.2 Periodic Internal Audits

Internal auditing is conducted by the QA Department or designee. Typically these audits focus on either performance relative to an SOP or a specific project. Internal audits take two forms - performance audits and systems audits. Performance audits involve submittal of blind spikes to the laboratory by the Quality Assurance Department for assessment of analytical accuracy. Systems audits consist of a thorough review of procedures and documentation to confirm that work is being performed in accordance with this Manual, SOPs, and/or project QA Plan and that adequate documentation exists to satisfy the project requirements.

13.2.1 Performance Audits

Audit Standards

Due to the high number of Performance Evaluation studies that Katahdin Analytical Services participates in, the Quality Assurance Department does not routinely conduct internal performance audits. Commercial vendors have the ability to perform shelf life studies and round robin studies on the samples that they provide. Most of the PE samples that are analyzed at Katahdin are provided by commercial vendors. The results of each PE study are carefully reviewed by the laboratory staff and QAO to determine if corrective action should occur. Corrective action may encompass incorporating blind PE samples into the normal sample flow. The QAO shall communicate quarterly all findings made during PE review to the General Manager

The Quality Assurance Department may provide independent check samples (audit standards) if required on specific projects. The QA Department prepares any audit standards that can be prepared readily from relatively non-hazardous, pure materials or certified concentrated standards. The nature of the audit standards and the frequency of performance audits are specified in the Quality Assurance Plan of each project for which performance auditing is required. When practical, audit standards are provided in matrices resembling real project sample matrices, and undergo the full sample preparation and analysis procedure. However in many cases this is impractical, and it is necessary to submit audit samples as extracts, for analysis only. All measurable constituents in the audit standards should be within the expected range of concentrations to be encountered in the real samples (or in the extracts).

13.2.2 Systems Audits

Systems audits address general laboratory operations and conformance to the Laboratory Quality Assurance Manual. Systems audits of laboratory operations are performed at a minimum frequency of once per year per laboratory group (i.e. wet chemistry, metals, organic extractions, GC, GC/MS).

Some quality assurance project plans, QAPPs, require project-specific laboratory systems audits (Project Audits).

Systems Audit Procedures

Systems audits are performed by the QA Department. Audit checklists may be used to ensure that all salient points are addressed and documented. The checklists are filled out legibly and reproducibly, in ink, by the auditor, and are signed and dated by the auditor when completed. The audit checklist is based on EPA laboratory evaluation criteria, the provisions of the Laboratory Quality Assurance Manual and Katahdin Analytical Services SOPs. Project audit checklists are drawn from the applicable QAPPs, as well as relevant provisions of the QA Manual.

Audit checklists will cover at least the following areas:

- Systems Audit
  - Personnel qualifications and training records
  - Adequacy of laboratory facilities, including work space, lighting, ventilation, and supplies
  - Maintenance and calibration recordkeeping for analytical equipment
  - General operations, including glassware cleaning, inventory and checking of reagents and standards, and storage procedures
  - Recordkeeping, including sample log-in and tracking, traceability of standards, control charts, and raw data recording and tracking.
- Project Audit
  - Sample log-in and chain-of-custody records
  - Sample storage procedures and records
  - Sample preparation and analysis procedures
  - Method validation (where applicable)
  - Conformance to QAPP
  - Control charts (if applicable)
  - Precision and accuracy assessment
  - Method blanks, reagent blanks, duplicates, check samples, fortifications, surrogates, etc.
  - Calibration
  - Data packages

- Analyst qualifications
- Data validation and reporting

13.3 External Audits

In addition to internally conducted systems audits, the laboratory is regularly audited by clients, potential clients, state and federal program regulators, and other organizations. These audits may be specific to program or project requirements, encompass a complete review of laboratory systems, or both.

Katahdin Analytical Services uses these external audits to additionally evaluate laboratory function and performance. The QA Department distributes audit reports to supervisors and management, coordinates corrective actions to any findings, formalizes and documents the responses required, and may use external audit findings as the basis for future internal audits.

13.4 QA Reporting and Corrective Action

Each systems audit (internal or external) is immediately followed by a debriefing, in which the auditor discusses his/her findings with the laboratory representatives. The debriefing serves a two-fold purpose. First, laboratory management is afforded an early summary of findings, which allows them to begin formulating corrective strategies, and second, the auditor has a chance to test preliminary conclusions and to correct any misconceptions before drafting his/her report.

The systems audit report (which may or may not contain performance audit findings) is issued to the Operations Manager and appropriate Supervisors and personnel for corrective action. Responses to the findings are forwarded, in writing, to the auditor. The auditor then circulates the report to the QA Officer and laboratory management.

The Quality Assurance Officer reports results of interlaboratory performance surveys and in-house audits, along with unresolved corrective action items, to the General Manager.

14.0 PREVENTIVE MAINTENANCE

To minimize downtime and interruption of analytical work, preventive maintenance is routinely performed on each analytical instrument. Designated laboratory personnel are trained in routine maintenance procedures for all major instrumentation. When repairs are necessary, they are performed by either trained staff or instrument manufacturer service personnel.

SOPs are written for each instrument that cover basic operation and maintenance procedures. Refer to Katahdin Analytical Services SOPs CA-101, Equipment Maintenance, and CA-102, Balance Calibration. Detailed logbooks documenting preventive maintenance, non-routine maintenance and repairs are also maintained for each instrument. The following are brief summaries of maintenance for each major instrument.

14.1 Preventive Maintenance - GC/MS

Regularly performed maintenance includes, but is not limited to, the following for GC/MS instrumentation:

- hard tune with calibration gas (PFTBA)
- removal of 2-3 inches from the injection end of the capillary columns
- injection port liner replacement
- replace injection port septum
- clean ion source as needed
- check vacuum pump oil level
- check carrier gas tanks
- replace or recondition vent traps

14.2 Preventive Maintenance - GC

Regularly performed maintenance includes, but is not limited to, the following for GC extractable organics instrumentation:

- replacement of 5-10 inches of guard column (if applicable) and 2-3 inches from the injection end of the capillary columns
- injection port liner and RP seal replacement
- replacement of septum

- check carrier and support gases
- fill solvent rinse bottles as needed
- NRC wipe test ECD

Regularly performed maintenance includes, but is not limited to, the following for GC volatile organics instrumentation:

- clean and bake sparge tubes
- replace trap as needed
- check carrier and support gases
- replace transfer line as needed
- replace nickel tube as needed
- clean or replace PID as needed

14.3 Preventive Maintenance - ICP

- check liquid argon tank level
- change pump tubing
- clean nebulizer and spray chamber as needed
- replace and realign plasma torch when required
- check cooling system water level
- empty waste reservoir when full

14.4 Preventive Maintenance - AA Graphite Furnace

- check and align source lamps
- clean and inspect graphite tube, replacing when surface appears excessively burnt or cracked
- clean and inspect contact ring, replacing when excessively worn
- clean mirrors for optical sensor and sample compartment windows
- check autosampler injector alignment and deposition

14.5 Preventive Maintenance - Mercury Analyzer

- Check and align source lamp
- remove and clean sample cell and connecting tubes
- check sparger for proper operation
- clean sample compartment windows

14.6 Preventive Maintenance - General Laboratory Areas

- clean and calibrate balances biannually (minimum)
- check balance calibration each day of use
- clean balance pan prior to each use
- calibrate ASTM Class 1 weights every five years
- calibrate automatic pipettes and burettes monthly
- calibrate thermometers yearly against an NIST traceable thermometer; calibrate digital thermometers quarterly
- record refrigerator, freezer, and oven temperatures each weekday
- clean, check, calibrate to manufacturers' specifications all pH, DO, conductivity, and Turbidity meters annually (minimum); clean, check, calibrate to manufacturers' specifications all spectrophotometers biannually
- general housekeeping: keep counter tops, hoods, and floors clean
- check airflow in hoods once a week

15.0 CORRECTIVE ACTION

For most laboratory situations, problem identification, corrective action, and resumption of operation and/or return to control occurs at the bench, with documentation written directly in the appropriate log books. These occurrences include events where laboratory quality control criteria have been exceeded but which can be corrected without compromising the analytical results or delaying the preparation or analytical process.

For other situations, problem identification, corrective action, and resolution are tracked via Corrective Action Reports (CARs). The underlying purpose of the corrective action process is to identify instances that may adversely affect the data. CARs should be initiated whenever errors, testing discrepancies or deficiencies, departures from documented policies and procedures, or client complaints occur. An example of a CAR is shown in Figure 1.

15.1 Problem Identification

The analyst generating the data is responsible for reviewing all results against the established limits. Any deviations are immediately evaluated as potential out-of-control events. Specific examples of some out-of-control events may be: LCS failures, blank contamination, poor precision, prep errors, missed holding times, login errors, calibration failures, retention time window problems, matrix spike failures and surrogate failures The review process may include the application of statistics. Please refer to the current revision of Katahdin SOP SD-904, Data Reduction and Validation. If data are outside accepted limits, the analyst should review and evaluate the data and all associated Quality Control elements together before making a decision as to the acceptability of the data. Each individual method SOP contains corrective action tables to help guide analysts in making these decisions. Once all QC items have been considered, the analyst should immediately take the appropriate actions.

In the event that problems are not identified prior to reaching the client, the Katahdin Project Manager would receive notification. Events that would require formal corrective action are: inaccurate reports, incomplete reports or that the client is requesting additional information. At Katahdin, such inquiries are handled as client "complaints". The Project Manager shall obtain all of the pertinent information from the client. When the client "complaint" concerns a data quality issue, especially one that may impact the usability of data, the Operations Manager, General Manager or the QAO must be informed. They will help to determine what corrective action, if any, should be taken. All reissued reports must be accompanied by a CAR, which documents the problem and ultimate resolution.

15.2 Corrective Action

The appropriate action will differ with each situation. In some cases data may be reported, but may be reanalyzed in other cases. Making new reagents and standards may be necessary if the standardization is suspect. The supervisor, Operations Manager, General Manager and/or Quality Assurance Officer may be consulted to evaluate data. Due to the extremely short hold time

15.2.2 Surrogates

The % recovery of the surrogates is calculated for each sample, blank, and LCS. Corrective action is taken whenever one (or more) surrogate recovery is outside the acceptance criteria. The following corrective actions are taken when required:

- Check calculations to assure there are no errors;
- Check internal standard and surrogate solutions for degradation, contamination, etc., and check instrument performance;
- If instrument failure is indicated, reanalyze the sample;
- If a method blank surrogate is outside of acceptance criteria, then the problem must be corrected before proceeding with sample analysis. This may include reanalysis, reextraction or recalibration;
- If the surrogate could not be measured because the sample required a dilution, no corrective action is required. The recovery of the surrogate is recorded with the note "surrogate diluted out".
- If all QC associated with the sample is within acceptance limits (the method blank surrogate recovery and LCS spike recovery), the problem may be attributed to a matrix effect. Samples exhibiting a matrix effect as indicated by out-of-criteria surrogate recoveries will be qualified and discussed in the report narrative.

15.2.3 Laboratory Control Samples

The % recovery of Laboratory Control Samples (LCS) is calculated. Corrective action is taken whenever the % recovery is outside the established acceptance criteria. The following corrective actions are taken when required:

- Check calculations to assure there are no errors;
- Check internal standard and spiking standard solutions for degradation, contamination, etc., and check instrument performance;
- If LCS fails high and samples are non-detect, report associated data with a narrative explanation
- Reanalyze other samples associated with a failed LCS, if available;
- If that does not correct the problem, then the data is reported and a qualifying statement included in the report narrative.

15.2.4 Matrix Spike and Matrix Spike Duplicates

The % recovery of Matrix Spike and Matrix Spike Duplicates are calculated. The following corrective actions are taken when required:

- If all QC associated with a sample is within acceptance limits (method blank and LCS spike recoveries), the problem may be attributed to a matrix effect.

15.2.5 Calibration

Individual methods specify calibration frequency and criteria. If the calibration curve is suspect, the following steps should be taken:

- Check internal standard and standard solutions for degradation, contamination, etc.,
- Check instrument for contamination;
- If no source of the problem is identified, then a complete initial calibration must be performed.
- Check instrument for incorrect operating conditions, etc.;

15.3 Documenting Corrective Action

All corrective actions that may affect the reporting of the data as described above shall be documented on a Katahdin Corrective Action Report as soon as possible after problem identification. The following information must be documented on the CAR:

15.3.1 When and where the out-of-control event occurred.

15.3.2 The person who discovered the out-of-control event

15.3.3 What analysis was being performed.

15.3.4 What samples are affected by the out-of-control event

15.3.5 A brief description of the out-of-control event

15.3.6 Steps taken to investigate the out-of-control event

15.3.7 The probable cause of the out-of-control event

15.3.8 Any corrective actions taken, both immediate and long term to prevent reoccurrence

15.3.9 Supervisor review of the corrective actions

15.3.10 QAO review of the CAR

All documentation associated with the CAR, i.e. raw data or reissued reports shall be filed with the associated samples. A copy of the CAR shall also be filed with the samples. The original CAR shall in the QAO's office.

FIGURE 15-1

KATAHDIN ANALYTICAL SERVICES, INC.
CORRECTIVE ACTION REPORT

Katahdin
ANALYTICAL SERVICES

CORRECTIVE ACTION REPORT #________________

Date____________ Analysis/Area__________________________ Matrix________________
Sample Number(s) and Corresponding Client(s):

NOTE: If LCS, Blank, or Check Standard, also list associated samples and clients

I. PROBLEM IDENTIFICATION Brief description of problem: (to be completed immediately by individual discovering problem)

FORWARD CAR TO RESPONSIBLE INDIVIDUAL OR YOUR SUPERVISOR UPON COMPLETING THIS SECTION.

II. PROBLEM INVESTIGATION Steps taken to investigate problem: (to be completed and photocopied to QAC by individual(s) responsible for problem within 12 hours of problem identification)

Probable cause of problem:

Corrective Action Plan (CAP):

Additional Documentation Recommended (circle applicable): Logbook ROA Notation Cover Letter None Narrative

Signature(s)____ Date____________
Intermediate Distribution: Photocopy - QAO

FORWARD CAR TO SECTION SUPERVISOR UPON COMPLETING THIS SECTION.

III. SUPERVISORY REVIEW (to be completed by Section Supervisor within 36 hr. of problem identification)
Response and CAP Review: Acceptable__________ Unacceptable__________
If unacceptable, preferred course of action:

Additional Documentation Recommended (circle applicable): Logbook ROA Notation Cover Letter None Narrative

Corrective actions taken: Verified by________________________________ Date____________
Comments of Section Supervisor:

Steps taken to prevent recurrence:

Signature____ Date____________

FORWARD CAR TO QAO UPON COMPLETING THIS SECTION.

IV. QUALITY ASSURANCE REVIEW (to be completed by QA Officer ASAP after receiving completed CAR)

Problem Resolved: YES______ NO______ New CAR Issued: #______________ Date____________
Comments of laboratory QA Officer:

Signature____ Date____________
Final Distribution: Original - QAO; Photocopy - Section Supervisor, Operations Mgr, General Mgr, ROA File(s)

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Quality Assurance Department is responsible for preparing reports, either written or verbal, to management indicating the effectiveness of the Katahdin Analytical Services Quality Assurance Program.

16.1 Quality Assurance Auditors

Results of audits performed by the QA staff are detailed in formal, written audit reports. These reports are distributed to the appropriate department personnel, Supervisor, Laboratory Operations Manager, QA Officer, and General Manager for review and appropriate action. These and other QA-related reports are distributed as produced, with no set schedule.

Auditor reports will include, but not be limited to:

- Results of internal laboratory review activities
- Results of internal data review activities
- Results of Proficiency Evaluation studies
- Results of state certification applications
- Summary of holding time violation and data qualification
- Method detection limit study status

To demonstrate management review, the audit report will contain a page which will be signed and dated by the QA Officer and General Manager acknowledging that they have received the report and have reviewed its contents, and taken the necessary action dictated by their position.

16.2 Quality Assurance Officer

The Quality Assurance Officer will issue a report of QA activities and findings on a periodic basis to the General Manager. The status report will include:

- Results of internal systems or performance audits
- Corrective Action recommendations
- Discussion of QA issues raised by laboratory users
- Results of third party or external audits
- Status of laboratory certifications
- Other significant events
- Performance Evaluation Sample Results

16.3 Management Review of the Quality Assurance Program

Review of the appropriateness and adequacy of the Quality Assurance Program is ongoing. At a minimum, the General Manager, Operations Manager, and QA Officer(s) review the QA Program Manual and its effectiveness on an annual basis (generally in January) and make modifications as deemed appropriate to improve or update the program. Any laboratory employee may present recommended changes to the Quality Assurance Officer, Supervisors or Operations Manager at any time.

During system audits, the Quality Assurance Program should be discussed. The audit report will document recommendations made by the Operations Manager or the auditor for revision.

REFERENCES

1. "EPA Requirements for Quality Assurance Plans for Environmental Data Operations", U.S. EPA QA/R-5, August 1994

2. "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans", U.S. EPA, QAMS-005/80, EPA-600/4-83-004, February 1983

3. "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act." Federal Register, 40 CFR Part 136, October 26, 1984.

4. "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846. 2nd edition, 1982 (revised 1984), 3rd edition, 1986, and Updates I, II, IIA, and III 1996, Office of Solid Waste and Emergency Response, U.S. EPA.

5. "Methods for Chemical Analysis of Water and Wastes", EPA 600/4-79-020, 1979 Revised 1983, U.S. EPA.

6. "Methods for the Determination of Inorganic Substances in Environmental Samples", EPA 600/R-93/100, August 1993.

7. U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis, SOW 2/88, OLM01.8, 8/91, OLM01.9, OLM02.0, and OLM03.1.

8. U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, SOW No. 788, ILM01.0, 3/90 through ILM04.0.

9. "Standard Methods for the Examination of Water and Wastewater", 15th, 16th, 17th, 18th, and 19th editions, 1980, 1985, 1989, 1992, 1995. APHA-AWWA-WPCF.

10. "Annual Book of ASTM Standards", Section 4: Construction, Volume 04.04: Soil and Rock; Building Stones, American Society for Testing and Materials, 1987.

11. "Annual Book of ASTM Standards", Section 11: Water and Environmental Technology, American Society for Testing and Materials, 1987.

12. "NIOSH Manual of Analytical Methods", Third Edition, 1984, U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health.

13. "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water", U.S. EPA, Environmental Monitoring and Support Laboratory - Cincinnati (September 1986).

14. New York State Department of Environmental Conservation. Analytical Services Protocol, October, 1995.

Statement
of
Qualifications

Revised: January 18, 1999

TABLE OF CONTENTS

ANALYTICAL INSTRUMENTATION

KEY INSTRUMENTATION	DATE IN SERVICE
Hewlett Packard 5972 GC/MS with EPC and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap concentrator equipped with sample heating assembly.	1993
Hewlett Packard 5970 GC/MS with a Tekmar LSC 2000 purge and trap concentrator and Tekmar ALS 2016 autosampler and heating unit.	1988/1998
Hewlett Packard 5972 GC/MS with EPC and Tekmar LCS-3000 Purge and Trap concentrator Archon autosampler capable of low soils per method 5035.	1998
Hewlett Packard 5972 GC/MS with EPC and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap sampler. Available 7673A autosampler.	1996
Hewlett Packard 5970 GC/MS and a model 7673A autosampler.	1989/1998
Hewlett Packard 5970 GC/MS with EPC and Model 7673A autosampler	1989/1996
Hewlett Packard 5972 GC/MS with EPC and Tekmar LSC 3000 Purge and Trap concentrator Archon autosampler capable of low soils per method 5035.	1995
Hewlett Packard 5970 GC/MS with EPC and Model 7673A autosampler	1988/1996
Hewlett Packard Model 5890 gas chromatograph with microcoulometric (Hall) and photoionization detectors and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap sampler equipped with sample heating assembly	1991
Hewlett Packard Model 5890 gas chromatograph with microcoulometric (Hall) and photoionization detectors and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap sampler equipped with sample heating assembly	1986
Hewlett Packard Model 5890 gas chromatograph with EPC and dual electron capture detectors(ECD), and Hewlett Packard Model 7673 autosamplers	1993
Hewlett Packard Model 5890 gas chromatograph with EPC and dual electron capture detectors(ECD), and Hewlett Packard Model 7673 autosamplers	1993
Hewlett Packard Model 5890 gas chromatograph with EPC and dual electron capture detectors(ECD), and Hewlett Packard Model 7673 autosamplers	1989
Hewlett Packard Model 5890 gas chromatograph with dual electron capture detectors(ECD), and Hewlett Packard Model 7673A autosamplers	1988

KEY INSTRUMENTATION	DATE IN SERVICE
Hewlett Packard Model 5890 gas chromatograph with EPC and dual flame ionization detectors and Hewlett Packard Model 7673 autosamplers	1993/1996
Hewlett Packard Model 5890 gas chromatograph with dual flame ionization detectors and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap	1991
Hewlett Packard Model 5890 gas chromatograph with flame ionization detector and photo ionization detector, and Tekmar ALS 2016 autosampler and Tekmar LSC 2000 purge and trap	1988
Hewlett Packard Model 5890 gas chromatograph with dual flame ionization or nitrogen-phosphorous detectors, and Hewlett Packard Model 7673 autosamplers	1992/1996
Hewlett Packard Model 5890 gas chromatograph with dual flame ionization detectors and Hewlett Packard Model 7673A autosampler	1987
Waters HPLC system with 486 uv/visible detector and 474 scanning fluorescence detector and autosampler	1997
Waters HPLC 490E detector, WISP712 autosampler and Foxy JR	1994/1998
ABC Autoprep 1000 GPC with UVD-1 ultraviolet detector, and chart recorder	1994
OI Analytical Soxtherm	1998
Thermo Jarrell Ash 61E "Super trace" axial ICAP with autosampler	1994
Thermo Jarrell Ash 61 simultaneous ICAP with autosampler	1991
Perkin-Elmer Model 5100 atomic absorption spectrophotometer with Model AS-60 autosampler, and Model HGA-600 graphite furnace.	1989
Perkin-Elmer Model 4100 atomic absorption spectrophotometer with zeeman graphite furnace, and Model AS-70 autosampler	1991
Leeman Labs PS200 Automated Mercury Analyzer with autosampler	1994
LACHAT Quickchem AE Ion Analyzer, and autosampler	1992
LACHAT Quickchem AE Ion Analyzer, and autosampler	1992

KEY INSTRUMENTATION	DATE IN SERVICE
Dionex Ion Chromatograph	**1991**
Dohrmann DC80 carbon analyzer with infrared gas analyzer and autosampler	**1987**
Dohrmann DC80 carbon analyzer with infrared gas analyzer, Dohrmann solids furnace.	**1994**
Mitsubishi TOX-10E	**1997**
10 position Lab Crest Cyanide Midi-Distillation system	**1998**
Bausch and Lomb Spectronic 601, UV-visible spectrophotometer	**1991**
Milton Roy Spectronic 301 spectrophotometer	**1987**
Mattson Galaxy Model 2020 FT-IR spectrometer equipped with FIRST software package	**1991**

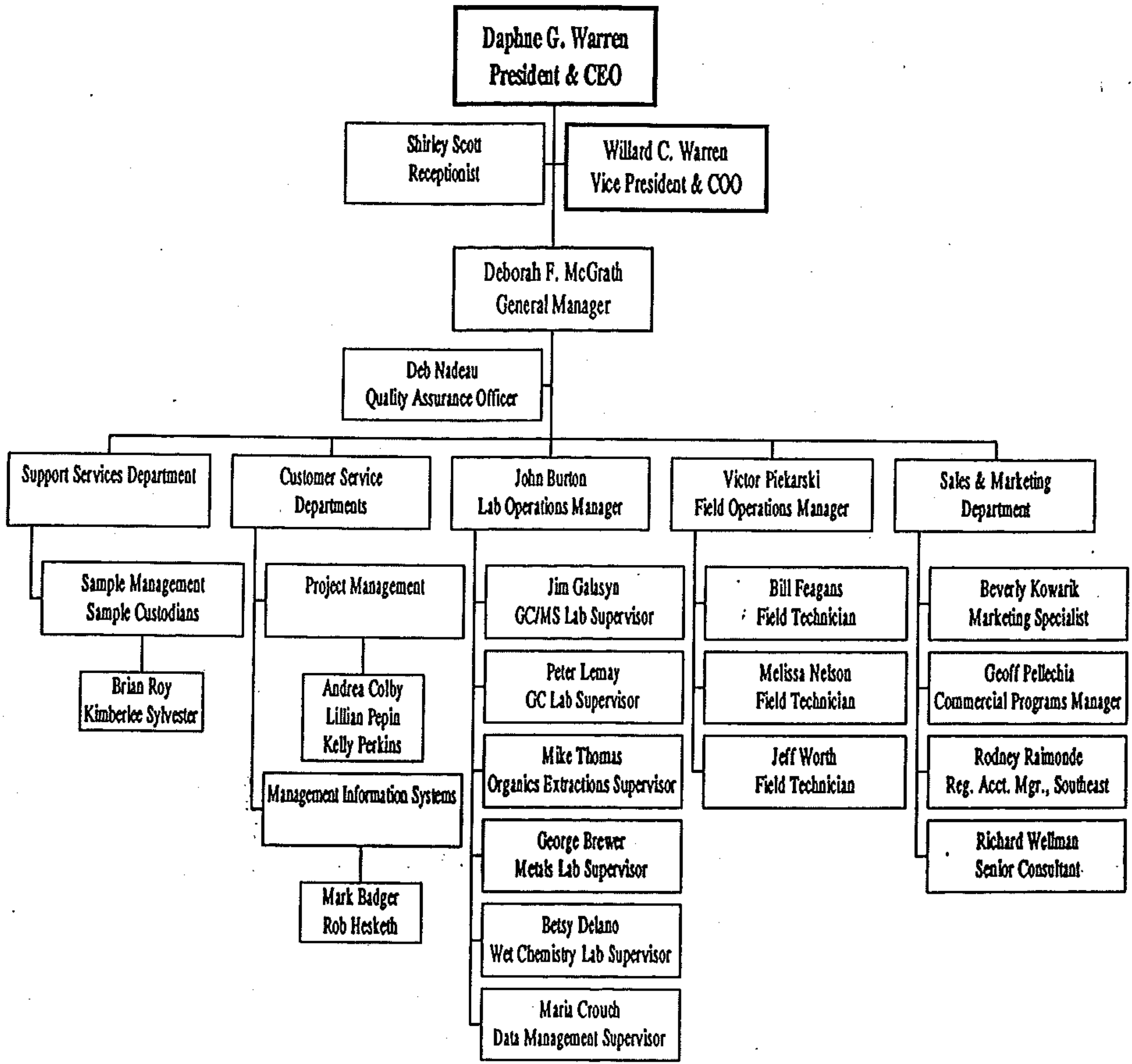
Updated: 1/99

Organizational Chart

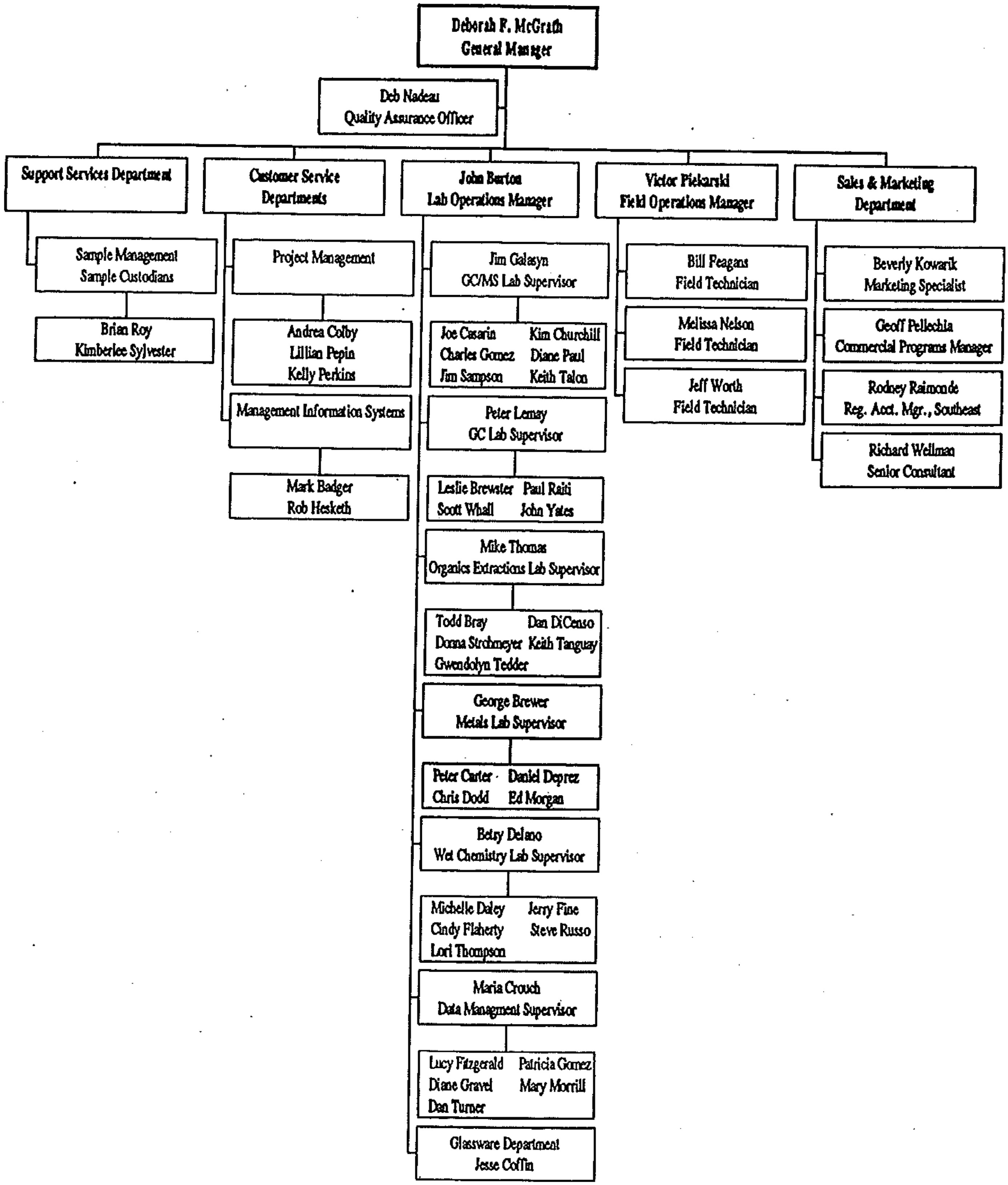
and

Resumes of Key Staff

Katahdin Analytical Services, Inc.
Organizational Chart - January 1999



Katahdin Analytical Services, Inc.
Organizational Chart - January 1999



DAPHNE G. WARREN, President and Chief Executive Officer

PRESENT QUALIFICATIONS SUMMARY

As President and Chief Executive Officer of Katahdin Analytical Services, Ms. Warren brings over 18 years of financial and managerial experience to Katahdin, having worked for Maine's largest banks. This expertise allows Ms. Warren to place the emphasis on the analytical processes of the company while maintaining administrative overhead at a minimum. Ms. Warren is responsible for the management of all aspects of Katahdin Analytical Services, Inc.

EDUCATION

Liberal Arts, University of Southern Maine, 1975

PROFESSIONAL EXPERIENCE

11/95-Present - President and Chief Executive Officer, Katahdin Analytical Services, Inc., Westbrook, ME

9/94-11/95 - Branch Manager, Atlantic Bank, So. Portland, ME -- Ms. Warren was responsible for the administration of one of Maine's largest bank branches. With a deposit base of over $ 30 million, Ms. Warren interacted with the institution's largest clients which included both locally-based and international corporate accounts. Ms. Warren was also responsible for the training in the operation of banking sales, client service, and staff.

4/90-9/94 - Branch Manager, Citibank, Falmouth, ME -- Ms. Warren was responsible for the operations of this branch office. Ms. Warren conducted business primarily with small business clients of this $ 34 million deposit base office. In addition to directing a staff, Ms. Warren also was in charge of consumer lending and sales.

9/89-4/90 - Assistant Branch Manager, Citibank, Falmouth, ME -- Ms. Warren was responsible for sales of deposits with emphasis on lending. She also directed teller activities, both operations and audit.

6/78-8/89 - Consumer Loan Administrator, Sun Savings & Loan Assoc., Portland, ME -- Ms. Warren was responsible for processing and approval of consumer loans, introduction of customer accounts, and client service.

PROFESSIONAL MEMBERSHIPS / COMMUNITY ACTIVITIES

1988-Present -- Board Member, Falmouth-Cumberland, ME Chamber of Commerce
1985-1988 -- Board Member, Greater Portland Council of Governments, Portland, ME
1987-1988 -- Chairperson of Town Council, Cumberland, ME
1983-1988 -- Member of Town Council, Cumberland, ME

updated: 1/96

WILLARD C. WARREN, Vice President and Chief Operating Officer

QUALIFICATIONS SUMMARY

As Vice President and Chief Operating Officer, Mr. Warren is primarily responsible for sales & marketing, and technical operations. In this function, Mr. Warren directs the sales force in targeting opportunities, writing technical proposals, and negotiating contracts. Mr. Warren also works with operational personnel to ensure project requirements are understood and expectations are met. Mr. Warren has operated the present day Katahdin laboratory for prior owners for over ten years.

EDUCATION

B.S./Civil Engineering, 1971, Northeastern University, Boston, MA

PROFESSIONAL EXPERIENCE

11/95-Present - Vice President and Chief Operating Officer

8/94-11/95 - Group Vice President, PACE, Incorporated, Minneapolis, MN -- Mr. Warren was responsible for eight laboratory operations of the eighteen PACE Incorporated Divisions. Mr. Warren had overall financial accounting and operational development of his group which generated over $ 25 million annually. As a Group Vice President, Mr. Warren worked with laboratory General Managers in developing sales and marketing programs, evaluating costs, and implementation of quality assurance standards at each of the laboratories.

1/92-8/94 - President, Northern Division, Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Mr. Warren was responsible for the management of CCAS's Northern Division with overall responsibility for its laboratory operations, including sales & marketing, quality assurance, and financial performance. Mr. Warren also served as project manager for several large scale Federal Program analytical projects within AFCEE and COE. Through his experience, he developed a working knowledge of Federal and State regulations including those promulgated under the Clean Water Act, SARA, CERCLA and RCRA.

1988-1/92 - Director of Laboratory Services, ABB Environmental Services, Inc., Westbrook, ME -- Mr. Warren had overall responsibility for ABB-ES's Westbrook, ME environmental laboratory. Under his direction, Mr. Warren designed ABB's new laboratory which led to the successful move of ABB's laboratory operations to Westbrook. The new lab layout and emphasis on TQM led to an increase in operational efficiency by over 40% within six months.

1971-1988 - Assistant Division Manager/Project Manager, ABB Environmental Services, Inc., Portland, ME -- Mr. Warren was responsible for several ABB-ES technical departments including the environmental laboratory, civil engineering, wastewater engineering, and special studies. Mr. Warren also managed ABB's technical assistance contract with EPA.

WILLARD C. WARREN, Vice President and Chief Operating Officer - Continued

PROFESSIONAL LICENSES

Professional Engineer - Maine

PROFESSIONAL AFFILIATIONS

TAPPI, Chairman, Environmental Division

COMMUNITY ACTIVITIES

Cumberland - North Yarmouth Lions Club - Past Treasurer

updated: 1/96

DEBORAH F. MCGRATH, General Manager

PRESENT QUALIFICATIONS SUMMARY

As General Manager, Ms. McGrath is responsible for the overall management of the Laboratory, which includes the oversight and coordination of the Laboratory and Field Operations, Quality Assurance, Administrative, Support Services, Customer Service, and Sales and Marketing departments.

EDUCATION

B.S. Chemistry, Simmons College, Boston, MA 1971

PROFESSIONAL EXPERIENCE

11/95-Present - General Manager, Katahdin Analytical Services, Inc., Westbrook, ME

3/93-11/95 - General Manager, PACE - Maine Laboratory, Westbrook, ME -- Ms. McGrath was responsible for the overall management of PACE New England's Westbrook, ME and Hampton, NH locations, which included the oversight and coordination of Laboratory and Field Operations, Quality Assurance, Support Systems, Administrative, and Sales/Marketing departments.

1989-3/93 - Vice President and Division Manager, NET Inc., Cambridge Division, in Bedford, MA (formerly Cambridge Analytical Associates, Inc.) -- from 1989-1993 where her responsibilities included oversight of the technical operations and business development of the division. She was Vice President of Environmental Services for one year and Director of Analytical Services for two while employed by Cambridge Analytical Associates, Inc. from 1986-1989.

1981-1986 - Manager of the Laboratory Analysis Department and Inorganics Section, GCA Technology Division, Bedford, MA

1971-1981 - Analytical Chemist, Kennecott Copper Ledgemont Laboratory, Lexington, MA

PUBLICATIONS

Ms. McGrath is the author/co-author of over 15 publications on methods development and comparison studies, waste oil and biota analysis, combustion assessments and waste minimization.

updated: 1/96

DEB NADEAU, Quality Assurance Officer

PRESENT QUALIFICATIONS SUMMARY

As Quality Assurance Officer, Ms. Nadeau is responsible for direction of the laboratory quality assurance program. Primary responsibilities include development and ongoing evaluation of laboratory quality assurance/quality control (QA/QC) procedures, review of quality control data, and performance of internal audits to assess conformance to the laboratory quality assurance program. Additional responsibilities include reviewing and implementating standard operating procedures (SOPs), maintaining laboratory certification programs, overseeing laboratory performance evaluation analyses, reviewing and revising the Laboratory Quality Assurance Manual as necessary and preparing QAPs as directed by the General Manager.

EDUCATION

B.A./Biochemistry, 1989, Brandeis University, Waltham, MA

PROFESSIONAL EXPERIENCE

10/97-Present - Quality Assurance Officer, Katahdin Analytical Services, Inc. , Westbrook, ME

11/95-10/97 - Data Management Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME -- Ms. Nadeau was responsible for coordinating tasks for the Data Management Group. Additional responsibilities included data review and data entry for data packages compilation for EPA.

5/95-11/95 - Data Management Coordinator, PACE - Maine Laboratory, Westbrook, ME -- Ms. Nadeau was responsible for coordinating tasks for the Data Management Group.

8/92-4/95 - Lab Analyst, PACE - Maine Laboratory, Westbrook, ME -- Ms. Nadeau was responsible for inorganic analysis using ICP, graphite furnace, flame AA and cold vapor AA, data review of metals and wet lab data, the compilation of CLP protocol data packages through Ward software, training of new personnel in laboratory skills, and maintenance of elemental instrumentation.

12/89-8/92 - Lab Analyst, Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Ms. Nadeau was responsible for inorganic analysis using ICP, graphite furnace, flame AA and cold vapor AA, data review of metals and wet lab data, the compilation of CLP protocol data packages through Ward software, training of new personnel in laboratory skills, and maintenance of elemental instrumentation.

5/89-12/89 - Inorganic Analyst, Northeast Laboratory, Winslow, Maine -- Ms. Nadeau's responsibilities included elemental analyses by flame AA and maintenance of the instrument.

CONTINUING EDUCATION

Thermo Jarrell Ash Corporation: Flameless Atomic Absorption Emission Spectroscopy course

updated: 10/97

BRIAN ROY, Sample Custodian/Chain-of-Custody Clerk

PRESENT QUALIFICATIONS SUMMARY

As Sample Custodian/Chain-of-Custody Clerk, Mr. Roy is responsible for receiving and processing all samples which come to Katahdin laboratories for analysis. This includes checking samples for acceptable condition at receipt, accepting custody of samples, coordinating with the Client Services Department to assure that client shipments are accurate and complete, storing samples appropriately to preserve their integrity, entering sample and project information into the Laboratory Information System (LIMS), and distributing sample receipt forms and materials to initiate scheduling of analysis by the laboratories. Other responsibilities include disposing of samples, assembling and shipping bottle orders, and maintaining the sample staging area and the supply of sample containers for client and laboratory needs.

EDUCATION

B.S./Environmental Science and Policy, 1998, University of Southern Maine, Gorham, ME

PROFESSIONAL EXPERIENCE

10/98-Present - Sample Custodian/Chain-of-Custody Clerk, Katahdin Analytical Services, Inc., Westbrook, ME

Summer 1996 - Quality Assurance Technician, Poland Spring Bottling Inc. -- Performed daily procedures of water quality analysis. Gained continued experience with water treatment procedures. Further assistance with MSDS updating and filing.

Summer 1995 - Quality Assurance Internship, Poland Spring Bottling Inc. -- Development of a procedural training program. Construction and editing of standard operating procedures within sanitation, quality control, maintenance, manufacturing and warehouse procedures. Assisted with quality assurance laboratory procedures. Completed orders for laboratory supplies as needed. Updated MSDS books, and increased their distribution within the facility. Many requirements met, were for the compliance of corporation, National Sanitation Foundation (NSF), and the Food and Drug Administration (FDA) audits. Continuous involvement with Microsoft desktop procedures; utilizing Microsoft Word and Excel.

updated: 10/98

KIMBERLEE SYLVESTER, Sample Custodian/Chain-of-Custody Clerk

PRESENT QUALIFICATIONS SUMMARY

As Sample Custodian/Chain-of-Custody Clerk, Ms. Sylvester is responsible for receiving and processing all samples which come to Katahdin laboratories for analysis. This includes checking samples for acceptable condition at receipt, accepting custody of samples, coordinating with the Client Services Department to assure that client shipments are accurate and complete, storing samples appropriately to preserve their integrity, entering sample and project information into the Laboratory Information System (LIMS), and distributing sample receipt forms and materials to initiate scheduling of analysis by the laboratories. Other responsibilities include disposing of samples, assembling and shipping bottle orders, and maintaining the sample staging area and the supply of sample containers for client and laboratory needs.

EDUCATION

A.A.S./Marine Biology and Oceanography, 1997, Southern Maine Technical College, South Portland, ME

PROFESSIONAL EXPERIENCE

10/97-Present - Sample Custodian/Chain-of-Custody Clerk, Katahdin Analytical Services, Inc., Westbrook, ME

updated: 11/97

ANDREA COLBY, Project Manager

PRESENT QUALIFICATIONS SUMMARY

As Project Manager, Ms. Colby is responsible for managing analytical projects from initiation to completion. Ms. Colby is the point of contact for client projects, priorities, preliminary data, bottle orders and price quotes for commercial work and work by special protocol such as CLP. Negotiates project specifications with clients, insures specifications are met by the lab and delivered to the client in the required time frame. Maintains communications channels with the Sales Department and the Laboratory Staff.

EDUCATION

B.A. Biology, 1987, University of California, Santa Cruz

PROFESSIONAL EXPERIENCE

11/95-Present - Project Manager, Katahdin Analytical Services, Inc. , Westbrook, ME

8/94-11/95 - GC/MS Chemist, PACE - Maine Laboratory, Westbrook, ME

1/92-8/94 - Elements Group Chemist, Coast-to-Coast Analytical Services, Inc., Westbrook, ME

1991-1/92 - Elements Group Chemist, ABB, Westbrook, ME

1988-1991 - Wet Chemistry Laboratory Associate Chemist, ABB, Westbrook, ME

1987-1988 - Extractions Laboratory Assistant, E.C. Jordan, Westbrook, ME

EXPERIENCE

Analysis of Landfill, Confidential Client, Winthrop, ME - Ms. Colby was involved in the digestion and elemental analyses of soils, groundwater, lake water and lake sediments sampled on a quarterly and annual basis from this unremediated waste site.

Ash and Sludge Testing - Ms. Colby performed elemental analyses for routine monitoring at municipal and industrial landfills in Maine.

Baseline Study, Proposed Mining Site, ME - Ms. Colby performed two level elemental analyses using furnace atomic absorption for samples from a pristine watershed.

Hazardous Waste Remedial Action Program (HAZWRAP), Confidential Client - Ms. Colby performed elemental analyses following CLP protocol for two out-of-state projects.

Surface, Groundwater and Ash Monitoring, Pulp and Paper Client, ME - Ms. Colby performed elemental analyses by graphite furnace and ICP techniques.

ANDREA COLBY, Project Manager -- Continued

State Priorities List Site, Rhode Island, MA - In support of a remedial investigation, Ms. Colby performed elemental analyses in compliance with client and MADEP reporting requirements.

Remediation Project, Maine Engineering Firm - Ms. Colby performed elemental analyses on samples from an ongoing remediation project.

CLP Deliverable Projects, Maine Engineering Firm - Ms. Colby performed elemental analyses following CLP protocol. One of these projects was a phase II site investigation.

updated: 1/96

LILLIAN PEPIN, Project Manager

PRESENT QUALIFICATIONS SUMMARY

As Project Manager, Ms. Pepin is responsible for managing analytical projects from initiation to completion. Ms. Pepin is the point of contact for client projects, priorities, preliminary data, bottle orders and price quotes for commercial work and work by special protocol such as CLP. Negotiates project specifications with clients, insures specifications are met by the lab and delivered to the client in the required time frame. Maintains communications channels with the Sales Department and the Laboratory Staff.

EDUCATION

Data Processing Certificate, Hesser College, Portsmouth, NH, 1989
Nursing Assistant Certificate, State of NH 1985

PROFESSIONAL EXPERIENCE

11/95-Present - Project Manager, Katahdin Analytical Services, Inc. , Westbrook, ME

6/92-11/95 - Project Manager, PACE - New Hampshire Laboratory, Hampton, NH -- Ms. Pepin was responsible for project management from initiation to completion. Ms. Pepin was the point of client contact for projects, priorities, preliminary data, bottle orders and price quotes for commercial work and work by special protocol such as CLP. Ms. Pepin also served as liaison for PACE Network projects in which PACE, Inc. New England - New Hampshire Lab was involved.

8/90-6/92 - Sample Management Custodian, Resource Analysts, Inc., Hampton, NH -- Ms. Pepin worked in Sample Management where she was responsible for the receiving, handling, storage, and distribution of incoming samples. Her duties also included client contact, data entry, maintenance of sample storage area security, and sample separation for proper disposal.

Ms. Pepin has significant previous experience in the health care industry and has pursued an education in data processing.

CONTINUING EDUCATION

"Exceptional Customer Service," Seminar, Dun & Bradstreet, Portland, ME, May 1991

updated: 1/96

KELLY A. PERKINS, Project Manager

PRESENT QUALIFICATIONS SUMMARY

As Project Manager, Ms. Perkins is responsible for managing analytical projects from initiation to completion. Point of contact for client projects, priorities, preliminary data, bottle orders and price quotes for commercial work and work by special protocol such as CLP. Negotiates project specifications with clients, insures specifications are met by the lab and delivered to the client in the required time frame. Maintains communications channels with the Sales Department and the Laboratory Staff.

EDUCATION

B.S./Chemistry, 1984, Muhlenberg College, Allentown, PA

PROFESSIONAL EXPERIENCE

11/95-Present - Project Manager, Katahdin Analytical Services, Inc., Westbrook, ME

8/94-11/95 - GC Section Supervisor, PACE - Maine Laboratory, Westbrook, ME -- Ms. Perkins performed Gas Chromatographic analysis for pesticides and Polychlorinated Biphenyls by SW846 and CLP methods. She was responsible for the daily supervision of section chemists. She interpreted and reviewed technical data to ensure compliance with established procedures and laboratory QA program. She scheduled the completion of analyses to meet contractual agreements and analyzed environmental samples for routine and non-routine analyses. She was responsible for meeting acceptable performance criteria, for performance evaluations, and laboratory audits. She was responsible for the Pesticides/PCB fraction for EPA CLP program work.

9/91-8/94 - GC Section Supervisor, Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Ms. Perkins performed Gas Chromatographic analysis for pesticides and Polychlorinated Biphenyls by SW846 and CLP methods. She was responsible for the daily supervision of section chemists. She interpreted and reviewed technical data to ensure compliance with established procedures and laboratory QA program. She scheduled the completion of analyses to meet contractual agreements and analyzed environmental samples for routine and non-routine analyses. She was responsible for meeting acceptable performance criteria, for performance evaluations, and laboratory audits. She was responsible for the Pesticides/PCB fraction for EPA CLP program work.

8/89-9/91 - Chemist/Bench Supervisor Chemist, State of Maine Public Health Laboratory, Augusta, ME -- Ms. Perkins worked in the Pesticide Department. Her duties included sample preparation and extraction, standard preparation, Gas Chromatographic and High Performance Liquid Chromatographic analysis, data reduction and review, client consultation, and scheduling the completion of analyses to meet client and method criteria. Analytical methods used ranged from EPA drinking water methods to FDA Pesticide Analytical Methods for pesticide residue analysis in soils, tissues and vegetative material. She participated in AOAC Method Evaluation Studies and EPA, FDA and NEIC Performance Evaluation Studies. She also researched and validated new methods for use by the Public Health Laboratory.

KELLY A. PERKINS, Project Manager -- Continued

Ms. Perkins also supervised a program for the State of Maine Department of Agriculture that analyzed feed and fertilizer samples for micro and macro nutrients. She scheduled completion of analyses, performed data review and formatted the yearly summary of results that is published by the Maine Department of Agriculture.

8/88-8/89 - Pesticide Residue Analysis, State of Maine Public Health Laboratory, Augusta, ME -- Ms. Perkins supervised the analysis of Pesticide/PCB residues in a variety of matrices including water, soil, vegetation and tissues. She trained other chemists to perform these analyses.

8/87-8/88 - Fyrol FR-2 Analysis, State of Maine Public Health Laboratory, Augusta, ME -- Ms. Perkins performed method development for Gas Chromatographic Analysis for residues of Fyrol-FR2 in drinking waters, river and mill effluents.

CONTINUING EDUCATION

High Performance Liquid Chromatographic Analysis, Waters, Milford, MA, 1989

updated: 1/96

MARK BADGER, Management Information Specialist

PRESENT QUALIFICATIONS SUMMARY

As Management Information Specialist, Mr. Badger is responsible for the management and quality control of all computing systems (hardware, software, documentation and procedures), generating, updating, and controlling quality of automated deliverables. Mr. Badger is also responsible for maintaining archives of electronic data including software. Mr. Badger is responsible for the operations and maintenance of all PC based computer systems and for integration with the LIMS and CLP software. He is responsible for managing databases, developing macros and required programs as well as providing electronic data in various formats such as Access, ASCII, dBase, Excel, Monitor and GISKey.

EDUCATION

B.S., Physics, University of New Hampshire, Durham, NH
May 1990 minor in Electrical Engineering

PROFESSIONAL EXPERIENCE

2/97-Present, Information Specialist, Katahdin Analytical Services, Inc., Westbrook, ME

4/96- 2/97, GC/MS Laboratory Chemist, Katahdin Analytical Services, Inc., Westbrook, ME -- Mr. Badger analyzed a wide variety of analytes in different matrices using common instrumentation and standardized methods. Coordinated and executed sample analyses and provided appropriate interpretation of results and insured quality control criteria were met.

11/95-4/96, Wet Chemistry Laboratory Chemist, Katahdin Analytical Services, Inc., Westbrook, ME -- Mr. Badger analyzed a wide variety of analytes in different matrices using common instrumentation and standardized methods. Coordinated and executed sample analyses and provided appropriate interpretation of results and insured quality control criteria were met.

1/93-11/95, Wet Chemistry Laboratory Technician, PACE - New Hampshire Laboratory, Hampton, NH -- Mr. Badger was responsible for the analysis of samples for Cyanide and for other analyses as assigned.

ADDITIONAL EXPERIENCE

Laboratory Experience, Space Science Group, University of New Hampshire.

updated: 7/98

ROB HESKETH, Management Information Specialist

PRESENT QUALIFICATIONS SUMMARY

As Management Information Specialist, Mr. Hesketh is responsible for the management and quality control of all computing systems (hardware, software, documentation and procedures), generating, updating, and controlling quality of automated deliverables. Mr. Hesketh is also responsible for maintaining archives of electronic data including software. Mr. Hesketh is responsible for the operations and maintenance of all PC based computer systems and for integration with the LIMS and CLP software. He is responsible for managing databases, developing macros and required programs as well as providing electronic data in various formats such as Access, ASCII, dBase, Excel, Monitor and GISKey.

EDUCATION

B.S./Biochemistry, 1992, State University of New York, Binghamton, NY

PROFESSIONAL EXPERIENCE

7/98-Present, Information Specialist, Katahdin Analytical Services, Inc., Westbrook, ME

4/96-7/98, GC Chemist, Katahdin Analytical Services, Inc., Westbrook, ME -- Mr. Hesketh analyzed a wide variety of analytes in different matrices using common instrumentation and standardized methods. Coordinated and executed sample analyses and provided appropriate interpretation of results and insured quality control criteria were met. Mr. Hesketh also acted as the MIS liaison for the GC Department.

9/92-9/95, Research Support Specialist, State University of New York at Stony Brook, NY -- Managed the daily business of the lab, including ordering of supplies and equipment; training graduate students and technicians; as well as, trouble shooting experiments, techniques, and instruments. Functioned as the Radiation Safety Officer for the laboratory. Established and maintained a home page on the Internet for technical assistance with a scanning densitometer. Implemented the use of a scanning densitometer for the department, including developing protocols and training personnel. Performed independent research on the characterization of the structure of the 7S particle in *Xenopus laevis*.

11/90-5/92, Central Supply Technician, Lourdes Hospital, NY -- Decontaminated equipment, surgical instruments and trays. Assembled O.R. trays for sterilization. Set up A-lines with proper instruments, sutures, linen , and trays for surgical procedures. Learned aseptic and antiseptic principles and techniques. Became familiar with many medical supplies and surgical instruments.

ADDITIONAL EXPERIENCE

Emergency Medical Technician (EMT) on Harpur's Ferry Volunteer Ambulance Service, 9/89-5/92

updated: 7/98

JOHN C. BURTON, Laboratory Operations Manager

PRESENT QUALIFICATIONS SUMMARY

As Laboratory Operations Manager, Mr. Burton oversees management of both inorganics and organics laboratory sections providing pesticides/PCB, volatiles, semivolatiles, wet chemistry, metals preparation, and metals analysis.

Mr. Burton has extensive experience in the environmental analytical chemistry field. Mr. Burton has over nine years of experience in Gas Chromatography, Mass Spectrometry, HPLC, and IR. Mr. Burton also has experience using GC/MS-SIM for various special projects including Love Canal.

EDUCATION

M.S. Forensic Chemistry, Northeastern University, Boston, MA, 1987
B.A. Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA, 1982

PROFESSIONAL EXPERIENCE

11/95-Present - Laboratory Operations Manager, Katahdin Analytical Services, Inc., Westbrook, ME

10/94-11/95 - Laboratory Operations Manager, PACE - Maine Laboratory, Westbrook, ME -- Mr. Burton managed both the inorganics and organics laboratory sections providing pesticides/PCB, volatiles, semivolatiles, wet chemistry, metals preparation, and metals analysis.

1/93-10/94 - Laboratory Operations Manager, NET - Thorofare, Thorofare, NJ -- Mr. Burton, was responsible for oversight management of both the inorganics and organics laboratory sections providing pesticides/PCB, volatiles, semivolatiles, wet chemistry, metals preparation, and metals analysis.

3/91-12/92 - Organic Section Manager, NET-Thorofare, Thorofare, NJ

6/89-3/91 - GC/MS Supervisor, Cambridge Analytical Assoc./NET Cambridge, Cambridge, MA

6/87-6/89 - GC/MS Chemist, Cambridge Analytical Associates, Boston, MA

5/86-6/87 - Analytical Toxicologist, New England Pathology Services, Woburn, MA

Summer 1985 - Chemist, Bureau of Alcohol Tobacco & Firearms, Rockville, MD

CONTINUING EDUCATION

NET Professional Development Series TQM, 1991
NET Professional Development Series, 1990
Hewlett Packard System Manager Course, 1989
Hewlett Packard Aquarius User Course, 1988

updated: 1/96

JAMES F. GALASYN, Senior Chemist, GC/MS Laboratory Supervisor

PRESENT QUALIFICATIONS SUMMARY

Dr. Galasyn is supervisor of the GC/MS laboratory and as such is responsible for all GC/MS activities, including scheduling and tracking of samples, supervision of chemists within the group, and operation and maintenance of the GC/MS equipment. Dr. Galasyn authors all of the organic standard operating procedures.

EDUCATION

NSF Post-doctoral Fellowship in Analytical/Atmospheric Chemistry, 1984-1986, Colorado College, Colorado Springs, CO
Ph.D./Analytical/Environmental Chemistry, 1984, Dartmouth College, Hanover, NH
B.S./Chemistry, 1980, University of Connecticut, Storrs, CT

PROFESSIONAL EXPERIENCE

11/95-Present - GC/MS Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

8/94-11/95 - GC/MS Supervisor PACE - Maine Laboratory, Westbrook, ME -- Dr. Galasyn was responsible for the supervision of the GC/MS laboratory and as such was responsible for all GC/MS activities, including scheduling and tracking of samples, supervision of chemists within the group, and operation and maintenance of the GC/MS equipment. Dr. Galasyn authored all of the organic standard operating procedures.

6/87-8/94 - GC/MS Supervisor - Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Dr. Galasyn was responsible for the supervision of the GC/MS laboratory and as such was responsible for all GC/MS activities, including scheduling and tracking of samples, supervision of chemists within the group, and operation and maintenance of the GC/MS equipment. Dr. Galasyn authored all of the organic standard operating procedures.

2/86-6/87 - GC/MS Supervisor and Chemist, Confidential Laboratory, CT -- Served as GC/MS Supervisor and was responsible for the analysis of CLP and non-CLP extractable, base/neutral, and acid semivolatile target compound list and priority pollutant compounds. Instrumental responsibilities included the operation and maintenance of Hewlett-Packard GC/MS equipment.

9/82-6/84 - Graduate Student, Dartmouth College, Hanover, NH -- As a graduate student, Dr. Galasyn operated and maintained Finnigan GC/MS equipment for the environmental laboratory, which included analysis and interpretation of all organic intermediates for the chemistry department.

JAMES F. GALASYN, Senior Chemist, GC/MS Laboratory Supervisor -- Continued

ADDITIONAL EXPERIENCE

Dr. Galasyn's Post-doctoral Fellowship research was in the field of atmospheric chemistry and was an investigation of the contribution that dry deposition made to the wet deposition normally associated with acid rain. Various locales were studied, including the remote free troposphere at the Mauna Loa Observatory in Hawaii. Ionic species monitored included nitric acid vapor, aerosol nitrate, sulfate, and various actions. Instrumental responsibilities included operation and maintenance of ion chromatographs, an atomic absorption (AA) spectrometer, and field equipment.

For his Doctoral thesis, entitled "Residential Indoor and Outdoor Air Pollution," Dr. Galasyn examined the ambient air at various indoor and outdoor locations, and especially focused upon indoor air quality in the vicinity of woodstoves, fireplaces, and kerosene heaters. Pollutants monitored included polycyclic aromatic hydrocarbons, carbon monoxide, nitrogen dioxide, and total and respirable suspended particulates. Instrumentation employed included Finnigan GC/MS, various GC's, and HPLC.

PUBLICATIONS AND PRESENTATIONS

J.F. Galasyn, K.L. Tschudy, and B.J. Huebert, "Daily and Seasonal Variability of Nitric Acid Concentrations in the Remote Free Troposphere at Mauna Loa, Hawaii," Journal of Geophysical Research, Vol. 92, No. 03, Pg. 3105-3113, March 20, 1987.

J.F. Galasyn and B.J. Huebert, "Daily and Seasonal Variability of Nitric Acid Concentrations in the Remote Free Troposphere at Mauna Loa," presented at the IAMAP/IAPSO Joint Assembly, Honolulu, Hawaii, August 5-16, 1985.

B.J. Huebert and J.F. Galasyn, "Measurements of the Dry Deposition of Nitric Acid to a Developing Winter Wheat Crop," presented at the Rocky Mountain conference - First Symposium on Atmospheric Chemistry, Denver, CO, July 14-18, 1985.

B.J. Huebert, J.F. Galasyn, and K.L. Tshudy, "Measurements of the Seasonal and Diurnal Variations of Nitric Acid Vapor at the Mauna Loa Observatory," presented at the Rocky Mountain Conference - First Symposium on Atmospheric Chemistry, July 14-18, 1985.

J.F. Galasyn, J.F. Hornig, and R.H Soderberg, "The Loss of PAH from Quartz Fiber High Volume Filters," J. Air Pollute. Control Assoc., 34, 57 (1984).

J.F. Hornig, R.H. Soderberg, A.C. Barefoot, and J.F. Galasyn, "Woodsmoke Analysis: Vaporization Losses of PAH from Filters and Levoglucosan as a Distinctive Marker for Woodsmoke," in Polynuclear Aromatic Hydrocarbons, ed. by Cooke, Battelle Press, Columbus, Ohio (1984).

JAMES F. GALASYN, Senior Chemist, GC/MS Laboratory Supervisor -- Continued

CONTINUING EDUCATION

Member, EPA Air Toxics Workgroup, 1990 - 1991
Hewlett-Packard 5988/96 RTE System Manager Course; Paramus, New Jersey, December 1986
American Chemical Society Short Course, "Effective Management of Chemical Analysis Laboratories," June 1986

PROFESSIONAL AFFILIATIONS

American Chemical Society
Air and Waste Management Association
American Society for Mass Spectrometry
Phi Beta Kappa

updated: 1/96

PETER LEMAY, GC Group Supervisor/GC Operator

PRESENT QUALIFICATIONS SUMMARY

As GC Group Supervisor/GC Operator, Mr. Lemay is responsible for coordinating daily operations of the GC laboratory section. His activities include training of personnel, scheduling equipment and staff, prioritizing analytical work to meet holdtime requirements, ensuring that quality control criteria are met and performing data review. Mr. Lemay's responsibilities include oversight of analysis of samples for GC volatiles, pesticides, PCBs, PNAs, and PHCs, DROs/GROs by methods 601/602, 8010/8020, 608/8080A, 8015 mod. He has experience in the performance of herbicide analysis as well as the above methods and is trained in the operation of the following GCs and detectors: HP 5890, HP5880, HP 5840, Tracon and Waters Dimension; ECD, ELCD, NPD, FID, FPD with either packed or capillary columns.

As a GC Operator, he is responsible for the analysis of solid and aqueous sample extracts for detection of pesticides, PCBs, PNAs, and PHCs. Mr. Lemay has more than eight years experience in GC analysis and nine years of supervisory experience.

EDUCATION

B.A., Chemistry, University of Maine, Orono, ME, 1985

PROFESSIONAL EXPERIENCE

11/95-Present - GC Group Supervisor/GC Operator, Katahdin Analytical Services, Inc., Westbrook, ME

6/92-11/95 - GC Group Supervisor/GC Operator, PACE - New Hampshire Laboratory, Hampton, NH -- Mr. Lemay was responsible for the supervision of three analysts and the daily operations of the GC section performing pesticide, PCB, PNA, PHC, and herbicide analysis.

1987-6/92 - GC Group Supervisor/GC Operator, Resource Analysts, Inc., Hampton, NH -- Mr. Lemay was responsible for the supervision of three analysts and the daily operations of the GC section performing pesticide, PCB, PNA, PHC, and herbicide analysis.

1985-1987 - Chemist, Burgess Analytical Laboratory -- Mr. Lemay was responsible for performing chemical analyses on a variety of materials, sample preparation, instrument operation, data review and evaluation, and training new employees.

1977-1981 - Medical Laboratory Specialist, United States Air Force

PETER LEMAY, GC Group Supervisor/GC Operator -- Continued

CONTINUING EDUCATION

Introduction to GC/MS, Hewlett Packard, 1988

"Frontline Leadership," Managerial Training by Zenger-Miller, Millipore Corp., Bedford, MA, 9/90 - 10/90

Occupational and Environmental Radiation Protection, Harvard School of Public Health, August 1991

"Waste Testing and Quality Assurance," Washington DC, July 1993

updated: 4/98

MICHAEL F. THOMAS, Organic Extractions Supervisor

PRESENT QUALIFICATIONS SUMMARY

As Organic Extractions Supervisor, Mr. Thomas is responsible for coordinating the daily operations of the extractions laboratory. Mr. Thomas is also responsible for coordinating sample preparation for BNA, PCB, pesticide, PHC, PNA, and other analyses. He is responsible for scheduling the work load such that hold times are met and sample preparation turn-around time goals are routinely achieved. Mr. Thomas interfaces with managers, supervisors, and analysts to coordinate extraction lab activities with those of the instrumental analysis groups. He also ensures sample preparation documentation is current and complete. Mr. Thomas oversees the initial training of extraction analysts, as well as on-going technical support and direction to maximize individual analysts' efficiency and the overall productivity of the group. Mr. Thomas also initiates cross-training measures to improve versatility within the group.

EDUCATION

A.A.S., Chemical Technology, Community College of Rhode Island, 1979.

PROFESSIONAL EXPERIENCE

5/96-Present - Organic Extractions Laboratory Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

1989--5/96 - Organic Extractions Laboratory Supervisor, NET Inc., Cambridge Division, Bedford, MA -- Mr. Thomas was responsible for the supervision of the organic extraction laboratory. Mr. Thomas was experienced in the preparation of wastewater, soil, sludge, oil and leachate matrices for the analyses of such parameters as pesticides and polychlorinated biphenyls, semi-volatile and volatile organic compounds, herbicides and other environmental pollutants. Mr. Thomas was the primary extraction analyst for the Method 515.1 Method Validation Study for chlorinated acid herbicides.

1988-1989 - Organic Extractions Laboratory Supervisor, Cambridge Analytical Associates, Inc., Boston, MA -- Mr. Thomas was responsible for the supervision of the organic extraction laboratory.

1987-1988 - Organic Extractions Laboratory Chemist, Cambridge Analytical Associates, Inc., Boston, MA -- Mr. Thomas performed routine extraction and concentration procedures with attendant clean-up of extracts on various types of environmental samples using EPA Sample Management Office/Contract Laboratory Program and other agency protocols. Mr. Thomas prepared wastewater, soil, sludge, oil and leachate matrices for the following parameters: pesticides, PCBs, BNAs, VOCs, herbicides and other environmental pollutants.

1979-1987 - Organic Extraction Laboratory Chemist, Alliance Technologies Division (formerly GCA/Technology Division), Bedford, MA -- Mr. Thomas assisted in the development of preparative methodologies for samples from a variety of local government and commercial clients. He collaborated in the recovery, extraction, concentration and gravimetric analysis of stack gases and ambient air monitoring samples from toxic waste sites and other generators such as boilers and kilns.

updated: 5/96

GEORGE BREWER, Metals Laboratory Supervisor

PRESENT QUALIFICATIONS SUMMARY

As Metals Laboratory Supervisor, Mr. Brewer is responsible for the direction and daily operation of the metals laboratory including scheduling of analyses, performing sample analysis, maintenance of instrumentation and maintenance of SOPs for method compliance. His responsibilities include the preparation and analysis of water and wastewater, soil, sludge and other solid waste matrices, particularly ash, for elemental parameters. In addition, he is responsible for equipment maintenance and training of laboratory personnel. Mr. Brewer has extensive experience in the operation of atomic absorption and inductively coupled plasma (ICP) spectroscopy equipment.

EDUCATION

M.S./Geological Sciences, 1986, University Of Maine At Orono, Orono, ME
B.S./Geology, 1979, Yale University, New Haven, CT

PROFESSIONAL EXPERIENCE

11/95-Present - Metals Laboratory Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

8/94-11/95 - Metals Laboratory Supervisor, PACE - Maine Laboratory, Westbrook, ME -- Mr. Brewer was responsible for supervision of the metals instrumentation laboratory including scheduling of analyses, performing sample analysis, maintenance of instrumentation and maintenance of SOPs for method compliance.

1/94-8/94 - Metals Laboratory Supervisor, Coast-to-Coast Analytical Services, Inc., Westbrook, ME -- Mr. Brewer was responsible for supervision of the metals instrumentation laboratory including scheduling of analyses, performing sample analysis, maintenance of instrumentation and maintenance of SOPs for method compliance.

Chief Chemist, Millipore Corp., Bedford, MA -- Mr. Brewer was involved in all aspects of the lab's work including sample log-in through analysis to report generation and customer service. He was also responsible for initiating a quality control program at the lab, and oversaw analyses of all EPA WP and WS performance evaluation samples.

Senior Atomic Spectroscopist, Clean Harbors Analytical Services, Inc., Braintree, MA -- Mr. Brewer's responsibilities included training and supervising new analysts, scheduling trace metals in complex matrices such as wastewater, soil, ash, and oil. He was responsible for bringing the laboratory's first ICP on line and developing all ICP methods used by the lab. He also assumed managing responsibility for the successful completion of analyses on EPA CLP inorganic performance evaluation samples during the 1987 bid period.

GEORGE BREWER, Metals Laboratory Supervisor – Continued

Various Government Programs – Mr. Brewer supervised the inorganic analyses of performance evaluation samples and the production of data packages to successfully obtain laboratory approvals to perform work for HAZWRAP (Hazardous Waste Remedial Action Programs), the U.S. Army Corps of Engineers, and AFCEE (Air Force Center for Environmental Excellence). Mr. Brewer subsequently oversaw metals analyses of samples from site assessments and clean ups administered under these programs.

Elemental Analyses of Landfill, Confidential Client, Winthrop, ME – Mr. Brewer supervised the elemental analyses of more than 80 soils, groundwaters, surface waters, and lake sediments sampled on a quarterly basis from this unremediated landfill site. He insured that all contractual Quality Control (QC) requirements were fulfilled and prepared the necessary QC documentation.

Baseline Studies, Proposed Mine Sites, ME – Mr. Brewer directed the analysis of groundwater and sediment samples and monthly surface water samples in two recent baseline studies of pristine watersheds. Each study involved an extensive list of metals analyzed at trace and ultratrace levels, primarily by graphite furnace atomic absorption spectroscopy.

New York CLP – Mr. Brewer directed the inorganic analyses of performance evaluation samples and the production of data packages while certified in the New York Contract Laboratory Program.

Special Analytical Services, U.S. EPA – In two recent projects for the U.S. EPA, Mr. Brewer directed the preparation and analyses of high volume air filters and mine drainage samples. Both projects required adherence to U.S. EPA Contract Laboratory Program (CLP) analytical and reporting protocols.

Pulp and Paper Manufacturers, ME -- Mr. Brewer supervised the elemental analyses of monthly ash samples from boilers operated by various pulp and paper manufacturers throughout the state.

Hazardous Waste Characterization, ME – Mr. Brewer directed and performed elemental analyses and TCLP testing to characterize waste materials from a Maine paper company in compliance with the Maine Solid Waste Regulations.

GEORGE BREWER, Metals Laboratory Supervisor -- Continued

ADDITIONAL EXPERIENCE

Mr. Brewer's background has provided him with extensive experience in flame and graphite furnace atomic absorption spectrophotometry, plasma emission spectrometry, ion chromatography, and several other instrumental and wet chemical inorganic analytical techniques.

Mr. Brewer's graduate work involved the study of the history of acidification and heavy metal loading in a Maine watershed through the analyses of sediment cores and water samples by atomic absorption spectrophotometry and ion chromatography.

PROFESSIONAL AFFILIATIONS

American Chemical Society
Society for Applied Spectroscopy

updated: 7/96

BETSY A. DELANO, Wet Chemistry Laboratory Supervisor

PRESENT QUALIFICATIONS SUMMARY

As Wet Chemistry Laboratory Supervisor, Ms. Delano is responsible for coordinating the daily operations of the wet chemistry laboratory. As an Analytical Chemist, Ms. Delano is responsible for the preparation and analysis of solid and aqueous samples by standard inorganic wet chemistry methods. Ms. Delano has more than six years of experience in wet chemistry procedures.

EDUCATION

B.S./Marine Biology, 1989, Gordon College, Wenham, MA

PROJECT EXPERIENCE

11/95-Present - Wet Chemistry Laboratory Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

8/92-11/95 - Analytical Chemist, PACE - Maine Laboratory, Westbrook, ME -- Performed wet chemistry analyses, including cyanide, chloride, total organic carbon, chemical oxygen demand, total dissolved solids, total suspended solids, fluoride, sulfide, and sulfite. She also prepared ASTM extractions of soils/solid samples for wet chemistry analyses, and was responsible for PM-10 and total suspended particulate testing of air monitoring projects. In the Elements Group, she was involved in sample digestion and analysis by atomic absorption (both furnace and flame) and atomic emission (ICP) for the detection of various metals.

1990-8/92 - Analytical Chemist, PACE - Maine Laboratory, Westbrook, ME -- Performed wet chemistry analyses, including cyanide, chloride, total organic carbon, chemical oxygen demand, total dissolved solids, total suspended solids, fluoride, sulfide, and sulfite.

Special projects following:

Sampling and Analyses of Landfill, Confidential Client, Winthrop, ME -- Was involved in the digestion and elemental analyses of soil, groundwater, lake water, and lake sediments on both quarterly and annual basis from this unremediated waste site. She was responsible for all particulate concentration parameters.

Ash and Sludge Testing, Confidential Client -- Performed elemental analyses of ash and sludge samples from various industrial incinerators and wastewater treatment facilities. The analyses included sample digestion, analysis by graphite furnace, ICP analyses, and ASTM extraction. Subsequent analyses for nitrite, nitrate, sulfate, fluoride, and chloride were her responsibility.

Surface and Groundwater Monitoring, ME -- Performed elemental and wet chemistry analyses for routine monitoring at municipal and industrial landfills in Maine. Specific responsibilities included COD analyses, all particulate concentration parameters, mercury analyses by cold vapor techniques, cyanide, chloride, and TOC.

Industrial Technology Division, U.S. EPA -- For a survey of various industries, including pulp and paper, wood preserving, and pharmaceutical manufacturing, conducted all particulate concentration parameters, alkalinity, DOD analyses, and fluoride analyses.

BETSY A. DELANO, Wet Chemistry Section Supervisor -- Continued

Baseline Monitoring, Confidential Client -- For the initial site monitoring of stream watersheds to determine baseline criteria at a potential mining site, conducted the following tests: total suspended solids, total dissolved solids, chloride, chemical oxygen demand, total organic carbon, sulfite, sulfide, and fluoride.

Air Monitoring Project, Confidential Client, MA -- Responsible for the PM - 10 and total suspended particulate testing of air monitoring filters for a project at a major road construction site in Massachusetts.

Special Analytical Services (SAS), U.S. EPA -- Was involved in numerous aspects of US EPA SAS work. Some projects have been done for metal finishing plants.

Hazardous Waste Remedial Action Program (HAZWRAP), Confidential Client, MA -- Performed cyanide analysis, following CLP protocol.

CLP Deliverables Projects (SAS), U.S. EPA -- Performed cyanide analysis following CLP protocol.

updated: 10/98

MARIA CROUCH, Data Management Supervisor

PRESENT QUALIFICATIONS SUMMARY

As Data Management Supervisor, Ms. Crouch is responsible for coordinating the workload of the Data Management Group and overseeing such daily functions as data entry, checking and secondary technical review of organics and inorganics results and compilation and production of final client reports. Her responsibilities also include working with data collection software and supervising forms generation and data package production for projects requiring special protocols such as CLP. Ms. Crouch communicates with the operations manager, project managers, and laboratory supervisors on the daily status and reporting requirements of projects.

EDUCATION

B.A./Chemistry, summa cum laude, University of Southern Maine, Portland, ME 1993

PROFESSIONAL EXPERIENCE

10/97-Present - Data Management Supervisor, Katahdin Analytical Services, Inc., Westbrook, ME

1/97-10/97- Data Specialist II, Katahdin Analytical Services, Inc., Westbrook, ME – As Data Specialist II, Ms. Crouch oversaw the preparation of data package deliverables. Also responsible for the assurance that the deliverable packages meet criteria for technical compliance and completeness.

1993-1996 - Data Validator, ABB Environmental Services, Inc., Portland, ME – As Data Validator, Ms. Crouch was responsible for the review of analytical data for the USEPA Contract Laboratory Program (Superfund) and private clients. Other duties included, writing fate and transport chemical profiles for use in report appendix, assistance in the preparation of data quality reports for presentation to clients, participation in the evaluation and process of improvement of validation SOPs and training of new data validation employees.

1986-1988 - Office Manager, Mangino, Inc., Windham, ME

OTHER

Taught the laboratory section of introductory level chemistry courses at the University of Southern Maine, Spring and Fall 1996.

updated: 11/97

VICTOR PIEKARSKI, Field Services Manager

PRESENT QUALIFICATIONS SUMMARY

As Field Services Manager, Mr. Piekarski is responsible for the daily operations of the Field Services Department. Mr. Piekarski has extensive experience in on-site operations and management of groundwater monitoring projects. In the field of wastewater treatment, Mr. Piekarski supervises NPDES collection programs and has considerable experience in the operations of flow monitoring projects.

Additionally, Mr. Piekarski has over 7 years experience in the sampling design and collection techniques of marine sediments, invertebrate and fishery studies.

EDUCATION

B.S., Natural Resource Management, University of Alaska, Fairbanks, 1982
A.A.S., Conservation Technology, Essex Agricultural and Technical Institute, Danvers, MA, 1980

PROFESSIONAL EXPERIENCE

11/95-Present - Field Services Manager, Katahdin Analytical Services, Inc. , Westbrook, ME

6/92-11/95 - Field Services Manager, PACE - New Hampshire Laboratory, Hampton, NH -- Mr. Piekarski was responsible for the operations of the Field Services Office. He had extensive experience in on-site operations and management of groundwater monitoring projects. In the field of wastewater treatment, Mr. Piekarski supervised NPDES collection programs and was experienced in the operations of flow monitoring projects.

3/92-6/92 - Director of Field Operations, Environmental Field Services, Inc. (EFSI), a Division of Resource Analysts, Inc., Hampton, NH -- Mr. Piekarski was responsible for the operations of EFSI. He had extensive experience in on-site operations and management of groundwater monitoring projects. In the field of wastewater treatment, Mr. Piekarski supervised NPDES collection programs and was experienced in the operations of flow monitoring projects.

7/88-3/92 - Field Supervisor, Environmental Field Services, Inc. (EFSI), a Division of Resource Analysts, Inc., Hampton, NH

1987-7/88 - Field Technician, Environmental Field Services, Inc. (EFSI), a Division of Resource Analysts, Inc., Hampton, NH

1981-1985 - Fisheries Biologist I, Alaska Department of Fish and Game, Anchorage, Alaska

1984 - Laboratory Technician, IWR-EES University of Alaska, Fairbanks, Alaska

1982-1983 - Laboratory Technician, Institute of Marine Sciences, Fairbanks, Alaska

VICTOR PIEKARSKI, Field Services Manager – Continued

CONTINUING EDUCATION

"OSHA Hazardous Site Worker Training," (40 hours), 1989

"OSHA Hazardous Site Worker Supervisory Training," (8 hours), 1989

"OSHA Refresher Course," Hazardous Site Worker (40 hrs), 1990

"OSHA Refresher Course," Hazardous Site Worker (40 hrs), 1991

WMI/EML Groundwater Sampling Seminar, EML, IL, 1991

Eastern Regional Groundwater Issues, conference, NWWA, 1991

updated: 4/98

WILLIAM L. FEAGANS, Field Technician

PRESENT QUALIFICATIONS SUMMARY

Mr. Feagans is responsible for sampling groundwater and wastewater, monitoring landfill gases, and performing field measurements and analyses. Mr. Feagans reports to Mr. Piekarski, Field Services Manager.

EDUCATION

A.S., Environmental Technology, Southern Maine Technical College, South Portland, Maine 1995

PROFESSIONAL EXPERIENCE

3/96-Present - Field Technician, Katahdin Analytical Services, Inc., Westbrook, ME

6/95 - 3/96 - Field Technician, Saco River Salmon Club and Central Maine Power, Southern Maine Technical College, South Portland, ME -- Collected data on the Saco River for the salmon restoration project. Identified macro and micro invertebrates. Monitored Saco River Salmon Club's fish hatchery.

CONTINUING EDUCATION

OSHA 40 Hour Emergency Response: 5/18/94, 8 hr. Refresher: 3/24/95, Technician Level: 12/14/95

updated: 4/96

MELISSA NELSON, Field Technician

PRESENT QUALIFICATIONS SUMMARY

Ms. Nelson is responsible for sampling groundwater and wastewater, monitoring landfill gases, and performing field measurements and analyses. Ms. Nelson reports to Mr. Piekarski, Field Services Manager.

EDUCATION

B.S./Environmental and Resource Economics, College of Life Science and Agriculture, University of New Hampshire, Durham, NH 1997

PROFESSIONAL EXPERIENCE

10/98-Present - Field Technician, Katahdin Analytical Services, Inc., Westbrook, ME

9/97-10/98 - Client Services/Laboratory Technician, Analytics Environmental Laboratory, Inc., Portsmouth, NH – Duties included client services and extractions lab technician. Responsibilities related to client services included direct client interaction, sample receipt, data entry, analytical reporting and bottle order preparation. Responsibilities related to extractions involve sample preparation of soil and water matrices for the instrument lab.

10/96-Present - Portsmouth Athletic Club - Portsmouth, NH – General office duties including receiving current members, signing new members to club memberships and other administrative responsibilities including opening and closing facility for management.

6/97-9/97 & 6/98-9/98 - NHDRED, Hampton Beach Parks and Recreation Division, Hampton, NH – Supervise 8-10 person crew in general park maintenance and beach cleaning for the enjoyment of visitors. Responsible for management and assignment of duties to coworkers for the New Hampshire Department of Recreation.

5/96-9/96 - City of Dover, NH Planning Department, Dover, NH – Summer internship for UNH program; assisted the Director of Planning in conducting an environmental assessment for the movement of existing homes to a new location; performed field work including site reviews; presented formal proposal to NH Planning Department upon completion of internship.

updated: 10/98

JEFFREY WORTH, Field Technician

PRESENT QUALIFICATIONS SUMMARY

Mr. Worth is responsible for sampling groundwater and wastewater, monitoring landfill gases, and performing field measurements and analyses. Mr. Worth reports to Mr. Piekarski, Field Services Manager.

EDUCATION

Chemistry, currently attending University of Southern Maine, Portland, ME

A.S., Applied Marine Biology and Oceanography, Southern Maine Technical College, South Portland, ME, 1990

PROFESSIONAL EXPERIENCE

11/95-Present - Field Technician, Katahdin Analytical Services, Inc., Westbrook, ME

6/92-11/95 - Field Technician, PACE - New Hampshire Laboratory, Hampton, NH -- Mr. Worth was responsible for sampling groundwater and wastewater, monitoring landfill gases, and performing field measurements and analyses.

3/91-6/92 - Field Technician, Environmental Field Services, Inc. (EFSI), a Division of Resource Analysts, Inc., Hampton, NH -- Mr. Worth was responsible for sampling groundwater and wastewater, monitoring landfill gases, and performing field measurements and analyses.

8/88-3/91 - Field/Laboratory Technician, Southern Maine Technical College, South Portland, ME -- Mr. Worth was responsible for chemistry and oceanographic sample collection and maintenance of ship-board oceanographic equipment.

CONTINUING EDUCATION

General Oceanography and Marine Biology, Penn State Consortium, Wallops Island, VA, 7/76

Winter Emergency Care Instructor, Shawnee Peak Ski Patrol, since 7/89

Avalanche Rescue and Mountaineering Training, National Ski Patrol 4/90

Advanced First Aid/CPR Training, Waterboro Rescue Squad 1/87,
renewed annually by National Ski Patrol

WMX/EML Groundwater Sampling Seminar, Environmental Monitoring Lab, Geneva, IL 6/91

Health and Safety course - 40 hours, GZA/AET, Northeastern University, Dedham, MA 11/91
renewed annually by Safetech Consultants, South Portland, ME

International Paper Site Safety Trainer, Androscoggin Mill, Jay, ME 3/96
renewed annually by International Paper, Androscoggin Mill

Database Management, Adult Education, Bonney Eagle High School, Buxton, ME 9/97

updated: 10/97

SECTION III QUALIFICATIONS

OVERVIEW

Katahdin Analytical Services, Inc.'s capabilities are driven by a combination of client requirements, environmental regulatory programs, government agencies, certifications, clean-up requirements, and matrices.

CERTIFICATIONS & APPROVALS

Katahdin Analytical Services maintains extensive state, local, and federal certifications and approvals (Table 1).

Katahdin Analytical Services participates in certification programs in the states of California, Connecticut, Delaware, Florida, Kentucky, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, North Carolina, Rhode Island and South Carolina, Vermont, and Virginia.

ORGANIZATION AND CLIENT SERVICE

Meeting a client's time constraints and data reporting requirements are as important as providing quality data. Katahdin Analytical Services helps clients plan, schedule, and interpret methods and data at any and all times in the analytical process.

Katahdin Analytical Services consists of the following teams: administrative, project management/client service, field services, data management, extractions, gas chromatography and gas chromatography/mass spectrometry (for organics), and metals and wet chemistry (for inorganics). All teams have one goal in common: to provide unsurpassed quality, service, and responsiveness.

Each team is headed by a Group Supervisor who is responsible for daily equipment scheduling and the interpretation and review of data generated by the section. They are also responsible for the technical aspects of analyses, and for the administration of the section. These individuals also provide direction and support to the teams of chemists under their authority.

Administration

The administration team consists of laboratory management, marketing, and quality assurance/quality control personnel.

Project Management/Client Service

Every client is assigned a Project Manager who acts as the client's single point of contact with Katahdin Analytical Services. That way, expectations and communications remain well-defined and consistent, which is particularly important when rush work is required. Because we invest the time to find professionals who can adapt to changing requirements with speed and accuracy, Katahdin Analytical Services remains competitive in any and all laboratory situations.

The project management/client services team provides project management/client liaison services and are available to expedite your requests for quotations, in-house sample progress and tracking information, verbal and FAX data transmittal, and technical consultation. If technical issues require such, a Technical Project Coordinator may also be assigned to a project. Project managers conduct in-house project meetings to ensure client project requirements are met. Project managers have in-depth knowledge of laboratory procedures and regulatory requirements.

Field Services

The field services team provides day-to-day collection and coordination of field programs. The level of support may range from the simple receipt of samples to assuming full responsibility for planning, conducting and supervising field projects including client/regulator interactions. Sample containers, preservatives, bailer decontamination, field & trip blank materials, coolers, seals, chain of custody documents, packing materials, and shipping documents are provided. Katahdin Analytical Services provides these sampling services at very competitive rates.

Data Management

The data management team produces data and quality control packages and operates and maintains the LIMS. Please see Section IV for detailed information.

Extractions

The extractions team prepares samples for organic analyses. Solid and liquid samples for semi-volatiles, pesticides/PCBs, herbicides, fuel constituents, and TCLP extracts are processed by this group.

Gas Chromatography

The gas chromatography team conducts all gas chromatography analyses of organics, including pesticides, herbicides, volatiles organic compounds, fuels, n,n-dimethylformamide, and solvents. These analyses are completed by GC, using these various detectors: FID, FPD, ELCD, PID, NPD, and ECD.

Gas Chromatography/Mass Spectroscopy

The gas chromatography/mass spectroscopy team conducts all GC/MS analyses of organics, including volatiles and semi-volatile organic compounds.

Metals

The metals team prepares and analyses all samples that require elemental metal analysis techniques; furnace, cold-vapor and inductive coupled plasma.

Wet Chemistry

The wet chemistry team prepares and analyzes inorganic samples for mineral, nutrient, and residue analysis, plus demand parameters and specialized procedures.

PROJECT EXPERIENCE

FEDERAL

Katahdin Analytical Services' personnel have vast experience working in a variety of Department of Defense Programs. The Maine facility has been successfully audited by contractors representing the Air Force, Navy, Army and DOE. In addition, Katahdin Analytical Services processes the necessary data systems to render the diverse electronic data deliverable packages mandated by these Federal programs.

AFCEE - Air Force Center for Environmental Excellence

Katahdin Analytical holds two contracts in support of AFCEE BRAC sites in New England. These contracts, established in 1995, have placed Katahdin as one of the largest volume AFCEE subcontractors in the Northeast. Under these agreements, Katahdin performs full suite multi-media, multi-concentration analysis utilizing the EPA Methods SW-846. Tasks include analyses of contaminated soils and water for fuels, VOA, SemiVOA, TCLP, PCB's PAH's and metals. Data is provided in rapid turn-around and standard time both in hard copy and on a project specific AFCEE electronic format.

NFESC - Naval Facilities Engineering Service Center

Katahdin Analytical performed over $ 1 million in analytical support for the Navy CLEAN program in 1997. The lab has supported task orders on Naval Facilities from Maine to Virginia. As many groundwater wells within the Naval facilities experience saline intrusion, Katahdin developed a special low level metals analysis now utilized on many sites. Analyses incorporated both CLP and SW-846 with results submitted both in hard copy and contractor specific electronic format.

COE-MRD - U.S. Army Corps of Engineers

Katahdin has one of the most extensive parameter certifications available from the Army Corps of Engineers. The lab was revalidated in December 1997 under the Army's new Compendium of Analytical methods. Katahdin currently supports Army RAC and TERC contractors throughout New England. In 1998, the laboratory brought on line explosives analysis utilizing method 8330. To further provide screening techniques, Katahdin is also supporting method 8510 for RDX.

HAZWRAP - Hazardous Waste Remedial Action Plan

Katahdin Analytical is one of only seven approved HAZWRAP laboratories in the nation. First approved in 1996, Katahdin supports HAZWRAP contractors nationwide. HAZWRAP Level D analytical results are presented in both hardcopy and in CLP format diskette deliverables.

EPA Superfund/RCRA Sites

Katahdin Analytical has supported remedial efforts on three sites. In 1995, our laboratory provided site approved methods for the analysis of PCB's and PAH's in soil on the Saco Landill site in Maine. On two PRP led sites, Katahdin provided and manned a fixed site laboratory. Once again, developing site specific screening techniques approved by the Regulatory agencies, Katahdin helped reduce cost by producing validatable data in the field.

COMMERCIAL/INDUSTRIAL

For our commercial, industrial, and waste clientele, Katahdin Analytical Services maintains State certifications throughout the eastern seaboard. These accreditations allow Katahdin Analytical Services to perform RCRA and NPDES analyses in accordance with State requirements and report results in a client specific format regardless of the customer's physical location. This client service is enhanced by utilizing Katahdin Analytical Services' field sampling group, a fully OHSÀ-trained department that processes the equipment to service any sampling need. This allows Katahdin Analytical Services' clients to access one laboratory to service several sites in multiple States.

RCRA MONITORING

Confidential Pulp & Paper Client 1992-1998

Katahdin Analytical Services directly supports this client with groundwater and surface water monitoring analysis on sites throughout the east coast. Katahdin Analytical Services' Field Group samples the sites on a quarterly basis and ships samples back to the laboratory for analysis. Results are presented in a client specific format on electronic diskette deliverables.

LANDFILL MONITORING

Confidential Waste Company 1993-1998

Katahdin Analytical Services supports this national waste company with sampling and monitoring analysis at sites in several States. These closed landfills require Katahdin Analytical Services field crews to sample on a quarterly basis at sites throughout the Northeast. Each site has its own list of compounds of concern and each has a specific State reporting requirement for which Katahdin Analytical Services must comply. All results are reported in a client specific format electronically.

NPDES

Confidential East Coast Industrials 1992-1998

Katahdin Analytical Services performs routine discharge analysis for several Fortune 500 industrials along the eastern seaboard. These clients utilize Katahdin Analytical Services' ability to report their results in one format regardless of the State in which the plant operates. Each client has a specific report format and a specific discharge schedule.

Table 1 CURRENT CERTIFICATIONS & APPROVALS

STATE	CERTIFICATIONS
California DHS	*Hazardous Waste*
Connecticut DHS	*Drinking Water/Wastewater/Hazardous Waste*
Delaware DPH	*Drinking Water*
Florida DER	*Environmental*
Kentucky DEP	*Drinking Water*
Maine DHS	*Drinking Water/Wastewater/ DRO/GRO*
Maryland DHMH	*Drinking Water*
Massachusetts DEP	*Drinking Water/Wastewater*
Michigan DEQ	*Drinking Water*
New Hampshire DES	*Drinking Water/Wastewater*
New Jersey DEP	*Drinking Water/Wastewater*
New York DOH	*Wastewater/Solid & Hazardous Waste*
North Carolina DOEHNR	*Wastewater/Groundwater*
Rhode Island DOH	*Drinking Water/Wastewater*
South Carolina DHEC	*Wastewater/Solid & Hazardous Waste*
Vermont DEC	*Drinking Water*
Virginia DGS	*Drinking Water*

FEDERAL PROGRAMS APPROVALS
US Air Force (AFCEE/ESR IRP)
US Army Corps of Engineers - Missouri River Division (USACE-MRD)
DOE Hazardous Waste Remediation Action Program (HAZWRAP)
US EPA Contract Laboratory Program (CLP) - Experience
US Navy - NFESC (NEESA)
US Department of Agriculture Soil Import Permit

Revised: 12/10/98

SECTION IV STATEMENT OF QUALITY ASSURANCE

QA POLICY AND OBJECTIVES

Katahdin Analytical Services, Inc. is committed to providing chemical measurements of quality consistent with client needs and requirements while maintaining cost control. This commitment recognizes the need for data to be representative of the environmental conditions under consideration, and for data to be produced within a system that assures their validity, reliability and suitability for making decisions that involve public health and safety, property rights and legal liabilities. To this end, Katahdin Analytical Services, Inc. has developed an ongoing Quality Assurance (QA) program, governed by a Quality Assurance Manual and implemented by QA Officer who report directly to the General Manager. Katahdin Analytical Services, Inc. is committed to employing proper analytical methods and quality control measures, to acquiring suitable equipment and maintaining it in good condition, to securing and training qualified staff, and to coordinating all aspects of its operations so as to take raw data and produce a useful report in a timely manner. Integral to the QA Program, is documentation of all laboratory QA/QC activities.

ORGANIZATION / PERSONNEL / RESPONSIBILITIES

For efficient laboratory operation, it is important that all laboratory employees understand the operational structure, specific areas of responsibility and lines of authority within the organization. It is equally important for laboratory personnel to understand that the structures of the Quality Organization may be separate and independent from other laboratory operations but that the quality function is totally integrated into every aspect of laboratory operation. All laboratory personnel are responsible for knowing and following proper methods and standard operating procedures; recording quality control information required by those procedures in the proper location; and suspending analyses when quality control criteria are not met.

ANALYTICAL METHODOLOGY

Numerous sources of information are available that offer guidance in choosing appropriate analytical methods and developing laboratory standard operating procedures (SOPs). The list at the end of this section describes the references routinely used by Katahdin Analytical Services. Analytical work at Katahdin is conducted in strict adherence with SOPs developed by the laboratory from these sources or SOPs generated in-house as project needs require.

QUALITY CONTROL ELEMENTS

It is Katahdin Analytical Services, Inc.'s QA policy and objective to produce data that meet all pertinent regulations for completeness, precision, accuracy, representativeness, documentation, and comparability. A quality control program is the systematic process that controls the validity of analytical results so that they meet these criteria. Katahdin Analytical Services Inc. maintains and adheres to a set of QC requirements for each method performed and documents these requirements in the QC section of the method SOP.

Primary QC measures include initial method validation and technician demonstration of ability. Subsequent analysis of blanks, calibration check standards, laboratory replicates, duplicates and spiked samples performed at a specified frequency demonstrate continuing control of the analytical system.

TECHNICAL AND MANAGERIAL REVIEW OF QA/QC

The General Manager is responsible for managing all activities related to laboratory services, including the QA Program and for assuring that the QA program is effective in accomplishing its underlying goals. She also assures that deficiencies are reported, as appropriate, to the QAO, Operations Manager and/or laboratory Supervisor involved and that corrective actions are taken when necessary and are documented. Any significant changes to written SOPs shall be authorized in writing by the General Manager.

The QA Officer oversees the implementation of the elements of the QA plan, documentation, and the success or failure in meeting data objectives. The QA Officer monitors out-of-control situations as documented on corrective action reports and periodically audits laboratory operations and reviews data reports. The QA Officer communicates with the General Manager and Operations Manager on a regular, as needed basis.

The Operations Manager has oversight for the analytical operations and daily laboratory functions at Katahdin. He approves methodologies and standards for the associated QC control limits, monitors out-of-control situations, helps Group Supervisors to bring out-of-control situations back within acceptable limits, and initiates remedial action if required.

Group Supervisors are responsible for assuring that required QC is performed, and the QC data gets reduced and logged into method control files. They also review the QC data to establish whether QC control limits are being achieved, provide review of analytical results prior to submission to the reporting group, and initiate corrective actions where needed.

Analysts are responsible for performing the QC specified in the method and logging QC data into method control files. They review QC data to establish whether control limits are being achieved and analysis can continue, report results to Group Supervisors for review, and initiate corrective actions, when within their area of ability, to bring out-of-control analyses back within acceptable limits.

Trainees, working under the direction of designated senior personnel, must demonstrate successful performance of a method, normally on practice samples or check samples, prior to the routine analysis of real samples.

LABORATORY AUDITS

The General Manager, Operations Manager, and QA Officer meet periodically to review quality assurance issues. The QA Officer performs periodic laboratory audits inspecting various aspects of the QA program including but not limited to the following:

- Sample storage
- Chain of Custody documentation
- QC precision activities
- QC accuracy activities
- Instrument maintenance
- Documentation

Any deviations noted during the audit are discussed with the personnel or group involved and their Group Supervisor and are written in a formal report by the QA Officer. The Operations Manager and/or General Manager are responsible for correcting systematic errors or misunderstandings.

The QA Officer reviews program and audit performance on a regular basis and report findings to the General Manager.

SAMPLE AND DATA MANAGEMENT

When samples are received at the laboratory, sample custodians are responsible for transcribing information from chain of custody documents into a master log book and assigning a unique laboratory project number. A work order is generated for each set of samples. The work order is used to initiate a project holding file. The holding file is maintained by the data management group until all analyses are completed and ready for final reporting. All analytical data generated within Katahdin Analytical Services laboratories undergo a well-defined, well-documented multi-tier review process before being reported to a client.

Organics Data Management

The work order is used by the organics supervisors who assign the work to the appropriate extractions or analytical laboratories.

All data pertinent to sample preparation, including sample weight or volume, final volume, dilutions performed, and spiking levels, are recorded by the laboratory staff in laboratory logbooks with numbered pages. After preparation, an extract tracking sheet containing laboratory project numbers, date of extraction, method, analyst's initials, final volumes, relevant blank and spike data, surrogate data, and the instrumental analysis to be performed on each extract is prepared for the project by the extraction technician. The extraction technician places all extracts in a secure area where they may be retrieved for analysis, and files the preparation sheet with the project file. At the time of analysis, sample identification, amount injected, and other relevant sample data are entered into a runlog for each instrument by the GC or GC/MS operator.

After instrumental analysis, a hard copy of all chromatograms, spectra, and computer output used in calculations is generated by the GC or GC/MS operator. The raw output is reviewed by the operator for reasonableness and QC limit acceptance, and final results are calculated. The operator submits the raw data package to the Group Supervisor, who reviews the data for completeness, reasonableness, QC control, and accuracy in calculation. When all required sample report summaries are present, the entire project is reviewed for completeness, appropriateness, accuracy in calculation, and QC acceptance. Upon acceptance, the data package is forwarded to the data management group for entry and/or for inclusion in the project holding file.

Inorganics (Wet Chemistry) Data Management

The work order is used by the inorganics Group Supervisor to assign the work to the appropriate bench. All pertinent data including any calculations performed by the analyst are entered by the analysts into method-specific logbooks with numbered pages. Completed data package are reviewed by the group supervisor for completeness, QC acceptance, correctness in calculation, and appropriateness. Upon acceptance, the package is forwarded to the data management group for inclusion in the project holding file.

Metals Data Management

The work order is used by the metals Group Supervisor to assign the work to the instrumentation laboratory for direct analysis, or to the preparation laboratory for work up. All data relevant to the digestion and work up of samples, including sample weight or volume, preparation method, final volume, and analyses required, is recorded by the analyst on method-specific benchsheets. The analyst then transmits the sample bottle to the instrumentation laboratory for analysis. At the time of analysis, the instrument operator enters all relevant data, including laboratory identification and dilutions, into an instrument-specific logbook. Instrument output is included in the data package. The analyst reviews the data for QC acceptance, completeness, and accuracy of calculations. When all samples associated with a specific project have been completed, the metals group supervisor reviews the data for appropriateness, QC acceptance, completeness, and accuracy of calculation. Upon acceptance, the data package is forwarded to the data management group for inclusion in the project holding file.

Routine Data Reporting

Data review may occur within the laboratory group or the data management group or both. After review, the data management department enters the data into proprietary Katahdin Analytical Services software and/or draws a preliminary report from LIMS (Laboratory Information Management System). The Operations Manager then reviews the report and returns it to data management for compilation into a actual final report and data package. The data package receives final review by the Data Management Supervisor for overall consistency prior to forwarding to clients.

CLP and Non-Routine Data Management

For Contract Laboratory Program (CLP) analyses, data and narrative notes are passed to a reviewer in the data management group, where they are entered into commercial CLP forms generation software. The data package and case narrative are complied by the data reviewer and reviewed by the Operations Manager or designee. The data package is then sent back to data management for pagination, copying and hard copy assembly or disk creation.

METHOD REFERENCES

- "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act." Federal Register, 40 CFR Part 136, October 26, 1984.
- "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846. 3rd edition, 1986, Final Updates I, II, IIA, and III (1996), Office of Solid Waste and Emergency Response, U.S. EPA.
- "Methods for Chemical Analysis of Water and Wastes", EPA 600/4-79-020, 1979 Revised 1983, U.S. EPA.
- "Standard Methods for the Examination of Water and Wastewater", 15th, 16th and 17th and 18th editions, 1980, 1985, 1989, 1992. APHA-AWWA-WPCF.
- U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis, SOW 2/88, OLM01.8, 8/91, OLM01.9, OLM02.0, and OLM03.0.
- U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, SOW No. 788, ILM01.0, 3/90 through ILM03.0.
- "Annual Book of ASTM Standards", Section 4: Construction, Volume 04.04: Soil and Rock; Building Stones, American Society for Testing and Materials, 1987.
- "Annual Book of ASTM Standards", Section 11: Water and Environmental Technology, American Society for Testing and Materials, 1987.
- "NIOSH Manual of Analytical Methods", Third Edition, 1984, U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health.
- "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water", U.S. EPA, Environmental Monitoring and Support Laboratory - Cincinnati, September 1986.

SECTION V SERVICES AND RELATED INFORMATION

Katahdin Analytical Services, Inc. provides analytical services which include a range of analytical procedures on a variety of sample matrices. Sampling and analytical procedures comply with regulated protocols as applicable. In addition, technical staff are experienced in methods development for non-routine analyses. Accuracy and precision of results are ensured by a quality assurance philosophy of strict adherence to sampling and analysis procedures and a rigorous Quality Assurance/Quality Control (QA/QC) program.

Katahdin Analytical Services offers both Inorganic and Organic laboratory services. Inorganic capabilities include both Wet Chemistry and Elements parameters. Organic capabilities include both GC (Gas Chromatography) and GC/MS (Gas Chromatography/Mass Spectrometry), and HPLC (High Pressure Liquid Chromatography) parameters.

Laboratory Capabilities

- Sampling and analysis of surface water, groundwater, wastewater, process wastes, soils, sediments, solids, and hazardous wastes;
- Priority Pollutant (PP) analyses;
- National Pollutant Discharge Elimination System (NPDES) analysis;
- Hazardous Waste Characterization analysis;
- Toxicity Characteristic Leaching Procedure (TCLP) analysis;
- Extraction Procedure Toxicity (EPTOX) analysis;
- Contract Laboratory Program (CLP) analysis;
- Safe Drinking Water Act (SDWA) analysis;
- Resource Conservation and Recovery Act (RCRA) analysis;
- Permit Compliance sampling and analysis;
- Industrial process trouble shooting;
- Analytical chemistry and sampling support in response to chemical spills;
- Method research and development; and
- Expert Testimony.

Analytical Services

Services

- Data interpretation
- Electronic deliverables (Diskette)
- Electronic deliverables (Internet)
- Expert testimony
- Field sampling
- Field laboratory analysis
- Landfill gas monitoring
- Method development
- Project management
- Sample and container preparation
- Courier sample pick-up

Analyses

- EPH/VPH
- Explosives
- Fuel and gasoline fingerprinting
- Herbicides
- Metals
- Microbiology
- PAH by HPLC
- PCBs
- Pesticides
- Semivolatile organics
- TCLP
- Volatile organics
- Wet chemistry

Matrices

- Drinking Water
- Groundwater
- Hazardous wastes
- Industrial wastes
- Landfill Gases
- Leachates
- Petroleum products
- Residues
- Sediments
- Soils
- Wastewater
- Wipes

Commercial Programs

- Industrial Permit Compliance
- Landfill Monitoring
- Pulp & Paper Industrial Process
- Site Investigations/Remediation

Federal Regulatory Programs

- CERCLA, SARA, Superfund
- NPDES
- RCRA
- Safe Drinking Water Act (SDWA)
- Underground Storage Tanks (UST)

Market Niches

- Federal Programs
- Pulp & Paper
- Process Chemistry

Priority Services

Most analyses are available on a rush or "priority" basis in specified formats (verbal, FAX, internet, preliminary hard copy, final hard copy) at a surcharge with advance notice. Katahdin Analytical Services, Inc. will decline work that cannot be undertaken with confidence in our ability to satisfy the client's requirements.

Deliverables

Katahdin Analytical Services, Inc. offers a full range of deliverables. Quality Control data is reported on request on a Batch, Project, or Sample Specific basis. Formats specific to various regulatory uses are also routinely provided. Katahdin Analytical Services offers approximately 15 electronic deliverable formats. Standard Katahdin offerings are compatible with the database programs, Access, dBase, GIS Key, Monitor and Microsoft database, and spreadsheet programs, Excel, Lotus and QuartoPro.

SECTION VI FIELD SERVICES

Katahdin Analytical Services, Inc. currently provides sample collection and field analysis to both the public and private sector throughout the New England region. Katahdin Analytical Services provides a source of highly professional, fully trained and equipped personnel; all personnel are OSHA Hazardous Waste Certified.

Capabilities

- Groundwater and leachate monitoring
- Low flow evaluation and sampling
- Hazardous waste sampling
- Surface water sampling
- Sediment collection (core and grab)
- Wastewater sampling and flow monitoring
- Landfill gas migration surveys

Field Services adheres to USEPA and state protocols regarding collection methods and materials, sample storage and preservation, *in situ* analyses, chain of custody, and delivery of samples to an approved laboratory for all samples collected. Field Services personnel understand the importance of quality. Katahdin Analytical Services' quality assurance/quality control program includes the collection of blank samples, proper preservation of samples and completion of chain-of-custody forms.

Field Experience

Katahdin Analytical Services' Field Services Group has provided ground and surface water monitoring services to landfills which range from municipal to major regional sites in New England.

Field Services has been called in to perform sampling of surface water, groundwater, private well sampling, and landfill gas at regional facilities.

Ongoing surface and groundwater monitoring programs are conducted by Field Services at industrial sites for: industrial baseline, septage lagoons, asbestos landfill sites, ash landfill monitoring, town board of health investigations, paper mill waste landfills, and spill monitoring, including EPA National Priorities List CERCLA sites and RCRA sites. Field Services is equipped to provide OSHA Health and Safety Certified field personnel for industrial sites.

Field Services has provided bottom sediment sampling at dredge sites in harbors and rivers within Connecticut, Massachusetts, Maine and New Hampshire for various developers, engineers, state and federal governments.

Field Services has been employed by three of the major hazardous waste handling firms in New England for support services including: sampling Massport's fish pier waste, coring sludge from waste lagoons and monitoring well water collection.

Numerous New England electronic firms, printers, plating shops, machine shops and the photographic industry have employed Field Services to sample their wastewater for NPDES programs or for their town's pretreatment requirements. Several New England towns have used Field Services to perform the town's pretreatment surveys.

Field Services has been retained by several engineering/consulting firms for sampling services throughout New England as well as five analytical/bioassay laboratories.

Field Services has sampled large and small sites for PCB, pesticide, and herbicide contamination.