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WORK PLANS

RCRA Investigation Analytical Lab Quality Assurance Manual

Feb. 23, 2009

Western Refining
BLOOMFIELD REFINERY

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February 23, 2009

James Bearzi, Bureau Chief
New Mexico Environmental Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Re: Giant Refining Company, Bloomfield Refinery (currently known as Western Refining Southwest, Inc. – Bloomfield Refinery) Order No. HWB 07-34 (CO) RCRA Investigation Analytical Laboratory Quality Assurance Manual

Dear Mr. Bearzi:

Western Refining Southwest, Inc. - Bloomfield Refinery has contracted with Hall Environmental Analysis Laboratory to provide analytical services for RCRA Investigation activities at the Bloomfield Refinery. RCRA Investigation field activities commenced the week of September 22, 2008. Western submits copies of the analytical laboratory's Quality Assurance Manual pursuant to Section VIII.D.1 of the July 2007 HWB Order.

If you have any questions, please contact me at (505) 632-4171.

Sincerely,

James R. Schmaltz
Environmental Manager
Western Refining Southwest, Inc.
Bloomfield Refinery

cc: Hope Monzeglio – NMED HWB
Brad Jones – NMOCD (w/attachment)
Wayne Price – NMOCD
Carl Chavez – NMOCD
Dave Cobrain – NMED HWB
Laurie King – EPA Region 6 (w/attachment)
Todd Doyle – Bloomfield Refinery
Allen Hains – Western Refining El Paso

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Hall Environmental Analysis Laboratory

QUALITY ASSURANCE MANUAL

Effective Date: December 1st 2008

Revision 8.3

www.hallenvironmental.com

Control Number: 0000082

Approved By:

1/15/09

Nancy McDuffie Date
Laboratory Manager

Table of Contents

3.0 Introduction

Purpose of Document

The purpose of this Quality Assurance Manual is to formally document the quality assurance policies and procedures of Hall Environmental Analysis Laboratory, Inc. (HEAL), for the benefit of its employees, clients, and accrediting organizations. This laboratory continually implements the aspects of this plan as an essential and integral part of laboratory operations in order to assure that high quality data is produced in an efficient cost effective manner.

Objectives

The objective of HEAL is to achieve and maintain excellence in environmental testing. This is accomplished by developing, incorporating and documenting the procedures and policies specified in this manual. A laboratory staff that is analytically competent, well qualified, and highly trained carries out these activities. An experienced management team, knowledgeable in their area of expertise, monitors them. Finally, a comprehensive Quality Assurance program governs laboratory practices and assures that the analytical results are valid and defensible.

HEAL establishes and thoroughly documents its activities to ensure that all data generated and processed will be scientifically valid and of known and documented quality. Routine laboratory activities are detailed in method specific. All data reported meets the applicable requirements for NELAC, EPA and/or State Bureaus. For specific method requirements refer to Standard Operating Procedures (SOP's), EPA methods, Standard Methods 20th edition or state specific methods.

The management assures that this documentation is correct in terms of required accuracy, data reproducibility, and that the procedures contain proper Quality Control measures. The management additionally assures that all equipment is reliable, well maintained and calibrated. The procedures and practices of the laboratory are able to conform to client specifications and regulatory requirements. Meticulous records are maintained for all samples and their respective analyses so that results are well documented and defensible in a court of law.

The HEAL QA Officer is responsible for supervising and administering this quality assurance program, insuring each individual is responsible for its proper implementation. All HEAL management remains committed to the encouragement of excellence in analytical testing and will continue to provide the necessary resources and environment conducive to its achievement.

Policies

Understanding that quality cannot be mandated, it is the policy of this laboratory to provide an environment that encourages all staff members to take pride in the quality of their work. In addition to furnishing proper equipment and supplies, HEAL stresses the importance of continued training and professional development. Further, HEAL recognizes the time required

for data interpretation. Therefore, no analyst feels pressure to sacrifice data quality for data quantity. Each staff member must perform with the highest level of integrity and professional competence, always being alert to problems that could compromise the quality of technical work.

Management and senior personnel supervise analysts closely in all operations. Under no circumstance is the willful act or fraudulent manipulation of analytical data condoned. Such acts must be reported immediately to the management. Reported acts will be assessed on an individual basis and resulting actions could result in dismissal. The laboratory staff is encouraged to speak with lab managers or senior management if they feel that there are any commercial, financial, or other undo pressures, which might adversely affect the quality of their work.

All client information at HEAL is considered confidential. No information will be given out without the express verbal or written permission of the client. All reports generated will be held in the strictest of confidence.

This is a controlled document. Each copy is assigned a unique tracking number and when released to a client or accrediting agency the QA Officer keeps the tracking number on file.

4.0 Organization and Responsibility

Company

HEAL is accredited in accordance with NELAC standards (see NELAC accredited analysis list) and by the Arizona Department of Health Services. Additionally, HEAL is qualified as defined under the Petroleum Storage Tank Regulations of the State of New Mexico Environmental Improvement Board (USTR §1201), the State of New Mexico Water Quality Control Commission regulations and the New Mexico State Drinking Water Bureau. It is a locally owned small business that was established in 1991. HEAL is a full service Environmental Analysis Laboratory with analytical capabilities that include both organic and inorganic methodologies and has performed analyses of soil, water and air samples for many sites in the region. HEAL's client base includes local, state and federal governmental agencies, private consultants as well as individual homeowners. It has performed as a subcontractor to the state of New Mexico and to the New Mexico Department of Transportation. HEAL has been acclaimed by its customers as producing quality results and as being adaptive to client-specific needs.

The laboratory is divided into a volatile organic section, a semi-volatile organic section, and an inorganic section. Each section has a designated manager/technical director. The section managers report directly to the laboratory manager, who oversees all operations.

Certifications

National Environmental Laboratory Accreditation Program (NELAP) – Oregon Primary accrediting authority.

Arizona Department of Health Services

See appendix A for copies of current licenses and licensed parameters.

Personnel

All employees training certificates and diplomas are kept on file with demonstrations of capability for each method they perform. An Organizational Chart can be found on page 11.

Laboratory Director

The Laboratory Director is responsible for overall technical direction and business leadership of Hall Environmental Analysis Laboratory, Inc. The Laboratory Manager and the Business Manager report directly to the Laboratory Director. Someone with a minimum of 7 years of directly related experience and a BS in a scientific or engineering discipline should fill this position.

Laboratory Manager/Technical Director

The Laboratory Manager is responsible for the daily operations of the laboratory. The Laboratory Manager is the technical director of the laboratory and in conjunction with the technical directors of the sections, is responsible for coordinating activities within the laboratory with the overall goal of efficiently producing high quality data in a reasonable time.

In events where employee scheduling or current workload is such that new work cannot be incorporated with missing holdtimes, the Laboratory Manager has authority to modify employee scheduling or re-schedule projects.

Additionally, the laboratory manager reviews and approves new analytical procedures and methods, and performs a technical review of most analytical results. The Laboratory Manager provides technical support to customers and staff.

The Lab Manager also observes the performance of supervisors to ensure good laboratory practices and proper techniques are being taught and utilized, assisting in overall quality control implementation, and strategic planning for the future of the company. Other duties include assisting in establishing laboratory policies which lead to the fulfillment of requirements for various certification programs, assuring that all Quality Assurance and Quality Control documents are reviewed and approved, and assisting in conducting Quality Assurance Audits.

The lab manager addresses questions or complaints that cannot be answered by the section managers. Someone with a minimum of 7 years of directly related experience and a BS in a scientific or engineering discipline should fill this position.

Business/ Project Manager

The role of the business/project manager is to act as a liaison between the client and the laboratory. The business project manager reviews reports, updates clients on the status of projects in-house, prepares quotations for new work, and is responsible for the marketing effort.

All new work is assessed by the project manager and reviewed with the other managers so as the not exceed the laboratories capacity. In events where employee scheduling or current workload is such that new work cannot be incorporated with missing holdtimes, the Business Manager has authority to re-schedule projects.

It is also the duty of the project manager to work with government agencies and other clients to make certain that the laboratory is compliant on specific work plan requirements.

Additionally, the Business Manager can initiate the review of the need for new analytical procedures and methods, and performs a technical review of some analytical results. The Business Manager provides technical support to customers. Someone with a minimum of

7 years of directly related experience and a BS in a scientific or engineering discipline should fill this position.

Quality Assurance Officer

The Quality Assurance Officer (QAO) is responsible for developing and carrying out the approved Quality Assurance Program, and advising and assisting management in meeting these requirements. The QAO monitors quality control activities of the laboratory in order to determine conformance with the Quality Assurance Program, performing Quality Assurance Audits, writing reports, providing follow-up action, and issuing Observation and Corrective Action Reports as needed.

Additional responsibilities include cataloged documentation of the following: Staff Training and Demonstration Of Capability (DOC) records, Instrument Detection Limits (IDL), Method Detection Limits (MDL), and Instrument/Equipment Certification and/or Maintenance records.

Complaints from clients are logged on a complaint form, which is reviewed by the QAO to ensure that it is handled according to the Quality Systems Section 5.5.3.1 and kept on file. When procedures are not in compliance with the requirements of this plan, "stop work orders" can be issued.

Finally, the QAO provides clients with Quality Control data and Quality Assurance reports as requested. Someone with a minimum of 3 years of directly related experience and a BS in a scientific or engineering discipline should fill this position or it can be filled by a senior manager.

Section Manager/Technical Directors

The Section Manager/Technical Directors are responsible for training and supervising departmental staff. They schedule incoming work and monitor laboratory personnel to ensure that proper procedures and techniques are being used. They supervise and implement new Quality Control procedures as directed by the QAO, update and maintain quality control records and evaluate laboratory personnel in their Quality Control activities.

They are the technical director of the associated section and review analytical data to acknowledge that data meets all criteria set forth for good Quality Assurance practices. Someone with a minimum of 3 years of directly related experience and a BS in a scientific or engineering discipline should fill this position.

Chemist I, II and III

A Chemist is responsible for the analysis of soil and water samples and the generation of high quality data in accordance with the laboratory SOPs and QA/QC guidelines in a reasonable time as prescribed by standard turnaround schedules or as directed by the Section Manager, Laboratory Manager or Business Manager.

The chemist is responsible for making sure all data generated is entered in the database in the correct manner and the raw data is reviewed, signed and delivered to the appropriate peer for review. A Chemist reports daily to the section manager and will inform them as to material needs of the section specifically pertaining to the analyses preformed by the chemist. Additional duties may include preparation of samples for analysis, maintenance of lab instruments or equipment, cleaning and providing technical assistance to lower level laboratory staff.

The senior chemist in the section may be asked to perform supervisory duties as related to operational aspects of the section. The chemist may perform all duties of a lab technician.

The position of Chemist is a full or part time hourly position and may divided into three levels, Chemist I, II, and III. Chemist I must have a minimum of an AA in a related field or equivalent experience. Chemist II must have a minimum of an AA in a related field or equivalent plus, at least 2 years of environmental or closely related lab experience. Chemist III must have Bachelors degree and 3 years of environmental or closely related lab experience.

Lab Technician

A lab technician is responsible for providing support in the form of sample preparation, sample analysis, general lab maintenance, glassware washing, chemical inventories and sample kit preparation.

Sample Control Manager

The sample control manager is responsible for receiving samples and reviewing the sample login information after it has been entered into the computer. The sample control manager also checks the samples against the chain-of-custody for any sample and/or labeling discrepancies prior to distribution.

The sample control manager is also responsible for sending out samples to the sub-contractors along with the review and shipping of field sampling bottle kits. The sample control manager acts as a liaison between the laboratory and field sampling crew to assure the appropriate analytical tests is assigned. If a discrepancy is noted the sample Control Manager or sample custodian will contact the customer to resolve any questions or problems. The Sample Control Manager is an integral part the customer service team.

This position should be filled by someone with a high school diploma and a minimum of 3 years of directly related experience and can also be filled by a senior manager.

Delegations in the Absence of Key Personnel

Planned absences shall be preceded by notification to the Laboratory Manager. The appropriate staff members shall be informed of the absence. In the case of unplanned absences, the organizational superior shall either assume the responsibilities and duties or delegate the responsibilities and duties to an appropriately qualified member.

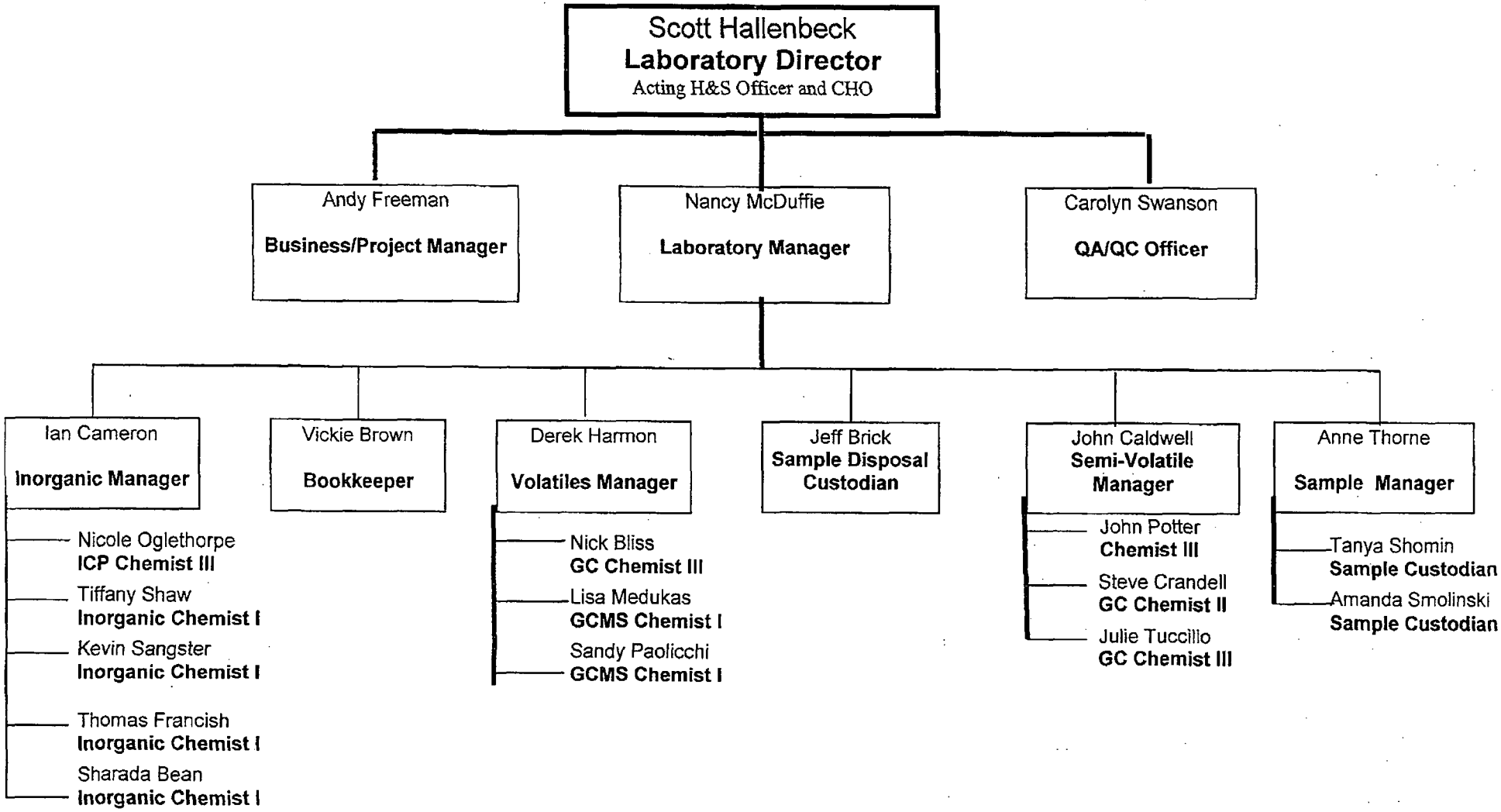
Laboratory Personnel Qualification and Training

All personnel joining HEAL shall undergo orientation and training. During this period the new personnel shall be introduced to the organization and their responsibilities, as well as the policies and procedures of the company. They shall also undergo on the job training and shall work with trained staff. They will be shown required tasks and be observed while performing them. Initial demonstration of capability must be completed and documented prior to performing assignments unsupervised.

New employees that do not have prior analysis experience will not be allowed to perform analysis until they have demonstrated attention to detail with minimal errors in the assigned tasks. To ensure a sustained level of quality performance among staff members, continuing demonstration of capability shall be performed at least once a year.

Laboratory staff must successfully pass an external Proficiency Testing (PT) sample or initial PT sample. Each new employee shall sign an ethics and data integrity agreement to ensure that they know that data quality is our main objective. Every HEAL employee recognizes that although turn around time is important, quality is put above any pressure to complete the task expediently. Analysts are not compensated for passing QC parameters nor are incentives given for the quantity of work produced.

Diagram of Organizational Structure



5.0 Receipt and Handling of Samples

Sampling

Procedures

HEAL does not provide field sampling for any projects. Sample kits are prepared and provided for clients upon request. The sample kits contain the appropriate sampling containers (with a preservative when necessary), labels, blue ice, a cooler, chain-of-custody forms, plastic bags, bubble wrap, and any special sampling instructions. The sample control manager reviews the kits prior to shipment.

Containers

Containers which are sent out for sampling are purchased by HEAL from a commercial source. Glass containers are certified "EPA Cleaned" QA level 1. Those containers are received with a Certificate of Analysis verifying that the containers have been cleaned according to the EPA wash procedure. Containers are generally used once and discarded. If the samples are collected and stored in inappropriate containers the laboratory may not be able to accurately quantify the amount the desired components. In this case re-sampling may be required.

Preservation

If sampling for an analyte(s) requires preservation, the sample custodians fortify the containers prior to shipment to the field. The required preservative is introduced into the vials in uniform amounts and done so rapidly to minimize the risk of contamination. Vials that contain a preservative are labeled appropriately.

The following pages contain tables specifying additional preservation requirements for samples.

Tables of Standard Holding Times, Preservation, and Containers

Organic Compounds

Compound	Matrix	Container	Preservative	Holding Time
Purgeable halocarbons and aromatics	aqueous	40 mL glass voas, teflon-lined septum	$HgCl_2$, or HCl, pH <2; cool, <6° C	14 days to analysis
Purgeable halocarbons and aromatics	Soil/MeOH*	4 oz. Jar/2-20 ml VOAs w/ methanol	cool, <6° C	14 days to analysis
Semi-volatiles	aqueous	1 L amber	cool, <6° C	7 days to extract, 40 days after extraction to analyze
Semi-volatiles	soil	8 oz. Jar	cool, <6° C	14 days to extract, 40 days after extraction to analyze
PCBs, pesticides, herbicides	aqueous	1 L amber	cool, <6° C	7 days to extract, 40 days after extraction to analyze
PCBs, pesticides, herbicides	soil	8 oz. Jar	cool, <6° C	14 days to extract, 40 days after extraction to analyze

*Use of field methanol kits are available and recommended for the PSTB.

Inorganic Compounds

Compound	Matrix	Container	Preservative	Holding Time
Acidity	aqueous	250-mL HDP	cool, <6° C	14 days
Alkalinity	aqueous	250-mL HDP	cool, <6° C	14 days
Ammonia	aqueous	1-L HDP	cool, <6° C, H_2SO_4 pH<2	28 days
Biochemical Oxygen Demand	aqueous	2-L HDP	cool, <6° C	48 hours
Bromide	aqueous	250-mL HDP	none required	28 days
Chemical Oxygen Demand	aqueous	125-mL HDP	cool, <6° C, H_2SO_4 pH<2	28 days
Chloride	aqueous	125-mL HDP	none required	28 days
Chloride	solid	4-oz jar	none required	28 days
Chlorine, total residual	aqueous	500-mL HDP	none required	analyze immediately
Chromium VI	aqueous	250-mL HDP	cool, <6° C	24 hours
Chromium VI	solid	8-oz jar	cool, <6° C	as soon as possible

Compound	Matrix	Container	Preservative	Holding Time
Color	aqueous	125-mL HDP	cool, <6° C	48 hours
Cyanide	aqueous	1-L HDP	cool, <6° C NaOH pH>12	14 days
Cyanide	solid	4-oz jar	cool, <6° C	14 days
Fluoride	aqueous	500-mL HDP	none required	28 days
Hardness	aqueous	250-mL HDP	HNO_3 or H_2SO_4 pH<2	6 months
Hydrogen ion (pH)	aqueous	60-mL HDP	none required	analyze immediately
Hydrogen ion (pH)	solid	4-oz jar	none required	analyze immediately
Kjeldahl and organic nitrogen	aqueous	1-L HDP	cool, <6° C, H_2SO_4 pH<2	28 days
Mercury	aqueous	250-mL HDP	HNO_3 pH < 2	28 days
Mercury	solid	8-oz jar	none required	28 days
Metals (except Cr VI and Hg)	aqueous	500-mL HDP	HNO_3 pH < 2	6 months
Nitrate	aqueous	250-mL HDP	cool, <6° C	48 hours
Nitrate	solid	8-oz jar	cool, <6° C	analyze immediately
Nitrate-Nitrite	aqueous	250-mL HDP	cool, <6° C, H_2SO_4 pH<2	28 days
Nitrate-Nitrite	solid	8-oz jar	cool, <6° C	28 days
Nitrite	aqueous	125-mL HDP	cool, <6° C	48 hours
Oil and Grease	aqueous	2-L wide-mouth glass	cool, <6° C, H_2SO_4 pH<2	28 days
Oil and Grease	solid	2-L wide-mouth glass	cool, <6° C	28 days
Organic Carbon	aqueous	125-mL HDP	cool, <6° C, HCl or H_2SO_4 pH<2	28 days
Organic Carbon	solid	4-oz jar	cool, <6° C	28 days
Orthophosphate	aqueous	125-mL HDP	Cool, <6° C	48 hours
Phenolics	aqueous	1-L Boston Round	cool, <6° C, H_2SO_4 pH<2	28 days
Phenolics	solid	8-oz jar (glass only)	cool, <6° C	28 days
Phosphorous (elemental)	aqueous	1-L Boston Round	cool, <6° C	48 hours
Phosphorous (total)	aqueous	125-mL HDP	cool, <6° C, H_2SO_4 pH<2	28 days
Residue, total	aqueous	250-mL HDP	cool, <6° C	7 days
Residue, filterable(TDS)	aqueous	250-mL HDP	cool, <6° C	7 days
Residue, non-filterable (TSS)	aqueous	250-mL HDP	cool, <6° C	7 days
Residue, settleable	aqueous	Imhoff Cone	cool, <6° C	48 hours

Residue, volatile	aqueous	250-mL HDP	cool, <6° C	7 days

Compound	Matrix	Container	Preservative	Holding Time
Silica	aqueous	125-mL HDP	cool, <6° C	28 days
Specific conductance	aqueous	250-mL HDP	cool, <6° C	28 days
Specific conductance	solid	8-oz jar	cool, <6° C	28 days
Sulfate	aqueous	125-mL HDP	cool, <6° C	28 days
Sulfate	solid	4-oz jar	cool, <6° C	28 days
Sulfide	aqueous	1-L HDP	cool, <6° C, ZnAc + NaOH pH>9	7 days
Sulfide	solid	8-oz jar	cool, <6° C	7 days
Surfactants	aqueous	500-mL HDP	cool, <6° C	48 hours
Turbidity	aqueous	250-mL HDP	cool, <6° C	48 hours

Sample Custody

Chain-of-Custody Form

A Chain-of-Custody (CoC) form is used to provide a record of sample chronology starting with the field sampling through laboratory analysis. HEALs CoC contains the client's name, address, phone and fax numbers, the project name and number, the project manager's name, and the field sampler's name. It also identifies the date and time of sample collection, sample matrix, field sample ID number, number/volume of sample containers, sample temperature upon receipt, and any sample preservative information.

There is also a space to record the HEAL ID number assigned to samples after they are received. Next to the sample information is a space for the client to indicate the desired analyses to be performed. Finally, there is a section to track the actual custody of the samples. The custody section contains lines for signatures, dates and times when samples are relinquished and received. The CoC form also includes a space to record special sample related instructions, sampling anomalies, time constraints, and any sample disposal considerations.

A sample chain-of-custody form can be found at the end of this section.

Receiving Samples

Samples are received by authorized HEAL personnel. Upon arrival, the CoC is compared to the respective samples. After the samples and CoC have been determined to be complete and accurate, the sampler signs over the CoC. The HEAL staff member in turn signs the chain-of-custody, also noting the current date and time. This relinquishes custody of the samples from the sampler and delegates sample custody to HEAL. The third (pink) copy of the CoC form is given to the person who has relinquished custody of the samples.

Logging in Samples and Storage

Standard Operating Procedures have been established for the receiving and tracking of all samples (refer to HALL Login SOP). These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, are complete and consistent with the samples received. Each sample set is given a unique HEAL tracking ID number. Individual sample locations within a defined sample set are given a unique sample ID suffix-number. Labels with the HEAL numbers, and analytes requested, are generated and placed on their respective containers. The pH of preserved samples is checked and noted if out of compliance. Samples are reviewed by the sample control manager prior to being distributed to the storage refrigerators or appropriate laboratory personnel.

Samples are stored in the volatile section refrigerator, the semi-volatile section refrigerator, or the inorganic section refrigerator. If a soil sample must be extracted for both volatile and semi-volatile analysis, it is first placed into the volatile soil sample refrigerator. After the volatile extraction, the sample is moved to the semi-volatile refrigerator to minimize any risk of contamination.

Each project (sample set) is entered into the Laboratory Information Management System (LIMS) with a unique ID given to every container. The ID tag includes the Lab ID, Client ID, date and time of collection, and the analysis/analyses to be performed. The LIMS continually updates throughout the lab. Therefore, at any time, an analyst or manager may inquire about a project and/or samples status. For more information about the login procedures, reference the Sample Login SOP.

Disposal of Samples

Analytical results are used to characterize their respective sample contamination level(s) so that the proper disposal can be performed. These wastes will be disposed of according to their hazard as well as their type and level of contamination. Refer to the Hall Environmental Analysis Laboratory Chemical Hygiene Plan for details regarding waste disposal.

Waste drums are provided by an outside agency. These drums are removed by the outside agency and disposed of in a proper manner.

The wastes that are determined to be non-hazardous are disposed of as non-hazardous waste.

CHAIN-OF-CUSTODY RECORD

Accreditation Applied:
NELAC ☐ USACE ☐
Other: _____

Client:

Address:

Phone #:

Fax #:

Project Name:

Project #:

Project Manager:

Sampler:

Sample Temperature:

Date	Time	Matrix	Sample I.D. No.	Number/Volume	Preservative			HEAL No.
					H_2Cl_2	HNO_3		

Date: Time: Relinquished By: (Signature) Remarks:

Date: Time: Relinquished By: (Signature) Remarks:

HALL ENVIRONMENTAL ANALYSIS LABORATORY
4901 Hawkins NE, Suite D
Albuquerque, New Mexico 87109
Tel. 505.345.3975 Fax 505.345.4107
www.hallenvironmental.com

ANALYSIS REQUEST

BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gasoline Only)	TPH Method 8015B MOD (Gas/Diesel)	TPH (Method 418.1)	EDB (Method 504.1)	EDC (Method 8021)	8310 (PNA or PAH)	RCRA 8 Metals	Cations (Na, K, Ca, Mg)	Anions (F, Cl, NO_3, NO_2, PO_4, SO_4)	8081 Pesticides / PCB's (8082)	8260 (VOA)	8270 (Semi-VOA)					Air Bubbles or Headspace (Y or N)

Remarks:

6.0 Analytical Procedures

All analytical methods used at HEAL incorporate necessary and sufficient Quality Assurance and Quality Control practices. A Standard Operating Procedure is used for each method to provide the necessary criteria to yield acceptable results. These procedures are updated each year or more often if necessary and are attached as a pdf file in the Laboratory Information Management System (LIMS) for easy access by each analyst. The sample is almost always consumed or altered during the analytical process. Therefore, it is important that each step in the analytical process be correctly followed in order to yield valid data.

When unforeseen problems arise, the analyst, section manager, and lab manager meet to discuss the factors involved. The analytical requirements are evaluated and a suitable corrective action, or resolution is established. The client is notified in the case narrative with the final report or before if validity is in question.

List of Procedures Used

Typically, the procedures used by HEAL are EPA approved methodologies. However, proprietary methods for client specific samples, are sometimes used. The following tables list EPA Method numbers with their corresponding analytes and/or instrument classification.

Organic Analysis

Methodology	Title of Method
8021B	"Halogenated and Aromatic Volatile Organics by Gas Chromatography"
8015B	"Nonhalogenated Volatile Organics by Gas Chromatography" (Gasoline Range and Diesel Range Organics)
8081A	"Organochlorine Pesticides by Gas Chromatography"
8082	"PCBs as Aroclors by Gas Chromatography"
8151A	"Chlorinated Herbicides by GC using Methylation or Pentafluorobenzylation Derivitization"
8310	"Polynuclear Aromatic Hydrocarbons"
8330	"Nitroaromatics and Nitramines"
8315	"Formaldehyde"
1005	"TNRCC – Total Petroleum Hydrocarbons"
504.1	"EDB" & "DBCP"
418.1	"Total Petroleum Hydrocarbons"
413.2	"Oil and Grease"

Gas Chromatographic/Mass Spectrometric Methods

Methodology	Title of Method
8260B	"Volatile Organic Compounds by GC/MS: Capillary Column Technique"
8270C	"Semivolatile Organic Compounds by GC/MS: Capillary Column Technique"
624	"Purgeables"
625	"Base/Neutrals and Acids"

Inorganic Analysis

Methodology	Title of Method
310.1	Alkalinity
350.3	Ammonia
300.0/300.1	Anions (aqueous)
9065	Anion (soil)
120.1	Electrical Conductivity
3500	Ferrous Iron
351.2	Total Kjeldhal Nitrogen (TKN)
9095	Paint Filter
150.1	pH
420.3	Phenols
160.1	Total Dissolved Solids (TDS)
160.2	Total Suspended Solids (TSS)
180.1	Turbidity

Metals

200.7/6010B	ICP Metals
7470	Mercury (aqueous)
7471	Mercury (soil)

Preparative Methodologies

Methodology	Title of Method
1311	Toxicity Characteristic Leaching Procedure
1312	Synthetic Precipitation Leaching Procedure
3005	Acid Digestion of Waters for Total Recoverable or Dissolved Metals
3010	Acid Digestion of Aqueous Samples and Extracts for Total Metals
3050	Acid Digestion of Sediment, Sludge, and Soil samples
3510B	Separatory Funnel Liquid-Liquid Extraction
3540	Soxhlet Extraction
3545	Accelerated Solvent Extraction
3665	Sulfuric Acid/Permanganate Cleanup (PCB)
5030	Purge-and-Trap for Aqueous Samples
5035	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples

Analytical Standard Operating Procedures (SOPs) are based upon the above listed methods and a variety of other publications. A log of all current SOPs is on file with the QAO and detailed SOPs are available at request.

7.0 Calibration

All equipment and instrumentation used at HEAL are operated, maintained and calibrated according to manufacturers guidelines, as well as criteria set forth in applicable analytical methodology. Personnel who have been properly trained in there procedures perform operation and calibration. Brief descriptions of the calibration processes for our major laboratory equipment and instruments are found below.

Thermometers

The thermometers in the laboratory are used to measure the temperatures of the refrigerators/freezers, ovens, water baths, TCLP Extractions, digestion blocks and samples at the time of log-in. All of these are checked for annually with a NIST certified thermometer and a correction factor is noted on each thermometer log.

Refrigerators/Freezers

Each laboratory refrigerator or freezer contains a thermometer capable of measuring to a minimum precision of 1°C. The thermometers are kept with the bulb immersed in liquid. Each workday, the temperatures of the refrigerators are recorded in a designated logbook to insure that the refrigerators are between ± 2° C. Samples are stored separately from the standards to reduce the risk of contamination.

Ovens

The oven contains a thermometer graduated by 1° C. the temperature is measured before and after a cycle when the operating procedure demands this level of precision. Otherwise they are checked daily.

Instrument Calibration

An instrument calibration is the relationship between the known concentrations of a set of calibration standards introduced into an analytical instrument and the measured response they produce. Calibration curve standards are a prepared series of aliquots at various known concentrations levels from a primary source reference standard. Specific mathematical types of calibration techniques are outlined in SW-846 8000B. The entire initial calibration must be performed prior to sample analyses.

The lowest standard in the calibration curve must be at or below the required reporting limit.

A minimum of 5 calibration points must be used for the calibration curve for GC, GC/MS and HPLC methods.

Most compounds tend to be linear and a linear approach should be favored when linearity is suggested by the calibration data. Non-linear calibration should be considered only when a linear approach cannot be applied. It is not acceptable to use an alternate calibration procedure when a compound fails to perform in the usual manner. When this occurs it is indicative of instrument issues or operator error.

If a non-linear calibration curve fit is employed, a minimum of six calibration levels must be used for second-order (quadratic) curves and a third order polynomial requires a minimum of seven calibration levels.

When more than 5 levels of standards are analyzed in anticipation of using second- or third-order calibration curves, all calibration points MUST be used regardless of the calibration option employed. The highest or lowest calibration point may be excluded for the purpose of narrowing the calibration range, and meeting the requirements for a specific calibration option. Otherwise, unjustified exclusion of calibration data is expressly forbidden.

Analytical methods vary in QC acceptance criteria. HEAL follows the method specific guidelines for QC acceptance. The specific acceptance criteria are outlined in the analytical methods and its corresponding SOP.

Analytical balance

All of the analytical balances are capable of weighing to a minimum precision of 0.1 grams. Records are kept of daily calibration checks for the balances in use. Certified weights are used in these checks. The balances are annually certified by an outside source and the certifications are on file with the QAO.

pH Meter

The pH meter measures to a precision of 0.01 pH units. The log book contains the calibration before each use, or each day, if used more than once per day. It is calibrated using 3 certified buffers. Also available with the pH meter is a magnetic stirrer with a temperature sensor.

Other Analytical Instrumentation and Equipment

The conductivity probe constant shall be determined prior to use. A 3 point linear curve is used.

Eppendorf (or equivalent brands) pipettes are calibrated gravimetrically once a week and verified prior to use.

Standards

All of the source reference standards used are ordered from a reliable commercial vendor. A Certificate of Analysis (CoA), which verifies the quality of the standard, accompanies the standards from the vendor. The Certificates of Analysis are dated and stored on file by the Technical Directors. These standards are traceable to the National Institute of Standards (NIST).

All standard solutions, calibration curve preparations, and all other quality control solutions are labeled in a manner that can be traced back to the original source reference standard. All source reference standards are entered into the LIMS with an appropriate description of the standard. Dilutions of the source reference standard (or any mixes of the source standards) are fully tracked in the LIMS as well. Standards are labeled with the date opened for use, and an expiration date. New source standards received into

the laboratory are checked with current standard solutions. Source standard vials will never be altered. Rather, small aliquots are removed and stored in working standard solution vials from which measured amounts can be withdrawn.

As part of the quality assurance procedures at HEAL, analysts strictly adhere to method protocols for storage times and policies of analytical standards and quality control solutions.

Reagents

HEAL assures that the reagents used are of acceptable quality for their intended purpose. This is accomplished by ordering high quality reagents and adhering to good laboratory practices so as to minimize contamination or chemical degradation. All reagents must meet any specifications noted in the analytical method.

Upon receipt, all reagents are assigned a separate ID number, and logged into the LIMS. All reagents shall be labeled with the date received into the laboratory and again with the date opened for use. Recommended shelf life shall be documented and controlled. Dilutions or solutions prepared shall be clearly labeled, dated, and signed. These solutions are traceable back to their primary reagents.

All gases used with an instrument shall meet specifications of the manufacturer. Recommended shelf life shall be documented and controlled. All safety requirements that relate to maximum and/or minimum allowed pressure, fitting types, and leak test frequency, shall be followed. When a new tank of gas is delivered, it shall be checked for leaks and marked with the date put in use. The date and initial pressure of a new tank will be noted on the new tank.

HEAL has a Quality Assurance Procedure designed to assure that the quality of laboratory reagent water meets established criteria for all analytical methods. HEAL continuously monitors the quality of the reagent water and provides the necessary indicators for maintenance of the purification systems.

Reagent blank samples are also analyzed to ensure that no contamination is present at detectable levels. The frequency of reagent blank analysis is the same as calibration verification samples. The reagent blank and calibration verification should be analyzed successively. Refrigerator storage blanks are stored in the volatiles refrigerator for a period of one week and analyzed and replaced once a week.

8.0 Maintenance

Maintenance logs are kept for each major instrument. In the front of the log, the following information is included:

Unique name of the item or equipment
Manufacturer

Type of Instrument
Model Number
Serial Number
Date received and date placed into service
Location of Instrument
Condition of instrument upon receipt

For routine maintenance, the following information shall be included in the log:

Maintenance Date
Maintenance Description
Maintenance Performed by Initials

A manufacturer service agreement (or equivalent) covers most major instrumentation to assure prompt and reliable response to maintenance needs beyond HEAL instrument operator capabilities.

9.0 Quality Control

Internal Quality Control Checks

Hall Environmental Analysis Laboratory, Inc. utilizes various internal quality control checks, including replicates, spiked samples, blanks, laboratory control spikes, calibration standards, quality control charts, uncertainty measurements and surrogates.

Replicates, or duplicates, are identical tests repeated for the same sample in order to determine the precision of such a method. A Relative Percent Difference (RPD) is calculated as a measure of this precision.

Spiked Samples (MS/MSD) are samples evaluated with a known added quantity of a target compound. This is to help determine the accuracy of the analyses. A percent recovery is calculated to assess the quality of the accuracy.

Duplicate samples, laboratory control spikes (LCS) and spiked samples (MS/MSD) are performed according to the following schedule for each area:

Organics: LCS and MS/MSD samples are analyzed for every batch of 20 samples (sufficient sample volume permitting for the MS/MSD).

Metals and wet chemistry: LCS, MS/MSD and sample duplicate analysis are performed, at a minimum, for every batch of 20 samples (sufficient sample volume permitting for the MS/MSD and sample duplicate).

Anions: LCS, MS/MSD and sample duplicate analysis are performed, at a minimum, for every batch of 10 samples (sufficient sample volume permitting for the MS and sample duplicate).

Blanks consist of all the reagents measured and treated as they are with samples, except without the samples. This enables the laboratory to assure clean reagents and procedures.

Blind Quality Control Samples are samples provided by an unbiased third party. They contain a pre-determined concentration of the target compound, which is unknown to the analyst. They are analyzed quarterly, and enable the laboratory to assess the quality of its results.

Calibration standards are standards run to calibrate and confirm the consistency of the instrumentation. Calibration standards are utilized at the beginning and end of each batch, and more frequently for larger batches.

Quality Control Charts are charts with acceptable ranges of the values of quality control checks. If a value falls outside the appropriate range, immediate evaluation and assessment of the procedures is required.

A surrogate compound, a substance that has similar properties to the target compounds (but not expected to be present), is added in all applicable tests. It is a measure of the level of recovery achieved in testing.

Uncertainty measurements are used to estimate the range of uncertainty of a certain result.

The specific types and frequency of QC sample analysis differ from method to method and section to section. Individual method specific QC sample criteria are outlined in the each Methods SOP.

SOPs will be update annually or more often if changes are deemed necessary. SOPs are stored as a linked .pdf file in the test portion of the LIMS. This is done by right clicking on the SOP tab of the test screen and adding the appropriate path where the current SOPs are located on the server. The QAO will update these links as necessary.

An initial demonstration of capability is performed each time there is a change in instrument type, personnel, or test method. A minimum of 4 replicate control spikes are prepared and analyzed according to the test method. Sample results are compared against current acceptable LCS recovery limits.

Precision, Accuracy, Detection Levels

Precision

The laboratory uses sample duplicates to assess precision. A duplicate sample is analyzed for each batch of 20 samples (5% frequency) when possible. HEAL requires the RPD to fall within the 99% confidence interval of established control charts or a RPD of less than 20 if control charts are not available. RPD's greater than these limits are considered out-of-control and require an appropriate response. Allowances can be made for high RPD values when the sample results are above the detection limit but less than less than 5X the detection limit. Criteria (based on sample matrix and methodology) for these situations require analyst/supervisor review to determine appropriate corrective action required.

Accuracy

The accuracy of an analysis refers to the difference between the calculated value and the actual value of a measurement. The accuracy of a laboratory result is evaluated by comparing the measured amount of QC reference material recovered from a sample and the known amount added. Control limits are established for each analytical method and sample matrix. Recoveries are assessed to determine the method efficiency and/or the matrix effect.

Analytical accuracy is expressed as the percent recovery (%R) of an analyte or parameter. A known amount of analyte is added to an environmental sample before the sample is prepared and subsequently analyzed. The equation used to calculate percent recovery is:

%Recovery = {(concentration* recovered)/(concentration* added)} X 100

*or amount

HEAL requires that the Percent Recovery to fall within the 99 % confidence interval of established control limits. A value that falls outside of the confidence interval requires

a warning and process evaluation. The confidence intervals are calculated by determining the mean and sample standard deviation. If control limits are not available, the range of 85 to 115% is used unless the specific method dictates otherwise. Percent Recoveries outside of this range mandate additional action such as analyses by Method of Standard Additions, additional sample preparation(s) where applicable, method changes, out-of-control action or data qualification.

Detection Limit

Current practices at HEAL define the Detection Limit (DL) as the smallest amount that can be detected above the baseline noise in a procedure within a stated confidence level.

HEAL presently utilize an Instrument Detection Limit (IDL), a Method Detection Limit (MDL), and a Practical Quantitation Limit (PQL). The relationship between these levels is approximately
IDL: MDL: PQL = 1:5:5.

The IDL is a measure of the sensitivity of an analytical instrument. The IDL is the amount which, when injected, produces a detectable signal in 99% of the analyses at that concentration. An IDL can be considered the minimum level of analyte concentration that is detectable above random baseline noise.

The MDL is a laboratories measure of the sensitivity of an analytical method. An MDL determination (also outlined in SW-846 Appendix B part 136) consists of replicate spiked samples carried through all necessary preparation steps. The spike concentration is three times the standard deviation of three replicates of spikes. Seven replicates are spiked and then analyzed successively and their Standard Deviation (s) calculated. The method detection limit (MDL) can be calculated using the standard deviation according to the formula:

$$MDL = s * t\ (99\%)$$

Where t (99%) is the student's t value for the 99% confidence interval. It depends on the number of trials used in calculating the sample standard deviation, so choose the appropriate value according to the number of trials.

Number of Trials	t(99%)
6	3.36
7	3.14
8	3.00
9	2.90

The calculated MDL must not be less than 10 times the spiked amount or the study must be performed again with a lower concentration.

The PQL is significant because different laboratories can produce different MDLs although they may employ the same analytical procedures, instruments and sample matrices. The PQL is about two to five times the MDL and represents a practical,

and routinely achievable, reporting level with a good certainty that the reported value is reliable. It is often determined by regulatory limits. The reported PQL for a sample is dependent on the dilution factor utilized during sample analysis.

Quality Control Parameter Calculations

Mean

The sample mean is also known as the arithmetic average. It can be calculated by adding all of the appropriate values together, and dividing this sum by the number of values.

$$\text{Average} = (\Sigma x_l) / n$$

x_l = the value x in the l^{th} trial
n = the number of trials

Standard Deviation

The sample standard deviation, represented by s, is a measure of dispersion. The dispersion is considered to be the difference between the average and each of the values x_i. The variance, s^2, can be calculated by summing the squares of the differences and dividing by the number of differences. The sample standard deviation, s, can be found by taking the square root of the variance.

$$\text{Standard deviation} = s = [\Sigma (x_l - \text{average})^2 / (n - 1)]^{1/2}$$

Percent Recovery (MS, MSD, LCS and LCSD)

$$\text{Percent Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{(\text{Spike Added})} \times 100$$

Confidence Intervals

Confidence intervals are calculated using the average (x), the sample standard deviation (s), and the Student's t distribution (s-dist), which depends on the number of values used to calculate the average and sample standard deviation.

The formula is: confidence interval = $x \pm s * \text{s-dist}$

Student's t Distribution

# values	10	15	20	25	31	41	61	121	> 121
95 %	2.262	2.145	2.093	2.064	2.042	2.021	2.000	1.980	1.960
99%	3.250	2.977	2.861	2.797	2.750	2.704	2.660	2.617	2.576

Unless there is insufficient data, at least 20 values will always be used in calculating the confidence intervals.

RPD (Relative Percent Difference)

Analytical precision is expressed as a percentage of the difference between the results of duplicate samples for a given analyst. Relative percent difference (RPD) is calculated as follows:

$$RPD = 2 \times \frac{(\text{Sample Result} - \text{Duplicate Result})}{(\text{Sample Result} + \text{Duplicate Result})} \times 100$$

Uncertainty Measurements

All procedures allow for some uncertainty. For most analyses the components and estimates of uncertainty are reduced by following well established test methods. To further reduce uncertainty, results are generally not reported below the lowest calibration point (PQL) and above the highest calibration point (UQL). Ranges of uncertainty are also calculated using LCS recoveries. These are kept on file with the QAO and are updated annually.

Calibration Calculations

1. Response Factor or Calibration Factor:

$$RF = ((A_x)(C_{is}))/((A_{is})(C_x)) \qquad CF = (A_x)/(C_x)$$

a. Average RF or CF

$$RF_{AVE} = \Sigma RF_i / n$$

b. Standard Deviation

$$s = SQRT \{ [\Sigma (RF_i - RF_{AVE})^2] / (n-1) \}$$

c. Relative Standard Deviation

$$RSD = s / RF_{AVE}$$

Where:
A_x = Area of the compound
C_x = Concentration of the compound
A_{is} = Area of the internal standard
C_{is} = Concentration of the internal standard
n = number of pairs of data
RF_i = Response Factor (or other determined value)
RF_{AVE} = Average of all the response factors
Σ = the sum of all the individual values

2. Linear Regression

$y=mx+b$

a. Slope (m)

$$m =(n\Sigma x_i y_i - (n\Sigma x_i)*(n\Sigma y_i)) / (n\Sigma x_i^2 - (\Sigma x_i)^2)$$

b. Intercept (b)

$$b = y_{AVE} - m*(x_{AVE})$$

c. Correlation Coefficient (cc)

$$CC (r) =\{ \Sigma((x_i-x_{ave})*(y_i-y_{ave})) \} / \{ SQRT((\Sigma(x_i-x_{ave})^2)*(\Sigma(y_i-y_{ave})^2)) \}$$

Or

$$CC (r) =[(\Sigma w * \Sigma wxy) - (\Sigma wx * \Sigma wy)] / (sqrt(([(\Sigma w * \Sigma wx^2) - (\Sigma wx * \Sigma wx)] * [(\Sigma w * \Sigma wy^2) - (\Sigma wy * \Sigma wy)])))]$$

d. Coefficient of Determination

$$COD (r^2) = CC*CC$$

Where:
y = Response (Area) Ratio A_x/A_{is}
x = Concentration Ratio C_x/C_{is}
m = slope
b = intercept
n = number of replicate x,y pairs
x_i = individual values for independent variable
y_i = individual values for dependent variable
Σ = the sum of all the individual values
x_{ave} = average of the x values
y_{ave} = average of the y values
w = weighting factor, for equal weighting w=1
Σ = the sum of the values indicated

3. Quadratic Regression

$y = ax^2 + bx + c$

a. Coefficient of Determination

$$COD\ (r^2) = (\Sigma(y_i - y_{ave})^2 - \{[(n-1)/(n-p)] * [\Sigma(y_i - Y_i)^2]\}) / \Sigma(y_i - y_{ave})^2$$

Where:
y = Response (Area) Ratio A_x/A_{is}
x = Concentration Ratio C_x/C_{is}
a = x^2 coefficient
b = x coefficient
c = intercept
y_i = individual values for each dependent variable
x_i = individual values for each independent variable
y_{ave} = average of the y values
y_{ave} = average of the y values
n = number of pairs of data
p = number of parameters in the polynomial equation (I.e., 3 for third order, 2 for second order)
Yi = ((2*a*(Cx/Cis)^2)-b^2+b+(4*a*c))/(4a)

b. Coefficients (a,b,c) of a Quadratic Regression

$$a = S_{(x2y)}S_{(xx)} - S_{(xy)}S_{(xx2)} / S_{(xx)}S_{(x2x2)} - [S_{(xx2)}]^2$$

$$b = S_{(xy)}S_{(x2x2)} - S_{(x2y)}S_{(xx2)} / S_{(xx)}S_{(x2x2)} - [S_{(xx2)}]^2$$

$$c = [(\Sigma yw)/n] - b*[(\Sigma xw)/n] - a*[\Sigma(x^2w)/n]$$

Where:
n = number of replicate x,y pairs
x = x values
y = y values
$w = S^{-2} / (\Sigma S^{-2}/n)$
$S_{(xx)} = (\Sigma x^2 w) - [(\Sigma xw)^2 / n]$
$S_{(xy)} = (\Sigma xyw) - [(\Sigma xw)*(\Sigma yw) / n]$
$S_{(xx2)} = (\Sigma x^3 w) - [(\Sigma xw)*(\Sigma x^2 w) / n]$
$S_{(x2y)} = (\Sigma x^2 yw) - [(\Sigma x^2 w)*(\Sigma yw) / n]$
$S_{(x2x2)} = (\Sigma x^4 w) - [(\Sigma x^2 w)^2 / n]$
Or If unweighted calibration, w=1
S(xx) = (Sx2) - [(Sx)2 / n]
S(xy) = (Sxy) - [(Sx)*(Sy) / n]
S(xx2) = (Sx3) - [(Sx)*(Sx2) / n]
S(x2y) = (Sx2y) - [(Sx2)*(Sy) / n]
S(x2x2) = (Sx4) - [(Sx2)2 / n]

10.0 Data Reduction, Validation, Reporting, and Record Keeping

All data reported must be of the highest possible accuracy and quality. During the processes of data reduction, validation, and report generation, the work is thoroughly checked to insure that error is minimized.

Data Reduction

The analyst who generated the data usually performs the data reduction. The calculations include evaluation of surrogate recoveries (where applicable), response factor calculations for manual calculations, and other miscellaneous calculations related to the sample quantitation.

If the results are computer generated, then the formulas must be confirmed by hand calculations.

Validation

A senior analyst, most often the section supervisor, validates the data. All data undergoes peer review. If an error is detected it is brought to the analyst attention to rectify and further checks ensure that all data for that batch is sound. Previous and/or common mistake are stringently monitored throughout the validation process. Data is reported using appropriate significant figure criteria. In most cases, two significant digits are utilized, but three significant digits can be used in QC calculations. Significant digits are not rounded until after the last step of a sample calculation. All final reports undergo a review by the management to provide a logical review of all the results before they are released to the client.

If data is to be manually transferred from one medium to another, the transcribed data is checked by a peer. This includes data typing, computer data entry, chromatographic data transfer, data table inclusion to a cover letter, or when data results are combined with other data fields.

All hand written data from run logs, analytical standard logbooks, hand entered data logbooks, or on instrument generated chromatograms, are systematically archived should the need for future retrieval arise.

Data that is being reported is treated with the utmost respect and care to help eliminate errors. Unethical practices will be detected through peer review and be dealt with the utmost severity.

Reports and Records

The reports are compiled by the Laboratory Information Management System (LIMS). Most data is transferred directly from the instruments to the LIMS. After being processed by the analyst and reviewed by the section supervisor, reports are approved and signed by the senior laboratory management. A comparative analysis of the data is performed at this point. For example, if TKN and NH3 are analyzed on the same sample the NH3 result should never be greater than the TKN result. Lab results and reports are released only to appropriately designated individuals. Release of the data can be by fax, email, diskette deliverables, or mailed hard copy.

When a project is completed, the project file folder is stored with a hard copy of the report, relevant supporting data, and the quality assurance/control worksheets. These folders are kept on file and are arranged by project number. Additionally, all electronic data is backed up daily on the HEAL main server. The backup includes raw data, chromatograms and report documents. Hard copies of chromatograms are stored separately according to the instrument and the analysis date. All records and analytical data reports are retained in a secure location as permanent records for a minimum period of five years (unless specified otherwise in a client contract). Access to archived information shall be documented with an access log. Access to archived electronic reports and data will be protected by a project manager password. In the event that HEAL transfers ownership or terminates business practices, complete records will be maintained or transferred according to the client's instructions.

After issuance, the original report shall remain unchanged. If a correction to the report is necessary, then an additional document shall be issued. This document shall have a title of "Addendum to Test Report or Correction to Original Report", or equivalent. Demonstration of original report integrity comes in two forms. First, the report date is included on each page of the final report. Second, each page is numbered in sequential order, making the addition or omission of any data page(s) readily detectable.

11.0 Corrective Action

The limits that have been defined for data acceptability also form the basis for corrective action initiation. Initiation of corrective action occurs when the data generated from continuing calibration standard, sample surrogate recovery, laboratory control spike, matrix spike or sample duplicates exceed acceptance criteria. If corrective action is necessary, the analyst or the section supervisor will coordinate to take the following steps to determine and correct the measurement system deficiency:

Check all calculations and data measurements systems (Calibrations, reagents, instrument performance checks etc.).

Assure that proper procedures were followed.

Unforeseen problems that arise during sample preparation and/or sample analysis that lead to treating a sample differently from documented procedures shall be documented with a corrective action report. The section supervisor and lab manager shall be made aware of the problem at the time of the occurrence. See the SOP regarding departures from documented procedures.

Continuing calibration standards below acceptance criteria can not be used for reporting analytical data unless method specific criteria states otherwise.

An analyte above control limits in a Continuing Calibration may be acceptable if the previous continuing calibration standard was acceptable for that analyte. Further, the target analyte in the samples analyzed after the acceptable calibration standard and before calibration standard with the high bias, are reported as non-detected. Finally, the samples following an analyte that is above control limits for a continuing calibration standard can not be reported for that analyte.

Samples with non-compliant surrogate recoveries should be reanalyzed unless deemed un-necessary by the supervisor for matrix, historical data, or other analysis related anomalies.

Laboratory and Matrix Spike acceptance criteria vary significantly depending on method and matrix. Analysts and supervisors meet and discuss appropriate corrective action measures as spike failures occur.

Sample duplicates with RPD values outside control limits require supervisor evaluation and possible reanalysis.

A second mechanism for initiation of corrective action is that resulting from Quality Assurance performance audits, system audits, inter and intra-laboratory comparison studies. Corrective Actions initiated through this mechanism will be monitored and coordinated by the laboratory QA officer.

All corrective action forms are entered in the LIMs and included with the raw data for peer review, signed by the technical director of the section and included in the case narrative to the client whose samples were affected. All Corrective action forms in the LIMs are reviewed by the QA Officer.

12.0 Quality Assurance Audits, Reports and Complaints

Internal/External Systems' Audits, Performance Evaluations, and Complaints

Several procedures are used to assess the effectiveness of the quality control system. One of the methods includes internal performance evaluations, which are conducted by the use of control samples, replicate measurements and use control charts. Another method is external performance audits, which are conducted by the use of inter-laboratory checks, such as participation in laboratory evaluation programs and performance evaluation samples available from a NELAC accredited Proficiency Standard Vendor.

Proficiency samples will be obtained twice per year from the appropriate vendor. We also participate in soil and water Underground Storage Tank PT studies. Copies of our results are available upon request.

Quality Assurance Audits are performed annually by the Quality Assurance Officer. They are performed using the guidelines outlined below:

The system audit consists of a qualitative inspection of the QA system in the laboratory and an assessment of the adequacy of the physical facilities for sampling, calibration, and measurement. This audit includes a careful evaluation and review of laboratory quality control procedures. Including but not limited to:

1. Review of staff qualifications, demonstration of capability, and personnel training programs
2. Storage and handling of reagents, standards and samples
3. Standard preparation logbook and LIMS procedures
4. Extraction logbooks
5. Raw data logbooks
6. Analytical logbooks or batch printouts and instrument maintenance logbooks
7. Data review procedures
8. Corrective action procedures
9. Review of data packages is performed regularly by the lab manager/QA Officer.

The Quality Assurance Officer will conduct these audits on an annual basis. Performance evaluation will, in part, be based upon the results obtained on the proficiency results.

Complaints

Complaints from clients are documented and given to the laboratory manager. The lab manager shall review the information and contact the client. If doubt is raised concerning the laboratories policies or procedures, then an audit of the section or sections may be performed. All records of complaints and subsequent actions shall be maintained for 3 years unless otherwise stated.

Internal and External Reports

The Quality Assurance Officer is responsible for preparation and submission of quality assurance reports to the appropriate management personnel as problems and issues arise. These reports include the assessment of measurement systems, data precision and accuracy, and the results of performance and system audits. Additionally, they also include significant QA problems, corrective actions, and recommended resolution measures. Reports of these Quality Assurance Audits describe the particular activities audited, procedures utilized in the examination and evaluation of laboratory records, and data validation procedures. Finally, there are procedures for evaluating the performance of Quality Control and Quality Assurance activities, and laboratory deficiencies and the implementation of corrective actions with the review requirements.

13.0 Analytical Protocols Utilized at Hall Environmental Analysis Laboratory, Inc.

1. Standard Methods for the Examination of Water and Wastewater: AOHA, AWWA, and WPCG; 20th Edition, 1999.

2. Methods for Chemical Analysis of Water and Wastes, USEPA, EPA-600/4-79-020, March 1979 and as amended December, 1982 (EPA-600/4-82-055)

3. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, USEPA SW-846, 3rd Edition, Updates I, II, IIA, IIB, III, December, 1996.

4. Methods of Soil Analysis: Parts 1 & 2, 2nd Edition, Agronomy Society of America, Monograph 9

5. Diagnosis & Improvement of Saline & Alkali Soils, Agriculture Handbook No. 60, USDA, 1954

6. Handbook on Reference Methods for Soil Testing, The Council on Soil Testing & Plant Analysis, 1980 and 1992

7. Field and Laboratory Methods Applicable to Overburdens and Mine Soils, USEPA, EPA-600/2-78-054, March 1978

8. Laboratory Procedures for Analyses of Oilfield Waste. Department of Natural Resources, Office of Conservation, Injection and Mining Division, Louisiana, August 1988

9. Soil Testing Methods Used at Colorado State University for the Evaluation of Fertility, Salinity and Trace Element Toxicity, Technical Bulletin LT B88-2 January, 1988

10. Manual of Operating Procedures for the Analysis of Selected Soil, Water, Plant Tissue and Wastes Chemical and physical Parameter. Soil, Water, and Plant Analysis Laboratory, Dept. of Soil and Water Science, The University of Arizona, August 1989

11. Sampling Procedures and Chemical Methods in Use at the U.S. Salinity Laboratory for Characterizing Salt-Affected Soils and Water. USDA Salinity Laboratory.

12. Procedures for Collecting Soil Samples and Methods of Analysis for Soil Survey. USDA Soil Conservation Service, SSIR No. 1.

13. Soil Survey Laboratory Methods Manual. Soil Survey Laboratory Staff. Soil Survey Investigations Report No. 42, version 2.0, August 1992.

14. Methods for the Determination of Metals in Environmental Samples, USEPA, EPA-600/4-91-010, June 1991

15. The Merck Index, Eleventh Edition, Merck & Co., Inc. 1989.

16. Handbook of Chemistry and Physics, 62nd Edition, CRC Press, Inc. 1981-1982.

17. Analytical Chemistry of PCB's. Erickson, Mitchell D., CRC Press, Inc. 1992.

18. Environmental Perspective on the Emerging Oil Shale Industry, EPA Oil & Shale Research Group.

19. Polycyclic Aromatic Hydrocarbons in Water Systems, CRC Press, Inc.

APPENDIX A

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Fax (505) 476-8658

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

Cindy Padilla
Deputy Secretary

March 11, 2008

Hall Environmental Analysis Laboratory Inc.
4901 Hawkins Rd. NE, Suite D
Albuquerque, NM 87109

Dear Mr. Freeman

The Drinking Water Bureau of the New Mexico Environment Department (NMED-DWB) has received and reviewed your Nelap certification /accreditation information from the state of Oregon, The documentation is acceptable and your New Mexico certification is now valid through February 29, 2009.

This certification is to perform drinking water analysis in compliance with the Federal Safe Drinking Water Act, pursuant 40CFR Part 141, and the New Mexico Environment Department Drinking Water Regulations for the Primary Regulated contaminants, including Contaminants in as listed in your Oregon Scope Accreditation.

You must advise NMED-DWB of any change in your accreditation by the State of Oregon and continue to provide this office with performance evaluation results. You are also required to provide evidence of renewal of accreditation by the state of Oregon to continue certification past February 29, 2009.

Laboratories certified by the New Mexico can be purged from the list if there is no evidence that they are performing drinking water compliance samples analysis for public water supply systems in New Mexico.

IF you have any questions or require additional information, please contact me at 505-476-8635.

Sincerely,

Joe Chavez

OREGON

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

NELAP Recognized

Hall Environmental Analysis Laboratory, Inc.

NM100001

4901 Hawkins Rd. NE, Suite D

Albuquerque, NM 87109

IS GRANTED APPROVAL BY ORELAP UNDER THE 2003 NELAC STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW:

Air	*Drinking Water*	*Non Potable Water*	*Solids and Chem. Waste*	*Tissue*
	Chemistry	Chemistry	Chemistry	

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTIC TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Irene E. Ronning, Ph.D.
ORELAP Administrator
3150 NW 229th Ave, Suite 100
Hillsboro, OR 97124

ISSUE DATE: 3/1/2008

EXPIRATION DATE: 2/28/2009

Certificate No: NM100001-009

Oregon

Environmental Laboratory Accreditation Program

Public Health Laboratory
3150 NW 229th Ave, Suite 100
Hillsboro, OR, OR 97124
(503) 693-4122
FAX (503) 693-5602

NELAP Recognized

Department of Agriculture, Laboratory Division
Department of Environmental Quality, Laboratory Division
Department of Human Services, Public Health Laboratory

ORELAP Fields of Accreditation

ORELAPID: NM100001
EPACode: NM00035

Certificate:
NM100001-009

Hall Environmental Analysis Laboratory, Inc.

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Issue Date: 3/1/2008 ***Expiration Date:*** 2/28/2009

As of 03/01/2008 this list supercedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with ORELAP.

MATRIX: Drinking Water

Reference		*Code*	*Description*
EPA 200.7 5		**10014003**	**ICP - metals**
Analyte Code	***Analyte***		
1000	Aluminum		
1015	Barium		
1020	Beryllium		
1025	Boron		
1030	Cadmium		
1035	Calcium		
1040	Chromium		
1055	Copper		
1070	Iron		
1075	Lead		
1085	Magnesium		
1090	Manganese		
1100	Molybdenum		
1105	Nickel		
1125	Potassium		
1150	Silver		
1155	Sodium		
1175	Tin		
1180	Titanium		
1185	Vanadium		
1190	Zinc		
EPA 245.1 3		**10036609**	**Mercury by Cold Vapor Atomic Absorption**
Analyte Code	***Analyte***		
1095	Mercury		
EPA 300.0		**10053006**	**Ion chromatography - anions.**
Analyte Code	***Analyte***		
1575	Chloride		
1730	Fluoride		
1810	Nitrate as N		
1835	Nitrite		
2000	Sulfate		
EPA 300.0 2.1		**10053200**	**Inorganic Anions in water by Ion Chromatography**
Analyte Code	***Analyte***		
1870	Orthophosphate as P		

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EPA 5030B 2		**10153409**	**Purge and trap for aqueous samples**
Analyte Code	***Analyte***		
125	Extraction/Preparation		
EPA 504.1		**10083008**	**EDB/DBCP/TCP micro-extraction, GC/ECD**
Analyte Code	***Analyte***		
4570	1,2-Dibromo-3-chloropropane (DBCP)		
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
EPA 524.2 4.1		**10088809**	**Volatile Organic Compounds GC/MS Capillary Column**
Analyte Code	***Analyte***		
5105	1,1,1,2-Tetrachloroethane		
5160	1,1,1-Trichloroethane		
5110	1,1,2,2-Tetrachloroethane		
5165	1,1,2-Trichloroethane		
4630	1,1-Dichloroethane		
4640	1,1-Dichloroethylene		
4670	1,1-Dichloropropene		
5150	1,2,3-Trichlorobenzene		
5180	1,2,3-Trichloropropane		
5155	1,2,4-Trichlorobenzene		
5210	1,2,4-Trimethylbenzene		
4610	1,2-Dichlorobenzene		
4635	1,2-Dichloroethane		
4655	1,2-Dichloropropane		
5215	1,3,5-Trimethylbenzene		
4615	1,3-Dichlorobenzene		
4660	1,3-Dichloropropane		
4620	1,4-Dichlorobenzene		
4535	2-Chlorotoluene		
4540	4-Chlorotoluene		
4375	Benzene		
4385	Bromobenzene		
4390	Bromochloromethane		
4395	Bromodichloromethane		
4400	Bromoform		
4950	Bromomethane (Methyl bromide)		
4455	Carbon tetrachloride		
4475	Chlorobenzene		
4485	Chloroethane		
4505	Chloroform		
105	Chloromethane		
4645	cis-1,2-Dichloroethylene		
4680	cis-1,3-Dichloropropene		
4575	Dibromochloromethane		
4595	Dibromomethane		
4650	Dichloromethane (DCM, Methylene chloride)		
4765	Ethylbenzene		
4835	Hexachlorobutadiene		
4900	Isopropylbenzene		
5000	Methyl tert-butyl ether (MTBE)		
4435	n-Butylbenzene		
5090	n-Propylbenzene		

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4440	sec-Butylbenzene
5100	Styrene
4445	tert-Butylbenzene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dicloroethylene
4685	trans-1,3-Dichloropropylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane
5235	Vinyl chloride
5260	Xylene (total)

SM 2540 C 20th ED		**20050004**	**Total Dissolved Solids**
Analyte Code	***Analyte***		
1955	Residue-filterable (TDS)		

SM 4500-H+ B 20th ED		**20104807**	**pH by Probe**
Analyte Code	***Analyte***		
1900	pH		

SM 5310 B 20th ED		**20137400**	**Total Organic Carbon by Combustion Infra-red Method**
Analyte Code	***Analyte***		
2040	Total Organic Carbon		

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MATRIX: Non-Potable Water

Reference		*Code*	*Description*
EPA 300.0		**10053006**	**Ion chromatography - anions.**
Analyte Code	***Analyte***		
1540	Bromide		
1575	Chloride		
1730	Fluoride		
1810	Nitrate as N		
1840	Nitrite as N		
1870	Orthophosphate as P		
2000	Sulfate		
EPA 3005A 1		**10133207**	**Acid Digestion of waters for Total Recoverable or Dissolved Metals**
Analyte Code	***Analyte***		
125	Extraction/Preparation		
EPA 3510C 3		**10138202**	**Separatory Funnel Liquid-liquid extraction**
Analyte Code	***Analyte***		
125	Extraction/Preparation		
EPA 5030B 2		**10153409**	**Purge and trap for aqueous samples**
Analyte Code	***Analyte***		
125	Extraction/Preparation		
EPA 6010B 2		**10155609**	**ICP - AES**
Analyte Code	***Analyte***		
1000	Aluminum		
1005	Antimony		
1010	Arsenic		
1015	Barium		
1020	Beryllium		
1025	Boron		
1030	Cadmium		
1035	Calcium		
1040	Chromium		
1050	Cobalt		
1070	Iron		
1075	Lead		
1085	Magnesium		
1090	Manganese		
1100	Molybdenum		
1105	Nickel		
1125	Potassium		
1140	Selenium		
1150	Silver		
1155	Sodium		
1165	Thallium		
1175	Tin		
1180	Titanium		
3035	Uranium		
1185	Vanadium		
1190	Zinc		
EPA 7470A 1		**10165807**	**Mercury in Liquid Waste by by Cold Vapor Atomic Absorption**
Analyte Code	***Analyte***		
1095	Mercury		

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EPA 8015B 2		**10173601**	**Non-halogenated organics using GC/FID**
Analyte Code	***Analyte***		
9369	Diesel range organics (DRO)		
9408	Gasoline range organics (GRO)		
102	Motor Oil		
EPA 8021B 2		**10174808**	**Aromatic and Halogenated Volatiles by GC with PID and/or ECD Purge &**
Analyte Code	***Analyte***		
5210	1,2,4-Trimethylbenzene		
5215	1,3,5-Trimethylbenzene		
4375	Benzene		
4765	Ethylbenzene		
5240	m+p-xylene		
5000	Methyl tert-butyl ether (MTBE)		
5250	o-Xylene		
5140	Toluene		
5260	Xylene (total)		
EPA 8081A 1		**10178606**	**Organochlorine Pesticides by GC/ECD**
Analyte Code	***Analyte***		
7355	4,4'-DDD		
7360	4,4'-DDE		
7365	4,4'-DDT		
7025	Aldrin		
7110	alpha-BHC (alpha-Hexachlorocyclohexane)		
7115	beta-BHC (beta-Hexachlorocyclohexane)		
7105	delta-BHC		
7470	Dieldrin		
7510	Endosulfan I		
7515	Endosulfan II		
7520	Endosulfan sulfate		
7540	Endrin		
7530	Endrin aldehyde		
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)		
7685	Heptachlor		
7690	Heptachlor epoxide		
7810	Methoxychlor		
EPA 8082		**10179007**	**Polychlorinated Biphenyls (PCBs) by GC/ECD**
Analyte Code	***Analyte***		
8880	Aroclor-1016 (PCB-1016)		
8885	Aroclor-1221 (PCB-1221)		
8890	Aroclor-1232 (PCB-1232)		
8895	Aroclor-1242 (PCB-1242)		
8900	Aroclor-1248 (PCB-1248)		
8905	Aroclor-1254 (PCB-1254)		
8910	Aroclor-1260 (PCB-1260)		
EPA 8260B 2		**10184802**	**Volatile Organic Compounds by purge and trap GC/MS**
Analyte Code	***Analyte***		
5105	1,1,1,2-Tetrachloroethane		
5160	1,1,1-Trichloroethane		
5110	1,1,2,2-Tetrachloroethane		
5165	1,1,2-Trichloroethane		
4630	1,1-Dichloroethane		

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4640	1,1-Dichloroethylene
4670	1,1-Dichloropropene
5150	1,2,3-Trichlorobenzene
5180	1,2,3-Trichloropropane
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4570	1,2-Dibromo-3-chloropropane (DBCP)
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
4615	1,3-Dichlorobenzene
4660	1,3-Dichloropropane
4620	1,4-Dichlorobenzene
6380	1-Methylnaphthalene
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4535	2-Chlorotoluene
4860	2-Hexanone
6385	2-Methylnaphthalene
4540	4-Chlorotoluene
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4375	Benzene
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4950	Bromomethane (Methyl bromide)
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4485	Chloroethane
4505	Chloroform
105	Chloromethane
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4575	Dibromochloromethane
4595	Dibromomethane
4625	Dichlorodifluoromethane
4650	Dichloromethane (DCM, Methylene chloride)
4765	Ethylbenzene
4835	Hexachlorobutadiene
4900	Isopropylbenzene
5240	m+p-xylene
5000	Methyl tert-butyl ether (MTBE)
5005	Naphthalene
4435	n-Butylbenzene
5090	n-Propylbenzene
5250	o-Xylene

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4910	p-Isopropyltoluene
4440	sec-Butylbenzene
5100	Styrene
4445	tert-Butylbenzene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dicloroethylene
4685	trans-1,3-Dichloropropylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane
5235	Vinyl chloride
5260	Xylene (total)

EPA 8270C 3 **10185805** **SemiVolitile Organic compounds by GC/MS**

Analyte Code	***Analyte***
5155	1,2,4-Trichlorobenzene
4610	1,2-Dichlorobenzene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
6835	2,4,5-Trichlorophenol
6840	2,4,6-Trichlorophenol
6000	2,4-Dichlorophenol
6130	2,4-Dimethylphenol
6175	2,4-Dinitrophenol
6185	2,4-Dinitrotoluene (2,4-DNT)
6190	2,6-Dinitrotoluene (2,6-DNT)
5795	2-Chloronaphthalene
5800	2-Chlorophenol
6385	2-Methylnaphthalene
6400	2-Methylphenol (o-Cresol)
6460	2-Nitroaniline
6490	2-Nitrophenol
6412	3 & 4 Methylphenol
5945	3,3'-Dichlorobenzidine
6465	3-Nitroaniline
6140	4,6-Dinitro-2-methylphenol
5660	4-Bromophenyl phenyl ether
5700	4-Chloro-3-methylphenol
5745	4-Chloroaniline
5825	4-Chlorophenyl phenylether
6470	4-Nitroaniline
6500	4-Nitrophenol
5500	Acenaphthene
5505	Acenaphthylene
5545	Aniline
5555	Anthracene
123	Azobenzene
5575	Benzo[a]anthracene
5580	Benzo[a]pyrene
5585	Benzo[b]fluoranthene
5590	Benzo[g,h,i]perylene
5600	Benzo[k]fluoranthene

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482	Benzofluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5765	bis(2-Chloroethyl)ether
5770	bis(2-Chloroethyloxymethane)
5780	bis(2-Chloroisopropyl)ether
6255	bis(2-Ethylhexyl)phthalate (DEHP)
5670	Butyl benzyl phthalate
5680	Carbazole
5855	Chrysene
5895	Dibenz[a,h]anthracene
5905	Dibenzofuran
6070	Diethyl phthalate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6315	Indeno[1,2,3-cd]pyrene
6320	Isophorone
5005	Naphthalene
5015	Nitrobenzene
6535	n-Nitrosodiphenylamine
6540	n-Nitrosodipropylamine
6605	Pentachlorophenol
6615	Phenanthrene
6625	Phenol
6665	Pyrene
5095	Pyridine

EPA 8310 **10187607** **Polynuclear Aromatic Hydrocarbons by HPLC/UV-VIS**

Analyte Code	*Analyte*
6380	1-Methylnaphthalene
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
5575	Benzo[a]anthracene
5580	Benzo[a]pyrene
5585	Benzo[b]fluoranthene
5590	Benzo[g,h,i]perylene
5600	Benzo[k]fluoranthene
5855	Chrysene
5895	Dibenz[a,h]anthracene
6265	Fluoranthene
6270	Fluorene
6315	Indeno[1,2,3-cd]pyrene
5005	Naphthalene
6615	Phenanthrene

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6665	Pyrene		
SM 2540 C 20th ED		**20050004**	**Total Dissolved Solids**
Analyte Code	***Analyte***		
1955	Residue-filterable (TDS)		
SM 4500-H+ B 20th ED		**20104807**	**pH by Probe**
Analyte Code	***Analyte***		
1900	pH		

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MATRIX: Solids

Reference		*Code*	*Description*
EPA 3050A		**10135407**	**Acid Digestion of Sediments, Sludges, and soils**
Analyte Code	***Analyte***		
125	Extraction/Preparation		
EPA 3540C 3		**10140202**	**Soxhlet Extraction**
Analyte Code	***Analyte***		
125	Extraction/Preparation		
EPA 3545		**10140804**	**Pressurized Fluid Extraction (PFE)**
Analyte Code	***Analyte***		
125	Extraction/Preparation		
EPA 5035		**10154004**	**Closed-System Purge-and-Trap and Extraction for Volatile Organics in So**
Analyte Code	***Analyte***		
125	Extraction/Preparation		
EPA 6010B 2		**10155609**	**ICP - AES**
Analyte Code	***Analyte***		
1000	Aluminum		
1005	Antimony		
1010	Arsenic		
1015	Barium		
1020	Beryllium		
1025	Boron		
1030	Cadmium		
1035	Calcium		
1040	Chromium		
1050	Cobalt		
1055	Copper		
1070	Iron		
1075	Lead		
1085	Magnesium		
1090	Manganese		
1100	Molybdenum		
1105	Nickel		
1125	Potassium		
1140	Selenium		
1150	Silver		
1155	Sodium		
1165	Thallium		
1175	Tin		
1180	Titanium		
3035	Uranium		
1185	Vanadium		
1190	Zinc		
EPA 7471A 1		**10166208**	***Mercury in Solid Waste by Cold Vapor Atomic Absorption***
Analyte Code	***Analyte***		
1095	Mercury		
EPA 8015B 2		**10173601**	**Non-halogenated organics using GC/FID**
Analyte Code	***Analyte***		
9369	Diesel range organics (DRO)		
9408	Gasoline range organics (GRO)		
102	Motor Oil		

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EPA 8021B 2 **10174808** **Aromatic and Halogenated Volatiles by GC with PID and/or ECD Purge &**

Analyte Code	*Analyte*
4375	Benzene
4765	Ethylbenzene
5240	m+p-xylene
5000	Methyl tert-butyl ether (MTBE)
5250	o-Xylene
5140	Toluene
5260	Xylene (total)

EPA 8081A 1 **10178606** **Organochlorine Pesticides by GC/ECD**

Analyte Code	*Analyte*
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7115	beta-BHC (beta-Hexachlorocyclohexane)
7105	delta-BHC
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7685	Heptachlor
7690	Heptachlor epoxide
7810	Methoxychlor

EPA 8082 **10179007** **Polychlorinated Biphenyls (PCBs) by GC/ECD**

Analyte Code	*Analyte*
8880	Aroclor-1016 (PCB-1016)
8885	Aroclor-1221 (PCB-1221)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)

EPA 8260B 2 **10184802** **Volatile Organic Compounds by purge and trap GC/MS**

Analyte Code	*Analyte*
5105	1,1,1,2-Tetrachloroethane
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
4670	1,1-Dichloropropene
5150	1,2,3-Trichlorobenzene
5180	1,2,3-Trichloropropane
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4570	1,2-Dibromo-3-chloropropane (DBCP)

ORELAP Fields of Accreditation

ORELAPID: NM100001
EPACode: NM00035

Hall Environmental Analysis Laboratory, Inc.

4901 Hawkins Rd. NE, Suite D
Albuquerque, NM, 87109

Certificate:
NM100001-009

Issue Date: 3/1/2008 ***Expiration Date:*** 2/28/2009

As of 03/01/2008 this list supercedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with ORELAP.

4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
4615	1,3-Dichlorobenzene
4660	1,3-Dichloropropane
4620	1,4-Dichlorobenzene
6380	1-Methylnaphthalene
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4535	2-Chlorotoluene
4860	2-Hexanone
6385	2-Methylnaphthalene
4540	4-Chlorotoluene
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4375	Benzene
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4950	Bromomethane (Methyl bromide)
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4485	Chloroethane
4505	Chloroform
105	Chloromethane
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4575	Dibromochloromethane
4595	Dibromomethane
4625	Dichlorodifluoromethane
4650	Dichloromethane (DCM, Methylene chloride)
4765	Ethylbenzene
4835	Hexachlorobutadiene
4900	Isopropylbenzene
5240	m+p-xylene
5000	Methyl tert-butyl ether (MTBE)
5005	Naphthalene
4435	n-Butylbenzene
5090	n-Propylbenzene
5250	o-Xylene
4910	p-Isopropyltoluene
4440	sec-Butylbenzene
5100	Styrene
4445	tert-Butylbenzene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dicloroethylene

4685	trans-1,3-Dichloropropylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane
5235	Vinyl chloride
5260	Xylene (total)

EPA 8270C 3 **10185805** **SemiVolltile Organic compounds by GC/MS**

Analyte Code	*Analyte*
5155	1,2,4-Trichlorobenzene
4610	1,2-Dichlorobenzene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
6835	2,4,5-Trichlorophenol
6840	2,4,6-Trichlorophenol
6000	2,4-Dichlorophenol
6130	2,4-Dimethylphenol
6175	2,4-Dinitrophenol
6185	2,4-Dinitrotoluene (2,4-DNT)
6190	2,6-Dinitrotoluene (2,6-DNT)
5795	2-Chloronaphthalene
5800	2-Chlorophenol
6385	2-Methylnaphthalene
6400	2-Methylphenol (o-Cresol)
6460	2-Nitroaniline
6490	2-Nitrophenol
6412	3 & 4 Methylphenol
5945	3,3'-Dichlorobenzidine
6465	3-Nitroaniline
6140	4,6-Dinitro-2-methylphenol
5660	4-Bromophenyl phenyl ether
5700	4-Chloro-3-methylphenol
5745	4-Chloroaniline
5825	4-Chlorophenyl phenylether
6470	4-Nitroaniline
6500	4-Nitrophenol
5500	Acenaphthene
5505	Acenaphthylene
5545	Aniline
5555	Anthracene
123	Azobenzene
5575	Benzo[a]anthracene
5580	Benzo[a]pyrene
5585	Benzo[b]fluoranthene
5590	Benzo[g,h,i]perylene
5600	Benzo[k]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl)ether
5780	bis(2-Chloroisopropyl)ether
6255	bis(2-Ethylhexyl)phthalate (DEHP)
5670	Butyl benzyl phthalate

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5680	Carbazole
5855	Chrysene
5895	Dibenz[a,h]anthracene
5905	Dibenzofuran
6070	Diethyl phthalate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6315	Indeno[1,2,3-cd]pyrene
6320	Isophorone
5005	Naphthalene
5015	Nitrobenzene
6530	n-Nitrosodimethylamine
6535	n-Nitrosodiphenylamine
6540	n-Nitrosodipropylamine
6605	Pentachlorophenol
6615	Phenanthrene
6625	Phenol
6665	Pyrene
5095	Pyridine

EPA 8310 **10187607** **Polynuclear Aromatic Hydrocarbons by HPLC/UV-VIS**

Analyte Code	*Analyte*
6380	1-Methylnaphthalene
6385	2-Methylnaphthalene
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
5575	Benzo[a]anthracene
5580	Benzo[a]pyrene
5585	Benzo[b]fluoranthene
5590	Benzo[g,h,i]perylene
5600	Benzo[k]fluoranthene
5855	Chrysene
5895	Dibenz[a,h]anthracene
6265	Fluoranthene
6270	Fluorene
6315	Indeno[1,2,3-cd]pyrene
5005	Naphthalene
6615	Phenanthrene
6665	Pyrene