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PHASE II REMEDIAL INVESTIGATION / FEASIBILITY STUDY QUALITY ASSURANCE PROJECT PLAN

Pall Corporation Facility
NYSDEC IHWDS No. 1-30-053B
30 Sea Cliff Avenue
Glen Cove, New York

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1.0 INTRODUCTION

This Phase II Remedial Investigation/Feasibility Study Quality Assurance Project Plan (QAPP) outlines the quality assurance and quality control procedures to be implemented during Remedial Investigation (RI) activities at Pall Corporation's (Pall's) 30 Sea Cliff Avenue facilities located in Glen Cove, Town of North Hempstead, Nassau County, New York. The Pall property is listed by the New York State Department of Environmental Conservation (NYSDEC) as an Inactive Hazardous Waste Site (NYSDEC Site No. 1-30-053B). The NYSDEC has also listed the August Thomsen property located at 36 Sea Cliff Avenue as part of the Pall Inactive Hazardous Waste disposal Site. The terms "site" or "property" when used to describe the subject facilities shall include the 30 and 36 Sea Cliff Avenue properties.

The RI work planned for the site includes the installation and sampling of additional monitoring wells and soil borings throughout the site to better delineate the nature and extent of soil and/or groundwater contamination at the site. Groundwater samples will be collected from the newly installed monitoring wells and the existing wells at the site. A limited off-site groundwater investigation will also be included on the properties that are located adjacent to the northeast-northwest portions of the site in order to identify the apparent center of the contaminant plume located near the northern border of the Pall property.

1.1 Purpose and Objectives

The purpose of this Quality Assurance Project Plan (QAPP) is to document planned investigative activities and establish the criteria for performing these activities at a pre-determined quality, and to review and summarize such work performed by others at the Pall Corporation Site in Glen Cove, Nassau County, New York. The Pall Site is a New York State Department of Environmental Conservation (NYSDEC) Class 2 Inactive Hazardous Waste Site, Site Code 1-30-053B. The work will be completed by IT Corporation (IT) under contract to Pal and/or its agents.

Project work will be conducted in general accordance with the United States Environmental Protection Agency (EPA) Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, October 1988) and the NYSDEC Guidelines for Remedial Investigations/Feasibility Studies, Technical and Administrative Guidance Memorandum HWR-89-4025 (March 31, 1989) and TAGM #4030, Selection of Remedial Activities at Inactive Hazardous Waste Sites.

1.2 Project Management & Organization

1.2.1 Personnel

The general responsibilities of key project personnel are listed below.

- Project Manager — Mr. Daniel J. Smith, P.E. (IT), Project Manager, will have responsibility for overall project management and coordination with NYSDEC and Pall.
- RI Task Leader — Mr. Mitch Wiest (IT), will have overall responsibility of implementing and coordinating the Remedial Investigation project activities.
- RI Field Team — Mr. Matthew Bernstein (IT), will have overall responsibility for on-site implementation of the Remedial Investigation project activities.
- FS Task Leader — Mr. Daniel J. Smith, P.E. (IT), will be responsible for management, coordination and implementation of the Feasibility Study.
- QA Officer — Dr. Maureen Leahy, Ph.D. (IT) will serve as Quality Assurance Officer, and will be responsible for laboratory and data review, as well as data usability reports. The QAO will also be responsible for field sampling quality and adherence to this QAPP and the RI/FS Work Plan. Dr. Leahy's resume is included as Appendix A.
- H & S Officer — Mr. John Reineman, CIH (IT) will be responsible for the preparation of the project health and safety plan, and tracking of its implementation.
- Community Coordinator — Mr. Daniel J. Smith, P.E. (IT), Mr. Kurt Olsen, Esq., and Ms. Mary Ann Bartlett (Pall) will coordinate implementation of the community participation plan and its implementation.

1.2.2 Specific Tasks and Services

FDGTI will procure subcontractor specialists for services relating to drilling and monitoring well installation, laboratory/analytical services, and field surveying. The planned subcontractors for utilization at the Pall Site are:

- Laboratory Analysis — H2M Laboratories, Inc. or Ecotest Environmental Labs. The selected laboratory shall have and maintain NYSDOH ELAP CLP certification for volatile organic compound analyses throughout the project.

- Drilling Services — Land Air Water Environmental Services, Inc.
- Surveying — NYS Licensed Surveyor To Be Determined

2.0 SITE INVESTIGATION PROCEDURES AND RATIONALE

The field work proposed by IT is focused on supplementing data from previous investigations to obtain a better understanding of site specific conditions. Environmental sampling and other field activities will be performed in general accordance with the appropriate techniques presented in the following guidance documents.

- Sampling Guidelines and Protocols, NYSDEC, Division of Water, March 1991.
- Compendium of Superfund Field Operations Methods, US EPA, December 1987 (EPA/540/P-87/001).
- RCRA Ground-Water Monitoring: Draft Technical Guidance, US EPA, November 1992 (EPA/530-R-93-001).
- Soil Sampling Quality Assurance User's Guide (Second Edition), US EPA, March 1989, (EPA/600/8-89/046).
- USEPA Region II CERCLA Quality Assurance Manual, Revision 1, USEPA Region II, October 1989.
- Appropriate NYSDEC Department of Hazardous Waste Remediation Technical and Administrative Guidance Memoranda (TAGM); #4032 (Disposal of Drill Cuttings; November 1989); and #4047 (Priority Ranking System for Class 2 Inactive Hazardous Waste Sites; December 1992).

Field activities are described in the following sections.

2.1 Groundwater Sampling

Groundwater sampling of existing monitoring wells includes initial recording of data, purging of the well, and collection of the sample. The text below addresses these items. Groundwater sampling will also be completed from Geoprobe borings. Groundwater sampling from Geoprobe borings is discussed in Section 2.1.2.

2.1.1 Monitoring Wells

Well Evacuation

Groundwater sampling will begin by locating the well to be sampled and recording the appropriate field data, as summarized below.

- Observations of the well (conditions of cap, collar, casing, etc.) and the ambient conditions (weather; surrounding area; date and time; sampling crew members and observers if any will be recorded. See also Section 5.1 for information to be recorded in the field notebook).

- After unlocking the well cover, PID surveys of ambient air, upwind air, and air directly at the top of the well will be monitored and recorded.

- Water level measurements will be collected, noting the reference point from which the measurement is made (typically a notch on the inner casing).

- The well will then purged of standing water. The purpose of purging is to obtain a representative groundwater sample. If practical, a minimum of three standing water volumes of the well will be purged. However if the well is slow to recover, then the well will be purged until no further water can be removed from the well. If the water level is slow to recharge and does not reach to its pre-purge level within two hours, then samples will be collected after sufficient water has recharged to enable sample collection. Purging may be accomplished by bailing, inertial pumping, or pumping with a peristaltic or submersible centrifugal pump to remove water from the wells.

Groundwater Collection

Bailers will be used for sample collection and will be equipped with a check-valve. Bailers will be dedicated, disposable Polyethylene. Due to their light-weight and tendency to not sink after entering the top of the water column, disposable bailers will (if necessary) be fitted with weights provided by the vendor for that purpose. Bailers will be clean upon arrival at the site. Site decontamination of bailers will not be necessary. Bailers will be lowered gently with minimal water agitation into the well with dedicated polyethylene or polypropylene line.

The first bailer of water will be collected for volatile organics or other light weight/volatile compound analyses. A portion of the first bailer will also be retained for field measurements of pH, temperature, conductivity, and turbidity.

Two or three (depending on laboratory-specific requirements) 40-ml glass vials (with Teflon septa) will

be used to collect samples for volatile organic analysis (VOC). The vials will be filled by gently pouring water from the top of the bailer into the vial until overflowing and a convex meniscus is formed. The vial will then be capped, inverted and inspected for air pockets/bubbles that may be present on the inside surfaces of the vial. If any bubbles or aggregate of bubbles are observed, then a new sample will be obtained either using a new vial or the same vial. In accordance with NYSDEC preference, samples for VOCs will not be chemically preserved (i.e., no HCl will be added).

At the conclusion of collection of all analytical samples, a final measurement of field parameters will be made. Sample bottles are discussed in more detail in Section 3.2.

2.1.2 Geoprobe Groundwater Sampling

Groundwater samples will be collected using a SP15 screen point sampler. To collect groundwater samples using this sampler, a clean unit is threaded onto the leading end of a probe rod and driven to the desired sampling interval. While the sampler is driven to the desired depth, O-ring seals at the drive head and expandable drive point provide a water tight system. Once at the desired depth, the tool string is retracted while the screen is held in-place. The O-ring at the drive head maintains the seal at the top of the screen. As a result, any liquid entering the sampler, must pass through the screen. The screen point sampler utilizes a screen with a slot size of 0.004 inches and an exposed length of up to 41 inches.

The water sample will be brought to the surface using dedicated polyethylene tubing fitted with a stainless steel check valve. By oscillating the tubing up and down, the water will be brought to the surface. The water sample will then be placed in appropriate laboratory supplied containers and placed into a cooler.

2.2 Air Surveillance & Monitoring

Air surveillance screening of volatile compounds for health and safety concerns will be performed with a portable HNU photoionization detector (PID) or equivalent. Monitoring will be done during invasive activities such as Geoprobe drilling, monitoring well installation, well development, and sampling. Additional details are presented in the site specific Health and Safety Plan.

2.3 Soil Sampling

Select soil samples from the Geoprobes and Auger borings will be immediately placed in the appropriate glassware and sealed to prevent volatile loss prior to delivery to the analytical laboratory. A separate aliquot of the sample will be also field screened for VOCs. All VOC samples will not be mixed but will be placed directly into the VOC vial sample.

Geoprobe soil samples will be sampled by opening the acetate tube (Geoprobes), slicing the core (if

intact) vertically down the middle with a sharp knife or similar blade, and scooping sufficient sample from the long axis of the split core. If the core is not intact, then upon opening the tube, the contents can be scooped directly. Samples for VOCs will be collected and transferred to sample containers following PID screening. If the sample is not homogeneous, representative portions of each type of material within the sample will be collected. There may also be situations where it will be appropriate to grab-sample specific zones due to textural variations, the presence of apparent staining, or "hot spot" preliminary screening results.

Auger Probes

Soil samples will be classified by IT in the field by visual examination as appropriate. A log of each boring hole will be prepared with appropriate stratification lines, sample identification, sample depth interval and recovery, and date.

Selected overburden samples will be retained for analytical testing. These samples will be placed in certified clean sample containers, placed in an iced cooler and handled in accordance with appropriate Chain-of-Custody protocols as described in the QAPP.

The auger holes will be backfilled with native soils and if necessary, clean sand.

Soil Screening

Soil screening will be performed by headspace screening with the PID. The soil screening procedure is provided in Appendix B.

The PID will be calibrated daily, in accordance to manufacturer's requirements using a standard gas. Calibration records will be documented in the field notes or on a daily field calibration form. The peak PID response will be recorded. A response of less than 1 part per million (ppm) above ambient background using this method, is not considered significant and will be reported as not detected.

2.4 Surface Water & Sediment

2.4.1 Surface Water

If the collection of surface water samples is required, where possible, sample bottles (unpreserved) will be lowered below the water surface and allowed to fill. Normally, surface water samples will be collected from mid-depth and mid-channel (for flowing bodies such as streams). Sample preservation, where required, will be added to the samples after collection. Generally, surface water samples will be collected with a sediment sample from the same general location. After capping, bottles will be dried with a paper towel. Surface water sampling is not planned.

If required, surface water samples will be collected prior to the collection of the associated sediment samples. Surface water sampling will be conducted sequentially from the farthest downstream sample to the farthest upstream sample so that disturbed sediments from one sample location are not transported downstream to a subsequent sample.

2.4.2 Sediment

Sediment samples (if collection is included in the scope of work) will be collected using a stainless steel spatula or spoon directly from the stream bed. Samples for VOCs will be screened with the PID, then placed into the laboratory container and sealed.

2.6 Equipment Decontamination

To avoid cross contamination, sampling equipment (defined as any piece of equipment which may contact a sample) will be decontaminated according to the following procedures outlined below.

2.6.1 Non-Dedicated Reusable Equipment

Non-dedicated reusable equipment such as split spoons, stainless steel mixing bowls; pumps used for groundwater evacuation (and sampling, if applicable) etc. will require field decontamination. Acids and solvents will not be used in the field decontamination of such equipment. Decontamination will include scrubbing/washing with a laboratory grade detergent (e.g. alconox) to remove visible contamination, followed by potable (tap) water and analyte-free water rinses. Tap water may be used from any treated municipal water system; the use of an untreated potable water supply is not an acceptable substitute. Equipment should be allowed to dry prior to use.

Pumps will be decontaminated by running potable water through the pump, followed by an analyte-free water rinse. Tubing will not be re-used (new tubing will be used for each well). Submersible pumps and supporting lines and cables will be place in a large plastic garbage can filled with potable water and then run for several minutes (to decontaminate both exterior and interior parts); submersible pumps will also be given a final analyte free water rinse of both interior and exterior parts.

Equipment blanks will be collected and analyzed in accordance with Section 4.3.1 at a frequency of not less than one per twenty samples or one per day, whichever is more frequent.

2.6.2 Disposable Sampling Equipment

Disposable sampling equipment includes disposable bailers; and tubing associated with groundwater

sampling/purging pumps, etc. Such equipment will not be field-decontaminated; equipment other than bailers may be rinsed with analyte-free water prior to use.

2.7 Storage and Disposal of Investigation Generated Wastes

Development and purge water will be containerized in 55-gallon drums, labeled, and transferred to a drum staging area specified by Pall for future disposal. Monitoring well data will be utilized to characterize development and purge waters for proper disposal. Alternatively, a temporary storage tank may also be utilized for storage of development waters prior to bulk removal for proper disposal.

Personal protective equipment and disposable sampling equipment will be placed in plastic garbage bags for disposal as a non-hazardous waste.

Decontamination Fluids

Wash water and rinse water, including detergent, may be generated during site work. These wastes will be disposed into the on-site sanitary sewer system.

2.8 Hollow Stem Auger's and Geoprobes

The Geoprobe tools, Augers, Split-spoon samplers, etc. will be decontaminated between borings and between sample locations within the same boring. Decontamination will be accomplished using a non-phosphorous detergent rinse followed by an analyte free water rinse. Soil sampling devices will be cleaned manually with non-phosphate detergent wash and potable water followed by a potable water. The equipment will be cleaned prior to leaving the site.

A steam cleaner or high pressure wash equipment may also be utilized.

2.9 Survey

A surveyor will be contracted to measure the vertical and horizontal locations of the new monitoring wells at the site. Existing survey data will be utilized for those monitoring wells which already exist at the site. At least two existing monitoring well points will be re-surveyed to ensure consistency of survey data.

A water level survey which will consist of the collection of two rounds of water level data from each monitoring well at the site will be conducted. Water level elevations will then be calculated for each monitoring well based on the surveyed elevation of each monitoring well and measured depths to water. A groundwater elevation contour map will then be plotted for the site and inferred groundwater flow directions developed. Groundwater potentiometric surface maps will be developed for shallow,

intermediate, and deep groundwater zones.

3.0 SAMPLE HANDLING

3.1 Sample Identification Labelling

Samples will be assigned a unique identification using the sample location or other sample-specific identifier. Sample identification will be limited to seven alphanumeric characters to be consistent with the limitations of the laboratory tracking/reporting software. The general sample identification format follows.

SL-XX

Where:

- SL = Location identifier (2 or 3 characters, as below)
- GP = Geoprobe boring (GP) with numeric character indicating boring number from which the sample was obtained.
- AP = Auger probe (AP) with numeric character indicating boring number from which the sample was obtained.
- MW = Groundwater Monitoring Well
- EB = Equipment (Field Rinsate) Blank
- TB = Trip Blank
- XX = Numerical sample identifier (2 or 3 characters). This will ordinarily be an arbitrary, sequential number and will correspond to sample location information and numbering. However, for soil borings it will identify from which split spoon the sample was obtained (e.g., S1, S2, etc; the number will be the same as indicated on the boring log).

QC field duplicate samples will be submitted blind to the laboratory; a fictitious sample ID will be created using the same system as the original. The sample identifications (of the original sample and its field duplicate) will be marked in the field book and on the copy of the chain-of-custody kept by the

sampler and copied to the project manager. All sample containers will be labeled in the field prior to the collection of samples. Affixed to each sampling container will be a non-removable label on which the following information will be recorded with permanent water-proof ink:

- Site name, location, and job number;
- Sample identification code;
- Date and time;
- Sampler's name or initials;
- Preservative;
- Type of sample (e.g., water, soil, sludge, sediment); and,
- Requested analyses (on chain of custody).

3.2 Sample Bottles, Preservation and Holding Times

Table 1 specifies the analytical method, matrix, holding time, containers, and preservatives for the various analysis to be completed as part of the FRI. Sample bottle requirements, preservation, and holding times are discussed further below.

3.2.1 Sample Bottles

The selection of sample containers used to collect samples is based on the criteria of sample matrix, analytical method, potential contaminants of concern, reactivity of container material with the sample, QA/QC requirements and any regulatory protocol requirements. Sample bottles will be provided by the analytical laboratory and will conform to the requirements of USEPA's Specifications and Guidance for Contaminant-Free Sample Containers.

3.2.2 Sample Preservation

Samples will be preserved as indicated below and summarized on Table 1.

Soil Samples

- Analytical (all analysis) - cooled to 4 °C; no chemical preservatives added.

Aqueous Samples:

- Volatile organics - cooled to 4 °C; no chemical preservatives added.

Chemical preservatives (if required) will be added to the sample bottles (prior to sample collection) by the analytical laboratory.

3.2.3 Holding Times

Holding times are judged from the verified time of sample receipt (VTSR) by the laboratory; samples will be shipped from the field to arrive at the lab no later than 48 hours from the time of sample collection. Holding time requirements will be those specified in the NYSDEC ASP; it should be noted that for some analyses, these holding times are more stringent than the holding time for the corresponding USEPA method. Aqueous samples for volatile organics will not be subject to chemical preservation, and are therefore limited to a seven day holding time from VTSR.

Although trip blanks are prepared in the analytical laboratory and shipped to the site prior to the collection of environmental samples, for the purposes of determining holding time conformance, trip blanks will be considered to have been generated on the same day as the environmental samples with which they are shipped and delivered. Procurement of bottles and blanks will be scheduled (if possible) to prevent trip blanks from being stored for excessive periods prior to their return to the laboratory; the goal is that trip blanks should be held for no longer than one week prior to use.

3.3 Chain-of-Custody and Shipping

A chain-of-custody form will trace the path of sample containers from the project site to the laboratory. A sample Chain of Custody is included in Appendix A, Field Forms. Sample/bottle tracking sheets or the chain-of-custody will be used to track the containers from the laboratory to the containers' destination. The project manager will notify the laboratory of upcoming field sampling events and the subsequent transfer of samples. This notification will include information concerning the number and type of samples, and the anticipated date of arrival. Insulated sample shipping containers (typically coolers) will be provided by the laboratory for shipping samples. All sample bottles within each shipping container will be individually labeled with an adhesive identification label provided by the laboratory. Project personnel receiving the sample containers from the laboratory will check each cooler for the condition and integrity of the bottles prior to field work.

Once the sample containers are filled, they will be immediately placed in the cooler with ice (in Ziploc plastic bags to prevent leaking) or synthetic ice packs to maintain the samples at 4 °C. The field sampler will indicate the sample designation/location number in the space provided on the chain-of-custody form for each sample. The chain of custody forms will be signed and placed in a sealed plastic Ziploc bag in the cooler. The completed shipping container will be closed for transport with strapping, or shipping tape, and two paper seals will be affixed to the lid. The seals must be broken to open the cooler and will indicate tampering if the seals are broken before receipt at the laboratory. A

label may be affixed identifying the cooler as containing "Environmental Samples" and the cooler will be shipped by an overnight delivery service or hand delivered to the INYSDOH ELAP CLP certified aboratory by an individual designated by IT. When the laboratory receives the coolers, the custody seals will be checked and lab personnel will sign the chain-of-custody form.

4.0 DATA QUALITY REQUIREMENTS

Analytical Methods Groundwater samples submitted to the laboratory will be analyzed for VOCs in accordance with EPA Method 624. Soil samples submitted to the laboratory will be analyzed for VOCs in accordance EPA Method 8240. Specifically, the following parameters will be included:

Method 624 Parameters

Benzene
Bromomethane
Carbon Tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane
2-Chloroethylvinyl ether
Chloroform
Chloromethane
Dibromochloromethane
Cis-1,3-Dichloropropylene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorobromomethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
1,2-Dichloropropane
Ethylbenzene
Methyl bromide
Methyl chloride
Methylene chloride
1,1,2,2-tetrachloroethane
Tetrachloroethylene
Toluene
1,2-Dichloroethene (total)
Trans-1,3-Dichloropropylene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Trichlorfluoromethane
Vinyl chloride
Xylenes (total)

Method 8240Parameters

Acetone
Benzene
Bromoform
Bromomethane
2-Butanone
Carbon Disulfide
Carbon Tetrachloride
Chlorobenzene
Chloromethane
2-Chloroethylvinyl ether
Dibromochloromethane
Cis-1,3-Dichloropropylene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorobromomethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
1,2-Dichloropropane
Ethylbenzene
Styrene
Methylene chloride
1,1,2,2-tetrachloroethane
Tetrachloroethylene
Toluene
1,2-Dichloroethene (total)
Trans-1,3-Dichloropropylene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Vinyl chloride
Xylenes (total)

QA/QC sample collection and analysis including the collection of trip blanks, field blanks, duplicates, and matrix spike (ms)/matrix spike duplicate (MSD) samples will be conducted at the site as per the QAPP.

The laboratory chosen for this project will be certified by the NYSDOH Environmental Laboratory Approved Program (ELAP).

4.2 Quality Assurance Objectives

Data quality objectives (DQOs) for measurement data in terms of sensitivity and the PARCC parameters (precision, accuracy, representativeness, comparability, and completeness) are established so that the data collected are sufficient and of adequate quality for their intended uses. Data collected and analyzed in conformance with the DQO process described in this QAPP will be used in assessing the uncertainty associated with decisions related to this site.

4.2.1 Sensitivity

The sensitivity or detection limit desired for each analysis or compound is established by NYSDEC as part of the Analytical Services Protocol (ASP) Superfund Contract Laboratory Program (CLP). It is understood that such limits are dependent upon matrix interferences.

Volatile Organics. The Contract Required Quantitation Limits (CRQLs) for all analytes is 10 µg/L (10 µg/kg for soil). The reporting limit for non-detected analytes is the CRQL. Based on laboratory method detection limit (MDL) studies, detected analytes will be reported down to 1 ug/L; analytes reported at concentrations below the CRQL will be flagged "J" (estimated) by the laboratory.

4.2.2 Precision

The laboratory objective for precision is to equal or exceed the precision demonstrated for the applied analytical methods on similar samples. Precision is evaluated by the analyses of laboratory and field duplicates. Laboratory duplicate analyses will be performed once for every twenty samples for metals as specified in the NYSDEC ASP-CLP.

Relative Percent Difference (RPD) criteria, prescribed by the NYSDEC, and those determined from laboratory performance data, are used to evaluate precision between duplicates. A matrix spike duplicate will be performed once for every twenty samples for volatile organics.

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. Precision is usually stated in terms of standard deviation but other estimates such as the

coefficient of variation, relative standard deviation, range (maximum value minus minimum value), and relative range are common, and may be used pending review of the data.

The overall precision of measurement data is a mixture of sampling and analytical factors. Analytical precision is easier to control and quantify than sampling precision; there are more historical data related to individual method performance and the "universe" is not limited to the samples received in the laboratory. In contrast, sampling precision is unique to each site or project.

Overall system (sampling plus analytical) precision will be determined by analysis of field duplicate samples. Analytical results from laboratory duplicate samples will provide data on measurement (analytical) precision.

Precision will be determined from field duplicates, as well as laboratory matrix duplicate samples for metals analyses, and matrix spikes and matrix spike duplicates for organic analyses; it will be expressed as the relative percent difference (% RPD):

$$\% \text{ RPD} = 100 \times 2(X_1 - X_2) / (X_1 + X_2)$$

where:

X_1 and X_2 are reported concentrations for each duplicate sample and subtracted differences represent absolute values.

Criteria for evaluation of laboratory duplicates are specified in the applicable methods. The objective for field duplicate precision is < 50% RPD for all matrices.

4.2.3 Accuracy

The laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for the applied analytical method on similar samples. Percent recovery criteria, published by the NYSDEC as part of the ASP, and those determined from laboratory performance data, are used to evaluate accuracy in matrix (sample) spike and blank spike quality control samples. A matrix spike and blank spike will be performed once for every sample delivery group (SDG) as specified in the ASP-CLP. This will apply to inorganics and volatile and semivolatile organics analyses. Other method-specific laboratory QC samples (such as laboratory control samples for metals, and continuing calibration standards) may also be used in the assessment of analytical accuracy. Sample (matrix) spike recovery is calculated as:

$$\%R = (SSR-SR)/SA \times 100,$$

where

- SSR = Spiked sample Result
- SR = Sample Result, and
- SA = Spike Added

Accuracy measures the bias in a measurement system. It is difficult to measure accuracy for the entire data collection activity. Accuracy will be assessed through use of known QC samples.

Accuracy values can be presented in a variety of ways. Accuracy is most commonly presented as percent bias or percent recovery. Percent bias is a standardized average error, that is, the average error divided by the actual or spiked concentration and converted to a percentage. Percent bias is unitless and allows accuracy of analytical procedures to be compared.

Percent recovery provides the same information as percent bias. Routine organic analytical protocol requires a surrogate spike in each sample. Surrogate recovery will be defined as:

% Recovery = (R/S) x 100

where

- S = surrogate spike concentration
- R = reported surrogate concentration

Recovery criteria for laboratory spikes and other laboratory QC samples through which accuracy may be evaluated are established in the applicable analytical method.

4.2.4 Representativeness

The representativeness of data is only as good as the representativeness of the samples collected. Sampling and handling procedures, and laboratory practices are designed to provide a standard set of performance-driven criteria to provide data of the same quality as other analyses of similar matrices using the same methods under similar conditions. Representativeness will be determined by a comparison of the quality controls for these samples against data from similar samples analyzed at the same time.

4.2.5 Comparability

Comparability of analytical data among laboratories becomes more accurate and reliable when all labs follow the same procedure and share information for program enhancement. Some of these

procedures include:

- Instrument standards traceable to National Institute of Standards and Technology (NIST), the U.S. Environmental Protection Agency (EPA), or the New York State Departments of Health or Environmental Conservation;
- Using standard methodologies;
- Reporting results for similar matrices in consistent units;
- Applying appropriate levels of quality control within the context of the laboratory quality assurance program; and,

By using traceable standards and standard methods, the analytical results can be compared to other labs operating similarly. The QA Program documents internal performance. Periodic laboratory proficiency studies are instituted as a means of monitoring intra-laboratory performance.

4.2.6 Completeness

The goal of completeness is to generate the maximum amount possible of valid data. The highest degree of completeness would be to find all deliverables flawless, valid and acceptable. The lowest level of completeness is excessive failure to meet established acceptance criteria and consequent rejection of data. The completeness goal is 100% useable data. However, it is acknowledged that this goal may not be fully achievable; for example, individual analytes (e.g., 2-hexanone) may be rejected within an otherwise acceptable analysis. The impact of rejected or unusable data will be made on a case-by-case basis by the project QAO and summarized in the project QA reports. If the FRI/FS can be completed without the missing datum or data, no further action would be necessary. However, loss of critical data may require resampling or reanalysis.

4.3 Field Quality Assurance

Blank water generated for use during this project must be "demonstrated analyte-free". The criteria for analyte-free water is based on the EPA assigned values for the Contract Required Detection Limits (CRDLs) and CRQLs. If the levels of detection needed on a specific site are lower than the CLP CRDLs/CRQLs, then those levels are used to define the criteria for analyte-free water.

- Volatile organics < 10 µg/l
- Semivolatile organics < 10 µg/l or 25 µg/l (analyte specific)
- Inorganics < CRDL

However, specifically for the common laboratory contaminants (acetone and 2-butanone) the allowable limits are five times the respective CRQLs. For methylene chloride, the limit is 2.5 times the CRQL.

The analytical testing required for the water to be demonstrated as analyte free must be performed prior to the start of sample collection; thus, blank water will be supplied by the laboratory.

4.3.1 Equipment (Rinsate) Blanks

Equipment blanks consist of demonstrated, analyte-free water that show if sampling equipment has the potential for contaminant carryover to give a false impression of contamination in an environmental sample. When blank water is used to rinse a piece of sampling equipment (before it is used to sample), the rinsate is collected and analyzed to see if sampling could be biased by contamination from the equipment.

Field Equipment (Rinsate) blanks for bailers: For initial sampling, as well as at subsequent rounds of sampling when bailers are reused, at least one of the bailers used per decontamination batch, will be used to generate equipment (rinsate) blanks during groundwater sampling. Disposable bailers will be obtained from a single vendor for this project. One rinsate blank will be collected for each type of sampling apparatus during groundwater sampling events. Equipment blanks will be collected and analyzed for VOCs at a frequency of not less than one per twenty samples or one per day, whichever is more frequent.

4.3.2 Field Duplicate Samples

Field duplicate samples are used to assess the variability of a matrix at a specific sampling point and to assess the reproducibility of the sampling method. For soil samples, these samples are separate aliquots of the same sample; prior to dividing the sample into "sample" and "duplicate" aliquots, the samples are homogenized (except for the VOC aliquots, which are not homogenized). Aqueous field duplicate samples are second samples collected from the same location, at the same time, in the same manner as the first, and placed into a separate container (technically, these are co-located samples). Each duplicate sample will be analyzed for the same parameters as the original sample collected that day. The blind field duplicate Relative Percent Difference (RPD) objective will be +50% percent RPD for all matrices. Field duplicates will be collected at a frequency of 1 per 20 environmental samples for both matrices (aqueous and non-aqueous) and all test parameters.

4.3.3 Split Samples

Split samples are used for performance audits or inter-laboratory comparability of data. A split sample will be defined as at least two separate sub-samples taken from a single original sample which has been thoroughly mixed or homogenized prior to the formation of the split samples. The exception to

this is samples for volatile organics analysis which will not be homogenized. Collection of split samples is not planned.

4.3.4 Trip Blanks

The purpose of a VOC trip blank (using demonstrated analyte-free water) is to place a mechanism of control on sample bottle preparation and blank water quality, and sample handling. The trip blank travels from the lab to the site with the empty sample bottles and back from the site with the collected samples. There will be a minimum of one trip blank per shipment containing aqueous samples for volatile organic compounds (VOCs) analysis. Trip blanks will be collected only when aqueous volatile organics are being sampled and shipped; except that a trip blank is not required when the only aqueous samples in a shipment are QC samples (rinsate blanks).

4.4 Field Testing QC

Field testing of groundwater will be performed during purging of wells prior to sampling for laboratory samples. Field QC checks of control limits for pH, specific conductance (conductivity) and turbidity are detailed below. The calibration frequencies discussed below are the minimum. Field personnel can and should check calibration more frequently in adverse conditions, if anomalous readings are obtained, or subjective observations of instrument performance suggest the possibility of erroneous readings.

4.4.1 pH

The pH meter is calibrated twice daily (prior to initial use and midday), using two standards bracketing the range of interest (generally 4.0 and 7.0). If the pH QC control sample (a pH buffer, which may be the same or different than those used to initially calibrate the instrument) exceeds + 0.1 pH units from the true value, the source of the error will be determined and the instrument recalibrated. If a continuing calibration check with pH 7.0 buffer is off by + 0.1 pH units, the instrument will be recalibrated. Expired buffer solutions will not be used. A field pH Calibration Form is included in Appendix A.

Note that gel-type probes take longer to equilibrate (up to 15 minutes at near-freezing temperatures); this must be taken into account in calibrating the instrument and reading samples and standards.

4.4.2 Specific Conductivity

A vendor-provided conductivity standard will be used to check the calibration of the conductivity meter twice daily (prior to initial use and midday). Specific conductance QC samples will be on the order of 0.01 or 0.1 molar potassium chloride solutions in accordance with manufacturer's recommendations. A Field Specific Conductance Calibration Form is included in Appendix A.

4.4.3 Turbidity

The turbidity meter should be calibrated using a standard as close as possible to 50 NTU (the critical value for determining effectiveness of well development and evacuation). The turbidimeter will be calibrated/checked twice daily. The turbidity QC sample will be a commercially prepared polymer standard (Advanced Polymer System, Inc., or similar). A Field Turbidity Calibration Form is included in Appendix A.

4.4.4 Temperature

Temperature probes associated with instruments (such as the YSI SCT-33 conductivity and temperature meter) are not subject to field calibration, but the calibration should be checked to monitor instrument performance. It is recommended that the instrument's temperature reading be checked against a NIST-traceable thermometer concurrently with checking the conductivity calibration. The instrument manual will be referenced for corrective actions if accurate readings cannot be obtained. A Temperature Calibration Form is included in Appendix A.

4.5 Laboratory Quality Assurance

4.5.1 Method Blanks

A method blank is laboratory water on which every step of the method is performed and analyzed along with the samples. They are used to assess the background variability of the method and to assess the introduction of contamination to the samples by the method, technique, or instruments as the sample is prepared and analyzed in the laboratory. Method blanks will be analyzed at a frequency of one for every twenty samples analyzed or as otherwise specified in the analytical protocol.

4.5.2 Laboratory Duplicates

Laboratory duplicates are sub-samples taken from a single aliquot of sample after the sample has been thoroughly mixed or homogenized (with the exception of volatile organics), to assess the precision or reproducibility of the analytical method on a sample of a particular matrix. Laboratory duplicates will be performed on spiked samples as a Matrix Spike and a Matrix Spike Duplicate (MS/MSD) for volatile and semivolatile organics (where applicable), and as a Matrix spike and matrix duplicate for metals (where applicable) and cyanide (where applicable).

4.5.3 Spiked Samples

Two types of spiked samples will be prepared and analyzed as quality controls: Matrix Spikes and Matrix Spike Duplicates (MS/MSD) are analyzed to evaluate instrument and method performance and

performance on samples of similar matrix. MS/MSD will be analyzed at a frequency of one (pair) for every 20 samples

5.0 DATA DOCUMENTATION

5.1 Field Notebook

Field notebooks will be initiated at the start of on-site work. Each subcontractor in the field will have a notebook dedicated to record pertinent activities. The field notebook will include the following daily information for all site activities:

- Date;
- Meteorological conditions (temperature, wind, precipitation);
- Site conditions (e.g., dry, damp, dusty, etc.);
- Identification of crew members (FDGTI and subcontractor present) and other personnel (e.g., agency or site owner) present;
- Description of field activities;
- Location(s) where work is performed;
- Problems encountered and corrective actions taken;
- Records of field measurements or descriptions recorded; and,
- Notice of modifications to the scope of work.

During drilling operations, the supervising field engineer/geologist will add the following information:

- Geoprobe/HSA rig type;
- Documentation of materials used;
- Downtime;
- Time work is performed at an elevated or lowered level of respiratory protection;
- Description of soil or rock strata; and,
- Diagram of well or boring construction.

During sampling of wells and surface water (if required), field samplers will add the following:

- Sampling point locations and test results such as pH, conductance, etc.
- Information about sample collection
- Chain of custody information, and
- Field equipment calibration.

5.2 Field Reporting Forms

Field reporting forms (or their equivalent) to be utilized in this investigation are presented in Appendix A. These include:

- Drilling Safety Checklist;
- Unified Soil Classification Chart;
- Drilling Logs and Well Completion Form;
- Groundwater Sampling Worksheet;
- Survey Data Form
- Chain of Custody Form (typical);
- Calibration Logs (instrument specific).

These forms, when completed, will become part of the project file. In addition, the field notebook will be used for "free format" data entry for field tasks that are not documented on pre-printed forms.

6.0 EQUIPMENT CALIBRATION AND MAINTENANCE

6.1 Standard Water and Air Quality Field Equipment

Field equipment used during the collection of environmental samples, includes a turbidimeter (turbidity per EPA Method 180.1), pH meter (pH per EPA Method 150.1), conductivity meter (specific conductance per EPA Method 120.1), thermometer, and photoionization detector. See also Section 4.4 of this QAPP for additional discussion.

Calibration and standardization for the field water quality tests will be in conformance with the

manufacturers recommendations. Since the exact units to be used in the field are selected based upon availability on the day of field work, manufacturer's instructions for calibrating the field instruments to be used are not available at this time for the *specific* instrument to be used. However, once the required field instrument is selected (i.e., the *specific* intrument to be used is selected) copies of manufacturer instructions for calibration and use will be maintained by field staff and available for review by NYSDEC upon request.

The pH meter will be fully recalibrated (two points) at least two times daily and it will be checked with pH 7.0 buffer every five samples, two hours, or every time it has been turned off for more than two hours and then turned on, whichever occurs first.

The calibration of the specific conductance meter will be checked twice daily (at the beginning and in the middle of the work day).

Temperature will be measured with an NBS/NIST traceable thermometer, or with a platinum electrode, factory calibrated and coupled to the conductivity meter, or similar meter.

The Photovac HL-200 Microtip (or equivalent organic vapor analyzer) use for soil screening and health and safety air monitoring will be calibrated following the manufacturer's instructions, at the beginning of the day.

6.2 Laboratory Equipment

Laboratory equipment will be calibrated according to the requirements of the 1995 Revised NYSDEC ASP, Superfund Contract Laboratory Program for each parameter or group of similar parameters, and maintained following professional judgment and the manufacturer's specifications.

7.0 CORRECTIVE ACTIONS

If instrument performance or data fall outside acceptable limits, then corrective actions will be taken. These actions may include recalibration or standardization of instruments, acquiring new standards, replacing equipment, repairing equipment, and reanalyzing samples or redoing sections of work.

Subcontractors providing analytical services should perform their own internal laboratory audits and calibration procedures with data review conducted at a frequency so that errors and problems are detected early, thus avoiding the prospect of redoing large segments of work.

Situations related to this project requiring corrective action will be documented and made part of the project file. For each measurement system identified requiring corrective action, the responsible individual for initiating the corrective action and also the individual responsible for approving the

corrective action, if necessary, will be identified.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

The guidance followed to perform quality data validation, and the methods and procedures outlined herein and elsewhere in the Work Plan, pertain to initiating and performing data validation, as well as reviewing data validation performed by others (if applicable). An outline of the data validation process is presented here, followed by a description of data validation review summaries.

8.1 Laboratory Data Reporting and Reduction

The laboratory will meet the applicable documentation, data reduction, and reporting protocols as specified in the 1995 revision of the NYSDEC ASP CLP. Laboratory data reports for non-CLP data will conform to NYSDEC Category B deliverable requirements. With full CLP documentation, deliverables will include, but not be limited to:

- Chains of Custody
- Blanks
- Holding Times
- Internal Standards
- Laboratory Duplicates
- GC/MS Instrument Performance Check
- System Monitoring Compound Recovery
- Matrix Spike & Matrix Spike Duplicates
- GC/MS Tuning
- Surrogate Recoveries

In addition to the hard copy of the data report, the laboratory will be asked to provide the sample data in spreadsheet form on computer diskette. The diskette will be generated to the extent possible directly from the laboratory's electronic files or information management system to minimize possible transcription errors resulting from the manual transcription of data.

8.2 Data Validation

External data validation is not proposed for this project. If necessary, external data validation can be completed at a later date.

Data will be evaluated in accordance with NYSDEC Division of Environmental Remediation (DER) Guidance for the Development of Data Usability Summary Reports (DUSRs). A copy of this guidance is included in Appendix C. The data usability report will be prepared by the project QAO, Dr. Maureen Leahy, Ph.D. (see Section 1.2.1 and Appendix A).

8.3 Field Data

Field chemistry data collected during air monitoring, soil screening (e.g., PID readings), and water monitoring (i.e., pH, turbidity, specific conductance, and temperature) will be presented in tabular form with any necessary supporting text. Unless activities resulted in significant unexpected results, field data comments can be added as footnotes to the tables.

9.0 PERFORMANCE AND SYSTEM AUDITS

The laboratory assigned to this project is certified by the NYSDOH Environmental Laboratory Approval Program for the analytical protocols to be used. Therefore, no audit of the laboratory(s) during the FRI will be performed unless warranted by a problem(s) that cannot be resolved by any other means, or at the discretion of IT. Field audits are not planned.

TABLES

TABLE 1

Summary of Container, Preservation, and Holding Time Requirements

Matrix	Parameter	Methodology	Preservative	Container	Holding Time
Groundwater	VOCs	EPA 624	4 Deg. C.	40 ml glass vial w/ teflon septum	7 Days
Soil	VOCs	EPA 8021	4 Deg. C	4 oz. clear wide mouth glass jar	14 Days

APPENDIX A

QAO RESUME

Maureen C. Leahy, PhD
Senior Environmental Scientist

EDUCATION

Post Doctorate, Human Genetics, Yale University, 1982-1986
PhD, Molecular Biophysics and Biochemistry, Yale University, 1982
MPhil, Molecular Biophysics and Biochemistry, Yale University, 1976
BS, Chemistry, Fordham University, 1973

PROFESSIONAL PROFILE

Maureen Leahy, PhD, has more than 16 years of experience in environmental technologies, chemistry, and microbiology. As a Senior Environmental Scientist for Fluor Daniel GTI, Dr. Leahy provides technical support and system design in the application of biological and physical treatments of soil and groundwater for petroleum and hazardous waste contamination. Dr. Leahy also provides expertise in natural attenuation monitoring, metal chemistry, chemical processes, and risk assessment.

Dr. Leahy has served as an expert witness in the field of bioremediation and fate of chemicals in the environment, as well as a consultant for litigation support in the areas of chemical processes, remediation technology selection, and the fate of chlorinated hydrocarbons and petroleum products in the environment. This work has involved both the analysis of site data and laboratory experiments to determine potential fate mechanisms.

Before joining Fluor Daniel GTI, Dr. Leahy worked at ABB Environmental, Inc. and Cambridge Analytical Associates, where she was responsible for directing laboratory support services for the design and implementation of field remediation projects for the treatment of hazardous waste. She designed treatability studies to determine the feasibility of technologies for the remediation of sites contaminated with petroleum hydrocarbons, coal tar, chlorinated solvents, and other hazardous wastes. Dr. Leahy has served as a Project Manager for several government-sponsored research projects for the development of technology for the biodegradation of hazardous wastes including chlorinated solvents, petroleum hydrocarbons, and coal tar.

Prior to working in the environmental field, Dr. Leahy worked at Yale University as an Associate in Research. She studied bacterial enzyme systems for the repair of DNA damaged by chemicals or radiation. Dr. Leahy's research for her PhD thesis at Yale was on the metabolic control of enzyme production in bacteria. She has also worked on the development of assays for the detection of drugs in serum and urine by gas chromatography.

PROJECT EXPERIENCE

Expert Witness, Impact of Surfactants and Hydrotropes on Fate & Transport of Other Chemicals at Two Superfund Sites
Investigated the fate of sulfonates in the subsurface environment and the impact of their presence on the fate and transport of other

contaminants. Sulfonates included dodecyl benzene sulfonate, xylene sulfonate, and other alkylbenzene sulfonates.

Technical Lead, Intrinsic Biodegradation of Hydrocarbons
Initiated and overseeing natural attenuation monitoring programs at numerous sites impacted with gasoline and/or fuel oil hydrocarbon.

Technical Support, Feasibility Study for Industrial Site Impacted with PCBs
Providing technical oversight for technology selection, treatability studies, and additional investigation for river-front site impacted with PCBs.

Technical Lead, Feasibility for Remediation of Mixed Pesticides
Investigated the feasibility of *in situ* bioremediation and chemical oxidation of a mixture of organochloride and organophosphate pesticides at a former pesticide manufacturing facility.

Technical Support, Fate of Cyanide from MGP Wastes in Environment
Investigated the fate of iron cyanide complexes from purifier box wastes in the environment. Remedial action plan prepared.

Technical Support, Reduction of O&M Costs Associated with Groundwater Recovery and Treatment at Superfund Site
Investigated cause and treatment for biofouling, need for components in groundwater treatment train and natural attenuation as means for reducing costs to recover and treat groundwater; costs were reduced by more than 50 percent.

Technical Lead, Pilot-Scale Comparison of Two Bioreactors to Activated Carbon for the Treatment of Groundwater Impacted with MGP Wastes
Compared the performances of a fixed film bioreactor and a fluidized bed bioreactor with conventional treatment with activated carbon for the treatment of groundwater impacted with coal tar constituents at a former manufactured gas plant (MGP) facility.

Technical Lead, Demonstration Project Using Biovent/Biosparge Followed by Ozone for Coal Tar Impacted Soil and Groundwater for a Utility
Demonstrated the use of biovent/biosparge technology with ozone polish for the treatment of soil and groundwater impacted with coal tar constituents. The demonstration project involved a laboratory feasibility study and extended pilot testing.

Technical Support, Feasibility of Reducing Copper Migration
Investigated *in situ* chemical fixation of copper as a means of reducing the migration of copper in the subsurface.

Technical Lead, Intrinsic Bioremediation of Halogenated Hydrocarbons

Technical lead on a project to demonstrate the attenuation and mass reduction of chlorinated aliphatics (including PCE, TCA, TCE, 1,1-DCA, 1,1-DCE, EDB and carbon tetrachloride) by naturally occurring intrinsic

biological mechanisms. The site involves multiple overlapping groundwater plumes.

Technical Support, Intrinsic Attenuation of Pentachlorophenol
Providing technical oversight of two projects to follow intrinsic attenuation of pentachlorophenol in groundwater.

Litigation Support, Estimation of Timing of Petroleum Release
Estimated timing and/or source(s) of petroleum releases at more than 20 sites based on site data including occurrence of separate phase hydrocarbon, ratios of BTEX constituents, natural attenuation rates, chromatographic fingerprint data, and presence of various gasoline additives (MTBE, TBA and alkylleads).

Task Manager, Feasibility Study for the Treatment of Wastes from Steel and Coke Manufacturing
Designed and managed a feasibility study for the selection of treatment technologies for the remediation of steel and coke manufacturing wastes containing a mixture of volatile hydrocarbons, coal tars, and metals. Technologies investigated included vapor extraction, steam stripping, bioremediation, solidification, and thermal treatments for both *in situ* and *ex situ* application.

Expert Witness for Applicability of Bioremediation
Served as an expert witness and testified in court to support client's choice of bioremediation as the remediation technology at a site impacted with mineral spirits.

Selection

Project Manager, Risk Evaluation and Remediation Technology

Assessed the environmental contamination and associated risk to human health at two metal pipe manufacturing facilities, calculating risk-based cleanup objectives, evaluating applicable remediation technologies and estimating remediation costs.

Project Scientist, Feasibility Study For the Use of Nitrate to Support *in situ* Bioremediation
Investigated nitrate as an electron acceptor to support *in situ* biodegradation of gasoline in an anaerobic aquifer. Nitrate was under consideration since an aerobic process would be difficult to implement due to the impermeability and degree of stratification in the aquifer. The remediation plan is under review.

Litigation Support, Investigation of the Historical Manufacturing Practices at a Chemical Plant
Researched historical documents and depositions to identify the chemical manufacturing processes and disposal practices conducted at a chemical manufacturing facility over the past five decades. The processes included the syntheses of phthalate, sebacate and trimellitate plasticizers, dielectric fluids, benzyl chloride, and phthalic anhydride. The research covered identification of feed chemicals, impurities, end products and by-products, and their fate in the environment.

Technical Support and Design, Biostabilization of No. 6 Fuel Contamination in the Vadose Zone
Provided technical support and design services for the remediation of No. 6 fuel oil by biostabilization. The bioremediation system includes soil venting for aeration and bimonthly nutrient injection via vertical injection points and a lateral injection gallery. The goal of the project is to reduce the mobile constituents of the fuel in order to protect groundwater.

Conditions

Technical Support, Bioremediation Under Nitrate-Reducing

Provided technical support on a project to investigate the use of nitrate-reducing bacteria for the bioremediation of petroleum hydrocarbons. Nitrate was shown to stimulate biological degradation in site soil and groundwater.

Technical Support, Treatment of Diesel Using Vent/Sparge Aeration
Technology selection and design of an *in situ* remediation system for diesel contamination resulting from an aboveground pipeline spill. A system of combined venting/air sparging points have been installed throughout the 8-acre plume to provide oxygen to support biological degradation.

Project Manager, Bioreactor for Treatment of Chlorinated Solvents
Developed a bioreactor for the treatment of water contaminated with chlorinated ethenes. During the initial National Science Foundation (NSF) sponsored phase, Dr. Leahy directed the development and testing of a bench-scale reactor utilizing methanotrophic bacteria capable of oxidizing chlorinated solvents. In a second phase sponsored by the Gas Research Institute (GRI), the feasibility of full-scale implementation of this technology was evaluated.

Technical Support, *In Situ* Bioreclamation of Gasoline Contamination
Provided technical and laboratory support for the design and maintenance of an *in situ* bioreclamation system for gasoline contamination at the site of a former service station. Hydrocarbon and BTEX concentrations in soils and groundwater reached nondetectable levels within 6 months.

Project Supervision, Land Treatment of No. 6 Fuel Oil Contaminated Soils
Provided oversight management of a land treatment project for a southern utility company for the biological remediation of soils heavily contaminated with No. 6 fuel oil with a comprehensive monitoring program. Laboratory feasibility testing provided design parameters. Comparison of field and laboratory data showed excellent correlation.

Technical Support, Forced Aeration Soil Pile for the Remediation of Diesel-Contaminated Soil

Provided technical and laboratory support for the design and maintenance of a forced aeration soil pile for the remediation of soil contaminated with diesel fuel. Process monitoring data provided evidence of insufficient aeration in a portion of the pile and allowed remedial measures to be undertaken.

Bioremediation Team Lead, Feasibility of Biotreatment of Methylmethacrylate at a Superfund site
Designed the bioremediation component of a feasibility study to evaluate an effective treatment train for the remediation of methylmethacrylate contamination in soils at a Superfund site.

Treatability Study Leader, Feasibility of Using *In Situ* Bioremediation for Toluene and Acrylonitrile
Designed and conducted a biological treatability study to assess the feasibility of treating soil and groundwater contaminated with toluene and acrylonitrile at a chemical manufacturing facility. Laboratory testing showed rapid biological degradation of both toluene and acrylonitrile under aerobic conditions and supported the design of an *in situ* bioremediation treatment system for soil and groundwater.

Biodegradation Potential of Acetone, Benzene and Toluene in Soils
Data supporting the attenuation of plume of acetone, benzene and toluene by naturally occurring biological degradation in a contaminated aquifer were generated in laboratory microcosms. The rates of mineralization of Carbon 14, radiolabeled compounds in unamended soil/water samples.

Research Manager, Biodegradation of 4- and 5-ring PAH in Coal Tar
Managed an NSF-funded project to develop innovative strategies to stimulate the biological degradation of 4- and 5-ring PAH, constituents of coal tar and petroleum products which are normally recalcitrant to bacterial oxidation. The project investigated the use of agents to increase solubility and desorption of these compounds and the use of co-metabolites.

Technical Support, Sequential Anaerobic/Aerobic Treatment of Chlorinated Aliphatics
Provided technical support on a research and development project to investigate the use of sequential anaerobic/aerobic biological processes to treat chlorinated solvents such as tetrachloroethene in aquifer environments. The two-step process involves first reductive dechlorination under anaerobic conditions followed by methanotrophic degradation in the presence of methane and oxygen.

Technical Support, Composting of Coal Tar Impacted Soils
Provided technical support for a project co-funded by EPA and a New England utility company to demonstrate the feasibility of biological treating coal tar impacted soil by composting at bench- and pilot-scale.

Project Manager, Biodegradation of Adsorbed Jet Fuel
Managed a project funded by the US Air Force to investigate the potential of the biological remediation of jet fuel adsorbed to soil particles. The study covered both saturated and vadose zone systems.

Technical Support, *In Situ* Biological Treatment of Coal Tar for a Utility
Design and implementation of an *in situ* bioremediation system for a New England utility to control seeps of a light mobile coal tar fraction to an adjacent river. The composition of the seeps showed a high percentage of monoaromatic compounds and was demonstrated in laboratory feasibility testing to be amenable to biological degradation.

Technical Support, Land Treatment of Coal Tar Impacted Soils
Provided technical support for a project funded by the EPA and a New England utility company to demonstrate the feasibility of biological treating coal tar impacted soil by land treatment on a pilot scale.

Project Manager, Metabolic By-products and Mechanism of Chlorinated Ethene Degradation
Investigated the intermediates and products of the co-oxidation of chlorinated aliphatic compounds by methane-oxidizing bacteria for this NSF-sponsored study. The detection of transient intermediates suggested the mechanism of TCE and DCE oxidation went via formation of an epoxide intermediate with ultimately complete mineralization to carbon dioxide.

SPECIAL QUALIFICATIONS

Health and Safety Training
OSHA 40-Hour Safety Training
OSHA 8-Hour Refresher Training for Hazardous Waste Activities

Professional Affiliations
American Society for Microbiology
American Water Works Association
Water Environment Federation
American Association for the Advancement of Science

Awards
Sullivan Award for Intercompany Understanding &Teamwork, Fluor Daniel GTI (1996)
Goldmuntz Award for Technical Excellence, Fluor Daniel GTI (1995)
National Institute of Health Research Training Grant (1974-1978)
Analytical Chemistry Society Award (1973)
New York State Regents College Scholarship (1969-1973)

Patents
Moore, A., M.C. Leahy, M. Findlay and S. Fogel. Decomposition of Halogenated Aliphatic Hydrocarbons in a Bioreactor. March 23, 1993. U.S. Patent No. 5,196,121.

Recent Publications/Presentations

Leahy, M.C. and G. J. Skladany. 1998. Assessment of Intrinsic Biodegradation of Multiple Chlorinated Hydrocarbons To be presented at Battelle Symposium on Chlorinated Organics, Monterey, CA, May.

Callahan, B. G. and M. C. Leahy. 1998. Impact of Intrinsic Biodegradation of Chlorinated Hydrocarbons On Risk Assessment. To be presented at Battelle Symposium on Chlorinated Organics, Monterey, CA, May.

Leahy, M. C. 1997. Intrinsic Bioremediation as a Tool for Contaminant Control. NERM '97. The 27th Northeast Regional Meeting of the American Chemical Society, June 22-25, Saratoga Springs, NY.

Brown, R. A., C. Nelson and M. Leahy. 1997. Combining Oxidation and Bioremediation for the Treatment of Recalcitrant Organics. In: *In Situ and On-Site Bioremediation, Volume 4.* (B. C. Alleman and A. Leeson), Battelle Press, Columbus, OH, pp. 457-462.

Leahy, M. C., C. H. Nelson, A. M. Fiorentine and R. J. Schmitz. 1997. Ozonation for *In Situ* Bioremediation. In: *In Situ and On-Site Bioremediation, Volume 3.* (B. C. Alleman and A. Leeson, eds.), Battelle Press, Columbus, OH, pp. 479-483.

Leahy, M. C., B. W. Ahrens, T. L. Blazicek and G. B. Mayback. 1997. Bioreactor Treatment Comparison for Groundwater at a Former MGP Facility. In: *In Situ and On-Site Bioremediation, Volume 3.* (B. C. Alleman and A. Leeson, eds.), Battelle Press, Columbus, OH, pp. 463-467.

Leahy, M. C., A. M. Fiorentine and R. J. Schmitz. 1997. Biosparging for *In Situ* Treatment of Manufactured Gas Plant Residuals. In: *In Situ and On-Site Bioremediation, Volume 3.* (B. C. Alleman and A. Leeson), Battelle Press, Columbus, OH, pp. 445-450.

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Brown, R.A., and M.C. Leahy. 1995. A Rationale Approach to the Remediation of Soil and Groundwater at Manufactured Gas Plant Sites. Institute of Gas Technology Symposium. Dec. 11-13 Colorado Springs, Colorado.

Brown, R.A., M.C. Leahy and C. van de Meene. 1995. Site Closure Through Post Remediation Bioremediation. Fifth International KfK/TNO Conference on Contaminated Soil, Oct. 30-Nov. 3. Maastricht, The Netherlands.

Leahy, M.C., Brown, R.A., M. Jackson and M. Loucy. 1995. A Rationale Approach to the Remediation of Soil and Groundwater at Manufactured Gas Plant Sites. International Symposium and Trade Fair on the Clean-up of Manufactured Gas Plants. Sept, 19-21. Prague, Czech Republic.

Leahy, M.C. and G. Erickson. 1995. Reducing the Cost of Site Remediation with Bioventing. Hydrocarbon Processing.

Leahy, M.C., R. A. Brown and D. Cacciatore. 1995. Complications in the Analysis of Performance During the Biodegradation of Complex Compounds in Soil. Presented at Air & Waste Management Assoc. June 20-23. San Antonio, TX.

Brown, R.A., P.M. Hicks, R.J. Hicks and M.C. Leahy. 1995. Post Remediation Bioremediation. In: *Intrinsic Bioremediation*. (Hinchee, R.E., J.T. Wilson and D.C. Downey, eds.). Battelle Press, Columbus, Ohio, pp. 77-84.

Leahy, M.C., W.C. Leonard and R.A. Brown, April 24-27, 1995. Air Sparging for *In Situ* Bioremediation of Toluene. In: *In Situ Aeration: Air Sparging, Bioventing and Related Remediation Processes*, (R.E. Hinchee, R.N. Miller and P.C. Johnson, eds.) Battelle Press, Columbus, Ohio, pp. 185-190.

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Ram, N.M., D. Bass, R. Falotico, and M. Leahy. 1993. Decision Framework for Remediation at Hydrocarbon Contaminated Sites. J. Soil Contamination 2(2):167-189.

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Felten, D.E., M.C. Leahy, L.J. Bealer, and B.A. Kline. 1992. Case Study: Site Remediation Using Air Sparging and Soil Vapor Extraction. Petroleum Hydrocarbon and Organic Chemicals in Groundwater: Prevention, Detection and Restoration. (Nov. 4-6) Houston, TX.

Leahy, M. C. 1992. Groundwater. BioEast '92 (January 14) Washington, DC.

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APPENDIX B

SOIL SCREENING PROCEDURE

SOIL SCREENING PROCEDURE

1. Calibrate the PID in accordance with manufacturer instructions, document

2. After collecting the sample for laboratory submittal, collect a separate aliquot of the sample from the same acetate liner or the same split spoon sample. The sample shall be collected by gently placing approximately 4 oz. of soil into an 8 oz. jar. This will leave approximately 4 oz. of headspace.

3. Immediately after placing the soil into the soil screening jar, cover the jar with parafilm so that a vapor tight seal is obtained. Label the screening jar as follows:

   Sample ID: AAAA-BBBB-Screening Only (Date, Time)
   Where: AAAA represents the sample location (e.g., SB04, MW15, etc.)
   BBBB represents the sample depth (e.g., 10 ft bgs, 0-4 feet bgs, etc.).

4. Allow the jar to sit for 5 minutes in an area that is not in direct sunlight.

5. After sitting for 5 minutes, gently shake the jar for approximately 10 seconds. Wait 10 seconds then carefully insert the PID probe through the parafilm into the headspace so that the parafilm seals around the PID probe.

6. Record the highest PID reading obtained during the headspace screening.

7. Following headspace screening, seal the jar with the screw-on cover and store the field screening jars for a minimum of one month.

APPENDIX C

NYSDEC DER DATA USABILTY SUMMARY REPORT

New York State Department of Environmental Conservation
Division of Environmental Remediation

Guidance for the Development of Data Usability Summary Reports

Background:

The Data Usability Summary Report (DUSR) provides a thorough evaluation of analytical data without the costly and time consuming process of third party data validation. The primary objective of a DUSR is to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and data use.

Though the substitution of a DUSR for a full third party data validation may seem to be a relaxation of the Division's quality assurance requirements, this is definitely not the case. The development of the DUSR must be carried out by an experienced environmental scientist, such as the project Quality Assurance Officer, who is fully capable of conducting a full data validation. Furthermore, the DUSR is developed from a full New York State Department of Environmental Conservation Analytical Services Protocol (NYSDEC ASP) Category B or a United States Environmental Protection Agency Contract Laboratory Protocol (USEPA CLP) deliverables package.

The DUSR and the data deliverables package will be reviewed by the Division's Quality Assurance Unit. In most cases, we expect that this review will result in agreement or with only minor differences that can be easily reconciled. If data validation is found to be necessary (e.g. pending litigation) this can be carried out at a later date on the same data package used for the development of the DUSR.

Personnel Requirements:

The Environmental Scientist preparing the DUSR must hold a Bachelors Degree in a relevant natural or physical science or field of engineering and must submit a resume to the Division's Quality Assurance Unit documenting experience in environmental sampling , analysis and data review.

Preparation of a DUSR:

The DUSR is developed by reviewing and evaluating the analytical data package. During the course of this review the following questions must be asked and answered:

1. Is the data package complete as defined under the requirements for the NYSDEC ASP Category B or USEPA CLP deliverables?

2. Have all holding times been met?

3. Do all the QC data: blanks, instrument tunings, calibration standards, calibration verifications, surrogate recoveries, spike recoveries, replicate analyses, laboratory controls and sample data fall within the protocol required limits and specifications?

4. Have all of the data been generated using established and agreed upon analytical protocols?

5. Does an evaluation of the raw data confirm the results provided in the data summary sheets and quality control verification forms?

6. Have the correct data qualifiers been used ?

Once the data package has been reviewed and the above questions asked and answered the DUSR proceeds to describe the samples and the analytical parameters. Data deficiencies, analytical protocol deviations and quality control problems are identified and their effect on the data is discussed. The DUSR shall also include recommendations on resampling/reanalysis. All data qualifications must be documented following the NYSDEC ASP '95 Rev. guidelines.

Contact the Division of Environmental Remediation Quality Assurance Group at (518) 457- 9280, with any questions on the preparation of a DUSR.

Revised 09/97

APPENDIX D

FIELD FORMS

DRILLING SAFETY CHECKLIST
"Look up and Live"

Site Name _____ Project # _____

Your Name _____ Drillers Name _____

Signature _____ Signature _____

Do not proceed with today's work until this checklist is completed

_____Are your sub-contractors wearing Level D personal protection equipment?

_____Hard Hats _____Ear Protection

_____Safety Glasses _____Steel-Toed Boots

_____Have you designated a smoking and eating area?

_____Have you completed a Tailgate Safety Meeting?

_____Has the Health and Safety Plan (HASP) been review and signed?

_____Have you identified where the nearest pay phone and emergency equipment is located?

_____Do you have a copy of the Utilities Locate Checklist?

_____Do you have enough barricades/cones?

_____Have the utilities been marked out?

Have you notified the Site/Project Manager if the utilities have not been marked?

_____pink: temporary survey markings _____green: sewer

_____yellow: natural gas, oil, steam _____blue: water

_____orange: communications _____red: electric

_____white: proposed excavation/boring locations

Are your borings:

_____10/20 feet away from overhead lines (shielded and unshielded respectively)?

_____5 feet away from non-natural gas utilities?

_____10 feet away from natural gas lines?

_____3 feet away from concrete/asphalt seams/joints or repaved areas?

_____Are you prepared to hand dig to 5 feet?

_____Have any fiber optic lines been identified on site?

_____If so, do you have a copy of the fiber optics plan?

_____Is someone from Health and Safety and the Fiber Optics Company involved?

_____Are your borings a minimum of 15 feet away from the fiber optic line mark outs?

_____Do you have a copy of all access agreements?

_____Have you inspected the cable/rope on the drill rig?

_____Have you checked the "kill" switches on the drill rig?

_____Has the driller showed you that all the gauges, levers, safety devices, and switches are working properly?

_____Have you checked the rig for hydraulic fluid/oil leaks?

_____Are all the visible belts and hoses in good working condition?

_____Have you eliminated all tripping hazards to the best of your ability?

_____Has your driller and his helper removed all of their jewelry?

_____Are you prepared to monitor for vapors?

_____Have you calibrated your PID/FID and O$_2$/LEL?

_____Is someone CPR qualified in case of an emergency?

_____Do your drillers have all the supplies required to complete today's activities?

KEY-MAP

UNIFIED SOIL CLASSIFICATION SYSTEM

CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES	USCS FILL PATTERN
COARSE GRAINED SOILS OVER #200 SIEVE SIZE	GRAVELS MORE THAN 1/2 OF COARSE FRACTION #4 SIEVE SIZE	GW	Well graded gravels or gravel-sand mixtures, little or no fines	29
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines	25
		GM	Silty gravels, gravel-sand mixtures	26-11
		GC	Clayey gravels, gravel-sand-clay mixtures	28-14
	SANDS MORE THAN 1/2 OF COARSE FRACTION #4 SIEVE SIZE	SW	Well graded sands or gravelly sands, little or no fines	8
		SP	Poorly graded sands or gravelly sands, little or no fines	5
		SM	Silty sands, sand-silt mixtures	9
		SC	Clayey sands, sand-clay mixtures	10
FINE GRAINED SOILS OVER #200 SIEVE SIZE	SILTS & CLAYS LL<50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	7
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	14
		OL	Organic silts & organic silty clays of low plasticity	18
	SILTS & CLAYS LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	12
		CH	Inorganic clays of high plasticity, fat clays	15
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts	36
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils	20

GRAIN SIZE CHART

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 78.2
GRAVEL COARSE FINE	3" to No.4 3" to 3/4" 3/4" to No.4	78.2 to 4.76 78.2 to 19.1 19.1 to 4.76
SAND COARSE MEDIUM FINE	No.4 to No.200 No.4 to No.10 No.10 to No.40 No.40 to No.200	4.75 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No.200	Below No.0.074

WELL CONSTRUCTION MATERIALS

Asphalt
Concrete
Neat Cement
Base Course
Backfill
Bentonite
Filter Pack
Pea Gravel
Liner
Geotech

SCREENS

Solid
Slotted PVC
Slotted PVC High Flow
Wire Wound PVC
Wire Wound Steel
Saw Cut

SAMPLE TYPES

SS - Split Spoon
CORE - Continuous Core
CUTT - Cuttings Grab

SYMBOLS

Initial Water Level
Static Water Level

GROUNDWATER TECHNOLOGY

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well GTI DEMO LOG

Project _____ Owner _____

Location The Desert Project No. 203 399 1234 Date drilled 02/14/91

Surface Elev. 29 ft Total Hole Depth 20.0 ft. Diameter 1.75 ft.

Top of Casing 29 ft. Water Level Initial 9.5 ft Static 10 ft

Screen: Dia 4 in Length 8.5 ft. Type/Size 4 in

Casing: Dia 4 in. Length 9 ft. Type Sched. 40 PVC

Filter Pack Material 2/12 lapis lustre Rig/Core Type CAT Continuous

Drilling Company Powercore Method Hammer Core Permit # a123

Driller Mike Nosewicz Log By Craig Robertson

Checked By Peter Krogonick License No. AG ####

See Site Map For Boring Location

COMMENTS.

This is GTI demo LOG (GTILOG). Use to start a new log by editing this or Printed using LITHLOG script. SLOW COUNTS AND PID

Depth (ft.)	Well Completion	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
0					ASB	Asphalt
2					MH	Elastic SILT: Dark brown, damp, about 95% Silt, 5% Clay, trace fine. No reaction with HCl, high plasticity, soft, micaceous.
4			A		CL	Dark Brown, damp, CLAY, little sand
6						
8		120	B		SP	Brown SAND (poorly sorted, trace fines)
10			C			increasing clay
12					CL	Brown CLAY, little sand
14						Brown CLAY
16		250	D		SM	color grades to olive green.
18			E		SC	Dark green CLAY, some sand
20		10	F			Greenish-brown SAND, some clay, about 70% fine Sand, 30% Clay, [illegible] of Silt. Moist.
22						Encountered water 2/14/91 1020
24						End of boring, backfilled with bentonite pellets followed by neat cement.

GROUNDWATER SAMPLING WORKSHEET

CLIENT: _____
JOB NO: _____
DATE: _____

WELL I.D.	DEPTH TO BOTTOM	(–)	DEPTH TO BOTTOM	(=)	WATER COLUMN	ESTIMATE VOLUME	PURGE START	ACTUAL VOLUME	SAM TI

GROUNDWATER TECHNOLOGY ,

GROUNDWATER TECHNOLOGY, INC.
101-3 COLIN DRIVE
HOLBROOK, NY 11741
(516) 472-4000

PROJECT NAME/LOCATION: _____ PAGE _____ OF _____

PROJECT NO.: _____ TASK CODE: _____ DATE: _____

EQUIPMENT NO.: _____ SURVEYOR _____

ROD PERSON _____

SURVEY DATA

SURVEY POINT	AXIAL	TOP	BOTTOM	< DEGREE	READING CHECK TOP-AXIAL	READING CHECK AXIAL-BOTTOM	DISTANCE	TOP CASI ELEVA

COMMENTS:

NOTE: TOP OF CASING = 100 + BENCH MARK - AXI
DISTANCE = TOP READING - BOTTOM READING

TAILGATE MEETING FORM

Project Name: _____ Date: _____

Project Number: _____ Presented by: _____

Check the Topics/Information Reviewed:

- ☐ safety glasses, hard hat, safety boots
- ☐ site safety plan review and location
- ☐ equipment and machinery familiarization
- ☐ employee Right-To-Know/MSDS location
- ☐ open pits, excavations, and site hazards
- ☐ vehicle safety and driving/road conditions
- ☐ particle dust safety and awareness
- ☐ overhead utility locations and clearance
- ☐ first aid, safety, and PPE location
- ☐ sharp object, rebar, and across metal hazards
- ☐ safety is everyone's responsibility
- ☐ latex gloves inner/nitrile gloves outer
- ☐ excavation/trenching inspections/documentation
- ☐ full face respirators with proper cartridges
- ☐ ingress to level C at PID/PID (___ eV) > ___ ppm
- ☐ work egress at PID/PID(___ eV) > ___ ppm, % LEL > 10%
- ☐ slips, trips, and falls
- ☐ directions to hospital
- ☐ intoxicated visitors
- ☐ electrical ground fault
- ☐ public safety and fences
- ☐ excavator swing and loading
- ☐ orderly site and housekeeping
- ☐ smoking in designated areas
- ☐ leather gloves for protection
- ☐ effects of the night before
- ☐ vibration related injuries
- ☐ fire extinguisher locations
- ☐ eye wash station locations
- ☐ decontamination procedures
- ☐ daily work scope
- ☐ emergency protocol
- ☐ parking and laydown
- ☐ hot work permits
- ☐ strains and sprains
- ☐ noise hazards
- ☐ no horseplay
- ☐ heat and cold stress
- ☐ backing up hazards
- ☐ accidents are costly
- ☐ dust and vapor control
- ☐ refueling procedures
- ☐ confined space entry
- ☐ flying debris hazards

Discussion/Comments/Follow-up Actions: _____

NAME	SIGNATURE	COMPANY

Instructions:

- Conduct a daily safety meeting prior to beginning each day's site activities.
- Complete form by checking off specific topics and/or hazards.
- Obtain signatures from all GTI staff and GTI subcontractors.
- Follow-up on any noted items and document resolution of any action items.

ECO TEST LABORATORIES, INC. • ENVIRONMENTAL TESTING
377 Sheffield Avenue, North Babylon, New York 11703
(516) 422-5777 • FAX (516) 422-5770

CHAIN OF CUSTODY RECORD

Client:

Address:

Phone: FAX:

Person receiving report:

Sampled by:

Source:

Job No.:

MATRIX (Soil, Water, etc.)	COLLECTED DATE	COLLECTED TIME	SAMPLE IDENTIFICATION	TOTAL NUMBER OF CONTAINERS	TYPE & NUMBER OF CONTAINERS	REMARKS–TESTS REQUIRED, SPECIAL TURNAROUND, SPECIAL Q.C. etc

Relinquished by: *(Signature)*	DATE/TIME	SEAL INTACT ? YES NO NA	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE/TIME	SEAL INTACT ? YES NO NA	Received by: *(Signature)*
Representing:			Representing:	Representing:			Representing:
Relinquished by: *(Signature)*	DATE/TIME	SEAL INTACT ?	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE/TIME	SEAL INTACT ?	Received by: *(Signature)*

WELL SAMPLING DATA FORM

CLIENT : _____

SITE : _____

PROJECT NO. : _____

SAMPLED BY : _____

DATE : _____

WEATHER : _____

		A	B	C	D	E										
WELL NUMBER	WELL DIAMETER (INCHES)	GALLONS PER FOOT	WELL DEPTH (FEET)	DEPTH TO WATER FROM TOP OF CASING (FEET)	FEET OF WATER IN WELL (B - C)	GALLONS OF WATER IN WELL (A x D)	GALLONS OF WATER TO PURGE (E x 3)	PURGE METHOD (BAIL / PUMP)	TIME PURGING BEGAN (HH:MM)	TIME PURGING ENDED (HH:MM)	ACTUAL AMOUNT PURGED (GALLONS)	DEPTH TO WATER AFTER PURGING (FEET)	DEPTH TO WATER PRIOR TO SAMPLING (FEET)	TIME SAMPLE COLLECTED (HH:MM)	SAMPLED WITH DISPOSABLE OR DECONTAMINATED BAILER	METALS SAMPLES FILTERED (Y / N)

WELL DIAMETER	GALLONS PER FOOT
1"	0.04
2"	0.16
3"	0.37
4"	0.65

COMMENTS : _____

pH METER
CALIBRATION AND RESULTS LOG

CLIENT : _____ DATE : _____ INSTRUMENT # : _____

TE : _____ ANALYST'S NAME / INITIALS : _____

PROJECT NO. : _____ WEATHER : _____ °F

pH CALIBRATION

TIME CALIBRATION WAS STARTED :	BUFFER TEMPERATURE (°F)			COMMENTS:
	MEASURED	CORRECTION	CORRECTED	
TIME CALIBRATION WAS COMPLETED:				

pH BUFFER	ADJUSTMENT #1		ADJUSTMENT #2		ADJUSTMENT #3		FINA
	READING	ADJUSTED	READING	ADJUSTED	READING	ADJUSTED	READ
7.0							
4.0							
10.0							
7.0							

SAMPLE RESULTS

SAMPLE ID	TIME	TEMPERATURE (°F)			pH (S. U.)	COMMENTS
		MEASURED	CORRECTION	CORRECTED		
DEIONIZED WATER						
(DUPLICATE)						

1. RECORD THE TIME CALIBRATION WAS STARTED.

2. RINSE THE INSIDE OF THE SAMPLE CUP WITH DEIONIZED WATER AND FILL 2/3 FULL WITH ONE OF THE BUFFER SOLUTIONS

3. SLIDE THE FUNCTION SWITCH TO "TEMP", PUSH THE "READ" BUTTON, AND RECORD THE TEMP., THE CORRECTION (FROM THE CALIBRATION LOG IN THE FRONT OF THE BOOK), AND THE CORRECTED BUFFER TEMP.

4. ADJUST THE TEMP. COMPENSATION KNOB FOR pH TO THE CORRECTED TEMP. OF THE BUFFER

5. RINSE THE pH ELECTRODE WITH DEIONIZED WATER AND WIPE DRY.

6. SLIDE THE FUNCTION SWITCH TO "pH".

7. PLACE THE pH ELECTRODE IN THE 7.0 BUFFER SOLUTION, PRESS THE "READ" BUTTON, AND RECORD THE VALUE. ADJUS THE "ZERO" KNOB UNTIL THE DIGITAL DISPLAY INDICATES "7.00" AND ENTER 7.00 IN THE LOG AS THE "ADJUSTED" VALUE

8. RINSE THE pH ELECTRODE WITH DEIONIZED WATER AND WIPE DRY.

9. PLACE THE pH ELECTRODE IN THE 4.0 BUFFER SOLUTION, PRESS THE "READ" BUTTON, AND RECORD THE VALUE. ADJU THE "SLOPE" KNOB (NOT THE "ZERO" KNOB) UNTIL THE DIGITAL DISPLAY INDICATES "4.00" AND ENTER 4.00 IN THE LOG AS THE "ADJUSTED" VALUE

10. RINSE THE pH ELECTRODE WITH DEIONIZED WATER AND WIPE DRY.

11. PLACE THE pH ELECTRODE IN THE 10.0 BUFFER SOLUTION, PRESS THE "READ" BUTTON, AND RECORD THE VALUE. ADJU THE "SLOPE" KNOB (NOT THE "ZERO" KNOB) UNTIL THE DIGITAL DISPLAY INDICATES "10.00" AND ENTER 10.00 IN THE LO AS THE "ADJUSTED" VALUE

12. RINSE THE pH ELECTRODE WITH DEIONIZED WATER AND WIPE DRY.

13. PLACE THE pH ELECTRODE IN THE 7.0 BUFFER AGAIN AND PUSH THE "READ" BUTTON.

    A. IF THE DIGITAL DISPLAY DOES NOT INDICATE "7.00", THEN ENTER THE VALUE OBTAINED AND REPEAT THE ABOVE PROCESS BEGINNING WITH STEP 7.

    B. IF THE DIGITAL DISPLAY DOES INDICATE "7.00", THEN RECORD 7.00 AS THE "FINAL" VALUE FOR THE 7.0 BUFFER AND TAKE "FINAL" READINGS FOR THE 4.0 AND 10.0 BUFFERS ALSO.

14. RECORD THE TIME CALIBRATION WAS COMPLETED.

<u>AFTER THE pH ELECTRODE HAS BEEN CALIBRATED THE METER IS READY FOR USE AS FOLLOWS :</u>

<u>NOTE: EACH DAY THE DEIONIZED WATER AND A NATURAL DUPLICATE SAMPLE MUST BE ANALYZED.</u>

1. RECORD THE TIME OF ANALYSES.

2. RINSE THE INSIDE OF THE SAMPLE CUP WITH THE WATER TO BE ANALYZED AND THEN FILL 2/3 FULL

3. SLIDE THE FUNCTION SWITCH TO "TEMP", PUSH THE "READ" BUTTON, AND RECORD THE TEMP., THE CORRECTION, (FR THE CALIBRATION LOG IN THE FRONT OF THE BOOK), AND THE CORRECTED BUFFER TEMP. IF THE READING IS NOT STA EMPTY AND REFILL THE CUP SEVERAL TIMES TO BRING THE CUP AND SAMPLE TO THE SAME TEMP.

4. ADJUST THE TEMP. COMPENSATION KNOB FOR pH TO THE CORRECTED TEMP. OF THE SAMPLE

5. SLIDE THE FUNCTION SWITCH TO "pH"

    A. RINSE THE pH ELECTRODE WITH DEIONIZED WATER AND WIPE DRY.

    B. PLACE THE pH ELECTRODE IN THE SAMPLE CUP OR ANY NON-METALLIC SAMPLE CONTAINER, PUSH THE "READ" BUTTON, AND RECORD THE VALUE IN THE LOG.